

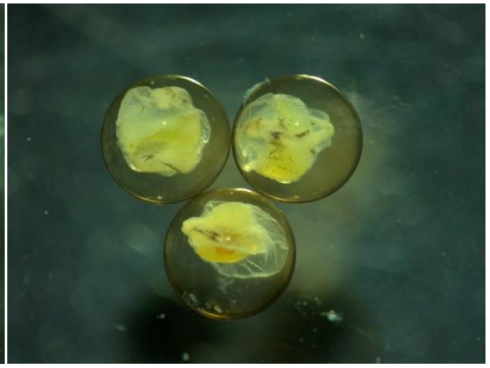




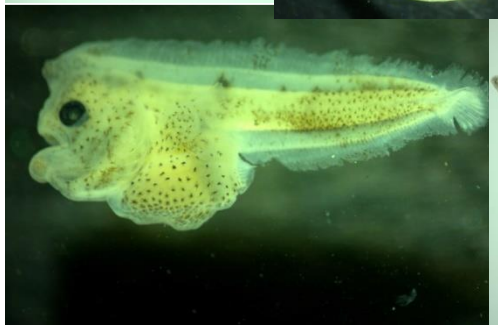


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Larval fish biodiversity in relation to biozones off the KwaZulu-Natal Coast: Biodiversity surrogates for marine conservation planning

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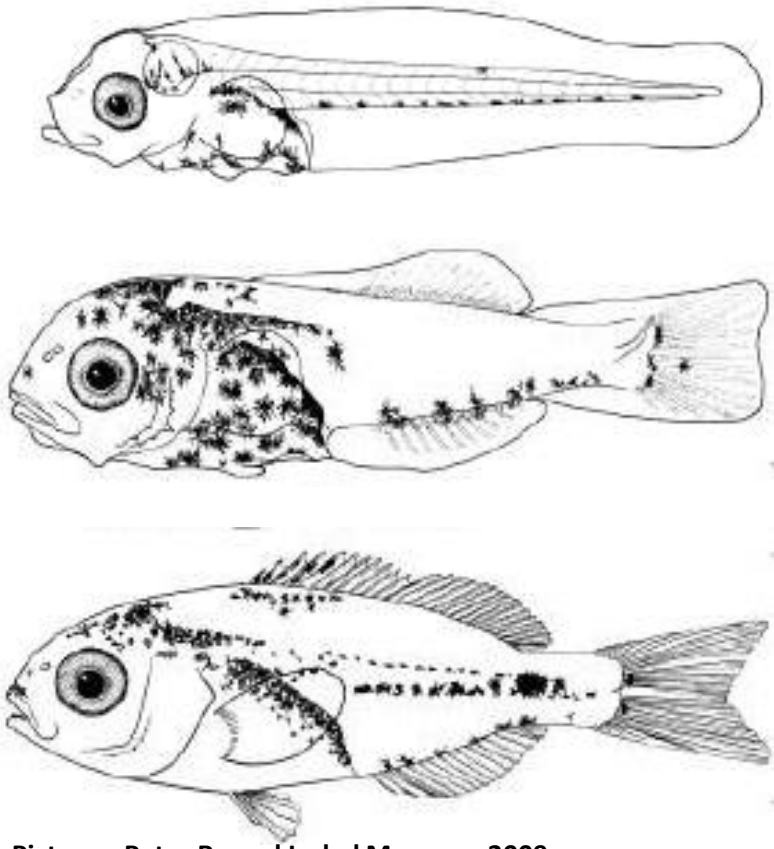
1.University of Zululand 2.Coucil for Scientific and Industrial Research

Introduction

- **Ichthyoplankton** include fish eggs and larvae that are found in the water column (the "**pelagic region**")
- Their distribution is influenced by ocean currents, winds etc.

