Approche systémique des pêches

Boulogne-sur-Mer 2008

Population responses to environmental forcing : approaches to model and monitor habitat characteristics

Pierre Petitgas[(1)], M. Huret[(1)], B. Planque[(2)], J. Massé[(1)], L. Pecquerie[(1)], S. Lehuta[(1)], C. Struski[(1)], M. Woillez[(1)]

[1] IFREMER, EMH, Nantes, France

Organisation of life cycle patterns

Monitoring the environment and suitability for fish

Modelling habitat characteristics

Perspectives

Ifremer

Forçages externes

Environnement

Activités humaines

Population

Démographie, Abondance, Traits de vie
Diversité contingents, Comportement
Occupation habitats
Connectivité larvaire

Facteurs internes :

modulation des forçages

Réponse

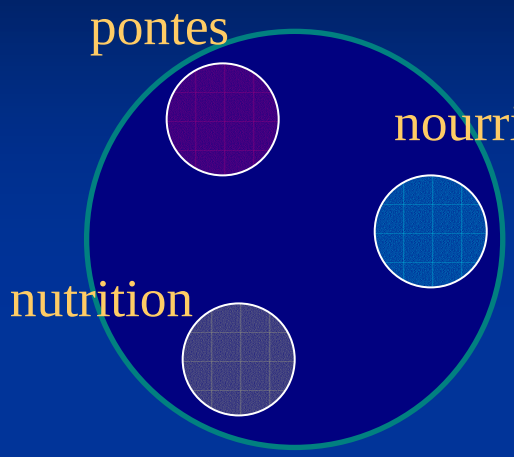
At low abundance, within population diversity has a key role

Ifremer

Organisation spatiale du cycle de vie

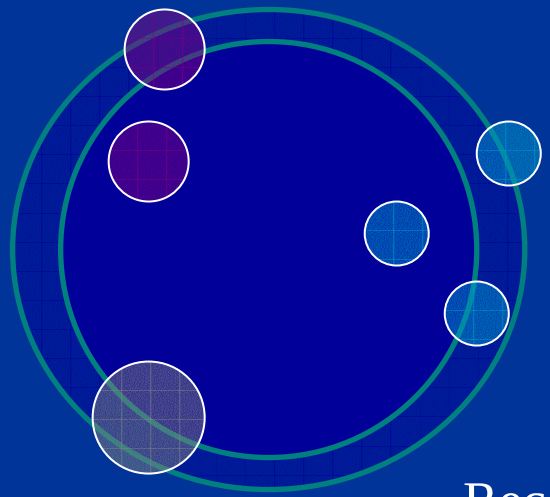
Comportement, contingents : Variations dans cycle de vie

Hypothèse ‘explicative’: Entrainement



Cycle déterminé maintenu par forçage environnemental

Dispersion = perte



Population = plusieurs contingents en interactions

Cycle maintenu par mémoire et entrainement = tradition

Dispersion = innovation

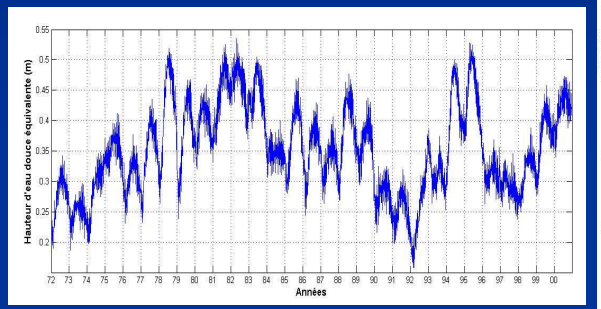
Reconstitution stock avec cycle spatial différent

