# Parasite diversity of an endemic intertidal fish, *Clinus superciliosus*: factors influencing parasite community structure

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## INTRODUCTION

Parasites comprise an estimated 40% of the global biodiversity (Wood *et al.,* 2013), and play an important ecological role in hosts, ecosystems and populations, as well as improve ecosystem function. They are considered to be significant drivers of biodiversity, where each host is regarded as an individual habitat that parasites can colonize (Hudson *et al.,* 2006). Even knowing this, records of parasites are limited to taxonomic descriptions and general surveys of parasite fauna (Reed, 2014), while their geographic distributions and ecological roles are less frequently focussed on (Torchin & Kuris, 2005). This is specifically true for South Africa as parasite records along the South African coastline are scattered, where the current trend is to focus on a specific parasite taxon and not on the total parasite community of a specific fish host (Smit & Hadfield, 2015) with limited data on ecological interactions. This is also true for *Clinus superciliosus* (Linnaeus, 1758), a klipfish endemic to Southern Africa, for which a number of parasite records do exist (15 species), but usually only reported on in taxa specific papers (Vermaak *et al.,* 2021 and references within).

This study **aims** to gain comprehensive information on which factors influence parasite community composition and structure within the endemic *C. superciliosus*. To achieve this, the following **objectives** were set: **i)** collect, identify and count all metazoan parasites of *C. superciliosus* from four different localities, **ii)** calculate various diversity indices for each locality, **iii)** do a multivariate differentiation of the different sampling localities considering spatial (four localities) and seasonal variability (two localities), habitat variability, parasite life cycle, as well as fish host size, -sex and -condition factors.

## MATERIALS & METHODS


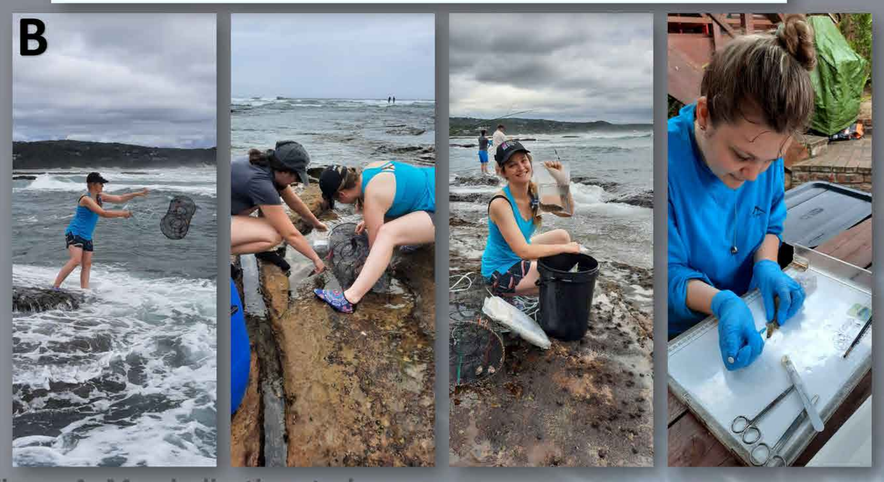


Figure A: Map indicating study area.
Figure B: Collection and processing of fish host for further parasitological examination.