Three developmental stages of the larval fish



Preflexion

Flexion

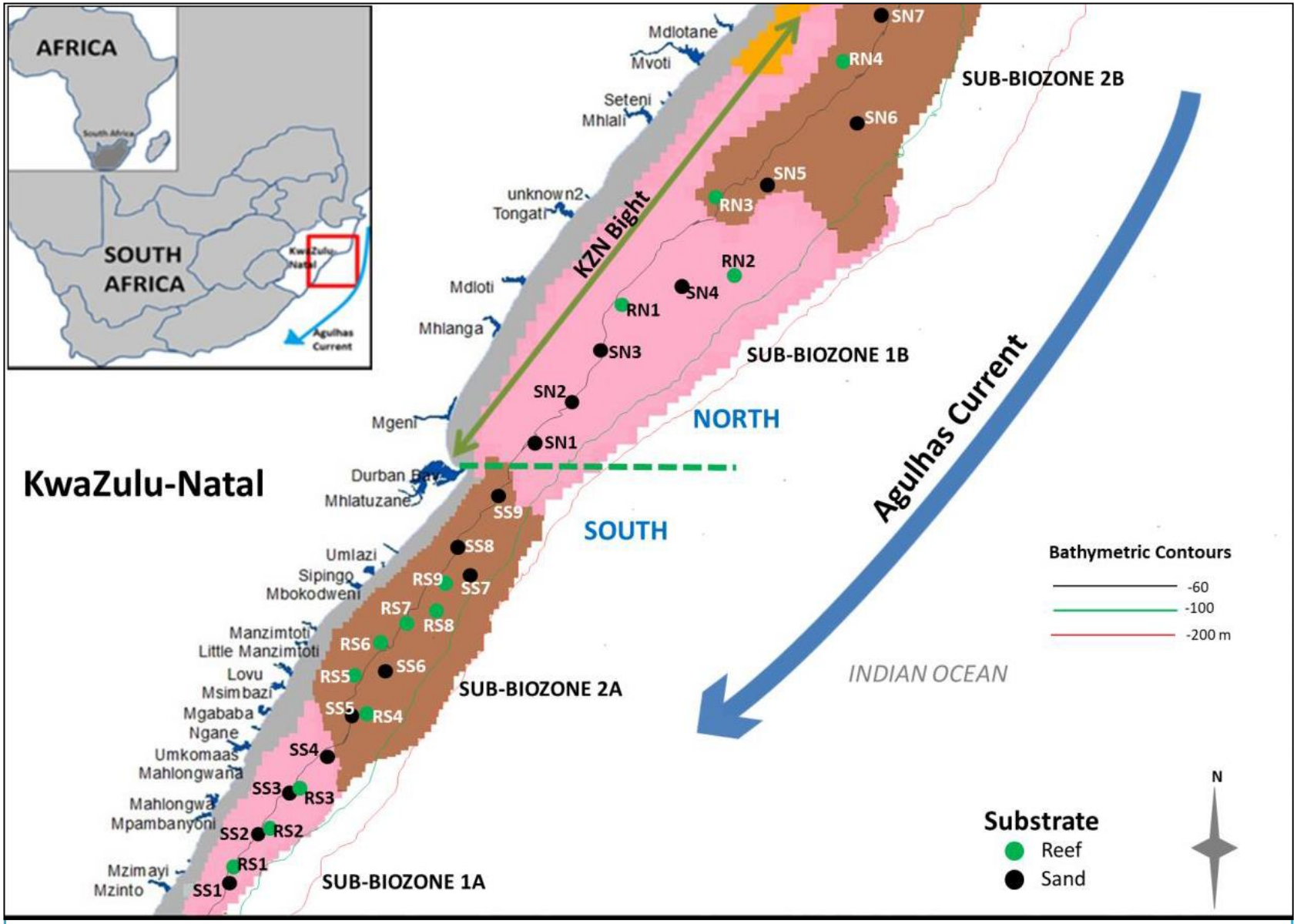
Postflexion

Pictures: Petro Re and Isabel Meneses 2009

1. Aims of the study

- Examine larval fish assemblages over reef and sand substrates of pre-identified biozones
- Investigate possible physico-chemical variables responsible for the larval fish distributions
- Test if the identified biozones act as biodiversity surrogates for larval fish communities to inform conservation planning of MPAs

2. Study Area



Biozone 1A and 1B - Shallow sandy shelf with low organic carbon and phosphate level and overlying warm oxygenated water
Biozone 2A and 2B - Shallow gravel area with low organic carbon and phosphate and warm oxygenated bottom water

