

Limitation of consequences on exploited natural resources : management of shellfish farming areas in the Erika's pollution.

Hélène Jeanneret, Sébastien Chantereau and Gilles Ratiskol. Laboratoire Morbihan Pays de Loire, Ifremer Nantes.

The oil spill of the Erika took place on September the 12th 1999, It is estimated that 20 000 tonnes of fuel spread on more than 400 km of coast from Finistère to Vendée. The fuel arrivals took different shapes (balls, patties, layers,...) and touched all environments. The shellfish farming areas of this sector, which produce 50 000 tonnes of shells every year, were particularly exposed to this oil spill.

So there was an urge to find a permanent solution allowing an efficient management of shellfish farming areas, in order to prevent, as long as possible, this spill from having disastrous consequences on the coastal economy.

Some options (destroying the stocks, removing to non-contaminated sectors, managing polluted areas on visual criteria) were rapidly given up because unfeasible on a technical plan and/or judged too expensive.

The idea of a sanitary norm based on an analysis of oils became then necessary. It was elaborated by the Agence française de Sécurité Sanitaire des Aliments (the French agency of sanitary security of food) from rare existing epidemic data and from series of data collected by the Ifremer through the Réseau National d'Observation de la qualité du milieu marin / RNO (national observation network of water quality in the sea environment) on the chronic contamination level of the coast by oils. The RNO revealed itself then to be the only surveillance network to assess the initial state of the contamination.

AFSSA determined a guidance value of $500\mu\text{g.kg}^{-1}$ of dry weight for the sum of the 16 polycyclic aromatic hydrocarbon (HAP)¹ analysed by the RNO . The Direction of Sea Fishing and Aquaculture set to $1000\mu\text{g.kg}^{-1}$ dry weight the exclusion value above which shellfish commercialisation was forbidden. It delegates to Ifremer the responsibility to undertake, on that basis, the contamination monitoring of shellfish farming areas. Obtained results during the monitoring (December 1999 – December 2001) allowed to give shape to the spatial and temporal evolution of the contamination. Information was regularly updated on the Ifremer's web site.

[http:// ifremer.fr/envlit/surveillance/ERIKA.htm](http://ifremer.fr/envlit/surveillance/ERIKA.htm).

While the chronic contamination level of this part of the coast was situated around $150\mu\text{g.kg}^{-1}$ dry weight for the 16 PAH, very high values (3 to $5000\mu\text{g.kg}^{-1}$ p.s.) were reached for several months onwards in some areas (Le Croisic, West coast of Noirmoutier), which then underwent long periods of closing. As an example, in Loire-Atlantique and Vendée, more than 95% of the shellfish farming sectors and professional and leisure feet fishing areas were subject to bans between January and March 2000. On other sites (Finistère, Morbihan), the exclusion value was never reached, and the closing measures set on a preventive basis were stopped very quickly.

To further the study on contamination levels, a work on the contamination composition was undertaken. On one hand, it showed that the return to contamination levels close to $150\mu\text{g.kg}^{-1}$ dry weight took place in spring 2001 for most of the sites. On the other hand, contamination profiles stayed different from those observed at the initial state, and highlighted again an obvious and characteristic print of the Erika two years after it sank.

¹ PAH: naphthalène, acénaphtylène, acénaphène, fluorène, phénanthrène, anthracène, fluoranthène, pyrène, benzo(a)anthracène, chrysène, benzo(b)fluoranthène, benzo(k)fluoranthène, benzo(a)pyrène, dibenzo(a,h)anthracène, benzo(g,h,i)pérylène, indéno(1-2-3-cd)pyrène.

The monitoring revealed efficient to handle shellfish farming areas. It probably allowed to minimise the impact of the Erika's oil spill on the shellfish farming sector, although damages underwent by shellfish farmers in Bretagne and Pays de la Loire have been estimated by 21,5 M €. It demonstrated that instils of an environmental surveillance network could constitute a strong basis for the setting of a sanitary monitoring program. It also highlighted the fundamental role of a tool such as the RNO to draw up a reference state of chronic contamination of the sea environment and to follow the impact of a major pollution.

Nevertheless some questions prevail, relative to :

- The relevance of « environmental » indicators to answer a « sanitary » aim
- The opportunity to enlarge the set of parameters, in the field of a regulation surveillance or a longer term monitoring, to other components of the Erika's fuel which are more specific or more toxic
- A more elaborate evaluation of the environmental impact including the return to initial state and long term effects on organisms.

Some of these points are monitored in the programme “monitoring of ecological and ecotoxicological consequences of the oil spill due the sinking of the Erika plan”, financed by the Ministry in charge of the Environment.

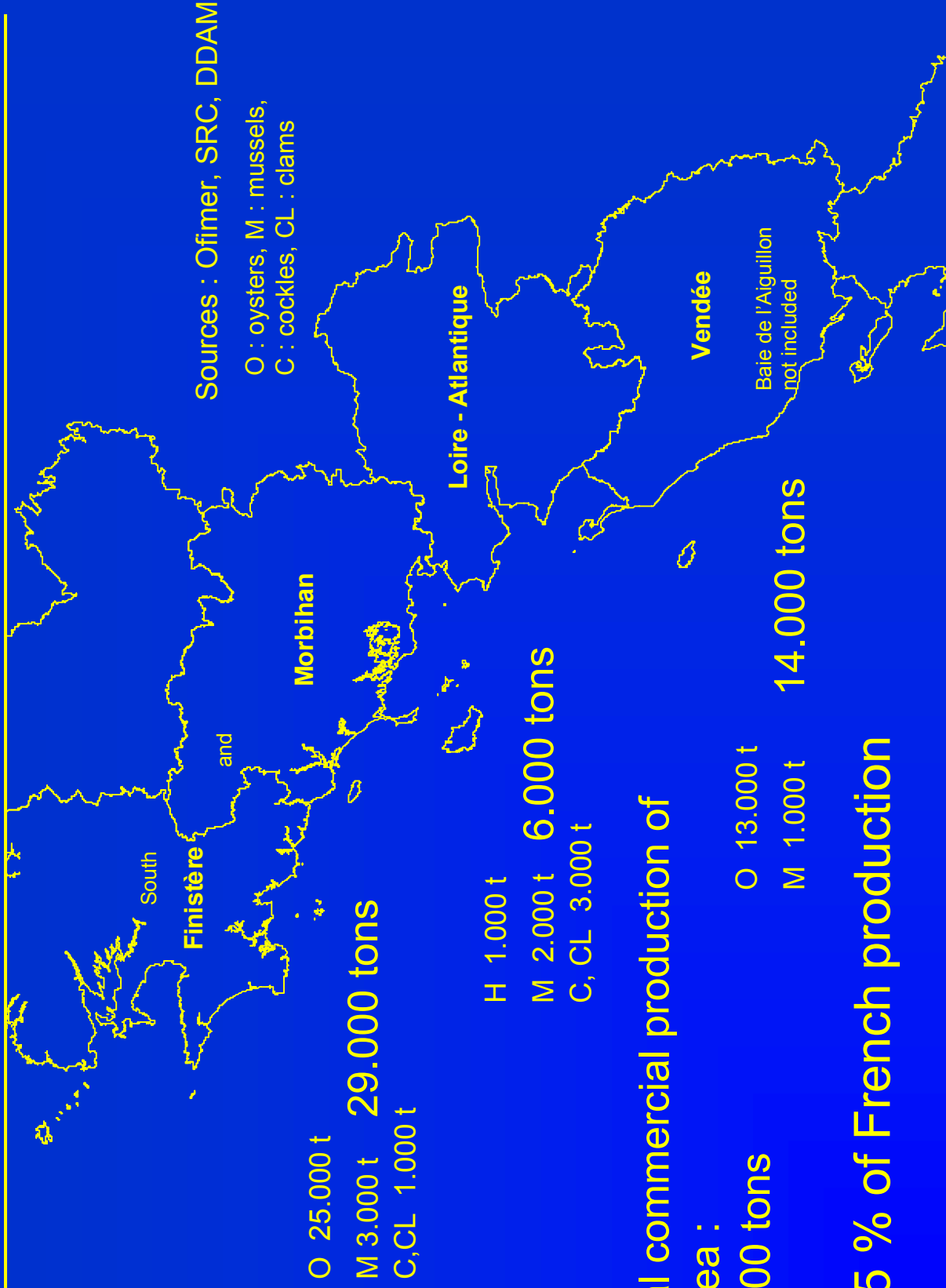
Reducing consequences on exploited natural resources