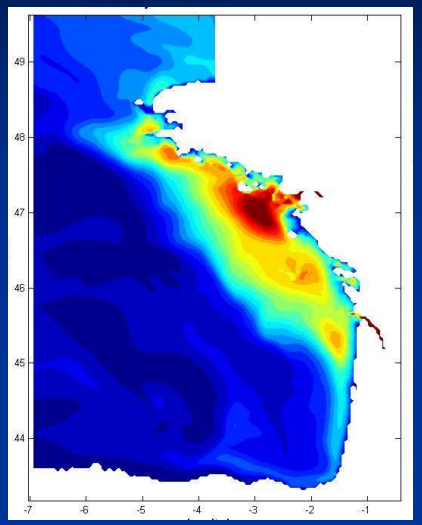
ICES, 2007

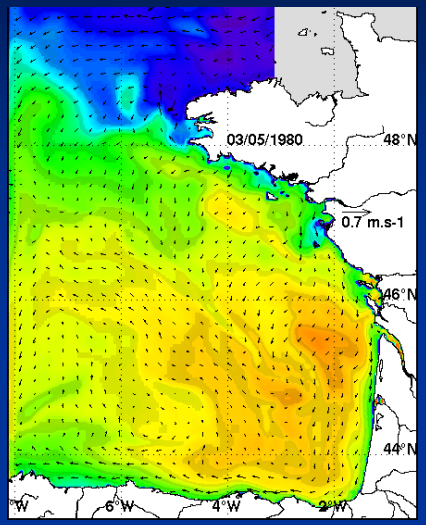
Océanographie Opérationnelle: produits pour l'halieutique, 1970 - actuel

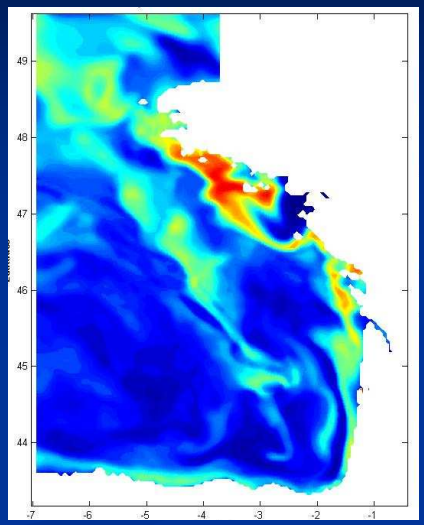
Cartes d'indices

Séries temporelles









'Panaches', Température, Courants, Prod.Primaire

Surveillance (indicateurs)

Modèles couplés/forcés (IBM larvaire / DEB) coupler tout le cycle de vie

Régressions (recrutement, habitats)

Integrated Ecosystem Assessment

Ifremer

Habitat models

Glossary of habitat characteristics with definition and estimation methods

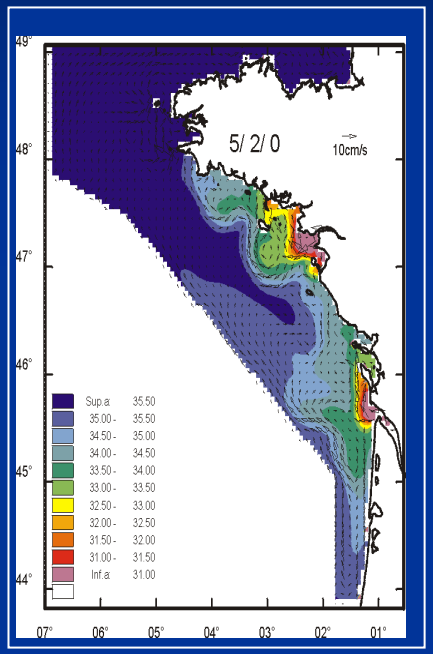
Terminology	Definition	Estimation Method
Potential habitat	Necessary conditions (physiology)	GAM applied to 0/1 data Physiological tolerance
Preferred habitat	Necessary conditions for high concentrations	Quotient plots Cumulative functions GAM (0/1 data) * GAM (pres.only data) Quantile regression
Realised habitat	Part of the potential effectively occupied	Empirical Orthogonal Functions (EOF)
Suitable habitat	Conditions supporting a biological function (e.g., growth, spawning)	Individual-based bioenergetic model
Essential habitat	Key area for population viability	Spatialised matrix population model

Application to : climate change predictions ; spatial management ; restauration ; conservation

