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Distribution and seasonal spread of zooplankton in Iraqi waters

Rasha Ahmed Hashim *

Department of Chemistry, College of Education for Pure Science/Ibn Al-Haitham, University of Baghdad, Iraq.

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Abstract

A summary of zooplankton research done in Peruvian marine waters is presented. We first provide a brief overview of the evolution of zooplankton studies off Peru before reviewing zooplankton biodiversity, regional distribution, seasonal and interannual fluctuation, trophodynamics, secondary production, and modeling are some of these topics. We evaluate research on various meroplankton, macroplankton, mesoplankton, and microplankton groups and provide a list of species from both published and unpublished sources. Three regional zooplankton groups have been identified:

- A shelf group on the continental shelf dominated by *Acartia tonsa* and *Centropages brachiatus*;
- A slope group on the continental shelf with siphonophores, bivalves, foraminifera, and radiolaria
- An oceanic group with adiversity of species.

Where the continental shelves are thin, between 4-6°S and 14-16°S, the largest zooplankton abundances and biomasses were frequently seen.

The diversity of species varies according to distance from the shore.

As a result of advection, peaks in larval production, trophic interactions, and community succession, species composition and biomass also change significantly over short time intervals.

Based on the detrimental consequences of weak summer upwelling intensity or exceptionally high and persistent winter upwelling on zooplankton abundance off Peru, an intermediate upwelling hypothesis is put forth. This concept states that a window of optimal environmental conditions for zooplankton groups is produced by intermediate upwelling. Finally, we identify significant knowledge gaps that demand future attention.

Keywords: Zooplankton; Water; Iraq; Groups; Spread; Community

1. Introduction

Zooplanktons are microscopic organisms that float in water. They are usually poor swimmers that only float along with the currents. Primary consumers (those who eat phytoplankton) and secondary consumers make up the zooplankton population (which feed on the other zooplankton) (1) They serve as a direct link between primary producers and higher food chain levels, such as fish. Freshwater zooplankton is smaller in size and has fewer animal phyla than its marine counterparts (2). Many environmental factors influence and govern the spatial and seasonal growth and succession of zooplankton, including DO and nutrients, which are critical for zooplankton spread and distribution, The development of zooplankton would be hampered by low DO levels.

* Corresponding author: Rasha Ahmed Hashim

Department of Chemistry, College of Education for Pure Science/Ibn Al-Haitham, University of Baghdad, Iraq.

Nutrients like as NH_4^+ and PO_4 are critical for zooplankton growth, and pH and TSS are important for zooplankton distribution (3).

A source of pure water Because zooplankton is a larger and easier to identify biological indicator of the trophic status of water systems and their health than phytoplankton, and because their occurrence, vitality, and responses change under adverse environmental conditions, they can be used as "bio indicators" for water pollution studies (4).

Biodiversity Indices are also used to describe and research biodiversity components of any aquatic ecosystem that are defined by their simplicity and the revelation of effective environmental factors (5). Gurney (1921) (6), form Rotifera, Cladocera, Copepoda main aggregates (7), Rotifera Small animals, often with a thin body of 50-2000 microns, and they are worm-shaped (8), own Rotifera Very short life cycle under appropriate conditions of temperature, nutrient availability and exposure to light and has the ability to reproduce rapidly under appropriate environmental conditions (9), As for the second group it is Cladocera It is an important group among zooplankton, and its bodies are usually covered with a chitinous structure known as a Carapace It also feeds by filtering and works on catching small animal plankton, bacteria and algae and is very sensitive to low concentrations of pollutants (10), The third group of zooplankton is Copepoda, Among all the zooplankton has Copepoda A rigid exoskeleton and strong appendages enable it to swim faster than other zooplankton And it usually has the ability to withstand unfavorable conditions compared to a group Cladocera (11),

2. Environmental factors affecting zooplankton

The abundance and distribution of zooplankton is greatly influenced by abiotic factors such as light, water depth, temperature, salinity and seasonal changes, and this change in abundance is gradual (12). and add (13) The abundance and productivity of plankton is affected by these factors, as well as the nature of food distribution and the nature of predation, (14) In their study on the seasonal distribution of plankton. (In Greece, the types of zooplankton have increased towards the bottom (Aliakmon) fauna in the Yakmon Riverriverbed; And that the wheels are dominant over the other groups, with the highest values of densities recorded in a season Autumn, they added that water temperature, dissolved oxygen, nitrate and monophosphate are the factors (15) The phenomenon of daily vertical migration of zooplankton in the water, pointed out (Stefanova) and studied.