*The management of shellfish farming areas
in the Erika incident*

Wreckage of the Erika / 12 December 1999



Shellfish production in the oiled area



What should be done with shellfish located in oiled areas ?

1 – Transfer to unpolluted sites

Where are the potential sites ?

Who will accept oiled shellfish in clean areas ?

Organisation of logistics?

When will it be possible to bring back the shellfish to their original area ?

What should be done with shellfish located in oiled areas ?

2 – Destruction of shellfish

- 50 000 t of shellfish at 1,5 €/kg (average)
↔ 75 M€
- Evaluation of the cost of replacement of the stock needed (loss of profit)
- What criteria should be considered for deciding to reintroduce shellfish in the area?

What should be done with shellfish located in oiled areas ?

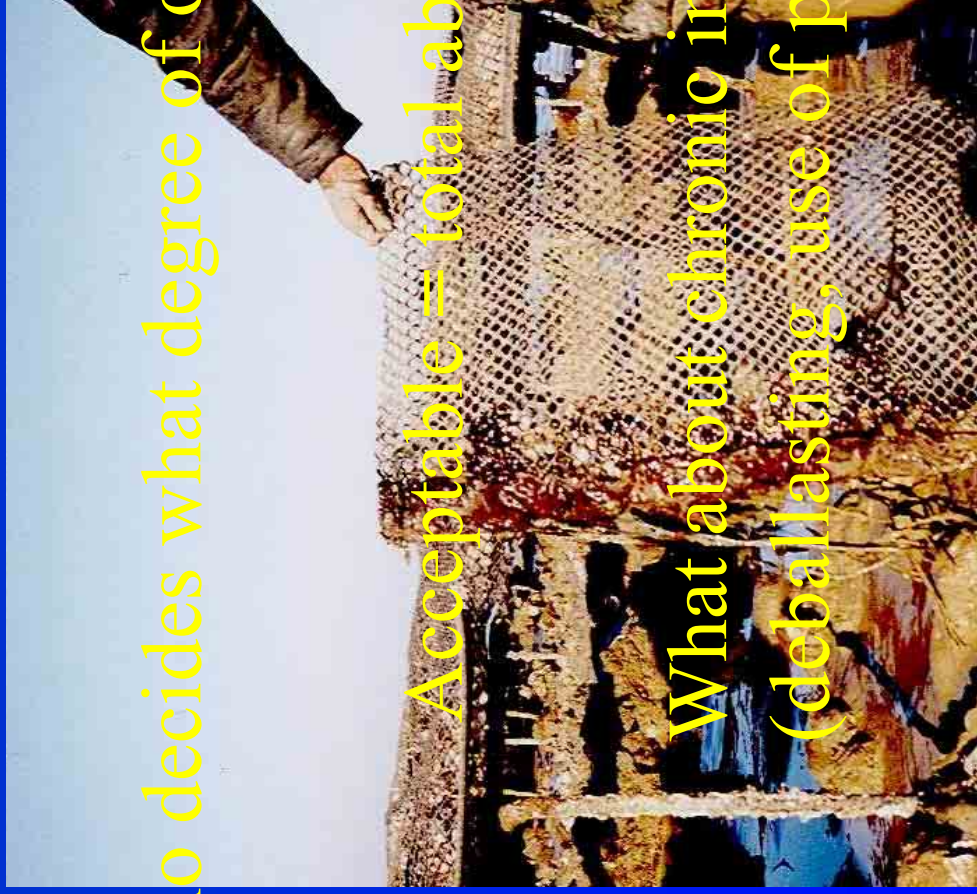
3 – Closure of the areas on the basis of existing criteria

- Regulatory monitoring well defined for a number of parameters (microbiology, phytoplankton, chemistry)
- BUT, no standards as regards hydrocarbons.
Visual control only.

How pertinent is this criterion ?



Who decides what degree of oiling is acceptable?



Acceptable = total absence of fuel?



What about chronic inputs
(deballasting, use of petrol,...)?



What should be done with shellfish located in oiled areas ?

4 – Management of sites on the basis of new criteria

- **AFSSA** guideline value : 500 $\mu\text{g}\cdot\text{kg}^{-1}$ of dry flesh
- **DPMA** exclusion threshold : 1000 $\mu\text{g}\cdot\text{kg}^{-1}$ of dry flesh

Sum of 16 the PAH known at the international level for presenting risks of toxicity for the environment



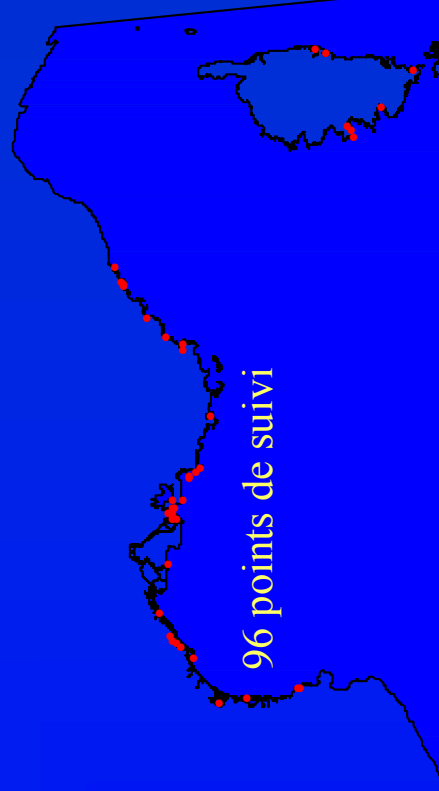
**Réseau National d'Observation de la
qualité du milieu marin
National Observation Network for marine
environment quality**

