Asian Journal of Fisheries and Aquatic Research

Volume 22, Issue 2, Page 25-32, 2023; Article no.AJFAR.98156
ISSN: 2582-3760

Comparative Survey of Parasites of African Catfish *Clarias gariepinus* in Ajiwa and Zobe Reservoirs in North-Western Nigeria

M. A. Sadauki [a*], A. H. Bichi [a] and T. Auta [b]

[a] Department of Fisheries and Aquacultural Technology, Federal University Dutsin-Ma, Katsina State, Nigeria.
[b] Department of Biological Sciences, Federal University Dutsin-Ma, Katsina State, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Author MAS designed the study, performed the analysis, wrote the draft of the paper and protocols. Author AHB supervised the work and managed the analysis of the study. Author TA managed the literatures searches, tables and discussion. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJFAR/2023/v22i2568

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/98156

Original Research Article

Received: 01/02/2023
Accepted: 03/04/2023
Published: 29/04/2023

ABSTRACT

Aims: The aims of this survey were to isolate, identify, classify and compare parasitic infestation of *Clarias gariepinus* obtained from Ajiwa and Zobe reservoirs, Katsina state. Also to investigated the prevalence and infestation of African catfish (*Clarias gariepinus*) from Ajiwa and Zobe reservoirs, Katsina.
Study Design: The research was conducted in Ajiwa and Zobe Reservoirs, Katsina State, Nigeria. The study was to compare the parasitic prevalence in Clarias gariepinus obtained from Ajiwa and Zobe reservoir. Three landing sites were selected from Ajiwa and Zobe reservoirs namely A, B, and C. landing site A water entrance, B middle of the water and C end of the reservoir. Five

**Corresponding author: Email: masadauki@fudutsinma.edu.ng;*

experimental fish samples were purchased from artisanal fisherman from three sample sites of Ajiwa and Zobe reservoirs for the duration of 6 months. Length and weight of fish samples were measured before parasite examination. Isolated parasite was identified using standard keys. Prevalence and incidence were analysed using descriptive statistic.

Place and Period of the Study: Fish samples were obtained from Ajiwa and Zobe reservoirs Katsina State. Live experimental fish samples were transported to the Biological Laboratory, Federal University Dutsin-Ma, Katsina State in a plastic container filled with water for identification, before parasitic examination. Experimental samples of various sizes were sampled between June, 2020 and September, 2021.

Methodology: A total of 180 live fish samples of males and females *Clarias gariepinus;* were randomly obtained from Ajiwa and Zobe Reservoirs. Experimental samples were range between 10.0-15.0cm fry, 15.1-20.0cm fingerlings, 20.0-25.0cm juveniles and 21.0-30.0cm adults. The skin, the gastrointestinal tract of the fish was examined for the presence of parasite, using standard procedures. Examination of the gastrointestinal parasites was done using light microscope for exposure of parasitic worm's presences. The different experimental fish samples were cut separately to expose the gastrointestinal area. The stomach and intestine region tract were cut off and divided into two portions comprising of the intestine and stomach. The stomach and intestine region was used for worms examination subsequently this is where sustenance is record abundant for the parasitic fauna. Investigation of the skin, fins and gills was done using hand lens for exposure of parasitic appearances. Gills were successively cut out and inserted into isolated petri dishes and detected with a hand lens for parasites identification.

Results: The prevalence in female specimens of *C. gariepinus* 29 (58.00%) was higher than that of the males 20 (50.00%) in Ajiwa reservoir while in Zobe the prevalence in male specimens of *C. gariepinus* 22 (46.80%) was higher than that of the females 20 (46.52%). Occurrence and mean intensity of parasitic infection were higher in samples in the Zobe reservoir than those in the Ajiwa reservoir.

Conclusion: The study displayed that the parasitic burdens were higher in *C. gariepinus* in Zobe environment compared to those obtained from Ajiwa environment. For that reason it was suggested that the stomach and intestinal tract collected from *C. gariepinus* from the survey region, have to be properly discarded instead of consumption to prevent the spread of infections from fish to human being. It is significant to regulate discharge of waste a round water bodies that will reduce possible actions that may backing a growth in parasitic worms in the environs.

Keywords: African catfish; Clarias gariepinus; comparative survey; parasites; Zobe, Ajiwa.