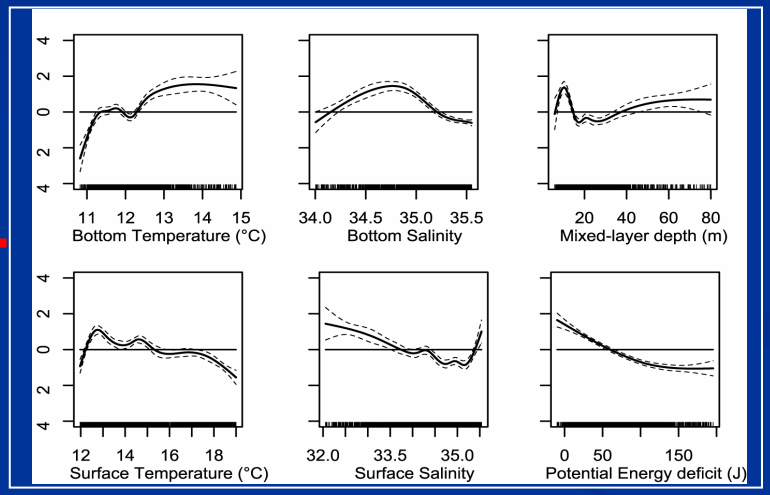
Ifremer

HABITATS POTENTIELS

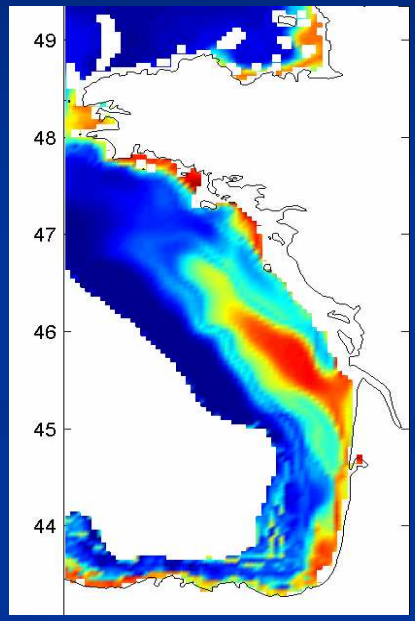
Simulation modèle hydro-dynamique 3D



GAM



Habitats potentiel de ponte



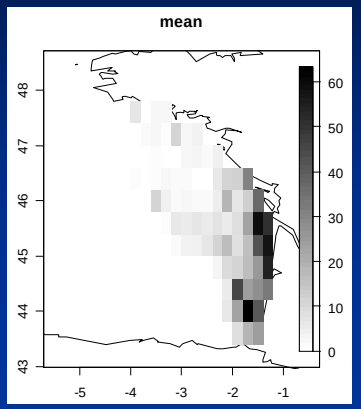
Planque et al., 2007

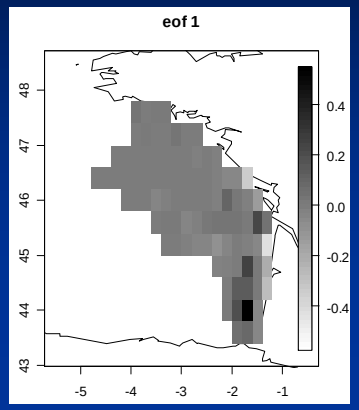
Anchois : habitat potentiel caractérisé par TS, SS, Stratification

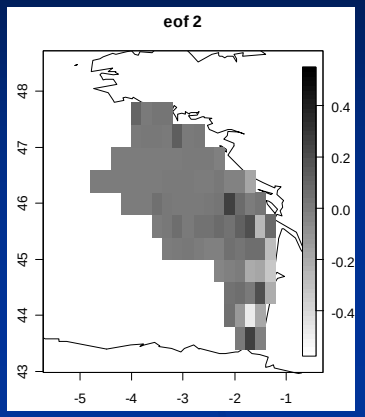
Ifremer

HABITATS REALISES

Mean (x) | eof 1 (x) | eof 2 (x)

