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SEASONAL EVOLUTION OF THE QUALITY MICROBIOLOGICAL OF THE NATURAL WATERS IN THE TOWNSHIP OF ABOMEY-CALAVI (SOUTH BENIN)

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ABSTRACT: *Water is indispensable at life. Resources in waters of the township of Abomey-Calavi are of a national importance. The township of Abomey-Calavi is very close to the biggest plan of water Beninese lagunaire: The Nokoué lake. Besides, not only the waters of the watertable are consumed by the majority of the population from the wells tradictionnels, but also, the underground waters of the terminal continnental of the township of Abomey-Calavi are exploited intensely by the Society Nationnale of the Waters of Benin (SONEB) to nourish in drinking water the townships of Abomey-Calavi, of Cotonou biggest city of the country and Sèmè. The microbiological parameter follow-up (total coliforms, coliforms thermotolerants and enterrococcis) to the level of pluisieurs well and boring and to pluisieurs points different some Nokoué lake was the object of a treatment of data by the establishment of card of fecal contamination of waters natural of the region, that informs us on the quality of waters by the slant of a microbiological quality indication that calculates itself according to the method of Bovesse and Depelchin (1980). The survey of the microbiological contamination indication, succeeds to the establishment of seasonal cards of quality of waters. The organic pollution represents a serious problem for the environment because of the dismissals poured in the rivers. The worn-out waters domesticated and non-purified represent the main source of organic pollution of waters. Followed it of analysis in the different points of observation made the object of a treatment of data by the establishment of a card of organic pollution of waters natural of the region, that informs us on the influence of the dismissals and the quality of waters by the slant of an organic pollution indication that himself calculation according to the method of Leclercq, Maquet (1987) whose principle is to distribute the values of the polluting elements in 05 classes, to determine from his own measures, the number class correspondent for every parameter to make the average of it. The interpretation of the card representing the different parameters of organic pollution of the natural waters gives some results on the contamination or no of these waters. The card shows that the different natural waters in the region of Abomey-Calavi pass a quality to another.*

KEYWORDS: Resources in Water, Microbiological Contamination, Organic Pollution Indication, Card of Pollution, Human Health.

INTRODUCTION

Pollution represents a serious problem for the environment because of the dismissals poured in the rivers (Derradji and al, 2007). The worn-out waters domesticate non purified represent the main source of organic pollution of waters (El Mostafa, 2006; Bahroun, 2011). They generate a deterioration of the quality of the surface waters and underground. The township of Abomey-Calavi doesn't have a system of treatment of the worn-out waters. The worn-out waters are poured directly in the nature without no treatment. The load of these dismissals is more and more increasing with the socioeconomic development of the region.

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The bad microbiological quality of water can be misled by activities anthropiques or by natural phenomena. In particular, the fecal contamination plays an important role in the microbiological deterioration of the underground waters and the waters of surface. Indeed, a gram of excreted includes a million to one billion of coliforms thermotolerants and hundred one thousand to 100 millions intestinal enterococcis. The tightness of the latrines and the septic pits being badly assured, there is percolation of the liquids in the surrounding soil, in the waters of surface and the underground waters. In the present survey, one intends to study the bacteriological quality of the waters of well, of the waters of boring and the waters of the Nokoué lake, because these last are currently in a serious state and constitute this fact a serious danger for the public health and a source of permanent contamination of the environment. In the departments of the survey region, during the season of rains, several people are reached of illnesses hydriques of which the cholera provoking some deaths.

