

Le projet BIOLUMOPS, Bioluminescence Marine, Observations spatio- temporelles in situ par Planeur Sous-marin

Séverine Martini (MIO) et Frédéric Jourdin (Shom)

Rencontre MIO-CNES, Marseille, France, 12 mars 2024

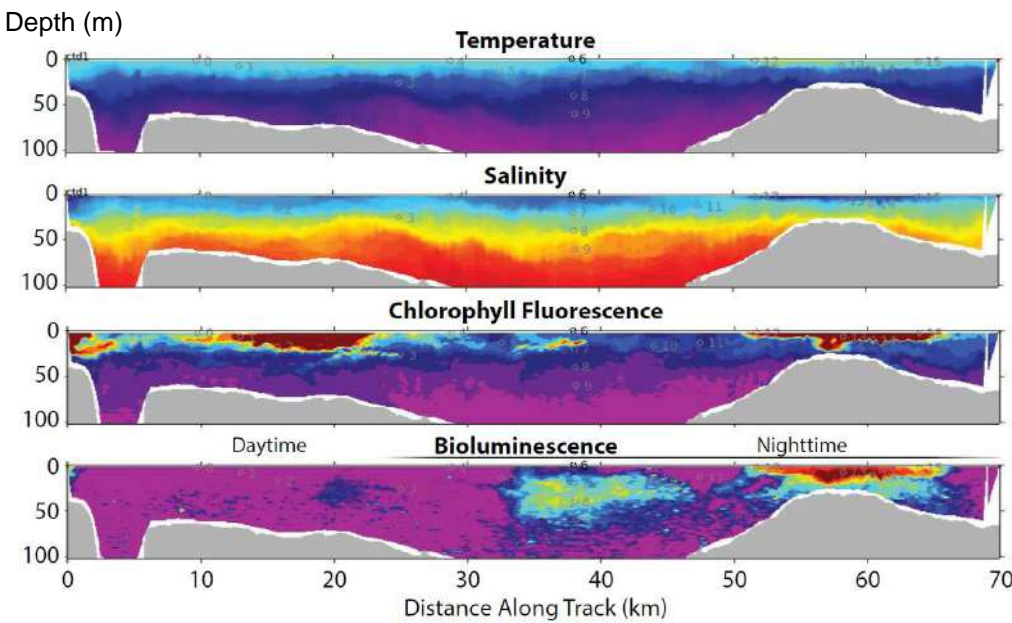
Main aims of the project ANR Astrid BIOLUMOPS

1

Contribute to studying **biological composition, structure of marine ecosystems**, including specific diversity; their spatio-temporal dynamics and related material and carbon fluxes, in the euphotic and twilight zones, through the bioluminescence signals.

2

Contribute to supporting the Navy with its assessment of bioluminescence **risks detection during night operations** involving either divers, boats, swimmer delivery vehicles and submarines (Naval Special Warfare, Under Sea Warfare).