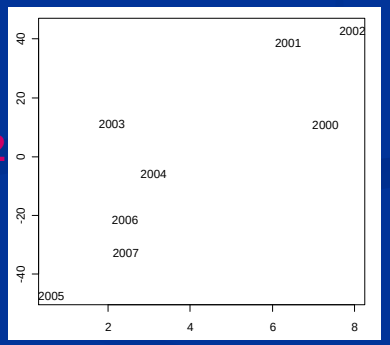
$Z(x,t) =$ 

$+ U1(t)$ 

$+ U2(t)$ 

Use eof decomposition

and relationship of amplitudes to a covariate

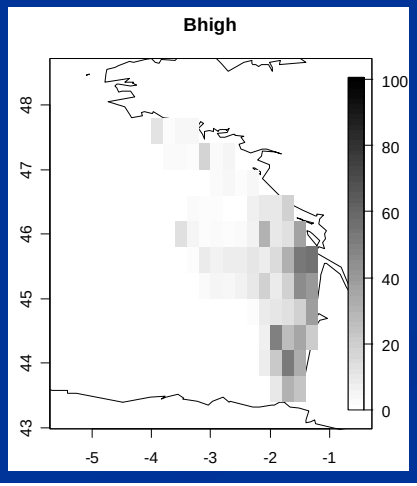
U2 

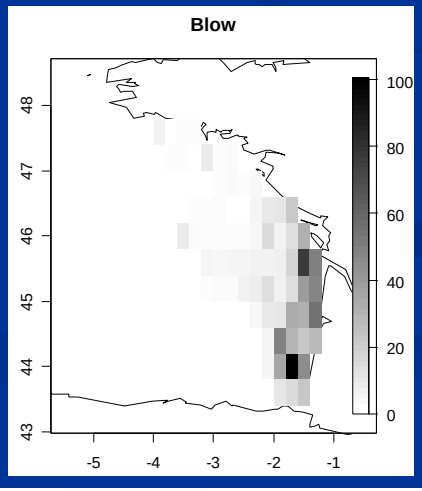
Biomass

to predict

scenario-based

realised habitats





Petitgas et al., 2008

