High-frequency study of benthic megafauna community dynamics in Barkley canyon :

a multi-disciplinary approach using the NEPTUNE Canada network

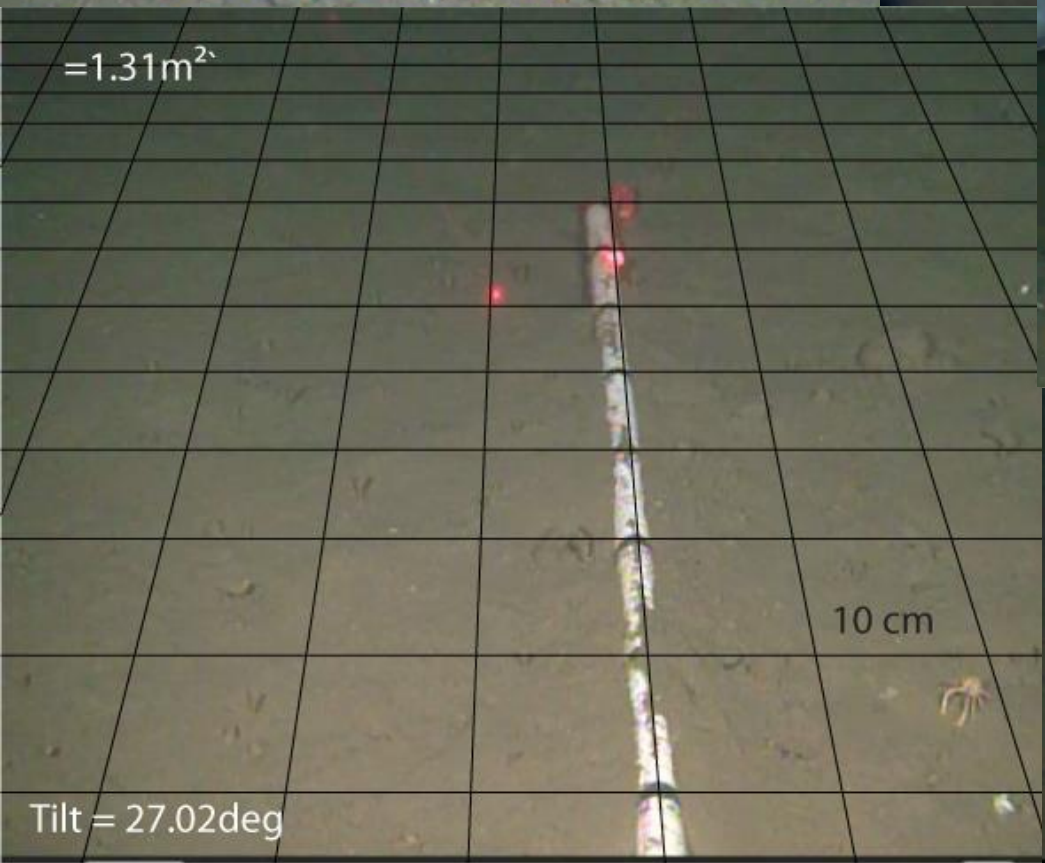
Matabos M, Mihaly S, Bui AOV, Juniper K, Aguzzi J*, Ravindran A,

