# Study on Crustacean Parasites from Commercial Marine Fish from Bhaucha Dhakka, Mumbai, India

**Sushma Singh[1], Varsha V Andhare[2]**
[1]Department of Zoology, R.J. College Ghatkopar, Mumbai; sushmasinghad@gmail.com
[2]Department of Zoology, The Institute of Science, Fort, Mumbai; varshandhare@yahoo.com

**Abstract*:*** The study provides a summary of information on the population dynamics of crustacean (isopod) parasites that were isolated from the fish *Rastelliger kanagurta* in Bhaucha Dhakka along west coast of Mumbai, India. The purpose of the study was to know the prevalence and severity of infestation of isopods during various seasons. The majority of the time, isopods parasitize the fish in warmer oceans. The report examines the altering of isopod population dynamics with the overall warming of the Arabian Sea brought on by climate change. Over the course of a year from May 2019 to April 2020, isopods were collected. Out of 185 *Rastelliger kanagurta* that were examined for infection, a total of 39 (27 females and 12 males) were found to be infected. The scope of the study is to examine the isopod intensity on fish and the factors that contribute to their spread, with the ultimate goal of improving the health and sustainability of the fish populations and the fishing industry.
**Key words:** Climate change, Intensity, Isopoda, Prevalence, Rastrelliger kanagurta

## Introduction

Isopods that parasitize fish are obligate ectoparasites that are quite prevalent. Numerous cymothoid isopods parasitize fish and shellfish, as has been studied and documented by a number of researchers. (Dipanjan *et al*., 2016).

Numerous isopod species have been detected on the body surface, gill chamber, and buccal cavity of diseased fish. They have also been reported to be connected to fins. These isopods consume the host fish's blood as food. (Brusca, 1981). Numerous studies have shown that isopods have a negative impact on fish health generally, which causes disease and mortality in specific fish populations. (Rameshkumar, Ravichandran, 2014). They cause damage to the gill filaments, which causes overproduction of mucus and impairs gas exchange through the gills. In comparison to female fish who are parasite-free, parasitized females lay only 12% as many eggs (Adlard, Lester, 1994). According to studies, fish parasites can act as biological indicators to reveal information about the ecology of their infected hosts, such as eating, migration patterns, and population dynamics (Palm, 2011). (Trilles, *et al*., 2011). According to studies on the isopod parasites of marine fish undertaken by different researchers, the majority of fish from Indian coasts are infected by Cymothoids isopods. (Trilles, *et al*., 2011) has provided a thorough list of Indian Cymothoidae that includes data from many studies conducted between 1783 and 2011.

The distribution of hosts affects the population variability of parasite infestation. Most recently, parasite infections in marine ecosystems have been linked to anthropogenic impact and environmental change. (Palm, 2011). The Indian Mackerel, which is categorized as an opportunistic feeder with a diet component that broadly reflects its seasonal-spatial habitats and local food availability, has ontogenetic differences in its diet, according to one study (Ganga, Radhakrishnan 2020).

Warm shallow coastal waters of the Indian and Western Pacific oceans are where you can find *Rastrelliger kanagurta*. Indeed, *R. kanagurta* is a fish with enormous commercial value.

Different species of parasitic isopods occurring in *R. kanagurta* include *Norileca indica*, *Nerocila phaeopleura*, *Joryma brachysoma* (Trilles *et al*., 2011). A study claims that after 1995, the natural decadal cycle of sea surface temperature (SST) in the Arabian Sea was disrupted as a result of global warming. This was followed by secular warming and related climatic change (Kumar, *et al*., 2009). In the northeastern Arabian Sea, Pakistan and India's two largest ports are Karachi and Mumbai. The annual mean SST in the coastal waters off Mumbai and Karachi has been shown to be increasing by about 0.3 degrees Celsius every decade (Khan, *et al*., 2004). The average of monthly data on Arabian Sea surface temperature (SST) between (January 2007 up to December 2016) derived from satellite shows unusual peaks in April and October. (Vinaya, *et al*., 2021).

According to future predictions, the failure of the Indian Oil Sardine (IOS) fishery to adapt to changing climatic conditions along the Kerala coast may lead to a decline in their distribution and population. Understanding how climate change may affect host-parasite dynamics is becoming crucial (Sajna, *et al*., 2019).

