



■ Consequences of human disturbances on the common sole population



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Outline

- Essential fish habitat
 - estuaries and coastal waters
 - notably for common sole
- Important human pressure
- What are the effects of human pressure on fish populations ?
- Evaluating consequences of habitat degradation
 - Coupling Generalized Linear Models and Geographical Information System
 - Evaluate historical production
- Transfer to population model
 - Coupling
 - Larval drift IBM
 - Matrix population model
 - Estimate the respective influence of different anthropogenic pressure
 - degradation of coastal and estuarine nursery habitat & fishing mortality




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Application in the eastern Channel

- 1. Sole juveniles nurseries map
 - Coupling GLM and GIS

Sole
 Nursery grounds → { Influent factors (known exhaustively)
Bathymetry
Sediment

Model of habitat suitability
 Nursery = f(Bathy, Sediment)
 + spatial heterogeneity
 ↓
 Exhaustive Knowledge
 of juvenile habitats

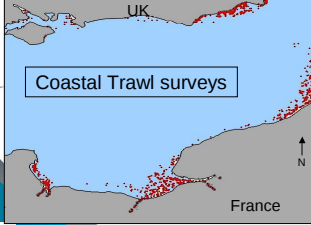



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Statistical model: data

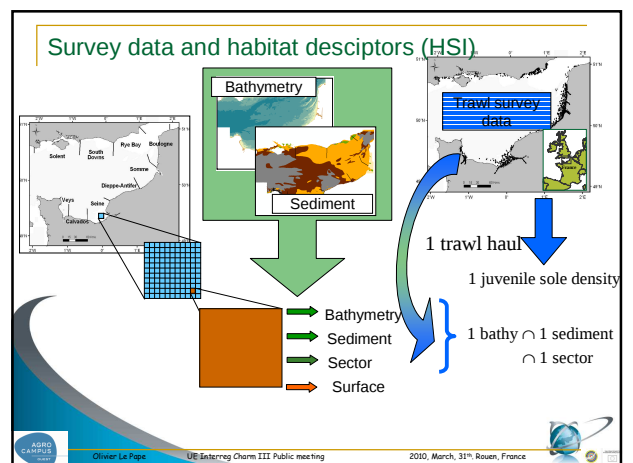
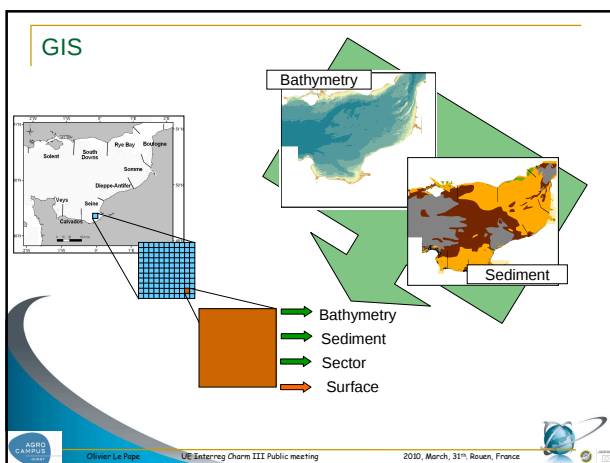
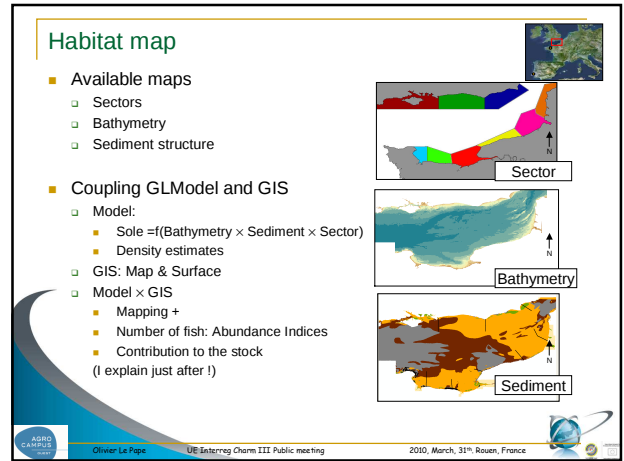
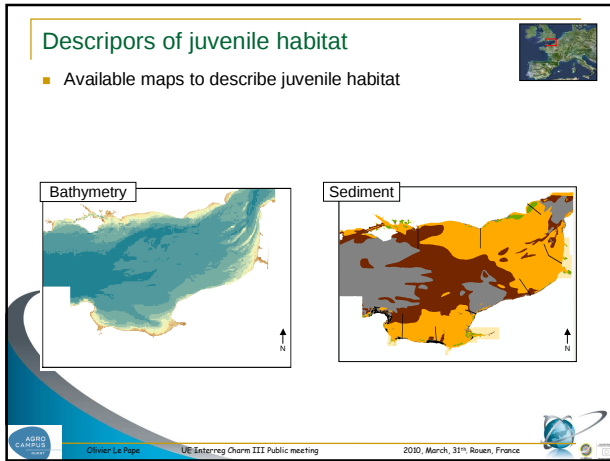
- Trawl surveys in eastern Channel
 - From 1974 to 2007
 - French and English coasts
 - > 5000 trawl hauls in September
 - Factors : bathymetry, sediment structure, sector
 - 0-group juvenile sole (young of the year, ≈ 6 months in September)