NEPTUNE Canada
University of Victoria, BC

*Instituto de Ciencas del Mar
Barcelona, Spain

Matabos et al., Journal of Marine System, 2014

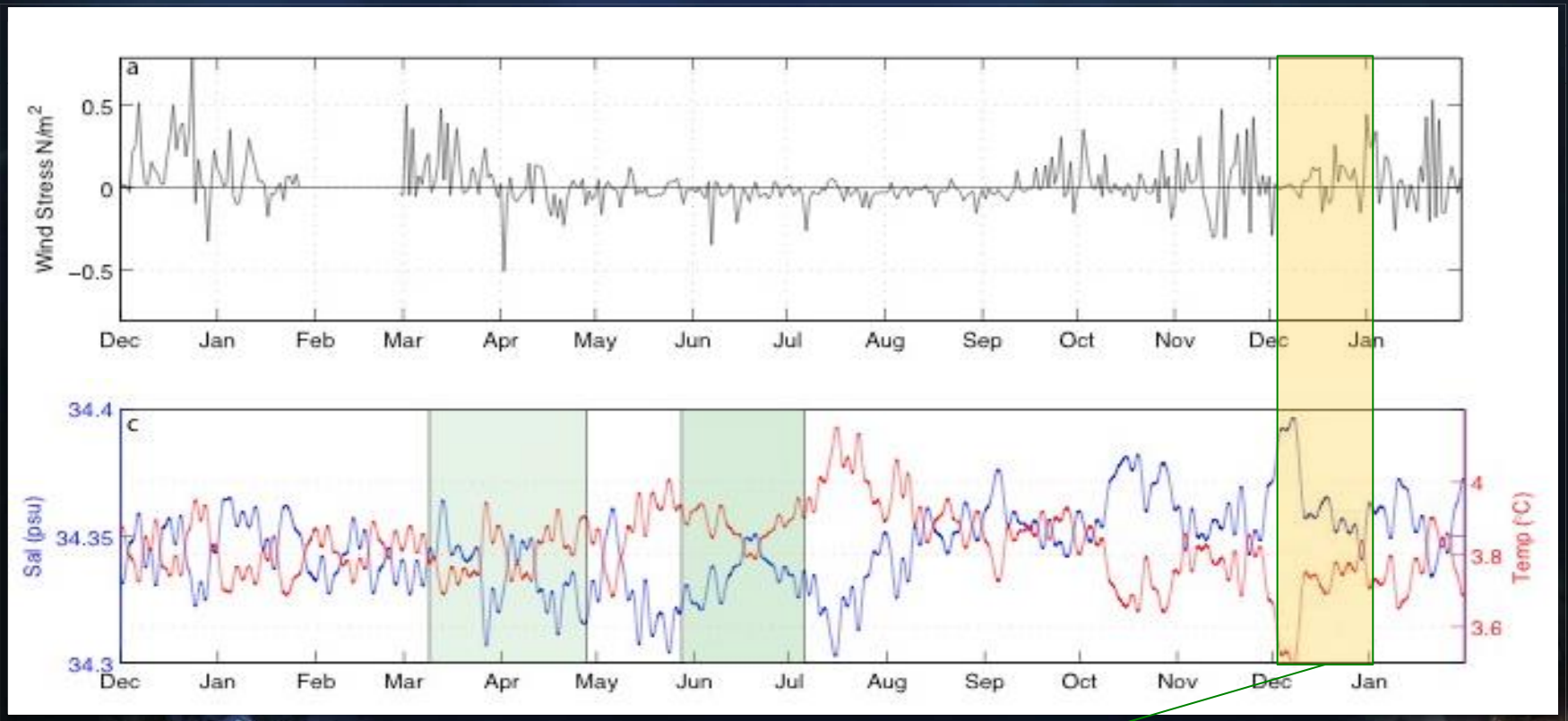
Barkley Canyon : POD4 camera



BARKLEY CANYON: Data collection

Environment

- CTD : 1 measurement every minute
  Temperature (˚C), Salinity (psu), Pressure (dbar), Density (kg/m^3)
- 150 kHz RDI ADCP and 2 MHz Nortek Aquadopp: currents



Biology

December 2011, One month high resolution data: One sweep every 2 hours

Data analysis

Relationship community structure and environnemental conditions

Canonical redundancy analysis (RDA) between species density data and environmental variables
(temperature, salinity, density, currents speed, suspension events, visiblity)

