

Avis de soutenance de thèse de doctorat

La soutenance de thèse de Mlle Ghoufrane Derhy sous la direction du Pr Karima Khalil se déroulera le Samedi 30 Novembre 2024, à 10h, à l'amphithéâtre de l'ESTE.

Title: Small pelagic stocks dynamics and assessment in the Moroccan Atlantic coast (Chub mackerel, *Scomber colias*): Data-driven Modelling approach

Abstract:

The Moroccan Atlantic waters are among the world's most productive ecosystems due to coastal upwelling, supporting a high biomass of small pelagic species such as the Atlantic chub mackerel, which is in decline. Despite their ecological and economic importance, managing these resources is challenging due to their rapid population fluctuations. Moreover, there is a lack of information on the dynamics and status of the chub mackerel stock, especially in the central and southern coasts of Morocco. This study aims to assess fluctuations in chub mackerel stock abundance in Moroccan Atlantic waters by examining the impacts of fishing pressure, environmental variability, and interspecies interactions. To address the complexity of stock dynamics, we developed a data-driven approach integrating multiple modelling tools, ranging from data-limited models to full state-space age-structured and ecosystem-based models. We applied two distinct stock assessment models: a surplus production model (SPiCT), testing scenarios such as Schaefer's dynamics, and the second length-based approaches (LBSPR) combined with the LIME model. Environmental factors (e.g. salinity and chlorophyll concentrations) were correlated with stock biomass trends and integrated into the WHAM framework to assess their influence on stock recruitment. Furthermore, the Ecopath model was implemented to evaluate the trophic role of small pelagic species among 43 fish species/functional groups within a 275 km² area of the Mogador MPA, located in the central Moroccan Atlantic coast. Stock assessment results indicate that the chub mackerel stock was fully to overexploited from 2016 to 2020, with biomass below MSY and fishing mortality above MSY. Environmental factors, particularly lower salinity and increased chlorophyll concentration, correlated with higher biomass estimates, reflecting stronger upwelling conditions, especially in the southern region, probably the species' wintering area. While chlorophyll concentration significantly influenced recruitment variability, leading to density dependent limitations as the spawning stock biomass increased. However, incorporating these environmental factors into the models did not substantially change the stock status estimates. The trophic relationship analysis highlights the crucial "wasp-waist" role of small pelagic species in

the ecosystem, where changes in their biomass due to fishing impact both upper and lower trophic levels. Additionally, model statistics indicate that the Mogador MPA ecosystem generates more energy than it consumes, suggesting it is a developing system with low stability and maturity. The study provides valuable insights into Atlantic chub mackerel stock dynamics and trophic relationships, evaluating the strengths and limitations of various models. While the flexible, data-driven methodology developed in this study can be applied to other stocks, further research is needed to refine stock unit structures and improve data accuracy for more precise assessments. Keywords: small pelagic, chub mackerel stock, population dynamics, Data-limited models, integrated analysis, fishing mortality, environmental covariates, trophic relationships, Moroccan Atlantic coast