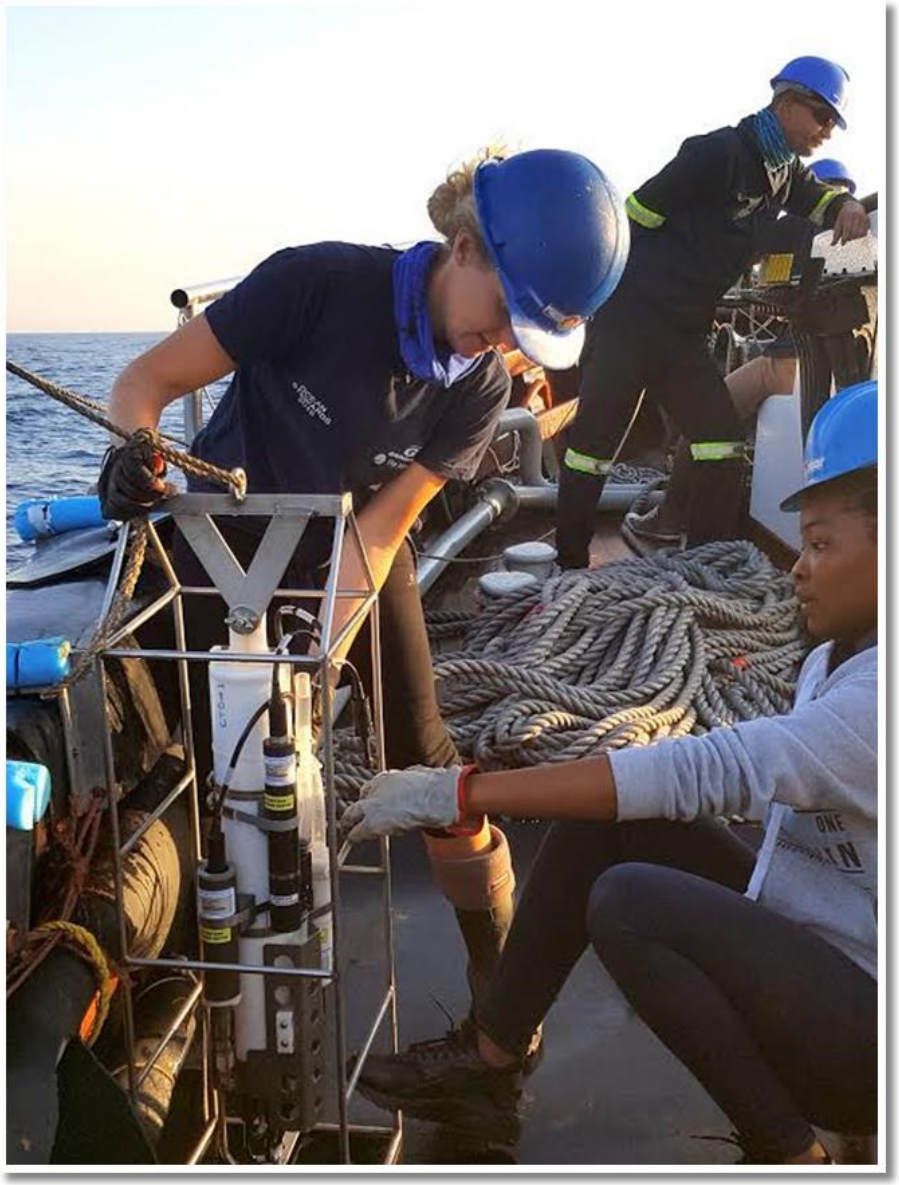
3. Field Sampling Procedure

- Plankton net (500µ mesh) with a cod-end was used to collect samples of fish larvae
- A flowmeter was attached in order to determine the volume of the water filtered
- At each of the 29 sites, 3 replicate oblique plankton tows were undertaken: Total 87 samples
- Sampling was conducted in May-June 2014
- Aboard R/V *Angra pequena*
- In the laboratory, fish larvae were picked out of the plankton samples and identified to nearest possible taxon/species.

