

Full Length Research Paper

Water supply, sanitation and health risks in Douala, Cameroon

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With a view to contribute to the hygiene condition and improvement in the urban zones of Cameroon, a survey was carried out in March 2007 among 1400 households with respect to the water supply, sanitation and health risks in seven quarters of spontaneous habitat of Douala town. It results from this study that the majority of participants were married (76%). The populations are supplied with of water especially by CAMWATER network (49% of households) and wells (50% of households). The majority of participants evacuate solid waste in public refuse vats (56% of households). Household's wastewater is especially discharged around the houses (21% of households) and in rivers (20% of households). The companies present in the quarters discharge their wastewater in the drains. 52% of households deposit their excrements in latrines. We noticed in these quarters a prevalence of residences made out of hard materials (43% of households). Cholera (88.5% of households), Diarrhoea (70% of households), Dysenteries (74% of households), Typhoid fever (72% of households), Malaria (32% of households) and skin diseases (76% of households) were the most frequent diseases. These results highlight problems for which, it would firstly be necessary to attack in the research of the improvement strategies for hygiene conditions in the populations of an urban environment.

Key words: Environment, sanitation, water, diseases, Douala.

INTRODUCTION

The demographic growth of Cameroon was very slow until 1960, when it abruptly accelerated (Kueté et al., 1991). The population, estimated at 4.8 million in 1958, the day before independence, was evaluated in 1991 to 12 239 000 inhabitants (given an increase of 155%) (FNUAP, 1994). The annual average rate of increase passed from 1.31% for the period between 1951 to 1960 to 3.57% between 1961 and 1970, 4.13% between 1971 and 1981 to reach 4.54% between 1981 and 1991. Experts foresee for 2010, a population of 23 665 000 inhabitants (Kuété et al., 1991). This increase in population amplified poverty and rural migration (FNUAP,

1994; Honga-Makanda et al., 2003). The rural migration, whose poverty and search for employment are precursor, constitutes the principal cause of the overpopulation in urban zones (Sadik, 1992). Being extremely widespread in the towns of tropical Africa, poverty puts the populations affected under precarious living conditions (Honga- Makanda et al., 2003).

According to Sadik (1994), urban gigantism increases the needs as regards housing, water, hygiene, energy, health care, educations, social services, food and the difficulties of sustainable sanitation. Rivers, spring and wells represent the major sources of water supply to the human and animal populations in the tropical zones and their pollution constitute a serious health risks (Djuikom et al., 2006). Inadequate supply of water has been identified as one of the central causes of poverty in developing countries as it affects their basic needs, health, food

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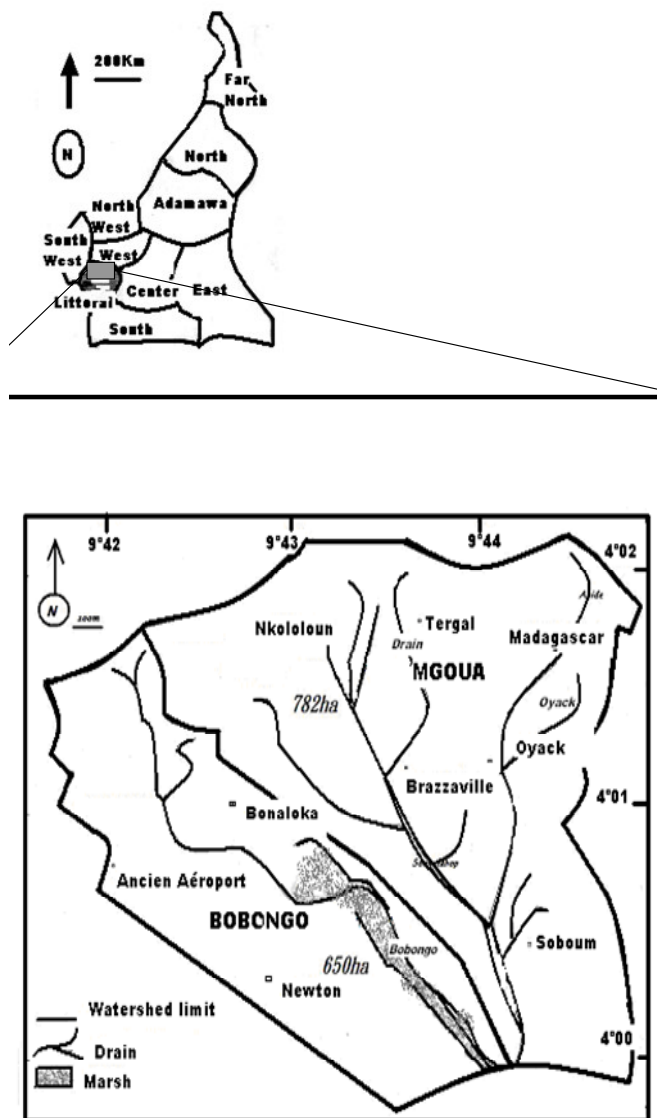