1. INTRODUCTION

Fish and fish products are important sources of omega-3 fatty acids. Fish is a low-priced and a reasonable source of animal protein and it is within reach of the average resident of the majority of nations. Demand for fish is constantly increasing due to population growth, high prices of other animal protein sources, and other health problems associated with the consumption of other animal protein sources [1]. Tropical freshwater fishes such as *Tilapia zillii* and *Clarias gariepinus* have been reported to act as definitive or intermediate hosts for numerous species of protozoan, metazoan and crustacean parasites [2]. Parasitic infections/infestations in fish have been reported to have serious impacts on the production and its commercial sustainability. The frequency and extent of parasite infection are closely related to the environmental situations of the water body and health of the fish [3]. In fisheries and aquaculture, certain parasites can be highly pathogenic, resulting in high fish mortality and economic loss, or even threaten the abundance and diversity of native fish species [1]. As obtainable among other animals, fish such as *Tilapia zillii* and *Clarias gariepinus* also suffer infestation by endoparasites and ectoparasites; particularly protozoans and helminths triggering high mortality rate. Fish parasites and diseases institute one of the major challenges threatening fish farming globally [2].

Edema et al. [4] reported a checklist of helminth parasitic infections in fresh water fish such as *Tilapia zillii* and *Clarias gariepinus* in African countries, and number of reports have also emerged from Africa, highlighting the intensity, occurrence, epidemiology and pathology of such parasitic infestations/infections. Accordance to Hussein et al. [5], *Clarias gariepinus* harbour several parasites which comprise adult *Digenea*;

trematode metacercaria of the family *Clinostomidae* encysting in tissues; and adult *Monogenea* of the families *Pousopothocotylidae, Dactylogyridae* and *Gyrodactylidae*. Parasites habitually injure fish (hosts) in the wild by destroying their tissues, which may lead to secondary infection/infestation or removal of body fluid and cell fluid from the host [6]. This research compared the prevalence of parasitic infestation in the sites- skin, gills, stomach and intestine among *Clarias gariepinus* obtained from Ajiwa and Zobe Reservoir reservoirs, Katsina state.

2. METHODOLOGY

2.1 Study Area

The research was conducted in Ajiwa and Zobe Reservoirs, Katsina State, Nigeria. Ajiwa reservoir is on the latitude 12°98' N and longitude 7°75' E, in Batagarawa LGA, Katsina State. The major purpose of the reservoir is irrigation farming and water source to the general public of Katsina, Batagarawa, Mashi and Mani LGAs. The reservoir was impounded in 1973 and commissioned in 1975. The volume of the water is nearly 22,730,000 m3 [7]. It functions as a source of profits for the bordering societies.

Zobe reservoir is an earth-fill building completed in 1983 on the coordinates 12°23'18" N latitude and 7°28'29" E longitude in Dutsin-Ma LGA of Katsina State. The reservoir has a height of 48 m, length of 360 m with a base width of 2,750 m. The artificial lake has a storing capability of 179 Mca, as it is impounded from two major rivers Karaduwa and Gada [7]. The impoundment was created mainly for the providing of domestic water supply with irrigation and fisheries improvement as a most important additional assistance.

2.1.1 Sample collection, identification and sexing of experimental fish

The fish samples were collected from the selected study areas for the periods of six months. The fish samples were transported alive to the Fisheries and Aquaculture laboratory of the Federal University Dutsin-Ma, Katsina State, in a plastic vessel filled with water for identification and examination. The fish were identified by Suleiman pictorial chart [8] and description guide Teugels et al. [9]. The urogenital papillae were examined by physical observation and the obesity of the testes in male and ovaries in the female was confirmed [1].

2.1.2 Morphometric determination of experimental fish

Body weight were recorded with a top loading sensitive weighing balance (GT4100 model) and the total and standard lengths of sampled fish were measured using meter rule [1].

2.1.3 Examination of experimental fish samples for ectoparasites

The skin, fins and gills were examined for exposure of parasitic appearances using hand lens. Gills were successively removed and placed into individual petri dishes and observed for parasite with a hand lens. Parasites were collected and fixed in buffered formalin for additional treating and sample recognition/identification using the method of Paperna [10]. The slime substance on the was taken with the help of a scalpel blade a scalpel blade smear was prepared. The slime from body was placed in separate Petri-dishes containing 0.9% normal saline solutions. Parasites were noticed by the wriggling movement in the normal saline solution with the help of hand lens [1].

