Macrofauna Standardization Workshop, ISA, Ujin, 23-30 Nov. 2014

ENVIRONNEMENTAL STUDIES CARRIED OUT BY IFREMER IN THE CLARION – CLIPPERTON FRACTURE ZONE

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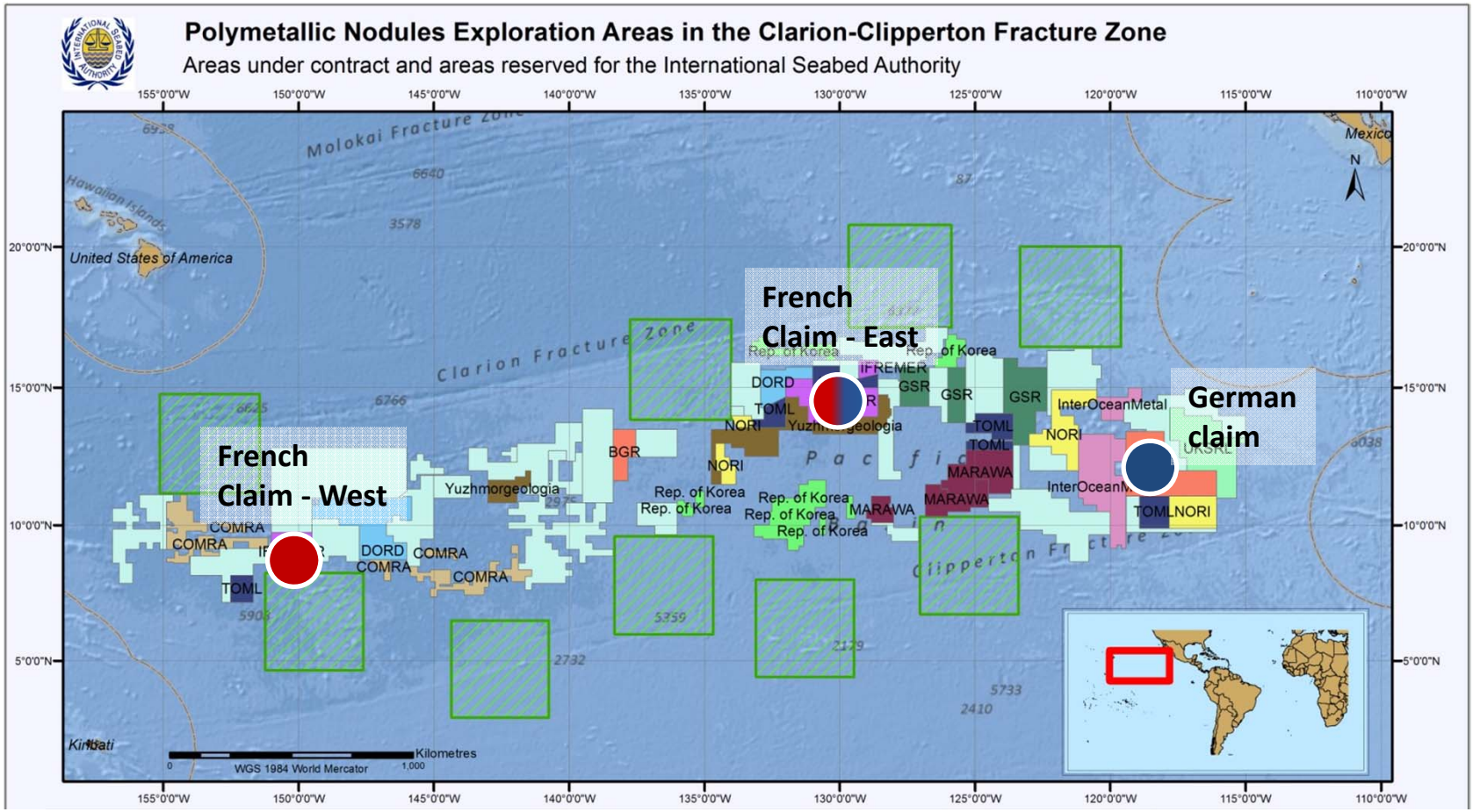
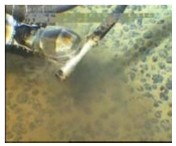
Sampling strategy: Cruises and study sites