Steven H.D. Haddock, *Oceanography* 2017

12 March 2024

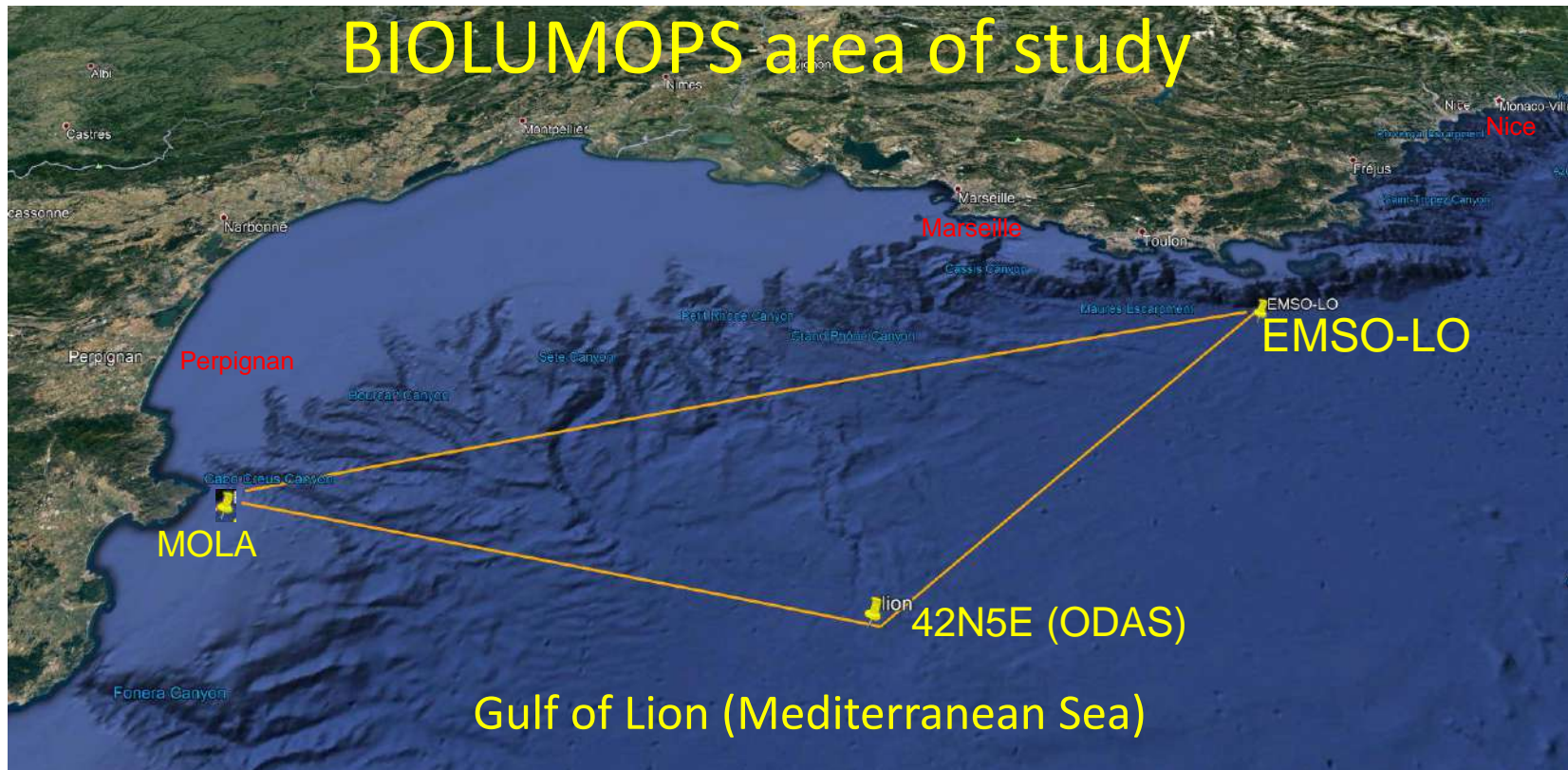


Mark Girardeau, *Photographer (Instagram)*

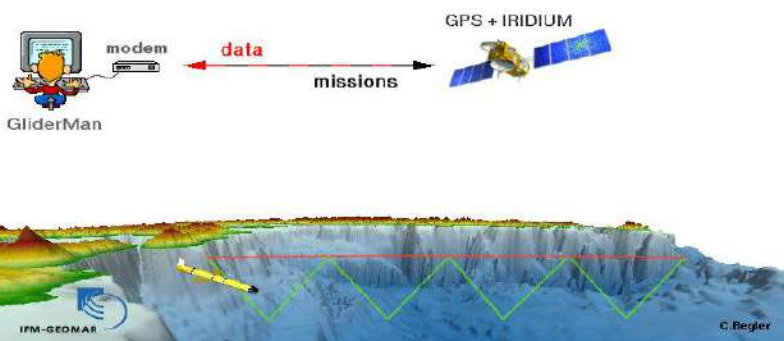
S. Martini and F. Jourdin

2

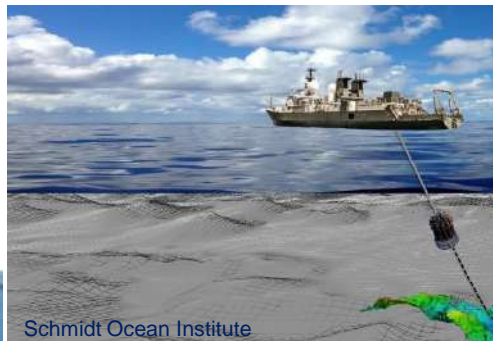
BIOLUMUMOPS area of study



Glider



CTD-rosette


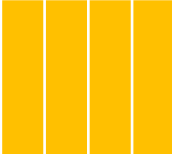




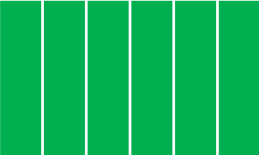
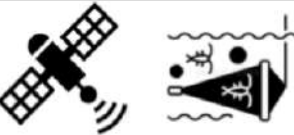



Lab



