iAtlantic
INTEGRATED ASSESSMENT OF ATLANTIC MARINE ECOSYSTEMS IN SPACE AND TIME

UNIVERSITÀ DEL SALENTO

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A FIRST APPROACH TO DECIPHER THE MEGABENTHIC TROPHIC NETWORK IN THE ANGOLAN COLD-WATER CORAL MOUNDS THROUGH STABLE ISOTOPE ANALYSIS

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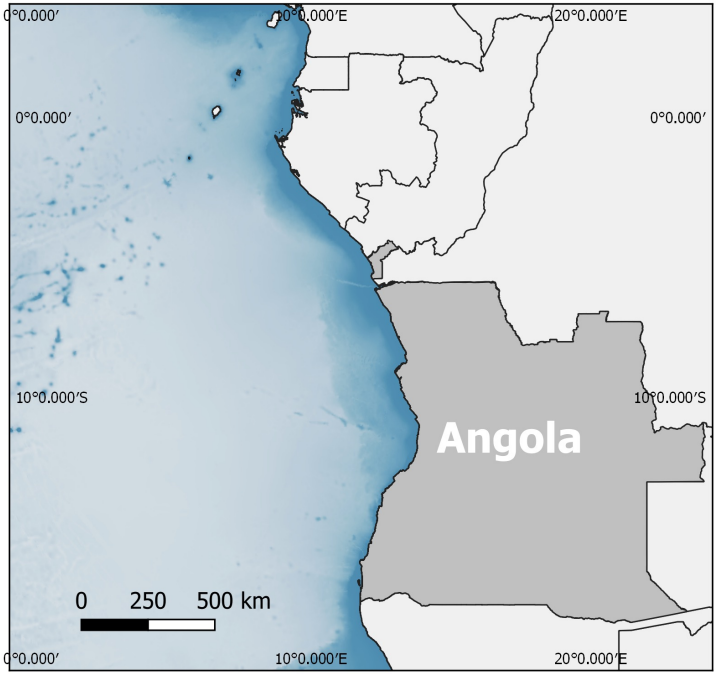
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 818123 (iAtlantic). This output reflects only the author's view and the European Union cannot be held responsible for any use that may be made of the information contained therein.

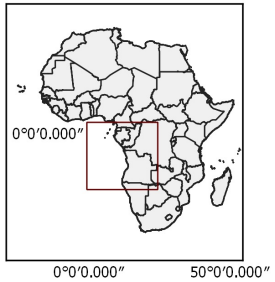
ANGOLA BASIN (SE ATLANTIC)

SE ATLANTIC

ONE OF THE MOST UNEXPLORED AREAS IN TERMS OF DEEP-SEA BENTHIC MEGAFAUNA

- Benguela Current Large Marine Ecosystem
- **Upwelling System** – one of the most productive in the world (0.37 Gt/Year)
- **Oxygen Minimum Zone** (OMZ)





ANGOLAN COLD-WATER CORAL MOUNDS

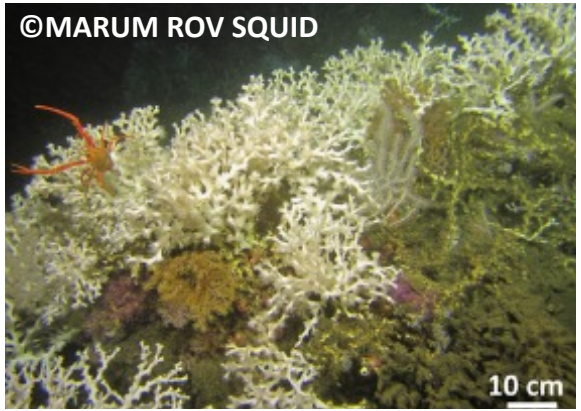
- Recently discovered CWC reef in the SE Atlantic composed mainly by *Lophelia pertusa* and *Madrepora oculata*

- *L. pertusa* CWC reef thriving in:

  - Temperatures ranging :
    6.8 to 14.2°C

  - Low dissolved O_2 concentrations:
    0.5 to 1.5 mL/L

M122 ANNA on R/V METEOR (2016)