Presentation of the Survey Zone

The township of Abomey-Calavi, situated in the South part of Republic of Benin and the Department of the Atlantic, is limited at the North by the township of Zè, to the South by the Atlantic Ocean, to the East by the townships of Sô-Ava and Cotonou and to the west by the townships of Tori-Bossito and Ouidah. It is the vast township of the department of the Atlantic of which it occupies more than 20% of the surface. It spreads on a surface of 536km² representative 0.48% the national surface of the common Bénin.La of Abomey-Calavi is very close to the biggest plan of water Beninese lagunaire: The Nokoué lake. Indeed, Long of 20km (East-west) and large of 11km (North - South), the Nokoué lake has a surface of étiage of about 160km^2 and represent the largest plan of water Beninese and most important lagunaire of the point of view of his/her/its planning because of his/her/its proximity with the city of Cotonou. The Nokoué lake influences the underground water pollution considerably close to him (HOUNSINOU, 2012). The township of Abomey-Calavi counts sixty ten (70) villages and districts of cities distributed on nine (09) precincts that are: Calavi - Centre, Godomey, Akassato, Zinvié, Ouèdo, Togba, Hêvié, Kpanroun and Golo-Djigbé.

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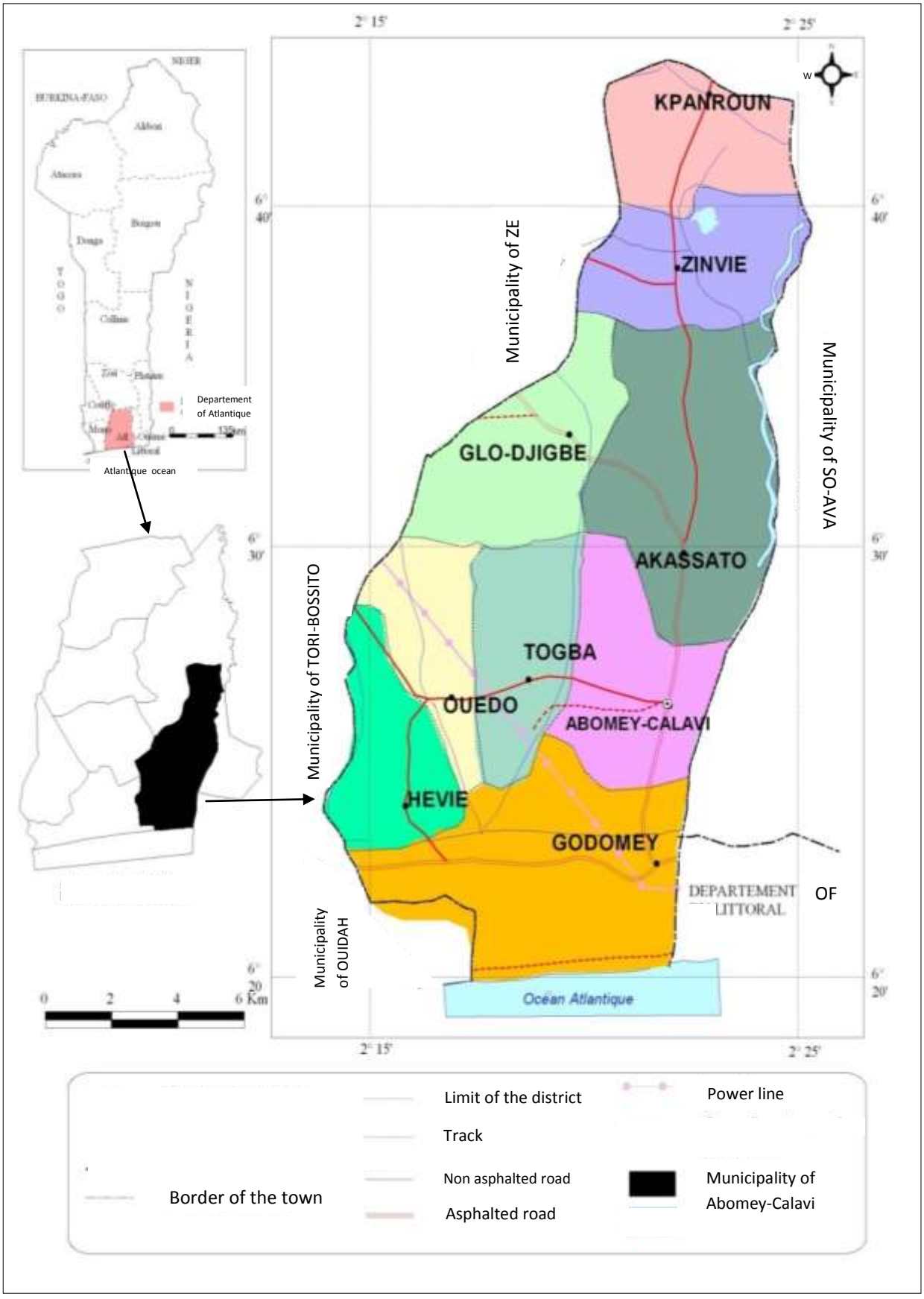