SEA090 - The purchase of this instrumentation is funded by CNES SWOT.

Work Packages (WP) of BIOLUMOPS project

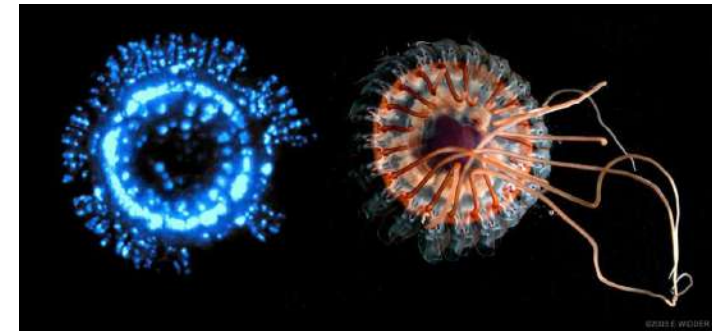
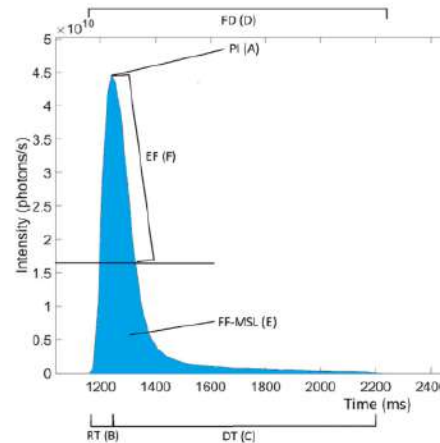
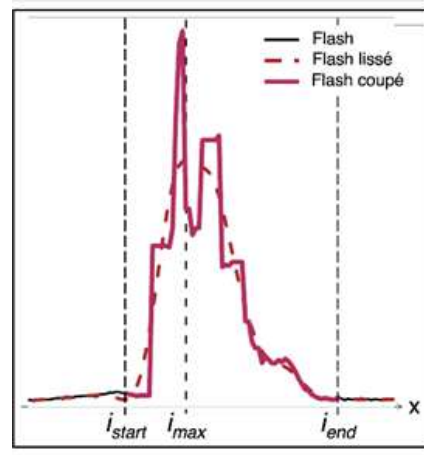
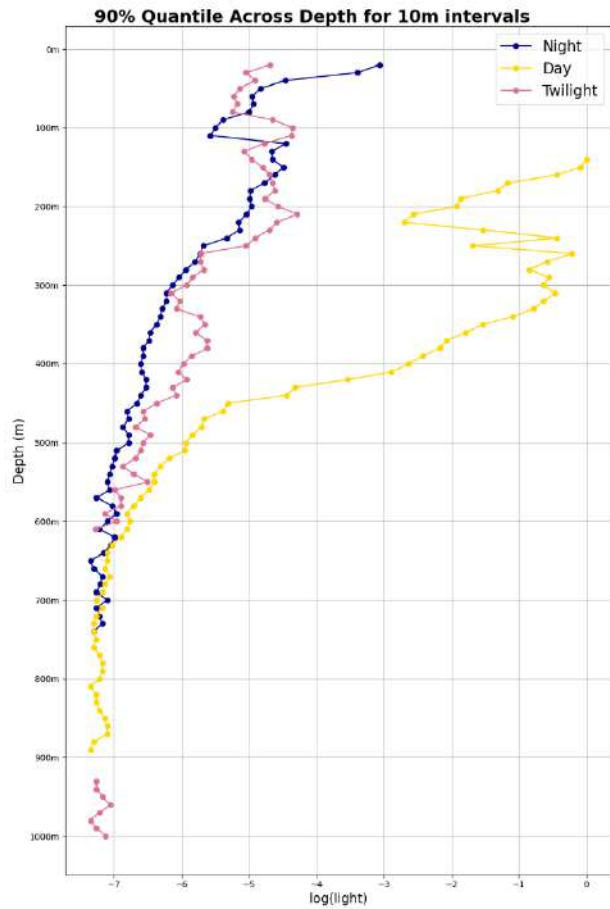
WP	type	2024	2025	2026	Work
1					 <p>UBAT + CEMSOR2 → SEAEXPLORER</p>
2					SEAEXPLORER glider, CTD-rosette (Seabird UBAT, Hydroptic UVP5, PAR/SPAR, FL-Chla, FL-CDOM, turbidimeter, transmissometer), plankton nets, CytoSense, Lab (SPM filters, aCDOM, HPLC pigments)
3*					<ul style="list-style-type: none"> Analyse vertical profiles of bioluminescence Characterize typology in function of environmental variables Analyse bioluminescent signals of individual planktonic species
4**					<ul style="list-style-type: none"> Process satellite ocean colour remote sensing images Detect dinoflagellates and other Phytoplankton Functional Types Validate with in situ measurements of phytoplankton groups