Figure 1. Localization the studied quarters in Douala town.

security and basic livelihoods (Katte et al., 2003). WHO estimates that 80% of diseases affecting the population of the planet are directly or indirectly related to water (Honga-Makanda et al., 2003). Fonteh (Katte et al., 2003) estimates that water-related diseases account for about two-thirds of all recorded diseases in Cameroon and are responsible for about 50% of the reported cases of death. The extent of the problem of the industrial emissions or domestic hearths, waste water and the urban refuses increased (Ramade, 1974; Kebiche et al., 1999). Surface or ground water contaminations by pathogenic bacteria and fermentable substances contained in the effluents and the refuses of domestic origin are noted (Fonkou, 1996; Ngnikam, 2000; Davis et al., 2005; Djuikom et al., 2006).

About 3.8 million Cameroonians, lack access to adequate sanitation (Katte et al., 2003). Sanitation in the Afri-

can cities (60 - 95%) is generally dominated by the autonomous systems (SAA) (WC + septic tanks, latrines, etc.) (Coulibaly et al., 2004). None of the major cities in Cameroon has a central sewage treatment plant and the few plants that have been constructed for some housing estates have all been abandoned, thereby allowing untreated sewage to flow into the environment (Katte et al., 2003). The effluents of the SAA are rich in coliforms and fecal, helminths, virus, protozoa and in various chemical and physical pollutants (Coulibaly et al., 2004). The intrusion of these fecal effluents in the aquifers or distribution water can generate various diarrheal diseases in the human population and contribute for a great part in deterioration of public health (Coulibaly et al., 2004).

According to the FNUAP (1992), the governments should take suitable measures to evaluate the consequences of the growth and geographical distribution of the population on the environment, and must act as consequence. From where the importance of this works undertaken in urban environment and whose objectives are to establish the portrait of the precarious quarters of the Douala town with regards to:

- i.) The types and the sites of construction of the habitat.
- ii.) The water supply mode.
- iii.) The refuse evacuation mode in the households.
- iv.) The typology of the sites of deposit of excrement.
- v.) The frequency of water – borne diseases.

The prospect being to draw the attention of governments of developing countries to the urgent questions of environment.

MATERIAL AND METHODS

Site of study

The study was carried out in seven quarters of Ngoua and Bobongo basins slopes of Douala town (Cameroon) (Figure 1), an urban zone of approximately 18 km² of surface, limited by 3° and 5° North latitude and 9° and 11° East of longitude (Figure 1). Douala town, whose average temperature is 26.4°C has a hyper humid equatorial climate (Cameroonian type) with a single long rain season (unimodal type), particularly abundant and presenting local nuances moderated by the breeze of sea (Bruneau, 1999). The dry season extends from December to February and the rainy season from March to August. Douala receives approximately 4000 mm of water per annum. All the landscape, very degraded by the anthropization is that of the equatorial ever green humid forest. This vegetation is supported by costal alluvial grounds (Westphall et al., 1981). Douala population is evaluated with approximately 2,000,000 inhabitants in which the autochthons are represented by Doualas (approximately 140,000 people), Bassa and Bakoko (approximately 260,000 individuals) (Westphall et al., 1981). The rise of the economic capital of Cameroon (Douala) is marked by the development of the plantations (palm plantation), the forestry development, the harbour activities and industrialization (Westphall et al., 1981). The coastal area of the South, starting from Douala is dominated by Cassava, Cocoyam and plantain. Fishing is an intense activity (Westphall et al., 1981). Within the framework of this

