Zoological Studies **59:**31 (2020)
doi:10.6620/ZS.2020.59-31

Zoological Studies

Open Access

Checklist and Distribution of Freshwater Cladocera (Crustacea: Branchiopoda) in Côte d'Ivoire (West Africa)

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Received 6 September 2019 / Accepted 12 June 2020 / Published 20 July 2020
Communicated by Benny K.K. Chan

This study provides a checklist of cladocerans and evaluates the species richness and composition of this order in Côte d'Ivoire. A checklist of cladocerans was created by evaluating data from the literature and fauna surveys focused on zooplankton in different types of aquatic environments over the past 50 years. In total, 39 Cladocera species have been reported from Côte d'Ivoire. This richness includes 24 genera and seven families, with Chydoridae being the most diversified family (16 species, 41% of the total Cladocera diversity in Côte d'Ivoire), followed by Daphniidae (eight species, 21%); Moinidae (four species, 10%); Bosminidae, Macrothricidae, and Sidiidae (three species, 8% each); and Ilyocriptidae (two species, 5%). *Ceriodaphnia cornuta*, *Moina micrura*, and *Diaphanosoma excisum* were the most frequently encountered species.

Key words: Cladocera, Diversity, Checklist, Biogeography and Distribution, Côte d'Ivoire.

BACKGROUND

Cladocera is one of the three main groups (along with Rotifera and Copepoda) of zooplankton in freshwater ecosystems. Cladocera and Copepoda are widespread planktonic microcrustaceans that predominantly occur in freshwater (Dumont and Negrea 2002). These taxa include littoral, pelagic, and benthic species that play key roles in food webs. They have great value for fisheries and help maintain ecosystem processes (Dela Paz et al. 2018). Moreover, as they readily respond to changes in water quality, they also can be used as environmental indicators of pollution (Forró et al. 2008). Indeed, according to Parmar et al. (2016), all changes in population density, species richness, and community structure of cladocerans and copepods are mostly affected by the physico-chemical conditions of the water in which they live. In addition, these animals have an important ecological role, functioning as a link between different trophic levels, since they scrape, filter, and collect organic matter (Fryer 1968). Cladocerans have also gained certain economic importance as they are also widely used in aquaculture, and large filter-feeding planktonic species have an indirect economic impact as important fish food or phytoplankton-controlling group (Alanis et al. 2009; Bogut et al. 2010; Gogoi et al. 2016). Hence, a review of hydrobiological literature focusing on the zooplankton community components in general and on cladocerans in particular seems to be necessary to gain deeper knowledge on cladocera composition and its global diversity. Indeed, according to Martens and Behen

Citation: Etilé RN, Bédia TA, Blahoua GK, Goore Bi G, Kouamelan PE, N'Douba V. 2020. Checklist and distribution of freshwater Cladocera (Crustacea: Branchiopoda) in Côte d'Ivoire (West Africa). Zool Stud **59:**31. doi:10.6620/ZS.2020.59-31.

(1994), establishing a checklist is also important for dealing with questions regarding existing biodiversity in certains regions, lakes, countries, or continents. Global and regional management strategies make increasing use of such databases, and this tendency should be encouraged. However, it is also a primary duty of biologists to regularly update these databases and make them accessible. According to López et al. (2018), national and/or regional checklists are crucial resources for gaining basic knowledge on biodiversity, and such efforts allow a firm taxonomic basis for derived studies.

To date, cladoceran checklists with taxanomic notes have been compiled for several countries around the world: Venezuela (Zopi de Roa and López 2008), Cuba (Elías-Gutiérrez and Varela 2009), Laos (Kotov et al. 2013a), Brazil (Sousa and Elmoor-Loureiro 2012 2013), South Korea (Jeong et al. 2014), Columbia (Kotov and Fuentes-Reinés 2015), China (Xiang et al. 2015), the Philippines (Dela Paz et al. 2018), and Ecuador and the Galapagos Islands (López et al. 2018). In Africa, few studies on cladocera species have been undertaken: Jeje (1989) (Nigeria), Smirnov (2008) (Republic of South Africa), and Ghaouaci et al. (2018) (Algeria). However, studies of Cladocera fauna taxonomy exist, and are concentrated on somes Africa regions as Uganda-Kenya-Tanzania (Lake Victoria) (Delachaux 1917), Sudan (Rzóska 1952; Dumont et al. 1984), Uganda-Democratic Republic of the Congo (Green 1967; Van Damme and Eggermont 2011), Uganda (Thomas 1961a b; Bourgie 1973), Chad (Rey and Saint-Jean 1968 1969; Guo and Dumont 2014), Mali (Dumont et al. 1981), Guinea (Dumont 1981), Nigeria (Egborge 1987; Jeje 1988; Egborge et al. 1994), Cameroon (Green and Kling 1988), Morocco (Tifnouti and Pourriot 1989), the Republic of South Africa (Van Damme et al. 2013), Ethiopia (Neretina and Kotov 2015; Neretina et al. 2017), and Kenya (Korovchinsky et al. 2017).

Diversity in the zooplankton community has been studied in various inland aquatic ecosystems of Côte d'Ivoire. Recent studies focused on the composition and ecology of zooplankton in several fresh and brackish water bodies in the country, such as Fresco Lagoon (Etilé et al. 2018), Hana (Diomande et al. 2018) and Bagoé (Berté et al. 2019) Rivers. Of these zooplanktonic communities found in the above mentioned ecosystems, several studies have been made concerning the biology and the demographic characteristics of somes cladocera species such as *Moina micrura* (Bonou et al. 1991; Saint-Jean and Bonou 1994; Pagano et al. 2000; Pagano 2008) and *Diaphanosoma excisum* (Pagano et al. 2000; Pagano 2008). Unfortunately, studies related to cladoceran systematics are scarce (Lamoot and Dumont 1974; Rey and Yté 1982).

Thus, here we add to a database of the species compositions and global diversity for the cladocerans of Côte d'Ivoire that began in the 1950s (De Beauchamp 1955; Lindberg 1957), and update the taxonomic list with valid names (Kotov et al. 2013b) and remove outdated taxonomic information. This paper provides a checklist of cladoceran species from Côte d'Ivoire and information on their distribution.

MATERIALS AND METHODS

This checklist presents findings from the following studies: Rahm (1964), Lamoote and Dumond (1974), Yté et al. (1982 1983 1996 2002 2009), Rey and Yté (1982), Yté and Kouassi (1983), Arfi et al. (1987), Legendre et al. (1987), Nobah (1998), Yté (1992), Aka et al. (2000 2016a b), Ouattara et al. (2007), Etilé et al. (2009 2015 2018), Yao et al. (2015), N'da et al. (2015), Monney et al. (2015 2015), Diomandé et al. (2018), Amian et al. (2018), Appiah et al. (2018), and Kouamé et al. (2018). Sites visited by these authors are listed in figure 1.

RESULTS

In total, 39 Cladocera species from Côte d'Ivoire were identified from the literature. This taxanomic richness includes 24 genera and seven families (Bosminidae, Chydoridae, Daphniidae, Ilyocryptidae, Macrothricidae, Moinidae, and Sididae). Chydoridae was the most diverse family (16 species, 41% of the total cladoceran diversity in Côte d'Ivoire), followed by Daphniidae (eight species, 21%); Moinidae (four species, 10%); Bosminidae, Macrothricidae and Sididae (three species each, 8%); and Ilyocryptidae (two species, 5%). *Chydorus* and *Macrothrix* were the most diversified genera, with five and four species, respectively. It is worth noting that, among these cladocera taxa recorded from Côte d'Ivoire, *Ceriodaphnia cornuta* was encountered the most (recorded in 15 sites / 19 studied), followed by *Moina micrura* (recorded in 13 sites / 19 studied) and *Diaphanosoma excisum* (recorded in 10 sites / 19 studied). In contrast, the following 13 species were each found in only one site: *Acroperus harpae*, *Alonella excisa*, *A. nana*, *Chydorus pubescens*, *Euryalona orientalis*, *Leberis diaphanous*, *Notoalona sculpa*, *Pseudochydorus globorus*, *Ceriodaphnia rigaudi* (*species inquirenda*), *Simocephalus vetulus*, *Grimaldina brazzai*, *Moina dubia*, and *Pseudosida szalayi*.

Cladocera species recorded in the literature on zooplankton from Côte d'Ivoire are listed below. In

the present list, the family, genera, and species names are arranged alphabetically to facilitate the search for a given taxon. Moreover, species names used are based on the checklist from the Freshwater Animal Diversity Assessment project (FADA) website (Kotov et al. 2013b).

TAXONOMIC CHECKLIST

Phylum Arthropoda Latreille, 1829
Subphylum Crustacea Brünnich, 1772
Class Branchiopoda Latreille, 1817

Suborder Cladocera Latreille, 1829
Order Anomopoda Sars, 1865
Bosminidae Baird, 1845

Bosmina Baird, 1845

Syn.: *Eunica* Koch, 1841; *Garbinia* Grochowski, 1910.

Bosmina (*Bosmina*) *longirostris* O.F. Müller, 1776

Distribution in Côte d'Ivoire: Ebrié Lagoon (Arfi et al. 1987); Comoé River (Comoé National Park) (Yao et al. 2015); Ebrié Lagoon (Aghien) (Aka et al. 2016b).