Pic 1: Location of the municipality of Abomey-Calavi

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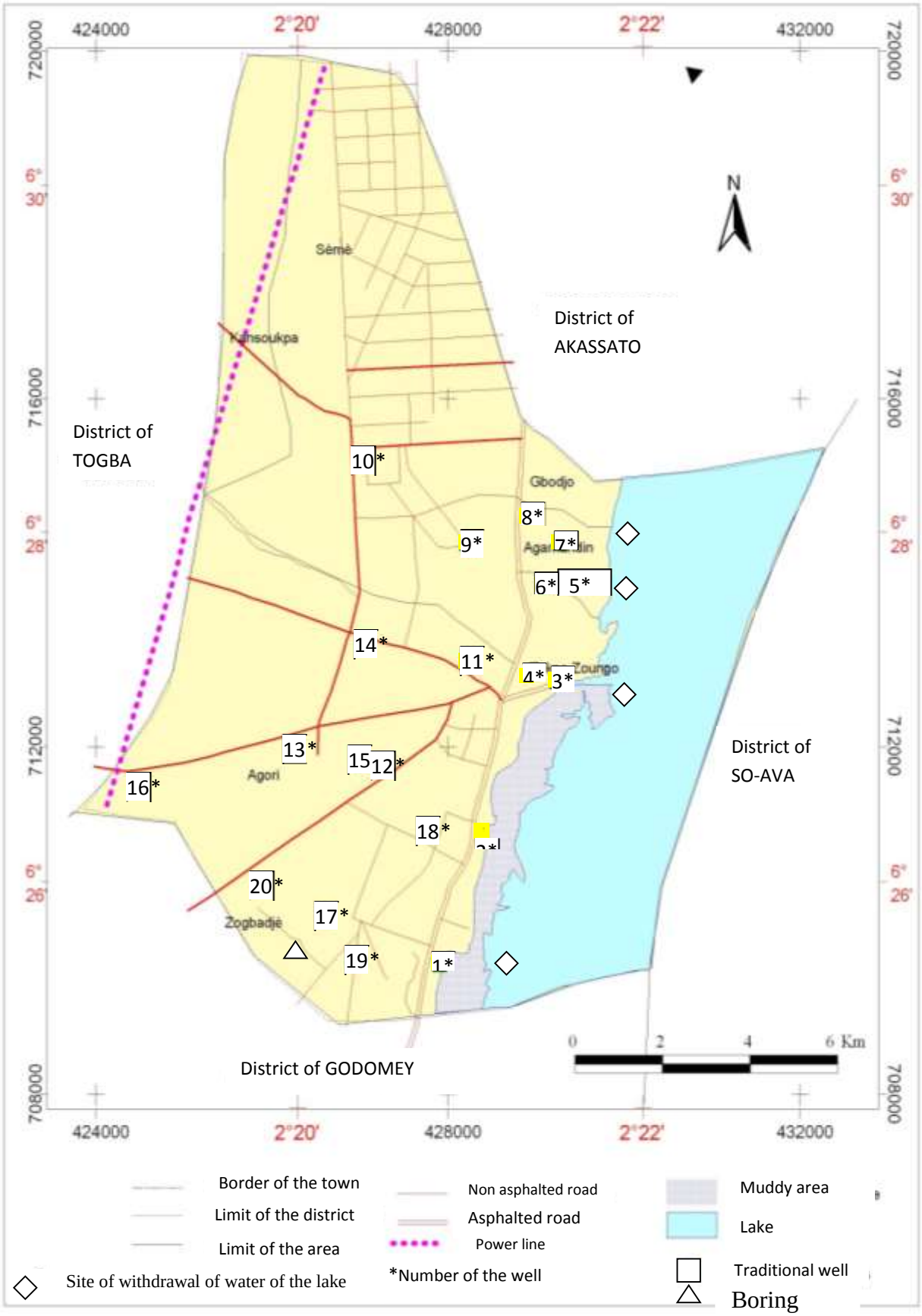