Aims : Pollution levels and trends

Chronic contamination of the shoreline by :

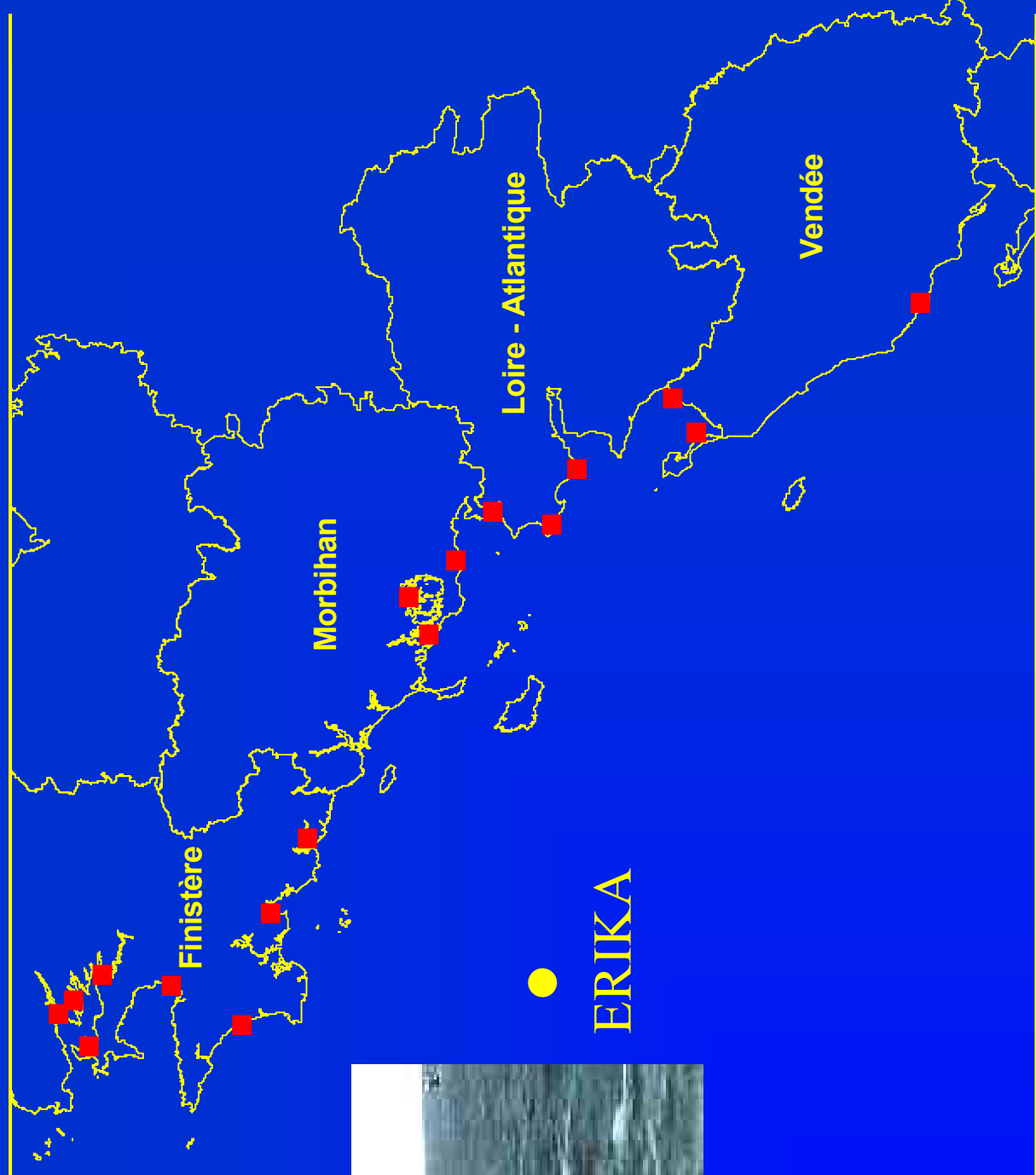
- trace metals
- plant protective agents
- polychlorobiphenyls PCB
- Polycyclic Aromatic Hydrocarbons **PAH**