This study aims to investigate the seasonal variation in the prevalence of isopod parasites in *R. kanagurta*, with regards to gender, over a one-year period. The study will explore the effect of temperature changes on parasite infestations in marine fish. The research is significant as the majority of information on parasites and diseases come from industrialized nations in temperate regions, with the exception of coral reefs. Understanding the effects of temperature disparities in the tropics and poles may provide insight into how temperature changes can impact parasite dynamics.

**Materials and methods**

Medium-sized (15.3 – 18.7cm), *R. kanagurta* were collected from Bhaucha Dhakka fish market in Mumbai for the purpose of studying the presence of Isopod parasites. Samples were collected over a year (excluding April) and were examined in the lab for Isopod infestation. The Isopods were removed, washed, and preserved in 4-10% formalin, and the number of collected parasites was recorded.

Parasites were observed and studied under a stereomicroscope. Most were found in the host's branchial cavity, positioned with their ventral side facing the operculum. The prevalence, mean intensity, and relative density of the parasitic infestation were calculated using methods established by (Margolis *et al.*, 1982) and (Bush *et al*., 1997). The length of each host was measured in centimeters. The sex of the host, *R. kanagurta*, was determined through internal examination of sex organs. The parasitic isopods were identified using keys (BRUCE, 1990).

The population parameters

$$Prevalence = (number\ of hosts\ infected) / (total\ number\ of\ hosts\ collected)$$

$$Mean\ intensity = (total\ number\ of\ parasites) / (total\ number\ of\ infected\ hosts)$$

$$Mean\ abundance = (total\ number\ of\ parasites) / (total\ number\ of\ hosts)$$

*Result*

Parasitic isopod *Norileca indica* was found in *R. kanagurta* fish from Bhaucha Dhakka fish market on the Mumbai coast. Out of 185 samples of *R. kanagurta* examined, 39 were infested with a prevalence rate of 21.08% (Table). The overall mean intensity and mean abundance were found to be 1.38 and 0.29 respectively as shown in table. The highest prevalence of infestation and abundance were recorded in the months of March & May. The mean intensity was maximum in May.

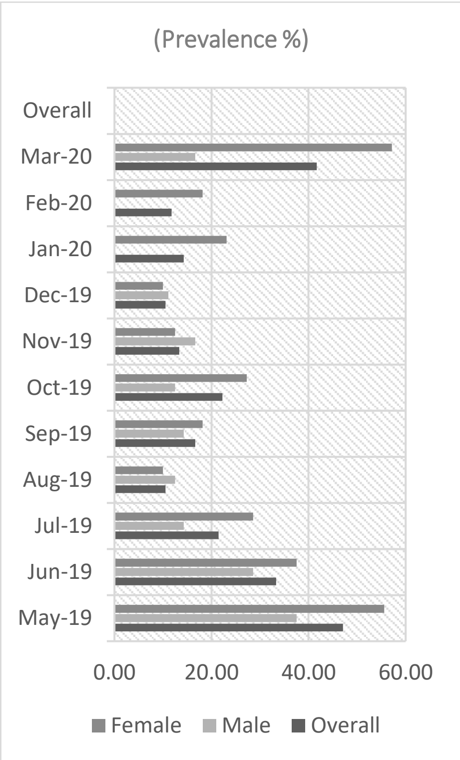
In the case of male hosts, the overall prevalence was 15 %. It was maximum in May and minimum in January & February. The overall mean intensity and mean abundance were found to be 1.75 and 0.26 respectively as shown in (Table). The highest abundance of infection was recorded in the months of May & June. The mean intensity was almost uniform through May to December.