Table 1. Household answers (%) about the site of construction of the habitats in 7 quarters of the town of Douala

Quarters sites	Newtown Airport	Bonaloka	Brazzaville	Madagascar	Oyack	Soboum	Tergal	Means
Slope of the hill	0.00	2.05	15.23	20.60	20.00	1.49	5.53	3.29
Low bottom	0.00	61.54	53.81	25.00	46.00	55.94	0.00	34.58
Marshes	96.46	2.56	28.43	54.50	28.00	6.44	0.50	30.98

N = 1400 households, 200 per quarter.

work the investigations proceeded in seven quarters: Newtown-airport, Bonaloka, Brazzaville, Madagascar, Oyack, Soboum and Tergal.

Data-gathering

Data was obtained in seven quarters of Douala (Figure 1) in March 2007 using the rapid participative appraisal research methods. The 1400 households (200 per quarters) were randomly selected in each quarter and were interviewed individually with the use of a questionnaire. The questionnaire contains 22 questions, regrouped in seven parts relating to:

- i.) Marital status.
- ii.) Water supply.
- iii.) Household refuse.
- iv.) The migrations of the head of household.
- v.) The site of habitat construction.
- vi.) The types of ease and defecation.
- vii.) Health risks.

In this questionnaire, we used opened-ended and close-ended questions. Each participant was subjected to an interview of approximately 30 to 45 min and was asked to talk about the marital status, the water supply sites and difficulties, site of evacuation of the household refuse, site of waste water drainage, place and province of birth, localization of habitat, presence of mosquitoes in the quarter, mosquitoes control, the site of evacuation of faecal matter, health risks (malaria, diarrhoeas, cholera, typhoid fever, amoebic dysenteric, skin diseases). The questions were asked in local language and/or French.

Statistical analysis

Frequencies were calculated by 'proc freq' procedure of the software SAS (Statistical Analysis System) version 9.1. The average comparison was done with the H-test of Kruskal-Wallis using the 'Non parametric One Way' procedure (NPAR1WAY WILCOXON). All probabilities were appreciated at 5% confidence level.

RESULTS

Origin of participants', matrimonial status and number of people per household

In the studied quarters, participants were originated from Far-North, North, Centre, South, East, North-Western, South-Western and Littoral provinces. None of them was

originating from the Adamaoua province. The West province was the most represented (48%), followed by Centre (15%) and Littoral (14%). However, in Bonaloka, the participant's autochthons of the Littoral (24%) were as many as those from the West province (23%). Most of participants were married (76%). They were especially the participants living in Newtown-Airport (90%) and Oyack (89%). The lowest rates were noticed in Brazzaville (63% of participants) and Madagascar (62% of participants).

The number of individuals per household varied from one to 24 with an average of 5.51 ± 3.02 individuals. The number of individual per household was greater in Oyack ($p < 0.0001$) (on average 6.48 ± 3.08 individuals); the lowest values were noticed in Tergal (on average 4.58 ± 2.22 individuals).

Typology of the habitat in the studied quarters

In general, 35 and 31% of housing were respectively located in low ground and marshes. Few houses were located on the slopes of hills (3%) (Table 1). The majority of houses of Newtown-Airport (97% of households), of Madagascar (55% of households) were located in the marshes, while in Bonaloka (62% of households), Brazzaville (54% of households), Oyack (46% of households) and Soboum (56% of households) the majority were in low ground (Table 1).

In these various sites, the houses were built in hard, semi-hard, board and carabote materials (Table 2). We especially noticed a prevalence of houses built with hard materials (43% of households) (Table 2). They were followed by board houses (32% of households); then by semi-hard materials houses (13% of households) and carabote houses (10% of households). However, in Newtown-Airport (46% of households) and in Madagascar (64% of households) the houses in boards prevail (Table 2).