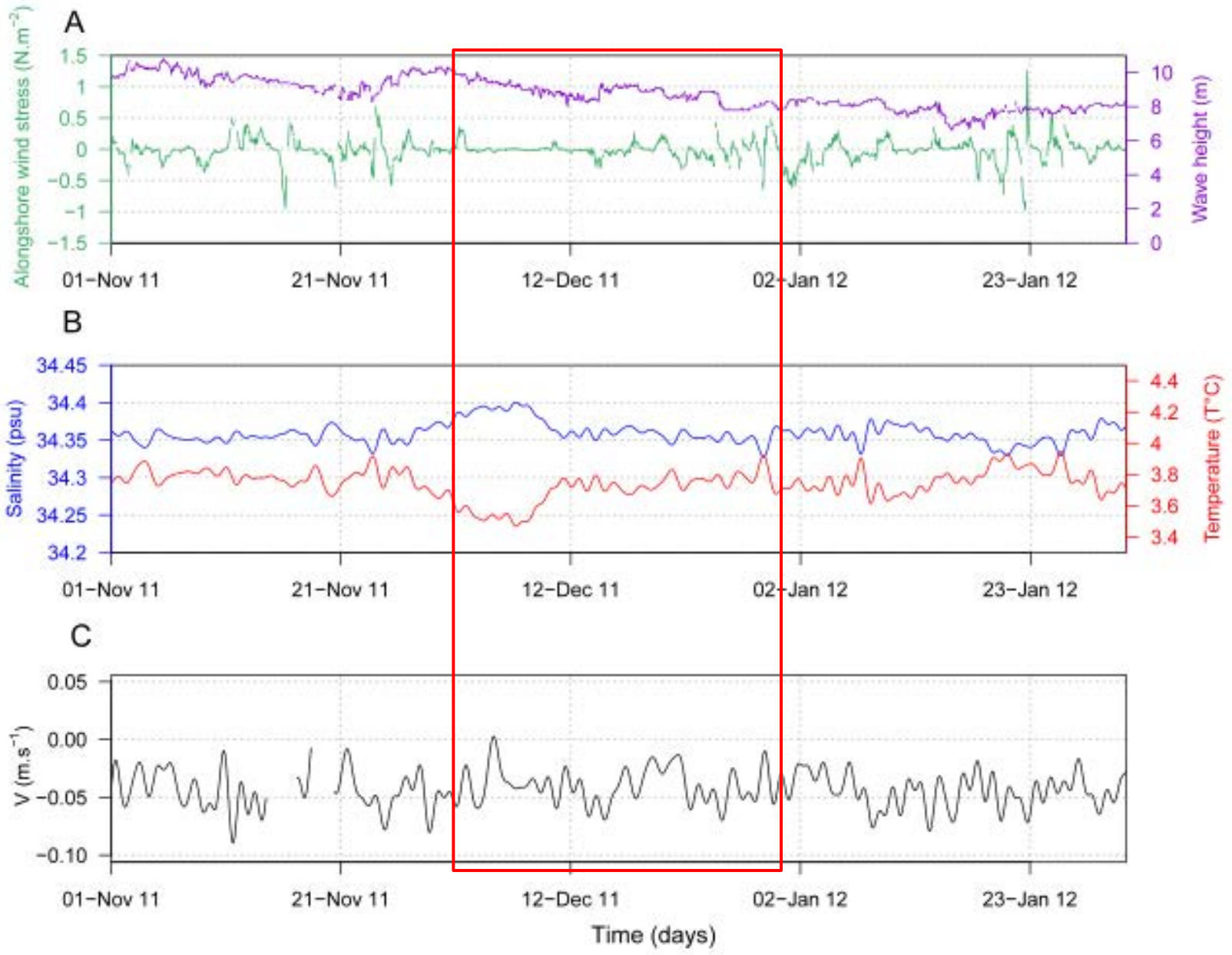
Community temporal structure

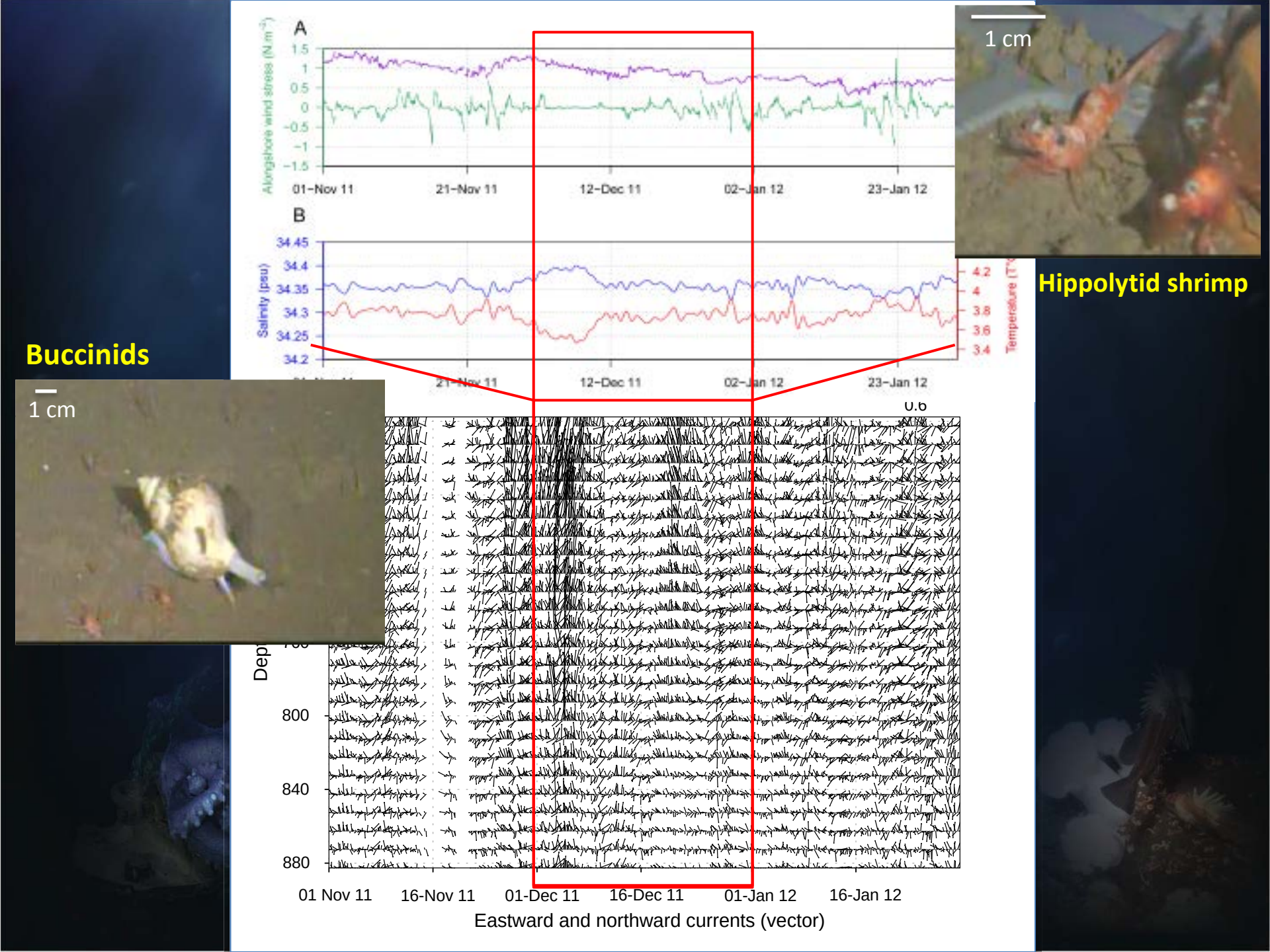
Distance-based Moran's Eigenvectors Map (dbMEMs) to describe the the community temporal structure:
Time vector decompose in a set of explanatory variables that represent each temporal scale detectable by the sampling design.

Activity rhythms

Regressive periodogram analysis to determine periodicities in species density.
Presence/absence of individuals as a proxy of their activity

