Tracking HABs' origins in the eastern Cantabrian Sea with coastal models and satellite imagery

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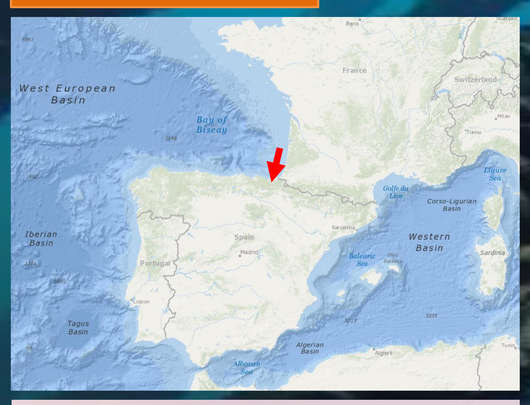
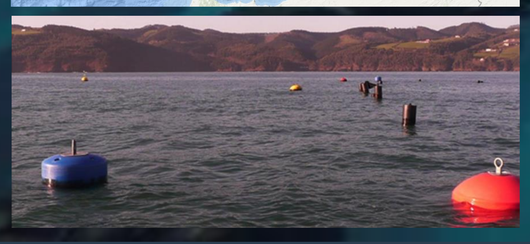
Study Area:





Integrated Marine Observing System in Mendexa shellfish production area

Sampling:
- Phytoplankton species identification and counting.
- Biotoxins in mussels.
- CTD profiler.
- Datalogger with submerged sensors for monitoring fluorescence and temperature (10 minutes, 3m depth).

Local meteorological and hydrographic observation networks:
- Meteorology (precipitation, wind, air temperature, radiance).
- River flows and nutrients.

Numerical models:
- CROCO (Coastal and Regional Ocean COmmunity model).
- TRIMODENA (Tridimensional hydrodynamic model).
- SOFT (Sediment, Oil spill and Fish Tracking model).

Satellite images:
- MODIS (AQUA/TERRA), VIIRS.
- Sentinel-3(A,B), Sentinel-2(A,B).

18-January-2022: Paralytic Shellfish Poisoning (PSP) toxins close to the legal limit

PSP toxins events above legal limit (800 µg STXdiHCl eq.·kg^{-1}) are scarce but entail serious health risks.
Previous PSP events in Mendexa were reported in autumn 2018 and 2019 (>1000 µg STXdiHCl eq.·kg^{-1}). PSP toxins in this area have been attributed to *Alexandrium ostenfeldii* (2018 event), but could also be produced by other species, such as *A. minutum* and *Centrodinium punctatum*.

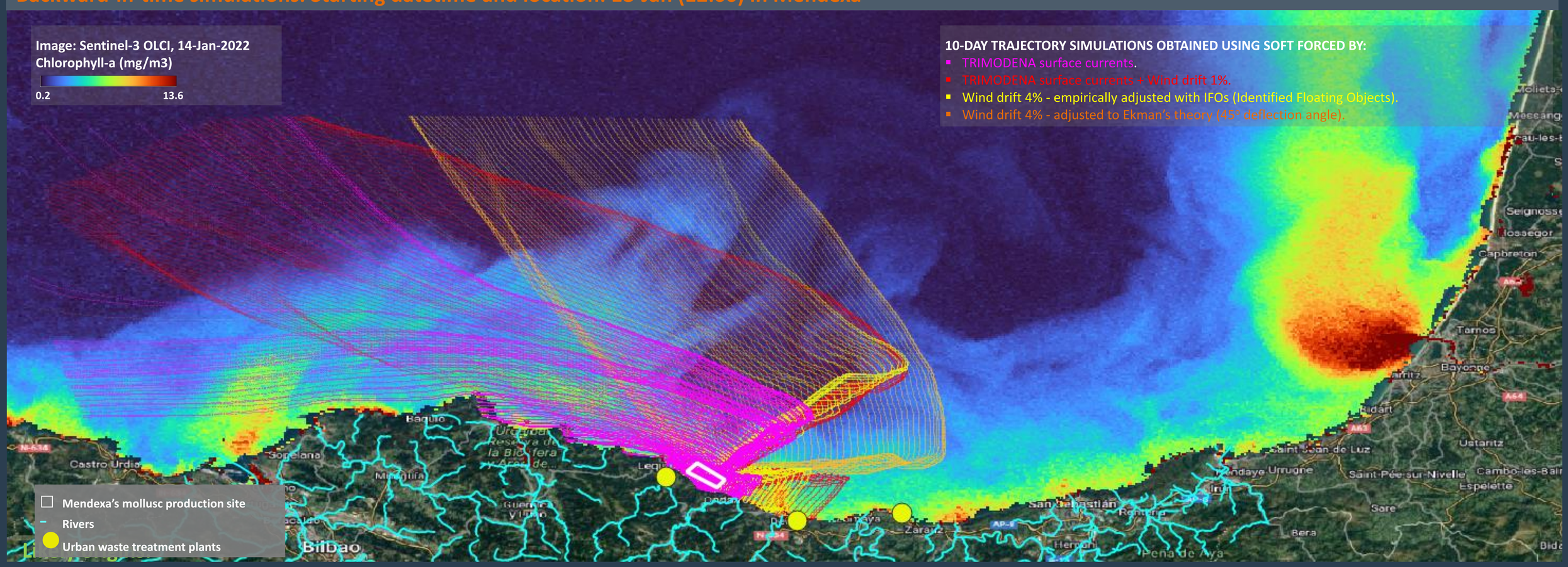
PSP (µg STXdiHCl eq.·kg^{-1}): ↑335 **788** (71% GTX1,4; 29% GTX2,3) ↓173