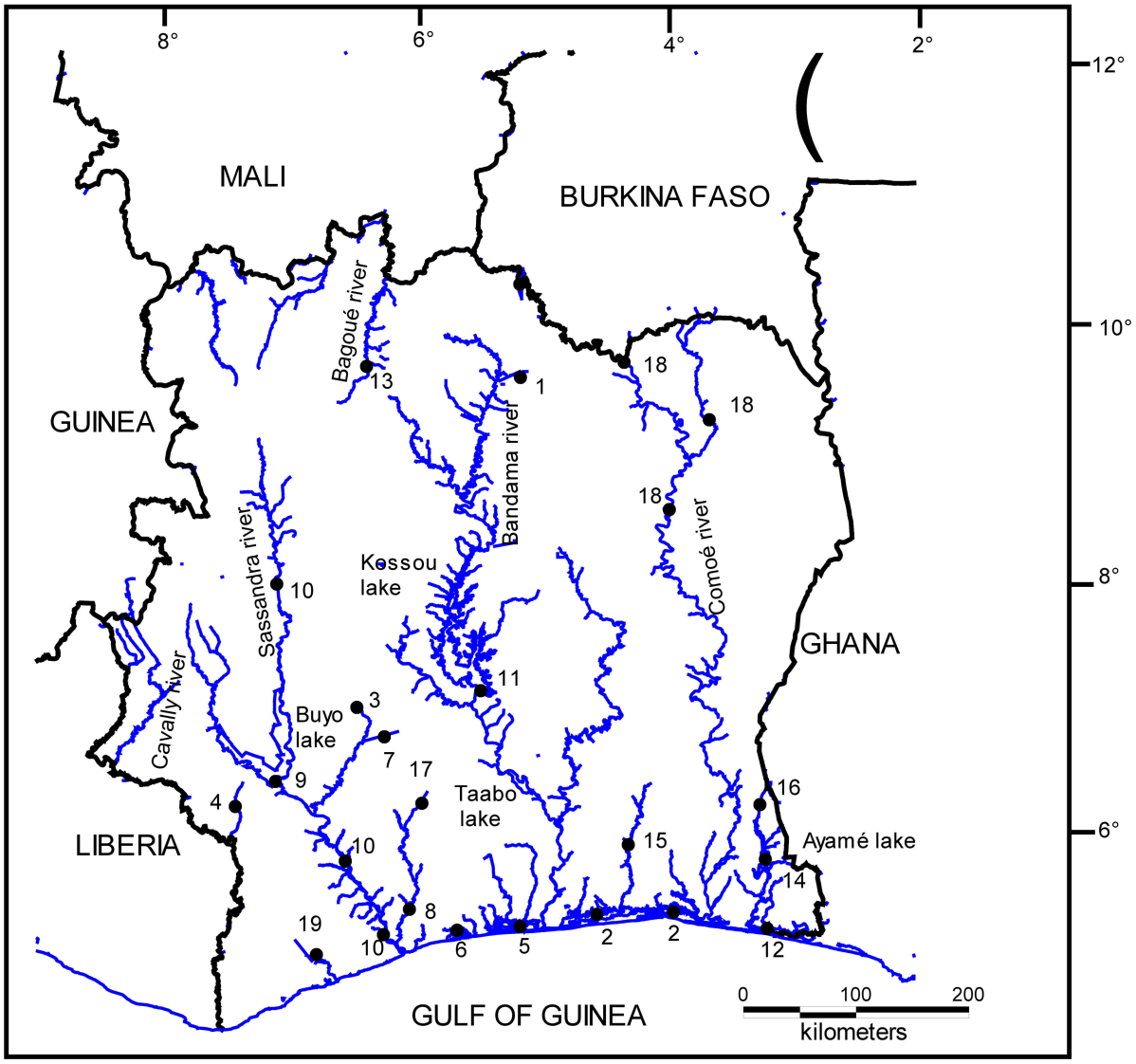

Fig. 1. Map showing the different sites visited by authors of the scientific works cited here that were focused on the cladocera community of Côte d'Ivoire. 1- Shallow reservoirs of the northern of Côte d'Ivoire. 2 - Ebrié Lagoon. 3 - Pisciculture pond at Daloa. 4 - Hana River in Taï Park. 5 - Grand-Lahou Lagoon. 6 - Fresco Lagoon. 7 - Lobo River (Sassandra Basin). 8 - Davo River (Sassandra Basin). 9 - Buyo Lake (Sassandra Basin). 10 - Sassandra River Main Reach. 11 - Kossou Lake. 12 - Tendo-Ehy-Aby lagoonal system. 13 - Bagoe River. 14 - Ayame Lake I. 15 - Agnebi River. 16 - Bia River. 17 - Gagnoa (low ground). 18 - Comoé River in the Comoé National Park. 19 - Fae Lake.

Synonyms: *Lynceus longirostris* O.F. Müller 1776; *Monoculus cornuta* Jurine 1820; *Bosmina curvirostris* Fischer 1854; *Bosmina brevicornis* Hellich 1877; *Bosmina japonica* Poppe and Richard 1890; *Bosmina pelagica* Stingelin 1895; *Bosmina pellucida* Stingelin 1895; *Bosmina stuhlmanni* Weltner 1898; *Garbinia adriani* Grochowski 1910; *Bosmina africanaaustralis* Methuen 1911; *Bosmina arostris* Schiklejew 1930.

World distribution: *B.* (*Bosmina*) *longirostris* is reported in all the main biogeographical areas described by Forró et al. (2008), but it is reported as not present in the Pacific Ocean islands or Antarctic region (Maiphae et al. 2008); it is considered cosmopolitan by Kotov et al. (2013b).

Bosmina (*Liederobosmina*) *tubicen* Brehm, 1953

Distribution in Côte d'Ivoire: Ayame Lake I (Rey and Yté 1982; Yté et al. 1982 1983; Ouattara et al. 2007); Buyo Lake (Yté et al. 1996); Bia River (Ouattara et al. 2007); the Agnebi River (Ouattara et al. 2007); the Sassandra River watershed (Kouamé et al. 2018).

Synonyms: *Bosmina americana* Aurich 1934; *Eubosmina tubicen* (Brehm 1953)

World distribution: *B.* (*Liederobosmina*) *tubicen* Brehm 1953 was reported by Kotov et al. (2013b) from the Nearctic and Neotropical regions.

Bosminopsis Richard, 1895

Syn.: *Bosminella* Daday, 1903.

Bosminopsis deitersi Richard, 1895

Distribution in Côte d'Ivoire: Ebrié Lagoon: Grand Bassam, Eloka, Bingerville, Banco, Cosrou, and Toupah (Rham 1964), Aghien (Aka et al. 2016b); Ayame Lake I (Yté et al. 1983); the Bagoe River (N'da et al. 2015).

Synonyms: *Bosminopsis zernowi* Linko 1901; *Bosminopsis ishikawai* Klocke 1903; *Bosminella anisitsi* Daday 1903; *Bosminella africana* Daday 1908; *Bosminopsis stingelini* Burckhardt 1909; *Bosminopsis typica* Burckhardt 1909; *Bosminopsis birgei* Burckhardt 1924; *Bosminopsis brehmi* Burckhardt 1924; *Bosminopsis pernodi* Burckhardt 1924; *Bosminopsis schroeteri* Burckhardt 1924; *Bosminopsis devendrari* Rane 1984; *Bosminopsis macaguensis* Rey and Vasquez 1986.

World distribution: *B. deitersi* was regarded as circumtropical by Maiphae et al. (2008), while Kotov et al. (2013a) reported it as tropicopolitan, very common in the tropics-subtropics of the old and new worlds. For Kotov et al. (2013b), *B. deitersi* is found in Afrotropical, Australasian, Nearctic, Neotropical, Oriental and Palaearctic regions. So, it is reported as not present in Pacific Ocean islands or Antarctic region.

Chydoridae Dybowski and Grochowski, 1894

Acroperus Baird, 1843

Syn.: *Alonopsis* Sars, 1861.

Acroperus elongatus Sars, 1862

Distribution in Côte d'Ivoire: Bia River (Ouattara et al. 2007); Buyo Lake (Kouamé et al. 2018).

Synonyms: *Alona elongatus* Sars 1862; *Acroperus intermedius* Schödler 1863; *Lynceus lacustris* Frič 1872; *Alonopsis jamaliensis* Werestschagin 1913.

World distribution: *Acroperus elongatus* was reported by Kotov et al. (2013b) from Nearctic and Neotropical regions. So, it is reported as a northern hemisphere species.

Acroperus harpae Baird, 1843

Distribution in Côte d'Ivoire: Ayame Lake I (Yté et al. 1983).

Synonyms: *Lynceus harpae* Baird 1834; *Acroperus bairdi* Langhans 1911; *Acroperus cavirostris* P.E. Müller 1867; *Acroperus frigida* Ekman 1904; *Acroperus leucocephalus* Koch 1841; *Acroperus striatus* Lilljeborg 1853; *Acroperus transylvanicus* Daday 1884.

World distribution: This species was reported from the Afrotropical, Australasian, Nearctic, Neotropical, Oriental, and Palaearctic regions (Kotov et al. 2013b). It was also reported as not being in the Pacific Ocean islands or Antarctic region. Note nevertheless that, according to Chatterjee et al. (2013), the presence of *Acroperus harpae* in tropical region is doubtful.

Alona Baird, 1843

Syn.: *Biapertura* Smirnov, 1971; *Biapertura pseudoverrucosa* Smirnov, 1971; *Halona* Agassiz, 1846.

Alona monacantha Sars, 1901

Distribution in Côte d'Ivoire: Ayame Lake I (Yté et al. 1983); Buyo Lake (Yté et al. 1996; Kouamé et al. 2018); Comoé River (Comoé National Park) (Yao et al. 2015).

Synonyms: *Alona acuticostata* Sars 1903; *Alona tridentata* Stingelin 1905; *Alona reiseri* Spandl 1926.