Opportunities

***Postdoc in biology** and data processing, 18 months, at MIO MARSEILLE, France.

****Satellite data engineer** (or postdoc), 18 months contract, at Shom BREST, France.

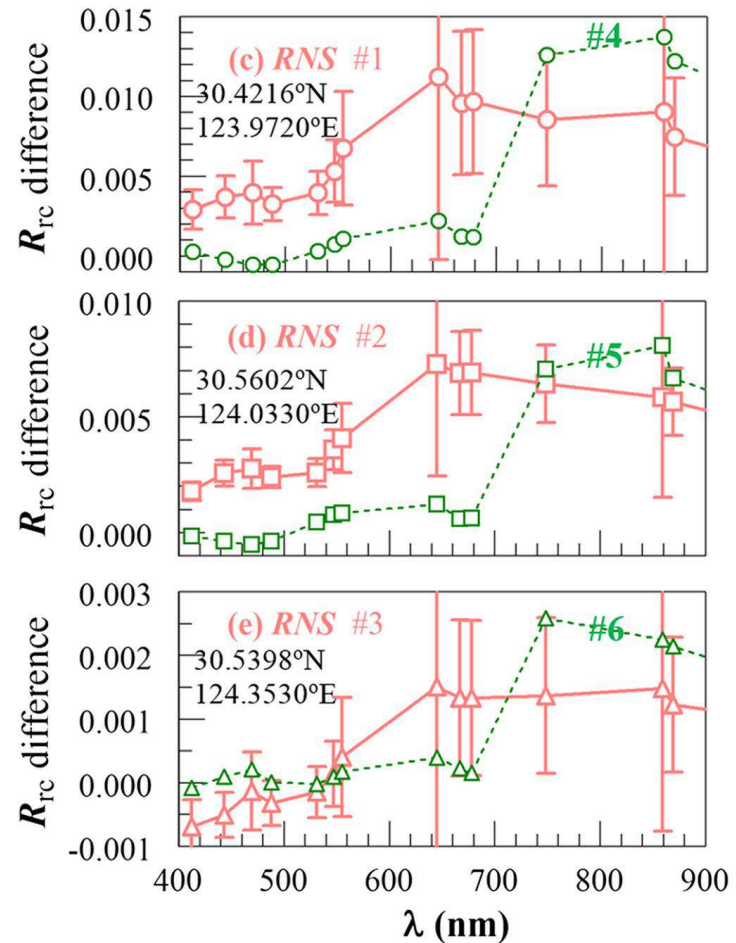
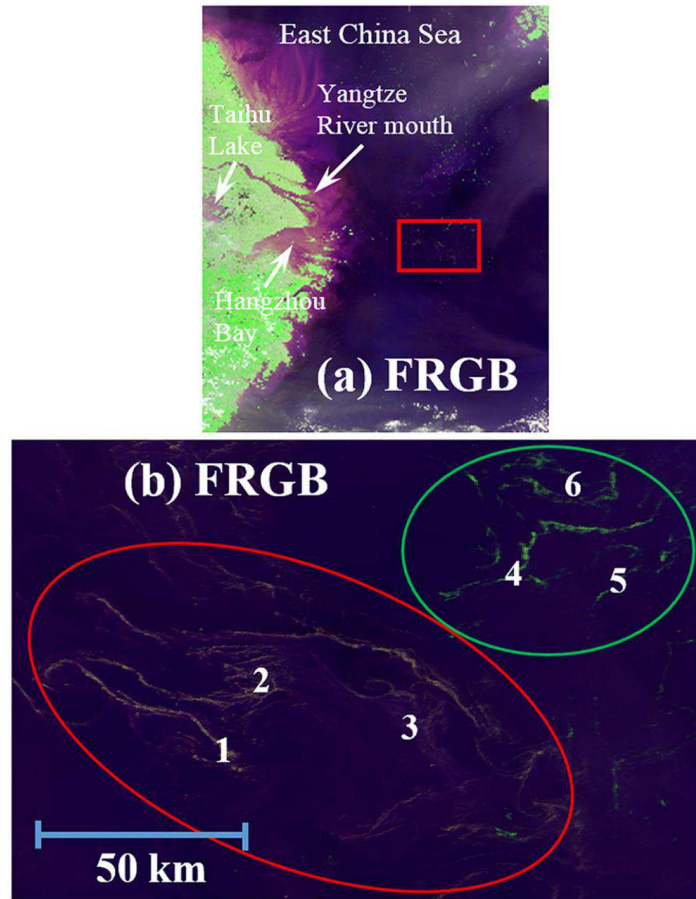
WP3: *In situ* bioluminescence-detection over depth



