MONITORING ENVIRONMENTAL IMPACTS OF

# OFFSHORE WIND FARMS

IN THE BELGIAN PART OF THE NORTH SEA

## HARD SUBSTRATUM FAUNA

Steven Degraer, Ilse De Mesel, Francis Kerckhof, Jean-Sébastien Houziaux, Alain Norro, Jan Reubens, Bob Rumes, Magda Vincx

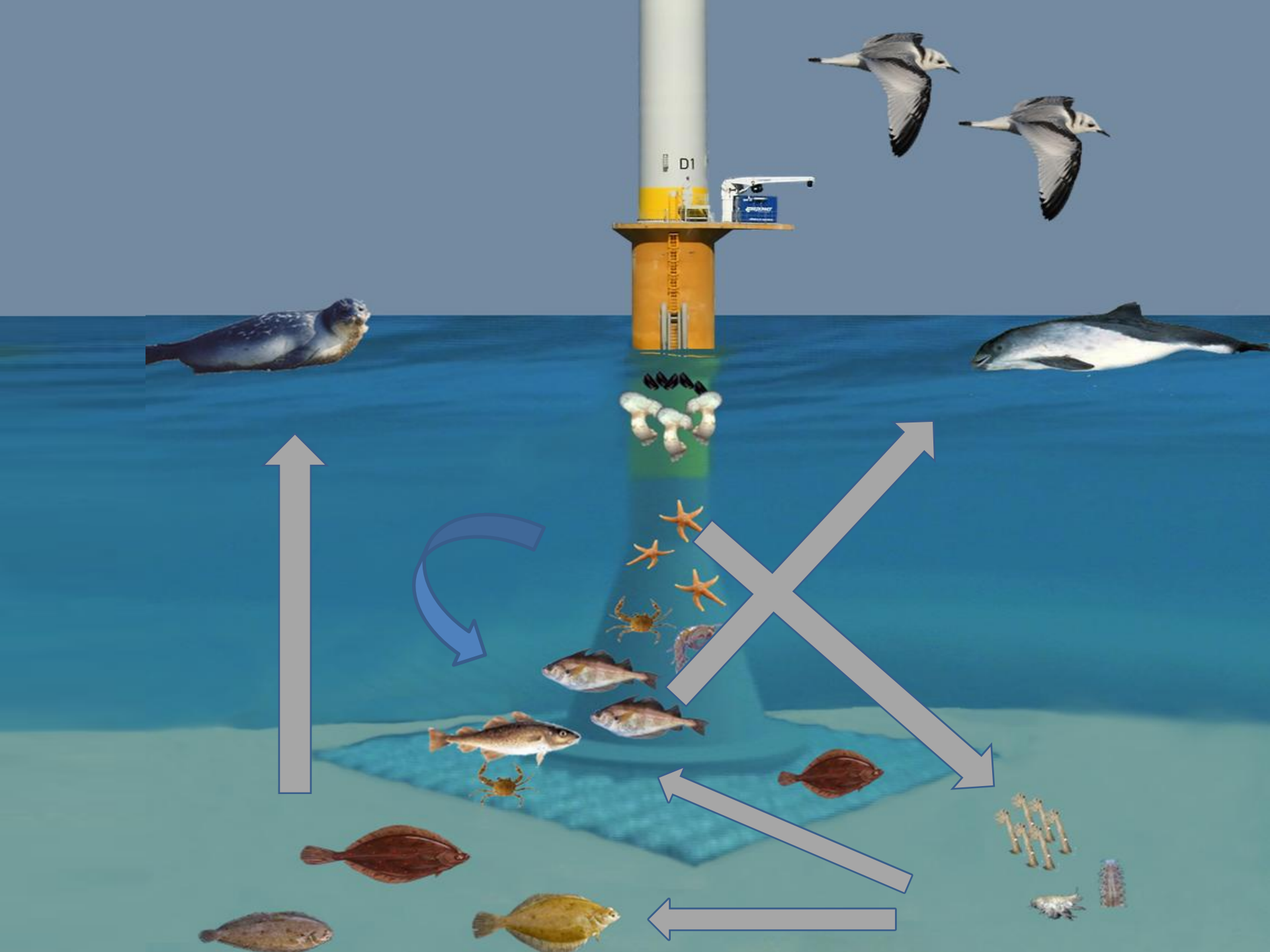
Presented by Ilse De Mesel & Francis Kerckhof






LEARNING FROM THE PAST TO OPTIMISE

FUTURE MONITORING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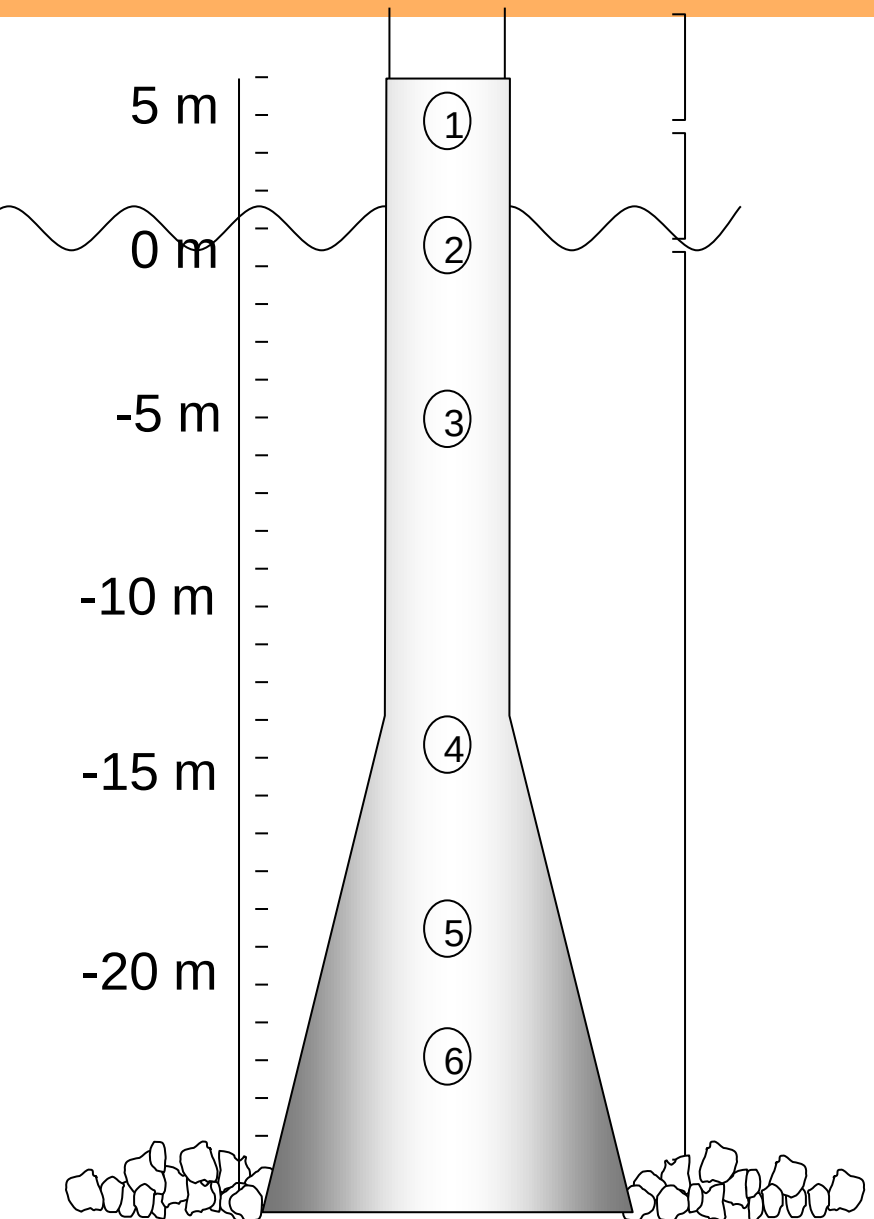
# HARD SUBSTRATUM FAUNA