The Nodinaut cruise (2004)
RV L'Atalante, HOV Nautile

The BIONOD cruise (2012)
RV L'Atalante



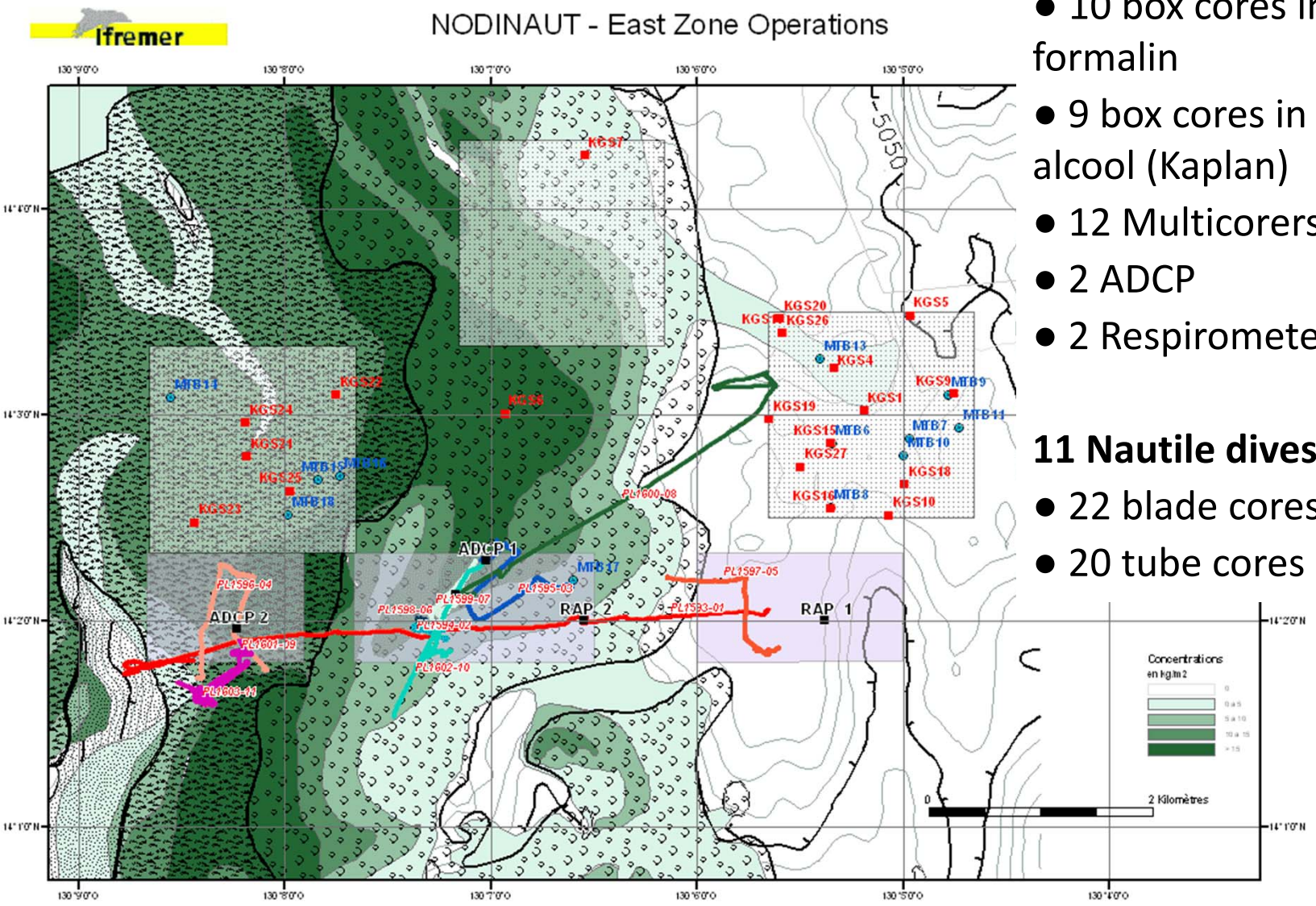
Sampling strategy: Biological sampling

Vehicle	Equipment	Purpose
R.V. L'Atalante 	Box corer 0,25 m² 	Macrofaunal sampling; 1, 0.5, 0.3 mm mesh size
	Multicorer Corer ø 10 cm 	Meiofaunal sampling; 40 µm mesh size
	Epibenthic sledge 	Macrofaunal sampling; 0.3 mm mesh size
H.O.V. Nautile 	Blade corer 300 cm² 	Macrofaunal sampling; 1, 0.5, 0.3 mm mesh size
	Tube corer ø 5.5 cm 	Meiofaunal sampling; 40 µm mesh size
	Arm & slurp gun 	Nodule and megafaunal sampling