That this phenomenon is related to the biological and environmental adaptation of these neighborhoods, and that the vertical distribution that follows this Migration is quantitative and qualitative temporarily, and thus this phenomenon leaves its effective impact on the values of biodiversity For zooplankton recorded per day, (16) To a number of factors that affect the (Cottenie & Meester) shape, they indicated Main in the abundance of zooplankton, including: primary productivity, water depth, basal, phytonutrients, predation, competition; And found an inverse correlation between the diversity of water fleas and turbidity, (17) In Florida in America that (Leonard and Paerl) in their study on the River (SJR) Cyanobacteria would cause a decrease in the zooplankton community and. Decrease in the energy of carbon used for consumers, ie fish, (18) and in a study on the Narmada River Wheels on groups of Cladocera, Copepoda and the association of zooplankton in a positive relationship with Temperature, pH, transparency, dissolved oxygen, calcium and experimentally proven the effect of temperature heat in the paddle, as it is more resistant to the lack of dissolved oxygen, (19) Anas pointed out in his study of the use of zooplankton as a vital guide to investigate the degree of Environmental pressure (acidity) in the lake system of Canada, if there is a change in the abundance of species and the emergence of species, tolerant of acidity and the disappearance of types that are sensitive to acid, (20) To link the presence of plankton with the environmental factors of China's rivers (Yuna) conducted in an environmental study it showed that the group of Rotifera was prevalent on the Cladocera and the Copepoda and that the temperature Salinity, conductivity and total nitrogen are the most influencing factors on the presence of plankton, (21) and in a study for the composition of zooplankton In Poland and the effect of the hydrological conditions of the river on zooplankton 95 Wel were identified and appeared in the river Species Rotifera and were the most quantitative and qualitative among most crustaceans, followed by the Copepoda, (22) In a study on the Mobo River In Nigeria's Delta it's Mbo 2015 During the dry season, its low density was recorded, and the size and quantity of zooplankton was, recorded during the season Rain and increased nutrient concentrations are followed by a high abundance of zooplankton.

2.1. The seasonal spread and distribution of zooplankton in various regions of Iraq

Many studies related to zooplankton have been conducted in Iraqi water bodies where Gurny studies were In 1921 he published a detailed research of forty species of aquatic invertebrates study, For the period from 1917 to 1918 in the vicinity of the city of Al-Amarah Dr. P.A. Buxton was collected and diagnoses 31 types of zooplankton, including 3 Speices of Rotifera and 14 types of Cladocera and Copepoda (23).

(24) Was the first to identify a zooplankton and a benthic crustacean from the Shatt Al- Arab and the Tigris River's city of Amara. From 1982 to 1984, studied the monthly fluctuations in zooplankton in the Shatt Al- Arab River.

And in study on the marshes The vine in southern Iraq has 32 species of (21) genera of zooplankton, and indicated that the highest growth of zooplankton Animals were at the end of spring, although the least growth was in the summer, and the Rotifera were the most dominant(25), (Mangalo and Akbar 1988) studied the quantitative and qualitative changes of Cladocera and differences Environmental factors and their comparison of the Tigris and Diyala rivers. It was found that the population density of the Tigris River is higher than it is in the river Diyala, the study also dealt with the relationship between groups of zooplankton (Cladocera) with environmental factors Such as water temperature, turbidity, electrical conductivity, oxygen content, and hydrogen ion concentration and current speed (26), (27) surveyed Rotifers in the northern half of the Shatt Al- Arab River.

(28)Sabri et al. (1993) investigated the zooplankton population in the river Tigris in Samarra weekly from July 1987 to July 1988 and discovered that zooplankton were most abundant during heavy river flows in March. The zooplankton population was severely reduced immediately by the barrage during the month of low river discharge, September, and remained so until the last downstream station.

