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Infestation of Copepods Parasite in the Gills of Economically Important Mugilidae Species from Lake Nokoue (Republic of Benin) and Lagos Lagoon (Nigeria)

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Abstract

Parasitic copepods infect virtually all aquatic animal groups and show a staggering diversity in body form and life cycle strategies infestation from Caligid copepods are related to farmed fish populations in temperate zones, due to the economic costs they represent and their higher incidence at high population densities such as those occurring in aquaculture. However, only a few research examined copepod infestations on wild fish populations or assemblages. Although the occurrence of *Lepeophtheirus* species has been widely recorded on different fish species, the characteristics and effects of infestation are poorly known hence this study. This study aims to detect the infestation of parasitic copepod and analyze its relationships according to season, sex and maturity on two fish species of Mugilidae (LF: *Liza falcipinnis* and MC: *Mugil cephalus*). A total number of 1139 pieces of LF were collected from Lake Nokoue and 1135 pieces of MC were collected from Lagos lagoon between April 2019 and October 2021. They were examined for parasites in both dry and wet seasons, results were analyzed using Chi-squared or Fisher's Exact test.

The result obtained shows the highest total percentage of copepod prevalence was found in Ganvie (86.23%) and the least in Djdje (63.14%). There is a significant difference ($P<0.05$) in the rate of infestation of *L. falcipinnis* at Djdje to the other two stations, there is a high prevalence of copepod parasites infestation in the Mugilidae studied in the wet season than the dry season and sex did not impact the degree of LF and MC infestation by parasites in the Lake Nokoue and Lagos lagoon.

Keywords: Mugilidae, Parasites, Lagos lagoon, Lake Nokoue.

Introduction

Copepods are aquatic crustaceans that are diverse and are the most numerous metazoans in the water community with habitats ranging from freshwater to hypersaline conditions (Barreiro & Torres, 2003). A distinctive characteristic very important of this group is their long antennae and a body design that includes a head, thorax and abdomen (Kabata, 1979)

Mullets are economically important species for both aquaculture and commercial fisheries around the world (Azien *et al.*, 2005).

Its farming still depends on fry or fingerlings stocked from natural water. This fact promotes disease including parasite infestation, which results in the constant dissemination of disease-causing agents between the cultured and natural population of mullet. Lagos lagoon in Nigeria is linked to Lake Nokoue in the Republic of Benin. In Nigeria and the Republic of Benin, *Mugil cephalus* and *Liza falcipinnis* in the family Mugilidae, constitute an important proportion of the catches by artisanal or subsistence fishermen and are of tremendous economic importance (Soyinka, 2008; Laleye *et al.*, 2003, Gnonhossou, 2006). Therefore it is fundamental to know about all the potential pathogens and parasites which can perturb their health and reproduction.

According to Aladetohun & Sogbesan (2010), there is still a paucity of information on the fish disease and environmental control in Nigeria and West Africa as a whole. It is noteworthy that in Nigeria and the Republic of Benin, no single work has been carried out on parasites of these economically important fish before embarking on this research work.

This study is to investigate the occurrence of copepods parasite in economically important mugilidae fish (*Mugil cephalus* and *Liza falcipinnis*) from LakeNokoue (Republic of Benin) and Lagos lagoon (Nigeria)

Materials and methods

Lagos lagoon lies between longitude 3°20′ and 3°40E and latitudes 6°154 and 6°40′N and has an area of 208km². It is the largest in the southern part of Nigeria and West Africa sub-region. (Soyinka, 2008). The Lagos lagoon extends eastward for about 200km from the Nigerian-Benin Republic border to the western limit of the transgressive mud coast. Lagos lagoon (Fig. 1) has tropical climatic conditions with the rainy season from April through October and the dry season from November through March. Three stations were selected within the Lagos lagoon for the study. The stations are Makoko (station 1) University of Lagos (station 2) and Mequin (station 3) (Fig. 1). The longitude and latitude of the sampling stations were measured using a G.P.S. device and the locations are presented in table I. Sampling was carried out at each station, from, April 2019, to October 2021, both in the dry and the rainy seasons.