Traitements statistiques de profils de bioluminescence échantillonnés par éléphants de mer le long de la colonne d'eau. Modélisation des pics sous-échantillonnés et détections d'organismes de la surface jusqu'en profondeur (700m).

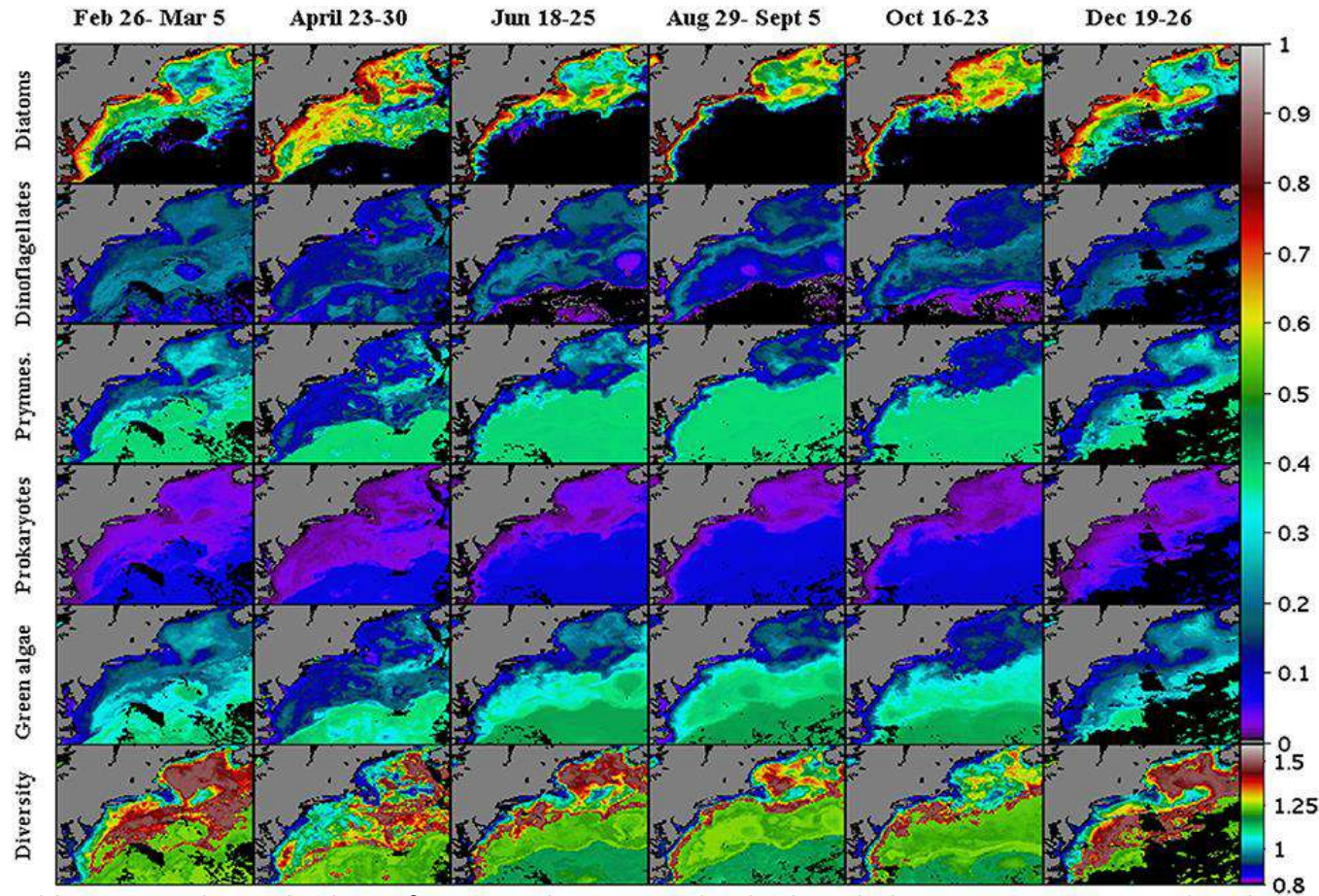
WP4: *Red Noctiluca Scintillans* (RNS) detection (MODIS sensor)

→ CNES-ISRO Trishna (80m all MED + large coastal zone NW Indian)



Interprétation d'une image issue du capteur MODIS convertie en fausses couleurs (FRGB: False Red Green Blue) et traitée spatialement (différence locale des réflectances) afin de faire ressortir les filaments. a) Emprise de l'image en mer de Chine. b) Zoom montrant des filaments rouge-brun (en #1 #2 #3) de RNS (*Red Noctiluca Scintillans*) et des filaments vert (en #4 #5 #6) de sargasses. c-e) Exemples des spectres différentiels des réflectances observées (Qi et al 2019).

WP4: PFTs detection (MODIS) in Atlantic off US East coast → S2/OLCI (300m) + NASA/PACE (hyperspec, 1km)



Modeled weekly-mean phytoplankton functional types and calculated Shannon Diversity Index during 2007. Starting from the upper row of images are distribution maps of Diatoms, Dinoflagellates, Prymnesiophytes, Prokaryotes, and Green Algae (% chlorophyll a). Weekly maps of the Shannon Index (H; n.d.) for the PFT diversity are shown along the lower row of panels. Regions where the inverse model yielded zero concentrations are shown in black.

Tiffany A. Moisan et al, *Frontiers in Marine Science* 2017

WP4: validation with in situ measurements

Issues and workarounds

- Clouds: lack of satellite data during BIOLUMOPS sea surveys
 - working with a historic database of **CytoSense** (MIO) and satellite images (CDSE)
- Sensing volume: discrepancy between satellite ($1\text{km}^2/K_d$) and **CytoSense** (1L/h)
 - Spatial analysis
- Sensing methods: discrepancy between *Rrs* and Cytometry/Particle imagery
 - Statistical analysis and Interpretation
- Matchups: un-located satellite and in situ data
 - Using Lagrangian method of fluid flow and Interpretation

MERCI !