(29)Researched the zooplankton of the Shatt Al- Basrah canal, whereas (30) researched the seasonal abundance of zooplankton in the southern Iraqi Marshes, and surveyed the zooplankton of the Garmat-Ali River.(31) During Autumn, the zooplankton population density ranged from 52 ind./m³ at station 5 (Al-Barga region) to 3309 ind./m³ at station 2 (Al-Turaba region) in Spring 2004. Crustacea was the most common species on all of the sites *Bestiolina arabica* (calanoid: copepod) was discovered by (32) in the Khor Al-Zubair and Shatt Al-Arab Rivers.

(33) Described *Phyllodiptomus irakiensis*, a new species of the genus *Phyllodiptomus*, The Shatt Al- Arab River is a tributary of the Tigris and Euphrates rivers.(34) In this investigation, sixty zooplankton taxa were discovered. Copepods were represented by 35 taxa, whereas other zooplankton were represented by 25 taxa,(35) The zooplankton was studied at sites on the Kufa River, and the results were Ninety-nine species from forty-six genera belonging to three zooplankton groups were identified, Alona, Bosmina, Camptocercus, Chydorus, Ceriodaphnia, Daphnia, Diaphanosoma, Graptoleberis, Hyocryptus, Latonopsis, Leydigia, Macrothrix, Pleuroxus, Simocephalus, and Simocephalus were among the Cladocera genera,, Asplanchna, Brachionus, Cephalodella, Colurella, Euchlanis, Filinia, Hexarthra, Keratella, Kellicottia, Lecane, Lepadella, Macrochaetus, Manfredium, Monommata, Notholca, Philodina, Proales, Polyarthra, Platyas, Syn, The Rotifera dominated the zooplankton community in this study, accounting for 41% of the total zooplankton community and including 13 families and 56 taxa, followed by Cladocera, which accounted for 36% of the total zooplankton community and included 6 families and 33 taxa, and Copepoda, which accounted for 23% of the total zooplankton community and included 4 families and 10 taxa. (36) The Lake Al-Habbaniya Table revealed a total of 67 zooplankton taxa (2). Rotifers had the most species (46), followed by cladocerans (13), and copepods (four species) (8 species). There were 18 genera of rotifers in the study. The genus *Brachionus* (6 species), *Cephalodella* (5 species), *Keratella* (4 species), and *Lecane* (4 species) have the most diversity (4 species). Almost every taxon was euplanktonic.

(37) A study conducted in 2019 north of Basrapopulation density varied from 20.3 ind/m³ in Autumn 2015 to 243.4 ind/m³ in Winter 2016. The average density per cubic meter was 140.6 ind/m³. Crustaceans were the most common in the area This area (92.9%), where their numbers ranged from 18.8ind/m³ During the winter, the density drops from 242.2 ind/m³ in the autumn to 242.2 ind/m³ in the autumn, Summer had the biggest peak in Cyclopoida of Copepoda (134ind/m³), accounting for 35.1 percent of total zooplankton and 88.3 percent of total Copepoda, while Cladocera saw a decrease in the winter of 2016 . 211ind/m³.(38) The zooplankton community from eight selected sites in the Alwand Rivers and Alwand Dam was studied. Water samples are taken once a month data was gathered between June 2018 and February 2019, Total zooplankton count increased from 4566.758 to 32433.98 ind.m-3.(39) In t his study, 626 individuals of crustaceans were recorded, divided into taxonomic units, including *Ostracudae*, *Decapod*, *Isopoda*, and *Amphipoda*

3. Conclusion

Through the studies that were radicalized in the article, which were conducted in different areas in Iraqi waters, the results indicated the presence of varieties Rotifera, Cladocera, Copepoda, Of the zooplankton, however, these groups differed in the composition of their societies in each study according to the quality of the water in each site. It differed between salty, fresh and polluted water and water affected by the presence of dams. These societies were also affected by the different seasons of the year.

Each type of zooplankton is able to withstand the environmental conditions of each site, and from this we find that zooplankton can be a vital guide to identifying the nature of the environmental conditions that dominate each region.

Compliance with ethical standards

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