Ifremer

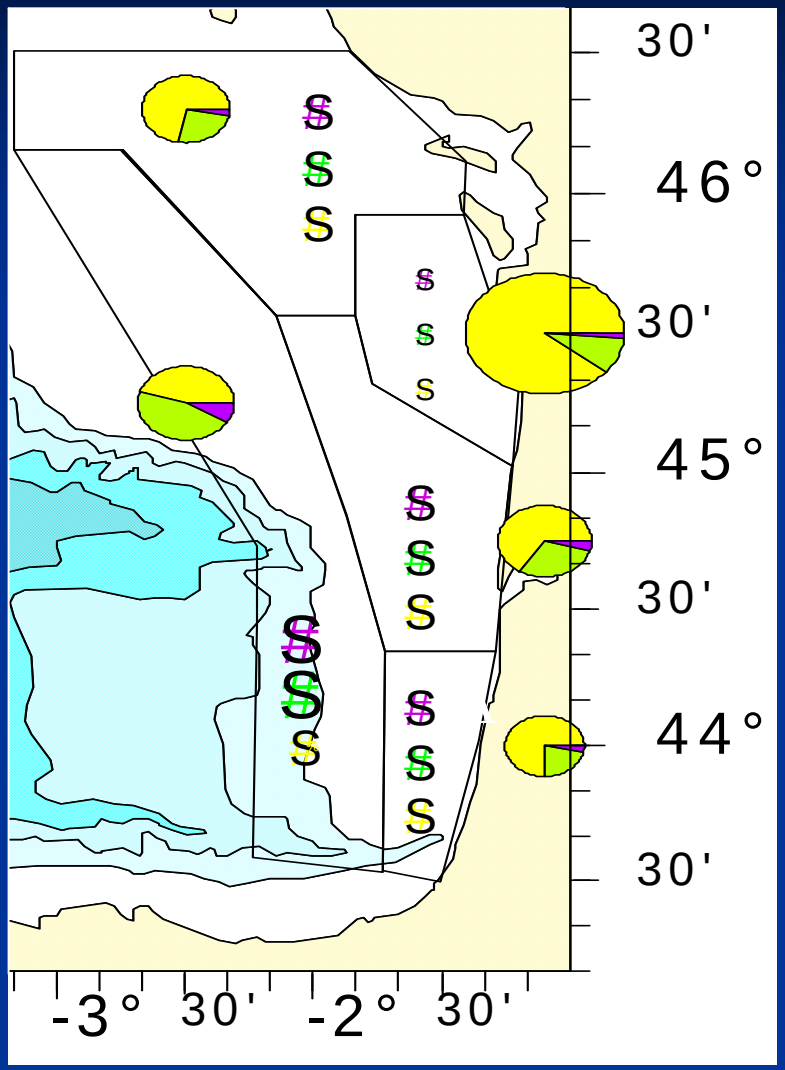
HABITATS ESSENTIELS

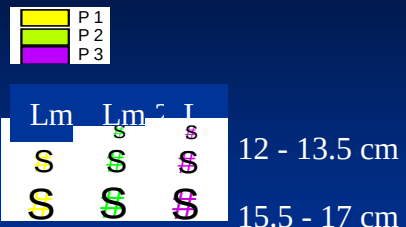
Anchois

Modèle matriciel

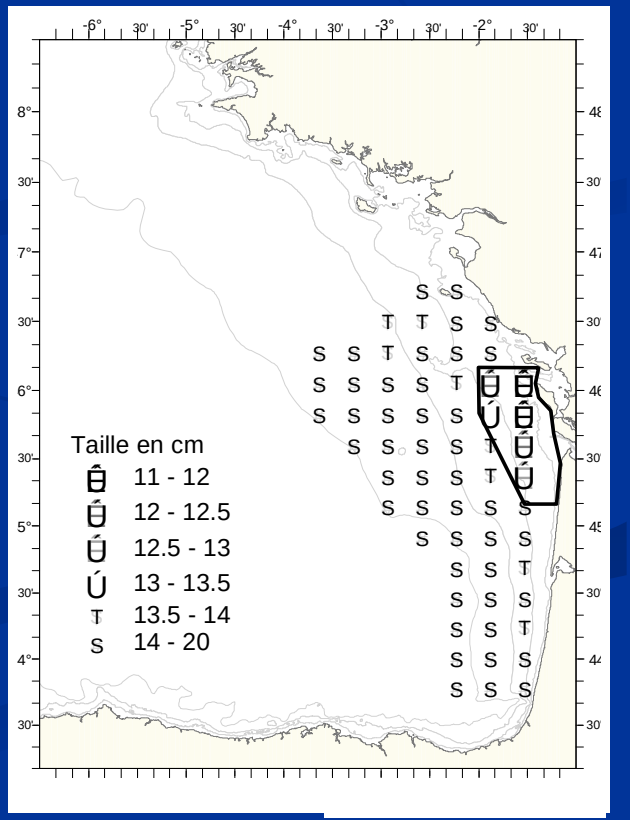
Cartographie géostatistique

Proposition zone à protéger





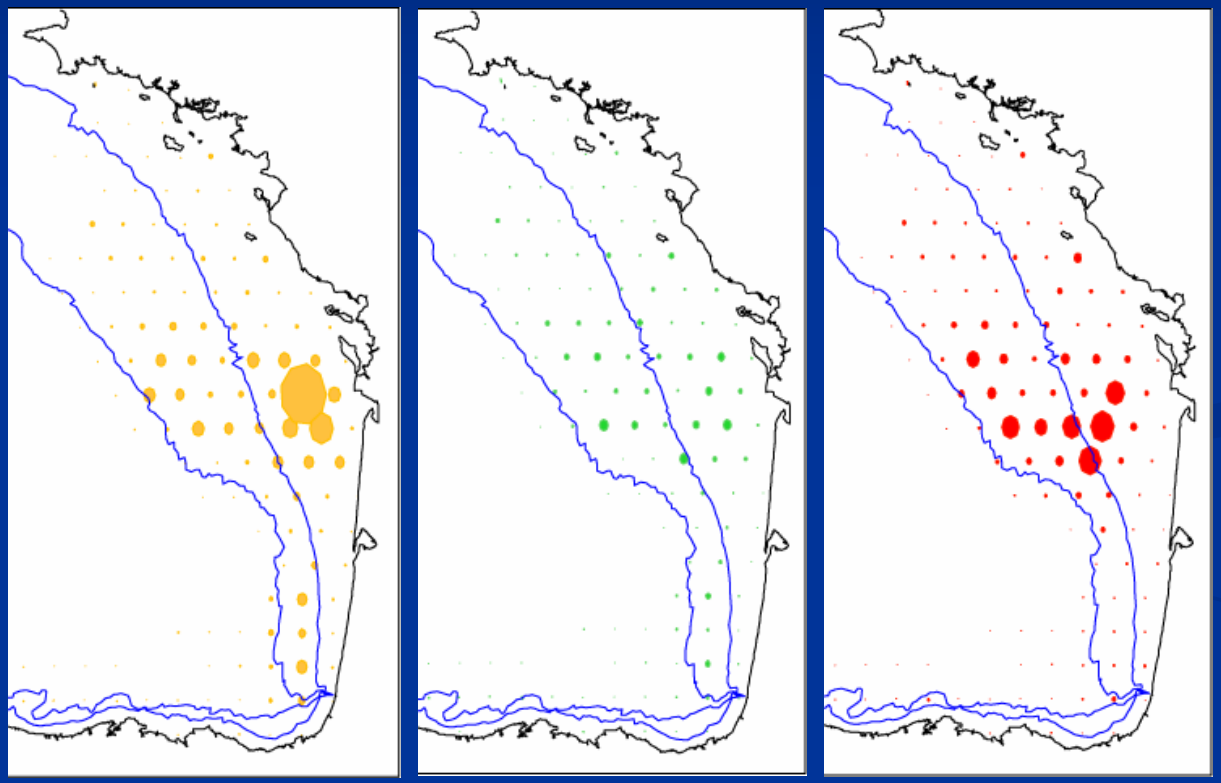
AVIS : TAC ou Fermeture zone ?