Water supply in the studied quarters

In the study site, 50% of households used water from wells and 49% (of households) from Cameroon National Water Company (CAMWATER) distribution network (Fi-

Table 2. Household answers (%) about the structure of the habitat in 7 quarters of the town of Douala.

Habitat structure	Newtown Airport	Bonaloka	Brazzaville	Madagascar	Oyack	Soboum	Tergal	Means
Carabote	6.57	5.15	15.74	13.00	12.00	16.83	2.01	10.22
Hard materials	21.21	64.43	36.22	11.50	58.00	47.52	62.81	43.05
Board	45.45	21.23	26.90	63.50	11.00	27.36	28.14	31.97
Semi-hard materials	26.77	7.22	18.27	11.50	19.00	5.94	5.03	13.28

N = 1400 households, 200 per quarter

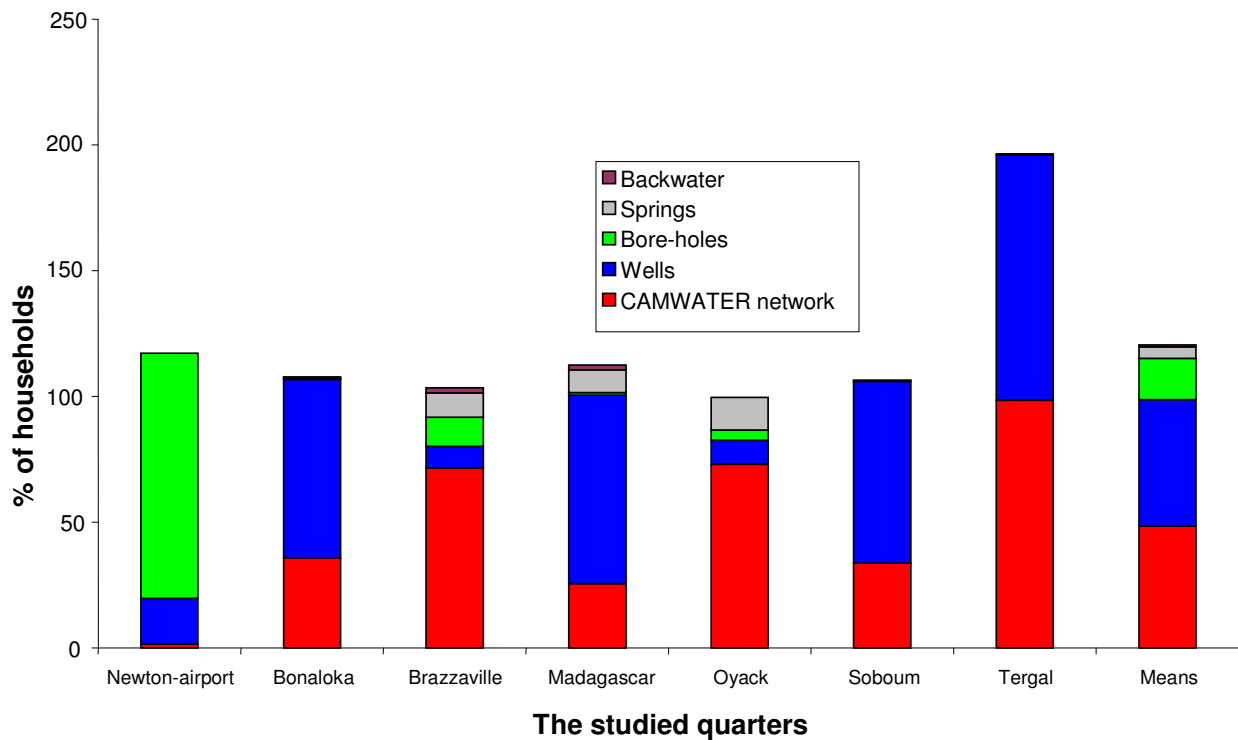


Figure 2. Household answers (%) about water supply in 7 quarters of the town of Douala.