Flowmeter

Cod-net

3. Field Sampling Procedure-*Water Parameter Probe Deployment*



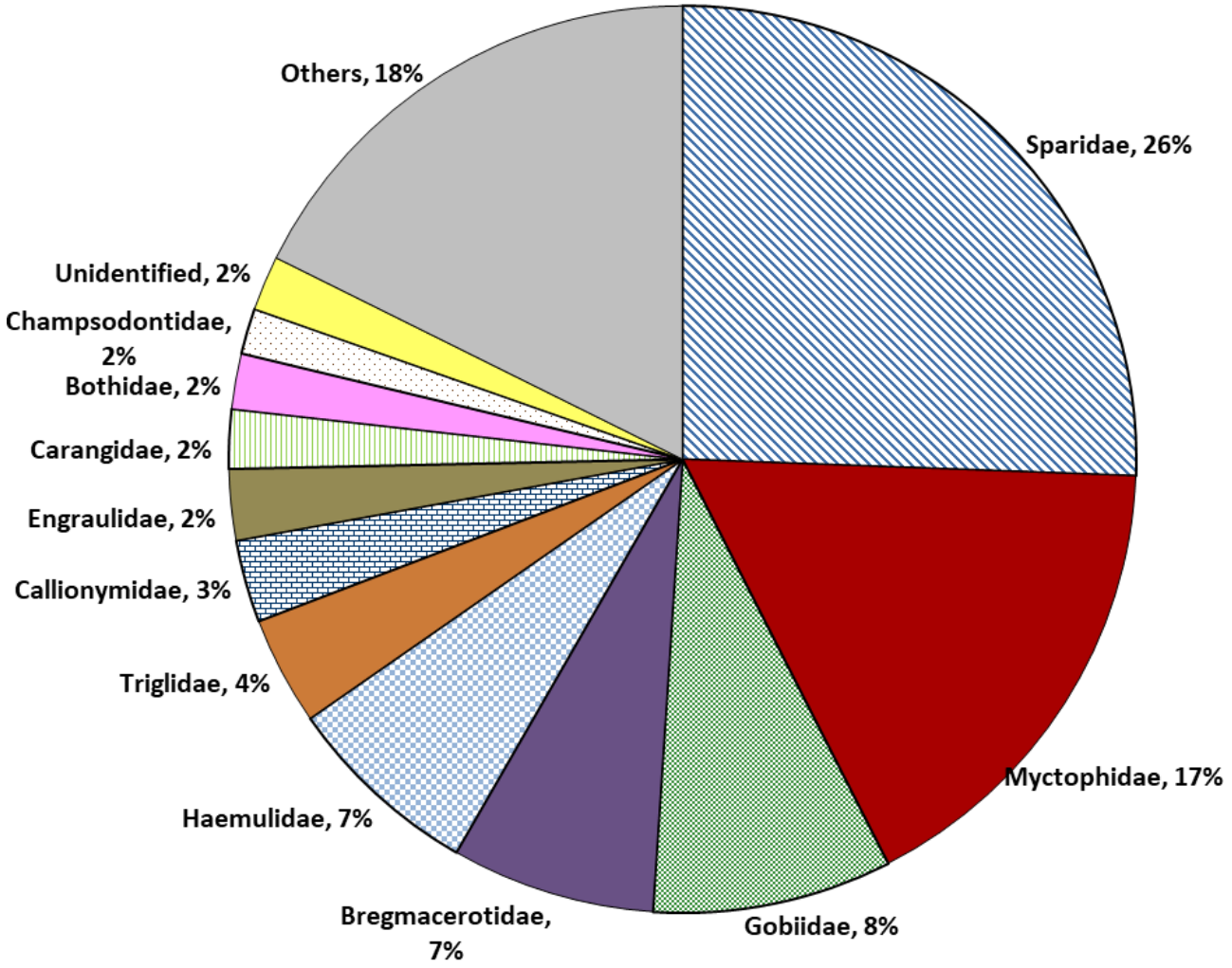
- **At each sampling station the following physical parameters were measured using CTD water parameter probe**

- Temperature (^{o}C)
- Salinity
- Dissolved Oxygen (mg/l)
- pH
- Chlorophyll
- Turbidity (NTU)