Vaz et al., 2002 ; Petitgas et al., 2005 ; CSTEP, 2005

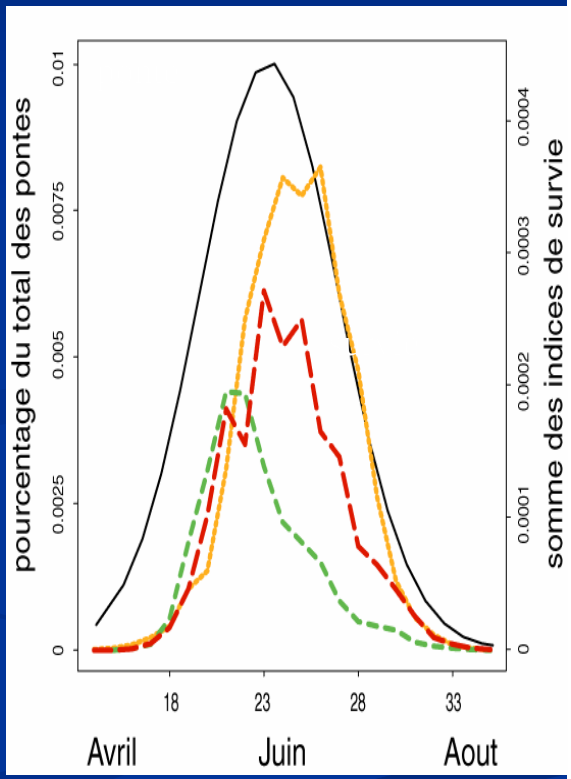
Origine des micro-cohortes de survivants - IBM larvaire