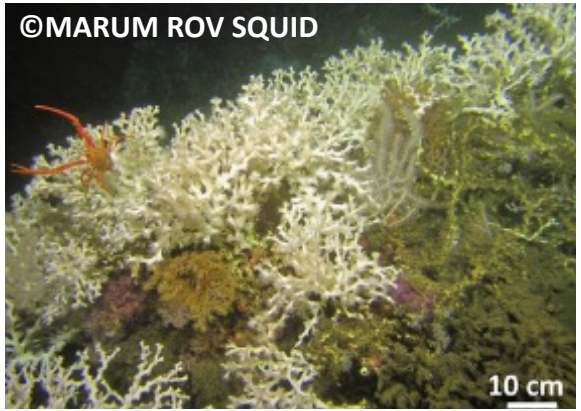
Hebbeln et al., 2017, Hanz et al., 2019, Hebbeln et al., 2020

ANGOLAN COLD-WATER CORAL MOUNDS

CWC might <u>compensate</u> low O_2 concentrations due to:

<u>high food availability</u> associated with a <u>high quality</u> Organic Matter (OM)

M122 ANNA on R/V METEOR (2016)



Büscher et al., 2017, Hebbeln et al., 2017, Hanz et al., 2019, Hebbeln et al., 2020

ANGOLAN COLD-WATER CORAL MOUNDS

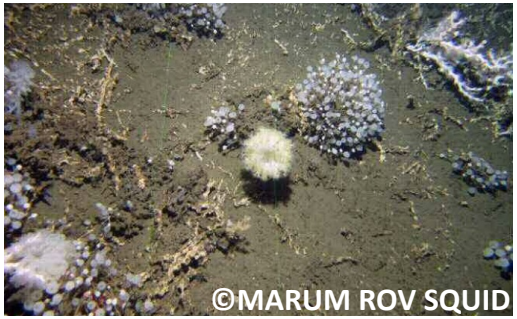
Associated Fauna in the CWC reefs

- Sponges
- Bryozoa
- Hydroids
- Octocorals
- Actiniaria
- Antipatharia
- Crustaceans
- Starfish
- Ophiuroids

Etc.

Hebbeln et al. 2017, 2020

M122 ANNA on R/V METEOR (2016)



What is the trophic structure of the Angolan CWC habitat?

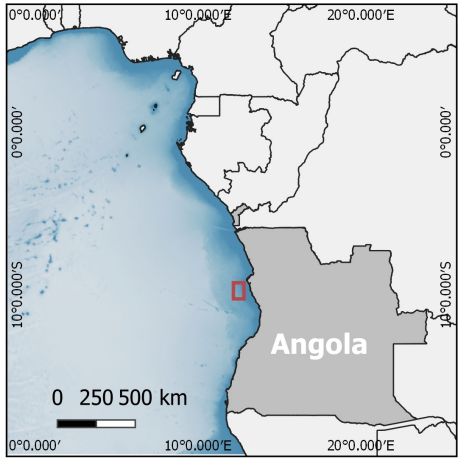
STABLE ISOTOPE ANALYSIS

$\delta^{15}N$	$\delta^{13}C$
Trophic Position	**Resource use**

MAIN OBJETIVE

To decipher, for the first time, the deep-sea megabenthic trophic network of the Angolan CWC mounds through Stable Isotopes Analysis