4. Results

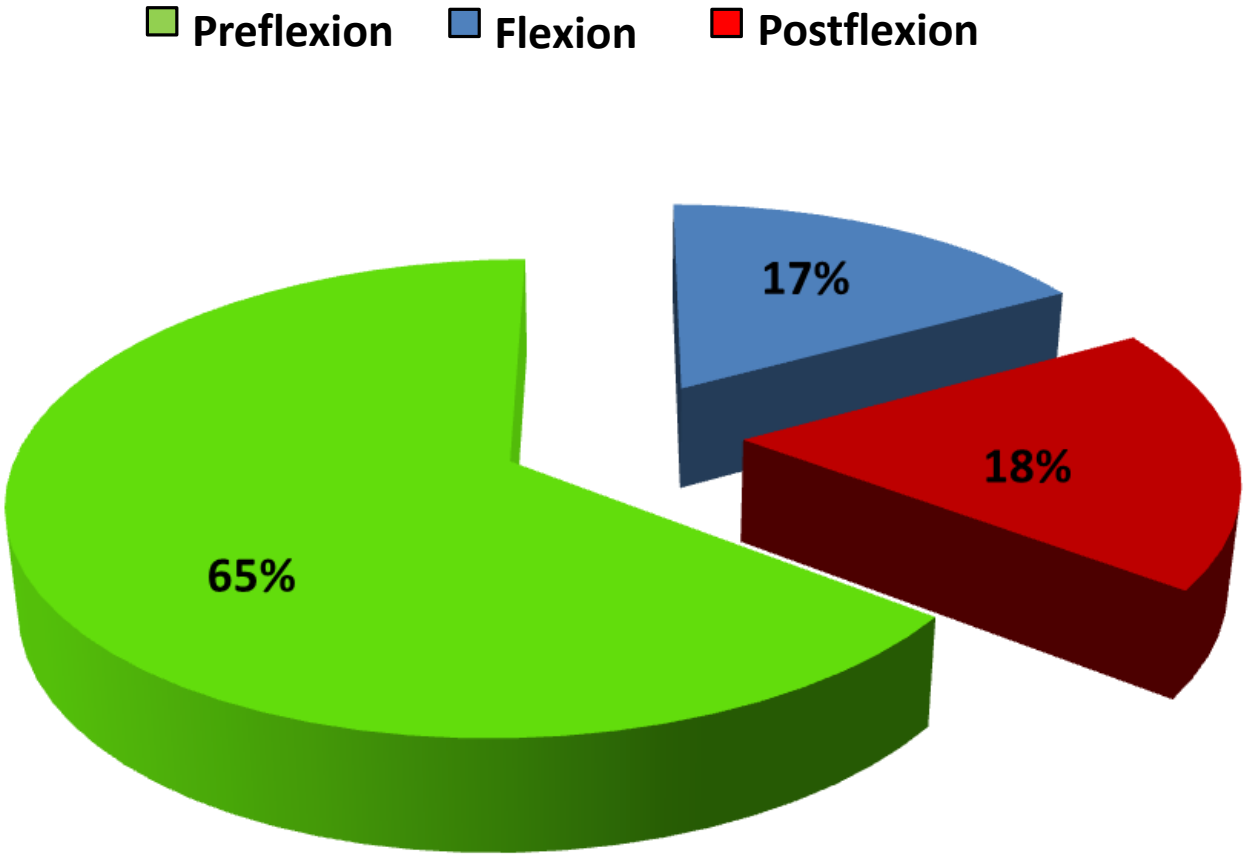
Larval fish composition

Total No. of larvae	No. of families	No. of Species
15085	99	168



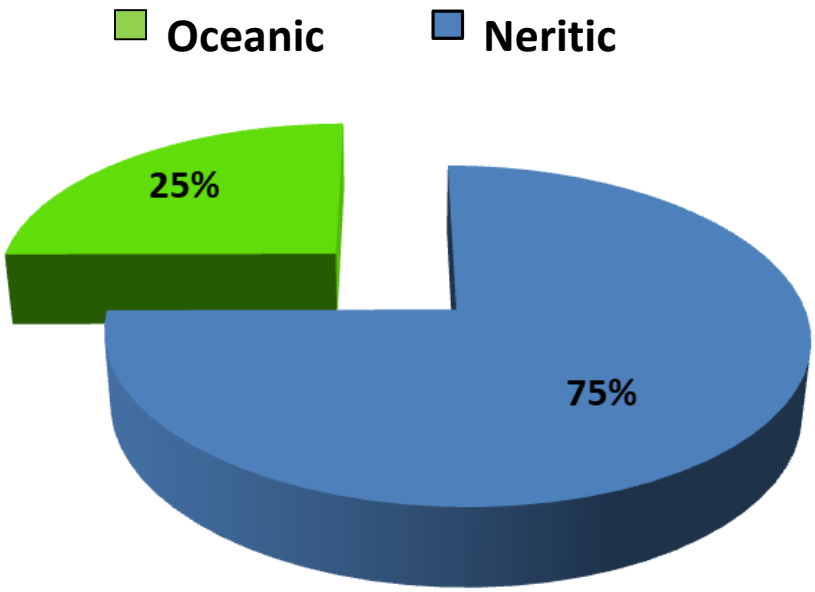
4. Results

Larval fish developmental stages