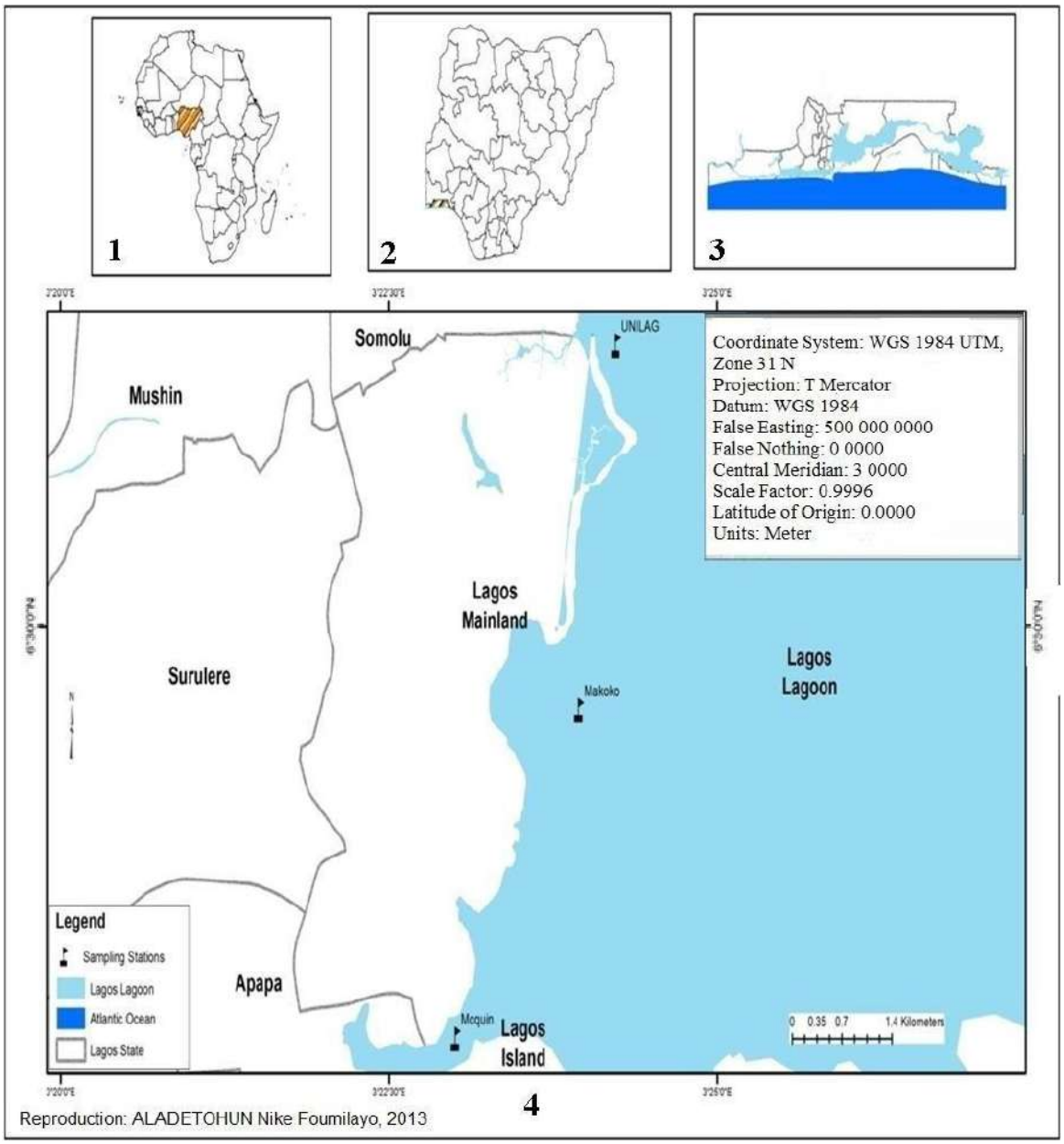

Figure 1: Map of Lagos lagoon (Nigeria), showing the sampling sites
Keys 1: Nigeria in Africa; 2: map of Nigéria; 3: river system in southern Nigeria; 4: study area in Nigeria

Table I: GPS locations of sampling stations in Lagos lagoon

Lagos Lagoon	Longitude	Latitude
STATIONS		
Mequin	30°23′0.594″E	60°27’57.686”N
Makoko	30°23’56.829”E	60°29’34.733”N
Unilag	30°996”E	60°31’22.977”N

3.2. Site 2: Lake Nokoue (Republic of Benin)

Lake Nokoue (Fig. 2) is the largest lagoon in the Republic of Benin (Moreau, 2004). It is a shallow, sub-tropical coastal lagoon (60°25N, 2036E) with a surface of 150 km2 and stretches 20 km in its east-west direction by 11 km in the north-south direction. Lake Nokoue opens directly into the Atlantic Ocean through a channel at Cotonou which is about 24.5 km long. The name Lake Nokoue is the name given to the lagoon since history (Laleye *et al.*, 2003). For this study, three stations were considered as sampling areas within the lake: Ganvie, Djidje, and Zogbo.

Table 2: GPS locations Showing sampling stations of (Lake Nokoue, Republic of Benin)

Lagos Lagoon	Longitude	Latitude
STATIONS		
Djidje	20°25'8.393"E	60°23'11.077"N
Zogbo	20°24'7.512"E	60°23'40.162"N
Ganvie	20°24'32.615"E	60°27'33.77"N

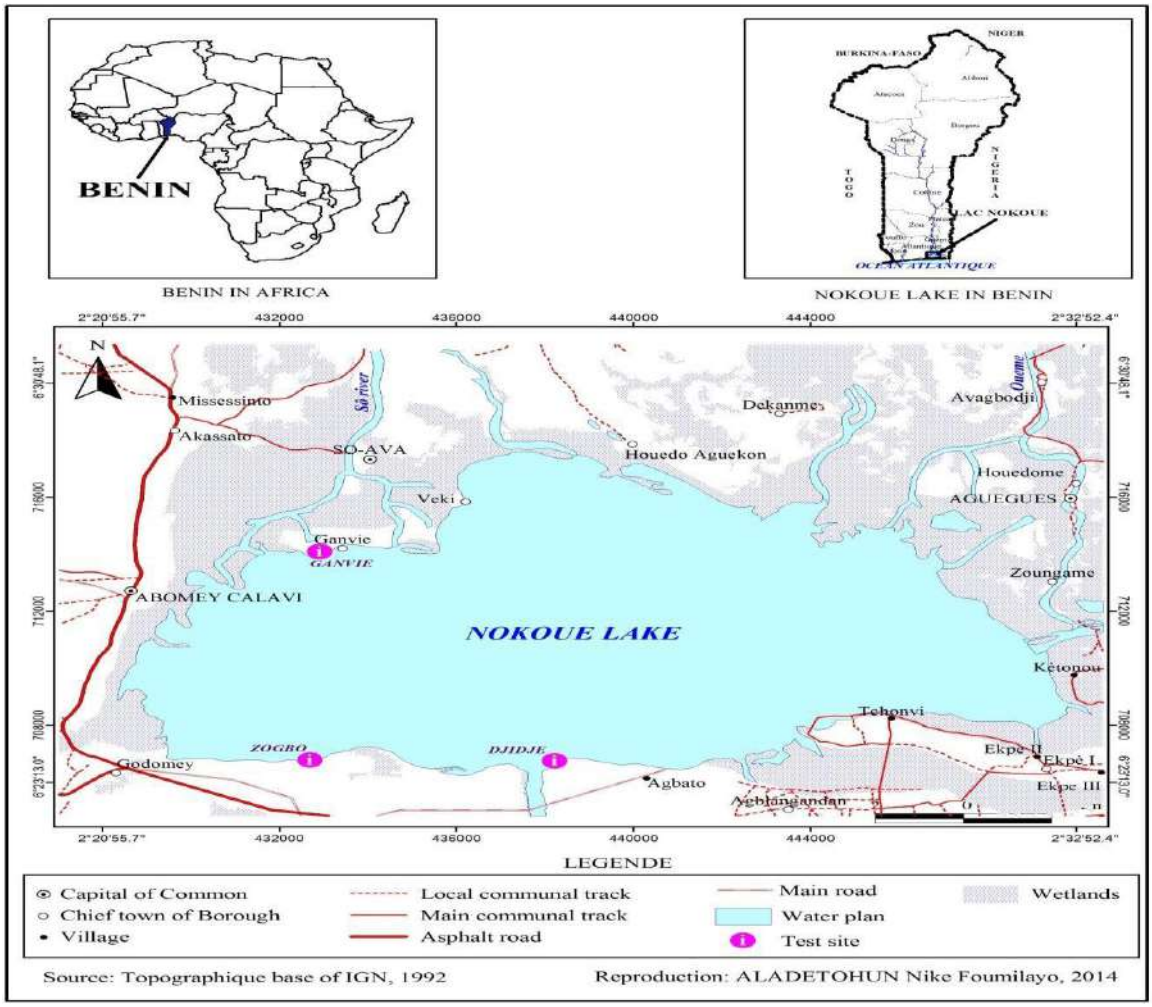

Figure 2: Map of Lake Nokoue lagoon
Keys: Republic of Benin, showing the sampling sites

Specimens of the two species of fish (*Mugil cephalus* and *Liza falcipinnis*) were collected from the Lagos lagoon (Nigeria) and Lake Nokoue lagoon (Republic of Benin) directly from the fishermen. The collected fish were transported in ice boxes to the laboratory and examined for parasites. The host species were identified using Fisher *et al*. (1987). Sex was determined according to Guerrero & Shelton (1974). The Weight (WT) of the fish was taken with a digital weighing balance and recorded. The total length (TL), standard length (SL) and forked length (FL) were measured with the aid of the meter rule.