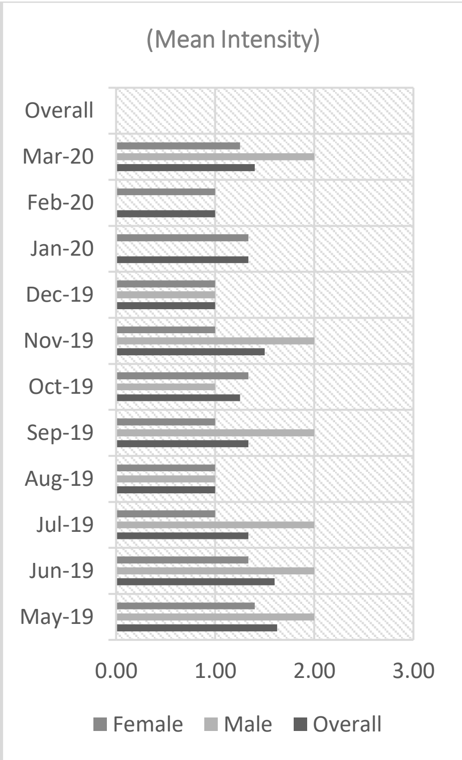
In the case of female hosts, the overall prevalence was 25.71%. It was maximum in March and minimum in August. The mean intensity and mean abundance were found to be 1.28 and 0.31 respectively as shown in table. The highest abundance and mean intensity of infection was recorded in the month of May.

We found that comparatively, for males, the proportion of the female host population was found to be infested more. On the basis of the above given details on quantification of parasitic load for both male and female host populations, although prevalence was seen to be rising in the month of March, it was at its peak in May (Fig-1). Mean intensity and abundance was found to be high during summer (May & June) in (Fig-2 & 3). Cymothoids, ovigerous females' isopods and various younger stages were also recovered.

| Month | Overall | | | | | | Male | | | | | | Female | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total no. of hosts examined | No. of infested hosts | Prevalence % | No of Parasites | Total No of parasites collected | | Total no. of hosts examined | No. of infested hosts | Prevalence % | No of Parasites | Total No of parasites collected | | Total no. of hosts examined | No. of infested hosts | Prevalence % | No of Parasites | Total No of parasites collected | |
| | | | | | (Mean intensity) | (Abundance) | | | | | (Mean intensity) | (Abundance) | | | | | (Mean intensity) | (Abundance) |
| **19-May** | 17 | 8 | 47.06 | 13 | 1.63 | 0.76 | 8 | 3 | 37.50 | 6 | 2.00 | 0.75 | 9 | 5 | 55.56 | 7 | 1.40 | 0.78 |
| **19-Jun** | 15 | 5 | 33.33 | 8 | 1.60 | 0.53 | 7 | 2 | 28.57 | 4 | 2.00 | 0.57 | 8 | 3 | 37.50 | 4 | 1.33 | 0.50 |
| **19-Jul** | 14 | 3 | 21.43 | 4 | 1.33 | 0.29 | 7 | 1 | 14.29 | 2 | 2.00 | 0.29 | 7 | 2 | 28.57 | 2 | 1.00 | 0.29 |
| **19-Aug** | 19 | 2 | 10.53 | 2 | 1.00 | 0.11 | 8 | 1 | 12.50 | 1 | 1.00 | 0.13 | 10 | 1 | 10.00 | 1 | 1.00 | 0.10 |
| **19-Sep** | 18 | 3 | 16.67 | 4 | 1.33 | 0.22 | 7 | 1 | 14.29 | 2 | 2.00 | 0.29 | 11 | 2 | 18.18 | 2 | 1.00 | 0.18 |
| **19-Oct** | 18 | 4 | 22.22 | 5 | 1.25 | 0.28 | 8 | 1 | 12.50 | 1 | 1.00 | 0.13 | 11 | 3 | 27.27 | 4 | 1.33 | 0.36 |
| **19-Nov** | 15 | 2 | 13.33 | 3 | 1.50 | 0.20 | 6 | 1 | 16.67 | 2 | 2.00 | 0.33 | 8 | 1 | 12.50 | 1 | 1.00 | 0.13 |
| **19-Dec** | 19 | 2 | 10.53 | 2 | 1.00 | 0.11 | 9 | 1 | 11.11 | 1 | 1.00 | 0.11 | 10 | 1 | 10.00 | 1 | 1.00 | 0.10 |
| **20-Jan** | 21 | 3 | 14.29 | 4 | 1.33 | 0.19 | 8 | 0 | 0.00 | 0 | 0.00 | 0.00 | 13 | 3 | 23.08 | 4 | 1.33 | 0.31 |
| **20-Feb** | 17 | 2 | 11.76 | 2 | 1.00 | 0.12 | 6 | 0 | 0.00 | 0 | 0.00 | 0.00 | 11 | 2 | 18.18 | 2 | 1.00 | 0.18 |
| **20-Mar** | 12 | 5 | 41.67 | 7 | 1.40 | 0.58 | 6 | 1 | 16.67 | 2 | 2.00 | 0.33 | 7 | 4 | 57.14 | 5 | 1.25 | 0.71 |
| **Overall** | **185** | **39** | **21.08** | **54** | **1.38** | **0.29** | **80** | **12** | **15.00** | **21** | **1.75** | **0.26** | **105** | **27** | **25.71** | **33** | **1.28** | **0.31** |

