



PARASITIC FAUNA OF *TENUALOSA ILISHA* (HAMILTON- BUCHANAN, 1822) AS A BIOLOGICAL INDICATOR OF FISH IMMIGRATION IN IRAQI WATERS

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ABSTRACT: In total, 1,456 specimens (428 males, 534 females and 494 unidentified small individuals) of *T. ilisha* were collected between, Jan. 2013 and Dec, 2014, 20 specimens of each monthly sample are isolated of the study area. Five stations were chosen, starting from the city of Al-FAW in the estuary section of the river to the northern-most station in the Al Hammar Marshs (The current study was completed within the scientific team of the study the migration and the biological of *Tenualosa ilisha* fishes). The study uses' the Parasite as biological tags of fish immigration, three specie's of parasite are described: *Nothobomolochus* sp. (copepod); *Faustula* sp and *Ectenurus papillatus* (digenea). The result of present study refers that the parasites were collected are appears only in the, starting from the city of Al-FAW in the estuary section of the river with total length 250-460 in male and female with *Faustula* sp and *Ectenurus papillatus* (digenea), and *Nothobomolochus* sp. (copepod), and there are not any infected with unidentified small individuals) of *T. ilisha*. The result refers also the Parasites are considered as new records in Iraqi marine fishes. Also, result of infected are compared with the type of parasites infection in Indian ocean fishes, and the results give us two important points, there are different in the type of parasite in to region and the infected are occur depend on the ecology and habitat feeding, and that led to the fishes don't emigrate from the Indian Ocean to Iraq or that the fish lose the types of parasites during migration, and fishes is likely to be endemic in the Arab Gulf region.

Key words: Parasitic fauna; *Tenualosa ilisha*; Parasite; Biological indicator of fish immigration; Iraqi Marine and Fresh Water fishes.

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INTRODUCTION

T. ilisha represent one of the important edible fish species especially in the south parts of Iraq and the countries which coast line in the Arab Gulf. Schooling in coastal waters and ascending rivers for as much as 1200 km (usually 50-100 km). The Hilsa shad, *Tenualosa ilisha* (Hamilton, 1822) is an anadromous clupeid that migrates from the Arabian Gulf towards freshwater rivers for spawning. In Iraq, it migrates in the Shatt al Arab River and surrounding marshes up to 100 km. It is a widely distributed species in Asia and the Middle East [1] and has recently been described in Malaysia [2]. A dramatic decline in annual catch of Hilsa shad in Iraq has been observed, mainly because of the decrease in water availability due to the construction of dams, which has affected its spawning, feeding and migration [3]. The species is known from the northern part of the India Ocean (from the Persian Gulf eastward to the Andaman coast of Myanmar, including western and eastern coasts of India, and western (Andaman) coasts of Thailand and Malaysia; Reported from Viet Nam (Gulf of Tonkin), the Tigris River basin and probably present in other rivers of southern Iran.

This species is restricted to the northwestern Gulf, north to the estuary of the Shatt al-Arab River in Iraq and other rivers in Iran. It ascends the Shatt al-Arab River to the great marsh area north of Basra City, Iraq. The upper limit of its northern distribution is Al-Hammer Marsh, 180 km north of Basra City, and up to 220 km inland to the Karun River and its tributaries in Iran. This species is also found in Kuwait Bay, Historically, *T. ilisha* was found to Qalaat Salah on the Tigris River and to Al-Fahod on the Euphrates River about 150-180 km north of Basrah. The Global Distribution: *Tenualosa ilisha* occurs in the Indian Ocean from The Gulf, east to the coasts of India, as far as Myanmar (Burma). It has also been reported from the Gulf of Tonkin (Viet Nam) as well as the Tigris River and probably other rivers of southern Iran (Coad 1995).

In [4] mentioned that this fish species play an economic role and is the largest single species contributor to the fisheries sector of Bangladesh. D'Silva *et al.* [5] pointed out that the parasitic fauna of *T.ilisha* captured in east parts of Indian coastal from the line consist of fourteen specie of endo- helminthes parasites and also he mentioned that all of this 14 species' were detected from fresh water brackish and salt water fishes ,with a remarkable spatial stability in the occurrence.