In Lagos lagoon, a total number of 1135 of both fish species of fish (MC-411, LF-724) were investigated. In Lake Nokoue, a total number of 1139 of both species of fish (MC-470, LF-669) were investigated, from April 2019 to November 2021. Three class sizes were examined for LF and MC individuals: fingerlings Total length ranges from (1to 10 cm); juveniles (10 to 20 cm of length) and adults (length> 20 cm).

A total of 381 males, 341female and 253 males, 164 females were caught for LF and MC in Lake Nokoue respectively. 386 males, 342 females and 257 males, 150 females were caught for LF and MC respectively in Lagos lagoon.

Parasitological examination

Gills were excised by cutting each gill at the upper and lower end, the extracted gills were put in a Petri dish. The gills were then examined for copepods parasites under a magnifying glass and later transferred on a glass slide for observation using a binocular microscope OPTIM 4 with an integrated video camera (Bykhovskaya-Pavlovskaya 1985).

The parasites were collected directly from the gills. The recovered parasites were fixed and preserved in ethanol (70%) Parasite species identification was based on morphological features according to Ben Hassine (1983), Vassiliades (1975), Kabata (1979) (1984), and Moravec (2007).

Parasitological analysis

The parasitological terms follow Bush *et al.* (2001): prevalence (P) is the number of fish infected with one or more individuals of a particular parasite species (or taxonomic group) divided by the number of hosts examined (expressed as a percentage):

$$\text{Prevalence} = \frac{Number\ of\ hosts\ infested}{Number\ of\ hosts\ examined} \times 100$$

The intensity of infection (I) is the number of individuals of a particular parasite species in a single infected host (expressed as a numerical range); mean intensity (of infection, mI) is the average intensity or the total number of parasites of a particular species found in a sample divided by the number of infected hosts:

$$\text{Mean intensity} = \frac{Total\ number\ of\ a\ particular\ parasite}{Number\ of\ infected\ hosts}$$

Statistical analysis

The one-way analysis of the variance (ANOVA) followed by the Tukey test has been performed to compare the average mean intensity among the stations inside each study area and for each species., Welch Two Sample t-test was used to compare the average mean intensity between the two Mugilidae inside each station of each study area on the one hand and for the same fish between the two countries on the other hand. All of these analyses have been done in R 2.15.3 statistical software.

4.0 Results

The three copepods of mullets found in this work belong to the family of Ergasilidae and generas, *Nipergasilus* and *Ergasilus*.

According to the anato-morphological characters, these copepods are identified as species *N. bora*, *E. latus* and *E. lizae*. (Plate 1). One of the fundamental characteristics of Ergasilidae is that only females are parasites; males live a free life.