World distribution: *A. monacantha* was reported from the African and Oriental regions by Maiphae et al.

(2008); according to Van Damme et al. (2010), it was distributed in the Neotropics, and its records outside Neotropics need revision or references to other species. However, it was regarded as being in Afrotropical, Australasian, Neotropical, and Oriental regions by Kotov et al. (2013b).

Alona pulchella King, 1853

Distribution in Côte d'Ivoire: Ayame Lake I (Yté et al. 1983; Ouattara et al. 2007), Buyo Lake (Yté et al. 1996; Kouamé et al. 2018).

Synonyms: No synonyms available.

World distribution: *A. pulchella* was recorded from African, Australian, Neotropical, and Oriental regions by Maiphae et al. (2008). However, it was reported from Australasian regions by Van Damme et al. (2010) and the Oriental region by Kotov et al. (2013b).

Alonella Sars, 1862
Alonella excisa Fischer, 1854

Distribution in Côte d'Ivoire: Agneby River (Ouattara et al. 2007).

Synonyms: *Lynceus excisa* Fischer 1854; *Alonella szczorsiana* Dybowski and Grochowski 1895; *Alonella setosa* Werestchagin 1913; *Alonella kulczynskii* Grochmalicki 1915.

World distribution: *A. excisa* is mentioned as a cosmopolitan species (Maiphae et al. 2008). But, Kotov et al. (2013b) reported it from Afrotropical, Australasian, Nearctic, Neotropical, Oriental and Palaearctic regions.

Alonella nana Baird, 1843

Distribution in Côte d'Ivoire: Agneby River (Ouattara et al. 2007).

Synonyms: *Acroperus nana* Baird 1843; *Alona pygmaea* Sars 1862; *Pleuroxus transversa* Schödler 1862; *Pleuroxus tusnadiensis* Daday 1883.

World distribution: This species was reported as absent from African and Neotropics regions by Maiphae et al. (2008), but reported in Afrotropical, Australasian, Neotropical, Oriental regions and the Palaearctic by Kotov et al. (2013b).

Camptocercus Baird, 1843

Syn.: *Acrokurzia* Brooks, 1953.

Camptocercus rectirostris Schödler, 1862

Distribution in Côte d'Ivoire: Ebrie Lagoon: Cosrou (Rham 1964); Bia and Agnebi Rivers (Ouattara et al. 2007).

Synonyms: *Camptocercus biserratus* Schödler 1862; *Camptocercus macrurus* Schoedler 1862; *Camptocercus abrau* Schiklejew 1933; *Camptocercus shiklejevi* Šrámek-Hušek et al. 1962; *Camptocercus serratunguis* Chiang Sieh-chih 1964.

World distribution: Reported from Afrotropical, Nearctic, and Palaearctic regions (Kotov et al. 2013b).

Chydorus Leach, 1816
Chydorus eurynotus Sars, 1901

Distribution in Côte d'Ivoire: Ebrie Lagoon (Rham 1964); Ayame Lake I (Ouattara et al. 2007); Agnebi River (Ouattara et al. 2007); Buyo Lake (Kouamé et al. 2018); Sassandra River watershed (Kouamé et al. 2018); Lobo River (Kouamé et al. 2018).

Synonym: *Chydorus flavescens* Daday 1905.

World distribution: *C. eurynotus* is regarded as a circumtropical species and was observed in Oriental, Australian, African, and Neotropical regions (Maiphae et al. 2008).

Chydorus pubescens Sars, 1901

Distribution in Côte d'Ivoire: Ebrie Lagoon (Rham 1964).

Synonyms: No synonyms available.

World distribution: Signaled as a circumtropical species (Smirnov 1996 in Yalım and Çıplak 2010), *C. pubescens* is observed in Oriental, Neotropical, and Nearctic regions according to Maiphae et al. (2008). But, it is reported as from Afrotropical, Australian, Neotropical, and Oriental regions by Kotov et al. (2013b).

Chydorus sphaericus O.F. Müller, 1776

Distribution in Côte d'Ivoire: Ayame Lake I (Yté et al. 1983); Buyo Lake (Yté et al. 1996; Kouamé et al. 2018).

Synonyms: *Lynceus sphaericus* O.F. Müller 1776; *Monoculus infusorius* Schrank 1781; *Chydorus lynceus* Langhans 1911; *Chydorus coelatus* Werestchagin 1913; *Chydorus mutilus* Kreis 1921; *Chydorus arcticus* Røen 1987.

World distribution: Cosmopolitan species according to Maiphae et al. (2008) and Jeong et al. (2014), it is reported as from all zoogeographical regions, except in Antarctic region by Kotov et al. (2013b).

Ephemeroporus Frey, 1982
Ephemeroporus barroisi Richard, 1894

Distribution in Côte d'Ivoire: Buyo Lake (Yté et al. 1996; Kouamé et al. 2018); Sassandra River watershed (Kouamé et al. 2018); Davo River (Kouamé et al. 2018).

Synonyms: *Pleuroxus barroisi* Richard 1894; *Chydorus barroisi* Richard 1894; *Ephemeroporus barroisi barroisi* Richard 1894.

World distribution: *E. barroisi* is recorded as distributed in Syria, Iran, India, Sri Lanka, Australia, Africa, Nicaragua and North America by Smirnov (1996) in Yalım and Çıplak (2010). It is also regarded as circumtropical species by Maiphae et al. (2008), but according to Kotov et al. (2013b), this species is recorded in all zoogeographical regions, except in the Antarctic region and may be qualified as tropicopolitan species.

Euryalana Sars, 1901
Euryalana orientalis Daday, 1898

Distribution in Côte d'Ivoire: Ayame Lake I (Yté et al. 1983).

Synonyms: *Alonopsis orientalis* Daday 1898; *Euryalona occidentalis* Sar 1901.

World distribution: According to Kotov et al. (2013a), *E. orientalis* is a very characteristic circumtropical species, but it is reported as species from the Afrotropical, Australasian, Neotropical, Oriental regions by Kotov et al. (2013b).

Kurzia Dybowski and Grochowski, 1894

Syn.: Pseudalona Sars, 1901.

Kurzia longirostris Daday, 1898

Distribution in Côte d'Ivoire: Ayame Lake I (Yté et al. 1983); Bia River (Ouattara et al. 2007): Sassandra River watershed (Kouamé et al. 2018); Lobo River (Kouamé et al. 2018).

Synonyms: *Alona longirostris* Daday 1898; *Alona macrohyncha* Daday 1900.

World distribution: *K. longirostris* is reported by Maiphae et al. (2008) as species recorded in African, Australian, and Oriental regions. In addition, it is reported as from Neotropical region by Kotov et al. (2013b).

Leberis Smirnov, 1989
Leberis diaphanus King, 1853

Distribution in Côte d'Ivoire: Ebrie Lagoon (Dabou) (Rham 1964).

Synonyms: *Alona diaphanus* King 1853; *Alona punctatus* Daday 1898; *Alona vermiculatus* Smirnov and Timms 1983.

World distribution: *L. diaphaunus* is regarded as species from African, Australian, Neotropical, and Oriental regions by Maiphae et al. (2008). In addition to these biogeographical regions, it is also reported as from the Pacific Ocean islands region by Kotov et al. (2013b). Nevertheless, according to Neretina and Sinev (2016), *L. diaphaunus* is frequently mentioned in the faunal lists from tropics and subtropics of the old world and Australia (Australia and Tasmania, Malaysia, Thailand, Vietnam, Laos, and Hainan Island: South China).

Notoalona Rajapaksa and Fernando, 1987
Notoalona sculpta Sars, 1901

Distribution in Côte d'Ivoire: Ebrie Lagoon: Dabou (Rham 1964).

Synonym: *Alonella sculpta* Sars 1901.

World distribution: Signaled as Neotropical species by Kotov et al. (2013b) and López et al. (2018).

Pseudochydorus Freyer, 1968
Pseudochydorus globosus Baird, 1843

Distribution in Côte d'Ivoire: Ebrie Lagoon (Rham 1964).

Synonyms: *Chydorus globosus* Baird 1843; *Chydorus globiformis* Dybowski and Grochowski 1898; *Chydorus paradoxus* Shikleev 1930.

World distribution: Cosmopolitan species (Smirnov 1996 in Yalım and Çıplak 2010; Maiphae et al. 2008); it reported in Afrotropical, Australasian, Nearctic, Neotropical, Oriental, and Palaearctic regions, but not in the Pacific Ocean islands or Antarctic region (Kotov et al. 2013b).

Daphniidae Straus 1820
Ceriodaphnia Dana 1853
Ceriodaphnia cornuta Sars 1885

Distribution in Côte d'Ivoire: Ayame Lake I (Yté et al. 1982 1983); Buyo Lake (Yté et al. 1996; Kouamé et al. 2018); Agro-pastoral reservoirs in northern Côte d'Ivoire (Aka et al. 2000); Bia and Agnebi Rivers (Ouattara et al. 2007); Grand-Lahou Lagoon (Etilé et al. 2009); Tendo-Ehy-Aby lagoonal system (Monney et al. 2015); Bagoe River (N'da et al. 2015); Ebrie Lagoon: Aghien (Aka et al. 2016a); Ebrie Lagoon (Aka et al. 2016b); Comoé River (Comoé National Park) (Yao et al. 2015); fish ponds in Gagnoa (Amian et al. 2018);

Sassandra River main stem (Kouamé et al. 2018); Lobo and Davo Rivers (Kouamé et al. 2018); Fresco Lagoon (Etilé et al. 2018).

Synonym: *Ceriodaphnia cornigera* Jiang Xiezhi 1977.