In Bangladesh, The helminthes parasites of *T.ilisha* were investigated by many workares [6,7,5]. Only two studies concerning with the helminthes parasite of *T. ilisha* were done in the Arabian Gulf region, [8,9]. Many techniques have been used to identify and discriminate stocks, including the application of artificial tags, such as acoustic tags, coded wire tags. In particular, parasites as biological tags have gained wide acceptance in recent decades [10] as they can provide a reliable guide to understanding the biology of their host. This is not to say parasites as tags are superior to other methods, but it is recognized that they have helped answer questions on host diet and feeding behavior, movements and ranges, connectivity of stocks, recruitment patterns of juveniles and phylogenies [11]. Parasites have also been used as bio-indicators of pollution [12-14] and in population studies to discriminate stocks [15,10]. Research on parasites as biological tags for marine organisms has increased at a steady rate, with nine papers on this subject published from the 1950s, more than 30 from the 1960s, more than 50 from the 1970s and more than 140 from the 1980s [16].

Present study is the first attempt to study the helminthes parasites fauna of a migratory fish, *T.ilisha* in different environment to determine anadromous if there was a difference in their composition between the infected freshwater, brackish and salt water and compare with Indian Ocean region studies.

MATERIALS AND METHODS

In total, 1,456 specimens (428 males, 534 females and 494 unidentified small individuals) of *T. ilisha* were collected between April, 2013 and March, 2014. Five stations were chosen, starting from the city of Al-FAW in the estuary section of the river to the northern-most station in the Al Hammar Marsh. The stations of Abu al-Khasib, Sebba and Tigris-Marsh were intermediary. The Tigris-Marsh station was at the junction of the Shatt Al and Garmat Ali rivers, which flow from the Al Hammar Marsh (Figure 1).

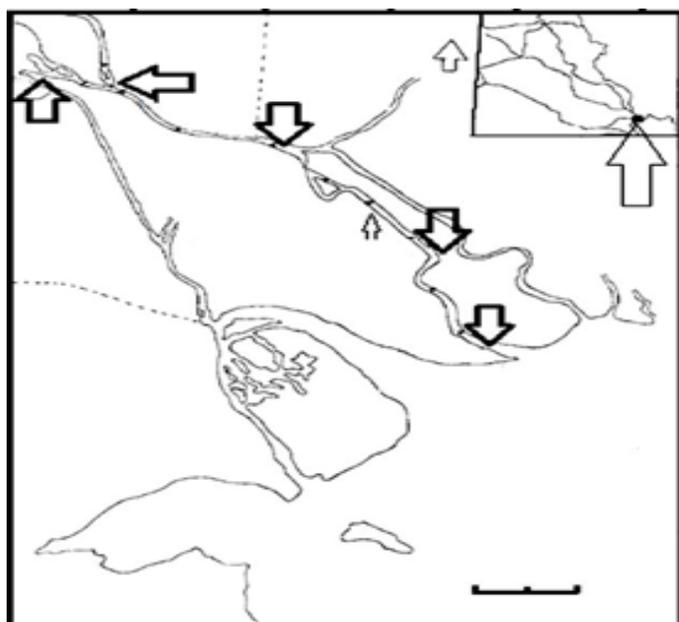


Figure 1: The map of studying area

Specimens were collected using gillnets. To control the selectivity, fish samples were collected using panels with different mesh size (67×67, 57×57, 48×48, 42×42, 33×33 and 30×30 mm). Port samples were also taken as supplement samples with different size group of fishes. A beach seine with mesh sizes of 20×20, 18×18 and 16×16 mm was used to collect juveniles in Marsh habitats. Total Length (TL) was recorded to the nearest 1.0 mm.

Fish were checked, skin and gills for ectoparasite before they were dissected the weight, length and sex of each fish were recorded, viscera of the fish were removed individually and put in 10% formalin in polyethylene bags with a label inside. Extensive search was made for helminthes parasites infecting the fish using dissecting microscope. Cardiac stomach, pyloric caeca, stomach, intestine and mesenteries were separated, placed in Petri dishes and searched. All the parasites from each organ were sorted, cleaned and counted. They were preserved in 70% alcohol. Berland's methods were used for staining and mounting. All helminthes specimens were sent to museum for identification. Parasite are identified by Dr. K. Mackenzie, The University of Aberdeen is a charity registered in Scotland, No SC013683. and copepod parasite by Нина Самотылова USSR museum. Photographs were taken by digital Sony camera attached to microscope.

RESULTS

The result of investigation of *T. ilisha*, three species of parasite are isolated and as a consider indicator of fish migration.

Taxonomy of the parasites

Nothobomolocus sp.

Order: Cyclopoida

Suborder: Poecilostomatoida

Family: Iomolochidae

Genus: *Nothobomolocus* Vervoort, 1962.