- First year: samples at different depths

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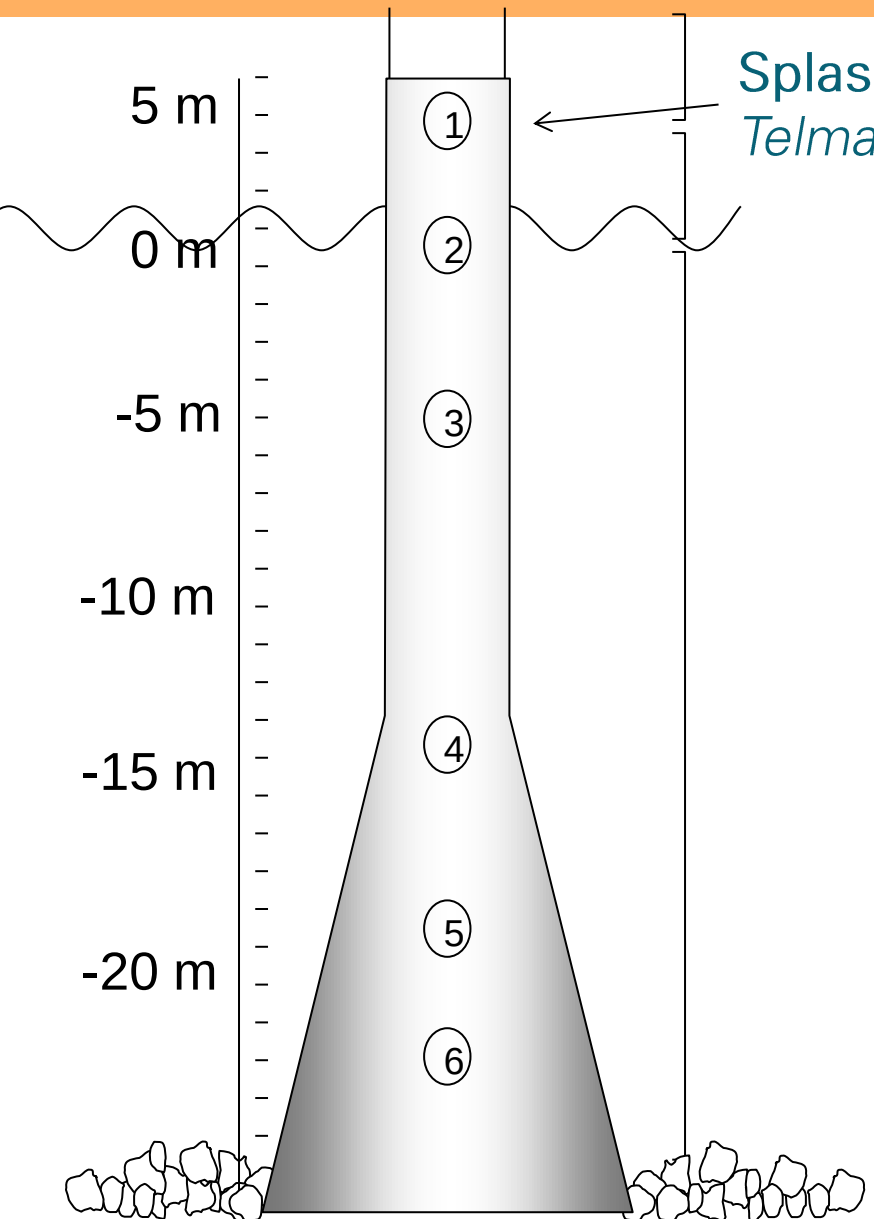
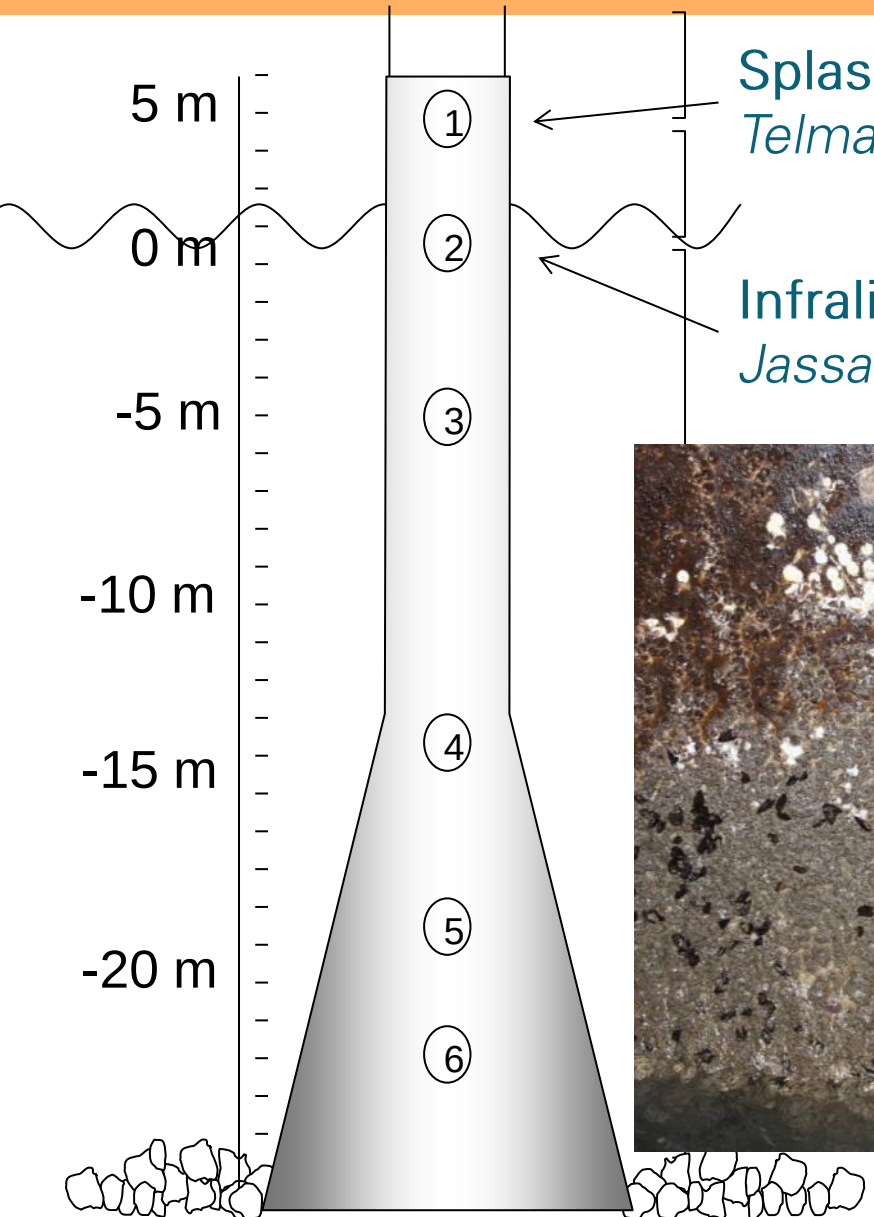



**Splash zone**: Dominated by *Telmatogeton japonicus*

# HARD SUBSTRATUM FAUNA





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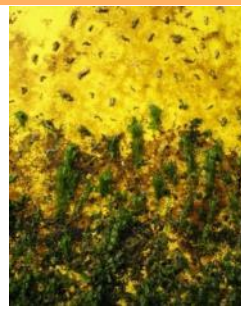
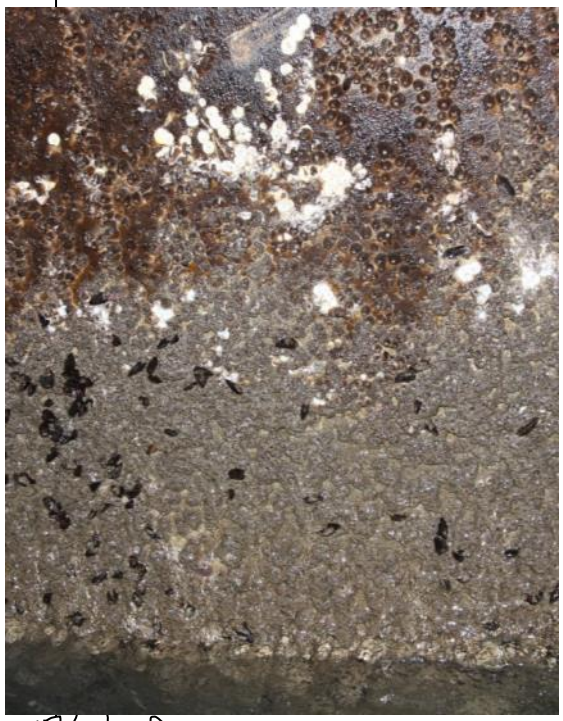


**Infralittoral zone**: from Barnacle-*Jassa* to Barnacle - mussel zone



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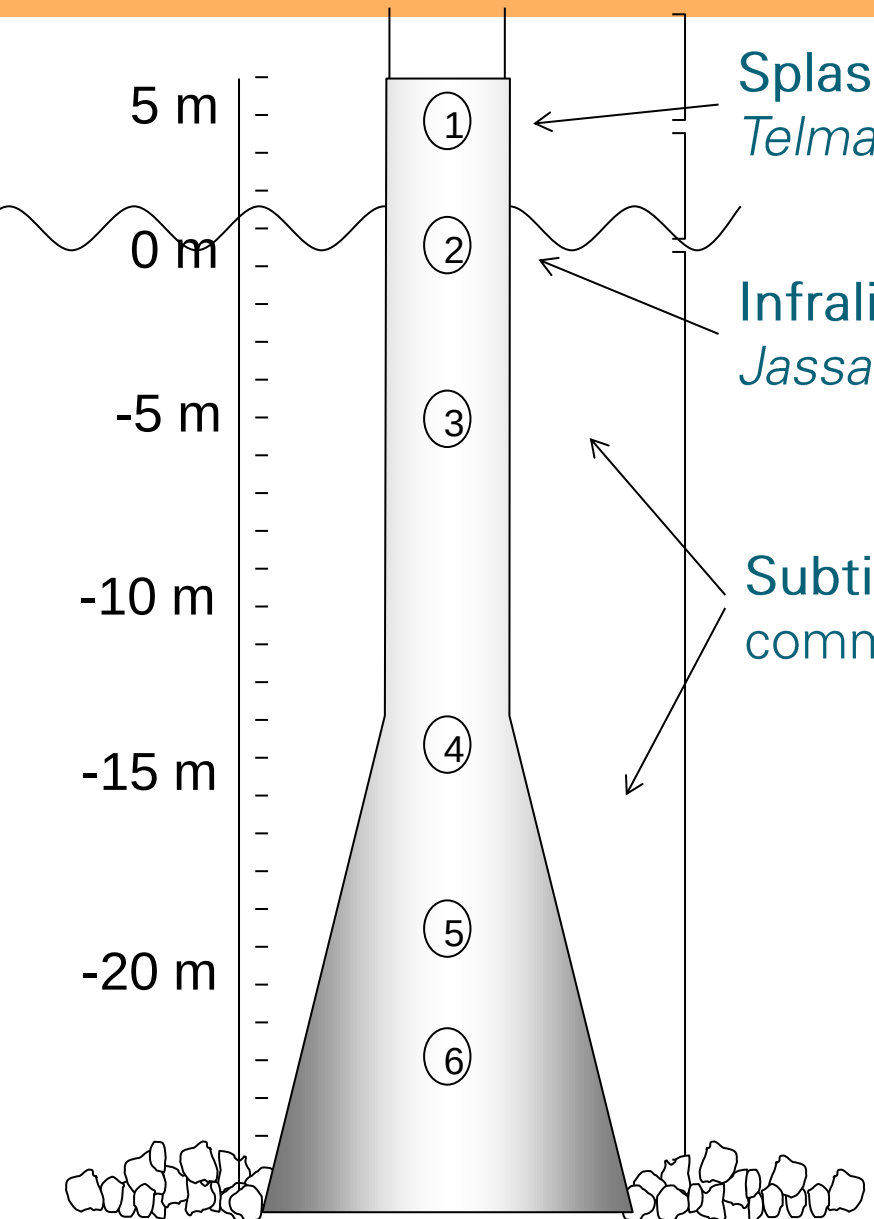


