FISHFORUM 2018 FORUM ON FISHERIES SCIENCE IN THE MEDITERRANEAN AND THE BLACK SEA

OCEANOGRAPHIC TURTLES

OCEAN MONITORING PLATFORMS FOR CONSERVATION AND DYNAMIC OCEAN MANAGEMENT

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FISHFORUM 2018

1 INTEGRATION OF SEA TURTLE TRACKING WITH OCEAN OBSERVING SYSTEMS

2 MONITORING SHIP-BASED ACTIVITIES USING AIS DATA

3 TOWARDS THE DEVELOPMENT OF OPERATIONAL TOOLS

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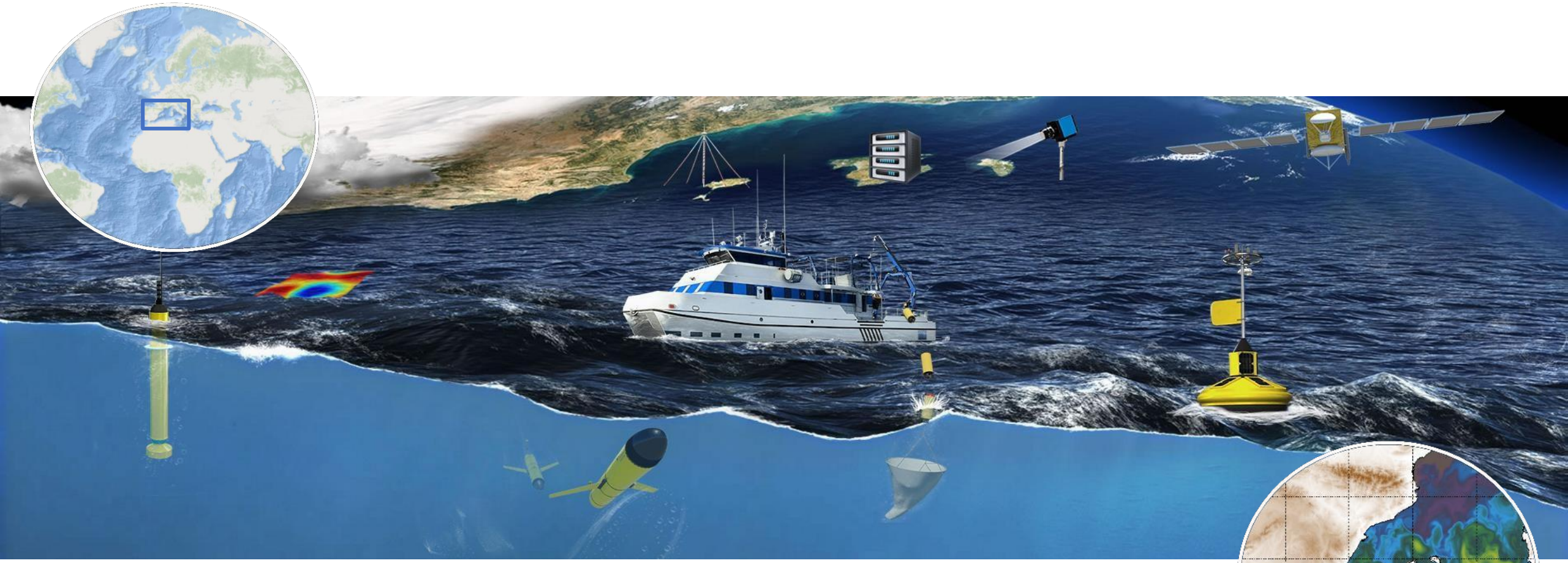
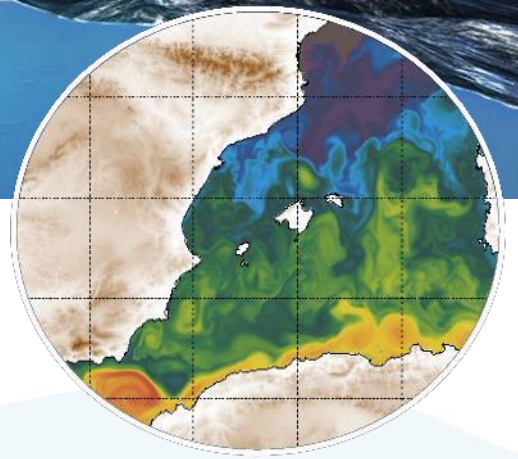
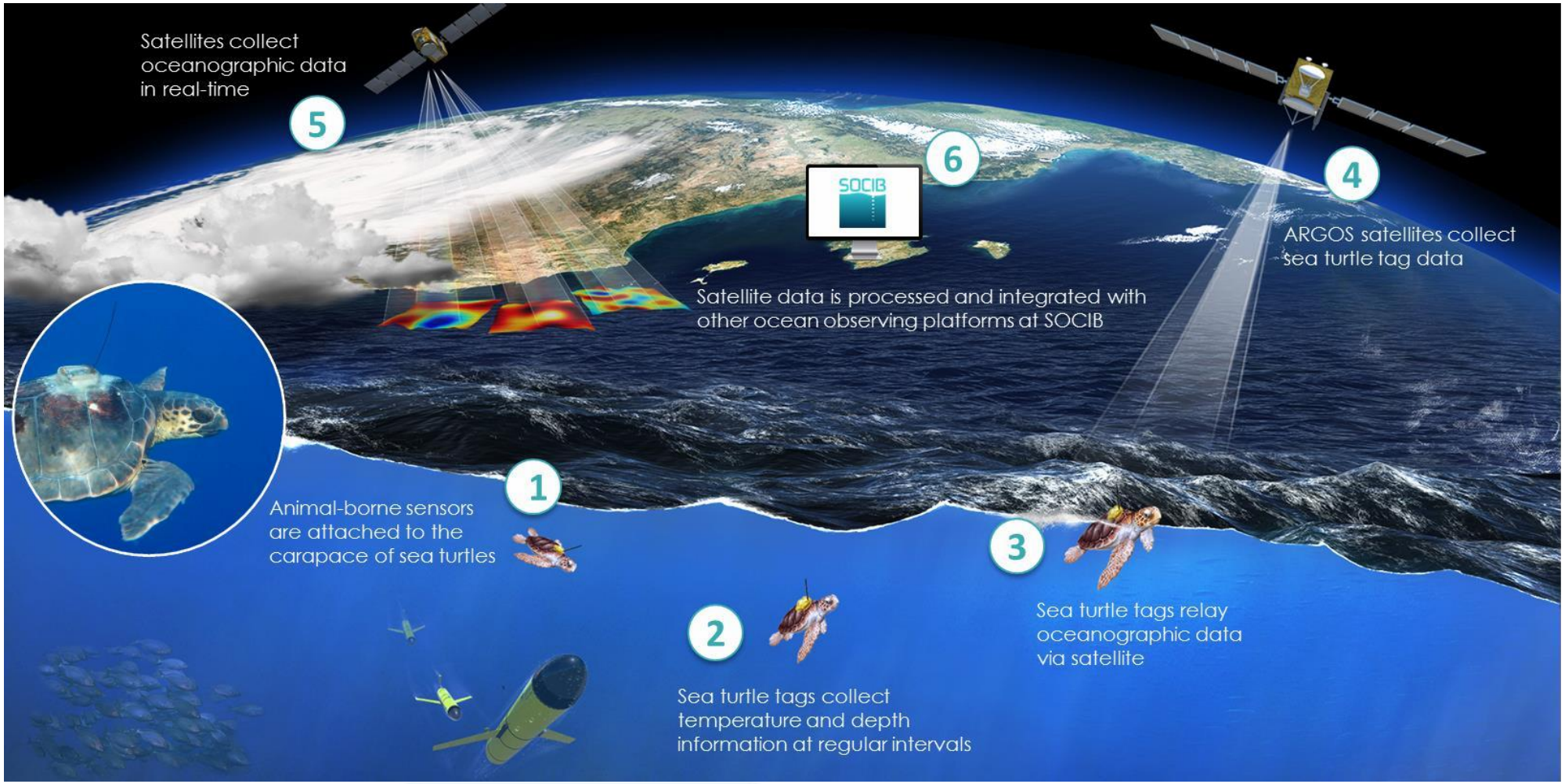
BALEARIC ISLANDS COASTAL OBSERVING AND FORECASTING SYSTEM (SOCIB)





