Preliminary results on long-term changes of estuarine benthic communities 45 years after the implementation of a tidal power station in the Rance basin (northern Brittany, France).

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Historical knowledges

The first tidal power station in the world was constructed at the Rance mouth, between Dinard and St-Malo (Southern Norman-Breton gulf, Fig. 1) , between 1963 and 1966.

Figure 1. Localisation map of the Rance bassin and of the estuarine study area.

The isolation of the estuary during three years (1963 to 1966) has strongly impacted both physically and biologically the system, leading to:

✓ a strong reduction of the brackish water area (Fig. 2) ;
✓ a modification of water levels ;
✓ an enhancement of the deposit of fine particles.

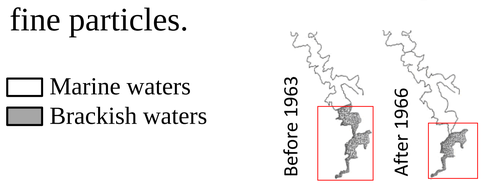

Figure 2. Characteristics of water bodies in the Rance bassin before and after the construction.

✓ a drastic reduction of biodiversity;
✓ a rapid recolonisation of the number of species occurred until 1976 (Fig. 3, Retière 1979) ;
✓a stabilisation in the number of species was registered and a slow increase in the main species abundance was observed, thirteen years later (Fig. 3, Desroy 1995).

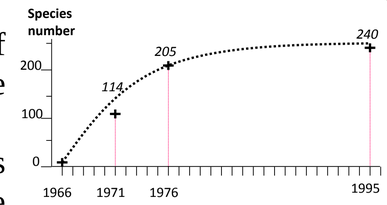

Figure 3. Evolution of the number of species from 1966 until 1995 (Retière 1979, Desroy 1995).

Objectives

In order to follow the benthic community change in the upstream part of the estuary (poly- and mesohaline areas), a spatio-temporal study is in progress, which aims to compare the structure of the benthic communities with:
(1) The previous results of Desroy (1995);
(2)Those present in a morphologically similar but unmanaged system, the Trieux estuary.

Material & Methods

Temporal study

A total of 54 stations were sampled in March 2010 (Fig. 4):
• 35 stations sampled by Desroy in 1995 (Desroy 1995) were repeated,
• 19 other stations were added to cover the whole area.
Three replicate samples were collected at each station using a 0.1 m² Smith Mc-Intyre grab (Fig. 5).

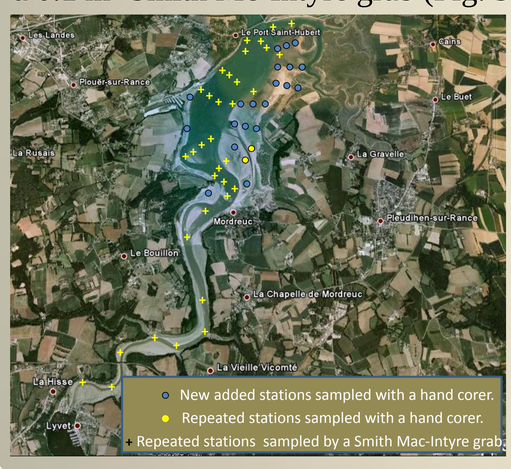

Figure 4 . Localisation map of the 54 sampled stations.

Figure 5. Smith Mc-Intyre grab picture

Spatial study

Located in the western side of the St-Brieux bay, the Trieux estuary is morphologically similar to the Rance estuary. A total of 20 stations were sampled (Fig. 6), using a 0.1 m² Smith Mc-Intyre grab.

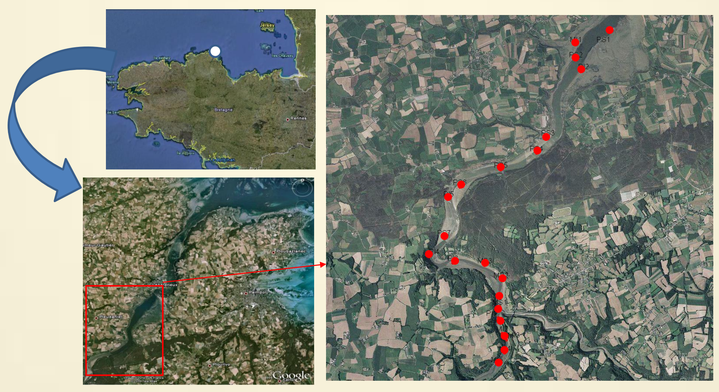

Figure 6. Location map of the Trieux estuary.