4. Results

Habitat Categories

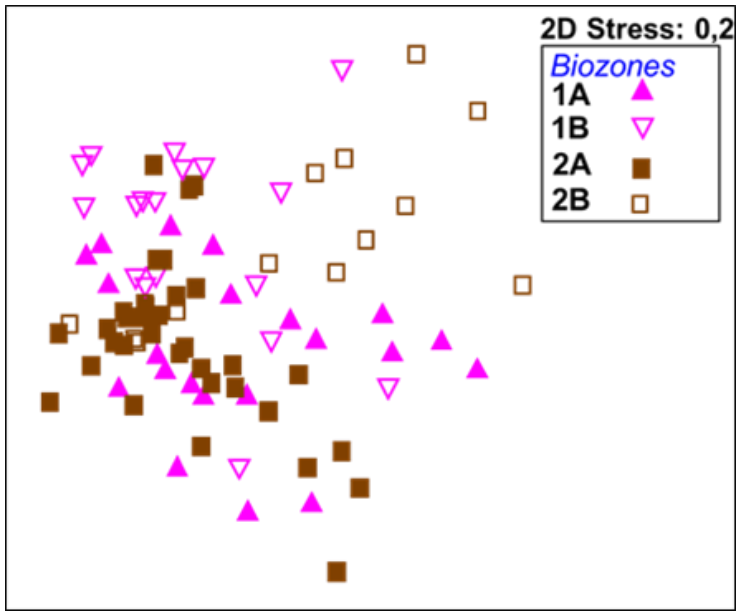


Neritic Species

Oceanic Species

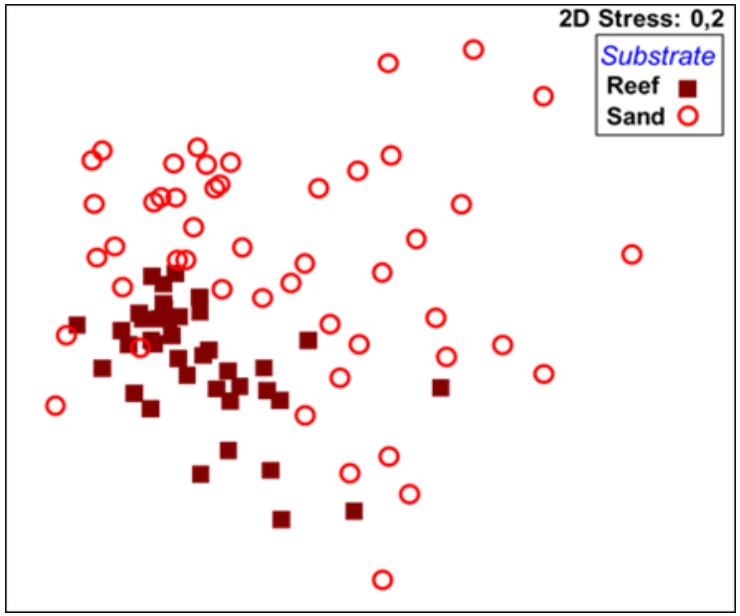
4. Results

Community analyses (non metric MDS)