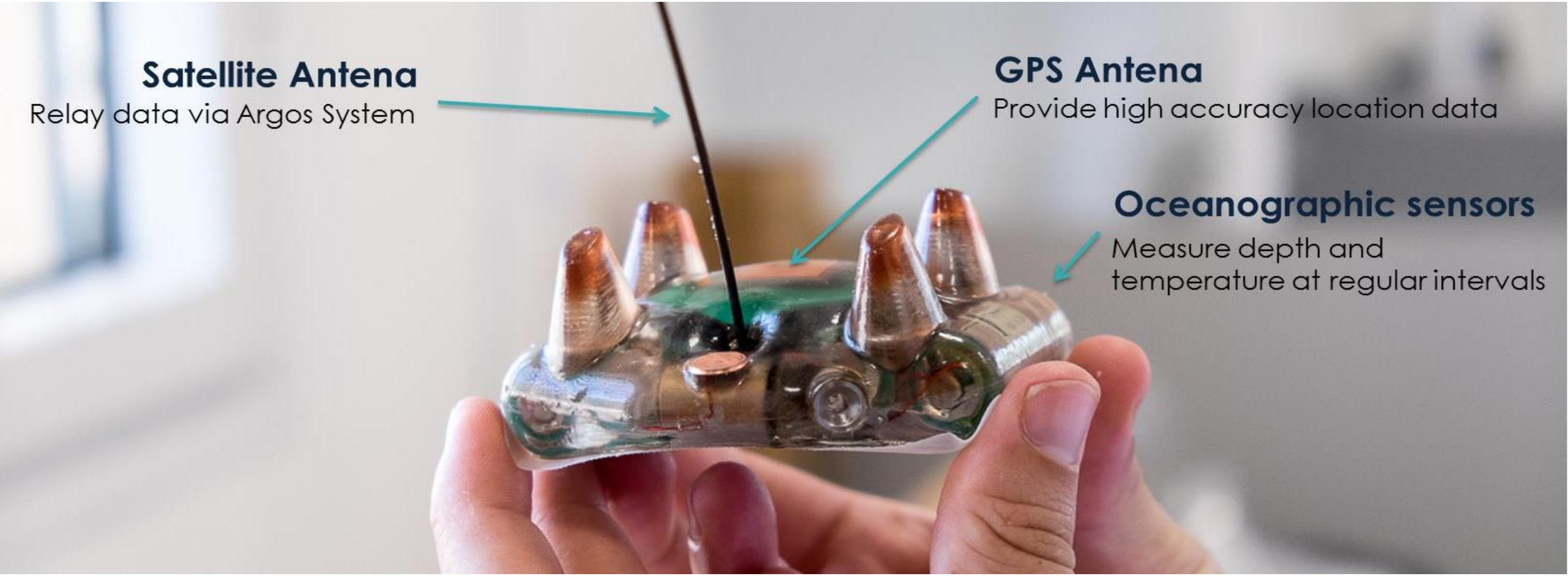
SOCIB provides multi-platform ocean observations -*in stiu* and satellite- and ocean forecasting in near real-time in the Western Mediterranean Sea

ANIMAL-BORNE INSTRUMENTS: A NEW OCEAN OBSERVING PLATFORM



SOCIB is working to integrate satellite tracking of juvenile loggerhead turtles (*Caretta caretta*) with Ocean Observing Systems