World distribution: *C. cornuta* is widely distributed in the tropics and subtropics (Chatterjee et al. 2013; Kotov et al. 2013a). This species is also reported by Kotov et al. (2013b) from Afrotropical, Australasian, Nearctic, Neotropical, Oriental, and Palaearctic regions.

Ceriodaphnia dubia Richard, 1894

Distribution in Côte d'Ivoire: Buyo Lake (Yté et al. 1996; Kouamé et al. 2018); Agro-pastoral reservoirs in northern Côte d'Ivoire (Aka et al. 2000); Ayame Lake I (Ouattara et al. 2007); Comoé River, Comoé National Park (Yao et al. 2015); Tendo-Ehy-Aby lagoonal system (Monney et al. 2015); Lobo and Davo Rivers (Kouamé et al. 2018).

Synonyms: *Ceriodaphnia acuminata* Ekman 1900; *Ceriodaphnia limicola* Ekman 1900; *Ceriodaphnia richardi* Sars 1901; *Ceriodaphnia affinis* Lilljeborg 1901.

World distribution: *C. dubia* is widespread throughout the world, and is currently considered a true cosmopolitan species (Chatterjee et al. 2013; Jeong et al. 2014). This species is reported from all zoogeographical regions defined by Kotov et al. (2013b), except the Antarctic region.

Ceriodaphnia rigaudi Richard, 1894 (species inquirenda)

Distribution in Côte d'Ivoire: Ebrie Lagoon: Toupah, Cosrou, and Bengerville (Rham 1964).

Synonyms: No synonyms available.

World distribution: *Ceriodaphnia rigaudi* is reported as *species inquirenda* by Kotov et al. (2013b) and Kotov and Fuentes-Reinés (2015).

Daphnia O.F. Müller, 1785

Syn.: *Cephaloxus* Sars, 1861; *Hyalodaphnia* Schoedler, 1866; *Leiodaphnia* Dybowski and Grochowski, 1895; *Dactylura* Brady, 1898; *Daphniopsis* Sars, 1903.

Daphnia (*Ctenodaphnia*) *barbata* Weltner, 1898

Distribution in Côte d'Ivoire: Buyo Lake (Yté et al. 1996; Kouamé et al. 2018).

Synonyms: No synonyms available.

World distribution: *D.* (*Ctenodaphnia*) *barbata* is reported from Afrotropical and Palaearctic regions (Kotov et al. 2013b).

Daphnia (*Daphnia*) *longispina* O.F. Müller, 1776

Distribution in Côte d'Ivoire: Buyo Lake (Yté et al. 1996; Kouamé et al. 2018).

Synonyms: *Daphne longispina* O.F. Müller 1776; *Daphnia rectispina* Krøyer 1838; *Daphnia muelleri* P.E. Müller 1867; *Daphnia leydigii* Hellich 1874; *Daphnia centricosa* Hellich 1877; *Daphnia paludicola* Hellich 1877; *Daphnia tenuitesta* Sars 1890; *Daphnia brevipennis* Sars 1890; *Daphnia hellichi* Stingelin 1895; *Daphnia rectifrons* Stingelin 1895; *Daphnia rotundirostris* Burckhardt 1899; *Daphnia pulchella* Sars 1903; *Daphnia aspina* Wereschagin 1911.

World distribution: *D.* (*Daphnia*) *longispina* is reported in Afrotropical and Palaearctic regions (Kotov et al. 2013b), but also in Europa, Asia, and North Africa (Benzie 2005 in Chatterjee et al. 2013; Jeong et al. 2014).

Scapholaberis Schödler, 1858
Scapholaberi kingii Sars, 1888

Distribution in Côte d'Ivoire: Ebrie Lagoon, Bengerville, Bimbresso (Rham 1964); Buyo Lake (Yté et al. 1996; Kouamé et al. 2018).

Synonyms: No synonyms available.

World distribution: Found in African, Australian, Neotropical, and Oriental regions (Maiphae et al. 2008), this species is reported to have a wide distribution (Chatterjee et al. 2013; Jeong et al. 2014) and is regarded as being from Afrotropical, Australasian, Nearctic, Neotropical, Oriental, and Palaearctic regions (Kotov et al. 2013b).

Simocephalus Schôldler, 1858

Syn.: *Simodaphnia* Angel and Chevey, 1927; *Simosa* Norman, 1903.

Simocephalus latirostris Stingelin, 1906

Distribution in Côte d'Ivoire: Ayame Lake I and Bia and Agnebi Rivers (Ouattara et al. 2007).

Synonyms: No synonyms available.

World distribution: According to Kotov et al. (2013b), this species' distribution is restricted to Neotropical regions. Nevertheless, according to Orlova-Bienkowskaja (1995 1998) and Orlova-Bienkowskaja (2001) in Chatterjee et al. (2013), numerous records of *S. latirostris* were reported from Australia, Malay Archipelago, South-East Asia, and Africa.

Simocephalus vetulus O.F. Müller, 1776

Distribution in Côte d'Ivoire: Ebrie Lagoon: Dabou (Rham 1964).

Synonyms: *Daphnia vetulus* O.F. Müller 1776; *Daphnia brandti* Fischer 1848; *Daphnia sima* O.F. Müller 1785; *Monoculus nasutus* Jurine 1820; *Simocephalus angustifrons* Lilljeborg 1901; *Simocephalus beianensis* Shi Xinlu and Shi Xinbai 1994; *Simocephalus gebhardti* Ponyi 1955; *Simocephalus hungaricus* Ponyi 1956.

World distribution: Maiphae et al. (2008) suggests that *S. vetulus* is from African, Australian, Neotropical, Oriental, and Palearctic regions. On the other hand, according to Kotov et al. (2013b), it is reported only in Palaearctic regions, while Orlova-Bienkowskaja (1998) and Jeong et al. (2014) report this species as only being present in Europe and North Africa.

Ilyocryptidae Smirnov, 1992
Ilyocryptus Sars, 1862

Syn.: *Iliocryptus* Sars, 1862.

Ilyocryptus sordidus Liévin, 1848

Distribution in Côte d'Ivoire: Ebrie Lagoon: Toupah (Rham 1964); Ayame Lake I (Yté et al. 1983).

Synonyms: *Acanthocercus sordidus* Liévin 1848; *Iliocryptus aequalis* Romijn 1919; *Iliocryptus balatonicus* Hankó 1926; *Iliocryptus inaequalis* Romijn 1919; *Ilyocryptus alexandrinae* Negrea 1987.

World distribution: This species is distributed in the Northern Palearctic, but close forms are widely distributed worldwide according to Ghaouaci et al. (2018). On the other hand, Kotov et al. (2013b) reported it like species from Afrotropical, Nearctic, Neotropical, and Palaearctic regions on the one hand and exclude it from the Oriental, Australasian, Pacific Ocean islands, and Antarctic regions.

Ilyocryptus spinifer Herrick, 1882

Distribution in Côte d'Ivoire: Ebrie Lagoon (Dabou, Eloka, Bengerville) (Rham 1964); Ayame Lake I (Yté et al. 1983); Buyo Lake (Yté et al. 1996; Kouamé et al. 2018); Sassandra River main stem (Kouamé et al. 2018).

Synonyms: *Ilyocryptus halyi* Brady 1886: *Ilyocryptus longiremis* Sars 1888; *Acanthocercus immundus* Ihering 1895; *Iliocryptus verrucosus* Daday 1905; *Iliocryptus tetraspinatus* Bergamin 1939.

World distribution: *Ilyocryptus spinifer* is signaled as widely distributed in the tropics and subtropics (Kotov and Dumont 2000). On the other hand, Kotov et al. (2013b) reported it to be like species from Afrotropical, Australasian, Nearctic, Neotropical, Oriental, Pacific Ocean islands, and Palaearctic regions, and excludes only the Antarctic region. According to Sousa and Elmoor-Loureiro (2019), *I. spinifer* is a cosmopolitan species with high ecological plasticity.

Macrothricidae Norman and Brady, 1867
Grimaldina Richard, 1892
Grimaldina brazzai Richard, 1892

Distribution in Côte d'Ivoire: Ebrie Lagoon: Dabou (Rham 1964).

Synonyms: No synonyms available.

World distribution: *Grimaldina brazzai* has been described from Gabon (Richard 1892 in Chatterjee et al. 2013) and is reported to be from Afrotropical, Australasian, Neotropical, and Oriental regions (Kotov et al. 2013b).

Macrothrix Baird 1843

Syn.: *Echinisca* Liévin, 1848; *Iheringula* Sars, 1900; *Drepanomacrothryx* Werestschagin, 1913; *Gurneyella* Brehm, 1930.

Macrothrix spinosa King, 1853

Distribution in Côte d'Ivoire: Buyo Lake (Yté et al. 1996; Kouamé et al. 2018); low ground at Gagnoa (Yté et al. 2009).

Synonyms: *Macrothrix goeldi* Richard 1897; *Macrothrix squamosa* Sars 1901; *Macrothrix affinis* Brady 1904; *Macrothrix dentata* Playfair 1915; *Macrothrix murati* Gauthier 1939.

World distribution: *M. spinosa* is regarded as a circumtropical species (Maiphae et al. 2008; Smirnov 1992 in Chatterjee et al. 2013); it is also believed to be widely distributed in Afrotropical, Australasian, Nearctic, Neotropical, Oriental, Pacific Ocean islands, and Palaearctic regions, but not from the Antarctic region (Kotov et al. 2013b).

Macrothrix triserialis Brady, 1886

Distribution in Côte d'Ivoire: Ebrie Lagoon: Dabou, Toupah, Bengerville (Rham 1964); Buyo Lake (Yté et al. 1996; Kouamé et al. 2018); Sassandra River main stem and Lobo River (Kouamé et al. 2018).