STUDY AREA

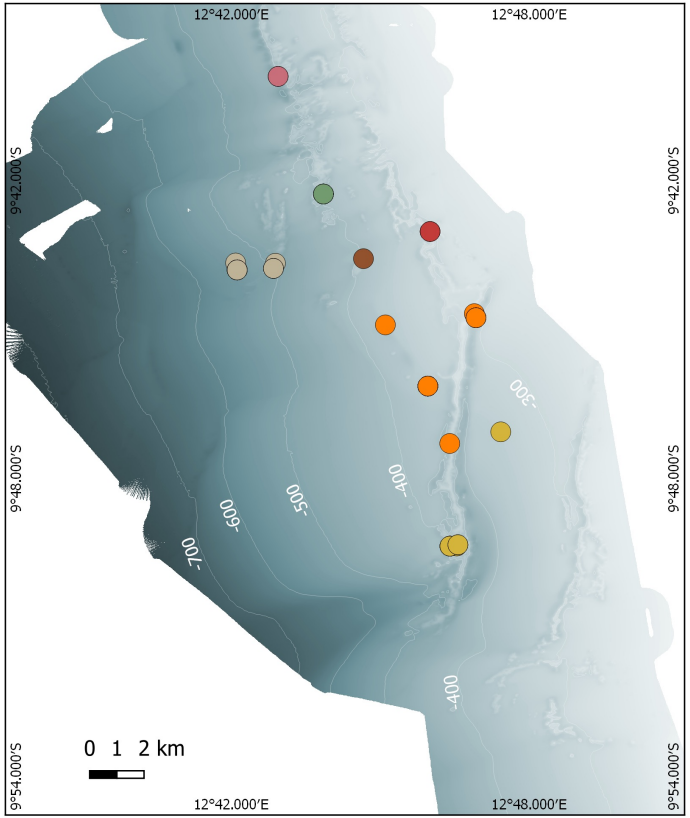


M122 ANNA on

R/V METEOR (2016)

CWC Mounds

- Anna Ridge
- Buffalo Mounds
- Castle Mounds
- Scary Mounds
- Snake Mounds
- Twin Mounds
- Valentine Mounds



SAMPLE COLLECTION

Angolan Benthic Megafauna

Van-Veen Grab

MARUM ROV SQUID

- **Freeze-dried at -80°C**
- **Stored at -25°C until analysis**

Cnidaria, Bryozoa, Porifera, Echinodermata, Annelida, Arthropoda, Mollusca, and Chordata

Sampling from 259 to 447m of depth

Total of 59 samples collected
Preliminary results for 39 samples

Lophelia pertusa
Madrepora oculata
Echinus sp.
Delectopecten vitreus
Bryozoa

→ **not included**

Hebbeln et al. 2017

SAMPLE COLLECTION

Potential Food Sources

Particulate Organic Matter (POM)

- **Sediment**

sampled at 259 and 345m of depth

Van-Veen Grab

Box Corer

- **Sediment trap material**

sampled at a daily interval at 342 and 532 m of depth

ALBEX Lander (NIOZ)

NIOZ Royal Netherlands Institute for Sea Research

- **Suspended Particulate Organic Matter (SPOM)**

sampled over a complete tidal cycle at 342 and 532 m of depth

Hebbeln et al. 2017

- **Stored at -20°C until analysis**

SAMPLE PREPARATION

Angolan Benthic Megafauna

Ground to Powder

Acidified drop-by-drop 10% HCl → Oven-dried at 50ºC → 3 replicates 1-4 mg Tin boats (11x4mm) → $\delta^{13}C$

Non-acidified → 3 replicates 1-4 mg Tin boats (11x4mm) → $\delta^{15}N$

SAMPLE PREPARATION

Potential Food Sources
Particulate Organic Matter (POM)

¼ section of GF/F Filter	→	Acidified by vapor 20% HCl	→ $\delta^{13}C$
Sediment trap Material			
Sediment	→	Non-acidified	→ $\delta^{15}N$

PRIMARY CONSUMERS

Fish, Crustacean, Polychaeta

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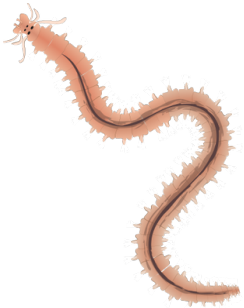
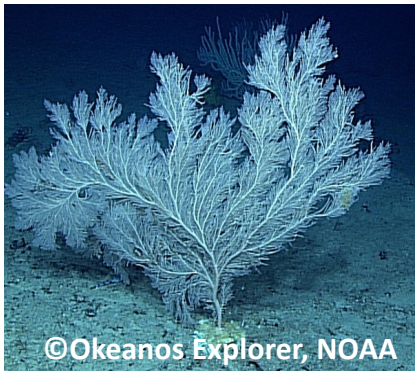


Cold-water corals (CWC)

Octocorals



Antipatharia

COLD-WATER CORALS (CWC)

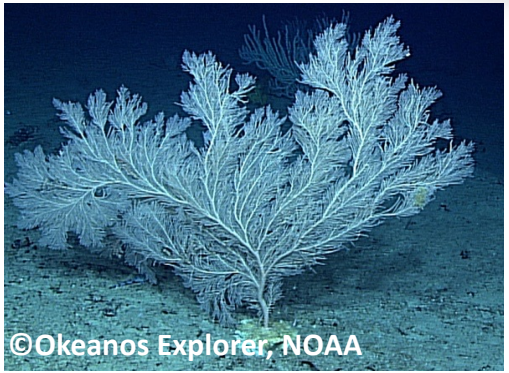
Fresh SPOM is not a food source for the analyzed CWC species