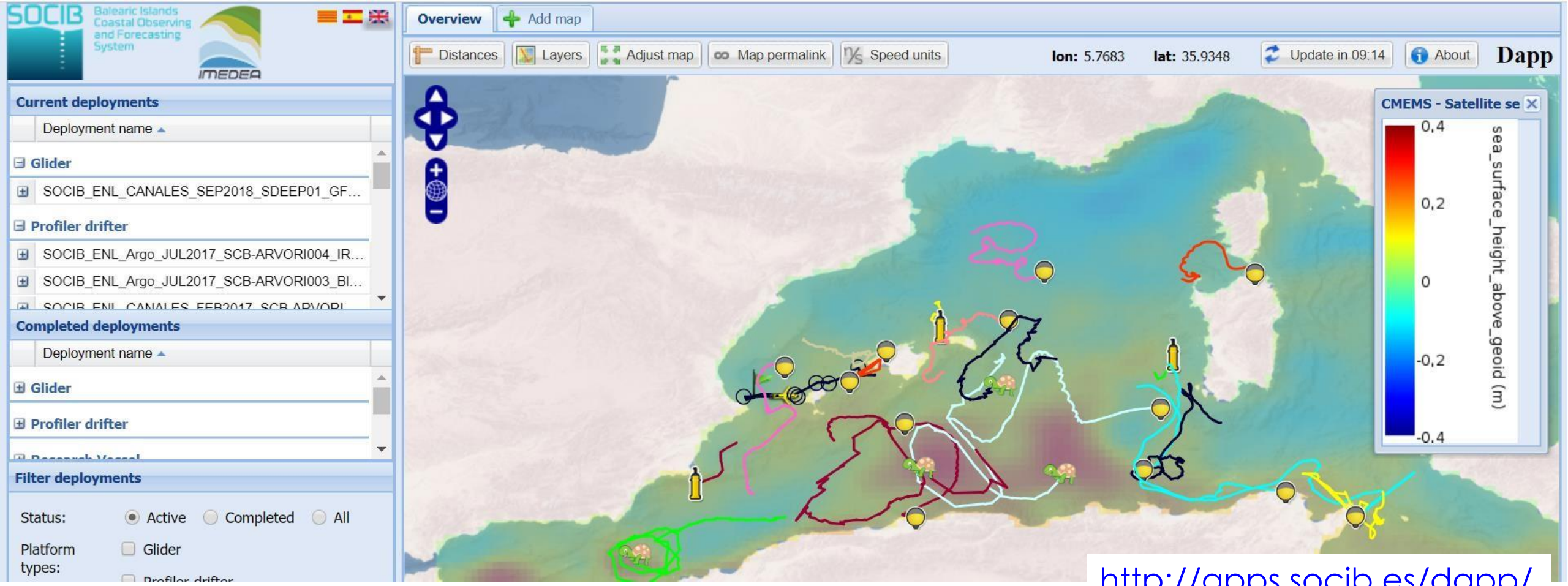
TURN YOUR TAG INTO AN ANIMAL-BORNE INSTRUMENT!



ARGOS platform terminal transmitters (PTT) equipped with pressure and temperature sensors (SPLASH tags, Wildlife Computers) suitable size for juvenile loggerheads (>45 cm CCL)

INTEGRATION IN NEAR-REAL TIME

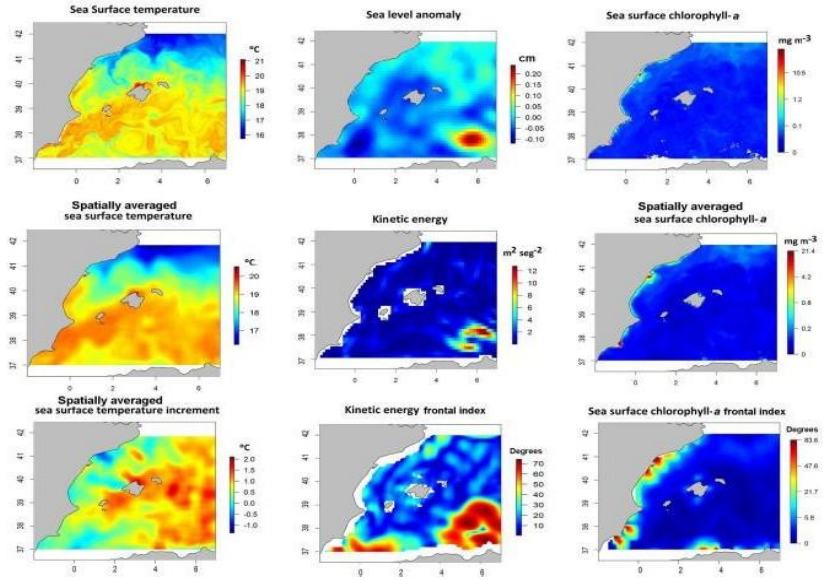
Location data from all platforms is currently integrated into SOCIB Deployment Application (DAPP)



http://apps.socib.es/dapp/

- Satellite tracks are integrated into ocean observing systems, providing simultaneous observations of multiple platforms in near real-time troughout a common marine data management system

INTEGRATION OF DATA-ASSIMILATIVE NUMERICAL MODELS AND REMOTE SENSING OBSERVATIONS



(Alvarez-Berastegui et al 2016)

SATELLITE TRACKING DATA (Location only)

- Loggerheads in oceanic phase (28-83 cm CCL)
- Long-term dataset: 2003-2017 (n=51)
- Source: Alnitak (unpubl.), Eckert et al. 2008, Cardona & Hays (2018).

ENVIRONMENTAL DATA

- Numerical models from CMEMS: SST, Salinity, PP, Phytoplankton
- Remote sensning from CMEMS: SLA, EKE, CHLa
- Bathymetry from EMODnet
- Derived products from SOCIB (gradients)