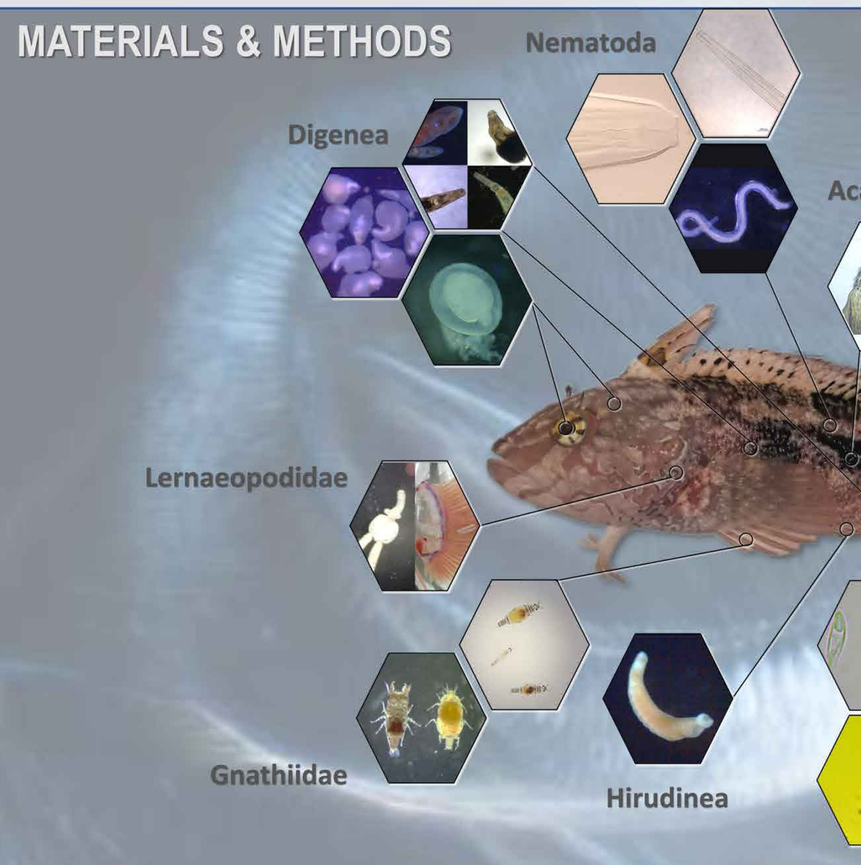


Diagram indicating various metazoan parasites collected from *Clinus superciliosus* from four localities

## RESULTS

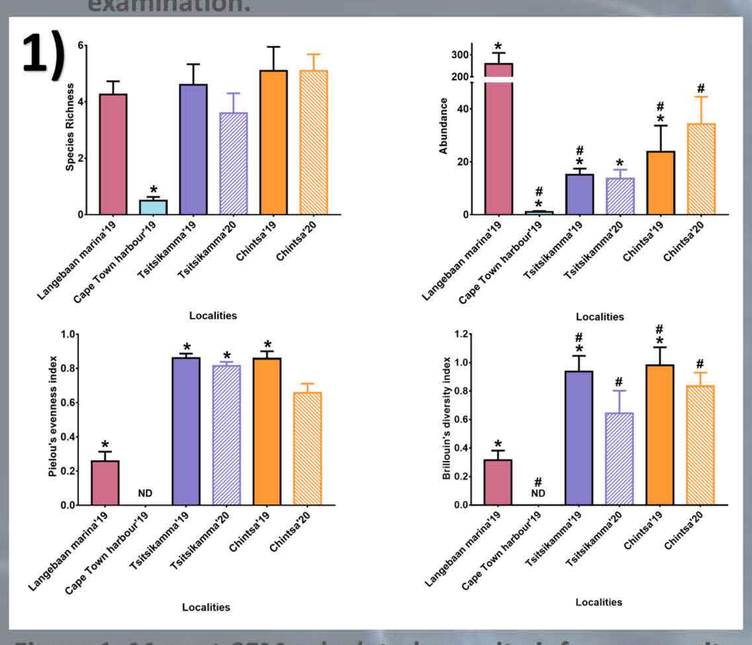


Figure 1: Mean ± SEM calculated parasite infracommunity richness, abundance, evenness and diversity sampled at Langebaan marina (2019), Cape Town harbour (2019), Tsitsikamma (2019, 2020) and Chintsa (2019, 2020).