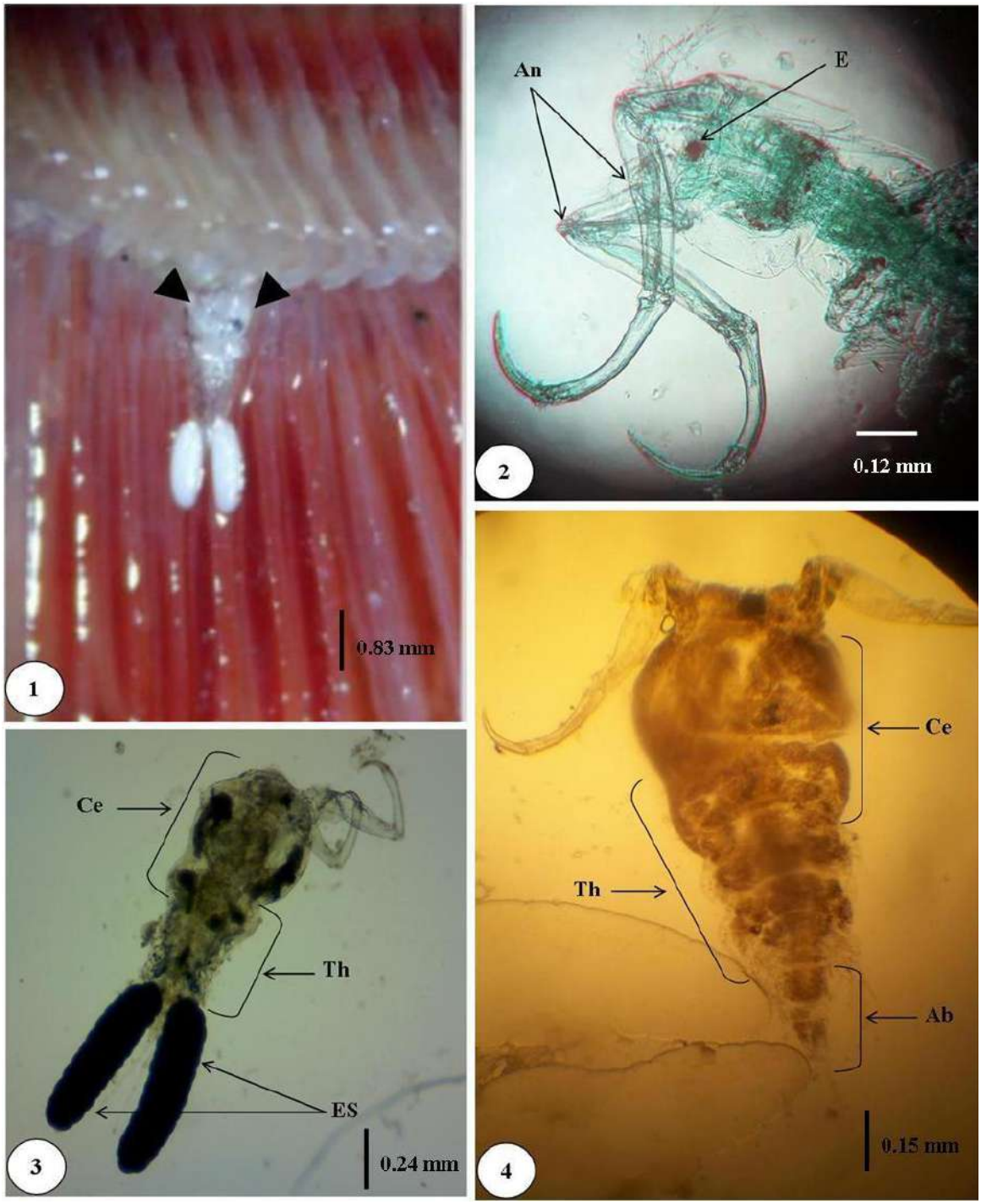

Plate 1: Copepoda

1: Gill showing the attachment of copepod on gill arche (arrowheads)
2: *Nipergasilus bora, in toto* view. An: antenna; E: eyes
3: *Ergasilus lizae, in toto* view. Ce: cephalothorax; Th: thorax; Ab: abdomen; ES: eggs sac
4: *Ergasilus latus, in toto* view. Ce: cephalothorax; Th: thorax; Ab: abdomen

Population patterns of hosts fishes in the two study area

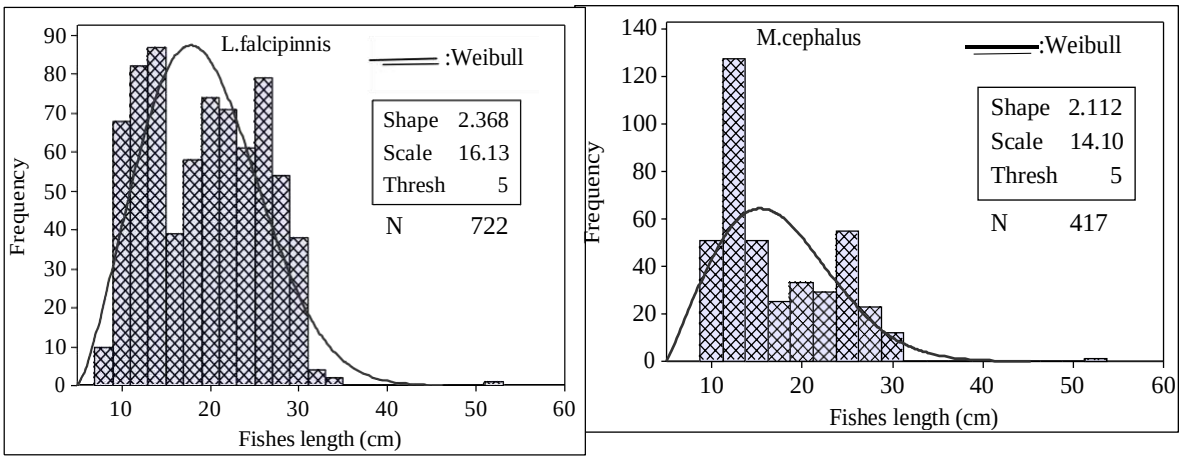

Figure 3: Size structure of (a): *Liza falcipinnis* and (b): *Mugil cephalus* populations in the Lagos lagoon

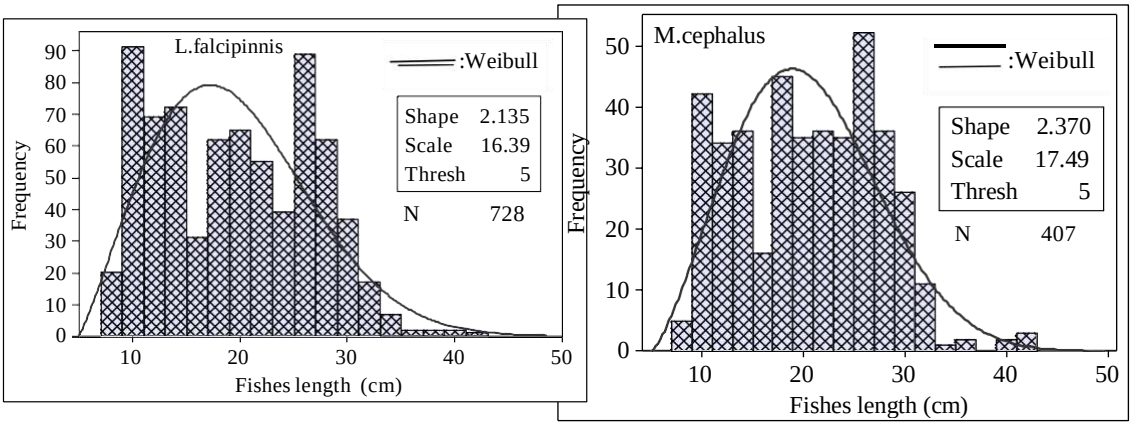

Figure 4: Size structure of: (a) *Liza falcipinnis* and (a): *Mugil cephalus* populations sample in the Lake Nokoue

The size structure of the two fishes populations in the two lakes (Fig. 3 and 4) showed that both LF and MC structure followed positive skew distribution with Weibull shape parameters included between 1 and 3.6 which indicate some populations fishes species with a predominance of young individuals particularly juveniles. Fingerlings are slightly represented. It should be because adults are more caught by fishers.

Assessment of the influence of season, stages and sex on the prevalence rate of whole parasitic copepods in Mugilidae (*M. cephalus* and *L. falcipinnis*) from Lake Nokoue and Lagos lagoon.