2.1.4 Examination of experimental samples for endoparasites

Investigation of the gastro-intestinal tract specifically the stomach and intestine were carried out. The individual fish samples were cut apart to expose the gastrointestinal tract. The gastrointestinal tract was cut off and split into two parts containing intestine and stomach. Every single segment was placed in petri dishes containing 0.9% normal saline [10]. Every single segment was cut longitudinally and observed under dissecting light microscope in 10X and 30X magnification [10]. The appearance of worm was assessed through its wriggling physical motion in the saline solution. Parasitic fauna observed were counted and preserved in 5% formalin. The typical parasite were stained overnight using weak solution of Erlich's haematoxylin [1,11].

2.1.5 Parasites identification

The parasitic fauna was identified up to species level morphologically using the standard identification guides [12,13] and with standard keys in texts [14,15].

2.1.6 Parasite prevalence and intensity estimation

The occurrence/prevalence of parasitic infestation was calculated for sex, location, length and weight using the model described by Amos et al. [16]:

$$\text{Prevalence (\%)} = \frac{\text{Number of fish host infected}}{\text{Total number of fish host Examined}} \text{ x } 100$$

$$\text{Percentage (\%) of infection} = \frac{\text{Number of a specific parasite in the samples}}{\text{Total number of parasite in the samples}} x100$$

2.1.7 Data analysis

Occurrence and intensity of infestation was expressed in percentage (%). Data were presented using descriptive statistics; a simple percentage was used to present the prevalence and distributions of parasites. The descriptive statistics was used to examine the association between infection and the risk parameters for the prevalence.

3. RESULTS

Female fish tended to have a highest number of infections 29 (58.0 %) while the male fish recorded 20 (50.0 %) (Table 1). The result was not significantly different between the fish sexes P<0.05. Ninety individual fish samples were collected from Zobe reservoir of which 47 were male and 43 were female. Male samples (fish) tended to have a highest number of infections 22(46.80 %) while the female fish recorded 20 (46.52 %) (Table 1). The result were not significantly different among the sex of fish (Table 1). *Clarias gariepinus* samples obtained from Ajiwa reservoir had the higher incidence of *Monobothrium sp.* 26(36.12%).A number of the diseased fishes have double infestation and as much as of 72 fully developed worms and larvae in addition to eggs were recorded in fishes examined, out of which 72 *Capilaria sp.* 16(22.23%), *Astiotrema sp.* 12(16.66%) *Larva Miracidium* 10(13.88%) *Ascaris eggs* 6(8.34%) followed by *Metacercariae sp.* 2(2.77%) as the least parasitic infection.They were cestodes, digeneans and nematodes respectively (Table 2).Samples of African catfish *Clarias gariepinus* collected from Zobe artificial lake, the parasitic worms that had the higher number incidence were *Monobothrium sp.* 21(24.42%).Some of the infested fishes had double infestation and a total of 86 fully developed worms, larval in addition to eggs were found in fishes examined, out of Which 86 *Ascaris eggs* 20(23.26%), *Capilaria sp.* 14(16.28), *Metacercariae sp.* 8(9.31%), *Camallanus sp.* 8(9.31%) *Pleurocercoid* or *Coradium* 5(5.82), *Astiotrema sp.* 5(5.82), *Larva Miracidium* 3(3.48) and followed by *Ascaridods* or *Anisakis* 2(2.33%) as the least parasitic infection. they were cestodes, digeneans and nematodes respectively (Table 2) the samples of African catfish *Clarias gariepinus* gotten in Ajiwa artificial lake. The stomach was the most infested 39(54.16%) of all the organs investigated, followed by the intestine with 33(45.86%). No parasite was found in the gills and skin (Table 3).The samples African catfish *Clarias gariepinus* found in Zobe artificial lake. The intestine was the most infected 51(59.3%) of all the organs investigated, followed by the intestine with 35(40.69%). No parasite was found in the gills and skin (Table 3).Out of the 90 fish samples collected from three (3) sample sites from Ajiwa and inspected, an total occurrence of 49(54.45%) were documented (Table 4). While there was no significant difference (P>0.05) in occurrence among fish from the various sample locations, catfish *Clarias gariepinus* obtained from Kadaji 17(56.66%) and Gajerar giwa 17(56.66%) (Harboured) had the highest percentage of infection, while Kundu waje sample location had the least percentage 15(15.00%). Statistical analysis showed that the result was not significant. Out of the 90 fish collected from 3 sample location from Zobe and examined, an overall prevalence of 42(44.66%) was recorded (Table 4). Although there was no significant difference (P>0.05) in prevalence among fish from the various sample location, catfish *Clarias gariepinus* obtained from Tabobi 18(60.00%) (harboured) had the highest percentage of infection, followed by Raddawa 14(46.66%), while Makera sample location had the least percentage 10(33.33%). Statistical analysis showed that the result was not significant. Table 5: Fish samples gotten in Ajiwa showed that catfish within the length of 10.0-15.0cm give refuge to more parasites 33(67.34%) followed by 15.1-20.0cm 7(43.75%), 20.1-25.0cm 7(41.17%) while individuals within the length of 25.1-30.0cm had smaller worm load 2(25.0%). Fish samples found from Zobe indicated that catfish within the length of 20.1-25.0cm sheltered additional worms 15(83.34%) followed by 10.0-15.0cm 14(40.0%), 15.1.20.0cm followed by 12(37.50%) whereas individuals sample within the length of 25.1-30.0cm had smaller parasitic load 1(20.0%) (Table 5).