Nothobomolocus sp. (Figure -1b)

Class: Trematoda

Order: Strigeataidea

Family: Fellodistomatidae

Genus: *Faustula*

Faustula sp. (Figure-1c)

Order: Plagiorchiidae

Family: Hemiuridae

Genus: *Ectenurus*

Species: *Ectenurus papillatus* (Figure -1D).

The result confirmed that the fish migrate from the Gulf region through destination areas until the marsh area recorded, the size and weight of the specimens of *T. ilisha* collected throughout the migration season in the study area (Table 1) ranged from 50-460 mm TL and 0.97-1253 g, (Table 1). Males were smaller in length and weight than females. Total length of females ranged from 90-460 mm, with an average of 261.03 (± 64.5 SD) mm and a body weight range of 7.0-1253 g, with an average of 231.79 (± 103 SD) g. Males had a total length range of 50-400 mm, with mean of 244 (± 56.5 SD) mm and a body weight range of 3.5-690 g with an average of 178.87 (± 67.6 SD) g. The biggest weight of females and males was observed in June.

The highest mean total length was observed in October. The monthly variation in mean length for both sexes combined showed two distinct peaks. The first was recorded during February-March and the second was recorded during September-November. However, a big decline in mean length was observed during May and July (The current study was completed within the scientific team to study the migration and biological of *Tenualosa ilisha* fishes). Fish infected appear in the total length 250-460 in both male and female. The study uses' the Parasite as biological tags of fish immigration, three specie's of parasite are described: *Nothobomolochus sp.* (copepod); *Faustula sp* and *Ectenurus papillatus* (digenea).

The result of present study refers that the parasites were collected are appears only in the, starting from the city of Al-FAW in the estuary section of the river with total length 250-460 in male and female with *Faustula sp* and *Ectenurus papillatus* (digenea), and *Nothobomolochus sp.* (copepod) and lose the copepod parasite in the Shatt Al and Garmat Ali rivers, which flow from the Al Hammar the northern-most station in the Al Hammar Marsh.

Whereas internal parasite appears in the Shatt Al and Garmat Ali rivers, which flow from the Al Hammar the northern-most station in the Al Hammar Marsh until the July after that lose all of the parasite species.

The present studies showed that there are varied in the percentage of prevalence and intensity of infection during study periods Table 2. Also, results showed that the infections with all of parasites species appear during the months Feb. to Jul. Of the years 2013, these are marine and brackish sample and some of fresh water area and disappear from the month of July to December, and these are freshwater sample area. In addition to that, results showed that there are varied in infections with *Nothobomolocus* species during the months of infection in March and April with 30% prevalence and 16.6, 5.75 Of intensity of infection during and decreased in January and February, with differ in the prevalence 15%,1% and intensity 1.66 ,5.75 (Table 2).

Highly infections were observed with *Faustula sp.* During the months January to April with prevalence 100% to 90% of infection in the in marine sample and intensity 19.25, 11.11, 17.5, 19.4. And decrease in May and June prevalence 10%, 5% and intensity 6, 9 in brackish fish sample, and losing the infection in the other months of years in the freshwater sample. Whereas, the *E. papillatus* height prevalence were observed in January and April 60% to 40% and decreased in May 30%, june 5% to 1%in Feb.in marine fish sample and with intensity 1.66,2,1.3,1.25,0,7 during the months January to June and absent in the other months of freshwater fish sample.