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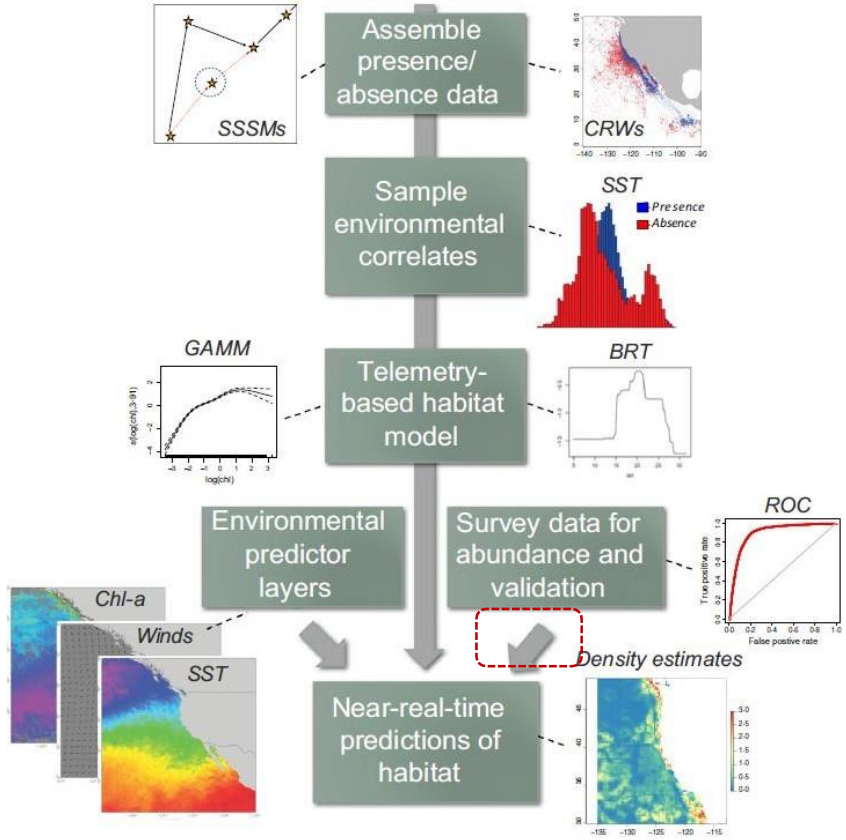
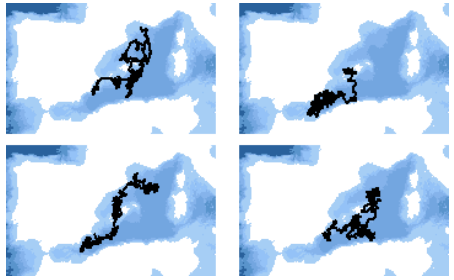
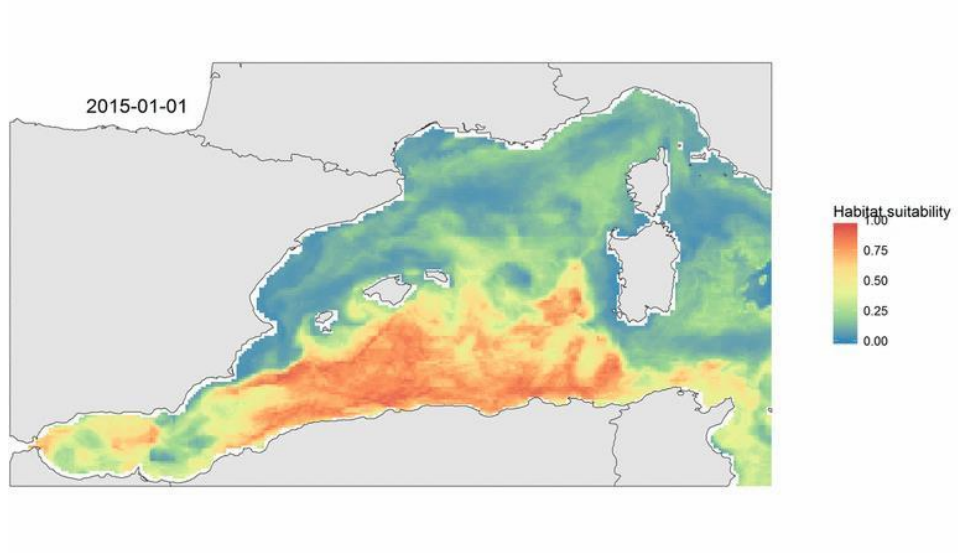


Modelling workflow (adapted from Hazen et al. 2016)



Pseudo-absences
100 CRW simulations per turtle



Daily predictions of the species-niche model (MaxEnt). Salinity, Bathymetry, SST and EKE are the 4 main predictors