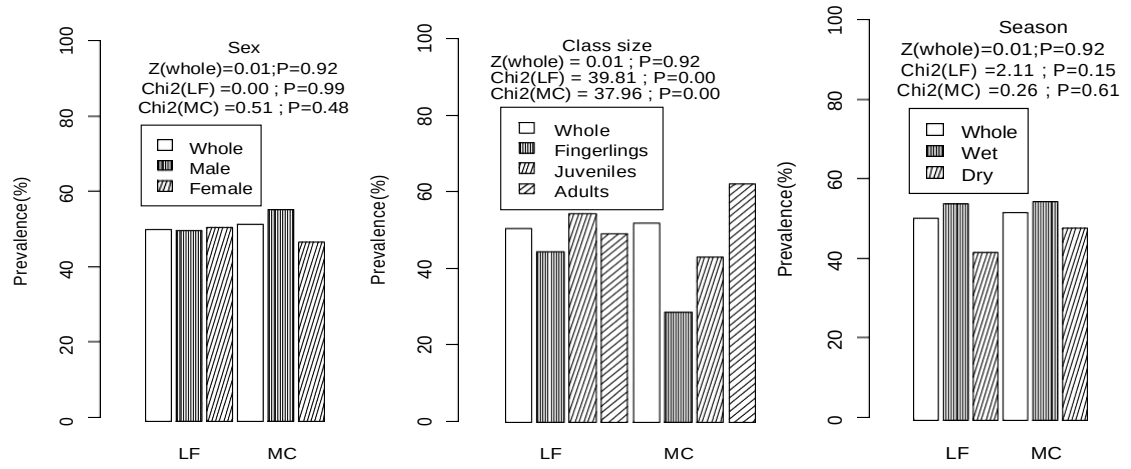

Figure 5: Copepods prevalence rate at Djidje station

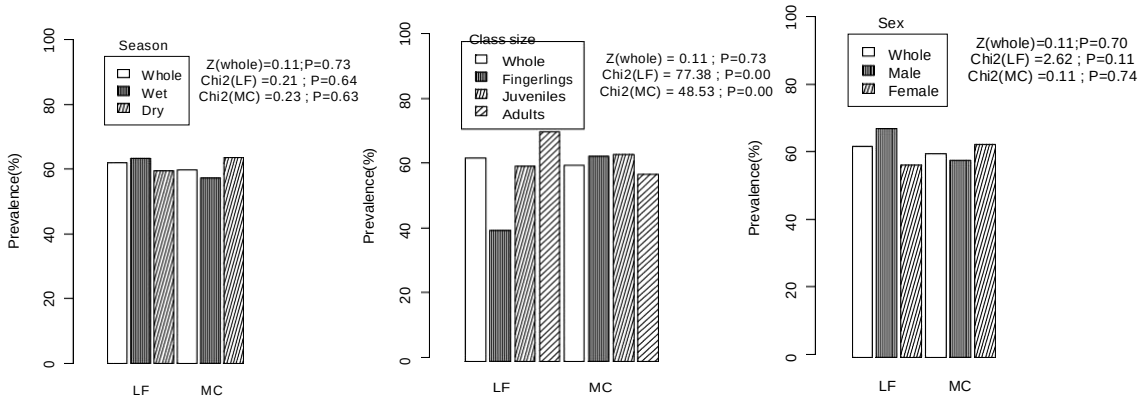

Figure 6: Copepods prevalence rate at Zogbo station

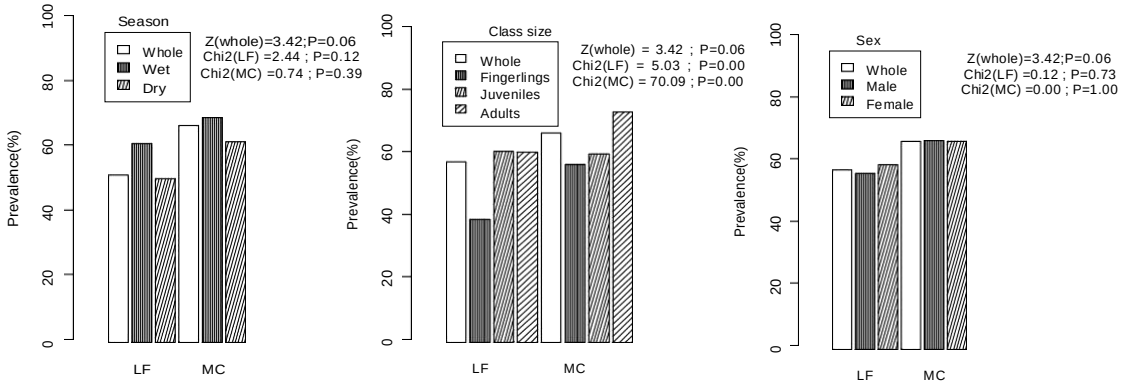

Figure 7: Copepods prevalence rate at Ganvie station

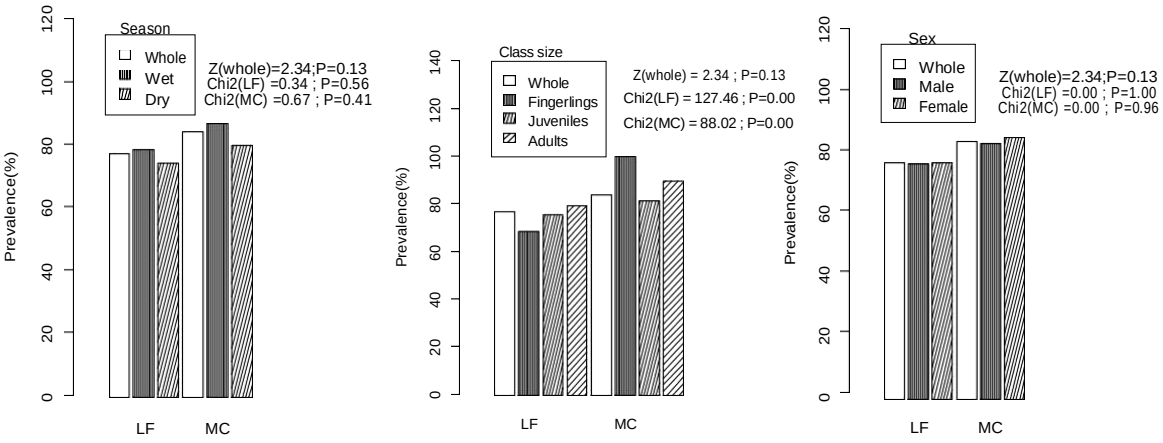

Figure 8: Copepods prevalence rate at Unilag station

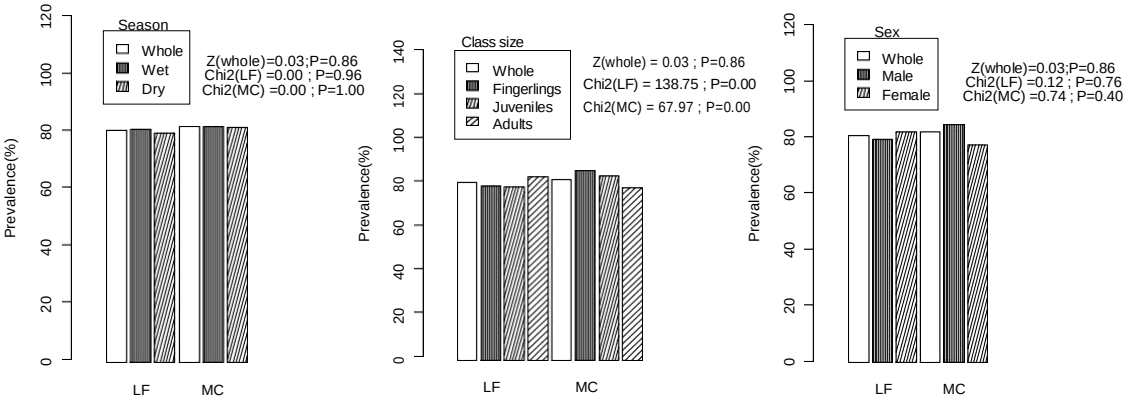

Figure 9: Copepods prevalence rate at Makoko station

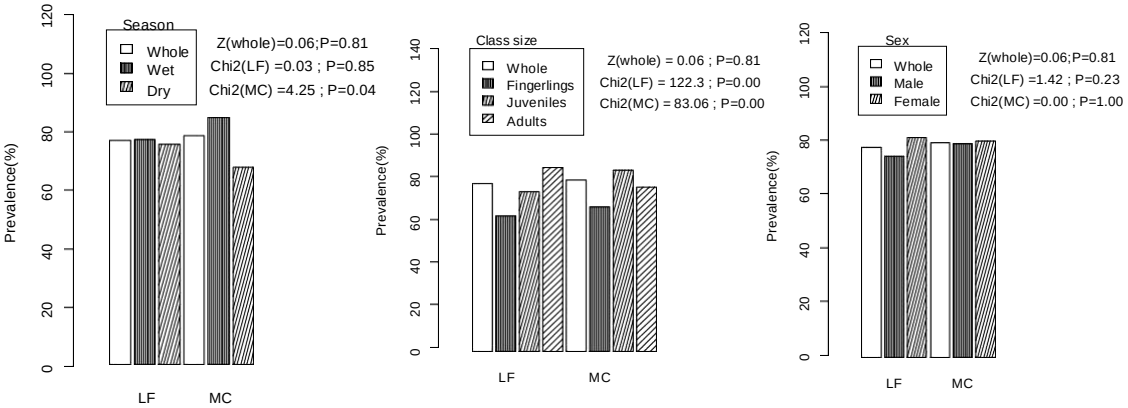

Figure 10: Copepods prevalence rate at Mequin station

The results of the Chi-squared or Fisher's Exact test revealed that the season and sex didn't impact the degree of LF and MC infestation by copepods in the Lake Nokoue and Lagos lagoon. Whereas, for LF and MC in all stations in Lake Nokoue and Lagos lagoon respectively the prevalence rate of copepods is determined significantly by stage (P-value <0.05).

In Djidje (Fig. 5; Table 3), juveniles of LF were more parasitized (54.32%) than adults (49.02) and fingerlings (44.44). Adults of MC were more infested (62.07%) than juveniles (42.86%) and fingerlings (28.57%). In Zogbo (Fig. 6; Table 4), it was adults of LF that were more infested (70.09%) than juveniles (59.63%) and fingerlings (40%). Juveniles of MC were more infested (63.04%) than fingerlings (62.5%) and adults (56.92%). At Ganvie (Fig. 7; Table 5), the degree of infestation of adults and juveniles of LF fishes were almost the same (60% and 60.20% respectively) but higher than fingerlings (38.89%). Adults of MC were more parasitized (72.73%) than juveniles (59.42%) and fingerlings (56.25%).

At Unilag (Fig. 8; Table 6), for LF, adults were more infested (79.51%) than juveniles (75.47%) and fingerlings (68.42%). Regarding MC, 100% of fingerlings were infested followed by adults (89.80%) and juveniles (81.25%). At Makoko (Fig. 9; Table 7), LF adults were more infested (82.61%) than fingerlings (78.57%) and juveniles (77.88%). Fingerlings of MC were more infested (82.93%) than juveniles (85.71%) and adults (77.78%). At Mequin (Fig. 10; Table 8), LF adults were more infested (84.76%) than juveniles (73.55%) and fingerlings (62.50%). However, it was juveniles of MC that were more infested (84.76%) than adults (75.47%) and fingerlings (66.67%).