Synonym: *Macrothrix chevreuxi* Guerne and Richard 1892.

World distribution: *M. triserialis* is considered a tropical and subtropical cladocera species (Dumont et

al. 2002); it is also believed to be from Afrotropical, Australasian, Neotropical, Oriental, and Pacific Ocean islands regions (Kotov et al. 2013b).

Moinidae Goulden, 1968
Moina Baird, 1850

Syn.: *Mediomoina* Arora 1931.

Moina dubia Guerne and Richard, 1892

Distribution in Côte d'Ivoire: Ebrie Lagoon: Bengerville, Bimbresso (Rham 1964).

Synonyms: No synonyms available.

World distribution: *M. dubia* is mentioned as being from Afrotropical and Palaearctic regions (Chatterjee et al. 2013; Kotov et al. 2013b).

Moina reticulata Daday, 1905

Distribution in Côte d'Ivoire: Kossou Lake (Lamoot and Dumont 1974).

Synonym: *Moinodaphnia reticulata* Daday 1905.

World distribution: Mentioned as an Afrotropical and Neotropical species (Kotov et al. 2013b).

Moina micrura Kurz, 1875

Distribution in Côte d'Ivoire: Ayame Lake I (Yté et al. 1982 1983; Ouattara et al. 2007); Ebrie Lagoon: Aghien, Layo (Arfi et al. 1987; Legendre et al. 1987; Aka et al. 2016a b); Bia and Agnebi Rivers (Ouattara et al. 2007); Grand-Lahou Lagoon (Etilé et al. 2009); Tendo-Ehy-Aby lagoonal system (Monney et al. 2015); Bagoe River (N'da et al. 2015); Comoé River in Comoé National Park (Yao et al. 2015); Buyo Lake (Yté et al. 1996; Kouamé et al. 2018); fish ponds in Gagnoa (Amian et al. 2018); Sassandra River main stem, Lobo and Davo Rivers (Kouamé et al. 2018); Fresco Lagoon (Etilé et al. 2018); Hana River in Taï National Park (Diomande et al. 2018).

Synonyms: *Moina weberi* Richard 1891; *Moina macrophtalma* Stingelin 1913; *Moina lacustris* Rammner 1931; *Moina macrocephala* Rammner 1933; *Moina latidens* Brehm 1933; *Moina parva* Jenkin 1934; *Moina dodhui* Rane 1987.

World distribution: According to Chatterjee et al. (2013) and Jeong et al. (2014), *M. micrura* is widely distributed in tropical and subtropical regions and southern Europe; it was considered a cosmopolitan species by De los Ríos-Escalante and Kotov (2015) and Ghaouaci et al. (2018).

Moinodaphnia Herrick, 1887

Syn.: *Paramoina* Sars, 1888.

Moinodaphnia macleayi King, 1853

Distribution in Côte d'Ivoire: Ebrie Lagoon: Bingerville, Aghien (Rham 1964; Aka et al. 2016a b); Grand-Lahou Lagoon (Etilé et al. 2009).

Synonyms: *Moina macleayi* King 1853; *Moina submucronata* Brady 1886; *Moinodaphnia alabamensis* Herrick 1887; *Moinodaphnia mocquerysi* Richard 1892.

World distribution: *M. macleayi* is widely distributed, in Afrotropical, Australasian, Nearctic, Neotropical, Oriental, and Palaearctic regions (Kotov et al. 2013b).

Order Ctenopoda Sars, 1865
Sididae Baird, 1850
Diaphanosoma Fischer, 1850

Syn.: *Daphnella* Baird, 1850.

Diaphanosoma excisum Sars, 1885

Distribution in Côte d'Ivoire: Ayame Lake I (Yté et al. 1982 1983); Agro-pastoral reservoirs in the northern Côte d'Ivoire (Aka et al. 2000); Ebrie Lagoon (Aghien, Layo) (Arfi et al. 1987; Legendre et al. 1987; Aka et al. 2016a b); Ayame Lake I, Bia and Agnebi Rivers (Ouattara et al. 2007); the Comoé River (Comoé National Park) (Yao et al. 2015); Tendo-Ehy-Aby lagoonal system (Monney et al. 2015); the Bagoe River (N'da et al. 2015); Buyo Lake (Yté et al. 1996; Kouamé et al. 2018); Fish ponds at Gagnoa (Amian et al. 2018); Sassandra river main stem, Davo and Lobo Rivers (Kouamé et al. 2018); Fresco Lagoon (Etilé et al. 2018).

Synonyms: *Diaphanosoma paucispinosum* Brehm 1933.

World distribution: *D. excisum* is found in the tropics and subtropics of the eastern hemisphere (Korovchinsky 2004). It is widely distributed in the old world (Kotov et al. 2013a), and species have been reported in the Afrotropical, Australasian, Oriental, and Palaearctic regions (Kotov et al. 2013b).

Diaphanosoma sarsi Richard, 1894

Distribution in Côte d'Ivoire: Ebrie Lagoon: Cosrou, Eloka, Bingerville, Banco, Dabou, Toupah, Grand Bassam (Rham 1964).

Synonym: *Diaphanosoma singalense* Daday 1898.

World distribution: *D. sarsi* is widely distributed in the old world (Kotov et al. 2013a); it has been

reported from the same zoogeographic regions as *D. excisum* (Afrotropical, Australasian, Oriental, and Palaearctic regions), plus the Pacific Ocean islands (Kotov et al. 2013b).

Pseudosida Herrick 1884

Syn.: Parasida Daday, 1904.

Pseudosida szalayi Daday 1898

Distribution in Côte d'Ivoire: Ebrie Lagoon: Bingerville (Rham 1964).

Synonym: *Parasida szalayi* Daday 1898.

World distribution: *P. szalayi* is widely distributed in the tropical and subtropical region (Kotov et al. 2013a). It has been reported from Afrotropical, Australasian, and Oriental regions (Kotov et al. 2013b). However, according to Korovchinsky (2010), the taxonomic status of African "*pseudosidas*" known under the names "*P. szalayi*"and "*P. bidentata*" remains uncertain.

DISCUSSION

This study lists for the first time all recorded cladoceran species from Côte d'Ivoire. This list was established using species names and synonyms from Kotov et al. (2013b). For example, in the reviewed literature, *Kurzia longirostris* and *Pseudalona longirostris* are considered the same species (*K. longirostris*) (Kotov et al. 2013b). Similarly, *Ceriodaphnia affinis* was considered *C. dubia* (Kotov et al. 2013b), *Ilyocriptus halyi* was considered *I. spinifer* (Kotov and Dumont 2000), and *Macrothrix chevreuxi* was considered *M. triserialis* (Dumont et al. 2002). Finally, our analysis of the literature on cladocerans in Côte d'Ivoire revealed a total of 39 species bebonging to 24 genera and seven families.

It is difficult to compare checklists among different countries (Chatterjee et al. 2013). However, cladoceran diversity in Côte d'Ivoire is low compared to the larger Afrotropical (134 species and 46 genera) and Neotropical regions (186 species and 50 genera) (Forró et al. 2008). It also low compared to countries in tropical regions such as Nigeria (61 species) (Jeje 1989), the Republic of South Africa (112) (Smirnov 2008), Venezuela (112) (Zoppi De Roa and López 2008), Cuba (70) (Elías-Gutiérrez and Varela 2009), Brazil (56) (Sousa and Elmoor-Loureiro 2012),Vientiane Province and Municipality of Laos (70) (Kotiv et al. 2013a), and Colombia (101) (Kotov and Fuentes-Reinés 2015).

There are several possible reasons why there is a low richness of Cladoceran in Côte d'Ivoire: (1) the insufficient number of cladoceran surveys, sampling efforts (only 13 studies focus on cladoceran from Côte d'Ivoire), and identification studies, and (2) zooplankton studies are relatively recent in Côte d'Ivoire (starting in 1955 with De Beauchamp's survey). Indeed, rarefaction analysis based on the number of water bodies sampled found that sampling efforts need to cover about 60 water bodies to stabilize the accumulation curve (Sousa and Elmoor-Loureiro 2012).

This low diversity of cladoceran from Côte d'Ivoire may also be linked to the fact that most of the database came from lotic and lagoonal ecosystems, which are considered unfavorable environments for cladocerans (Sousa and Elmoor-Loureiro 2012). This is because high water flow and turbulence and fish predation in lotic systems are unfavorable for cladoceran development (Viroux 2002). Moreover, this richness could be skewed by the fact that some species mentioned in Côte d'Ivoire [*Acroperus elongatus* (Ouattara et al. 2007; Kouamé et al. 2018), *Alona pulchella* (Yté et al. 1983 1996; Ouattara et al. 2007; Yao et al. 2015; Kouamé et al. 2018), *Simocephalus latirostris* (Ouattara et al. 2007), and *Simocephalus vertulus* (Rahm 1964)] are different from the Afrotropical species identified by Kotov et al. (2013b). This may be linked to errors in the identification of these taxa; if not, then the presence of these species in Côte d'Ivoire (tropical region) needs to be confirmed.

Cladoceran diversity from the Côte d'Ivoire analysis showed that community is qualitatively dominated by taxa of order Anomopoda (93.75% of the total diversity), followed by Ctenopoda (6.25%). This structure of cladoceran diversity from Côte d'Ivoire is similar to that noted by Forró et al. (2008) in the Afrotropical and Neotropical regions, and other parts of the world. Therefore, the cladoceran community of Côte d'Ivoire is marked by the total absence of Dumontiidae, Acantholeberidae, Ophryoxidae, Neothricidae, Holopedidae, Polyphemidae, and Leptodoriade, which were reported in Nigeria (Jeje 1989) and other Afrotropical regions (Forró et al. 2008).