	2022-01-08	2022-01-09	2022-01-10	2022-01-11	2022-01-12	2022-01-13	2022-01-14	2022-01-15	2022-01-16	2022-01-17	2022-01-18	2022-01-19	2022-01-20	2022-01-21	2022-01-22	2022-01-23	2022-01-24
Precip_cum(mm)	0.0	46.4	18.1	2.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0						
T_aire_C	9.48	11.96	12.80	11.70	6.69	6.55	8.46	5.51	5.12	4.79	4.15						
Wind_speed_m/s	7.84	21.95	28.05	7.14	1.69	8.70	4.84	3.79	4.75	6.93	5.21						
wind_dir_deg	↑ 203.26	→ 283.14	→ 297.88	→ 311.77	↓ 47.88	↓ 100.94	↑ 120.18	↓ 78.59	↓ 75.61	↓ 62.12	↓ 59.98						
Q. Deba/Altzola (m3/s)	1956.01	19683.04	30920.33	14219.37	7382.06	4142.72	2945.47	2311.09	1921.99	1598.53	1411.59						
Water_fluor	0.4318522	0.4431656	0.4177330	0.4211052	0.4691034	0.4853259	0.4986890	0.4812871	0.5799113	0.6096449	0.6518182						
Water_Temp_C	13.25432	13.16264	13.22255	13.24417	13.08037	13.07122	12.84781	12.74582	12.81829	12.92285	12.43929						

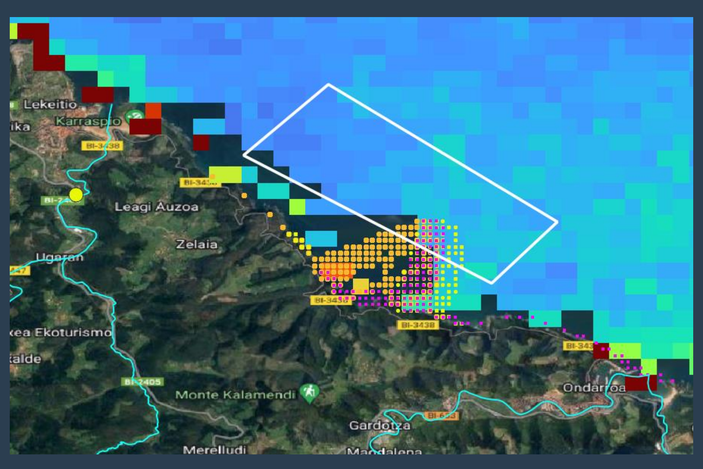
Environmental conditions 10 days before the toxic event:

- An episode of high rainfall and strong easterly winds on 9 and 10 January caused high river flows.
-A fluorescence peak was registered on 18 January, coincident with the peak of PSP concentration in mussels, although the increases of chlorophyll-a and PSP were evident from day 14.

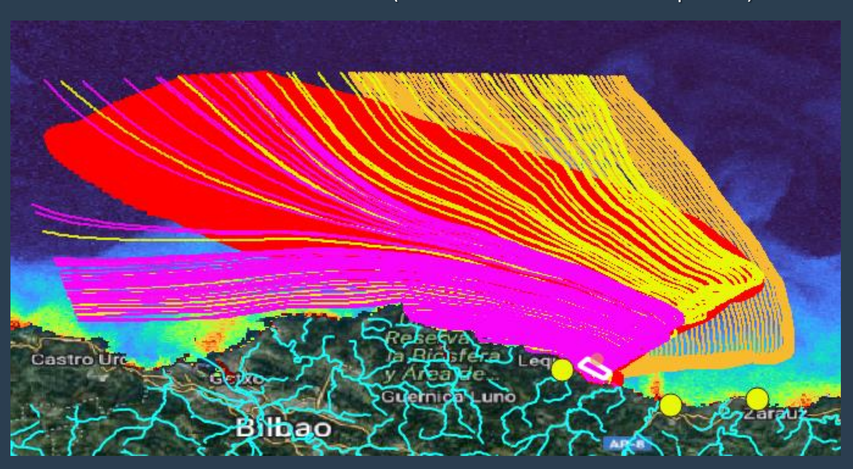
Backward-in-time simulations. Starting datetime and location: 18-Jan (12:00) in Mendexa



14-Jan 00:00-24:00 (84 hours before peak)



Before 14-Jan 00:00-24:00 (>108 hours before peak)



Backward-in-time simulation results:

-All the model configurations provide broadly coherent results but show some divergences as time from origin increases.
-All the simulations discard the areas located beyond east to Ondarroa. (2.4ºW longitude)
-In all simulations, two distinct potential origin areas appear:
  -During the 4 days prior to the PSP peak, the simulated origins are located locally near the coast and in the port of Ondarroa and the mouth of Artibai. In this case the growth of PSP-producing species may have been caused by nutrient loading from the river, resuspension of bottom cysts, or both.
  -In the older period (>5 days), the particles are probably transported from eastern offshore and coastal areas.

  The first hypothesis seems more likely as the common habitats of species producing PSP are rather found in coastal confined areas.

Conclusion:

Although similar analyses on other past PSP events are needed to describe the origin(s) of the PSP toxin affecting the Mendexa site, the backward-in-time simulations presented in this poster have greatly helped to refine and rule out hypotheses on possible spatial and temporal origins. Lagrangian models and backward-in-time simulations have a very promising potential to support risk management of HABs at aquaculture sites.

Work co-funded by AVACON, BIOTOX (Gobierno vasco. Dirección de Pesca y Acuicultura) and PRIMROSE (European Commission-Espacio Atlántico Operativo 2007-2013)