Figure 2). 16% only used bore-holes. A very small proportion supply used springs (5% of households) and in backwaters (1% of households) (Figure 2). However, bore-holes (98% of households) were the most used source of water supply in Newtown-Airport. Springs were not used in Newtown-airport and Bonaloka. It was the same for the Backwaters in Oyack, Soboum and Tergal and for bore-holes in Soboum and Tergal.

Evacuation of domestic waste in the studied quarters

56% of households disposed their refuse in public refuse vat. A weak proportion used pits (17%), opened air (13%) and farms (15%). Waste water was especially discharged around houses (21%) and in the yards (20%). A small

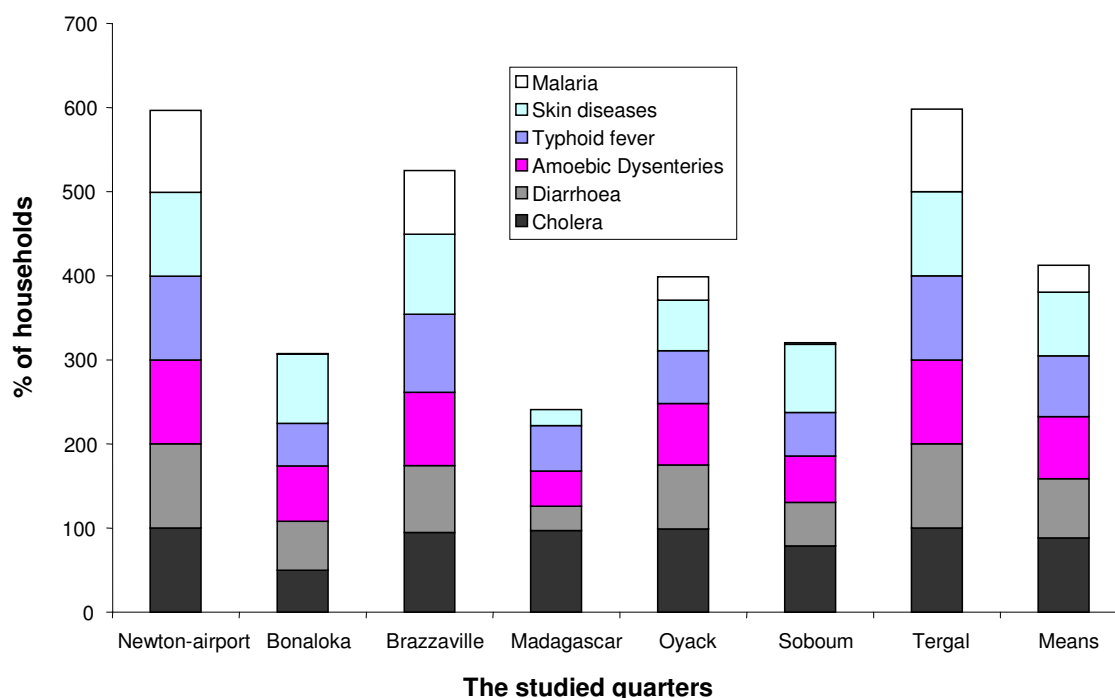
proportion made use of modern WC (6%) and drains (9%). Only 12% of participants recognize the existence of companies (Hospitals, Nettoycam, Soap factories, Gasoline stations) in the quarters. These companies in general empty their waster water in drains (30%) and some times in channels (5%), pits (6%) and in opened air (0.1%).

52% of the participants deposit their excrements in non-returnable latrines (Table 3). However, in quarters such as Bonaloka (69%), Madagascar (56%) and Soboum (58%), populations mostly use the Pile Water close (WC). Very few households have WC with water systems. In this city, the practices related to the deposition of excrements in the neighbourhoods of houses (0.4%) and in water pipelines (4%) are less used. The deposition of excrements in the neighbourhoods of

Table 3. Household answers (%) about Site of evacuation of excrements in 7 quarters of the town of Douala.