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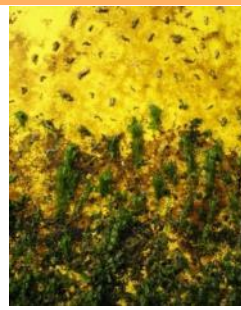
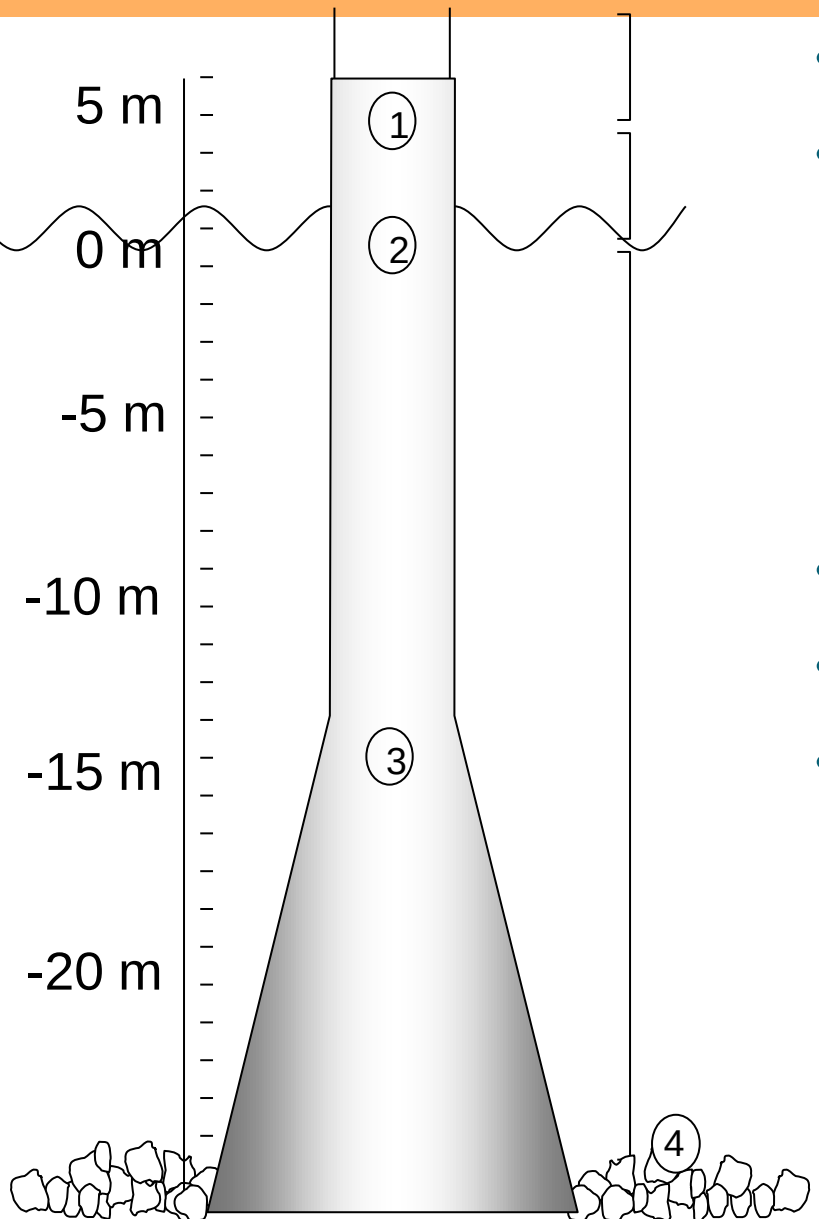


**Infralittoral zone**: from Barnacle-*Jassa* to Barnacle - mussel zone

**Subtidal zone**: species rich community

# HARD SUBSTRATUM FAUNA




- First year: samples at different depths
- Afterwards:
  - focus at -15 m
  - stones from scour protection
  - *semi-quantitative samples and observations in intertidal and splash zone*
- Seasonal sampling
- Organisms larger than 1 mm
- Distinction between:
  - counted individuals (ind/m²)
  - coverage of species (cover%)

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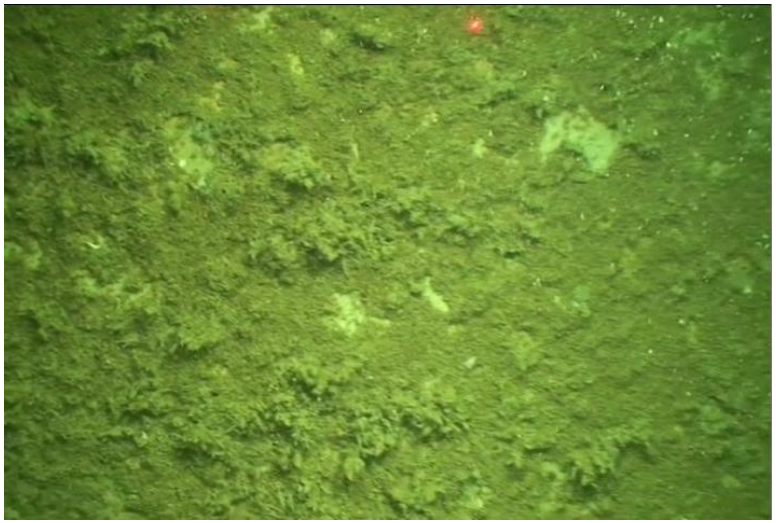
After 3 months…



- 28 species
- 1.900 ind/m²

3 mnth

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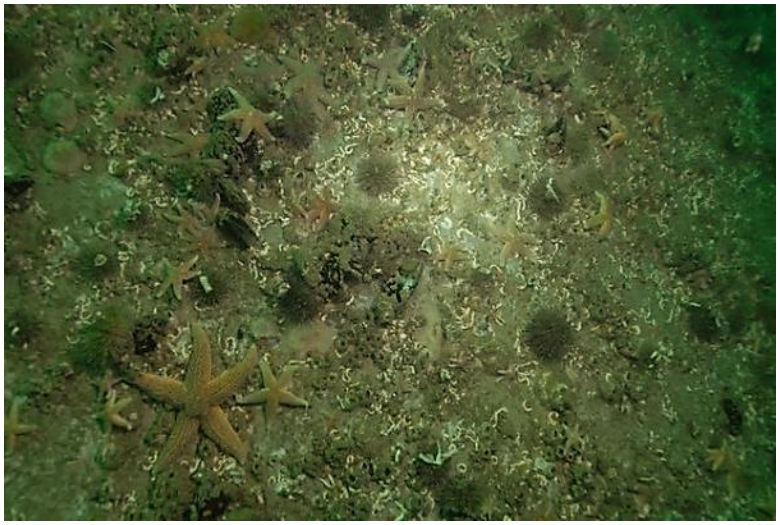
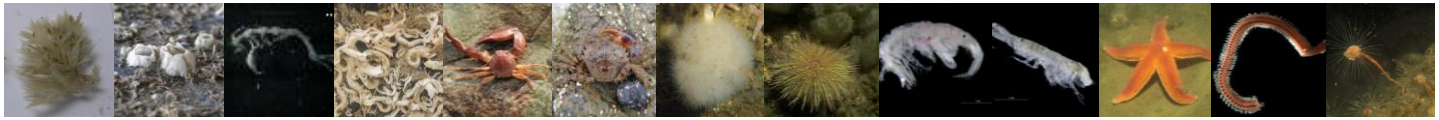
After 1 year…