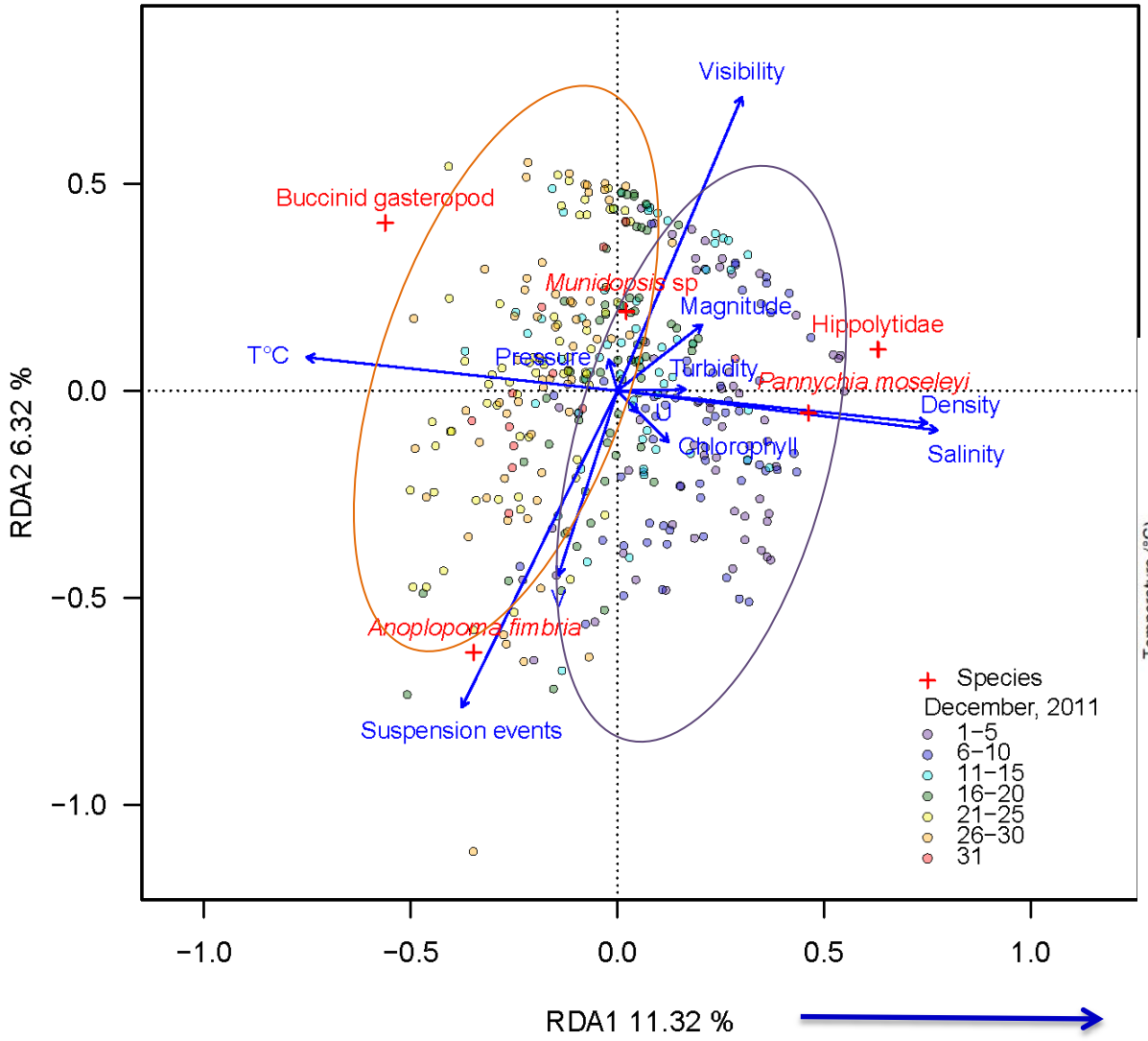
Environmental conditions



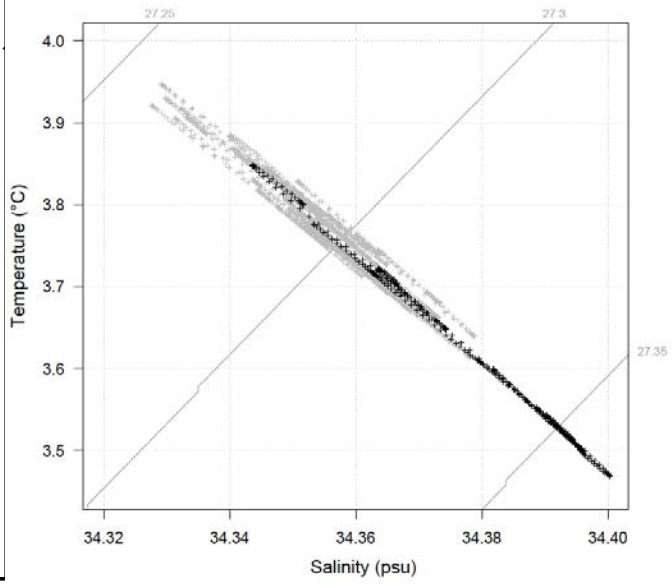

A
Alongshore wind stress (N.m⁻²)
1.5
1
0.5
0
-0.5
-1
-1.5
01-Nov 11
21-Nov 11
12-Dec 11
02-Jan 12
23-Jan 12
B
Salinity (psu)
34.45
34.4
34.35
34.3
34.25
34.2
Temperature (T°C)
4.2
4
3.8
3.6
3.4
21-Nov 11
12-Dec 11
02-Jan 12
23-Jan 12
0.6
800
840
880
01 Nov 11
16-Nov 11
01-Dec 11
16-Dec 11
01-Jan 12
16-Jan 12
Eastward and northward currents (vector)
1 cm
Hippolytid shrimp
Buccinids
1 cm