Quantitative indicator : filter-feeding molluscs



Location of RNO stations on the oiled shoreline

■ 21 RNO stations



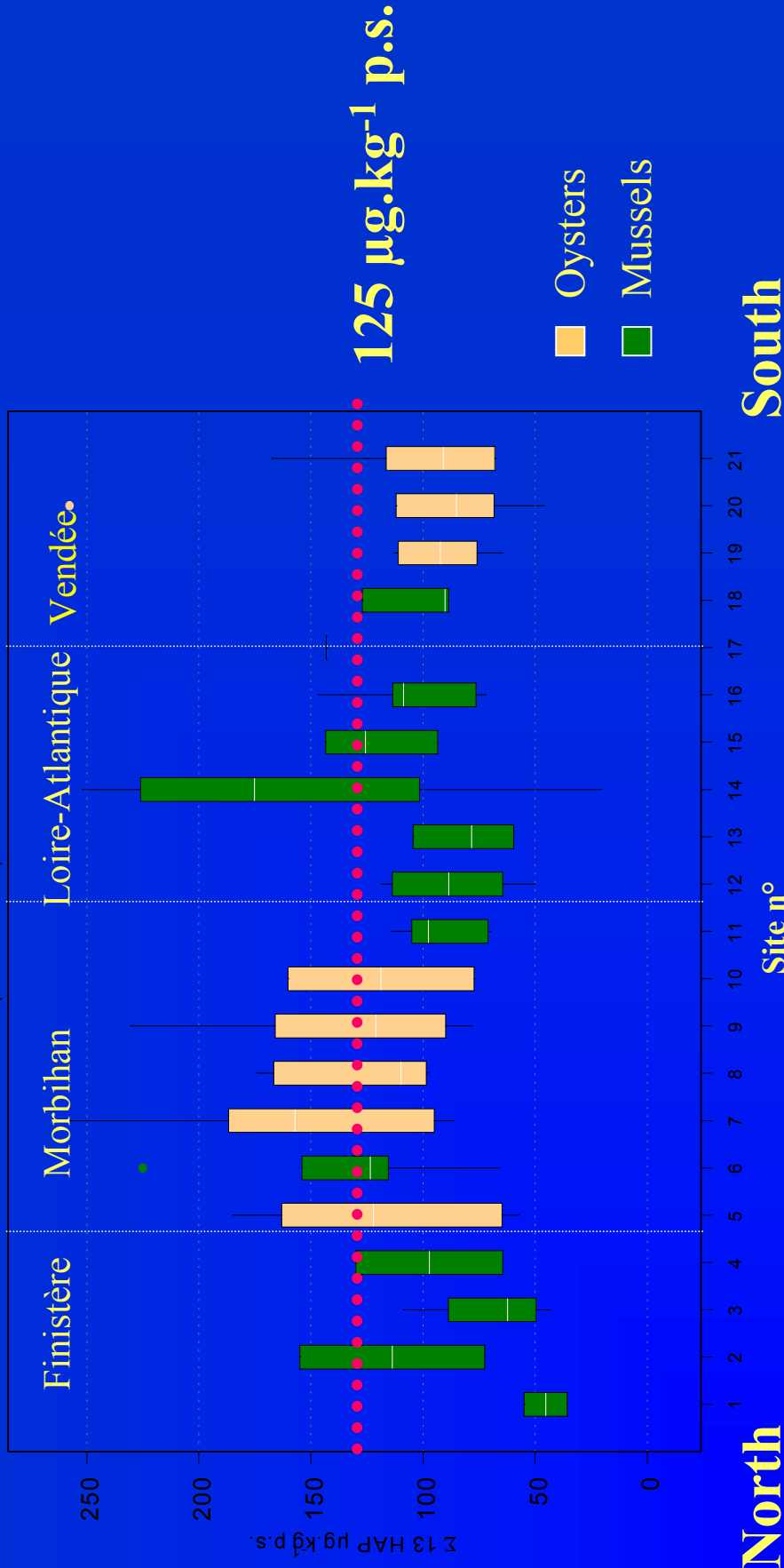
Initial contamination

• 50 – 125 $\mu\text{g.kg}^{-1}$ p.s. **Chronic contamination**

2 levels

• 125 - 175 $\mu\text{g.kg}^{-1}$ p.s. **Punctual contamination**

Distribution des valeurs observées pour la somme des 13 HAP par site entre 1994 et 1999
(données RNO)



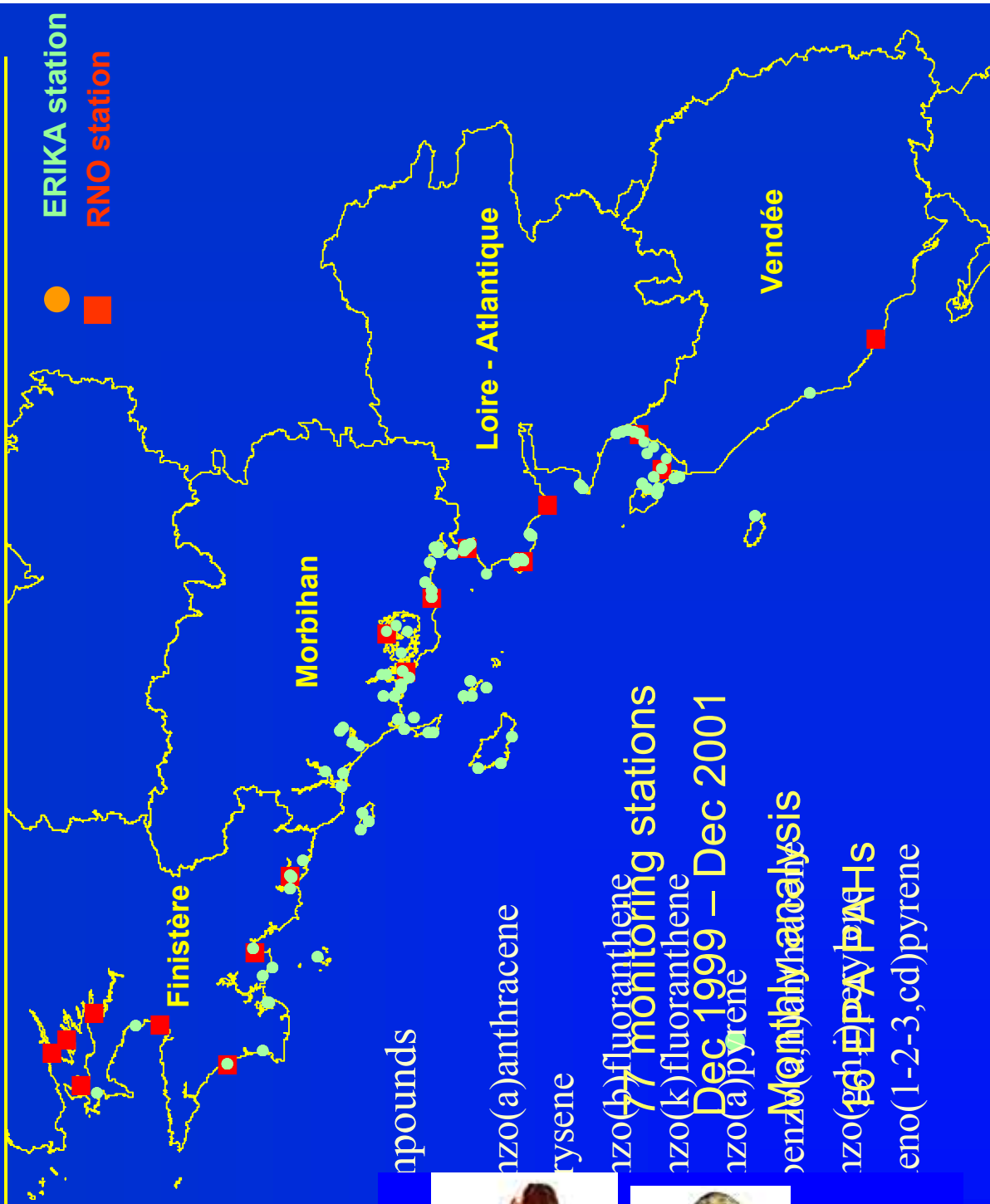
North

South

Ifremer

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Les journées d'information du CEDRE, Paris, octobre 2002. H. Jeanneret, S. Chantereau et G. Ratiskol.