Table 1. Prevalence of parasites of *Clarias gariepinus* in relation to sex from Ajiwa and Zobe reservoirs

Sex	Ajiwa reservoir			Zobe reservoir		
	Number examined	Number infected	Prevalence (%)	Number examined	Number infected	Prevalence (%)
Male	40	20	50	47	22	46.80
Female	50	29	58	43	20	46.52
Total	90	49	54	90	42	46.66

Table 2. Prevalence of parasites of *Clarias gariepinus* in Ajiwa and Zobe reservoir

Ajiwa Reservoir			Zobe Reservoir		
Name of parasite	Taxonomic group	Number isolated	Name of parasite	Taxonomic group	Number isolated
Monobothrium sp.	Cestode	26	*Monobothrium sp.*	Cestode	21
Capilaria sp.	Nematode	16	*Capilaria sp.*	Nematode	14
Larva miracidium	Digenea	10	*Larva Miracidium*	Digenea	3
Metacercariae sp.	Digenea	23	*Metacercariae sp.*	Digenea	8
Astiotrema sp.	Digenea	12	*Astiotrema sp.*	Digenea	5
Ascaris sp.	Nematode	6	*Ascaris sp.*	Nematode	22
			Camallanus sp.	Cestode	8
			Pleurocercoid sp.	Cestode	5

Table 3. Prevalence of parasites of *Clarias gariepinus* in Zobe reservoir in relation to site of infestation

Name of parasite	Ajiwa reservoir				Zobe reservoir			
	Ectoparasite (prevalence)		Endoparasite (prevalence)		Ectoparasite (prevalence)		Endoparasite (prevalence)	
	Skill	Gills	Intestine	Stomach	Skin	Gills	Intestine	Stomach
Monobothrium sp.	0	0	10(30.31)	16(41.02)	0	0	13(25.49)	8(22.85)
Capilaria sp.	0	0	10(30.31)	6(15.38)	0	0	8(15.68)	6(17.15)
Larva miracidium	0	0	6(18.18)	4(10.26)	0	0	1(1.96)	2(5.71)
Astiotrema sp.	0	0	4(12.13)	8(20.52)	0	0	2(3.92)	3(8.57)
Ascaris sp.	0	0	2(6.06)	4(10.26)	0	0	4(7.84)	3(8.57)
Metacercariae sp.	0	0	1(3.04)	1(2.56)	0	0	2(3.92)	3(8.57)
Pleurocercoid					0	0	17(33.34)	3(8.57)
Camallanus sp.					0	0	3(5.88)	5(14.28)