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SOCIB AIS INFRASTRUCTURE AND APPLICATIONS OF INTEREST

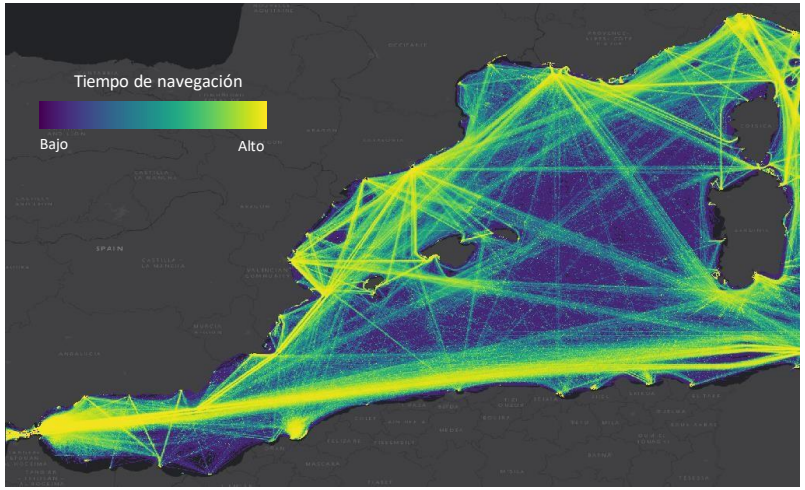
COLLISION RISK WITH AUVs

HUMAN IMPACTS

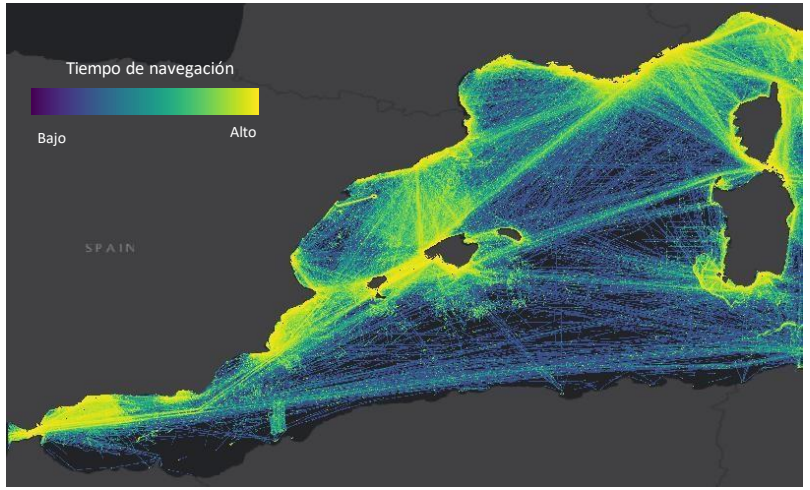
MARINE SPATIAL PLANNIG

MAPPING HUMAN PRESSURES USING AIS

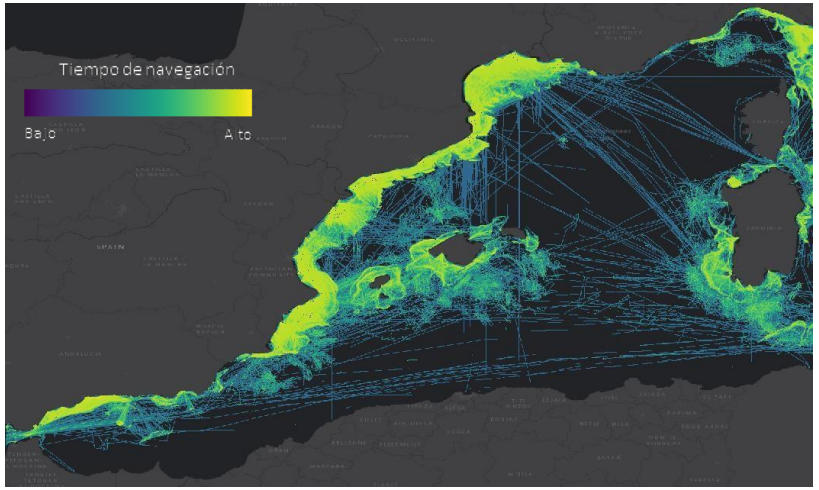
Navigation time per sectors



Domestic
(cargo, passenger, tanker)



