Annex 3: Presentation Abstracts

Acoustic Methods to Characterize Populations, Ecosystems, Habitat, and Behaviour

Probabilistic school classification of multiple species in acoustic echograms based on machine learning

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Multifrequency trawl-acoustic surveys are used worldwide for continuous monitoring of pelagic ecosystems. Acoustic backscattering energy partitioning in different species is typically done by visual scrutiny of the echograms with the aid of trawl species composition, which may be subjective and time-consuming. Alternatively, machine learning techniques may provide well-stablished, objective, and reproducible methods for automatic school classification in acoustic echograms. The pelagic ecosystem is a diverse one, where many species co-occur in space and time, being mixed catches very common during scientific surveys. However, most of the school classification models are built using single species composition trawls due to difficulties to assign a class to each school in multispecific trawls. The present study has the aim of developing and comparing different probabilistic multivariate models to identify pelagic species in mixed scenarios based on trawl catch proportions. In addition to the standard predictors, a novel variable, collective mean TS per nautical mile measured on the periphery of the schools, has shown to play an important role in species discrimination. The methods were applied on data from 7 consecutive years of an acoustic survey in the Bay of Biscay. Preliminary results yielded classification performances near 95 % in classifying 10 different pelagic species.

Acoustics surveys in North-West Africa reveal a spatial shift of small pelagic fish related to intense warming

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In the southern part of the CCLME, northward shifts in the distribution of sardinella and other species have been attributed to an intense warming trend in sea surface temperature. Such

warming is higher than 0.5 °C per decade in the southern part of the CCLME, the greatest increase in SST observed in the tropical Atlantic. The acoustics abundance of *Sardinella aurita*, the most abundant species along the coast, has increased in the subtropics and fallen in the intertropical region. Small pelagic acoustics assessment surveys confirm a robust northward shift of around 180 km per decade in *S. aurita* habitat, while *S. maderensis* did not move significantly. Spatial shifts in biomass from 70 to 230 kilometres were observed for six others exploited small pelagic species during the last 20 years, at similar ranges to those recorded for surface isotherms in their habitat. The change occurs more quickly in the central part of the CCLME. This shift widely overlaps national boundaries and combined to overexploitation adds a new threat on the pelagic fish resources. Such results are an advocacy to continue to lead acoustics survey on small pelagic in the West Africa.

Spatiotemporal variability of micronekton at two fronts in the central North Pacific

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The North Pacific Subtropical Frontal Zone (STFZ) seasonally aggregates economically important fish and protected species, hypothesized in results of enhanced prey biomass due to convergence at the Subtropical Front (STF) and a sharp northwards increase in primary productivity, the Transition Zone Chlorophyll Front (TZCF), both prominent in the STFZ. Given existing data gaps, characteristics of micronekton, forage for top predators, were investigated using multi-frequency active acoustics and the effects of STF and TZCF accessed from a combination of *in situ* and satellite environmental data. Results of this study show a significant increase in micronekton biomass across the STF with differing taxonomic composition from south to its north. The Pacific Decadal Oscillation as well as mesoscale events and subsurface processes were indicated to play important roles in affecting micronekton distribution and/or biomass. The largescale 2014-2017 extreme warming event positively corresponded with micronekton biomass and changes in its composition in the region, findings that are in agreement with expectations. Results of this work highlight the importance of our need to further our understanding of the role of largescale variability, extreme events, and subsurface processes on micronekton in the region's ecosystem to improve management of our living marine resources.

Development of a hydroacoustic technique for determination of the orientation of aggregated Baltic herring

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The spatial distribution of fish orientation is a very important factor influencing their target strength (TS), and thus the hydroacoustic assessment of fish biomass. A method is being developed to estimate the orientation distribution of the Baltic herring in schools by comparing the measured herring TS histograms with the TS histograms obtained from the theoretical backscattering model. The target strength data were collected by the National Marine Fisheries Research

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