4. DISCUSSION

Abiotic influences, such as increased water temperature, can alter the state of resistance situation in fish facilitating infestation and set up of parasitic worms [17]. Akinsanya and Otubanjo [18] preached that geo-climatic variances might be an important factor in influential/determining, not just the occurrence of parasites in freshwater bodies such as rivers and dams, but also the parasite populations found in freshwater fishes such as *T. zilli* and *C. gariepinus*. Data has displayed that parasitic worms are regularly discovered in entirely aquatic fishes such as *T. zilli and C. gariepinus*, with their incidence in addition strength dependent on the parasitic fauna also their ecology, host and its nourishing behaviours, physical factors in addition sanitation of the aquatic environment then manifestation of middle hosts where needed [5]. From current survey, six types of parasitic worms in Ajiwa reservoir and nine types of parasitic fauna in Zobe reservoir from three Classes were identified. Related outcomes were identified by Kawe et al. [19] from African catfish *Clarias gariepinus* from dissimilar Association zones from F.C.T, Abuja, Nigeria. Kawe et al. stated 2 (two) types of Nematode representative approximately 56% of the infestation, a classes of Cestode and two species of Trematode. Dan-Kishiya and Zakari [20] similarly identified Nematode, Cestode and Trematode from wild *C. gariepinus* in Gwagwalada Abuja, However Salawu et al. [21] identified Nematode Cestode from the digestive tracts of *C. gariepinus* from Ogun River and Asejire Dam in South-west, Nigeria. Abdel-Gaber et al., [22] and Khan, (2012) likewise identified related outcomes. On the other hand, Amos et al. stated [16] extreme highest in relations of total number, species and Classes. Nine Classes, 16 species and 396 separate parasitic worms was identified in 60 matured fish and 60 juveniles of *C. gariepinus* in Lake Gerico, Yola, Adamawa State. No parasite were recovered in the gills and skin of *C. gariepinus* obtained in Ajiwa and Zobe reservoirs dissimilar in the direction of our research, Amos et al. [16] identified the parasitic worms in the gill, skin, and gastrointestinal tract of sampled fish. Parasitic occurrence, the moderately highest infestation rate from most females than that of males in Ajiwa reservoir the study is related to the discoveries of Ratnabir et al. [23] and Amos et al. [16] who stated that female fish samples anchorage additional parasites associated male fish samples but disagrees with the discovery of Ugbor et al. (2014) who identified additional parasite infection from males fish samples than from female fish samples. While parasitic incidence, the moderately higher infection rate in most males than that of females in Zobe reservoir this research is disagree with the results of Ratnabir et al. [23] and Amos et al. [16] who stated that female fish samples anchorage extra parasitic worms associated male fish samples but agrees with the outcome of Ugbor et al. (2014) who indicated more parasite infection in males than in the female. However, the female sex documented higher infestation which may possibly be due to difference nutritive both by amount or excellence of nourishment consumed and as an outcome of dissimilar amounts of struggle/fight to infestation [24]. The present investigation displayed that, the higher degree of parasites invasion in diverse fishes was noted in lesser fishes. The likely purpose for this may possibly be that lesser fishes nourished on a smaller amount of nourishment henceforth gained a smaller amount of protection related to the bigger fishes. This is in conformity with Shehata et al. [25] who stated that lesser fish was additional disease-ridden related to bigger fishes maybe due to their nature of acquired resistance/protection with oldness. In dissimilarity, the current survey differs with discoveries of Ashade et al. [26] who stated that matured then therefore maybe adult fish have extra parasites associated to lesser fish since they nourish additional on dissimilar nourishment sources so revealing them to additional parasite worm's invasion [27].

Table 4. Prevalence of parasites of *Clarias gariepinus* in relation to sample location in Ajiwa and Zobe reservoirs

Sampling location	Ajiwa reservoir			Zobe reservoir		
	No. examined	No. infected	% of infection	No. examined	No. infected	% of infection
Station A	30	17	56.66	30	14	46.67
Station B	30	15	50.00	30	18	60.00
Station C	30	17	56.66	30	10	33.33
Total	90	49	50.44	90	42	46.67

Table 5. Prevalence of parasites of *Clarias gariepinus* in relation to length in Ajiwa and Zobe reservoirs