Epibenthic community temporal structure

Canonical Redundancy Analysis



Second axis:
Effect of the sablefish activity on observations



Linear trend: Adj R^2=0.10

Epibenthic community temporal structure

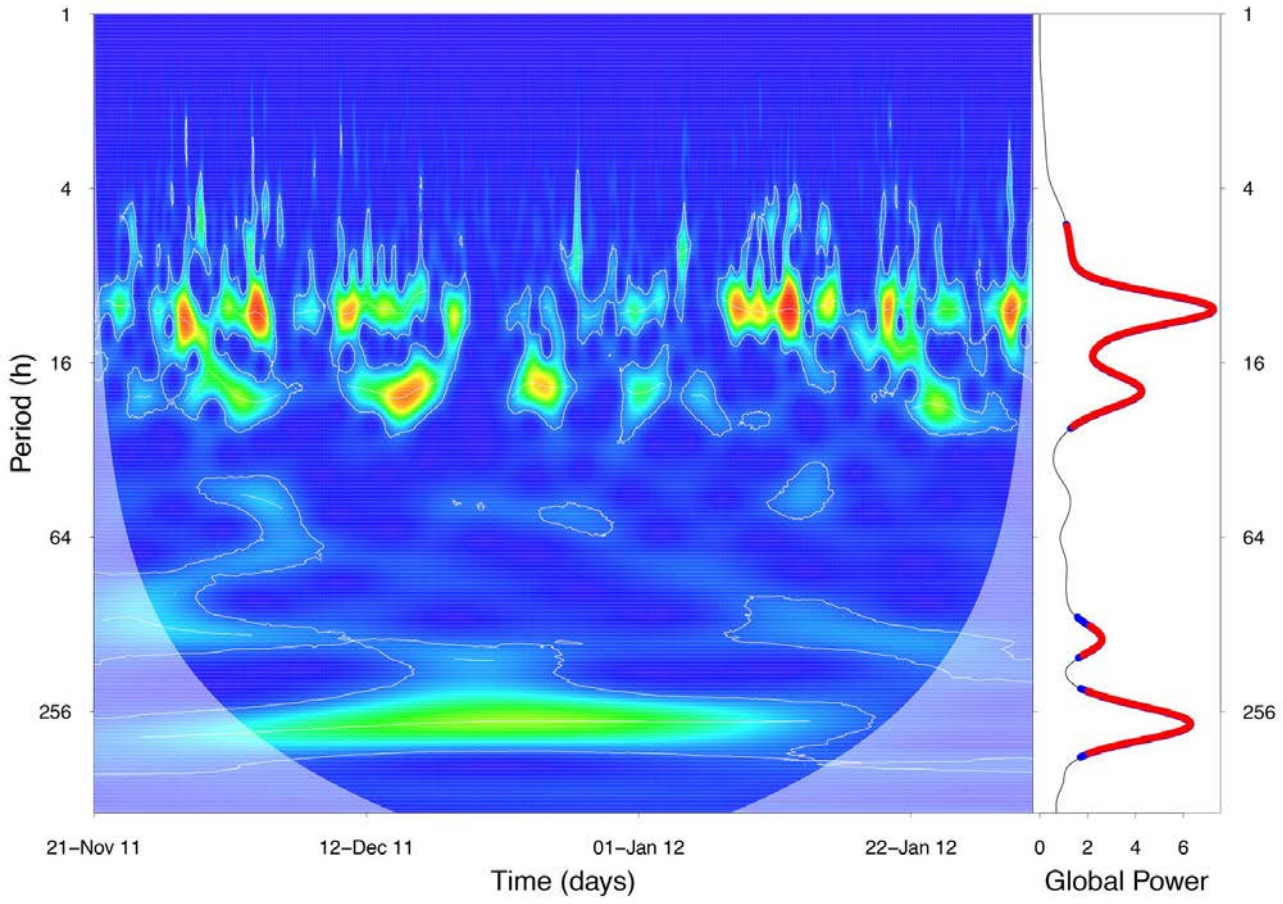
Distance-based Moran's Eigenvectors Maps (dbMEMs)