➢ **Biozone differences**

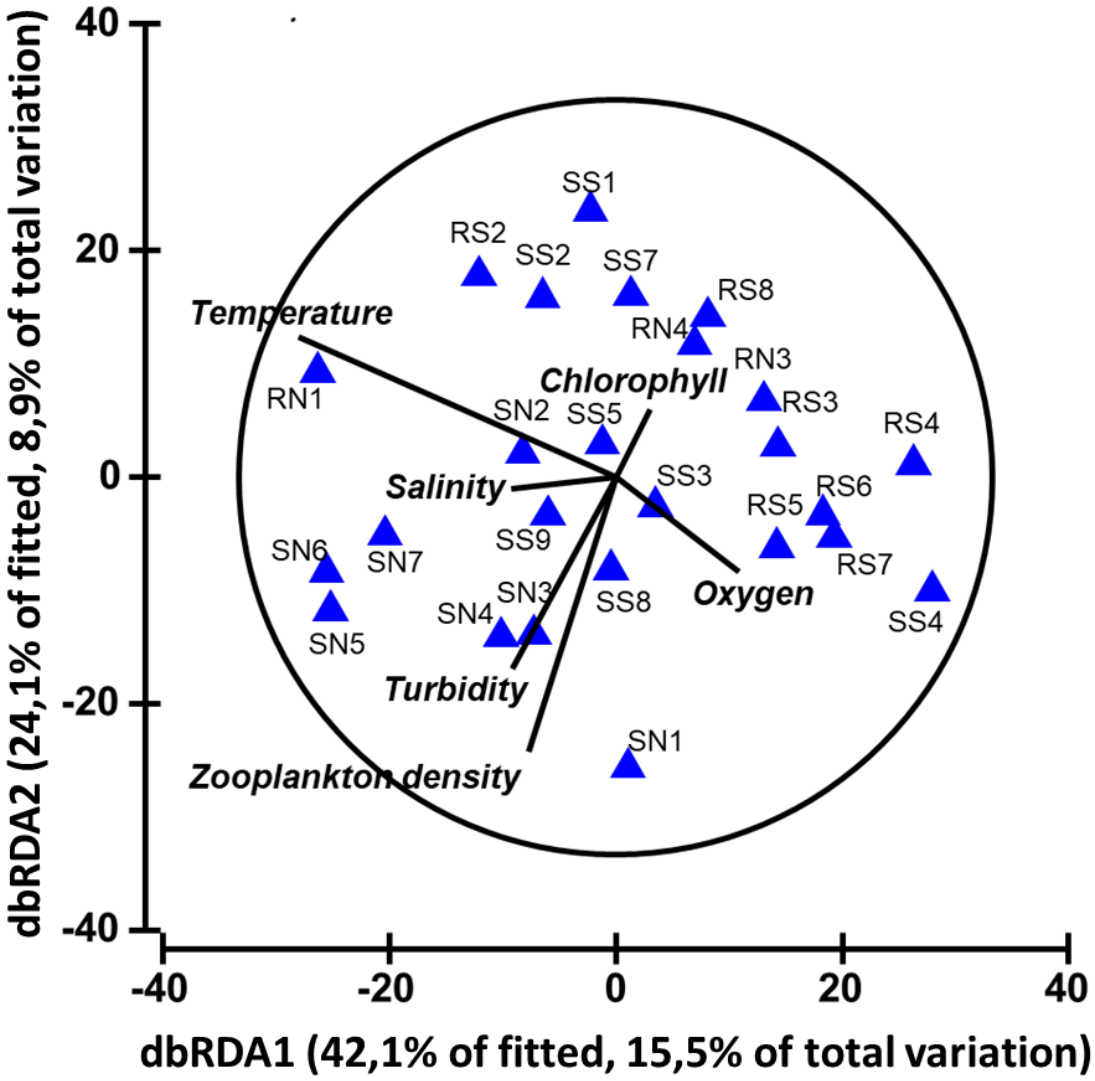
- PERMANOVA indicated no significant difference,
  Pseudo-F=1.40, P(Perm)>0.05
- Largest difference between 2A and 2B
- *Pagellus natalensis* influential (↑1A, 2A)



➢ **Substrate differences**

- PERMANOVA revealed a significant difference,
  Pseudo-F=1.99, P(Perm)<0.05
- *Pagellus natalensis* influential (↑Reef)