Length of fish	Ajiwa reservoir			Zobe reservoir		
	Number of examined	Number of infected	Per cent of infection	Number of examined	Number of infected	Per cent of infection
10.0 – 15.0	49	33	67.35	35	14	40.00
15.1 – 20.0	16	7	43.75	32	12	37.50
20.1 – 25.0	17	7	41.18	18	15	83.33
25.1 – 30.0	8	4	50.00	5	1	20.00
Total	90	49	54.44	90	42	46.67

5. CONCLUSIONS

The current survey in Ajiwa and Zobe reservoirs display a low to average occurrence of gastro-internal parasitic invasions and shown three classes of parasitic fauna existing in fish. The discoveries of this survey are predictable to help as reference line parasitic data for upcoming research to safeguard and improve the environmental potential of Ajiwa and Zobe reservoirs. Actions that have the possible of growing the richness of parasitic worms may perhaps be controlled by necessary management organizations that are in control for the supervision of the aquatic water body. With rise in fish farming, it is also vital/needed to have amenities/equipment's for examination and treatment of fish sicknesses mostly in the research areas.

6. RECOMMENDATION

This study recommends that consumption of correctly roasted fish serve as precautionary measures to possible zoonotic parasite infestation. A number of the parasitic worms detected particularly the cestode parasites identified are zoonotic skilful of causing severe community healthiness infestation in human being, consequently, the aforementioned is suggested that the intestine and stomach region of *Clarias gariepinus* collected in Ajiwa and Zobe reservoirs have to be thrown away before the fish is eaten. There is need for further researches on the status of contamination; highlighting the present physicochemical parameters conditions water of Ajiwa and Zobe Reservoirs, to find out the exact correlation between contamination, toxic waste and parasitism in the reservoirs.

In addition, study similarly recommends additional survey on lifespan of most important parasitic worms detected such as digeans, cestode and nematodes, should be carry out in direction to develop the procedures suitable to stop and govern parasitic worms.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Sadauki MA, Bawa SB, Umaru J. Studies on parasitic infestation and prevalence in *Clarias gariepinus* (burchell, 1822) from Zobe reservoir, Katsina State, Nigeria. Nigerian J. Anim. Sci. 2022b;24(1):100-107.
2. Ito EE. Survey of parasites of two fish species (*Tilapia zillii* and *Clarias gariepinus*) in Ase River Catchment, Delta State, Nigeria. Journal of Coastal Life Medicine. All rights reserved. 2017:J7-126. Available:https://doi.org/10.12980/jclm.5.2017
3. Ahmad I, et al. Effect of water quality parameters onIsopod parasite alitropustypus (aegidae) of ectotherms in Chashma Lake, Pakistan. Pakistan Journal of Zoology. 2016;48(3):769-779.
4. Edema CU, Okaka CE, Oboh IP, Okogub BO. A preliminary study of parasitic infections of some fishes from Okhuo River, Benin city, Nigeria. International Journal of Biomedical and Health Sciences. 2008;4(3):107-108.
5. Hussen A, Tefera M, Astrate S. Gastrointestinal helminth parasites of *Clarias gariepinus* (catfish) in Lake Hawassa, Ethiopia. Scientific Journal of Animal Science. 2012;1(4):131–136.
6. MSG. Parasites kill fish. Minnesota Sea Grant (MSG)
Available:www.seagrant.umn.edu/fisheries/parasites
Access on 18 February 2017
7. Sadauki MA, Bichi AH, Dauda AB, Geidam MB. Assessment of Water Quality Parameters of Zobe and Ajiwa Reservoirs, Katsina State, Nigeria African Scientist 2022;23(1). Printed in Nigeria.1595 © 2022 Society for Experimental Biology of Nigeria 6881/2021 $10.00 + 0.00
Available:http://www.niseb.org/afs
AFS2022002/23102
8. Suleiman B. Catalogue of fishes of Kaduna River, Kaduna, Nigeria. 2016:19.
ISBN: 978 978 53916 57
9. Teugels GG, Legendre M, Hung LT. Preliminary results of the morphological characterization of natural population and culture strains of *Clarias species* (suliriformes, clariidae) from Vietam. In: Legendre and Antonie Pariselle (Eds). The biological diversity and aquaculture of clariid and pangasiid catfishes in South-East Asia. Proceedings of the mid-term workshop of the "catfish Asian Project". 1998:27-30.
10. Paperna I. Diseases caused by parasites in the aquaculture of warm water fish.