Implementation of monitoring



Compounds

benzo(a)anthracene

pyrene

benzo(b)fluoranthene
77 monitoring stations

benzo(k)fluoranthene

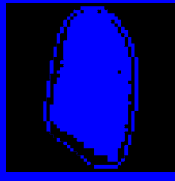
Dec 1999 – Dec 2001

benzo(a)pyrene

benz(a)anthracene

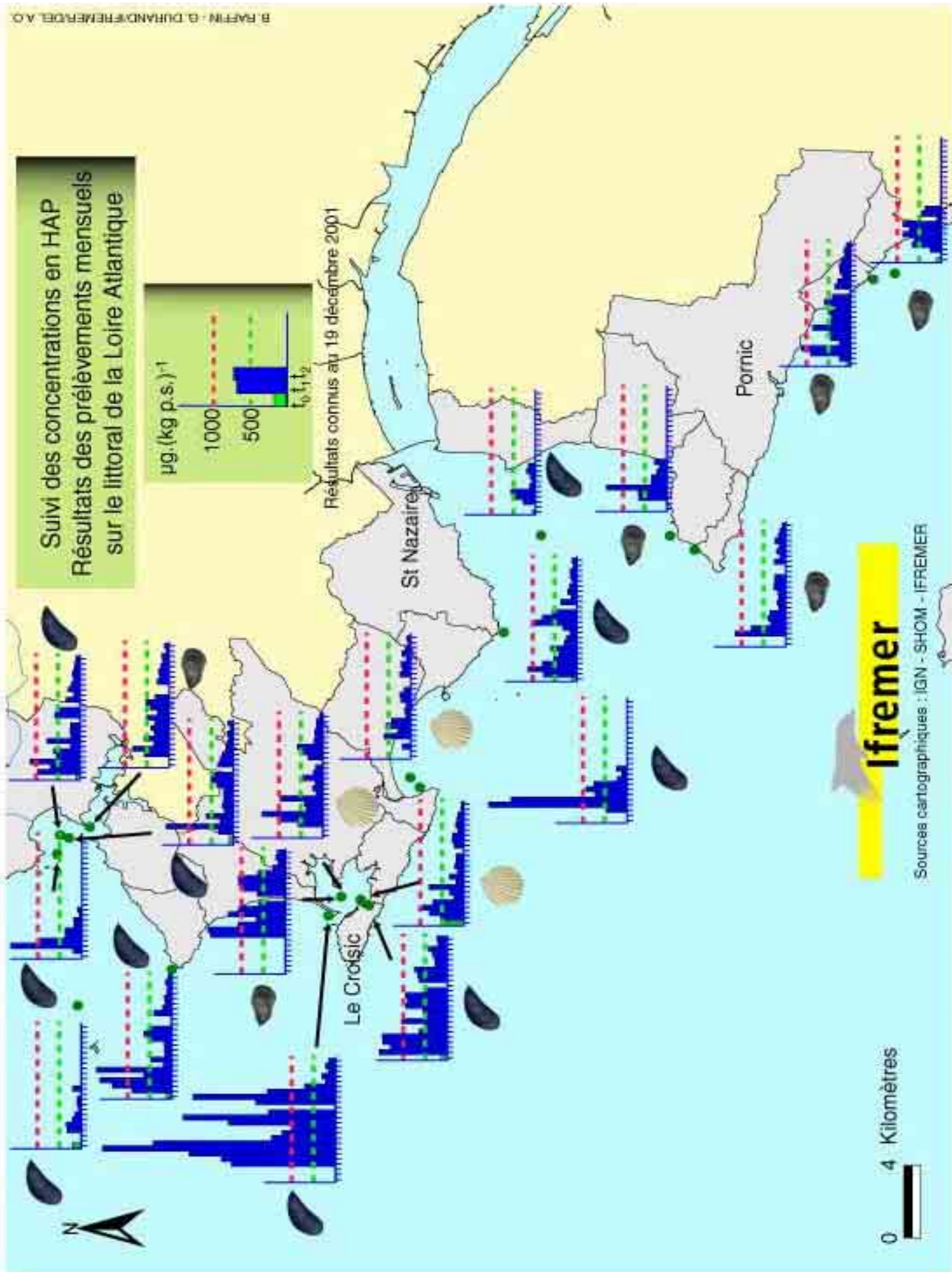
benzo(e)pyrene

benzo(1-2-3,cd)pyrene

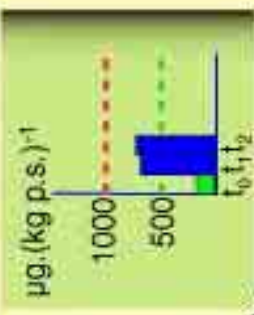


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Suivi des concentrations en HAP
 Résultats des prélèvements mensuels
 sur le littoral de la Loire Atlantique