In addition, the cladoceran community in Côte d'Ivoire is dominated by the Chydoridae family (16 species, 41% of total diversity of cladocerans recorded from Côte d'Ivoire), followed by Daphniidae (eight species, 21%). Chydoridae and Daphniidae are also reported as being dominant in Afrotropical regions (Forró et al. 2008), accounting for 49.25% (66 species) and 18.66% (25 species), respectively, of cladoceran diversity; in the Federal District of Brazil (Sousa and Elmoor-Loureiro 2012) [64% (33 species) and 12% (7 species), respectively]; Vientiane Province and Municipality, Laos (Kotov et al. 2013a) [64% (45) and

11% (8), respectively]; Colombia (Kotov and Fuentes-Reines 2015) [45% (46) and ~20% (20), respectively]; and Ecuador and the Galápagos Islands (López et al. 2018) [44% (15) and 35% (12), respectively].

The literature reviewed in this study suggest that *Ceriodaphnia cornuta*, *Moina micrura*, and *Diaphanosoma excisum* are Cladocera species frequently present in non marin aquatic ecosystems of Côte d'Ivoire. These species are also considered by Jeje (1989) to be the three most common limnetic cladocera of Nigeria, and are found in all the habitat types the study sampled (Lakes, Rivers, Streams, Deltas, Irrigation Canals, ponds, Fishponds pools, Marshes, Dam sites, and Reservoirs). These three are also considered very common and widely distributed tropical-subtropical species (Smirnov 1976; Sharma and Kotov 2013). This list contrasts with the ones reported by Sousa and Elmoor-Loureiro (2012) from Brazil, where the species with the highest occurrence among the water bodies evaluated were *Acroperus tupinamba*, *Alona guttata*, *Alona iheringula*, *Alonella clathratula*, *Alonella dadayi*, and *Ilyocryptus spinifer*.

CONCLUSIONS

This study lists for the first time cladoceran diversity in Côte d'Ivoire and reveals a relatively low total richness (39 species belonging to 24 genera and seven families). This low diversity may be the result of sampling efforts not reaching the number of species expected for Côte d'Ivoire based on cladoceran diversity in the larger Afrotropical region (134 belonging to 46 genera and seven families) (Forró et al. 2008). This finding contributes to the knowledge of the richness and species composition of cladocerans in Côte d'Ivoire. It can also help with future monitoring and management efforts in water bodies, and help select areas for new inventories.

Acknowledgment: The authors wish to express their sincere thanks to the staff of Unit of Pedagogy and Research in Hydrobiology of Felix Houphouet-Boigny University (Abidjan, Côte d'Ivoire), and to the anonymous referees for their helpful revisions of our manuscript.

Authors' contributions: RNE wrote the manuscript. TAB and GKB revised the manuscript. GGB, PEK, and VN (the Hydrobiology and Water Eco-technology Laboratory management team) conveived of the study. VN compiled a list of previous work on zooplankton.

Competing interests: RNE, TAB, GKB, GGB, PEK, and VN declare that they have no conflict of interests.

Availability of data and materials: All databases and accession numbers accessed are included in the manuscript.

Consent for publication: All authors agree to submit the manuscript to *Zoological Studies*, and agree to publish if accepted.

Ethics approval consent to participate: Not applicable.

REFERENCES

Aka MN, Etilé RN, Blahoua GK. 2016a. Anthropogenic Activities Impact on Zooplankton Community in a Tropical Coastal Lagoon (Ebrié, Côte d'Ivoire). International Journal of Contemporary Applied Sciences **3:**43–63.

Aka MN, Etilé RN, Konan FK, Bony YK. 2016b. Zooplankton Composition and Distribution in Relationship with Environmental Parameters in a Tropical Coastal lagoon (Ebrié lagoon: Aghien, Côte d'Ivoire). Int Res J Biol Sci **5:**1–12.

Aka MN, Pagano M, Saint-Jean L, Arfi R, Bouvy M, Cecchi P, Corbin D, Thomas S. 2000. Zooplankton Variability in 49 Shallow Tropical Reservoirs of Ivory Coast (West Africa). Int Rev Hydrobiol **85:**491–504. doi:10.1002/1522-2632(200008)85:4<491::AID-IROH491>3.0.CO;2-G.

Alanis JG, Sarma SSS, Nandini S. 2009. Prey selectivity and functional response by larval red-eyed tetra *Moenkhausia sanctaefilomenae* (Steindachner, 1907) (Characiformes: Characidae). Braz Arch Biol Techn **52:**1209–1216. doi:10.1590/S1516-89132009000500019.

Amian AF, Etilé RN, Aka MN, Wandan EN, Blé CM. 2018. Zooplankton diversity and abundance in extensive fish ponds during the rearing of tilapia *Oreochromis niloticus* juveniles fed with rice bran (West Africa, Côte d'Ivoire). IJFAS **6:**131–136.

Appiah YS, Etilé RN, Kouamé KA, Kouamélan EP. 2018. Zooplankton diversity and its relationships with environmental variables in a West African tropical coastal lagoon (Ebrié lagoon, Côte d'Ivoire, West Africa). JBES **13:**1–16.

Arfi R, Pagano M, Saint-Jean L. 1987. Communautés Zooplanctoniques dans une lagune tropicale (La lagune Ébrié, Côte d'ivoire): Variations spatio-temporelles. Rev Hydrobiol Trop **20:**21–35.

Benzie JAH. 2005. Cladocera: the genus *Daphnia* (including *Daphniopsis*) (Anomopoda: Daphniidae). *In*: Dumont HJF (eds), Guides to the identification of the microinvertebrates of the continental waters of the world, 21. Kenobi Productions, Ghent, Belgium and Backhuys Publishers, Leiden, The Netherlands, 376 pp.

Berté S, Etilé RN, Kamelan MT, Kouamelan PE. 2019. First Data on Zooplankton Community Structure and Abundance of Kankelaba River in Côte d'Ivoire (Bagoe Tributary, Basin Niger). Nat Sci **17:**125–135. doi:10.7537/marsnsj170819.18.

Bogut I, Adámek Z, Puškadija Z, Galović D, Bodakoš D. 2010. Nutritional value of planktonic cladoceran *Daphnia magna* for common carp (*Cyprinus carpio*) fry feeding. Ribarstvo **68:**1–10.

Bonou CA, Pagano M, Saint-Jean L. 1991. Développement et croissance en poids de *Moina (cf) micrura* et de *Mesocyclops*

ogunnus dans un milieu saumâtre tropical: les étangs de pisciculture de Layo (Côte d'Ivoire). Rev Hydrobiol Trop **24:**287–303.

Burgis MJ. 1973. Observations on the Cladocera of Lake George, Uganda. J Zool **170:**339–349. doi:10.1111/j.1469-7998.1973.tb01382.x.

Chatterjee T, Kotov AA, Van Damme K, Chandrasekhar SVA, Padhye S. 2013. An annotated checklist of the Cladocera (Crustacea: Branchiopoda) from India. Zootaxa **3667:**1–89. doi:10.11646/zootaxa.3667.1.1.

De Beauchamp P. 1955. Sur quelque Rotifères de la Côte d'Ivoire. Acta Trop **XX:**67–72. doi:10.5169/seals-310545.

De Los Rios-Scalante P, Kotov AA. 2015. A checklist of Branchiopoda (Anostraca and Cladocera) of Chilean continental waters. Zootaxa **4027:**366–388. doi:10.11646/zootaxa.4027.3.3.

Dela Paz ESP, Lopez MLD, David CIHA, Dela Cruz DRA, Viernes GAA, Wong JF, Pap RDS. 2018. Freshwater microcrustaceans (Cladocera: Anomopoda and Ctenopoda, Copepoda: Cyclopoida and Calanoida) in the highly urbanized Metropolitan Manila area (Luzon, Philippines). Check List **14:**751–762. doi:10.15560/14.5.751.

Delachaux T. 1917. Cladocères de la région du lac Victoria Nyanza. Rev Suisse Zool **25:**77–93.

Diomandé A, Etilé RN, Kamelan TM, Berté S, Kouamelan EP. 2018. Spatio-temporal variation of the zooplankton population in the Hana River in Taï National Park (West Africa). JBES **13:**236–250.

Dumont HJ. 1981. Cladocera and free-living Copepoda from the Fouta Djalon and adjacent mountain areas in West Africa. Hydrobiologia **85:**97–116. doi:10.1007/BF00006620.

Dumont HJ, Negrea SV. 2002. Introduction to the class Branchiopoda. *In*: Dumont HJ, Guides to the identification of the microinvertebrates of the continental waters of the world 19. Backhuys Publishers, Leiden, 398 pp.

Dumont HJ, Pensaert J, El Moghraby AI. 1984. Cladocera from the Sudan: Red Sea Hills, Jebel Marra and valley of the main Nile. *In*: Dumont HJ, El Moghraby AI, Desougi LA (eds). Limnology and Marine Biology in the Sudan. Developments in Hydrobiology **21:**163–169. doi:10.1007/978-94-009-6557-7_18.

Dumont HJ, Pensaert J, Van de Velde I. 1981. The crustacean zooplankton of Mali (West Africa). Hydrobiologia **80:**161–187. doi:10.1007/BF00008434.

Dumont HJ, Silva-Briano M, Babu KKS. 2002. A re-evaluation of the *Macrothrix rosea-triserialis* group, with the description of two new species (Crustacea Anomopoda: Macrothricidae). Hydrobiologia **467:**1–44. doi:10.1023/A:1014933227259.