Sampling strategy: Physico-chemical sampling

Purpose	Tool	Parameters
Characterisation of sediments	Multitube and tube corers	Total C, org. C, % water
		T°, pH, O_2
		^{210}Pb, ^{234}Th
Hydrology	ADCP (short-term, 5-6 days)	Current speed and direction
	Turbidimeter	Particle content in the water column
Biological demand in oxygen	Respirometer	Oxygen fluxes at the sediment/water interface

Sampling strategy: Sampling effort – Eastern area



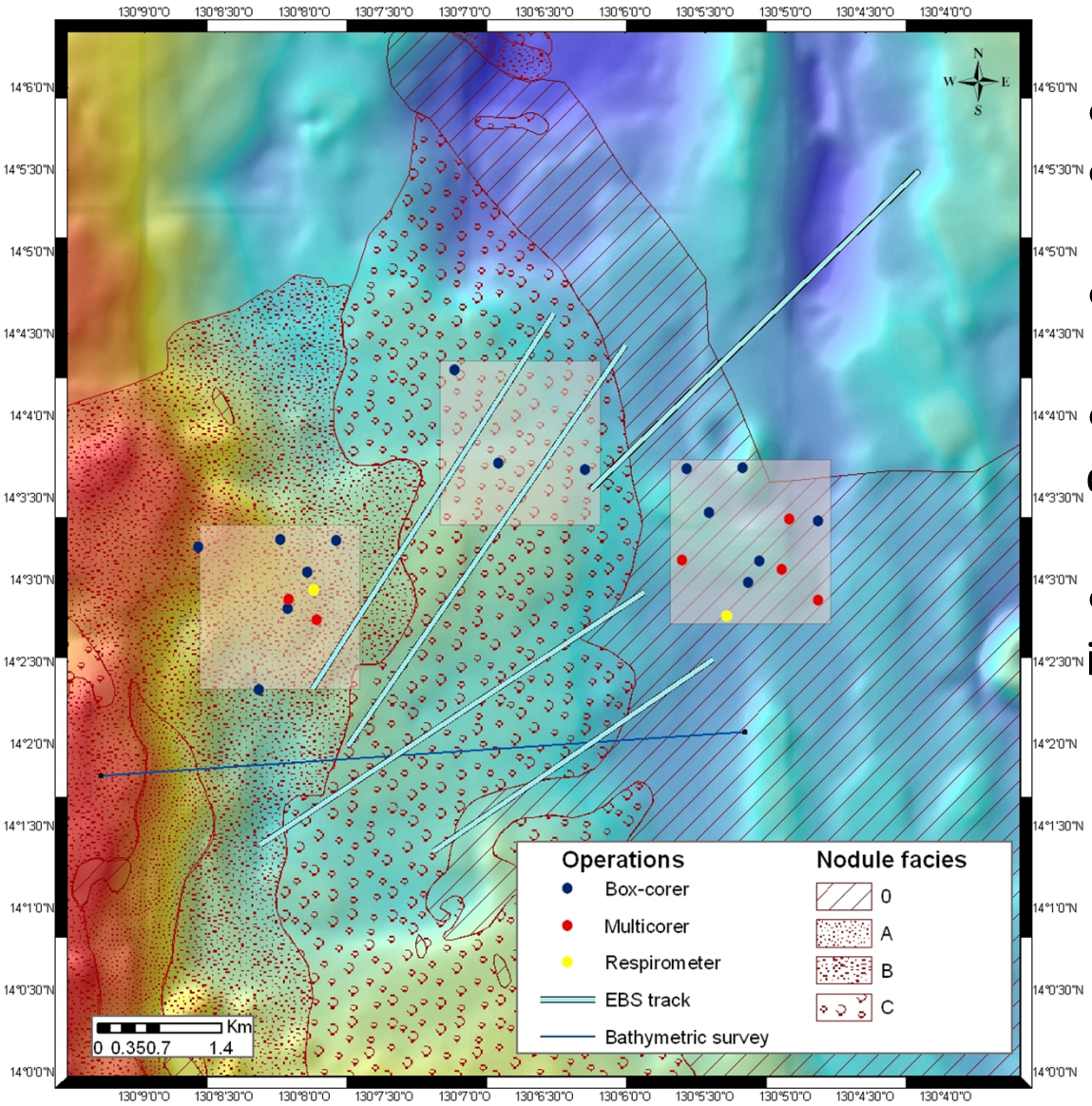
- 10 box cores in formalin
- 9 box cores in alcool (Kaplan)
- 12 Multicorers
- 2 ADCP
- 2 Respirometer