Recreational



Fisheries

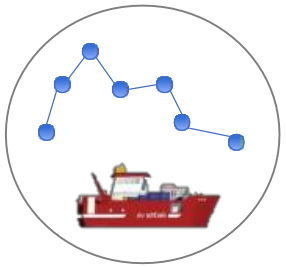
LONGLINE FISHING ANALYSIS

AIS Data

EU Fishing Fleet

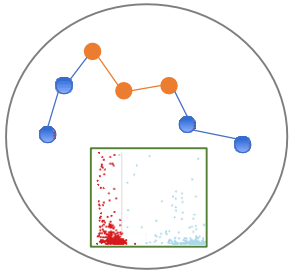
Matching algorithms

Longline trajectories

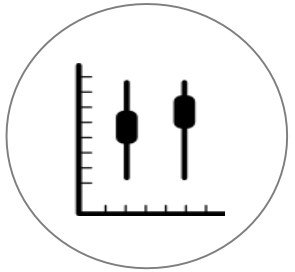


Expectation-Maximization Binary Clustering

Fishing identification

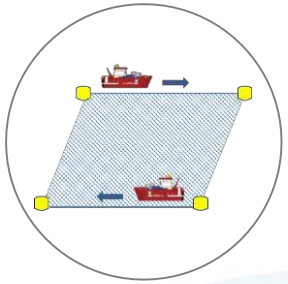


Segmentation Analysis



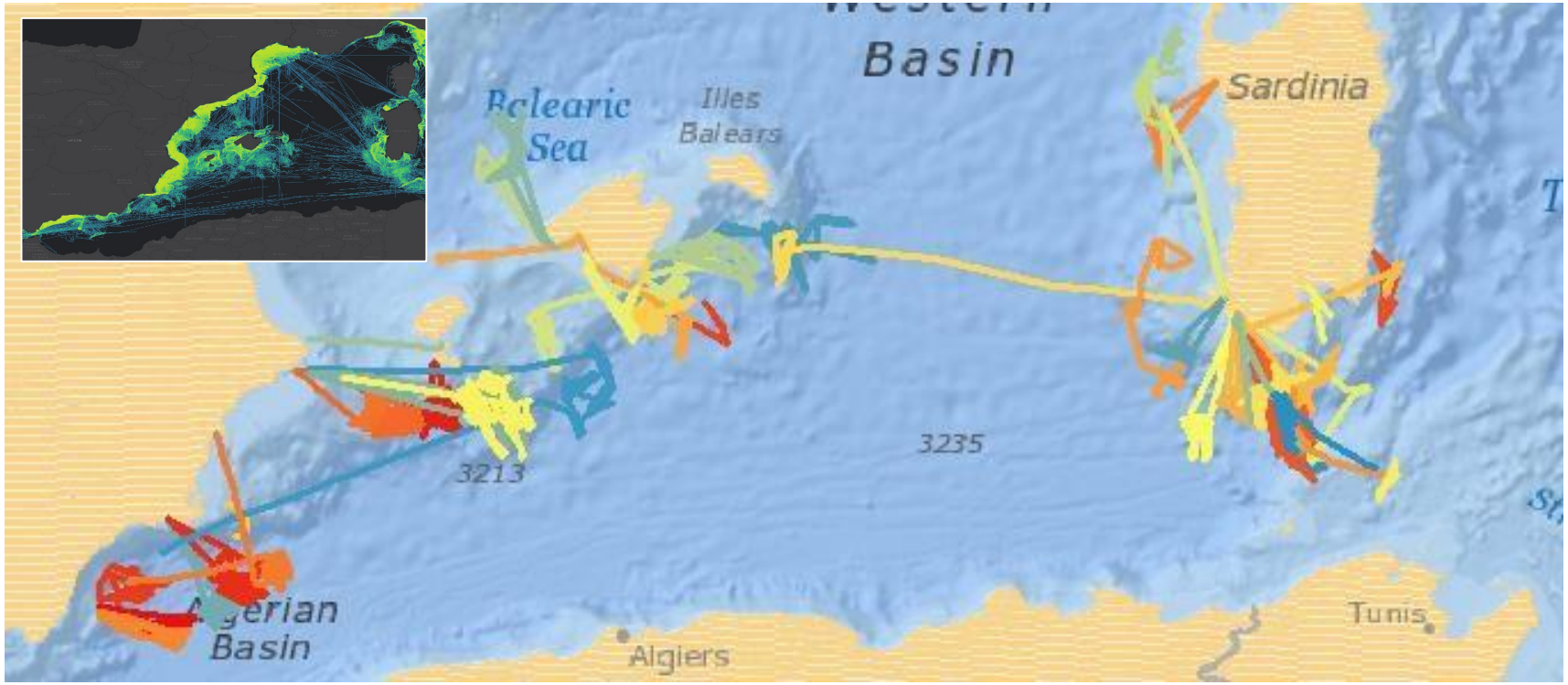
Setting & **Hauling** Identification

Minimum Convex Hull Polygon

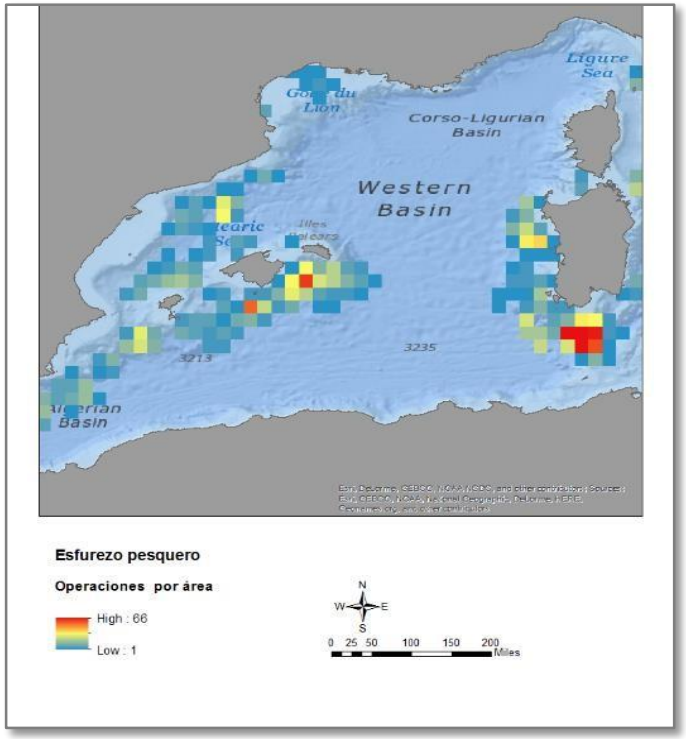


Fishing Effort

LONGLINE FISHING ANALYSIS



Longline trajectories from 22 days of data (2017-06-21 to 2017-07-12), extracted from the overall AIS data (right)



Density of "hauling" operations (n = 527) detected

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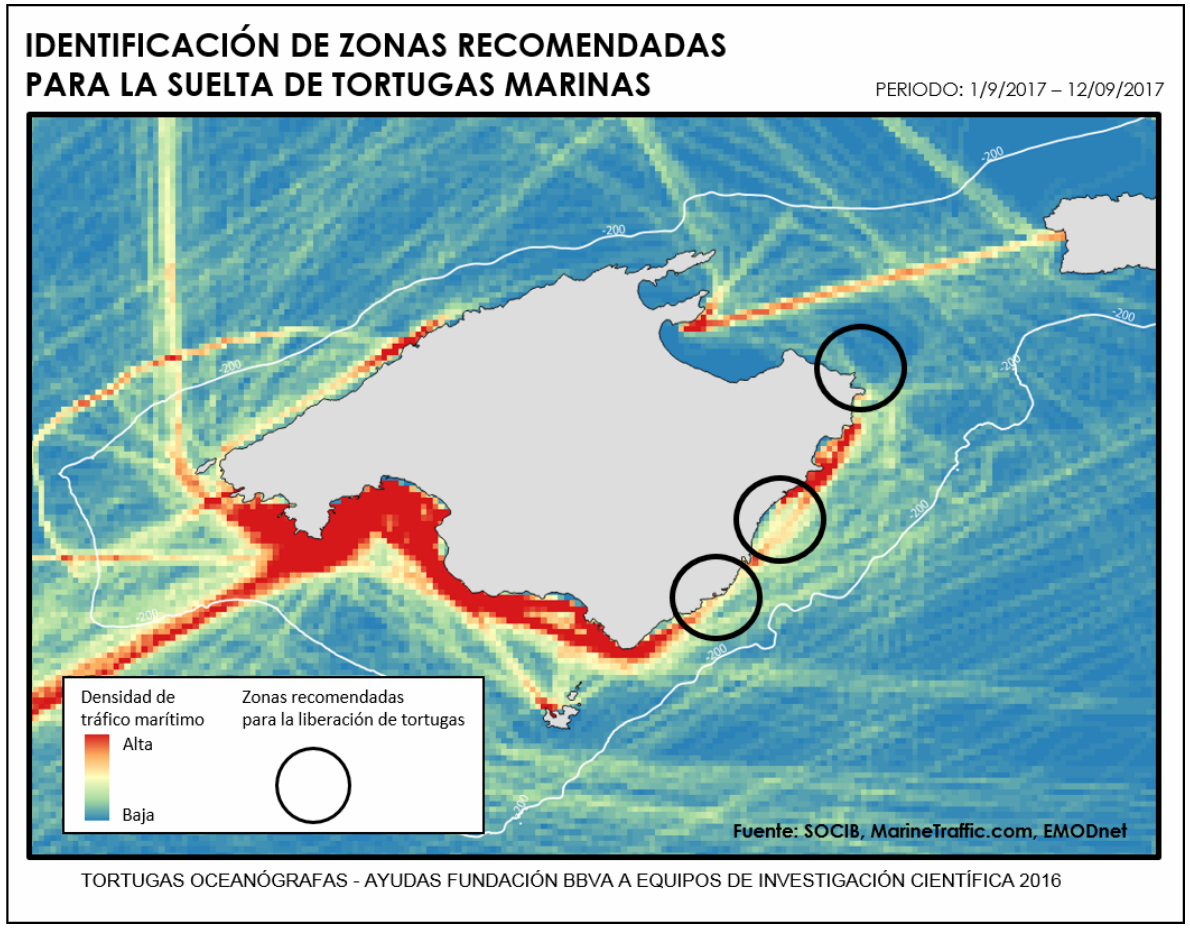
IDENTIFICATION OF OPTIMAL RELEASE LOCATIONS