Site of evacuation of excrements	Newtown Airport	Bonaloka	Brazzaville	Madagascar	Oyack	Soboum	Tergal	Means
Around houses	0.51	0.00	0.51	1.00	0.00	0.50	0.00	0.36
Water pipelines	0.51	1.55	4.59	19.00	1.50	1.49	0.50	4.18
Latrine	65.15	11.86	71.07	19.50	80.00	34.16	83.92	52.30
W-C on piles	0.51	12.37	11.68	6.50	17.00	5.45	11.06	9.21
W-C with water hunting	31.31	69.07	11.68	55.50	1.00	57.92	0.00	32.30

N = 1400 households, 200 per quarter

**Figure 3.** Household answers (%) about main diseases of 7 quarters of the town of Douala.

houses was non-existent in Bonaloka, Oyack and Tergal. In these quarters, the WC was located between 5 and 10 m away from houses (Table 3).

Health risks in the studied quarters

In the majority of the households, habitants were victims of Cholera (88.5%), Diarrhoea (70%), Dysenteries (74%), Typhoid fever (72%), Malaria (32%) and skin diseases (76%) (Figure 3). In Madagascar, diarrhoeas (29%), Amoebic dysenteries (42%) and skin diseases (19%) were far from present. It was the same for malaria in Bonaloka (1%) and Soboum (2%) (Figure 3). Populations contract these diseases at a frequency lower or equal to 2 years. Most of households announce the pre-

sence of mosquitoes (91%) in their quarter and were protected to 71% with mosquito nets (mechanical fight) (Table 4). A small proportion of inhabitants practice chemical fight (insecticidal) (30%). This proportion was greater in Newtown-Airport (53%) (Table 4).

DISCUSSION

Origin of participants, matrimonial status and number of people per household

The study showed that the number of individuals per household was high (on average 6). This average is close to the average number of children per African family which is one of the highest in the world (FNUAP,

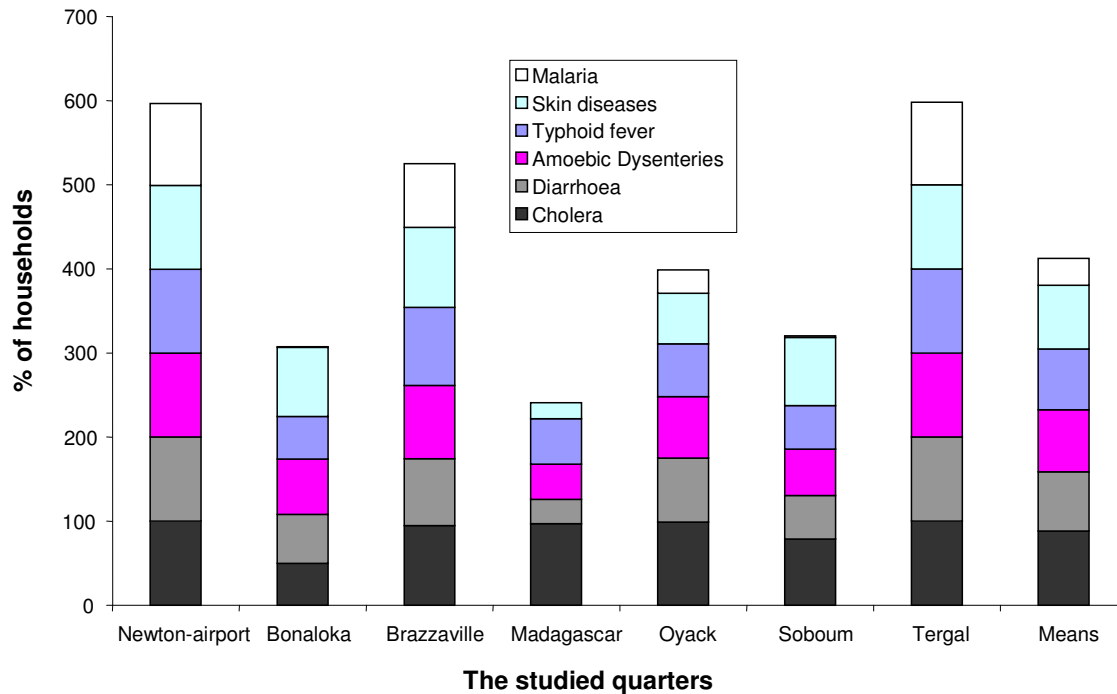


Figure 3. Household answers (%) about mains diseases of 7 quarters of the town of Douala.