11 Nautile dives:

- 22 blade cores
- 20 tube cores

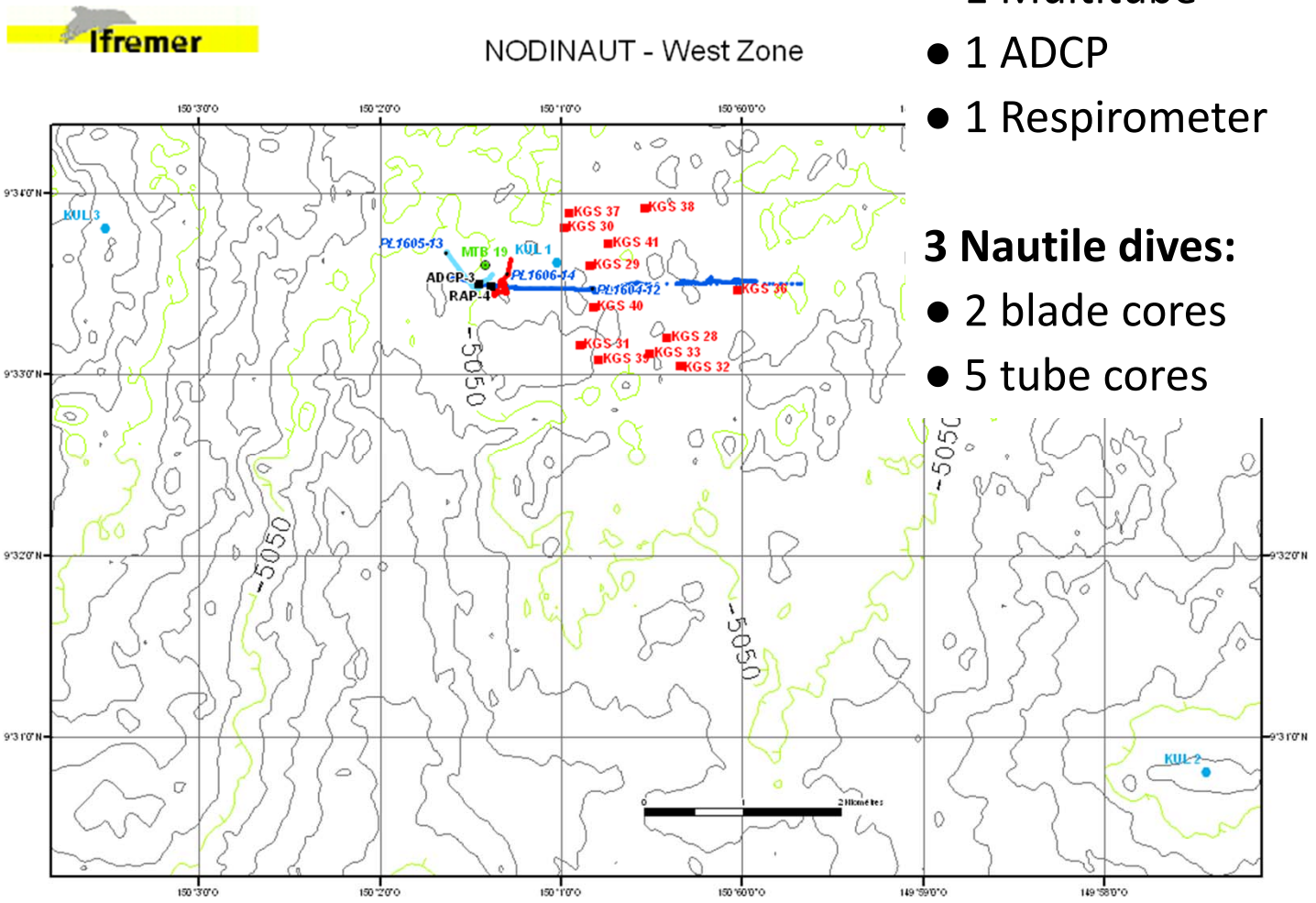
Sampling strategy: Sampling effort – Eastern area