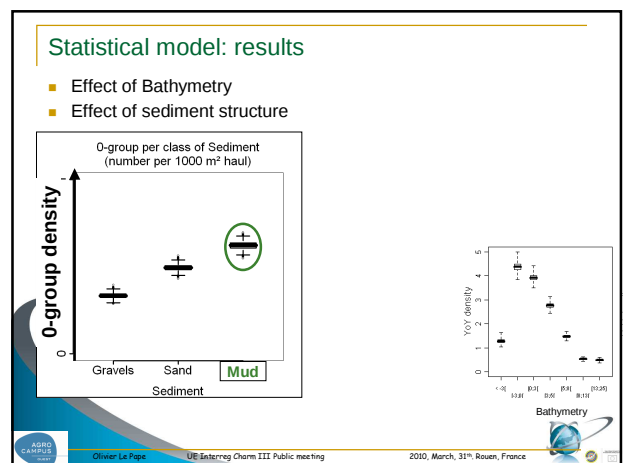
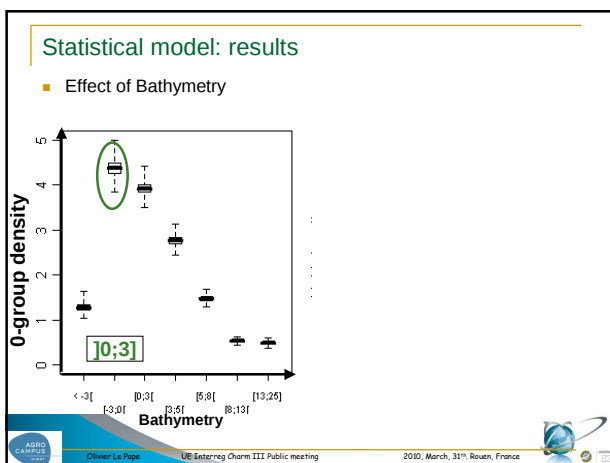
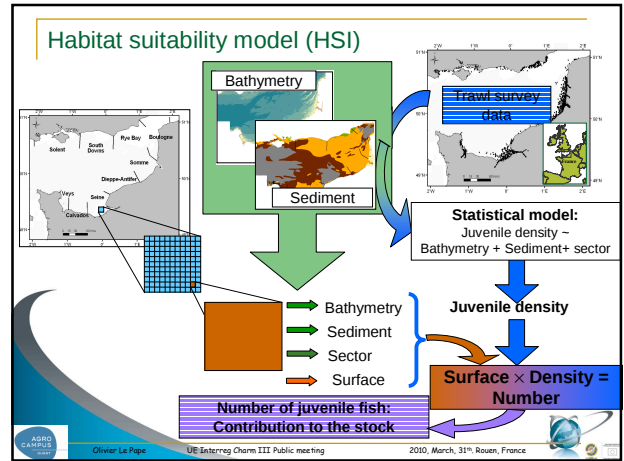
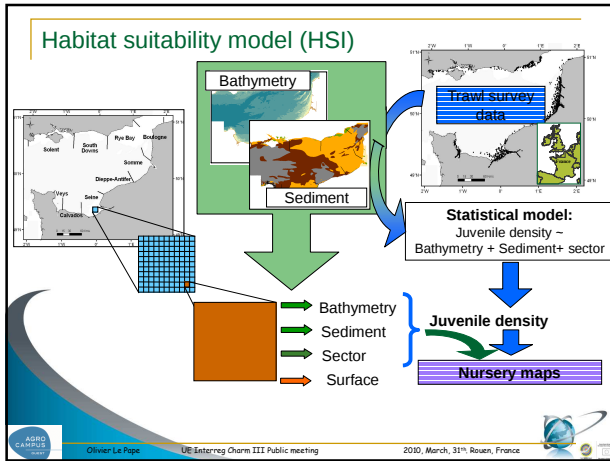
Coastal Trawl surveys