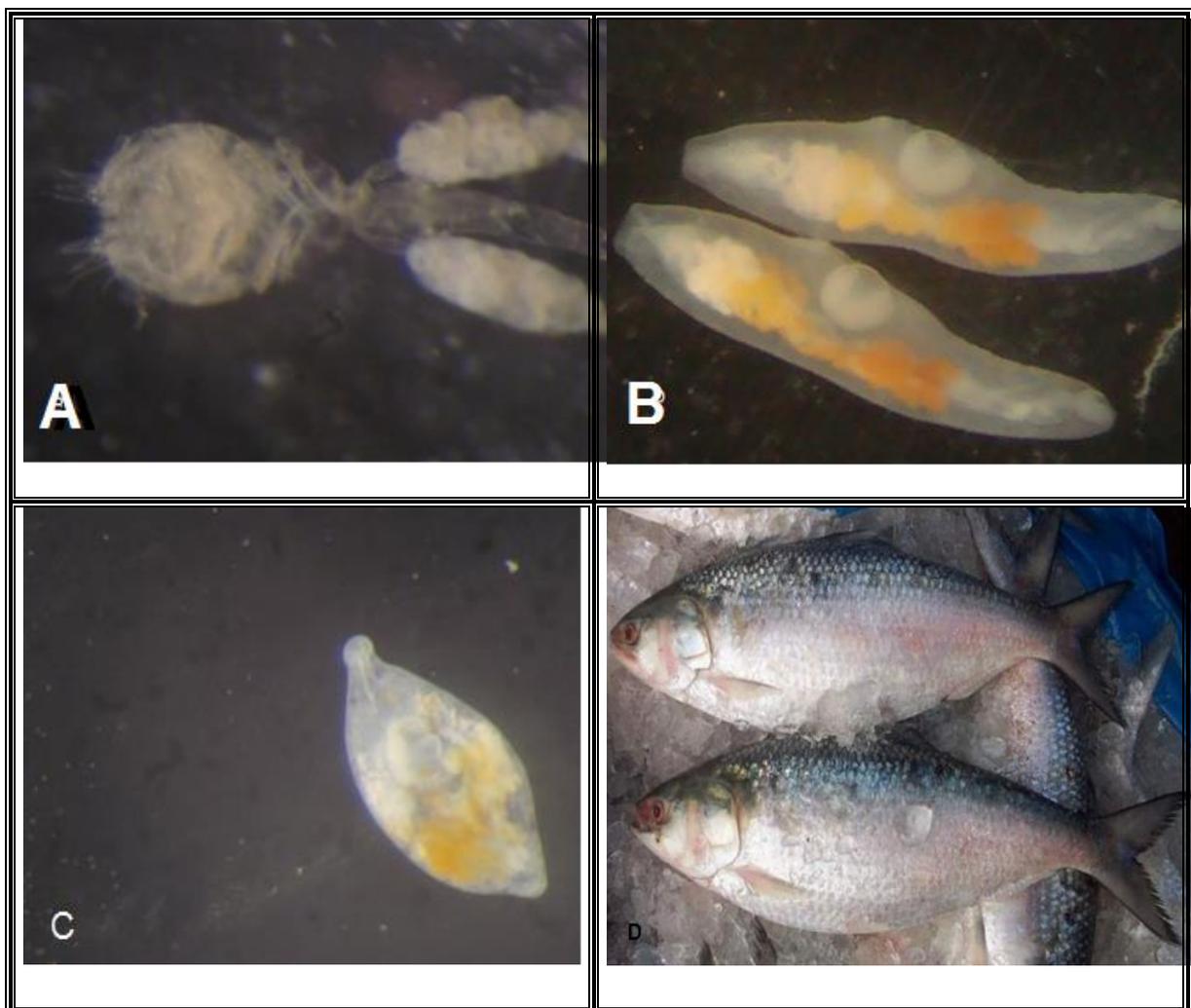


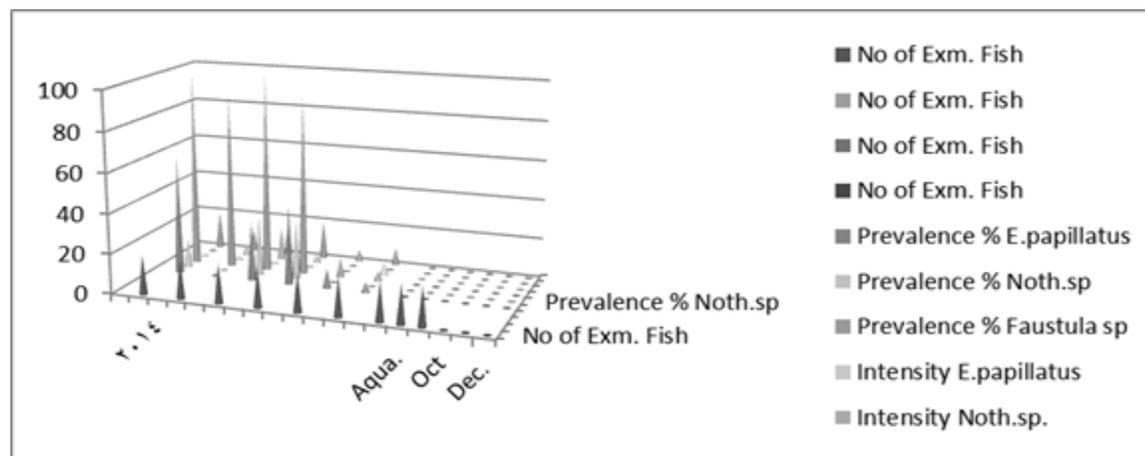
Figure 1: photograph of parasites A: *Nothobomolocus sp.*, C: *Faustula sp.* D: *Ectenurus papillatus*.