Regarding the degree of infestation of two fishes, two samples tested for equality of proportions showed that there is no difference between the prevalence rate of copepods on LF and MC (P-value > 0.05) in the two study areas.

The whole prevalence of parasitic copepods on LF in Lake Nokoue was 56.97 % (413 infested on 725 examined) against 78.08% (570 infested on 730 examined) in Lagos lagoon. Two samples tested for equality of proportions showed that there is a highly significant difference between the two prevalences (Z-value = 73.05, P-value = 0.00<0.05). Thus, LF was more infested by copepods in Lagos lagoon than in Lake Nokoue. For MC, the whole prevalence in Lake Nokoue was 60.86% (252 infested on 414 examined) against 81.95% (332 infested on 405 examined) in Lagos lagoon. Two samples test for equality of proportions showed also that there is a highly significant difference between the two prevalences (Z-value = 43.58, P-value = 0.00<0.05). Like this, MC was more infested by copepods in Lagos lagoon than in Lake Nokoue.

The average number of copepods per fish species (mean intensity)

Lake NokoueAt Djidje, the average number of copepods in LF was 7 against 6 in MC. Welch Two Sample t-test revealed that there is no significant difference between the number of copepods in LF and MC (t-value = 0.52, P-value = 0.66>0.05). At Ganvie, the average number of copepods in LF was 7 against 6 in MC. Welch Two Sample t-test revealed also that there is no significant difference between the number of copepods in LF and MC (t-value = 1.43, P-value = 0.39>0.05). At Zogbo, the average number of copepods in LF was 7 against 6 in MC. Welch Two Sample t-test revealed also that there is no significant difference between the number of copepods in LF and MC (t-value = 0.35, P-value = 0.77>0.05). The one way analysis of variance showed that there is no significance difference among the number of parasitic copepods in LF among the three stations (F-value = 0.11, P = 0.90>0.05) and also in MC among the three stations (F-value = 0.08, P = 0.93>0.05).