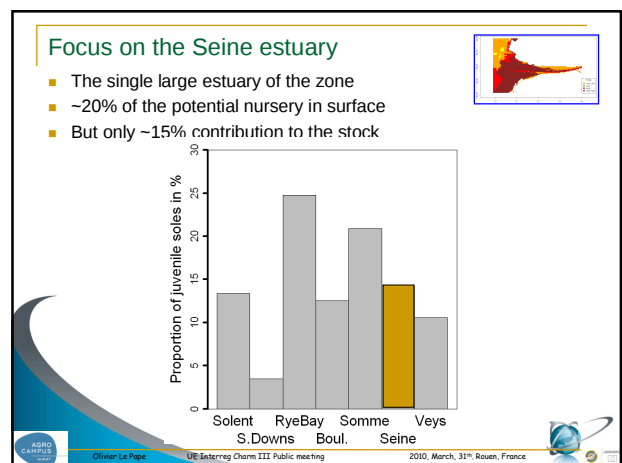
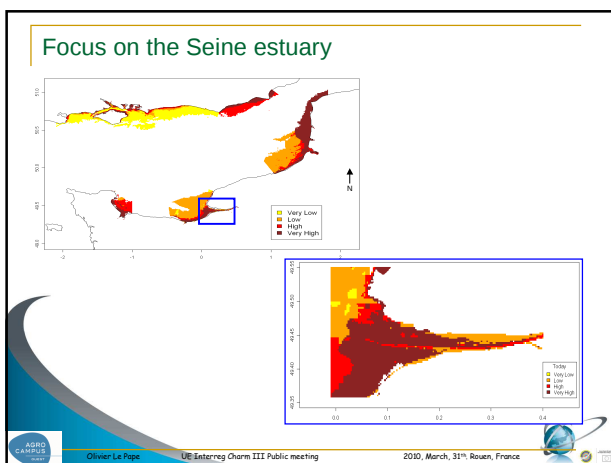
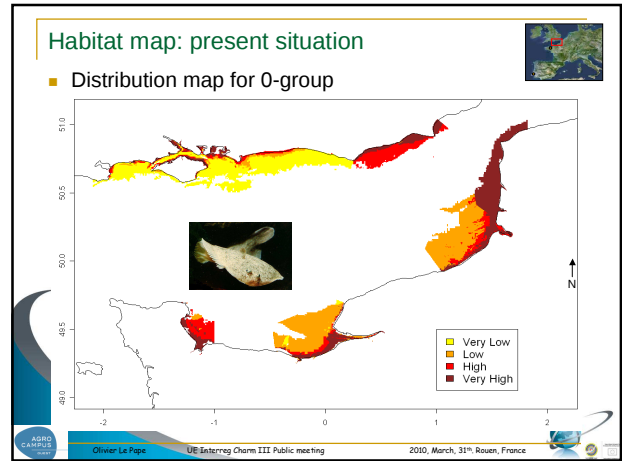
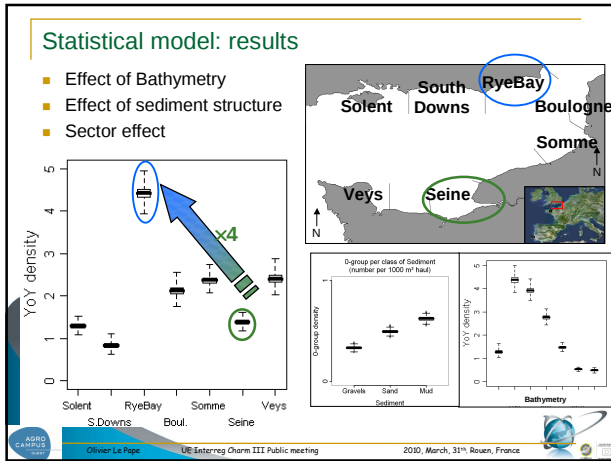