Table 4. Household answers (%) about presence of mosquitoes and mains control means in 7 quarters of the town of Douala.

Mosquitoes presence and mains control means	Newton Airport	Bonaloka	Brazzaville	Madagascar	Oyack	Soboum	Tergal	Means
Mosquitoes presence	95.96	91.24	76.14	97.50	91.50	88.61	92.96	91.15
Chemical control (Insecticide)	52.53	29.23	29.44	24.50	30.50	31.34	12.56	30
Physical control (mosquito nets)	86.36	77.44	54.31	73.00	60.00	70.79	75.38	71.33

N = 1400 households, 200 per quarter

1992, 1994). This high average highlights the popular character of the studied quarters and the unquestionable absence of the respect of the standards of family planning recommended by the United Nation Fund for Population (UNFPA/FNUAP) (Kuate et al., 1991). Indeed, with 41 per thousand, Cameroon presents one of the highest birth rates of the world and 2% only of the population practise family planning (Sadik, 1992).

In our study, the participants in majority originate from the West province of Cameroon. This is explained by the fact that this province (with the highest populations density of Cameroon), exerts a strong pressure on neighbouring provinces such as littoral (Kuate et al., 1991). Bamilekes (people of the Western province) are for the majority, traders who seek new sites for expansion of their trade. The low representativeness of Douala native inhabitant could be related to their status of minority.

Quarters such as Bonaloka would represent one of the hearts of concentration of the Douala native in their city-village. Thus, national campaigns of sensitization of populations as regards the strategy of urbanization and family planning which will take note of Bamilekes in Douala would likely succeed.

Typology of the habitat

The study showed that, in the studied quarters, residences are built in risks zones. The structure of the habitat and the sites of construction can be a criterion of classification of quarters. The fact that the majority of houses are built in low ground and in marshes indicates that populations do not respect the standards of construction, certainly because of the residual state of

poverty of households (Sadik, 1992). However, quarters of low ground such as Bonaloka, Oyack and Soboum in which we notice a prevalence of houses built in cement blocks (Table 1) would regroup populations with incomes higher than those of the marshy quarters such as Newtown-Airport and Madagascar (Table 2) in which houses built in ply-wood are prevalent. The study also showed that the level of the built framework is less diversified in Douala. The absence of the beaten ground houses (present in the provinces: Centre, South, West and East) is explained by the structure of the grounds of Littoral. Indeed, Douala is consisted of the yellow hydromorphic grounds with Gley belonging to the group of grounds of marshes rich in organic matter (Abata, 2000). They are grounds of the hydromorphic type, little or not consolidated and which have variable textures according to the conditions under which occurred the deposits: superposition or juxtaposition of sandy or gravel lenses (Boye et al., 1975). These grounds are very different from the ferralitic grounds of Yaounde. In general, it is the high cost of life in the large African metropolises which lead populations with modest incomes to live in non-developed sites (Coulibaly et al., 2004).

Supply of water and its constraints

The National Company of Water of Cameroon which is actually namely 'CAMWATER' is the single mass distribution firm of reliable drinking water in Cameroon. The rates of access to drinking water recorded in this study (49%) are close to the national rate estimated at 44% by the FNUAP (1992). This accessibility of populations to water provided by 'CAMWATER' translates the efforts of the authorities in the promotion of sanitation, healthiness and development (Coulibaly et al., 2004). In fact, the access to water of the 'CAMWATER' increased since the period of independence in Cameroon. This results on the one hand, from efforts of establishment of places of drinking water supply in quarter (personal subscription, paying fountains), and on the other hand, by the sensitization of the population to the importance of the use of the latter (Coulibaly et al., 2004). However, the high rate of provisioning also noticed with respect to water of wells shows that the rate / rhythm of subscription to the CAMWATER network is still slow in Douala town compared to Abidjan (Coulibaly et al., 2004) in Ivory Coast. This situation would be related to the state of poverty of populations and the fact that, extensions of the network do not follow the rate of urbanization (Katte et al., 2003). The differences noted between quarters with respect to the sites of water supply and the level of access to water could be explained by differences of incomes and schooling. In fact, Bonaloka (70.77%), Madagascar (75%) and Soboum (72.28%) in which wells are solicited are also the popular quarters and the poor-

est of the city. The level of access to drinking water increases with the income, the standard of living and the increase in the infrastructures of development.