- 22 - 32 species
- 19.000 ind/m²





# HARD SUBSTRATUM FAUNA

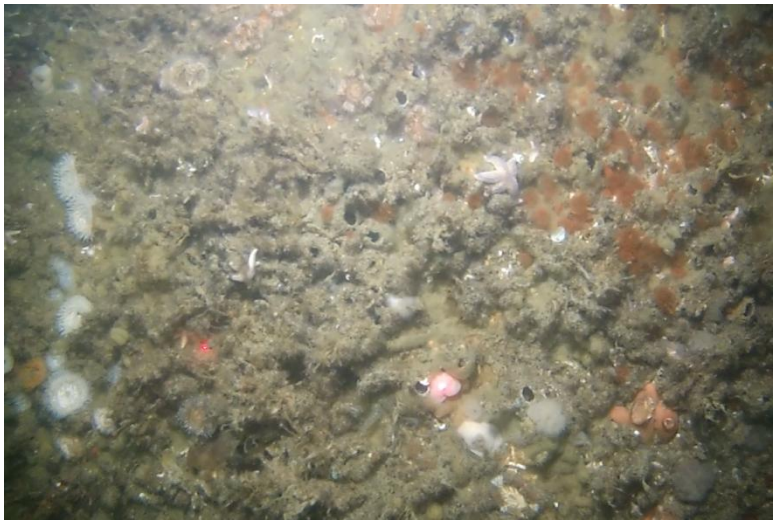
After 2 years…

- 25 - 34 species
- 185.000 ind/m²

# HARD SUBSTRATUM FAUNA

After 3 years…

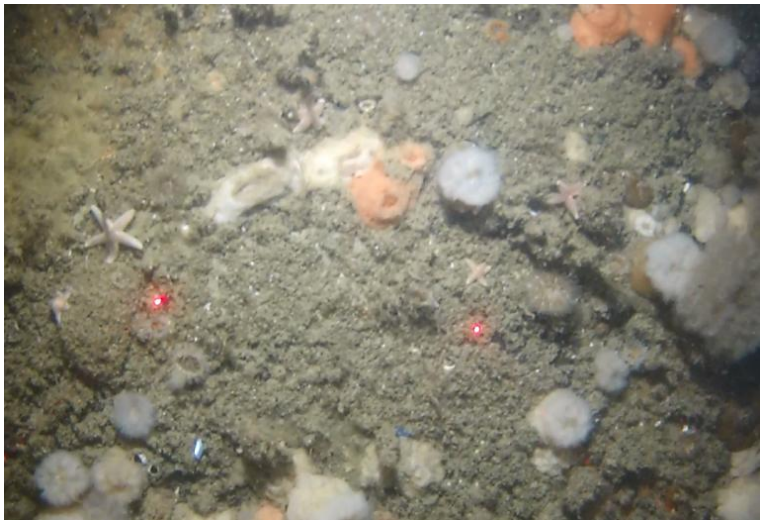
- 25 - 30 species
- 84.000 ind/m²

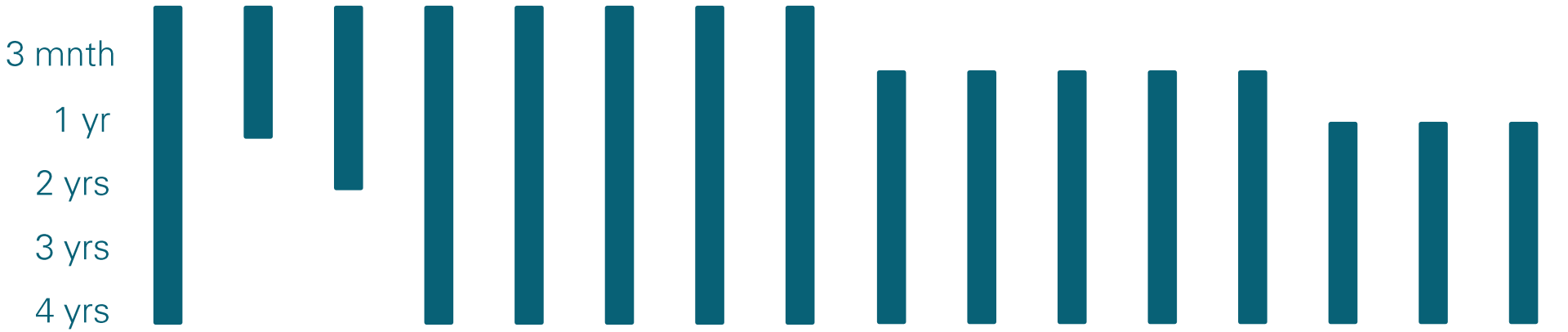


# HARD SUBSTRATUM FAUNA

After 4 years…

- 18 - 32 species
- 120.000 ind/m²





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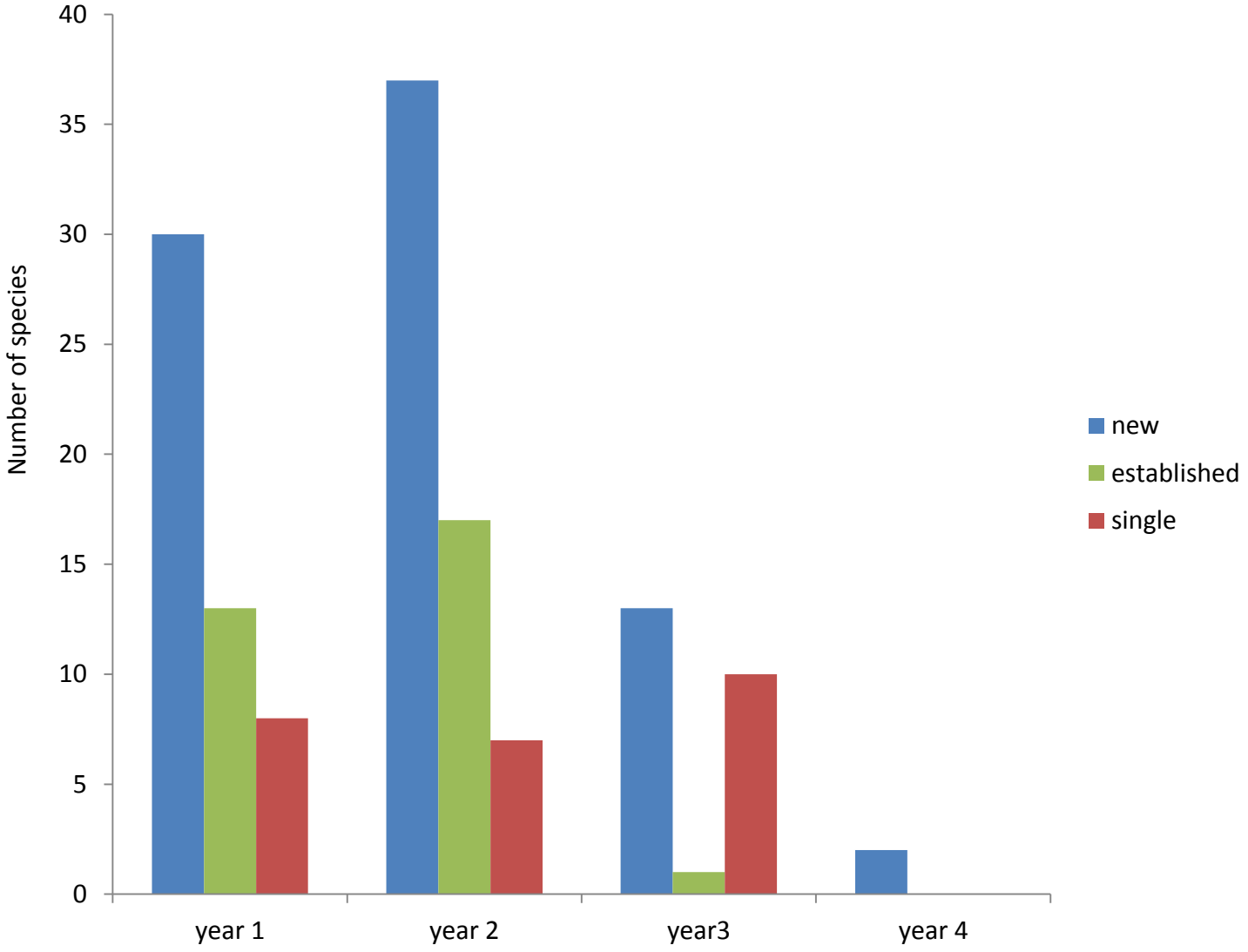

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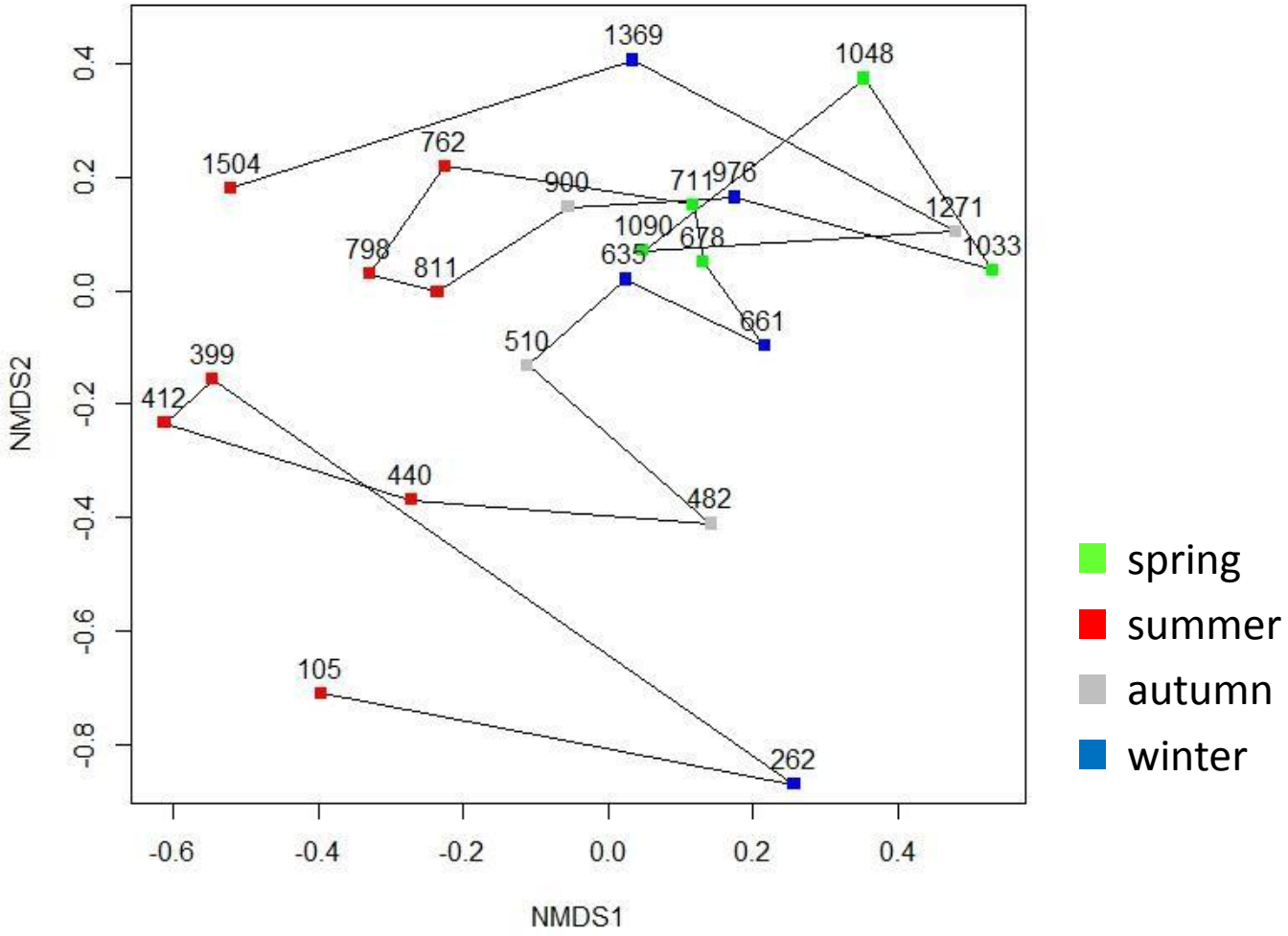