- ***Lagos lagoon***

At Makoko, the average number of copepods in LF was 13 against 10 in MC. Welch Two Sample t-test revealed that there is a significant

difference between the number of copepods in LF and MC (t-value = 12.05, P-value = 0.02< 0.05). At Mequin, the average number of copepods in LF was 10 against 10 in MC. Welch Two Sample t-test revealed also that there is no significant difference between the number of copepods in LF and MC (t-value = 0.70, P-value = 0.56>0.05). At Unilag, the average of copepods in LF was 11 against 10 in MC. Welch Two Sample t-test revealed also that there is no significant difference between the number of copepods in LF and MC (t-value = 1.64, P-value = 0.35>0.05). The one-way analysis of variance showed that there is a highly significant difference in the number of parasitic copepods in LF among the three stations (F-value = 0.11, P = 0.002<0.05). Turkey multiple comparisons of means showed that all stations are different (P (Mequin-Makoko) = 0.002<0.05; P (Unilag-Makoko) = 0.01<0.05; P (Unilag-Mequin) = 0.02 <0.05). However, there is no significance difference in MC among the three stations (F-value = 1.24, P = 0.41>0.05).

Overall, there is a highly significant difference between the whole number of copepods in LF between Lake Nokoue and Lagos lagoon (7 and 11 respectively, t-value = - 4.71, P-value = 0.001<0.05) and also for the whole number of copepods in MC between Lake Nokoue and Lagos lagoon (6 and 10 respectively, t-value = - 5.04, P-value = 0.002<0.05). In other words, both LF and MC contained more parasitic copepods in their organism in the Lagos lagoon than in Lake Nokoue.

Table 3: Copepods' prevalence rate estimation according to season, stage and sex in Mugilidae (*M. cephalus* and *L. falcipinnis*) from Djidje station in Lake Nokoue

			N.ex	N.inf	Prev(%)	χ^2	P-value	Prev. Total (%)	Z	P-Value	Total parasite	Mean intensity
Season	LF	Wet	148	80	54.05	2.11	0.15	50.48	0.01	0.92	717	8.96
		Dry	62	26	41.94						114	4.38
	MC	Wet	66	36	54.55	0.26	0.61	51.75			259	7.19
		Dry	48	23	47.92						67	2.91
Sex	LF	Male	112	56	50.00	0.00	0.99	50.48	0.01	0.92	435	7.77
		Female	98	50	51.02						396	7.92
	MC	Male	63	35	55.56	0.51	0.48	51.75			187	5.34
		Female	51	24	47.06						139	5.79
Stage	LF	Fing	27	12	44.44	39.1	0.00	50.48	0.01	0.92	88	7.33
		Juve	81	44	54.32						300	6.82
		Adul	102	50	49.02						443	8.86
	MC	Fing	7	2	28.57	37.96	0.00	51.75			22	11.00
		Juve	49	21	42.86						92	4.38
		Adul	58	36	62.07						212	5.89

N.ex=Number of fishes examined; N.inf= Number of fishes infested; Prev= Prevalence; Fing= Fingerlings; Juve= Jeveniles; Adul= Adults; Z are measures of standard deviation.

Table 4: Copepods' prevalence rate estimation according to season, stage and sex in Mugilidae (*M. cephalus* and *L. falcipinnis*) from Zogbo station in Lake Nokoue

			N.ex	N.inf	Prev(%)	χ^2	P-value	Prev. Total (%)	Z	P-Value	Total parasite	Mean intensity
Season	LF	Wet	172	109	63.37	0.21	0.64	62.1	0.11	0.73	834	7.65
		Dry	84	50	59.52						272	5.44
	MC	Wet	75	43	57.33	0.23	0.63	59.66			346	8.05
		Dry	44	28	63.64						88	3.14
Sex	LF	Male	134	90	67.16	2.62	0.11	62.1	0.11	0.73	666	7.40
		Female	122	69	56.56						440	6.38
	MC	Male	71	41	57.75	0.11	0.74	59.66			261	6.37
		Female	48	30	62.50						273	9.10
Stage	LF	Fing	30	12	40.00	77.38	0.00	62.1	0.11	0.73	80	6.67
		Juve	109	65	59.63						412	6.34
		Adul	117	82	70.09						614	7.49
	MC	Fing	8	5	62.50	48.53	0.00	59.66			25	5.00
		Juve	46	29	63.04						160	5.52
		Adul	65	37	56.92						249	6.73

N.ex=Number of fishes examined; N.inf= Number of fishes infested; Prev= Prevalence; Fing= Fingerlings; Juve= Jeveniles; Adul= Adults; Z are measures of standard deviation.

Table 5: Copepods' prevalence rate estimation according to season, stage and sex in Mugilidae (*M. cephalus* and *L. falcipinnis*) from Ganvie station in Lake Nokoue

			N.ex	N.inf	Prev(%)	χ^2	P-value	Prev. Total (%)	Z	P-Value	Total parasite	Mean intensity
Season	LF	Wet	169	103	60.95	2.44	0.12	57.14	3.42	0.06	880	8.54
		Dry	90	45	50.00						286	6.36
	MC	Wet	122	84	68.85	0.74	0.39	66.3			488	5.81
		Dry	62	38	61.29						226	5.95
Sex	LF	Male	138	77	55.80	0.12	0.73	57.14	3.42	0.06	524	6.81
		Female	121	71	58.68						592	8.34
	MC	Male	119	79	66.39	0.00	1.00	66.3			444	5.62
		Female	65	43	66.15						270	6.28
Stage	LF	Fing	36	14	38.89	5.03	0.00	57.14	3.42	0.06	103	7.36
		Juve	98	59	60.20						470	7.97

		Adul	125	75	60.00					543	7.24
		Fing	16	9	56.25					38	4.22
	MC	Juve	69	41	59.42	70.09	0.00	66.3		276	6.73
		Adul	99	72	72.73					400	5.56

N.ex=Number of fishes examined; N.inf= Number of fishes infested; Prev= Prevalence; Fing= Fingerlings; Juve= Jeveniles; Adul= Adults; Z are measures of standard deviation.