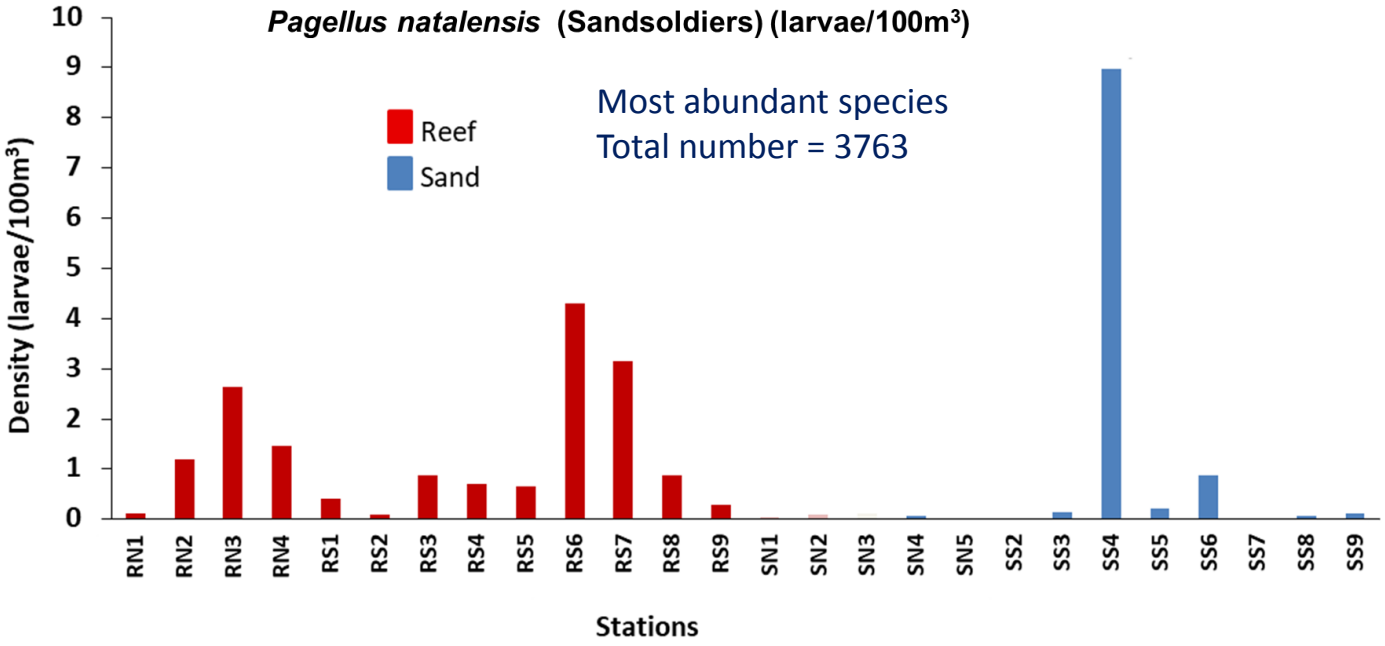
Relating biophysical variables to biological data



4. Results

Pagellus natalensis – Distribution & Developmental stages

	Developmental Stages		
Size	**Pr** (1.9-3mm)	**Fl** (4.2-5.8mm)	**Po** (6.3-19mm)
No. larvae	3015	571	177



5. Conclusion

- Larval fish assemblages showed no pattern with biozones, suggesting that these biozones are not good surrogates for the larval fish biodiversity.
  - **Lagabrielle (2012)** pointed out that biozones should be used with caution as they reflect areas of similarities based on a set of variables, not necessarily habitats with distinct species assemblages.

- **Substrate types** (reef and sand) nested within these biozones act as a potential surrogates for the larval fish communities of the KZN shelf and this could provide a guideline in implementing MPA networks.

- The higher density of ***Pagellus natalensis*** at the reef substrates is an indication that these reefs are potential settlement and nursery areas for this species.

- **Temperature**, **turbidity**, **pH** and **zooplankton density** were the best measured drivers of species assemblages.

6. Recommendation

- **Oceanographic data collection** should be included in studies to improve our understanding of the drivers of larval fish biodiversity patterns.
    - It is most likely that physical features such as ocean currents, upwelling and eddies are the key drivers in determining larval fish distribution patterns and such data must be incorporated in similar projects.

- Future work must consider factors such as **temperature**, **turbidity**, **pH**, **zooplankton density** and **fine-scale oceanographic data** in fine-tuning and improving the biozones that Livingstone *et al.* (2018) developed.

- Further biological sampling is encouraged to improve our knowledge of the spawning locations of adult fish populations, local oceanography and larval fish behaviour to ensure that informed decisions are made when **planning MPAs**.

Acknowledgements