Egborge ABM. 1987. Salinity and the distribution of Cladocera in Warri River, Nigeria. Hydrobiologia **145:**159–167. doi:10.1007/BF02530276.

Egborge ABM, Onwudinjo CC, Chigbu PC. 1994. Cladocera of coastal rivers of western Nigeria. Hydrobiologia **272:**39–46. doi:10.1007/BF00006511.

Elías-Gutiérrez M, Varela C. 2009. An annotated checklist of the cladocera of Cuba. Crustaceana **82:**1353–1364. doi:10.1163/001121609X12487811051426.

Etilé RN, Aka MN, Blahoua GK, Kouamélan PE, N'douba V. 2018. Zooplankton Diversity and distribution in Fresco Lagoon (West Africa, Côte d'Ivoire). Int Res J Environmental Sci **7:**9–20.

Etilé RN, Kouassi AM, Aka MN, Pagano M, N'douba V, Kouassi NJ. 2009. Spatio-temporal variations of the zooplankton abundance and composition in West African tropical coastal lagoon (Grand-Lahou, Côte d'Ivoire). Hydrobiologia **624:**171–189. doi:10.1007/s10750-008-9691-7.

Etilé RN, Yao SS, Kouassi AM, Aka MN, Pagano M, N'douba V. 2015. Diel Variation of Zooplankton Community Composition, Abundance and Biomass in a West African Tropical Coastal Lagoon (Grand-Lahou, Côte d'Ivoire). Int J Agric Innov Res **3:**2319–1473.

Forró L, Korovchinsky NM, Kotov AA, Petrusek A. 2008. Global diversity of cladocerans (Cladocera; Crustacea) in freshwater. Hydrobiologia **595:**177–184. doi:10.1007/s10750-007-9013-5.

Fryer G. 1968. Evolution and adaptive radiation in the Chydoridae (Crustacea: Cladocera): a study in comparative functional morphology and ecology. Philos T R Soc B **254:**221–385. doi:10.1098/rstb.1968.0017.

Ghaouaci S, Amarouayache M, Sinev AY, Korovchinsky N, Kotov AA. 2018. An annotated checklist of the Algerian Cladocera (Crustacea: Branchiopoda). Zootaxa **377:**412–430. doi:10.11646/zootaxa.4377.3.5.

Gogoi B, Safi V, Das DN. 2016. The cladoceran as live feed in Fish Culture: A Brief Review. Res J Animal, Veterinary and Fishery Sci **4:**7–12.

Green J. 1967. The distribution and variation of *Daphnia lumholtzi* (Crustacea: Cladocera) in relation to fish predation in Lake Albert, East Africa. J Zool **151:**181–197. doi:10.1111/j.1469-7998.1967.tb02109.x.

Green J, Kling GW. 1988. The genus *Daphnia* in Cameroon, West Africa. Hydrobiologia **160:**257–261. doi:10.1007/BF00007140.

Guo F, Dumont HJ. 2014. Relict populations of *Diaphanosoma* (Cladocera: Ctenopoda) in the Chadian Sahara, with the description of a new species. Zootaxa **3856:**135–142. doi:10.11646/zootaxa.3856.1.6.

Jeje CY. 1988. *Leydigia macrodonta macrodonta* Sars, 1916 (Cladocera, Chydoridae) Found in Nigeria, West Africa: A Redescription. Crustaceana **54:**113–116.

Jeje CY. 1989. The Cladoceran fauna of Nigeria: A checklist, review of literature and distribution. Rev Hydrobiol Trop **22:**3–11.

Jeong H, Kotov AA, Lee W. 2014. Checklist of the freshwater Cladocera (Crustacea: Branchiopoda) of South Korea. Proc Boil Soc Wash **127:**216–228. doi:10.2988/0006-324X-127.1.216.

Korovchinsky NM. 2004. Cladocerans of the order Ctenopoda of the world fauna (morphology, systematics, ecology, biogeography). KMK Press, Moscow, 410 pp. (in Russian)

Korovchinsky NM. 2010. A taxonomic revision of *Pseudosida szalayi* Daday, 1898 (Crustacea: Cladocera: Sididae) over its Asian range, with focus on the northernmost populations first rded from the Amur River basin (Far East of Russia). Zootaxa **2345:**1–18. doi:10.11646/zootaxa.2345.1.1.

Korovchinsky NM, Walsh EJ, Smolak R. 2017. *Diaphanosoma* Fischer, 1850 (Crustacea: Cladocera: Sididae) of Lake Turkana (East Africa), with the description of a new species of the genus. Zootaxa **4250:**77–89. doi:10.11646/zootaxa.4250.1.6.

Kotov AA, Damme KV, Bekker EI, Siboualipha S, Silva-Briano M, Ortiz AA, De la Rosa RG, Sanoamuang L. 2013a. Cladocera (Crustacea: Branchiopoda) of Vientiane province and municipality, Laos. J Limnol **72:**81–108. doi:10.4081/jlimnol.2013.s2.e6.

Kotov AA, Dumont HJ. 2000. Analysis of the *Ilyocryptus spinifer* s. lat. species group (Anomopoda, Branchiopoda), with description of a new species. Hydrobiologia **428:**85–113. doi:10.1023/A:1003983723896.

Kotov AA, Forró L, Korovchinsky NM, Petrusek A. 2013b. World checklist of freshwater Cladocera species. Available from: http://fada.biodiversity.be/group/show/17. Accessed 8 May 2019.

Kotov AA, Fuentes-Reinés JM. 2015. An annotated checklist of the Cladocera (Crustacea: Branchiopoda) of Colombia. Zootaxa **4044:**493–510. doi:10.11646/zootaxa.4044.4.2.

Kouamé KA, Etilé RN, Blahoua GK, Goore Bi G, Koumélan EP,

N'douba V. 2018. Composition and distribution of zooplankton in relationship to environmental parameters in tropical river (Sassandra river basin, Côte d'Ivoire). Journal of Global Biosciences **7:**5423–5438.

Lamoot E, Dumont HJ. 1974. *Moina retirulata* (Daday, 1905) (Cladocera, Moinidae) found in the Ivory Coast, West Africa. Crustaceana **26:**29–32. doi:10.1163/156854074X00037.

Legendre M, Pagano M, Saint-Jean L. 1987. Peuplements et Biomasse Zooplanctonique dans des Etangs de Pisciculture Lagunaire (Layo, Côte d'Ivoire), Etude de la Recolonisation Après la Mise en Eau. Aquaculture **67:**321–341. doi:10.1016/0044-8486(87)90217-1.

Lindberg K. 1957. Cyclopides (Crustacés Copépodes) de la Côte d'Ivoire. Bulletin de l'I.F.A.N. Tome XIX, Série A **1:**34–177.

López C, Mosquera PV, Hampel H, Neretina AN, Alonso M, Van Damme K, Kotov AA. 2018. An annotated checklist of the freshwater cladocerans (Crustacea: Branchiopoda: Cladocera) of Ecuador and the Galápagos Islands. Invertebrate Zoology **15:**277–291. doi:10.15298/invertzool.15.3.06.

Maiphae S, Pholpunthin P, Dumont HJ. 2008. Taxon richness and biogeography of the Cladocera (Crustacea: Ctenopoda, Anomopoda) of Thailand. Ann Limnol - Int J Lim **44:**33–43. doi:10.1051/limn:2008021.

Martens K, Behen F. 1994. A checklist of the recent non-marine Ostracods (Crustacea, Ostracoda) from the inland waters of South America and adjacent islands. Royal Belgian Institute of Natural Sciences, Freshwater Biology, Vautierstraat, 84 p.

Monney IA, Etilé RN, Ouattara IN, Koné T. 2015. Seasonal distribution of zooplankton in the Aby-Tendo-Ehy lagoons system (Côte d'Ivoire, West Africa). Int J Biol Chem Sci **9:**2362–2376. doi:10.4314/ijbcs.v9i5.9.

Monney IA, Ouattara IN, Etilé RN, Aka MN, Bamba M, Koné T. 2016. Distribution du zooplancton en relation avec les caractéristiques environnementales de quatre rivières côtières du Sud-est de la Côte d'Ivoire (Afrique de l'ouest). J Appl Biosci **98:**9344–9353. doi:10.4314/jab.v98i1.10.

N'da SA, Etilé RN, N'zi KG, Berté S, N'douba V. 2015. Composition and Distribution of Zooplankton Relationship to Environmental Factor in a Tropical River: (Bagoe, Côte d'Ivoire). Int Res J Biological Sci **4:**1–11.

Neretina AN, Kotov AA. 2015. A new species of *Acroperus* Baird, 1843 (Cladocera: Chydoridae) from Africa. Zootaxa **4039:**516–528. doi:10.11646/zootaxa.4039.4.2.

Neretina AN, Sinev AY. 2016. A revision of the genus *Leberis* Smirnov, 1989 (Cladocera: Chydoridae) in the old world and Australia. Zootaxa **4079:**501–533. doi:10.11646/zootaxa.4079.5.1.

Neretina AN, Zelalem W, Kotov AA. 2017. Studies of the cladocera (Crustacea: Branchiopoda) of Ethiopia: current state and further perspectives. Ethiop J Biol Sci **16(Suppl.):**171–180.

Nobah C. 1998. Distribution verticale des peuplements zooplanctoniques dans un lac de barrage ouest africain : lac d'Ayamé 1, Côte-d'Ivoire. Mémoire de DEA d'écologie Tropicale, option animale, Université de Cocody, 61 p.

Orlova-Bienkowskaja MJ. 1995. Revision of the *Simocephalus* (*latirostris*) species group (Crustacea: Anomopoda: Daphniidae). Hydrobiologia **316:**43–58. doi:10.1007/BF00019374.