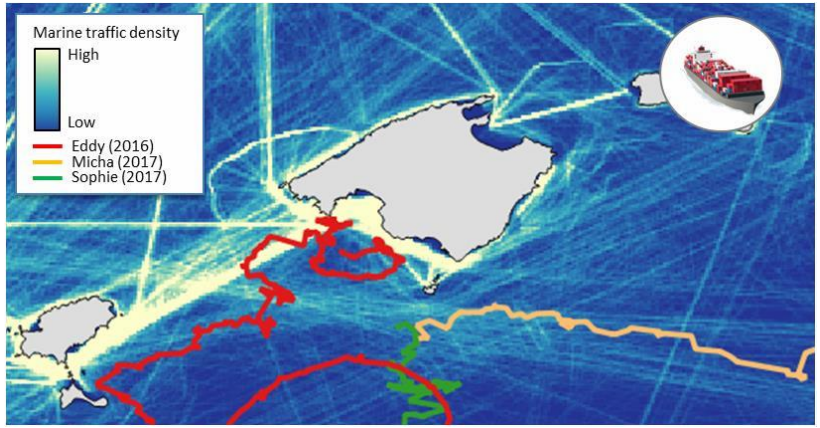
Marine traffic density map was generated using recent AIS data

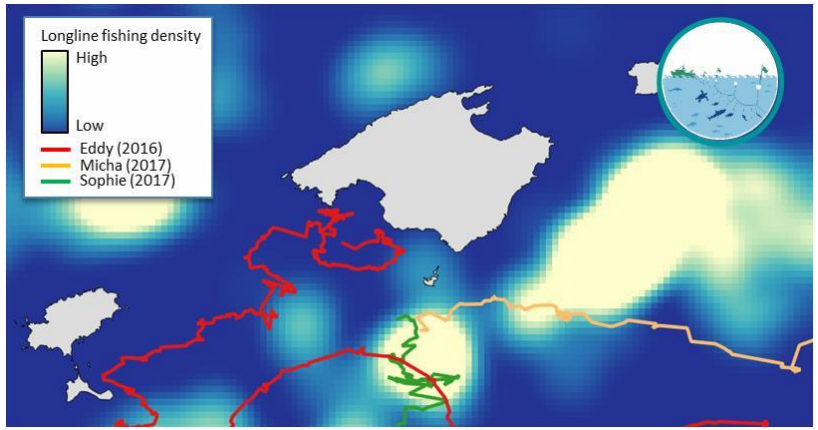
SOCIB Wave Forecast for the date of release

Real-time data using SOCIB viewer connected from www.fundacionpalmaaquarium.org

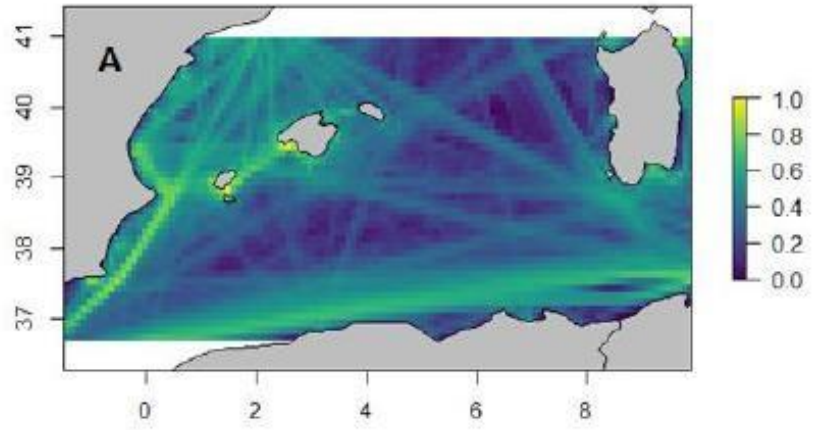
ASSESSING ANIMAL-SHIP INTERACTIONS

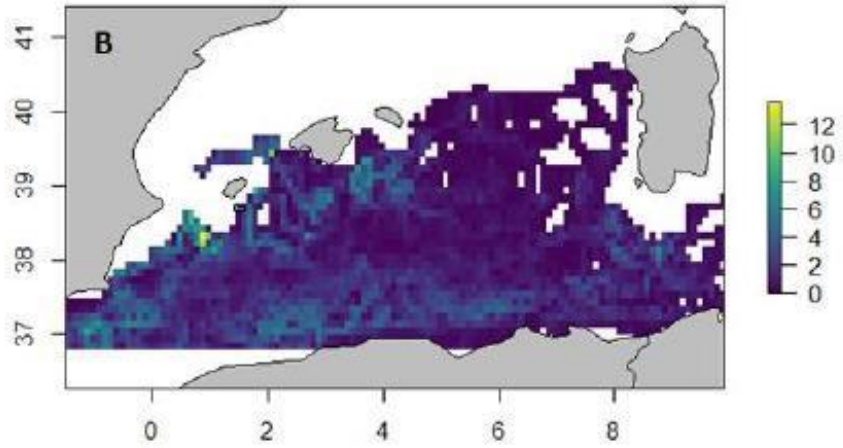
SIMULTANEOUS OBSERVATIONS OF AIS AND TELEMETRY DATA



