Heat waves and fisheries, practical integration of operational oceanography into the management of tunas.

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Introduction



EBFM= Ecosystem Based Fisheries Management

CHA

ALL fisheries Management Organizations include the EBFM in their strategic planning



From 1250 fisheries assessment reports analysed only 2% included quantitative ecosystem information

Dolan et al. FR 2016

Introduction

Objectives, Propel and implement EFBM through the integration of environmental variability in the monitoring and assessment process for the sustainability of tunas, TARGET EOV= SST and associated heat waves

Western Mediterranean,

- Biodiversity
 - Biodiversity hot spot

A main Tuna spawning ground,

One of most sensitive areas to heat waves at global scale





Methods







Image http://planettuna.com

International Commission for the Conservation of Atlantic Tunas

Results

Monitoring tools

SUB-REGIONAL MEDITERRANEAN SEA INDICATORS From event detection to climate change



Sea surface temperature

Products used: CMEMS near real-time & reprocessed satellite products in the Mediterranean Sea (14, 1/8°, daily)
 Diagnostics: 2D maps & regional time series of daily means (since 2018) - monthly means (since 2018) - annual means & trends (since 1982)

Daily means

Ocean state (last day)

Maps of the daily sea surface temperature (left) and sea surface temperature anomaly w.r.t. the daily climatology over 1982-2015 (right) for the last available day:



Ocean variability (2018-2021)

Timeseries of the sub-regional daily sea surface temperature for the current year, the last 3 years and the daily climatology over 1982-2015. Marine heat spikes (MHS, when values become higher than the climatological 90th percentile) are highlighted for the current year.



https://apps.socib.es/subregmed-indicators/index.htm Juza & Tintoré (FMS 2020)



Identification of Marine Heat Spikes (MHS) at daily scale Current Date

Results

Monitoring tools



End user oriented design through groups of experts



MEDITERRANEAN SURFACE EXPLORATION TOOL

This tool allows exploring various ocean variables providing information on the sea surface of the Western Mediterranean Sea. These variables include five key Essential Ocean Variables, temperature, salinity, sea level, chlorophyll-a and currents, and two additional variables, temperature and salinity fronts, derived from the EOVs. The information is obtained from the SOCIB Western Mediterranean Operational system and from satellite data provided by Copernicus Marine Service (CMEMS). Oceanographic features can be explored as layers or time series at specific points defined by the user when double-clicking the layer on display. This tool is aimed for a wide range of end users in the field fisheries sustainability, conservation and education. The implementation fully relies on Web Map Services (WMS). All data handled by the tool is publically available from the SOCIB and CMEMS data servers.



Time Series Charts

Double-click on the map in order to see the time serie chart of the selected variable at a given point. You can delete these points using the 'Remove marker' button that appears when a marker is clicked.



http://apps.socib.es/MSET/



Ecosystem Report Cards



Main Bluefin tuna spawning grounds in the Mediterranean



Alvarez-Berastegui et al, 2020a



Indices of abundance

Investigate how SST and anomalies drive Bluefin tuna habitats in the Western Mediterranean Sea



Alvarez-Berastegui et al. 2016



Integrate habitat variability in the standardization of the catches For improved indices of abundance



Alvarez-Berastegui et al. 2020b



Fisheries assessment models



9e+05 6e+05 stock 3e+05 geommean rickersst 0e+00 sst 150000 sst.random year 100000 50000 0.75 0.50 02 0.0

2010

2015

2005

2000

80000

40000



Maximum Sustainable Yield

Total Allowable catches (TACs)

Alvarez-Berastegui et al 2020c

-Implementing EBFM is an objective of all RFMOs responsibles for the sustainability of fisheries at global scale, but most fisheries stocks at global scale are still managed under the framework of single species approach, far from a effective EBFM

-Novel tools on ocean observation, web services and end-user engagement allow developing tools for effective transference of science to society

- Linking environmental variability and ecology of tunas in the western Mediterranean demonstrated the potential for improving scientific advice for fisheries and for advancing towards the practical implementation of EBFM

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References

Alvarez-Berastegui et al. (2016). Pelagic seascape ecology for operational fisheries oceanography: modelling and predicting spawning distribution of Atlantic bluefin tuna in Western Mediterranean. *ICES Journal of Marine Science*, 73(7), 1851-1862.

Alvarez-Berastegui et al. (2020 a) Environmental variability in three major mediterranean tuna spawning grounds: updating sst indicators for the ecosystem report card. SCRS 2020/044, Collect. Vol. Sci. Pap. ICCAT, 77(4): 137-143 (2020)

Alvarez-Berastegui et al. (2020b) Bluefin tuna larval indices in the Western Mediterranean, ecological and analytical sources of uncertainty, SCRS/2020/067, Collect. Vol. Sci. Pap. ICCAT, 77(2): 289-311 (2020),

Alvarez-Berastegui D et al. (2020c), Assessing the applicability of environmental indicators for improving the fisheries assessment of the albacore (Thunnus alalunga) under the A4A approach, SCRS/2020/106, Collect. Vol. Sci. Pap. ICCAT, 77(7): 377-390(2020), 377-390

Juza, M. and Tintoré, J. (2021). Multivariate sub-regional ocean indicators in the Mediterranean Sea: from event detection to climate change estimations, *Frontiers in Marine Science*, 8:610589, https://doi.org/10.3389/fmars.2021.610589.