BIONOD cruise



- 9 quantitative box cores
- 4 qualitative box cores
- 5 Epibenthic sledge
- 8 Multicorer deployments
- 2 Respirometer incubations

Sampling strategy: Sampling effort – Western area



- 5 box cores in formalin
- 6 box cores in alcool (Kaplan)
- 1 Multitube
- 1 ADCP
- 1 Respirometer

3 Nautile dives:

- 2 blade cores
- 5 tube cores

Macrofauna data: Nodinaut cruise

Number of specimens: 902

Preservation: Formalin/Ethanol

Collection: Ifremer in Brest / National History Museum in Paris

Taxonomic resolution: down to species/morphospecies for some groups

Taxon	Nb	Resolution	Taxonomists
Polychaeta	553	Family / morphospecies	L. Menot
Isopoda	73	Genus / morphospecies	S. Brix, W. Brockeland, B. Stramsky
Tanaidacea	124	Genus / morphospecies	K. Larsen
Brachiopoda		Species	D. Gaspard
Gastropoda	12	Genus / morphospecies	P. Bouchet

Macrofauna data: BIONOD cruise – in progress

Number of specimens sorted:
EBS = 12743 (Senckenberg Museum)
Box-core = 904 / 10 boxcores (Natural History Museum)

Preservation: Formalin/Ethanol or Ethanol

Collection: Ifremer in Brest / National History Museum in London / Senckenberg Museum in Wilhelmshaven

Taxonomic resolution:
Morphology :- Polychaeta : assigned to family (G. Paterson)
- Isopoda : 463 isopod specimens assigned to 59 morpho-species (S. Kaiser)

Barcoding : - Polychaeta : 120 specimens
- Isopoda : 74 specimens

Macrofaunal studies: What next?

Completion of species sorting, identification and barcoding of the BIONOD samples (coll. Senckenberg Museum, National History Museum)

Contribution to the E.U. project MIDAS: Biogeography and connectivity in the CCFZ

Contribution to the JPIO project and cruise in March-April 2015 (RV Sonne): ecology, resilience, species ranges and connectivity across the mid-eastern CCZ

Ecological aspects of deep-sea mining

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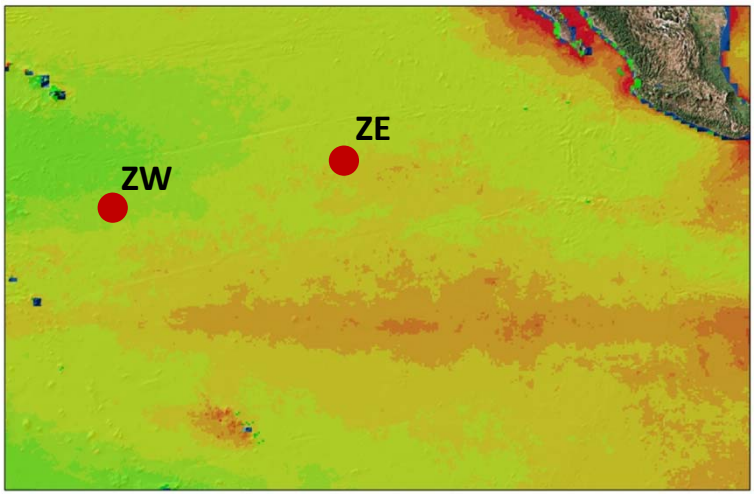
MACROBENTHIC COMMUNITY PATTERNS AT REGIONAL AND LOCAL SCALES IN THE CLARION – CLIPPERTON FRACTURE ZONE

- Results from the Nodinaut cruise -

Objectives

1. Describe and explain macrofaunal community patterns at regional scale, between the Eastern and Western French mining claim areas: the influence of primary productivity.