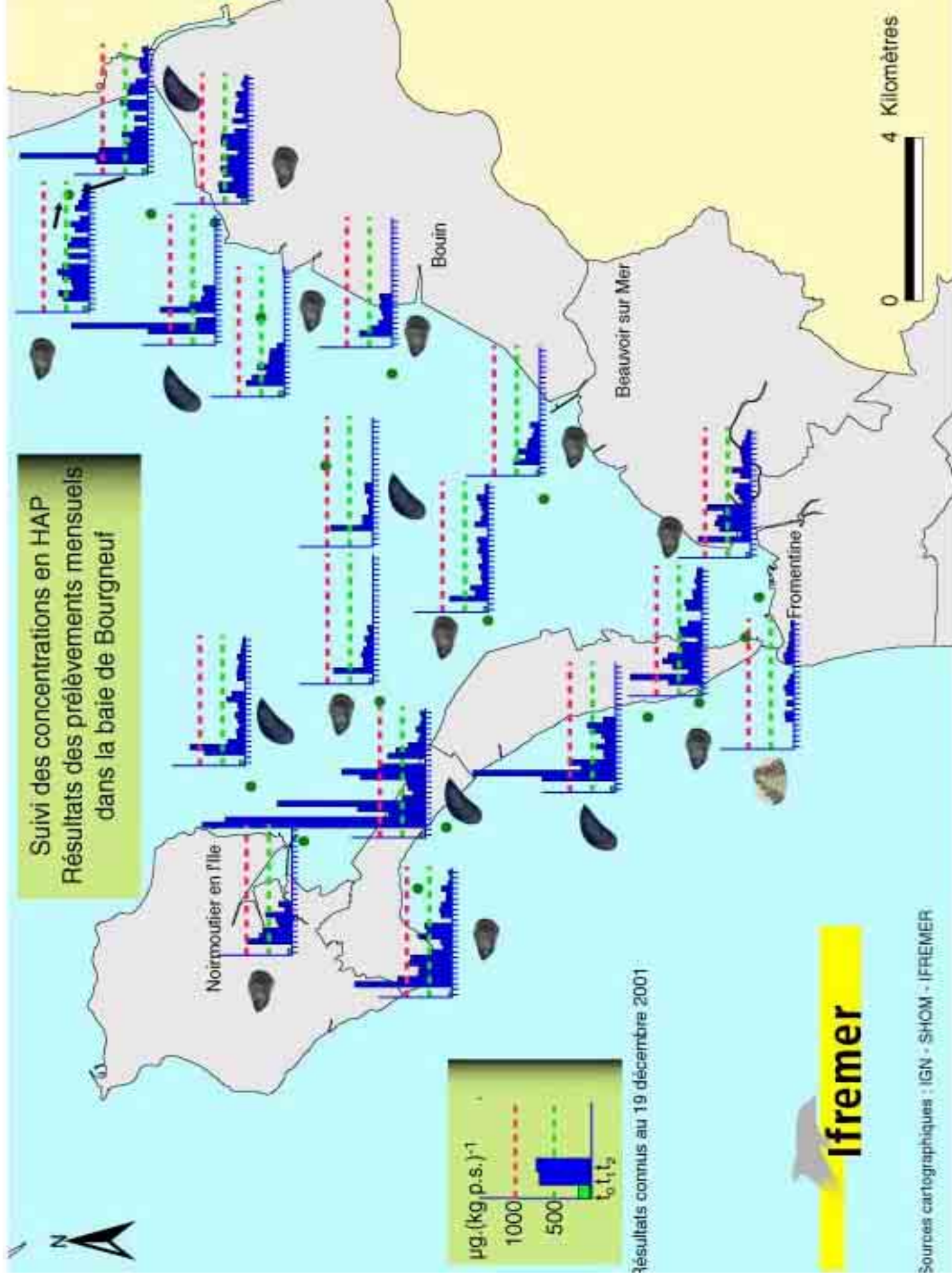
Résultats connus au 19 décembre 2001

Ifremer

Sources cartographiques : IGN - SHOM - IFREMER

0 4 Kilomètres

Suivi des concentrations en HAP
 Résultats des prélèvements mensuels
 dans la baie de Bourgneuf