Table 6: Copepods' prevalence rate estimation according to season, stage and sex in Mugilidae (*M. cephalus* and *L. falcipinnis*) from Unilag station in Lagos lagoon

			N.ex	**N.inf**	**Prev(%)**	χ^2	**P-value**	**Prev. Total (%)**	**Z**	**P-Value**	**Total parasite**	**Mean intensity**
Season	**LF**	Wet	166	130	78.31	0.34	0.56	76.92	2.34	0.13	1425	10.96
		Dry	81	60	74.07						662	11.03
	MC	Wet	89	77	86.52	0.67	0.41	84.06			734	9.53
		Dry	49	39	79.59						415	10.64
Sex	**LF**	Male	125	96	76.80	0.00	1.00	76.92	2.34	0.13	1031	10.74
		Female	122	94	77.05						1036	11.02
	MC	Male	84	70	83.33	0.00	0.96	84.06			628	8.97
		Female	54	46	85.19						521	11.33
Stage	**LF**	Fing	19	13	68.42	127.46	0.00	76.92	2.34	0.13	87	6.69
		Juve	106	80	75.47						751	9.39
		Adul	122	97	79.51						1249	12.88
	MC	Fing	9	9	100.00	88.02	0.00	84.06			43	4.78
		Juve	80	65	81.25						512	7.88
		Adul	49	44	89.80						594	13.50

N.ex=Number of fishes examined; N.inf= Number of fishes infested; Prev= Prevalence; Fing= Fingerlings; Juve= Jeveniles; Adul= Adults; Z are measures of standard deviation.

Table 7: Copepods' prevalence rate estimation according to season, stage and sex in Mugilidae (*M. cephalus* and *L. falcipinnis*) from Makoko station in Lagos lagoon

			N.ex	**N.inf**	**Prev(%)**	χ^2	**P-value**	**Prev. Total (%)**	**Z**	**P-Value**	**Total parasite**	**Mean intensity**
Season	**LF**	Wet	160	129	80.63	0.00	0.96	80.26	0.03	0.86	1621	12.57
		Dry	73	58	79.45						739	12.74
	MC	Wet	87	71	81.61	0.00	1.00	81.56			723	10.18
		Dry	54	44	81.48						463	10.52

Sex	LF	Male	129	102	79.07	0.12	0.76	80.26	0.03	0.86	1247	12.23
		Female	104	85	81.73						1123	13.21
	MC	Male	89	75	84.27	0.74	0.40	81.56			745	9.93
		Female	52	40	76.92						441	11.03
Stage	LF	Fing	14	11	78.57	138.75	0.00	81.26	0.03	0.86	84	7.64
		Juve	104	81	77.88						847	10.46
		Adul	115	95	82.61						1429	15.04
	MC	Fing	14	12	85.71	67.97	0.00	81.56			79	6.58
		Juve	82	68	82.93						607	8.93
		Adul	45	35	77.78						500	14.29

N.ex=Number of fishes examined; N.inf= Number of fishes infested; Prev= Prevalence; Fing= Fingerlings; Juve= Jeveniles; Adul= Adults; Z are measures of standard deviation.

Table 8: Copepods' prevalence rate estimation according to season, stage and sex in Mugilidae (*M. cephalus* and *L. falcipinnis*) from Mequin station in Lagos lagoon

			N.ex	**N.inf**	**Prev(%)**	χ^2	**P-value**	**Prev. Total (%)**	**Z**	**P-Value**	**Total parasite**	**Mean intensity**
Season	LF	Wet	167	130	77.84	0.03	0.85	77.2	0.06	0.81	1308	10.06
		Dry	83	63	75.90						602	9.56
	MC	Wet	81	69	85.19	4.25	0.05	78.9			680	9.86
		Dry	47	32	68.09						293	9.16
Sex	LF	Male	134	99	73.88	1.42	0.23	77.2	0.06	0.81	953	9.63
		Female	116	94	81.03						957	10.18
	MC	Male	84	66	78.57	0.00	1.00	78.9			586	8.88
		Female	44	35	79.55						387	11.06
Stage	LF	Fing	24	15	62.50	122.3	0.00	77.2	0.06	0.81	97	6.47
		Juve	121	89	73.55						767	8.62
		Adul	105	89	84.76						1046	11.75
	MC	Fing	9	6	66.67	83.06	0.00	78.9			39	6.50
		Juve	66	55	83.33						456	8.29
		Adul	53	40	75.47						478	11.95

N.ex=Number of fishes examined; N.inf= Number of fishes infested; Prev= Prevalence; Fing= Fingerlings; Juve= Jeveniles; Adul= Adults; Z are measures of standard deviation. Discussion

Discussion

The result of this study revealed a very high prevalence of copepods parasites *M. cephalus* and *L. calcarifer)* in the fish species in which Vinoth *et al.*, (2010) reported that the Infestation can result in serious loss and damage of gill rakers and gill lamella which hinders respiration and eventually result in the death of fish and significant economic loss also agrees with that of Barreiro and Fancinete, (2003), who worked on parasite copepod and discovered that, 66% family mugilidae were infested with copepod parasite. The prevalence of copepods is higher in the wet season than in the dry season in all the stations which agrees with the findings of this research agree with that of Barreiro & Torres (2003)

The highest total percentage of copepod parasites recorded in Ganvie might have been caused by organic pollution resulting from the human settlement. According to *Aladetohun et al.*, (2013), copepod parasites of these species of mugilidae fish from Lagos lagoon, Nigeria also shows that *Liza falcipinnis* had more copepod parasites than *Mugil cephalus*.

From this study, *Nipergasilus bora* copepods had the highest frequency of occurrence and relative abundance than genus ergasilus. This agrees with Morella and Garippa (2001) in their work on parasites of grey mullets from the Mistras lagoon, Western Mediterranean, who also reported *Caligus apolus* and *Nipergasilus bora* to be the most prevalent crustaceans. Ben-Hassin (1983) in his work on copepod parasites of mugilidae from the Mediterranean of France and Tunisia, reported *Nipergasilus bora.* Although *Ergasilus lizae* and *Ergasilus latus* were also found in all three stations. Perperna and Lahav (1971), also discovered the copepod parasite (*Ergasilus lizae*) in grey mullets in Israel.

Conclusion

The level of parasitic copepod infestation in both LF and MC from Lagos lagoon and Lake Nokoue is alarming especially in Lagos lagoon. Infestation can destroy fish gills resulting in respiratory disorders and thus can lead to the death of the fish. It is important to note that lesions caused by these parasites may cause secondary infections by bacteria and fungi in the fish which will result in the short or long time death of these important fish.

This work represents a breakthrough in the field of research, in Benin and Nigeria, on parasitic copepods of Mugilidae due to the scanty or virtual absence of work on the parasitic copepods of Mugilidae before this research, Genetic investigation of the copepods found will be carried out in future.

Recommendation

The results obtained in this investigation can still be deepened through the study of various types of head, and thoracic appendages and genetically for more identification purposes.

It is recommended that joint monitoring of these two linked largest lagoons of the two neighboring countries must be carried out by the government, for good management of the fisheries resources.

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