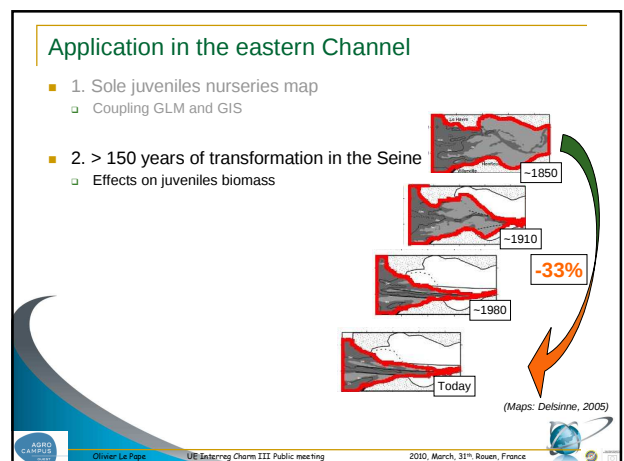
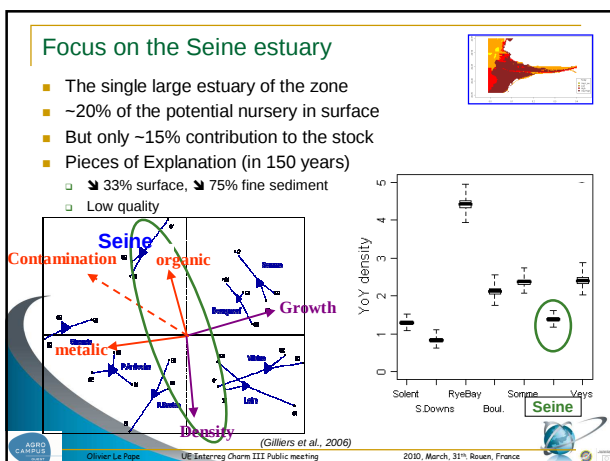
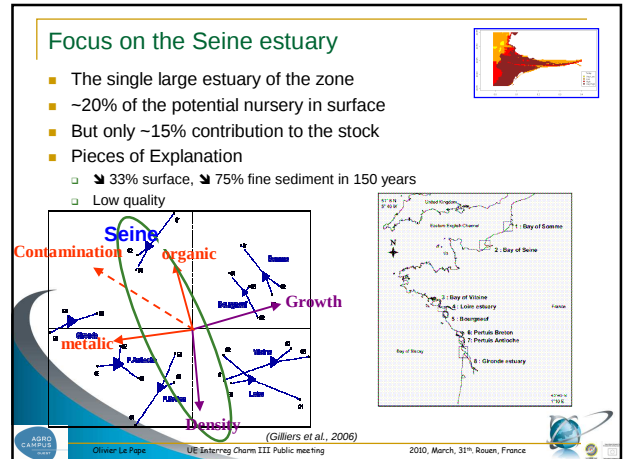
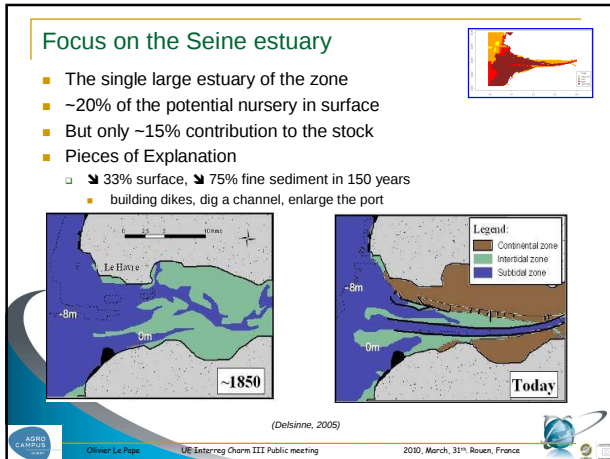