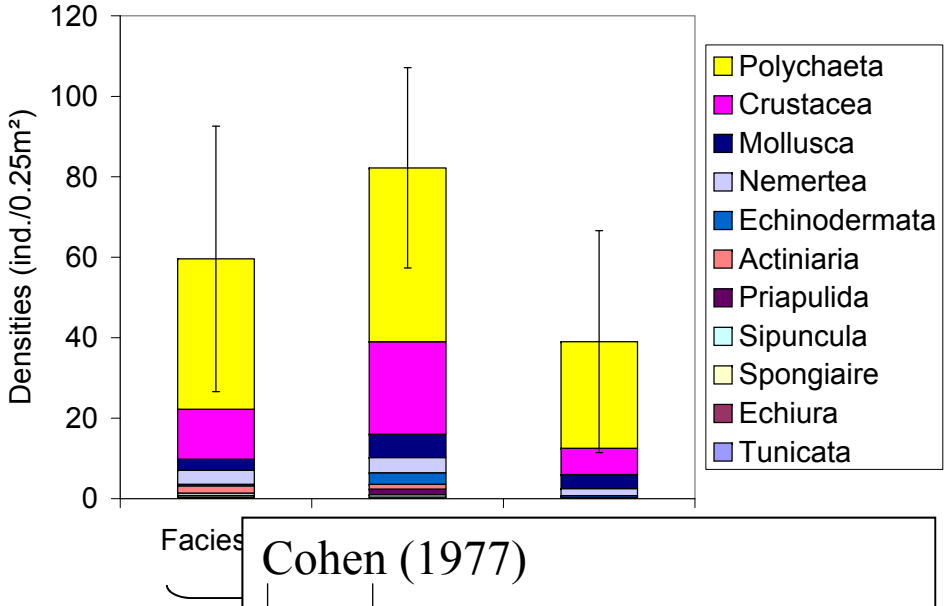


2. Describe and explain macrofaunal community patterns at local scale: the influence of nodule coverage

Facies 0

Facies B

Macrofaunal density and community patterns



Densities = 156 – 320 ind./m²

- ~ 285 – 290 ind./m² at EqPAC 9°N (Smith & Demopoulos, 2003)
- ~ 370 ind./m² at ECHOI (Wilson, 1987)
- Significantly lower densities at the western site (consitent with lower oxygen uptake)
- Lower densities on facies 0 than facies B (but not statistically significant, lack of power ?)

Cohen (1977)

$$\frac{|\mu_1 - \mu_2|}{\sqrt{\frac{\sigma_1^2 + \sigma_2^2}{2}}}$$

0.2 = small effect size
0.5 = medium effect size
0.8 = large effect size

- H_0 : « Facies 0 = Facies B »
- H_A : « Facies 0 < Facies B »

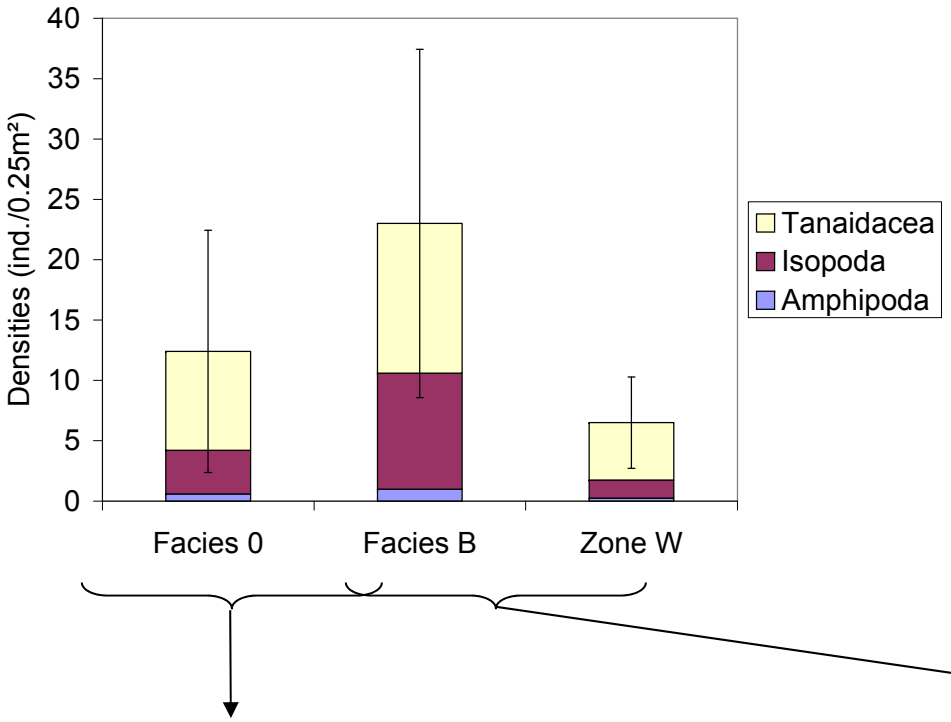
	Effect Size	Type I error (α)	Power (1 - β)	Sample size (β = 0.80)
Macrofauna	0.75	0.13	0.29	23
Polychaeta	0.55	0.20	0.20	44
Crustacea	1.07	0.06	0.46	12