Table 1: The percentage of prevalence and intensity of infection during study periods

Months	No.	Range	Average (±SD)	Range	Average (±SD)	No.	Range	Average (±SD)	Range	Average (±SD)
Jan	0	0	0	0	0	0	0	0	0	0
Feb	30	220-440	293.7 (±100)	185-1253	267.7 (±99)	8	170-280	280.2 (±57.9)	35-200	179.5 (±137.2)
Mar	25	200-400	288.7 (±103)	179-988	237.1 (±105)	17	165-350	208.2 (±60.6)	32-329	189.5 (±160.2)
Apr	80	120-445	247.7 (±110)	16-928	253.1 (±113)	143	92-400	248.2 (±79.6)	8.1-690.9	199.5 (±157.2)
May	84	110-435	180.3 (±75.8)	11-1071	107.1 (±77.3)	168	50-370	212 (±87.2)	13.7-576	148.6 (±120)
Jun	60	200-460	283.9 (±79.2)	26-1190	309.4 (±105.2)	122	80-300	192.1 (±57.6)	5.2-302.8	89.7 (±75.5)
Jul	74	90-400	195.1 (±89)	7.0-780.4	170 (±159)	31	70-320	219.3 (±57.1)	3.5-581	134 (±125)
Aug	64	160-370	257.3 (±29.1)	39-330.6	182.4 (±54.3)	11	160-310	253 (±45.1)	31.5-311	173.6 (±86.4)
Sep	48	220-410	281.4 (±25.2)	92.7-819.2	256.5 (±80.7)	10	190-300	260 (±52.1)	65-252.8	144.3 (±81.2)
Oct	20	255-310	294.5 (±16.9)	186-399	263 (±64.2)	15	275-325	295 (±13.6)	199-332	260 (±38.5)
Nov	20	270-350	287.7 (±20)	200-405	277.7 (±50)	19	280-309	279 (±11.6)	245-274	270 (±30.5)
Dec	0	0	0	0	0	0	0	0	0	0

TL: Total Length

Figure 2: The percentage of prevalence and intensity of infection during study periods.



Whereas , the *E. papillatus* height prevalence were observed in January and April 60% to 40% and decreased in May 30%,june 5% to 1%in Feb.in marine fish sample and with intensity 1.66,2,1.3,1.25,0,7 during the months January to June and absent in the other months of freshwater fish sample .

Table 2: The percentage of prevalence and intensity of infection during study periods

Month	No of Exm. Fish	No of fish infected with			Prevalence %			Intensity		
		E.papillatus	Noth. sp.	<i>Faustula sp.</i>	E.papillatus	Noth.sp	<i>Faustula sp.</i>	E.papillatus	Noth. sp.	<i>Faustula sp.</i>
Feb2013	20	12	3	385	60	15	100	1.66	1.66	19.25
Mar	20	4	4	200	1	1	90	2	5.75	11.11
Apr	20	6	6	350	30	30	100	1.3	16.6	17.5
May	20	8	6	350	40	30	90	1.25	4.16	19.4
June	20	2	0	12	10	0	10	0	0	6
Jul	20	1	0	9	5	0	5	7	0	9
Aug	20	0	0	0	0	0	0	0	0	0
Sept	20	0	0	0	0	0	0	0	0	0
Oct	20	0	0	0	0	0	0	0	0	0
Nov	20	0	0	0	0	0	0	0	0	0
Dec	20	0	0	0	0	0	0	0	0	0