Picture 2 : Water sampling sites

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MATERIALS AND METHOD

Material

Twenty five points of withdrawal of which twenty sites of sampling of water of well tradictionnels, a site of sampling of boring water and four sites of sampling of water of the Nokoué lake are chosen. Our survey was based on four countries of measures achieved then during the big and the small season of rains the big and the small dry season of the year 2013.

Methods

The method of treatment of microbiological data is based on the Microbiological Quality indication (IQM). The IQM depends on the concentrations in water the total coliforms, the coliformes thermotolerants and the intestinal enterrococcis. One definite 5 classes of concentrations for each of these parameters. The IQM is the average of the numbers of the classes of every parameter. The values of the IQMS permit to distribute the microbiological pollutions of waters in 5 classes of quality correspondent to colors standards.

The approach of interpretation of the data on the organic pollution is based on the calculation of the Organic Pollution indication (IPO). The IPO depends on contents of water in ions ammonium, in nitrite and in orthophosphate and the DBO_5. One definite 5 classes of contents for each of these parameters. The IPO is the average of the numbers of the classes of every parameter. The values of the IPO permit to distribute the organic pollutions of waters in 5 levels. The classification of the organic parameters makes itself according to five classes of quality corresponding to the generally admitted colors.

Table n°1: Classes of microbiological quality corresponding to every parameters.

	Total Coliforms / mL	Coliforms thermotolerants /mL	Intestinal enterococccis/mL
Class 5	<2,000	<100	<5
Class 4	2,000-9,000	100-500	5-10
Class 3	9,000-45,000	500-2,500	10-50
Class 2	450,00-360,000	2,500-20,000	50-500
Class 1	>360,000	>20,000	>500

Table n°2: Level of microbiological pollution of waters according to the Microbiological Contamination indication (IQM).

IQM	Level of microbiological pollution
4.3-5.0	Very weak (hopeless)
3.5-4.2	Weak
2.7-3.4	Moderate
1.9-2.6	Strong
1.0-1.8	Very strong

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Table n°3: Classes of contents for each of organic pollution parameters.

	DBO_5 (mg O_2/L)	NH_4^+ (mg N/L)	NO_2^- (µg O_2/L)	PO_4^{3-} (µg P/L)
Class 5	<2	<0.1	<5	<15
Class 4	2-5	0.1-0.9	6-10	16-75
Class 3	5.1-10	1.0-2.4	11-50	76-250
Class 2	10.1-15	2.5-6.0	51-150	251-900
Class 1	>15	>6	>150	>900

Table n° 4: Level of organic pollution of waters according to the Organic Pollution indication.

IPO	IPO Level of organic pollution
5.0 à 4.6	Very weak organic pollution (hopeless)
4.5 to 4.0	Weak organic pollution.
3.9 to 3.0	Organic pollution curbed
2.9 to2.0	Strong organic pollution.
1.9 to 1.0	Very strong organic pollution.

Picture 3: Color according to the classes of microbiological and organic pollution.

Results and Discussions

Followed it of analysis following the different points of withdrawal permitted to calculate the natural indications of microbiological quality and indications of organic pollution of waters of the township of Abomey-Calavi.

Table 5: Seasonal variation of the microbiological quality Indications (IQM) and Organic pollution indication (IPO) of the sampled waters.