- H_0 : « Zone E = Zone W »
- H_A : « Zone E ≠ Zone W »

	Effect Size	Type I error (α)	Power (1 - β)	Sample size (β = 0.80)
Macrofauna	2.21	0.01	0.80	
Polychaeta	1.48	0.05	0.52	
Crustacea	2.34	0.01	0.89	

Student t test

Crustacean patterns



Isopods are significantly more abundant on facies B

- H_0 : « Facies 0 = Facies B »
- H_A : « Facies 0 < Facies B »

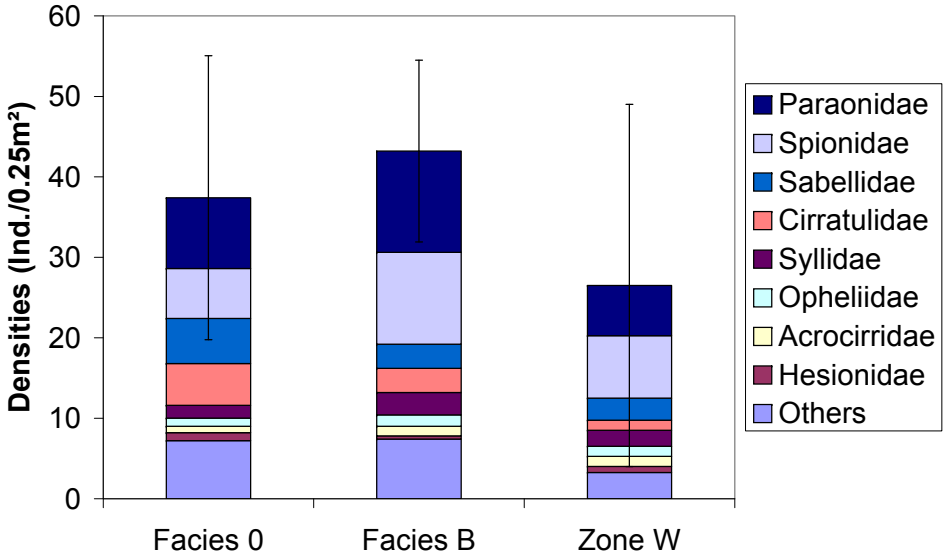
	Effect Size	Type I error (α)	Power (1 - β)	Sample size (β = 0.80)
Tanaidacea	0.69	0.15	0.26	27
Isopoda	1.18	0.05	0.52	

- H_0 : « Zone E = Zone W »
- H_A : « Zone E ≠ Zone W »

	Effect Size	Type I error (α)	Power (1 - β)	Sample size (β = 0.80)
Tanaidacea	1.64	0.04	0.61	
Isopoda	2.08	0.01	0.80	

Student t test

Polychaete patterns



Mostly no significant differences in densities at regional and local scales.

But note that spionids are significantly more abundant on facies B.