Evacuation of domestic waste in the town of Douala

The study revealed a strong use of public refuse vats in Douala town. This situation translates the success of campaigns carried out by authorities and sanitation and healthiness Company of Cameroon (HYSACAM) since independences. We notice a poor management of human excrements and water used for domestic needs. Indeed, in the studied quarters waste water is especially evacuated around houses and in the yards. This poor management of waste water also noted by Whété et al. (2003) in Yaoundé and Katte et al. (2003) in Dschang would be a general problem at all the cities of Cameroon. This can be due to the ignorance of the consequences by populations and to the fact that there exist no national policy of follow-up of environmental impacts of the activities of households and companies (Katte et al., 2003; Manga et al., 2008). The same reasons could also explain the fact that the industrial companies pour their water in the drains. This situation is all more serious for much polluted, untreated wastewater from hospitals flows into nearby streams where the population uses the water for domestic and agricultural purposes (Katte et al., 2003). The weak presence of WC with water systems and the high presence of the latrines in the studied quarters could be related to the low level of connection of households to CAMWATER network which would also linked to the high amount of the expenses of connection in CAMWATER network. Similar conclusions were drawn by Coulibaly et al. (2004) for the precarious quarters of Abidjan in Ivory Coast.

In general, the high utilization of autonomous Systems of sanitation (WC + septic tanks, latrines, etc.) noted in the studied quarters is typical of developing countries. In fact, in these countries, the establishment of the draining systems is very expensive (communities with low incomes) (Coulibaly et al., 2004). It is significant to note that the defecation in nature is very weak in the studied quarters compared to the results of Coulibaly (2004) in Abidjan in Ivory Coast where this kind of practice is increased.

Health risks in the households studied quarters

The study shows a permanent presence of water-borne diseases such as Cholera, Diarrhoeas, Dysenteries, Typhoid fevers, skin diseases and malaria within populations of precarious quarters of Douala. Similar results were noted by Wéthé et al. (2003) in Yaoundé and in Dschang (Katte et al., 2003) where significant sections of the population suffer from debilitating water-related

diseases. This situation which indicates a biological state of pollution of water and serious problems of public health could be related to the fact that nearly 50% of households supply themselves with water from the untreated wells, with backwaters, rivers etc. Indeed, it is in these ground and surface waters that waste of households and industries are regularly poured (Djuikom et al., 2006). It was shown that poor waste management can affect the quality of subsoil waters (David et al., 2005) and surface waters (Djuikom et al., 2006). In addition, Douala is a littoral zone in which, we notice frequent occurrence of stagnant water in quarters, just as the proximity of the lagoon with its many marshes which could be used as breeding grounds for the larvae of mosquitoes. The high rate of utilisation of mosquito nets could not only be related to a preventive strategy, but could indicate successes of the public awareness campaigns of the ministry of health by means of activities of the national programme of fight against malaria and the NGO. In all the cases, water of qualities and the poor sanitation of the area (management of the excreta, drainage of water) contribute for a great part in deterioration of public health.

Conclusion

The accelerated demographic growth of Douala town maintains poverty. In the quarters with spontaneous habitats, a good part of the population still uses water of wells. These populations discharge the waste water in drains and their excreta thanks to the autonomous systems of sanitation. The use of polluted water and the mode of evacuation of liquid and solid waste expose the populations to serious problems of public health (emergence of diseases). In a context of permanent fight against poverty, it would be significant for the authorities (1) to improve the rate of schooling, (2) to multiply the public awareness campaigns of the populations to hygiene, healthiness, the strategies of durable urbanization, (3) to encourage the CAMWATER to increase the level of distribution of water (4) to write a national policy of follow-up of environmental impacts of the households and industries wastes in Cameroon if we want to improve on the framework of life of the populations.

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