Potential food sources for Octocorals and Antipatharia

- Resuspended Organic Matter (OM) from sediment and degraded OM – this has been seen in Antarctic CWC species
- Zooplankton might be an important food source – as seen in other studies and in aquaria experiments

Elias-Piera et al., 2013, Carlier et al., 2009, Coppari et al., 2020, Rakka et al., 2021

Octocorals



Antipatharia

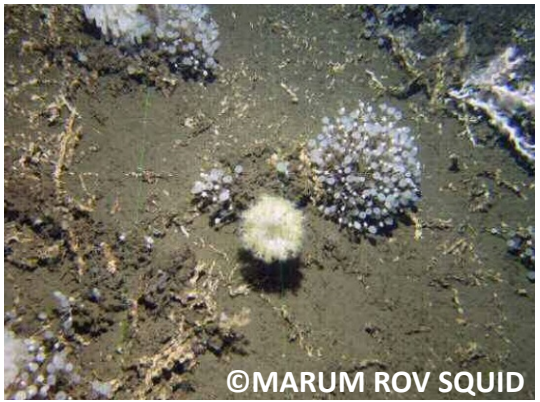
What could explain the high Trophic Position occupied by sponges?

- High $\delta^{15}N$ values for deep-sea sponges have been reported in literature

- **Bacterial symbionts**
  – in OMZs increase of remineralization of bacteria might increase N ratios

- **DOM and bacterioplankton as food source**
  – hexactinellid species assimilate bacteria more efficiently

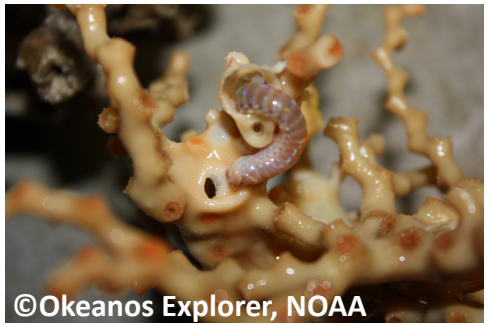
Bart et al., 2021



Deep-sea sponges in Angolan CWC mounds

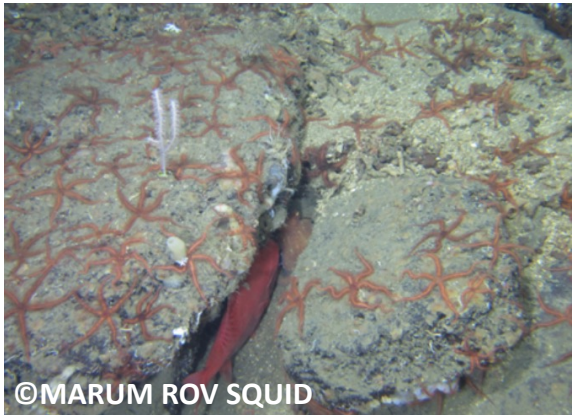
DEPOSIT FEEDERS / PREDATORS

Group with the most enriched values of $\delta^{13}C$
-15.38 to -13.65 ‰

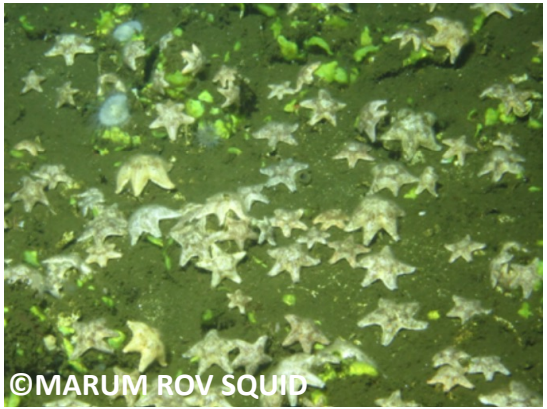


Eunice novergica
assimilation of 4 times more C in the presence of *L. pertusa*

Mueller et al., 2013



Ophiuroids



Asteroidea

CONCLUSIONS

- **Resuspended Organic matter** and **Zooplankton** as a potential food source for CWC
- **Sponges** occupy the **highest trophic position**
- **Similar** Trophic structure compared with **other CWC habitats**
- **Further steps:** Incorporation of *L. pertusa* and *M. oculata* to validate fresh SPOM as a food source

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Thank you!

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