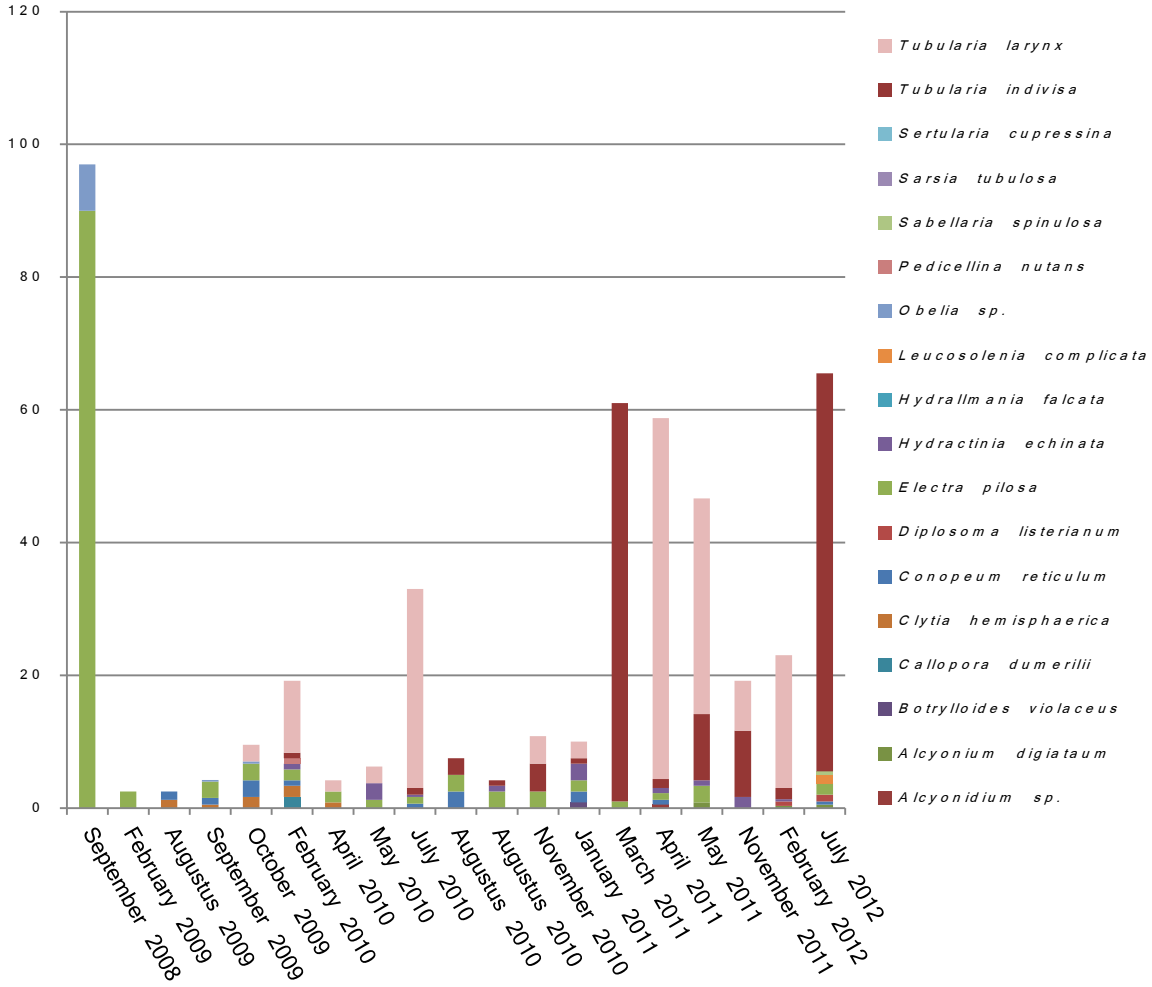

spring
summer
autumn
winter

# HARD SUBSTRATUM FAUNA





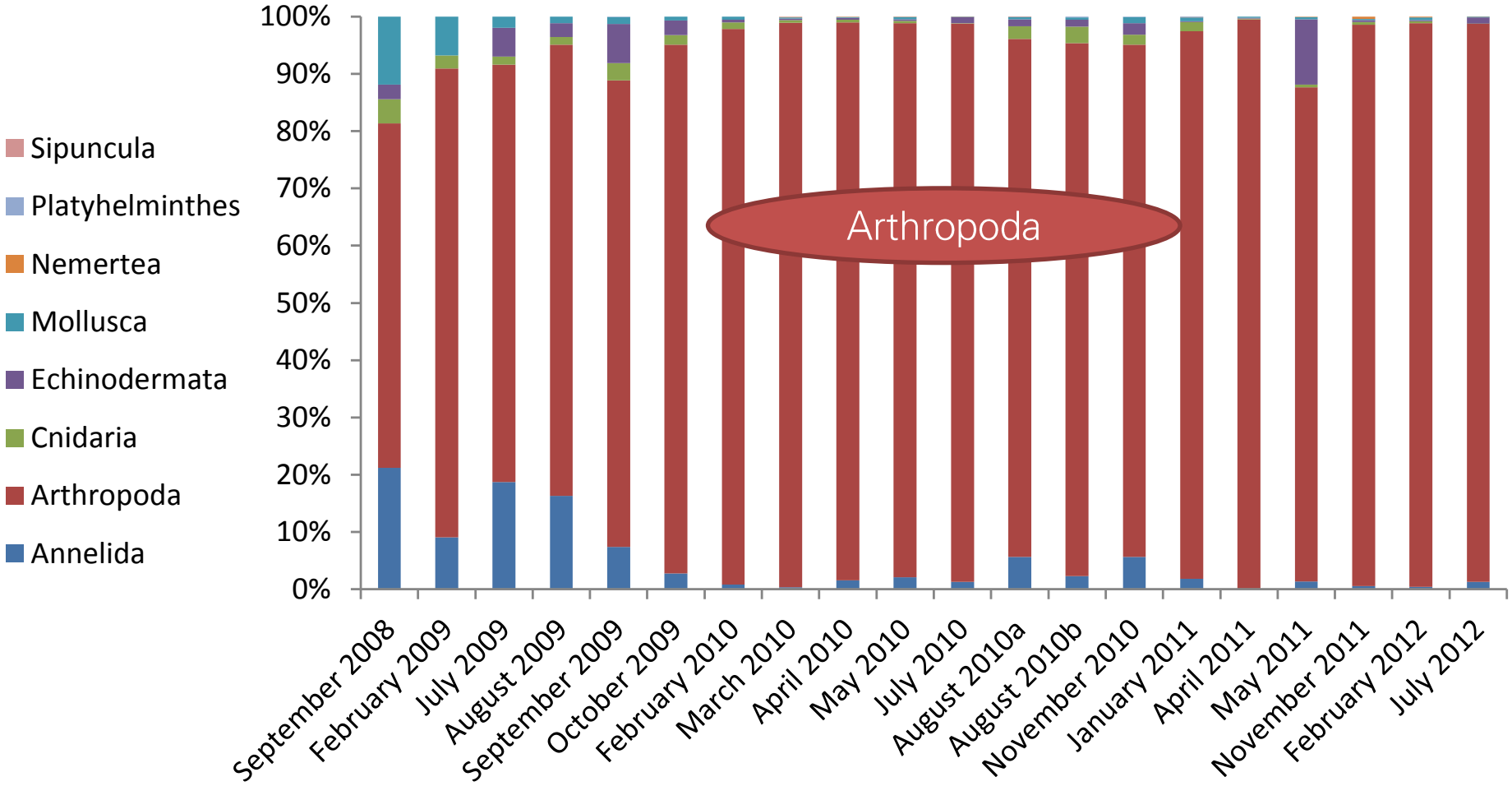
## COVERAGE





# HARD SUBSTRATUM FAUNA

## RELATIVE DENSITIES

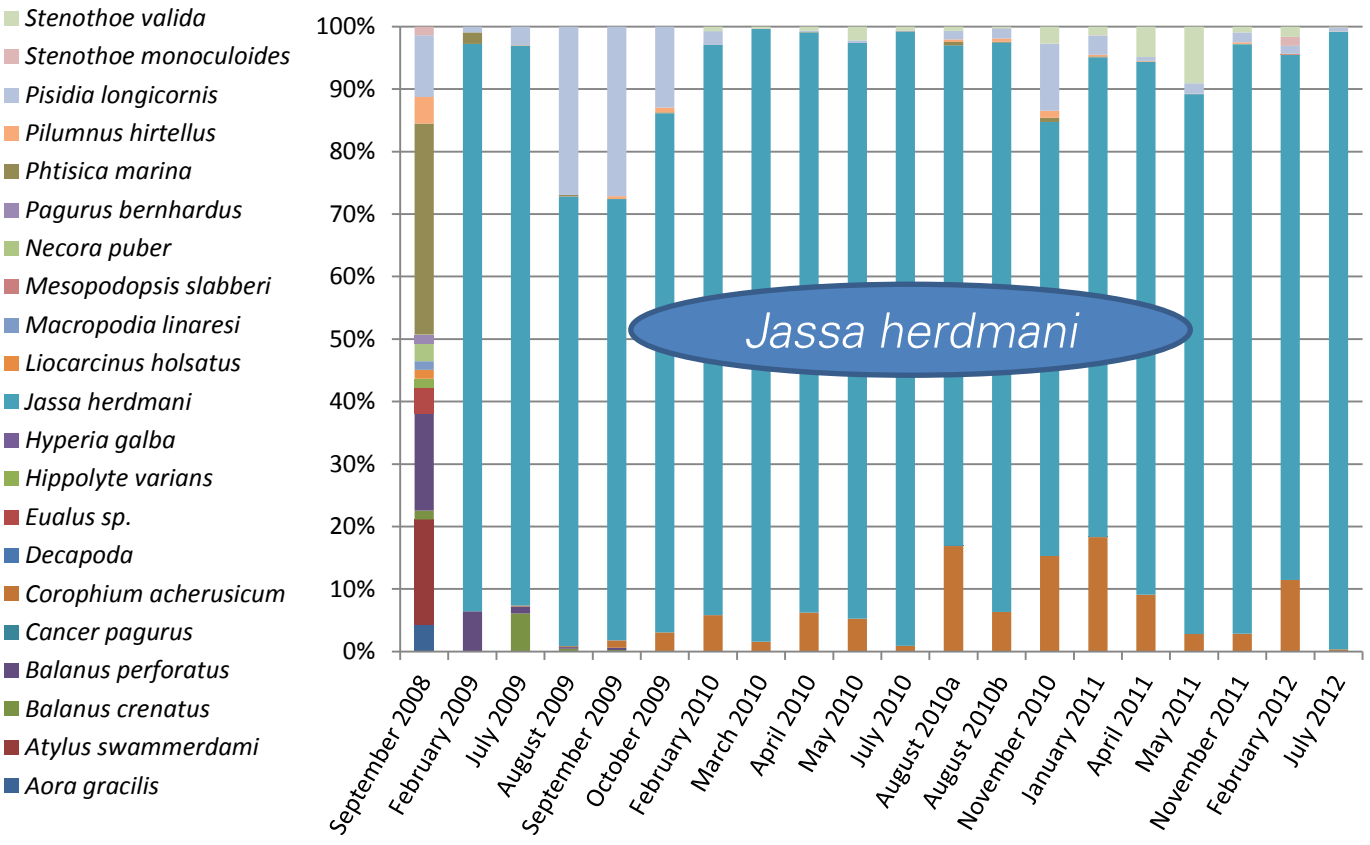


# HARD SUBSTRATUM FAUNA





## ARTHROPODA

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## ARTHROPODA



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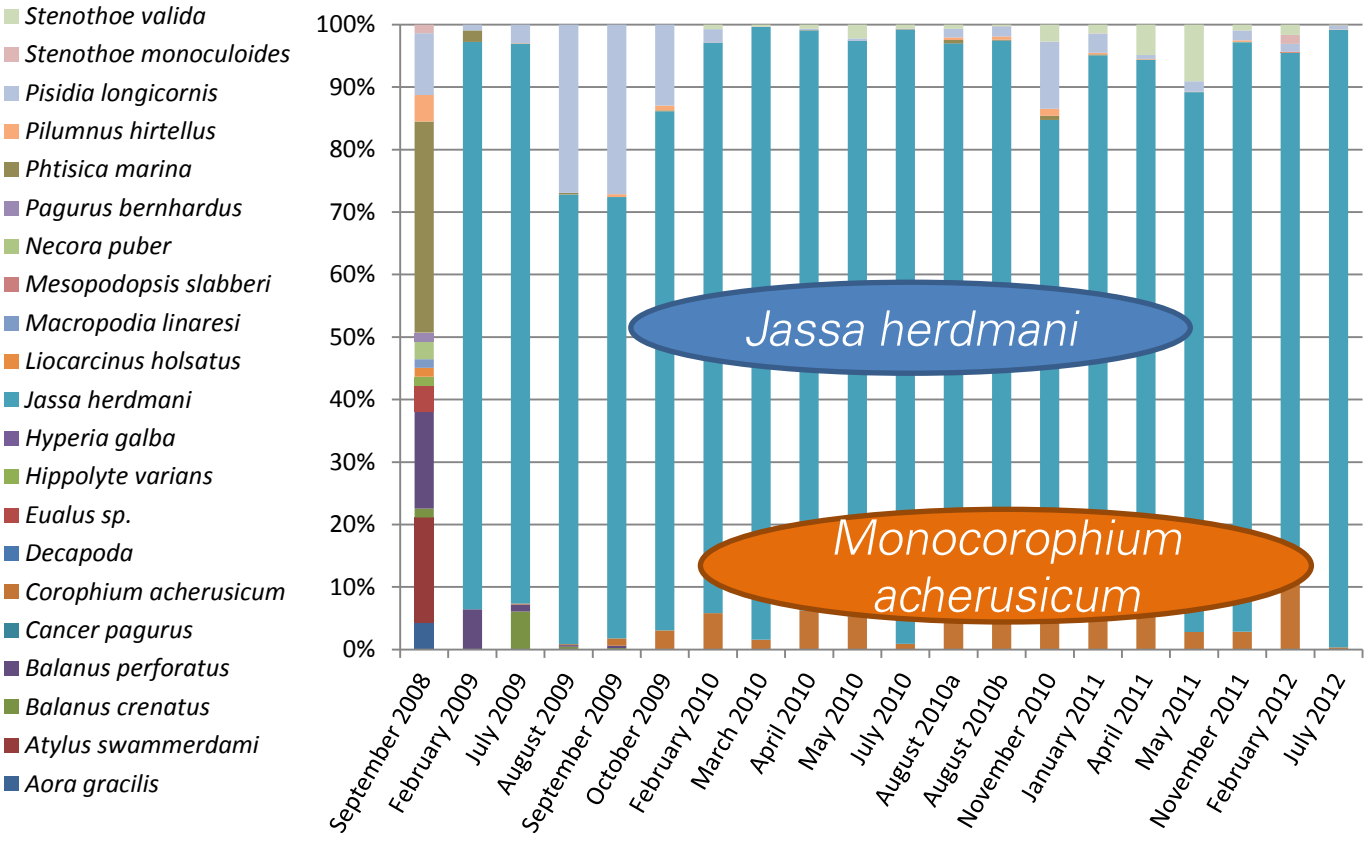


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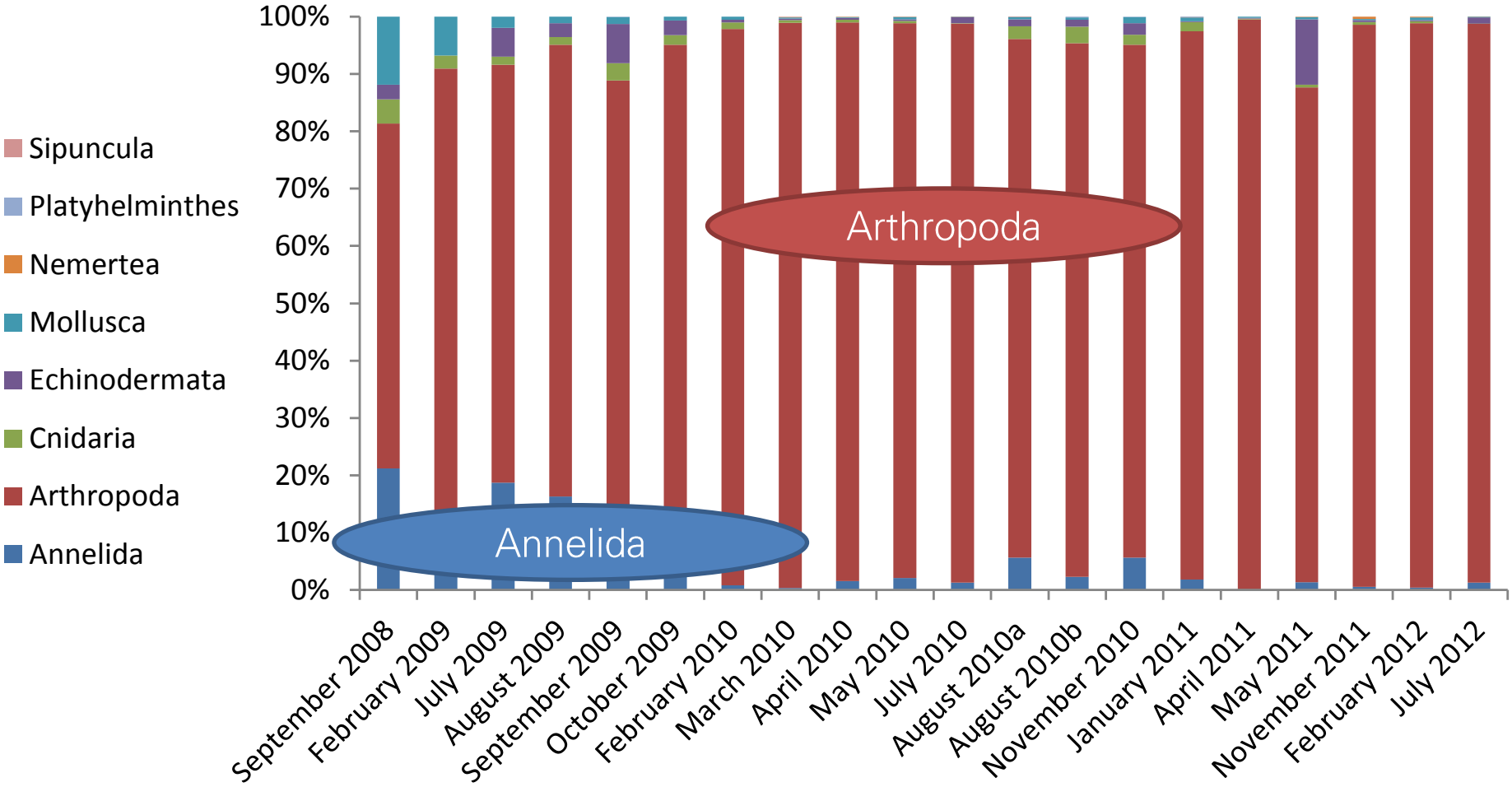

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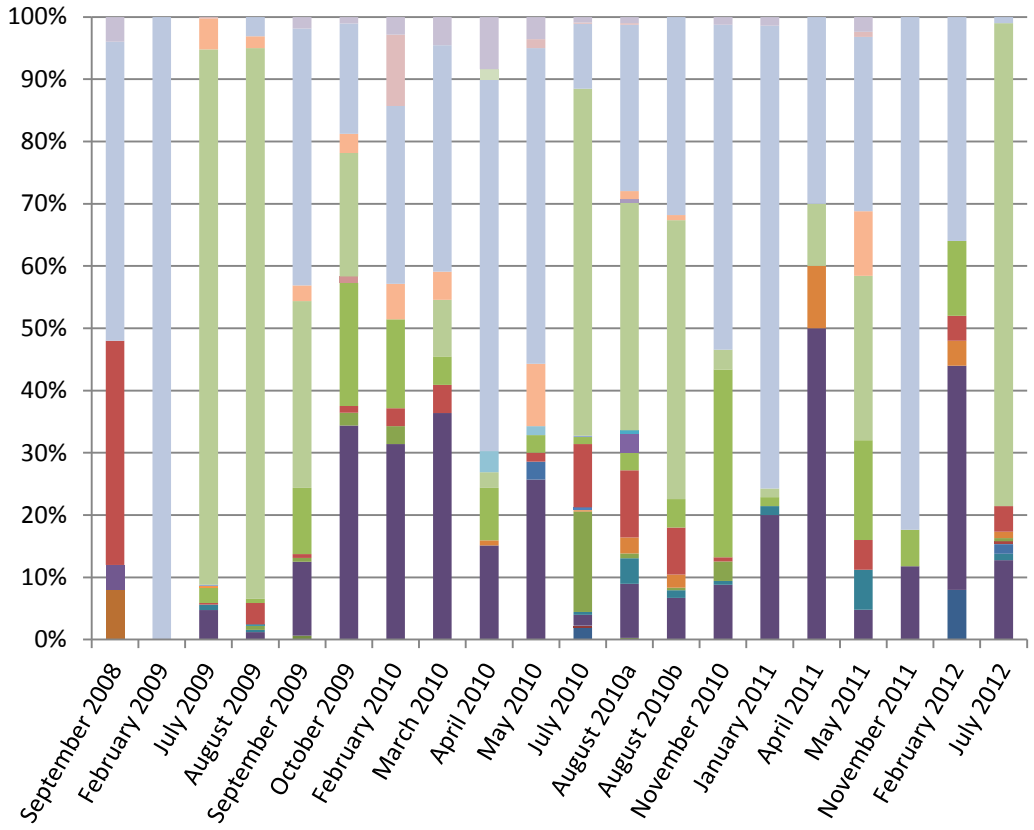
## ANNELIDA

- *Syllidae sp*
- *Spionidae*
- *Sabellaria spinulosa*
- *Pomatoceros triqueter*
- *Polynoidae*
- *Polychaeta*
- *Phyllodoce sp.*
- *Phyllodoce mucosa*
- *Phyllodoce longipes*
- *Pholoe inornata*
- *Pectinaria koreni*
- *Nereis sp.*
- *Maldanidae*
- *Lepidonotus squamatus*
- *Lanice conchilega*
- *Kefersteinia cirrata*
- *Harmothoe sp.*
- *Harmothoe pachenstegeri*
- *Harmothoe impar*
- *Harmothoe extenuata*
- *Harmothoe clavigera*
- *Harmothoe antilopes*
- *Gattyana cirrhosa*
- *Eunereis longissima*
- *Eulalia viridis*
- *Eteone sp.*
- *Dipolydora giardi*
- *Autolytinae*