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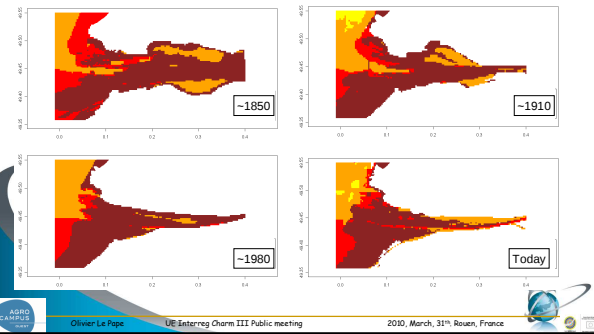






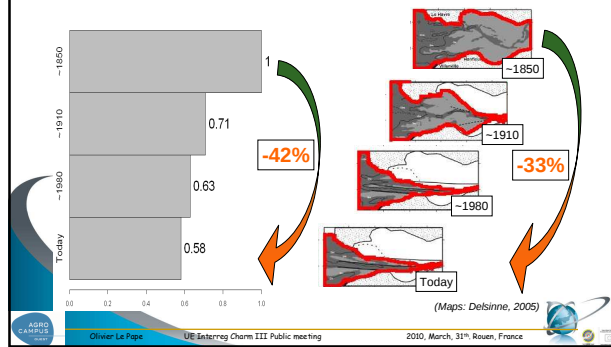
Historical maps

- Hypothesis: the Seine quality is constant over time



Abundance index

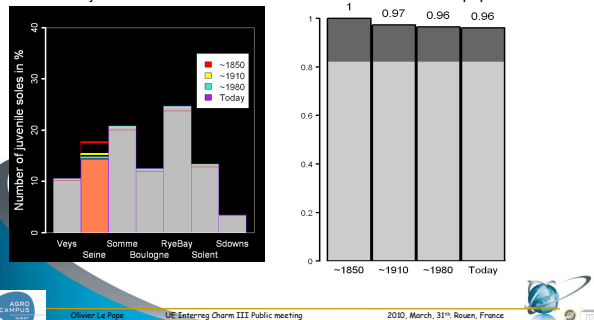
- 42% of Seine production lost
- 33% of surface lost



Total stock of juveniles

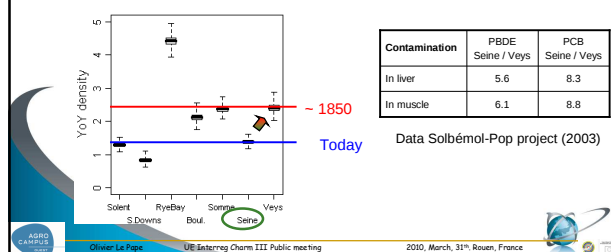
- Loss of 4 % of total 0-group juveniles

Loss of juvenile and Seine contribution at the Eastern Channel population scale



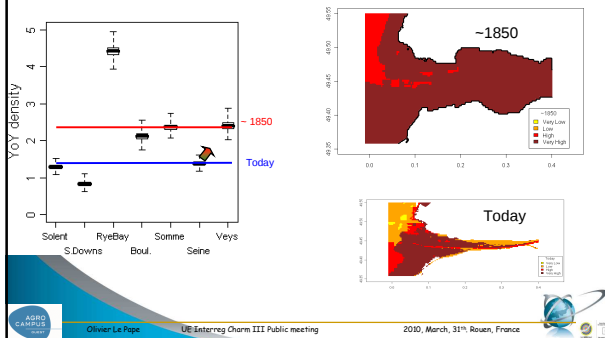
Application in the eastern Channel

- Sole juveniles nurseries map
 - Coupling GLM and GIS
- > 150 years of transformation in the Seine estuary
 - Effects on juveniles biomass
- If the habitat quality was good in the Seine estuary ?



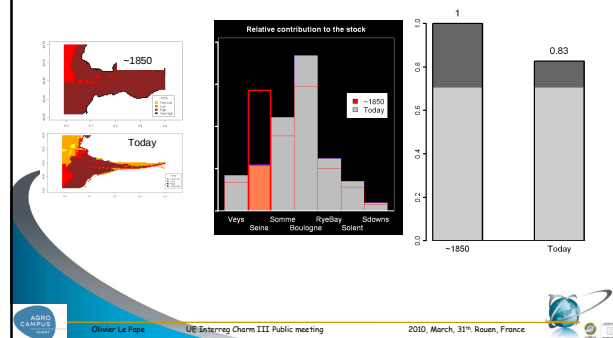
If the Seine was a “contamination safe” sector ?

- Seine with a “Bay of Veys effect” in the 1850s



If the Seine was a “contamination safe” sector ?

- Seine with a “Bay of Veys effect” in the 1850s
- Loss of 17% of total 0-group juveniles population

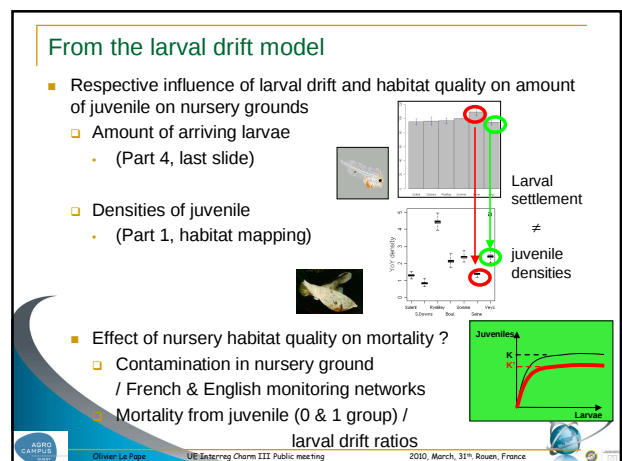
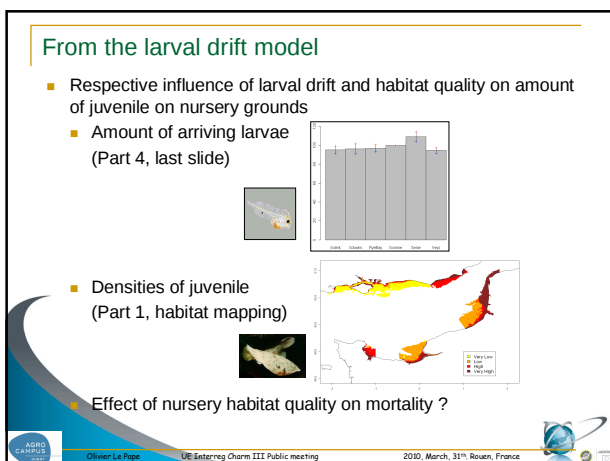
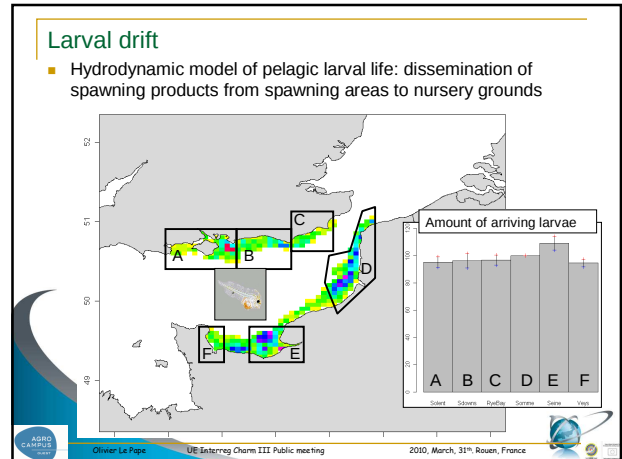
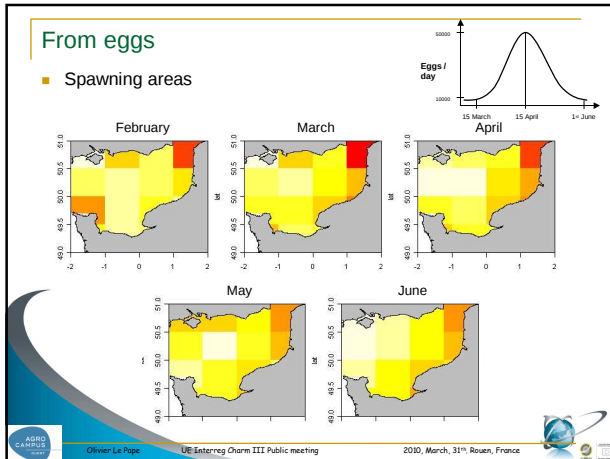


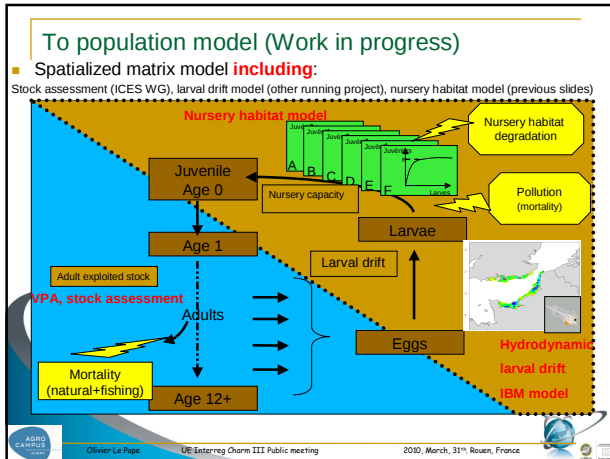
Conclusion

- The Seine estuary
 - Today: 15% contribution in eastern Channel
 - During the last 150 years :
 - 33% surface lost
 - 42% potential nursery in the Seine estuary
- Eastern Channel population
 - From 4% (constant quality) to 17% (Bay des Veys quality) decrease of total 0-group juvenile population
- Sharp decrease in sole population
- Consequences on fishing activities

Application in the eastern Channel

1. Sole juveniles nurseries map
 - Coupling GLM and GIS
2. > 150 years of transformation in the Seine estuary
 - Effects on juveniles biomass
3. If the habitat quality was good in the Seine estuary ?
4. Perspective: population model
 - Estimate the respective influence of different anthropogenic pressure
 - degradation of coastal and estuarine nursery habitat & fishing mortality





- ### To population model (Work in progress)
- Estimate, on the whole life cycle of the common sole, the influence of :
 - Degradation of coastal and estuarine nursery habitat
 - Habitat size
 - Habitat quality
 - Increased mortality of larvae and juvenile
 - Consequences of lower survival and altered fecundity on future reproduction, including the effect of fishing.
 - Fishing pressure
 - Mortality on older sole and population structure
 - At the population scale (Eastern Channel)
 - On fisheries
 - impacts of anthropogenic disturbances on ecosystem services

- ### 5. Transfer to Marxan (future work)
- From the previous parts of the work
 A tool to design marine protected areas and their effects
 In accordance with others advances in the Charm III project
- 5.1. Sole nursery habitats (part 1)
 with their respective influence on population renewal (part 2)
- 5.2. Possible introduction of spawning habitats (part 2)

■ Schedules :

- Population model: 2010
- Transfer of the results to Marxan: 2011

Thanks for attention
 Questions ?
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