Orlova-Bienkowskaja MJ. 1998. A revision of the cladoceran genus *Simocephalus* (Crustacea, Daphniidae). Bul Nat Hist Mus Zool **64:**1–62.

Orlova-Bienkowskaja MJ. 2001. Daphniidae: genus *Simocephalus*. Guides to the identification of the microinvertebrates of the continental waters of the World 17. Backhuys, Leyden, 130 pp.

Ouattara NI, Ouattara A, Koné T, N'douba V, Gourene G. 2007. Distribution du zooplancton le long sde deux petits bassins côtiers ouest africains (Bia et Agnébi, Côte d'Ivoire). Agron Afr **19:**197–2010. doi:10.4314/aga.v19i2.1715.

Pagano M. 2008. Feeding of tropical cladocerans (*Moina micrura*, *Diaphanosoma excisum*) and rotifer (*Brachionus calyciflorus*) on natural phytoplankton: effect of phytoplankton size-structure. J Plankton Res **30:**401–414. doi:10.1093/plankt/fbn014.

Pagano M, Saint-Jean L, Arfi R, Bouvy M, Shep H. 2000. Population growth capacities and regulatory factors in monospecific cultures of the cladocerans *Moina micrura* and *Diaphanosoma excisum* and the copepod *Thermocyclops decipiens* from Côte d'Ivoire (West Africa). Aquat Living Resour **13:**163–172. doi:10.1016/S0990-7440(00)00152-2.

Parmar TK, Rawtani D, Agrawal YK. 2016. Bioindicators: the natural indicator of environmental pollution. Front Life Sci **9:**110–118. doi:10.1080/21553769.2016.1162753.

Rahm U. 1964. Zur Oekologie des Zooplanktons der lagune Ebrié (Elfenbeinküste). Acta Trop **21:**1–47. doi:10.5169/seals-311180.

Rey J, Saint-Jean L. 1968. Les Cladocères (Crustacés, Branchiopodes) du Tchad (Première note). Cahier ORSTOM, Série Hydrobiologie **2:**80–118.

Rey J, Saint-Jean L. 1969. Les Cladocères (Crustacés, Branchiopodes) du Tchad (Deuxième note). Cah - ORSTOM, Sér Hydrobiol **3:**21–42.

Rey J, Yté AW. 1982. The presence of *Bosmina tubicen* (Brehm, 1953) (Cladocera, Bosminidae) on the Ivory Coast. Ann Limnol - Int J Lim **18:**173–178. doi:10.1051/limn/1982013.

Richard J. 1892. *Grimaldina brazzai*, *Guernella raphaelis*, *Moinodaphnia mocquerysi*, cladocères nouveaus du Congo. Mém Soc Zool Fr **5:**213–226.

Rzóska J. 1952. LIV.—Notes on some cladocera from the Upper White Nile. Ann Mag Nat Hist **5:**466–474. doi:10.1080/00222935208654318.

Saint-Jean L, Bonou S. 1994. Growth, production, and demography of *Moina micrura* in brackish tropical fishponds (Layo, Ivory Coast). Hydrobiologia **272:**125–146. doi:10.1007/BF00006517.

Sharma P, Kotov AA. 2013. Molecular approach to identify sibling species within *Ceriodaphnia cornuta* species group (Cladocera: Daphniidae) from Australia with notes on the continental endemism of this group. Zootaxa **3702:**79–89. doi:10.11646/zootaxa.3702.1.5.

Smirnov NN. 1976. Macrothricidae and Moinidae of the world fauna. Fauna SSSR, Novaya Seriya. Rakoobraznye **1:**1–237. (in Russian)

Smirnov NN. 1992. The Macrothricidae of the world (Guides to the identification of the microinvertebrates of the continental waters of the world). SPB Academic Publishing, 143 pp.

Smirnov NN. 1996. Cladocera: The Chydorinae and Sayciinae (Chydoridae) of the world. Dumont HJ (eds.): Guides to the Identification of the Microinvertebratres of the Continental Waters of the World, SPB Academic Publishing, Amsterdam **11:**150–163.

Smirnov NN. 2008. Check-list of the South-African Cladocera (Crustacea: Branchiopoda). Zootaxa **1788:**47–56. doi:10.11646/zootaxa.1788.1.4.

Sousa FDR, Elmoor-Loureiro LMA. 2012. How many species of cladocerans (Crustacea, Branc are found in Brazilian Federal District? Acta Limnol Bras **24:**351–362. doi:10.1590/S2179-975X2013005000008.

Sousa FDR, Elmoor-Loureiro LMA. 2013. Cladocerans (Crustacea: Anomopoda and Ctenopoda) of the Sempre Vivas National Park, Espinhaço Range, Minas Gerais, Brazil. Check List **9:**4–8. doi:10.15560/9.1.4.

Sousa FDR, Elmoor-Loureiro LMA. 2019. Identification key for the

Brazilian species and subspecies of the family Ilyocryptidae (Crustacea, Branchiopoda, Anomopoda). Pap Avulsos de Zool **59:**1–8. doi:10.11606/1807-0205/2019.59.23.

Thomas IF. 1961a. The Cladocera of the Swamps of Uganda. Crustaceana **2:**108–125. doi:10.1163/156854061X00284.

Thomas IF. 1961b. Review of the Genera *Pseudosida* Herrick, 1884 and *Latonopsis* Sars, 1888 (Cladocera). Crustaceana **3:**1–8. doi:10.1163/156854061X00482.

Tifnouti A, Pourriot R. 1989. Dynamique d'une population de *Moina micrura* (Crustacea, Cladocera) dans un bassin de lagunage à Marrakech (Maroc). Rev Hydrobiol Trop **22:**239–250.

Van Damme K, Bekker EI, Kotov AA. 2013. Endemism in the Cladocera (Crustacea: Branchiopoda) of Southern Africa. J Limnol **72:**440–463. doi:10.4081/jlimnol.2013.e36.

Van Damme K, Eggermont H. 2011. The Afromontane Cladocera (Crustacea: Branchiopoda) of the Rwenzori (Uganda - D. R. Congo): taxonomy, ecology and biogeography. Hydrobiologia **676:**57. doi:10.1007/s10750-011-0892-0.

Van Damme K, Kotov AA, Dumont HJ. 2010. A checklist of names in *Alona* Baird 1843 (Crustacea: Cladocera: Chydoridae) and their current status: an analysis of the taxonomy of a lump genus. Zootaxa **2330:**1–63. doi:10.11646/zootaxa.2330.1.1.

Viroux L. 2002. Seasonal and Longitudinal aspects of microcrustacean (Cladocera: Copepoda) dynamics in lowland River. J Plankton Res **24:**281–292. doi:10.1093/plankt/24.4.281.

Xiang X, Ji G, Chen S, Yu G, Xu L, Han B, Kotov AA, Dumont HJ. 2015. Annotated Checklist of Chinese Cladocera (Crustacea: Branchiopoda). Part I. Haplopoda, Ctenopoda, Onychopoda and Anomopoda (families Daphniidae, Moinidae, Bosminidae, Ilyocryptidae). Zootaxa **3904:**1–27. doi:10.11646/zootaxa.3904.1.1.

Yalım FB, Çıplak B. 2010. Redescription of *Ephemeroporus barroisi* (Richard, 1894) (Cladocera, Chydoridae) on the basis of material from Mediterranean Anatolia (Turkey). Turk J Fish Aquat Sci **10:**551–558. doi:10.4194/trjfas.2010.0416.

Yao SS, Etilé RN, Blahoua GK. 2015. Diversity and structure of zooplankton community of Comoé River in relation with environmental factors (Comoé National Park, Côte d'Ivoire). International Journal of Engineering Research and Management **2:**68–74.

Yté WA. 1992. Zooplancton des étangs de pisciculture de l'IDESSA (Bouaké, Côte-d'Ivoire): Evolution du peuplement et biomasse. Agron Afr **4:**87–178.

Yté WA, Getheme AM, Sanogo TA. 2009. Zooplancton des eaux de bas-fonds a Gagnoa, centre-ouest Côte d'Ivoire. Agron Afr **21:**253–260. doi:10.4314/aga.v21i3.56463.

Yté WA, Kouassi N. 1983. Structure des peuplements de Cladocères et de Rotifères du lac d'Ayamé (Côte d'Ivoire). Ann Univ. Abidjan, Sér E **16:**87–97.

Yté WA, Kouassi N, Ayékoué P, Yoro S. 2002. Observations sur le peuplement planctonique du lac Faé (Côte d'Ivoire). *In*: Rapport scientifique IDESSA-AISA-C.R.O. Etude bioécologique des peuplements ichtyologiques et planctoniques du lac Faé, dans la région du Sud-ouest de la Côte-d'Ivoire (San-Pedro), pp. 18–24.

Yté WA, Kouassi N, Rey J. 1982. Variation saisonnière du peuplement zooplanctonique du lac d'Ayamé (Côte d'Ivoire). Ann Univ Abidjan, Sér E **15:**103–120.

Yté WA, Kouassi N, Yoro S. 1996. Peuplement zooplanctonique du lac de Buyo (Côte d'Ivoire): Liste faunistique et distribution. Agron Afr **8:**143–152.

Yté WA, Rey J, Pourriot R. 1983. Peuplement zooplanctonique d'un lac de barrage de Côte d'Ivoire. Annls Limnol **19:**3–8. doi:10.1051/limn/1983004.

Zoppi De Roa E, López C. 2008. An updated checklist of inland Cladocera (Crustacea: Orders Ctenopoda and Anomopoda) from Venezuela. Zootaxa **1919:**45–57. doi:10.11646/zootaxa.1919.1.3.