spatiale



1997 1998 1999

temporelle



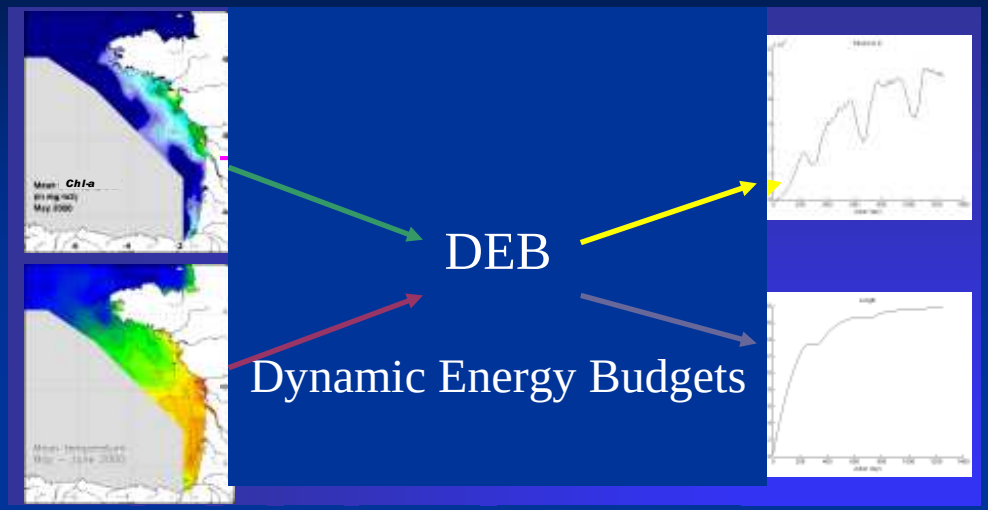
97 98 99

Allain et al., 2007

Ifremer

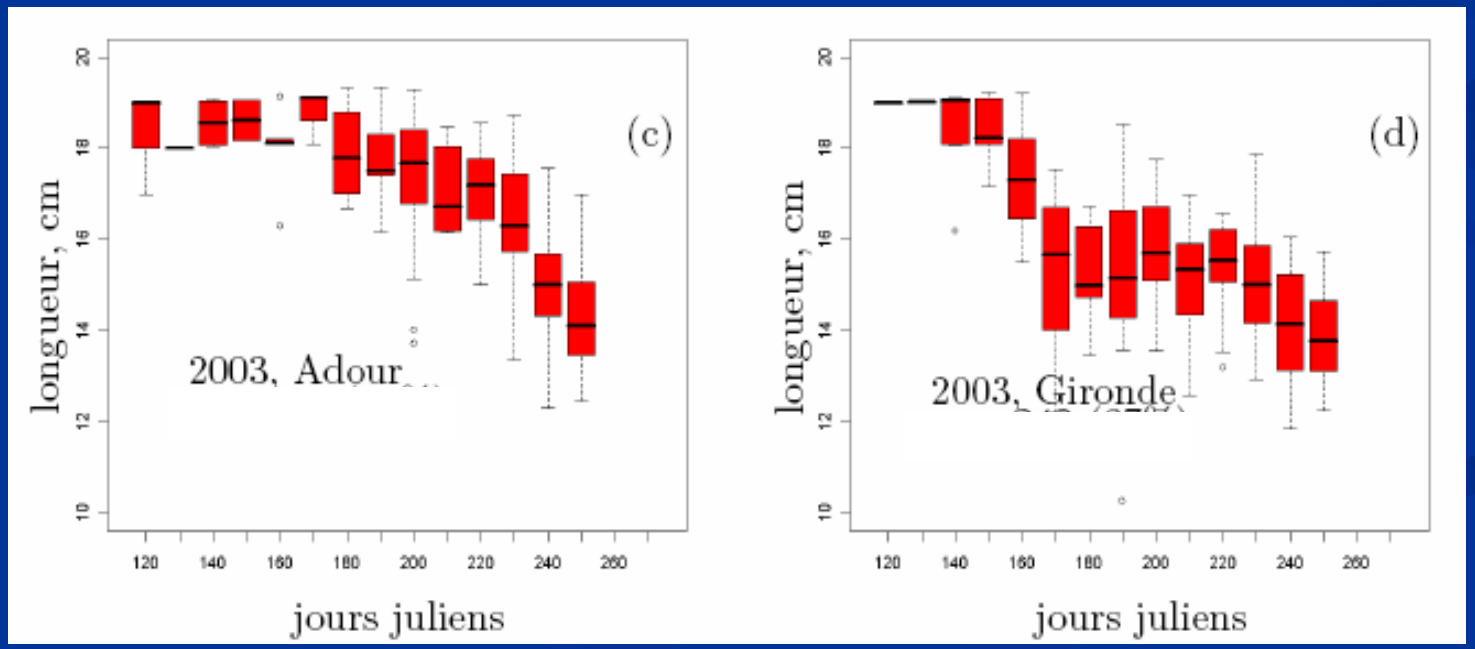
HABITATS 'DEFAVORABLES'

Zones à bilan énergétique non viable estimées par DEB [Thèse L. Pecquerie]



Interaction entre histoires de vie et d'environnement

Payer la maintenance en fonction réserves, temp, nourriture ?



Taille des individus physiologiquement limités

Ifremer

Perspectives

Objectives :

Monitor environment and spatial distributions

Predict recruitment, spatial occupation, functionality of habitats

Define management options based on habitats essential to population viability

To achieve these challenges :

→ Develop warehouse of modular tools (integrate processes and scales)

*** Combine tools : statistical (characterise pattern) ; mechanistic (predict functionality)**

*** Use operational oceanography products, develop monitoring systems**

*** Develop full life cycle IBM-Fish models forced by lower trophic & predator fields**

*** Develop simulation platforms : dynamic interaction in space of environment, fishing and populations**

→ Program observations at sea : distribution, individual behaviour, physiology and connectivity (parameterise/calibrate/validate models).

Ifremer


Ifremer