Temporal model after detrending (52 significant dbMEMS)

	All	Very broad 10-12 days	Broad 5-6 days	Medium 2-3 days	Fine 12-24 hours
R^2 submodel on community	-	0.074	0.042	0.087	0.064
R^2 environment on submodel	-	**0.121**	-0.005	0.01	**0.016**
R^2 environment on community	0.077	0.007	-	-	0.001
Density ($kg.m^3$)	0.17	**0.001**	-	-	0.712
Temperature (°C)	0.107	**0.001**	-	-	0.608
Salinity (psu)	0.21	**0.001**	-	-	0.752
Pressure (dbar)	0.17	**0.001**	-	-	0.761
Turbidity	0.39	0.085	-	-	0.631
Chlorophyll	0.8	0.113	-	-	0.764
U	0.89	0.37	-	-	0.358
V	**0.005**	0.138	-	-	0.889
Magnitude	0.053	**0.042**	-	-	0.701
Visibility	**0.005**	0.598	-	-	0.073
Suspension events	**0.005**	0.996	-	-	0.059

Environmental patterns

Along axis bottom currents
(20 cm above bottom)



Semi-diurnal and diurnal oscillations

11 days oscillation

Epibenthic community temporal structure

Linear trend: Adj R^2=0.10

Temporal model (52 significant PCNMs)

	All	Very broad 10-12 days	Broad 5-6 days	Medium 2-3 days	Fine 12-24 hours
R^2 submodel on community	-	0.074	0.042	0.087	0.064
R^2 environment on submodel	-	**0.121**	-0.005	0.01	**0.016**
R^2 environment on community	0.077	0.007	-	-	0.001
Density ($kg.m^3$)	0.17	**0.001**	-	-	0.712
Temperature (°C)	0.107	**0.001**	-	-	0.608
Salinity (psu)	0.21	**0.001**	-	-	0.752
Pressure (dbar)	0.17	**0.001**	-	-	0.761
Turbidity	0.39	0.085	-	-	0.631
Chlorophyll	0.8	0.113	-	-	0.764
U	0.89	0.37	-	-	0.358
V	**0.005**	0.138	-	-	0.889
Magnitude	0.053	**0.042**	-	-	0.701
Visibility	**0.005**	0.598	-	-	0.073
Suspension events	**0.005**	0.996	-	-	0.059

Periodograms

	1-10 Dec				11-21 Dec				22-31 Dec			
	P	%	S	%	P	%	S	%	P	%	S	%
A. fimbria	23.4	22.7	-	-	24.3	17.7	12.2	10.7		ns		
Hippolitydae	26.3	23.8	13.1	11.6		ns				ns		
***Munidopsis* sp**	24.1	17.2	-	-	24.0	19.3	15.4	15.0	-	-	15.1	11.3

Preliminary conclusions on temporal patterns

Influence of cyclic *versus* stochastic events on community temporal dynamics

- Change in community structure related to changes in water properties
- 11 days oscillation in fauna and environment (bottom currents)
- Important role of tide in organisms activity

- Storm can affect communities down to 900 m depth?

Most temporal variation was not explained by environmental variables measured: role of biotic interactions (food availability, competition, predation) ?

Are these periodicities present all year round? What about seasonal variations?

Juniper et al., Deep sea Res. (submitted)

ACKNOWLEDGMENTS

Françoise Gervais, Damian Grundle,
NC Barkley benthic group

ROV *ROPOS*
R/V Thomas G. Thompson
NEPTUNE Canada team

OCEAN NETWORKS CANADA
Exploration · Innovation · Action
for a Changing Planet
A University of Victoria Initiative

Funding agencies
Canada Foundation for Innovation
BC Knowledge Development Fund

University of Victoria