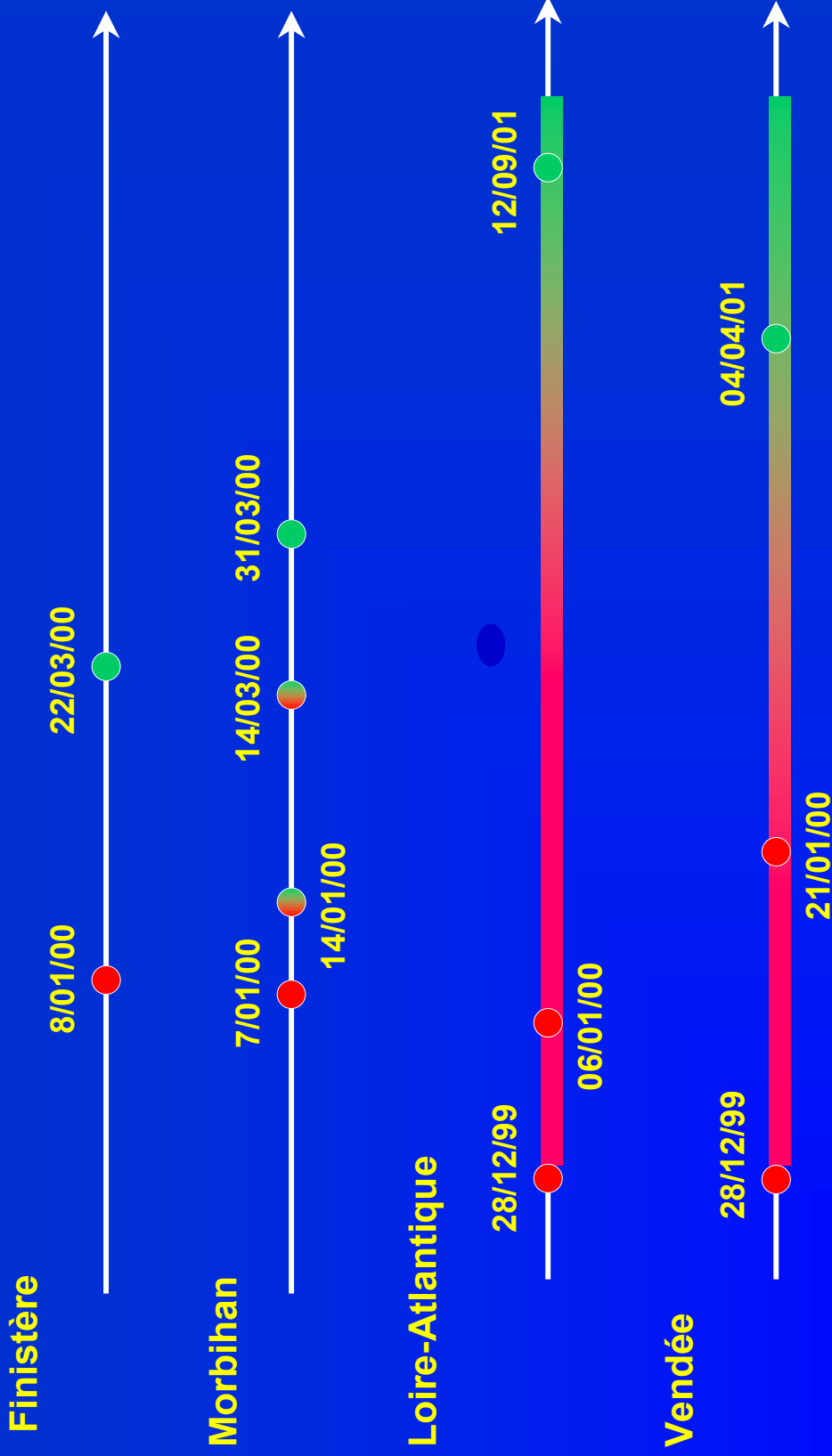


Résultats connus au 19 décembre 2001

Ifremer

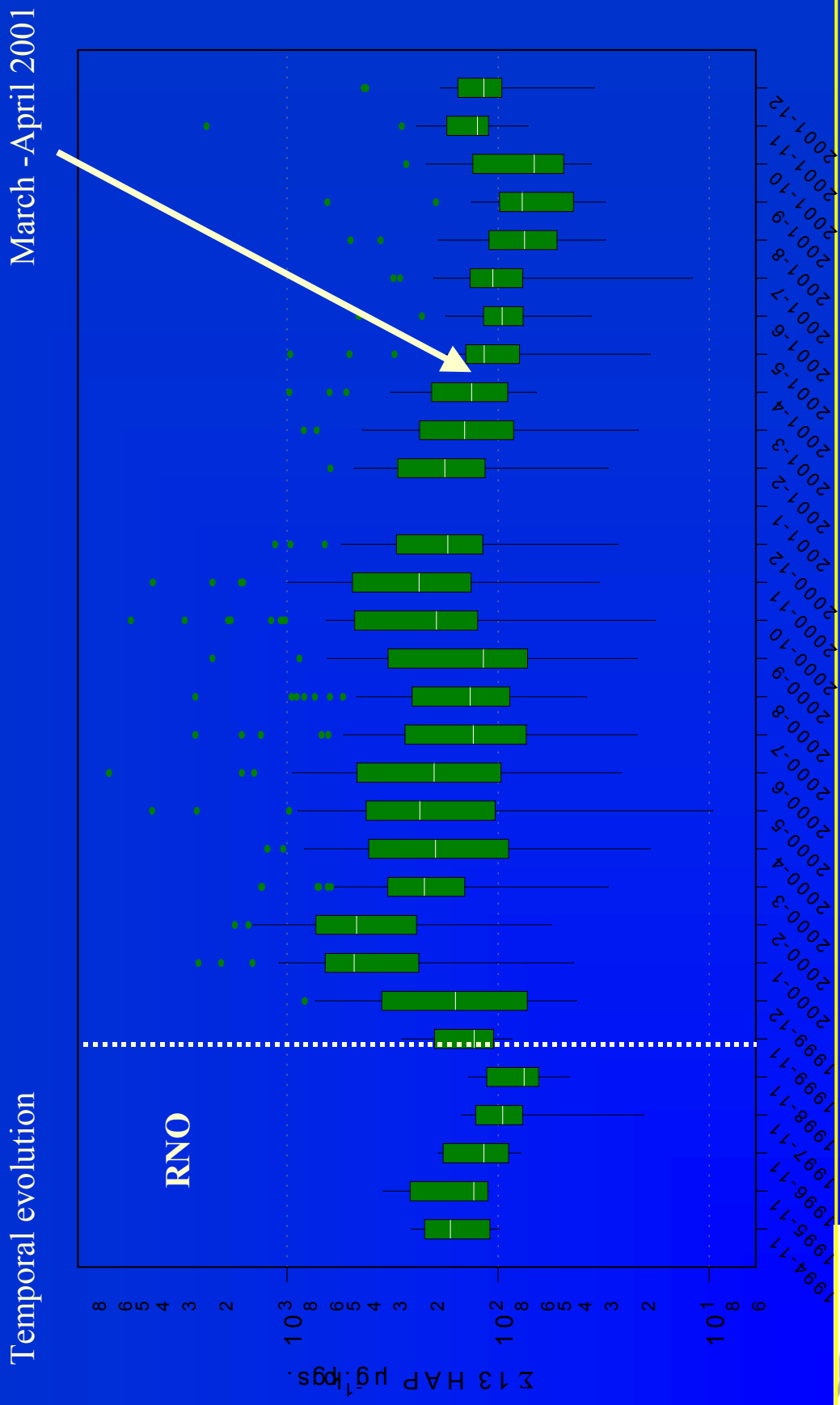
Sources cartographiques : IGN - SHOM - IFREMER

Duration of monitoring of shellfish farming areas



- Closure and opening of shellfish farming areas
- Partial reopening

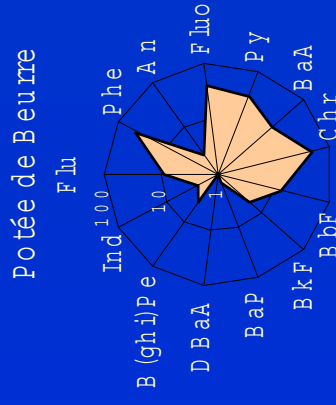
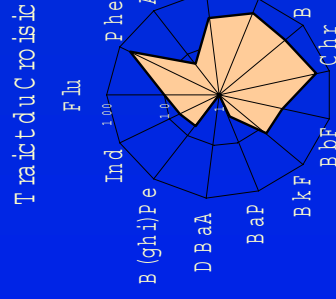
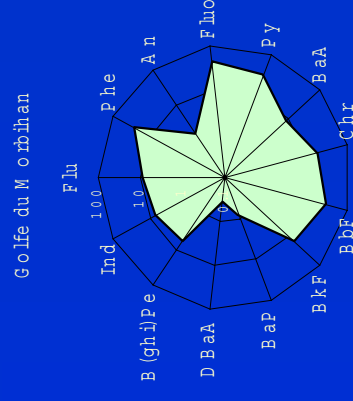
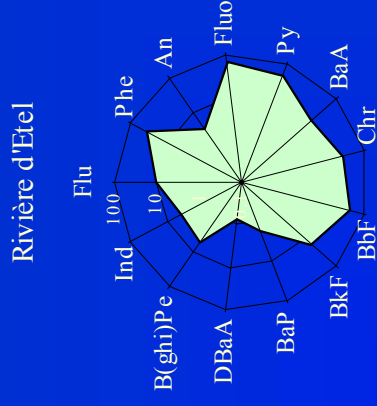
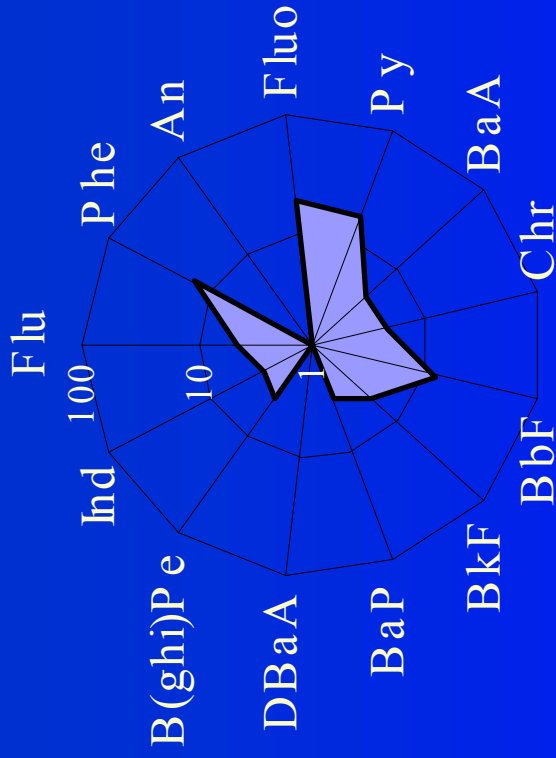
Levels of PAH contamination



Ifremer

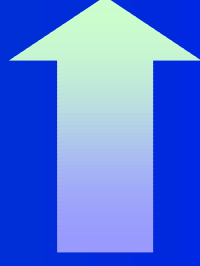
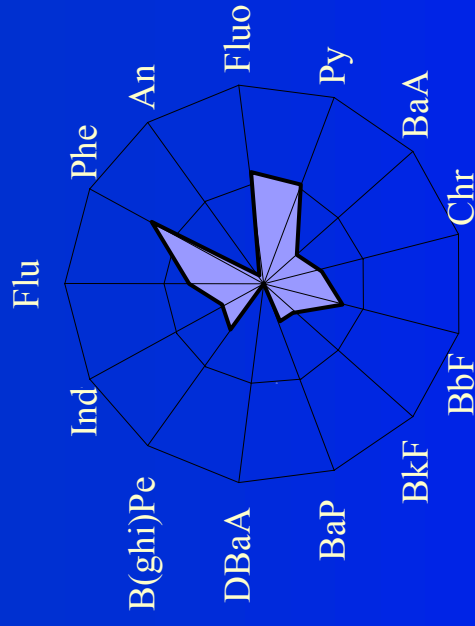
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Contamination prints : background levels