Nature of water sample	Points of withdrawals	Microbiological quality indication (IQM)		Organic pollution indication (IPO)
		Season dries	Saison of rains	
Water of surface (Lake Nokoué)	L_1	2.6	3	1
	L_2	1.3	1.6	1
	L_3	1.3	1.6	1
	L_4	2	2.3	1
	P_1	4.3	3.6	3.25
	P_2	3.6	3	2.9

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Water of traditional well	P_3	3	2.3	2.3
	P_4	3	2.3	2.6
	P_5	3.6	3	2.5
	P_6	4	3.3	2.7
	P_7	3.6	3	2.65
	P_8	4.3	3.6	2.9
	P_9	5	4.6	3
	P_{10}	5	5	3.2
	P_{11}	5	4.3	3.25
	P_{12}	4.3	3.6	3.75
	P_{13}	4.3	3.6	3.8
	P_{14}	5	4.6	3.75
	P_{15}	5	4.3	3.5
	P_{16}	4.6	4	3.9
	P_{17}	5	5	3.65
	P_{18}	4.3	3.6	3.5
	P_{19}	4	3	3.75
	P_{20}	4.3	3.6	3.8
Water of boring	F	4	3.6	4.25

The interpretation of the seasonal cards of indication of microbiological quality of the natural waters (The waters of the Nokoué lake, well tradictionnels and boring) indicates the degree of change of the waters of the survey region. One notes that waters pass a good quality with strong indications (4 <IQM <5) to a mediocre quality (1 <IQM <2). In the region of survey, when one passes from the dry season at the season of rains, one notes in general that the microbiological underground water quality deteriorates whereas the one of the waters of the Nokoué lake improves.

During the season of rains has a dillution of the waters of the Nokoué lake that has a better microbiological quality then that in dry season.

The septic pits and the latrines of the survey zone are not insulated. During the seasons of rains, the waters of infiltrations encourage the underground water pollution (waters of well and boring) by the septic pits and the latrines. The quality of the underground waters of the survey region deteriorates more then in seasons of rains that in dry season.

The interpretation of the card of indication of organic pollution of the natural waters indicates the degree of change of the waters of the survey region. All the samples of water of the Nokoué lake analyzed have a very strong level of organic pollution (IPO = 1). The assessment of the pollution of the underground waters by the IPO shows a contamination by the waters of surface polluted. However the degree of pollution remains least by contribution to the waters of surface because of the underground tablecloth power that self purifies water.

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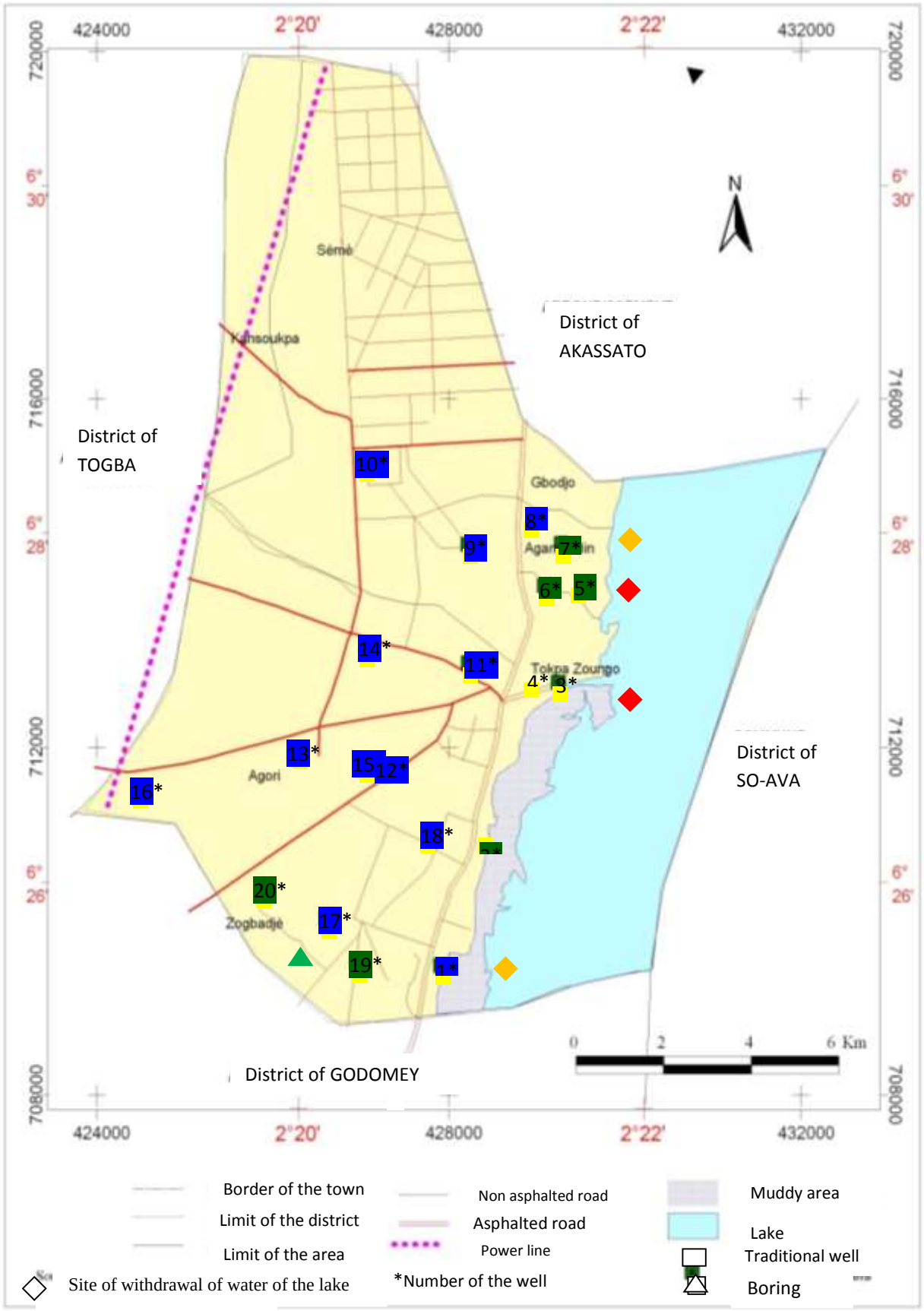

Picture 4:Card of distribution of indication of bacteriological contamination of the survey zone during the dry seasons.

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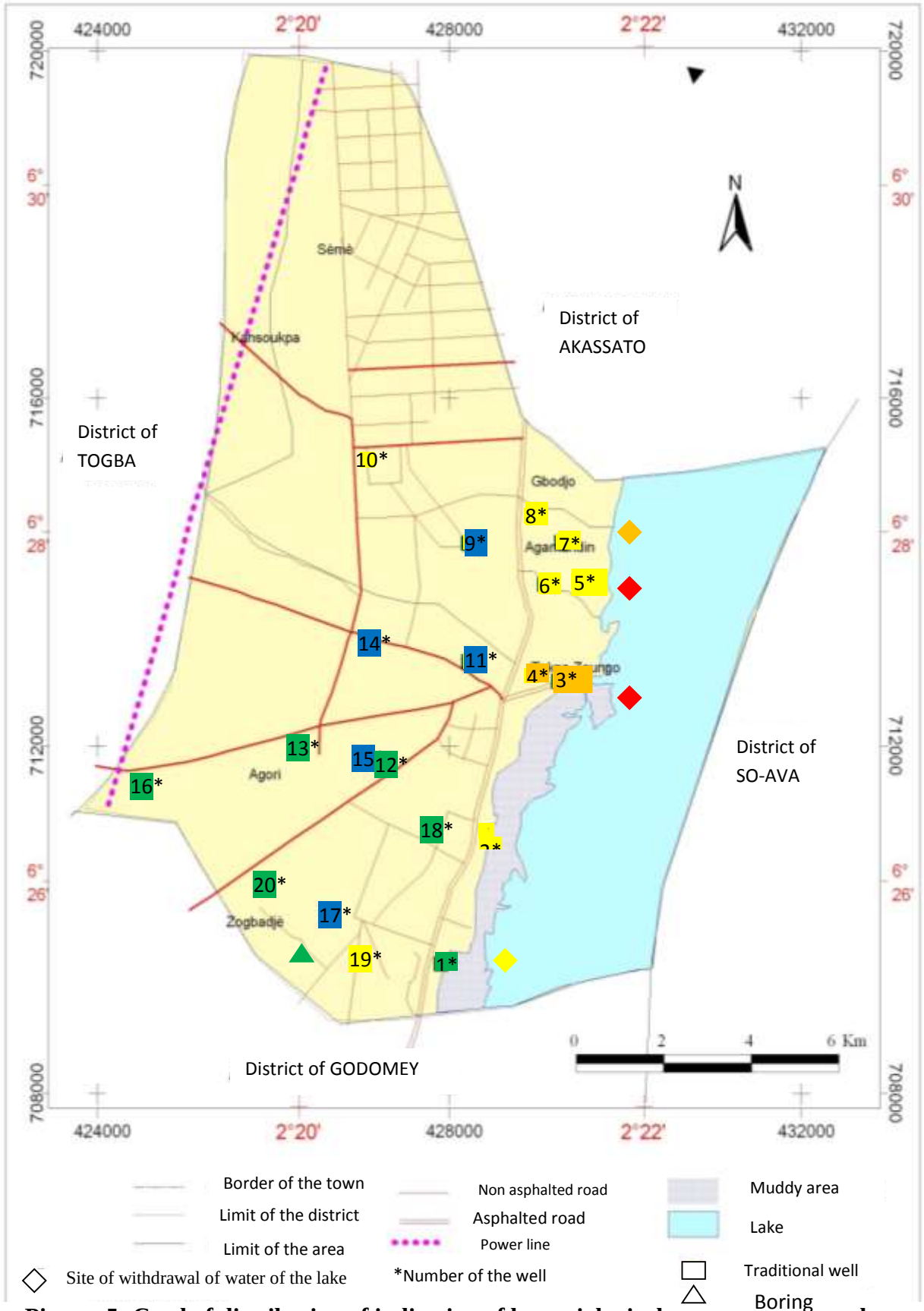

Picture 5: Card of distribution of indication of bacteriological contamination of the survey zone during the seasons of rains.

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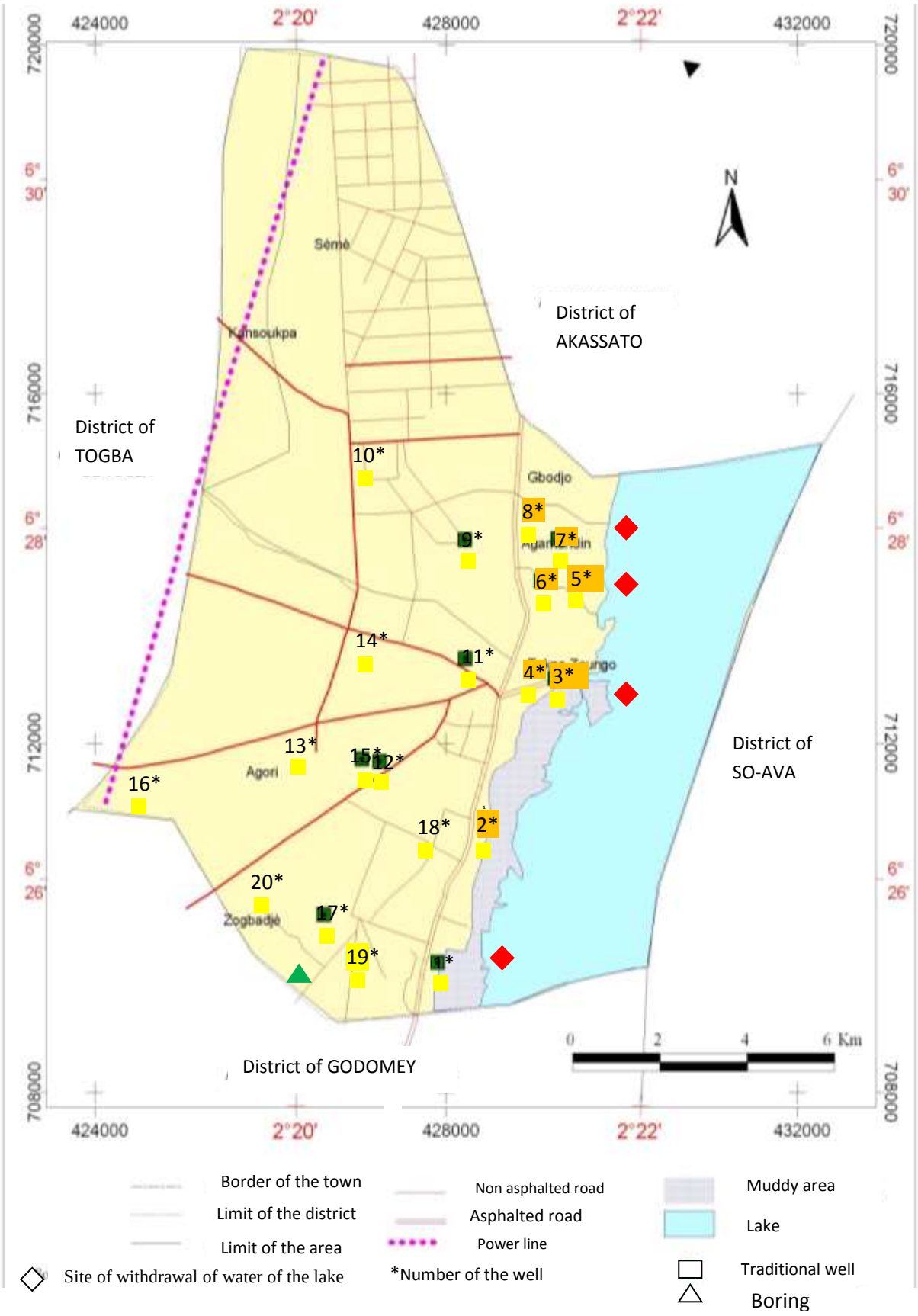

Picture 6: Organic pollution indication card (IPO) of the natural waters in the township of the survey zone.

ISSN 2055-0111(Print), ISSN 2055-012X(Online)

CONCLUSION

In conclusion, it is evident from the present survey that the variation of the bacteriological quality of the natural waters is bound to the precipitations. To shortcoming these cards one can say that the seasonal variation is not very clean for touts the different sites of withdrawal. The results of the analysis of waters permit to conclude that waters of the Nokoué lake have a better microbiological quality in season of the rains parceque they are dilluées by the waters of rains while the microbiological underground water quality deteriorates in season of rains because the waters of infiltrations encourage the underground water pollution by the septic pits and the latrines that are not insulated in the region of survey. However, the population of the survey region essentially consumes the underground waters. It justifies the fact that, during the seasons of rain, in the region of survey pluisieurs people are reached of illnesses hydriques of which the cholérat provoking some deaths.

The degree of the organic pollution varies from a zone to the other with contents that sometimes pass those that recommends the WHO. Water, by its elevated solvent power, dissolves the substances rejected by the human activity. The chemical pollutants are numerous, various and most harmful origins are the compounds of nitrogen as the nitrites, provoking serious unrests at the young vertebrates by deterioration of the blood hemoglobin and by the poisonous méthaemo-globine production (méthaémoglobinaemie of the infants). They can provoke hypertension and can be the precursors of carcinogenic nitrosamines (Castany, 1982). The assessment of the pollution of the underground waters by the IPO shows a contamination by the waters of surface polluted. However the degree of pollution remains least by contribution to the waters of surface because of the underground tablecloth power autoépurateur.

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