Annual Review of Fish Diseases. 1991;1:155-194.

11. Bichi AH, Ibrahim AA. A survey of ecto and intestinal parasite of *Tilapia zilli* (gervais) in Tiga Lake, Kano, Northen Nigeria. Bayero Journal of Pure and Applied Science. 2009;2(1):79-82.
12. Paperna I. Parasites, infections and diseases of fishes in Africa. CIFA Tech. paper 7. Fao of the UN, Rome, Italy. 1980:216.
13. Moravec F. Reconstruction of the genus *Rhabdochona railliet*, 1916 107 with a review of the species parasitic in fishes of Europe and Asia. Studies CSAV, Prague. 2006;(8):104.
14. Paperna I. Parasite, infections and disease of fishes in Africa- an update. CIFA Technical Paper. 1996;31:1-220.
15. Roberts RJ. Fish pathology. 3rd edn. Technical Director, Landa catches Ltd. Scotland. 2001:270–300.
16. Amos SO, Eyiseh TE, Michael ET. Parasitic infection and prevalence in *Clarias gariepinus* in Lake Gerio, Yola, Adamawa state. MOJ Anat Physiol. 2018;5(6):376-381.
DOI: 10.15406/mojap.2018.05.00229
17. Onyishi GC, Aguzie ION. Survey of helminth parasites of fish In Ebonyi River at Ehaamufu, Enugu State, Nigeria. Animal Research International. 2018;15(3):3112–3119.
18. Akinsanya B, Otubanjo OA. Helminth parasitesof *Clarias gariepinus* (clariidae) in LekkiLagoon, Lagos, Nigeria. Revista de Biologia Tropical. 2006;54(1):93-99.
19. Kawe SM, God'spower RO, Balarabe MR, Akaniru RI. Prevalence of gastrointestinal helminth parasites of *Clarias gariepinus* in Abuja, Nigeria. Sokoto Journal of Veterinary Sciences. 2016;14(2):26-33.
20. Dan-kishiya AS, Zakari M. Study on the gastrointestinal helminth parasites of *Clarias gariepinus* (tuegels) in Gwagwalada, FCT, Nigeria. BEST Journal. 4(2):79-81.
21. Salawu MT, Morenikeji OA, Sowunmi AA, Odaibo AB. Comparative survey of helminth parasites of *Clarias gariepinus* and *Clarias pachynema* from the Ogun River and Asejire Dam in Southwest Nigeria. International Journal of Fisheries and Aquaculture. 2013;5(1):7-11.
22. Abdel-Gaber R, El Garhy M. Morsy K. Prevalence and intensity of helminth parasites of African catfish *Clarias gariepinus* in Lake Manzala, Egypt. Advances in Bioscience and Biotechnology Sci Res. 2015;6:464-469.
Available:http://www.scirp.org/journal/abb
Available:http://dx.doi.org/10.4236/abb..67048
Access on July 2015
23. Ratnabir S, Shomorendra M, Kar D. Parasite infection of three freshwater fishes in Dolu Lake, Silchar, Assam. International Journal of Fisheries and Aquatic Studies. 2015;2(3):125-127.
24. Ogonna CA. Emmanuel IN, Cynthia E. Prevalence of intestinal parasites of fish farmed and harvested in Abakiliki, Nigeria: A pointer to the level of their vulnerability. International Journal of Research in Pharmacy and Biosciences. 2017;4:7-10.
25. Shehata SM, Mohammed RA, Ghanem MH, Abdelhadi YM, Radwan MK, Impact of the stresses environmental condition on the prevalence of parasite in freshwater aquaculture. Journal of Fisheries Sciences. EISSN 2018;1307-234X
Available:www.fisheriessciences.com
26. Ashade OO, Osineye OM, Kumoye EA. Isolation, identification, and prevalence of parasites on *Oreochromis niloticus* from three selected River Systems. J.Fish Aquatic Sci. 2013;1:115-121.
27. Shafi N, Ayub J, Akhtar T. Physico - chemical variables and fish parasites of River Neelum Azad Jammu and Kashmir, Pakistan. Journal of Bioresource Management. 2015;2(2):73-80.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/98156