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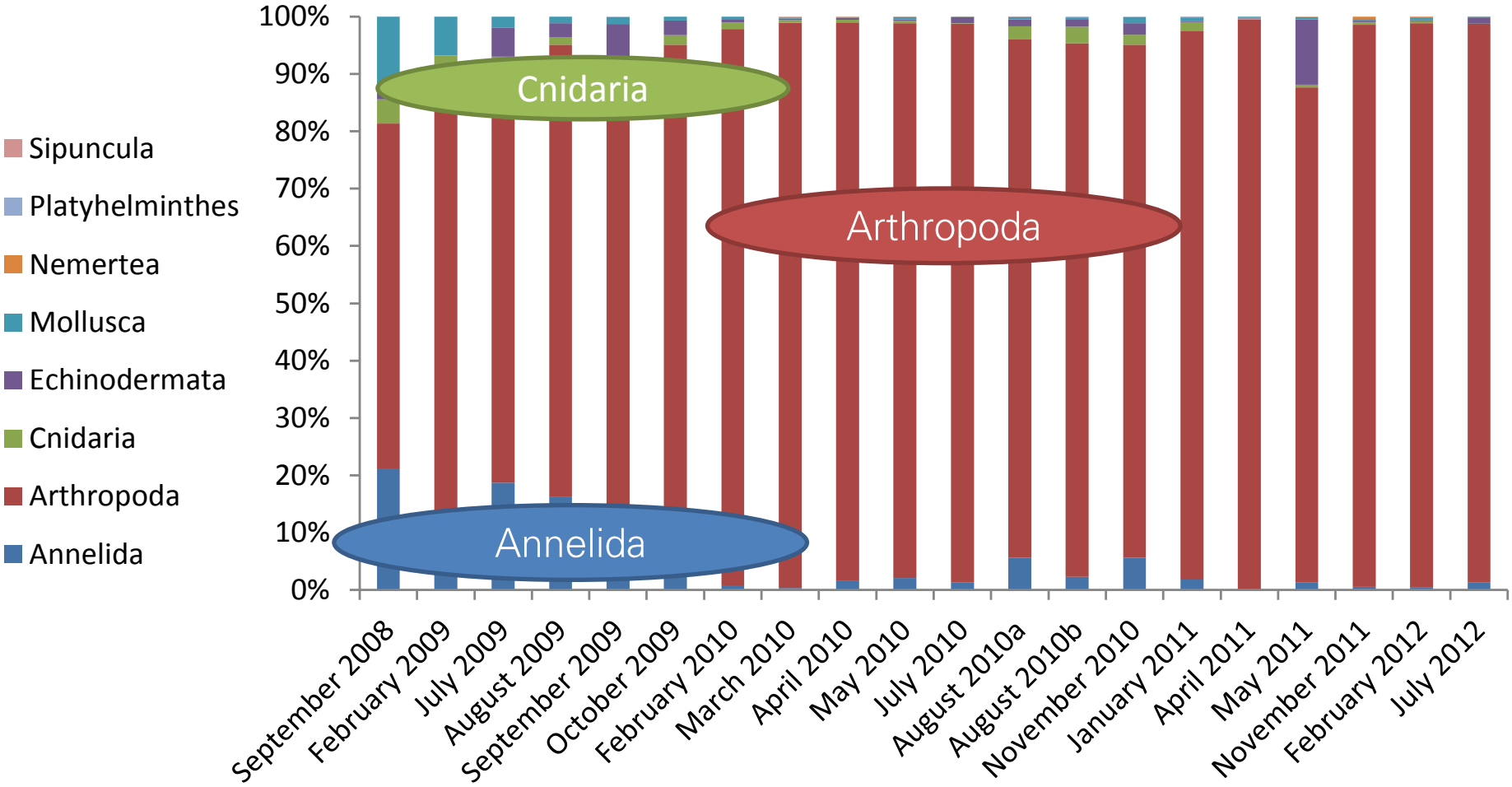

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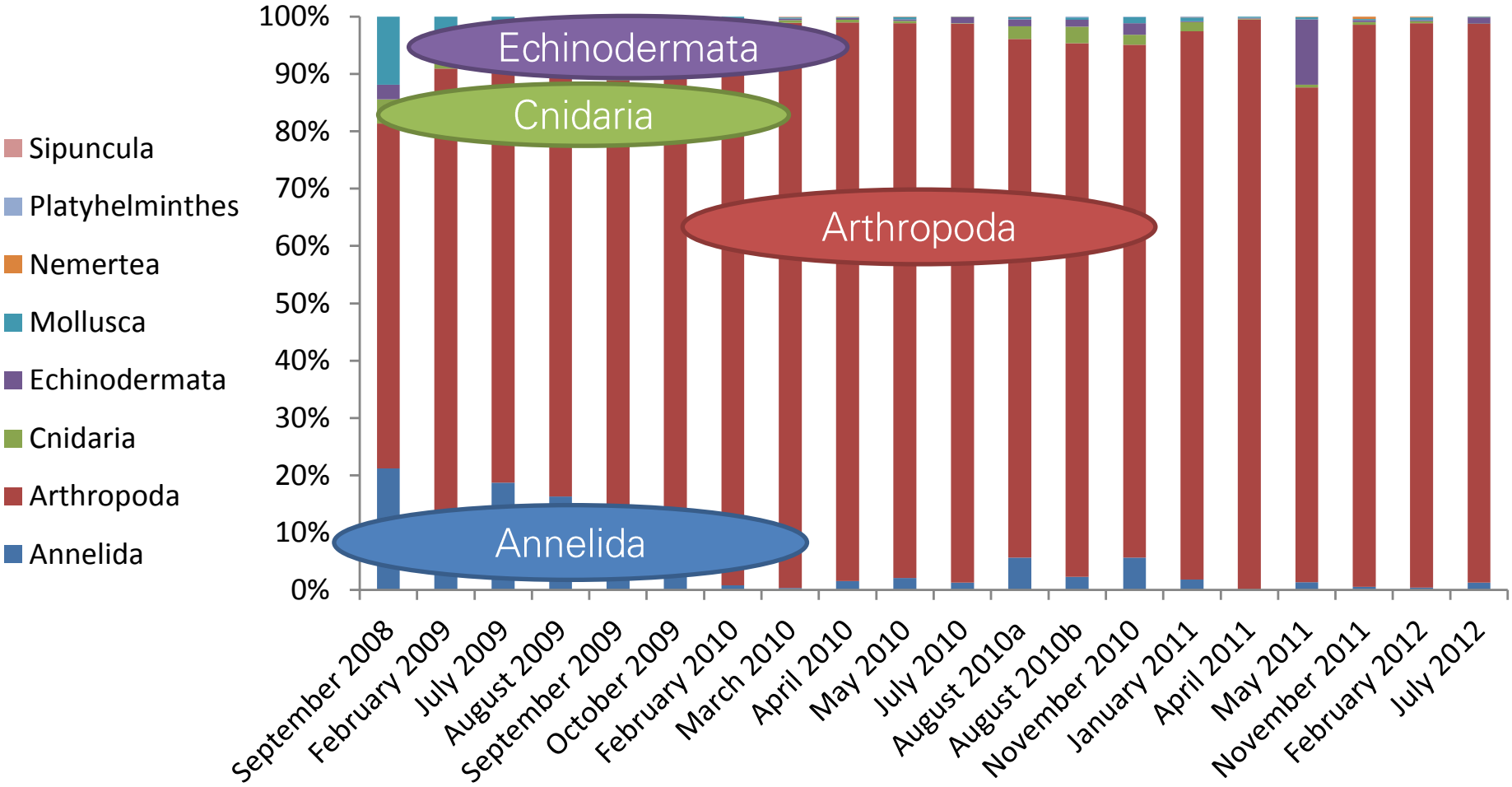

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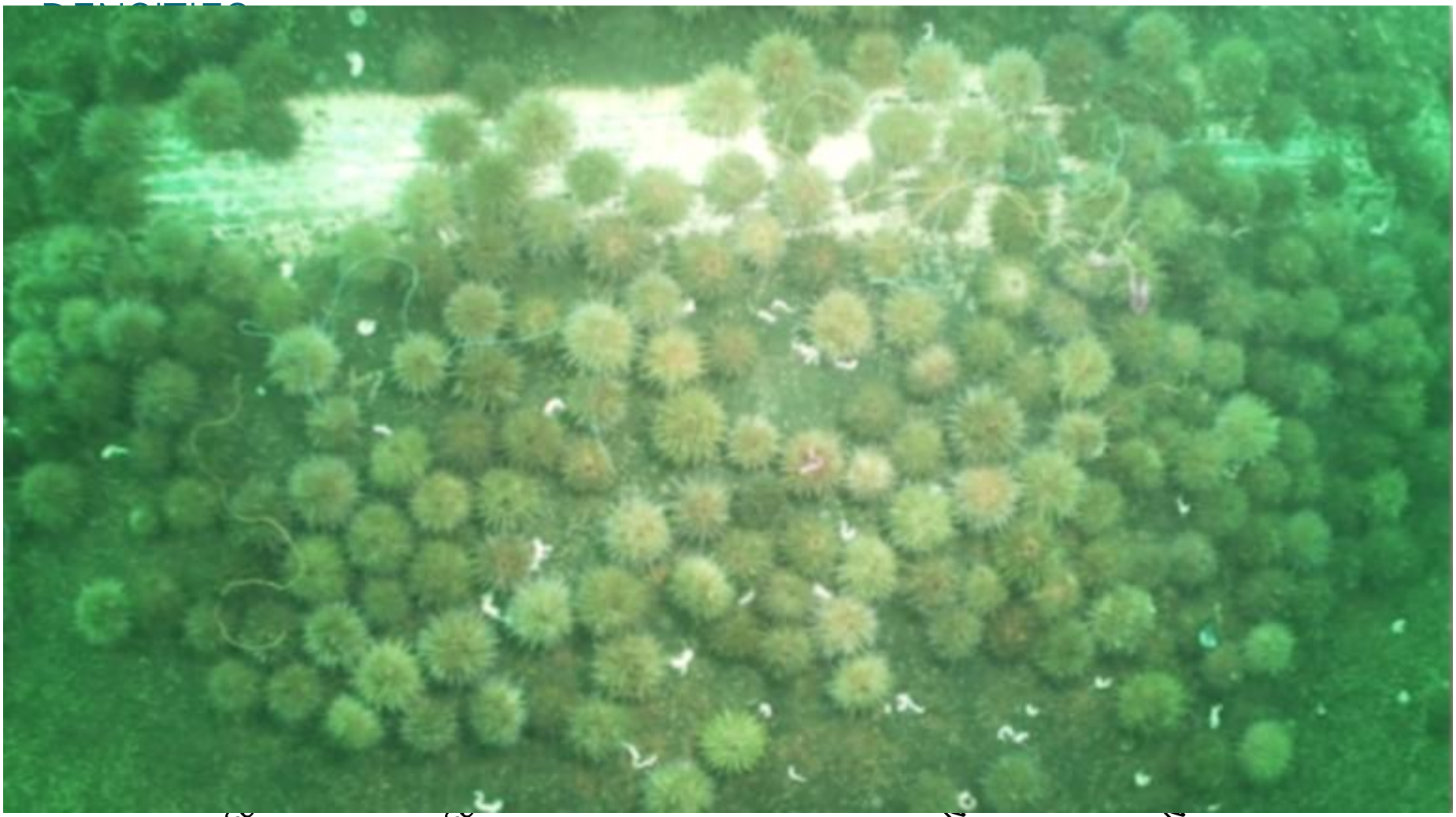