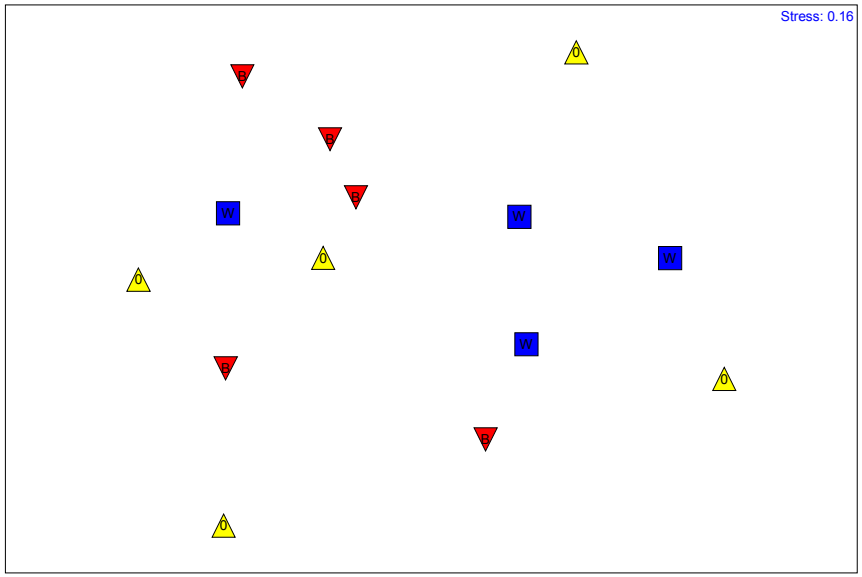
Student t test

- H_0 : « Facies 0 = Facies B »
- H_A : « Facies 0 < Facies B »

	Effect Size	Type I error (α)	Power (1 - β)	Sample size (β = 0.80)
Paraonidae	0.91	0.09	0.37	16
Spionidae	1.67	0.01	0.78	
Sabellidae	0.77	0.13	0.30	22
Cirratulidae	0.21	0.37	0.09	

Polychaete patterns

nMDS on Polychaete families



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Cirratulidae	0.21	0.37	0.09	

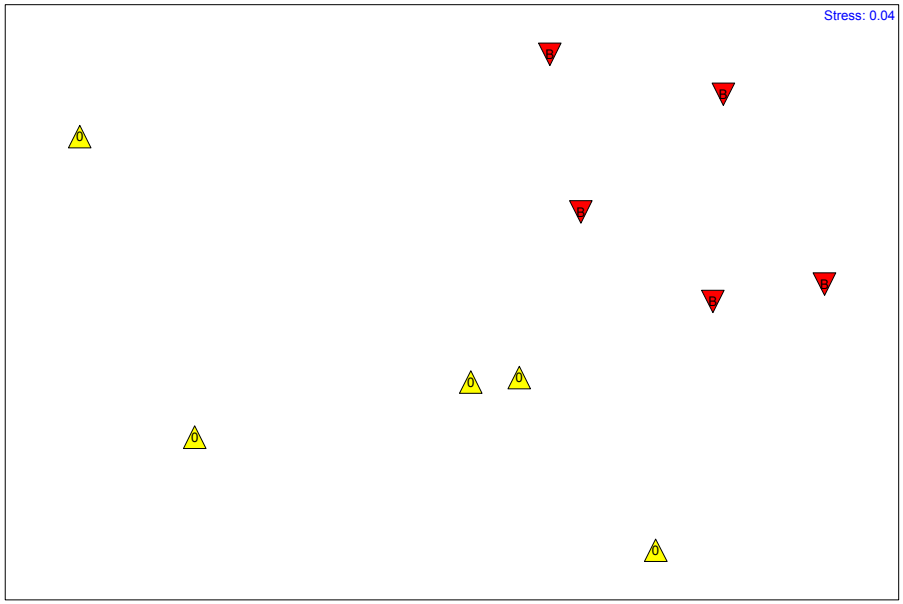
Mostly no significant differences in densities at regional and local scales.

But note that spionids are significantly more abundant on facies B.

No difference in community composition at family level.

Polychaete patterns

nMDS on spionid species



Facies 0 Facies B

Student t test

- H_0 : « Facies 0 = Facies B »
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Mostly no significant differences in densities at regional and local scales.

But note that spionids are significantly more abundant on facies B.

No difference in community composition at family level.

At species level however, spionids do show variations in community composition according to nodule coverage.

Conclusions

Macrobenthic community structure vary at both local and regional scales.

-> There is a need to **better describe and understand the distribution of species and its environmental drivers**

Distribution and diversity patterns are sensitive to taxonomic resolution.

-> There is a need to **consistently identify taxa down to species level and across a wide range of environmental settings in the CCZ**