Structure of benthic communities

✓ Actually, only 41 stations were treated ;
✓ 91 taxa were identified : annelids (54 %), molluscs (20 %), arthropods (15 %) and others (11 %)

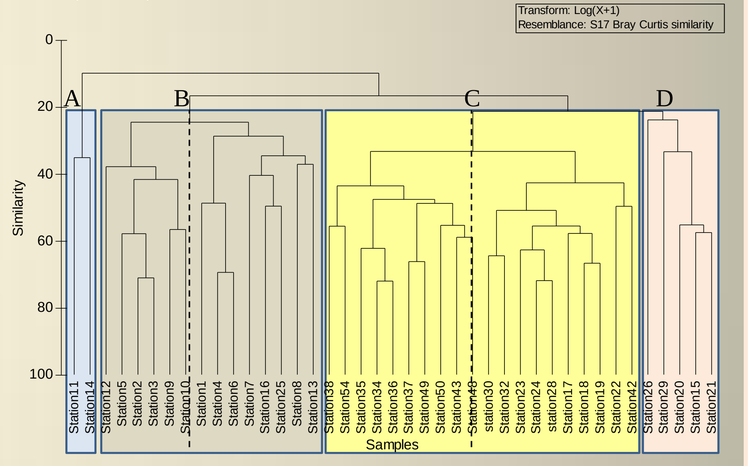

Figure 7. Hierarchical cluster analysis (PRIMER.v6 software) describing 4 benthic associations in the Rance estuary.

✓ four clusters (Fig. 7) were individualized, which belong to intertidal and/or brackish muddy fine sand assemblage as described by Desroy (1995) ;
✓ This assemblage covers almost the totality of the estuarine area.

Temporal study comparison

✓ In term of biological composition, similarities were observed between the two areas (Tab. 1).

Table 1. comparison of species richness (RS), number of species (N) and diversity index (H') between Rance and Trieux estuaries

RANCE	RS	N	H'
Mean	14±9	49±37	2,2±0,9
Max	32	117	3,4
TRIEUX	RS	N	H'
Mean	14±7	58±29	2,5±0,5
Max	31	132	3,4

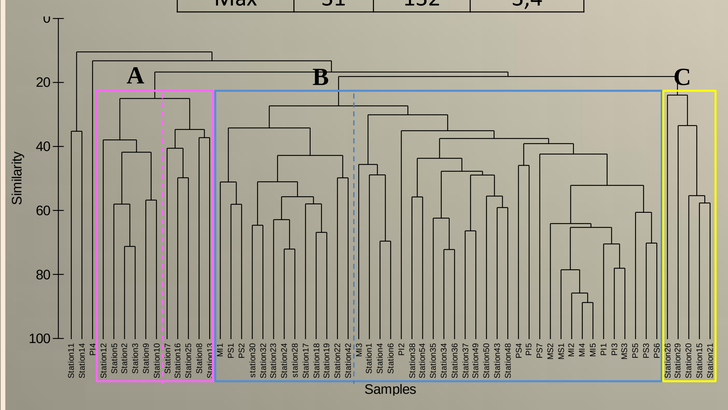

Figure 9. Hierarchical cluster analysis of both Rance and Trieux macrofauna data (PRIMER.v6 software) . Three main benthic associations were defined.

✓ Three main clusters are described, groups 'A' and 'B' are subdivided into two sub-clusters (Fig. 9) ;
✓ The cluster 'B' contains all the Trieux stations, mixed with 23 stations of the Rance

Conclusion

➢ **The benthic fauna belong to the intertidal and/or brackish muddy fine sand with *Cerastoderma edule* – *Scrobicularia plana* – *Hediste diversicolor* assemblage.**

➢ **45 years after the operational start of the tidal power station, the structure of benthic communities is stabilized.**

➢ **In spite of the damming construction in the Rance estuary, the benthic fauna composition is relatively similar to those observed in the Trieux estuary.**

These preliminary results confirm and highlight the stability and the adaptability of the macro-benthic fauna associations in the Rance estuary.

Spatial study comparison

➢ 75 taxa were identified in 2010 *vs.* 67 in 1995, with 37 common taxa
➢ 20 stations which sustain 101 taxa, were compared between 1995 & 2010

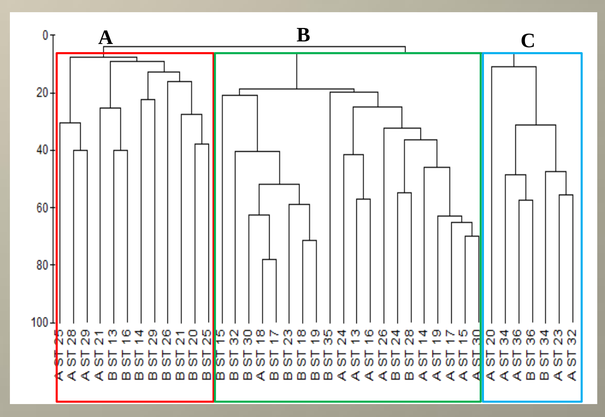

Figure 8. Hierarchical cluster analysis (PRIMER.v6 software) established on the benthic fauna data of 20 stations sampled during the two periods (1995 & 2010).

✓ Three benthic associations were observed (Fig. 8);
✓ No temporal difference between the two periods is observed ;
✓ The benthic structure is relatively homogeneous.