**Table:** Month wise Overall, Male and Female Prevalence, Mean Intensity and Abundance of N. indica on R. kanagurta




**Figure– I** **Figure – II**

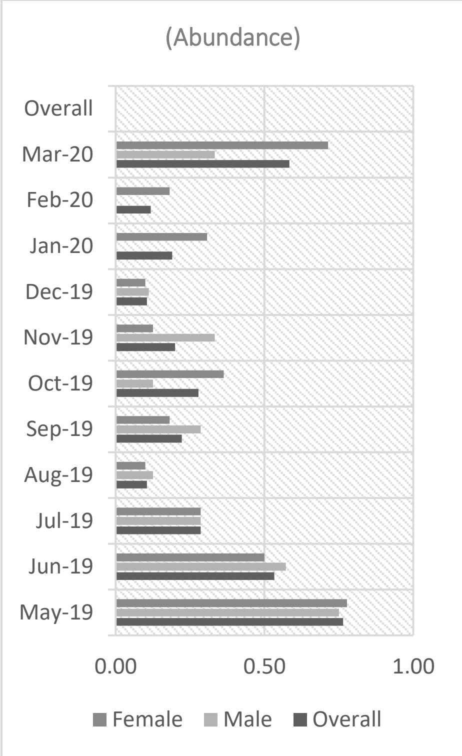



**Figure - III**

**Discussion**

Temperature affects host-parasite interactions and climate change is altering these interactions. (Kirk, *et al*., 2018) as per study by (Rameshkumar, *et al*., 2013) summertime (May) has the highest infection rate of host populations with parasites like *N. indica* and other isopods.

(Rijin *et al*., 2018) found the highest infestation of isopod species during summers and least during monsoon.

(Kottarathil, *et al*., 2019) also observed maximum infestation in summer. Studies have found a high rate of infestation of parasites isopod *Joryma brachysoma* in the host *R. kanagurta* during winter.

(Ravichandran S. *et al* 2009) and (Jemi, *et al*., 2020) also found high infestation of the isopod during winter.

(Neeraja, *et al*., 2014) also found higher infestation during winter, as did (Aneesh *et al*., 2013) and (Kudtarkar *et al*., 2018).

Isopods can live on land and in water. Most marine isopods feed on dead plant and animal material. However, the Cymothoidae and Gnathiidae families are parasitic on fish. Female Cymothoidae isopods give birth to live larvae, which become fish parasites. Gnathiidae isopods have been found to die quickly when exposed to temperatures 2-3°C higher than the average seasonal sea surface temperature (32°C) in laboratory studies. This suggests that temperature changes in the environment can affect the survival of Gnathiidae isopods. (Shodipo, *et al*., 2020, Dec).

A study using satellite-generated data on SST of the Arabian Sea for 2007-2016 showed unusual temperature trends, possibly due to climate change, with peaks in May and October, according to (Vinaya, *et al.*, 2021). This study found numerous temperature variations that may explain peak prevalence occurring in both summer and winter.

The present study found that the isopod parasite infests *R. kanagurta* throughout the year with higher prevalence during summer. Literature surveys show a peak in winter infestation as well, possibly due to rising sea surface temperature. The study highlights the role of the environment and its interaction with host physiology in affecting the infestation rate. Sea temperature, which is changing due to global warming, is a key factor affecting infestation. Future research is needed to better understand environmental factors and develop management strategies to control isopod infestation in fish culture farms. By identifying the impact of isopod parasites on fish species, policymakers can take action to protect the health of fish and the local fishing industry.

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