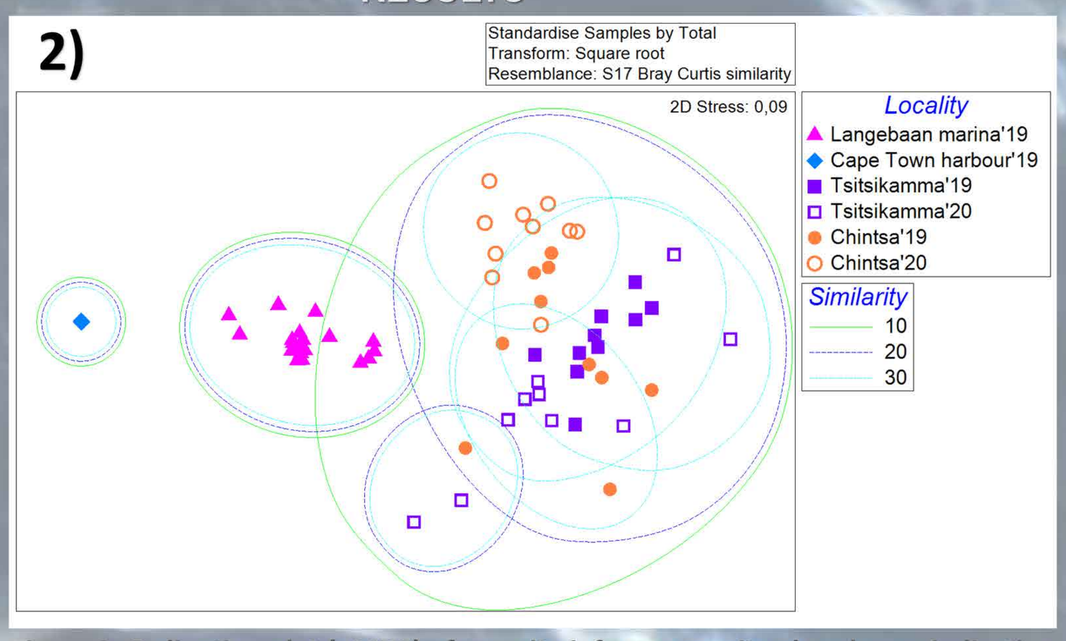


Figure 2: Ordination plot (nMDS) of parasite infracommunity abundance, indicating 10%, 20% and 30% similarity, sampled at Langebaan marina (2019), Cape Town harbour (2019), Tsitsikamma (2019, 2020) and Chintsa (2019, 2020).

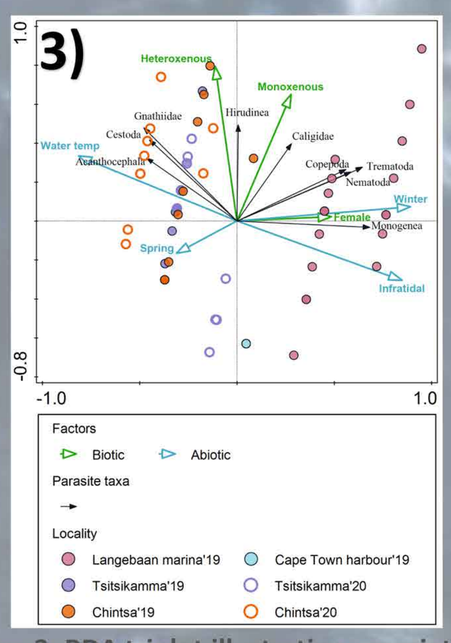


Figure 3: RDA triplot illustrating associations between abundance and factors, sampled at Langebaan marina (2019), Cape Town harbour (2019), Tsitsikamma (2019, 2020) and Chintsa (2019, 2020).

## DISCUSSION

This is the first comparative parasite community analysis of *C. superciliosus* from the western and southern coast of South Africa using abundance data of the infracommunity composition. Parasite fauna of *C. superciliosus* along the South African coast was species-rich (27 species) and dominated by digeneans (12 species). These 27 species included: nematodes (5 species); monogeneans (1 species); crustaceans (3 species); hirudinean (1 species); cestodes (2 species); acanthocephalans (3 species); and digeneans (12 species). Data were subjected to various diversity indices: species richness, abundance, Pielou's evenness index and Brillouin's diversity index. All of the localities, excl. Cape Town harbour '19, shared 17% (five species) of the parasite fauna, including two digenean species and a single species each of acanthocephalan, leech and gnathiid. This variety of parasite species are likely from the wide range of intermediate hosts *C. superciliosus* feeds on (Bennett *et al.,* 1983; Holleman *et al.,* 2012). Based on Pielou's evenness index, parasite assemblages at Tsitsikamma (2019, 2020) and Chintsa (2019) were the most evenly distributed, where no dominant species were present. The other localities had dominant species contributing to 91.9% at Langebaan marina (Trematoda sp. 14), 100% at Cape Town harbour (Monogenea sp. 1), and 67.3% at Chinsta (2020) (Cestoda sp. 2). While the two Chintsa surveys yielded the same species richness, 6 unique species were sampled, three from Chintsa 2019 and three from Chintsa 2020. According to the Brillouin diversity index, a higher diversity was found at Chintsa 2019 (1.884), Tsitsikamma 2019 (1.668), Tsitsikamma 2020 (1.661) and Chintsa 2020 (1.379), while the lowest diversity values were calculated for Langebaan marina 2019 (0.324) and Cape Town harbour 2019 (< 0.0001). Redundancy analysis indicated that parasite life cycle, habitat type and water temperature were considered to significantly influence community structure. The south coast has higher water temperatures than the west coast localities, and in combination with known upwelling events (Erasmus *et al.,* 2020), results in nutrient rich water. These eutrophic conditions correlate positively with overall parasite species richness.

## CONCLUSION

Even with this high species richness sampled, a rarefaction curve indicated that not all the parasite taxa from *C. superciliosus* have been sampled yet and that a greater effort has the potential to reveal even more species. The results from this study again emphasised the importance of parasitological surveys including all parasite taxa on hosts from various localities and seasons, in order to better establish the full ecological role of parasites in marine ecosystems.

## ACKNOWLEDGEMENTS

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