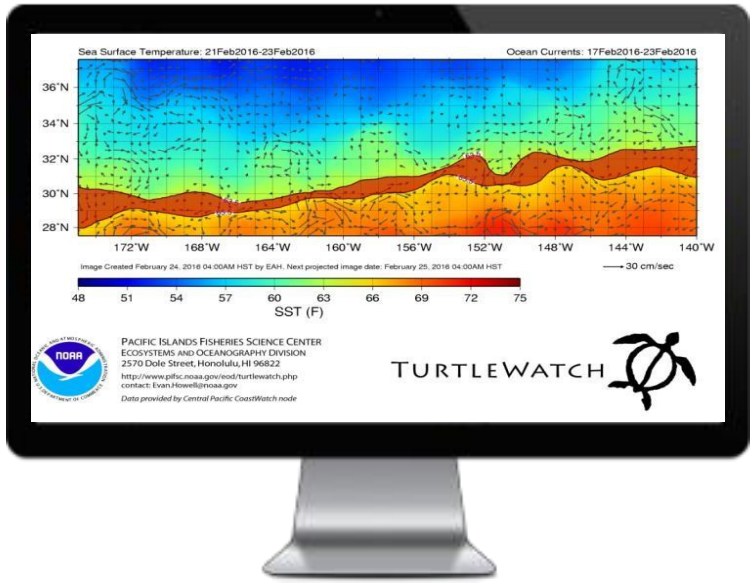


CUMULATIVE EFFECTS OF HUMAN PRESSURES

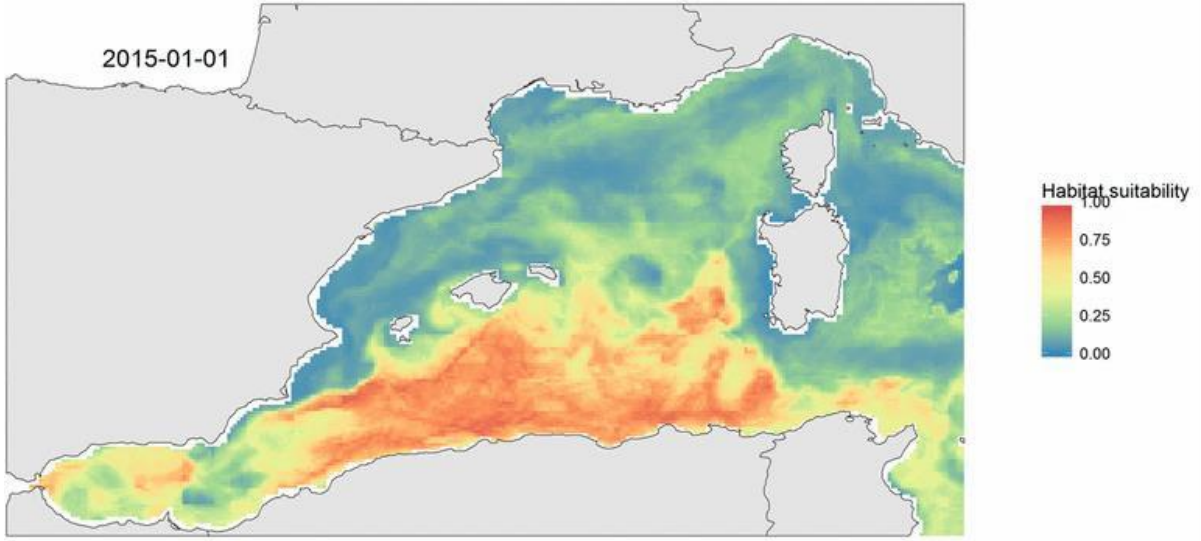




OPERATIONAL ECOLOGY: MOVING TOWARDS DYNAMIC OCEAN MANAGEMENT



NOAA uses Turtle Watch to **inform** fishermen about by-catch probability

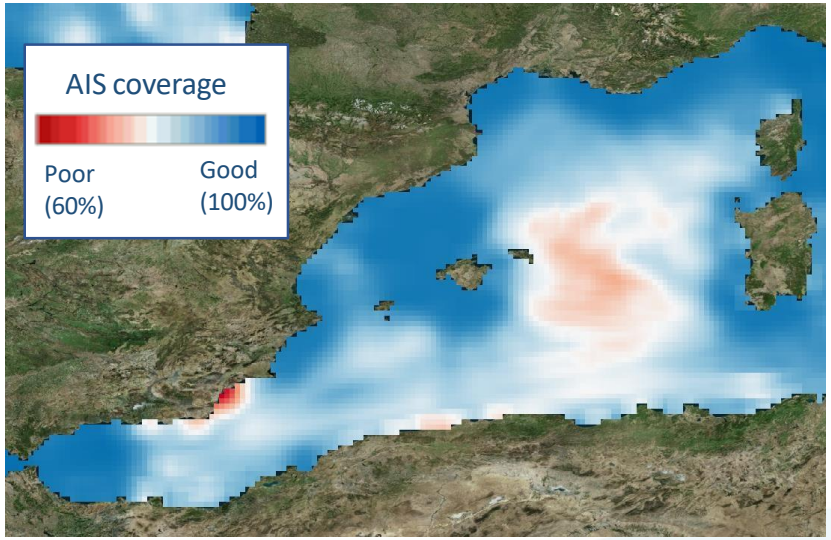


Species distribution models can be linked to with forecasts provided by Ocean Observing Systems

CHALLENGES AND OPPORTUNITIES

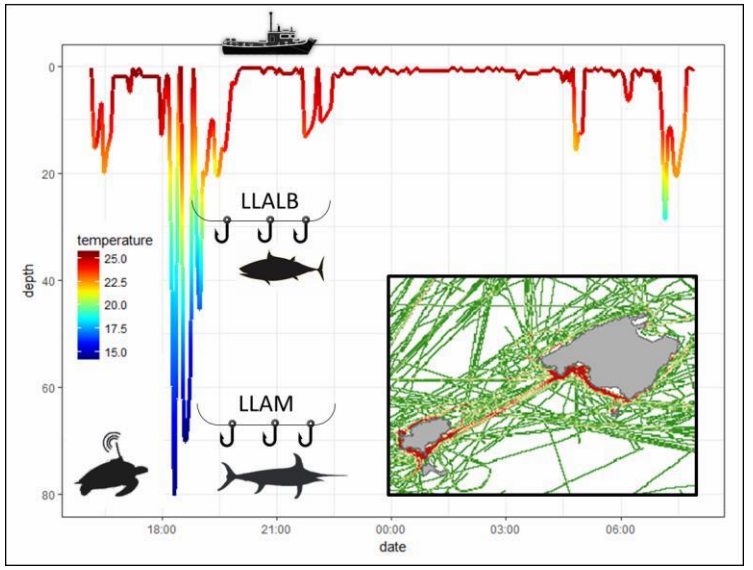
CHALLENGES

- Bias in AIS coverage
- Hidden fleet: small-scale fisheries, no-EU vessels
- No metier identification



OPPORTUNITIES

- AI & machine learning for metier identification
- Use animal diving behaviour data to assess vulnerability
- Move towards multispecies approaches
- Ocean observing systems: data-assimilative numerical models



TAKE HOME MESSAGES

- Electronic monitoring system and earth observations allow an unprecedented opportunity to link animal movement, ship-based activities and the marine environment

- Operational ecology can provide a scientific basis for the development of risk mitigation tools to minimize unwanted interactions between fisheries and vulnerable species

- Conservation of large pelagic marine animals in the Mediterranean will require moving towards multi-species, multi-sector and multiple jurisdictional approaches

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GRAZIE!

THANK YOU!

¡MUCHAS GRACIAS!

Dr. David March
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