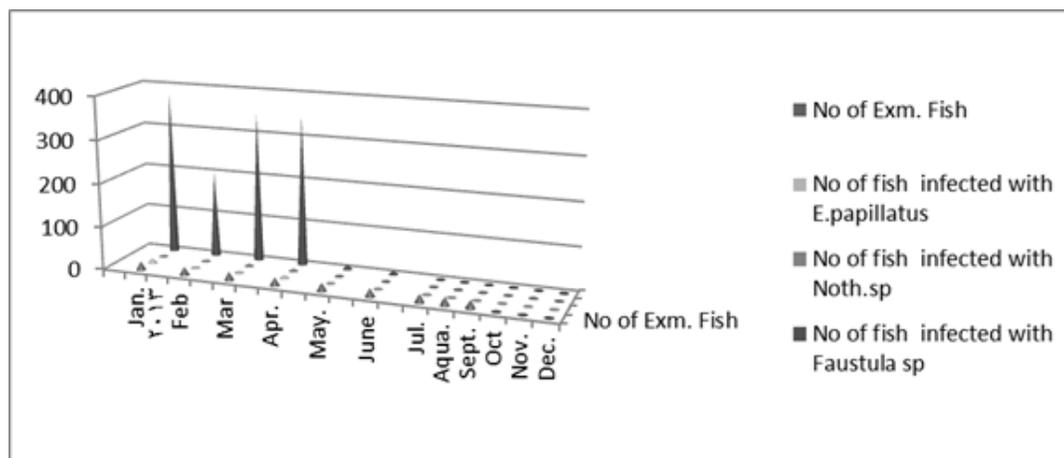


Figure 3: Infected fish during the period study

The current study also showed changed values of salinity and temperature during the seasonal variation, the salinity values ranged between in the northwest Arabian Gulf region and Al-Mashab in the region of marshes and Shatt Al-Arab, this change in salinity values reflected on the distribution and prevalence of parasites in their host, where there exists great diversity in terms of species and parasites setting down these values when you change the values of salinity in the Shatt al-Arab and particularly external parasites including. While no species of external parasites in freshwater areas in the Shatt Al-Arab and that is indicate on specialty contracting environment and that there is a relationship between them.

The results of this study have showed obvious seasonality per size group, suggesting two distinct peaks. The first peak was recorded during February-March and the second was recorded during September-November, indicating that fishes with different sizes have not occurred in the same area year-around. The observed temporal pattern of size structure was probably due to the spawning migration of the species [17-19]. Along the study period, males were slightly smaller than females except in June.

DISCUSSIONS

According to [7] *T. Hilsha* fishes are considers resident fish in the Bay of Bengal. During spawning, it migrates to upstream, the migration begins in the monsoon season around the month of May, and fish return to the Bay in December. In Iraq the migration starts in Feb.to May and return to Arabian Gulf in October and the hypothesis was that the *Tenulosa ilisha* might lose some parasites and acquire others during its migration and the frequency distribution of the parasites would be related to sex and size of the host fish.

This aspect of the hilsa parasites has not been reported although the parasites of hilsa have been reported by several workers in Iraq and other words. So, the Frequency of infestation and distribution of parasites within different organs of the fishes is influenced by age and diet, abundance of parasites within the fish and fish abundance and the goal of his study to analyze the epidemiology of parasitism of the size, and locality of infection.

The present studied model is represented by the helminthes parasitic in community of fish collected from two representative stations from marine water of Iraq by used prevalence and intensity as defined by Margolis *et al.* [20] to evaluate the demography of parasitism because we think these were the most reliable parameters reflecting the population aspects of parasite host relationships. The two earliest records describing the application of parasites as biological tags in population studies of fishes are that of Dogiel and Bychovsky (1939), who distinguished between groups of stur-geon (*Acipenser* spp.) in the Caspian Sea using the monogenean parasites *Diclybothrium circularis* and *Nitzschia sturionis*. Since these investigations, the use of parasites as biological tags in population structure studies has flourished to include a wide range of fish species and geographical localities. Investigations have primarily focused on, although not limited to, fish species of economic importance, such as herring [21-25]. A diverse range of taxonomic groups of parasites have also been applied as biological tags.

The benefits and limitations of using parasites as biological tags has been extensively reported by [21,24,25,15,14,10,26,11]. The use of parasites as biological tags in population structure studies has also been reviewed by many authors [24,15,26,16]. The most recent reviews of parasites as biological tags in fish population studies are given by [14,10]. In the past 5 years, numerous studies have been published which used parasites as biological tags as the sole approach to discriminate fish stocks [27-40].

When compare our study with the study that was done by [41] on investigation was conducted to study the protozoan parasites of Hilsha shad, *T. ilisha* collected from Aricha Ghat, result showed that A total of 1099 individuals of protozoan parasite of eight species have been recorded, these parasites were found on body surface, gills and gall bladder of the fish. The infection was differ from that recorded from the same host in marine and freshwater habitats depend on geographical distribution and variation ecological aspects that effect on both the parasite structure and their host [42-51].

Note the task in India there is a huge diversity in parasite fish found in the Arabian Gulf fish that gives the sign of two important points, one the fish don't emigrate fish from the Indian Ocean to Iraq or that the fish lose the types of parasites during migration and the fish is likely endemic in the Arab Gulf region.

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