# HARD SUBSTRATUM FAUNA

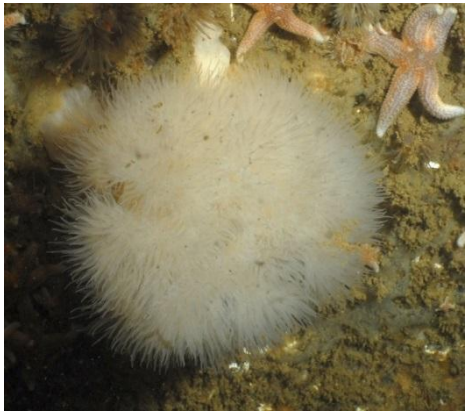
## PREDATOR PREY RELATIONSHIPS

*Odostomia turrita*


*Pomatoceros triqueter*

*Epitonium clathratulum*



*Metridium senile*

*Facelina bostoniensis*

*Tubularia larynx*

# HARD SUBSTRATUM FAUNA

## BLIGH BANK – BELWIND WINDFARM

Similar patterns in community development
- patterns in density
- patterns in diversity
- patterns in succession

Difference in subdominant species

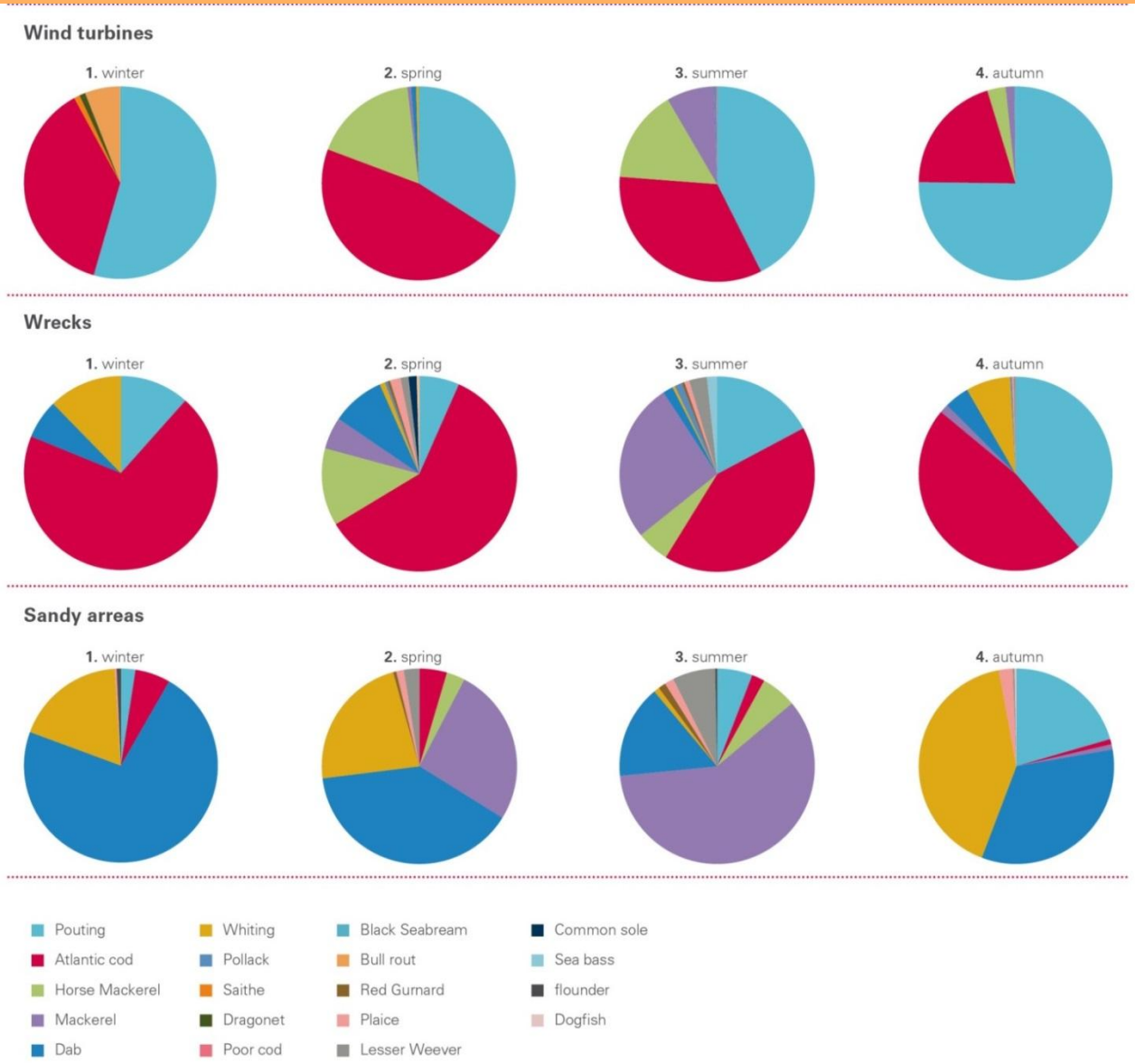
Due to:
- distance to the coast?
- foundation type?

# HARD SUBSTRATUM FAUNA





## FISH COMMUNITY

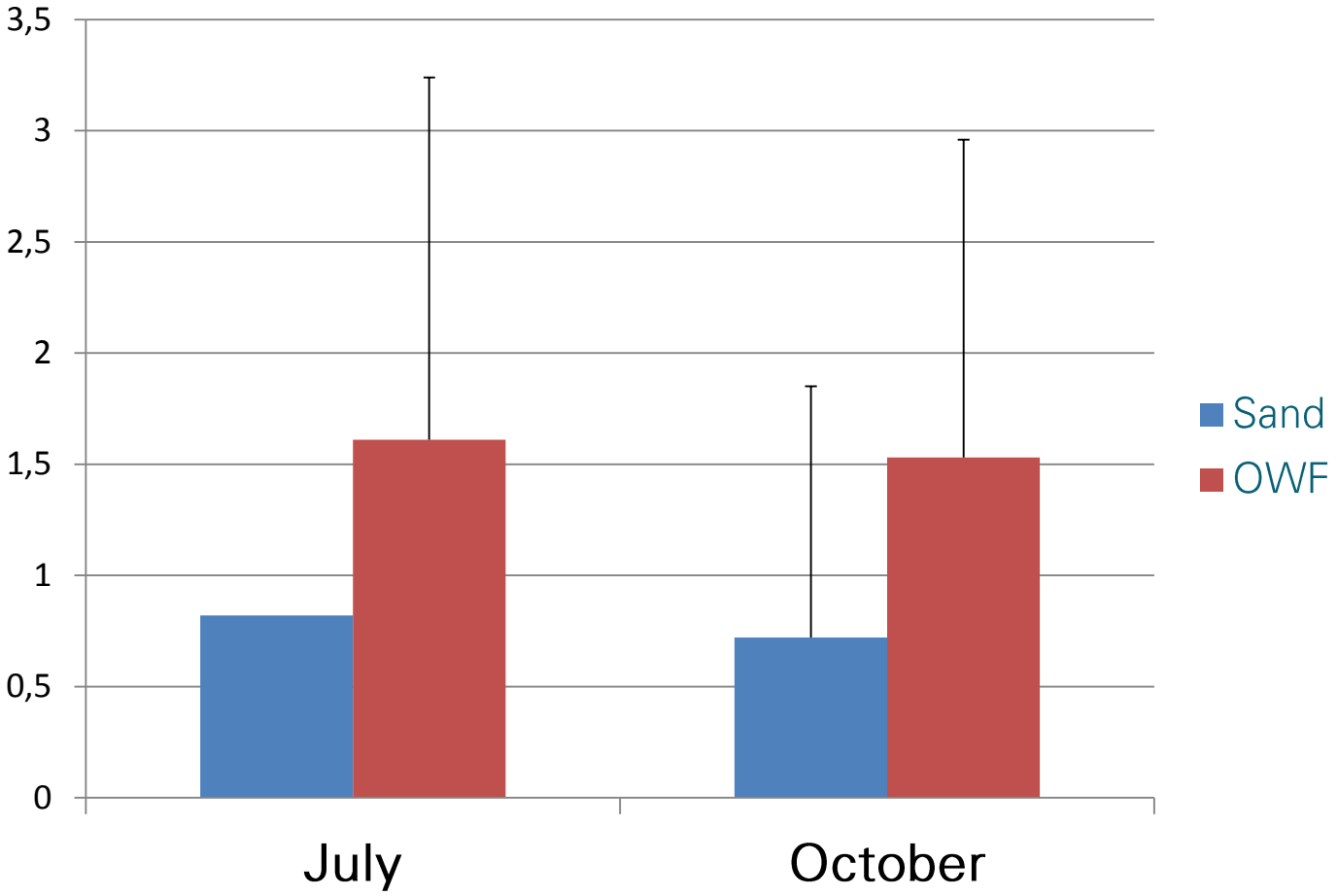


# HARD SUBSTRATUM FAUNA

| % G of pouting | | | |
|---|---|---|---|
| SAND | | OWF | |
| *Callionymus* sp. | 43.1 | *Jassa herdmani* | 62.0 |
| Pisces sp. | 9.8 | *Pisidia longicornis* | 10.2 |
| Actiniaria sp. | 9.7 | Pisces sp. | 8.4 |
| Polychaeta sp. | 4.7 | *Liocarcinus holsatus* | 5.5 |
| *Liocarcinus holsatus* | 4.3 | *Necora puber* | 3.1 |

# HARD SUBSTRATUM FAUNA

## FULLNESS INDEX OF POUTING



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## CONCLUSIONS

- Many species reach the foundation, only few establish a community
- High community dynamics during the first year, later on mainly seasonal dynamics.
- Dominance of few species (*Jassa* – Actiniaria – *Tubularia*), similar to other artificial hard substrata in the Southern North Sea
- Structuring force of generalist and specialised predators
- Fouling differs from natural hard substrata
- Fouling organisms are food for fish

# HARD SUBSTRATUM FAUNA

## FUTURE MONITORING

- Continuation of the current monitoring
- Large scale patterns :
  - on the turbines
  - onshore-offshore gradient
- Impact of foundation type:
  - on the fouling community
  - on the fish community
- Better assessment of food availability for higher trophic levels
- Scour protection: habitat for larger organisms (lobsters and crabs)

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## THANK YOU

Photo credits: Hans Hillewaert (ILVO), www.aphotomarine.com, Bernard Picton, RBINS






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# FUTURE MONITORING