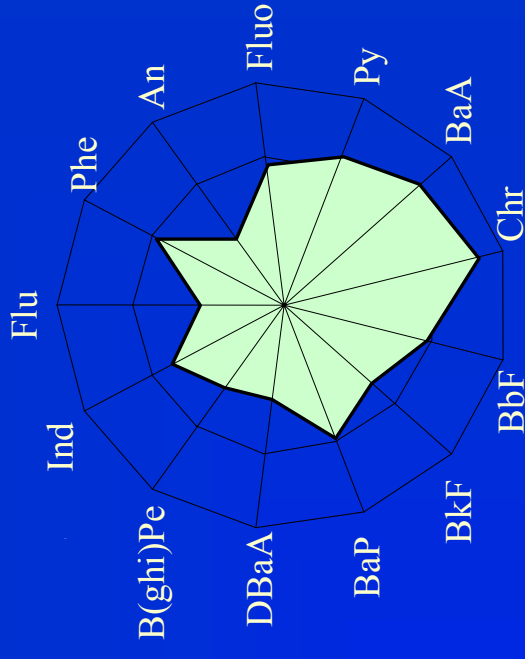


Evolution of prints after the Erika accident

Initial state



ERIKA



ERIKA print

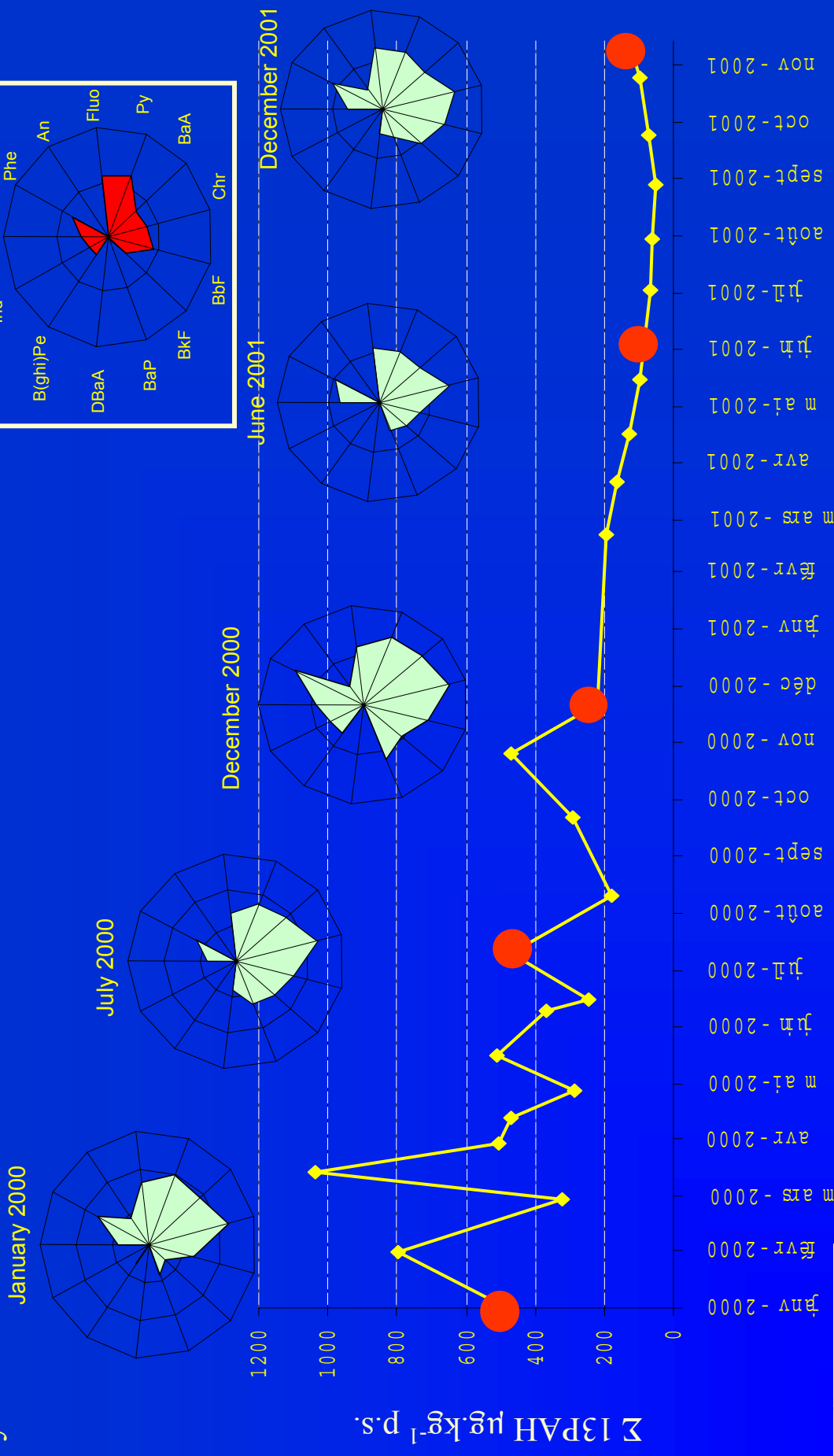
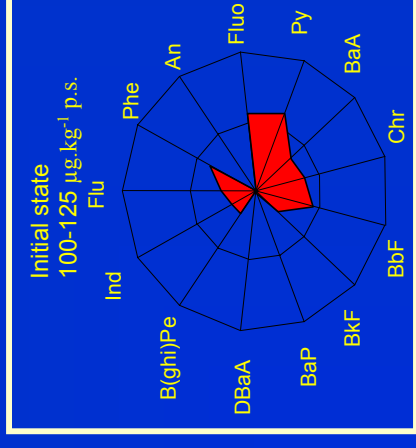
On all monitoring stations

December 1999 - December 2001

Persistence of the fuel from the ERIKA
in coastal environment

Evolution of contamination at Pen Bé headland

Pen-Bé headland (bay of the Vilaine)
Oysters



Assessment of monitoring

- Efficient management, minimised impact
- Interest of reference data
- Spatial and temporal evolution of contamination levels and composition
- First results on return to initial state

Questions...

- Choice of indicators? (environmental / health monitoring)
- Widen range of parameters?
- More precise assessment of the environmental impact (return to initial state ? Long-term effects on organisms ?)



We wish to thank everyone who contributed to the setting up and good functioning of this monitoring process:

On the field, to collect samples: coastal DEL laboratories of Concarneau, La Trinité sur mer et Nantes, RH /Lorient, RA/LCPL Bouin, Shellfish farmers and other professionals who allowed us to access to production sites and all volunteers from the IFREMER center in Nantes;

For analyses: Rouen municipal and regional laboratory;

For checking and exploiting our results: DEL /PC, DEL/AO and the trainees at our laboratory

For their financial participation: La Direction de Pêches Maritimes et de l'Aquaculture et la Préfecture de Loire – Atlantique, co-ordinator of the POLMAR plan: