

Red and green waters in southern Brittany (France) in March 2026 linked to a bloom of *Mesodinium* spp.

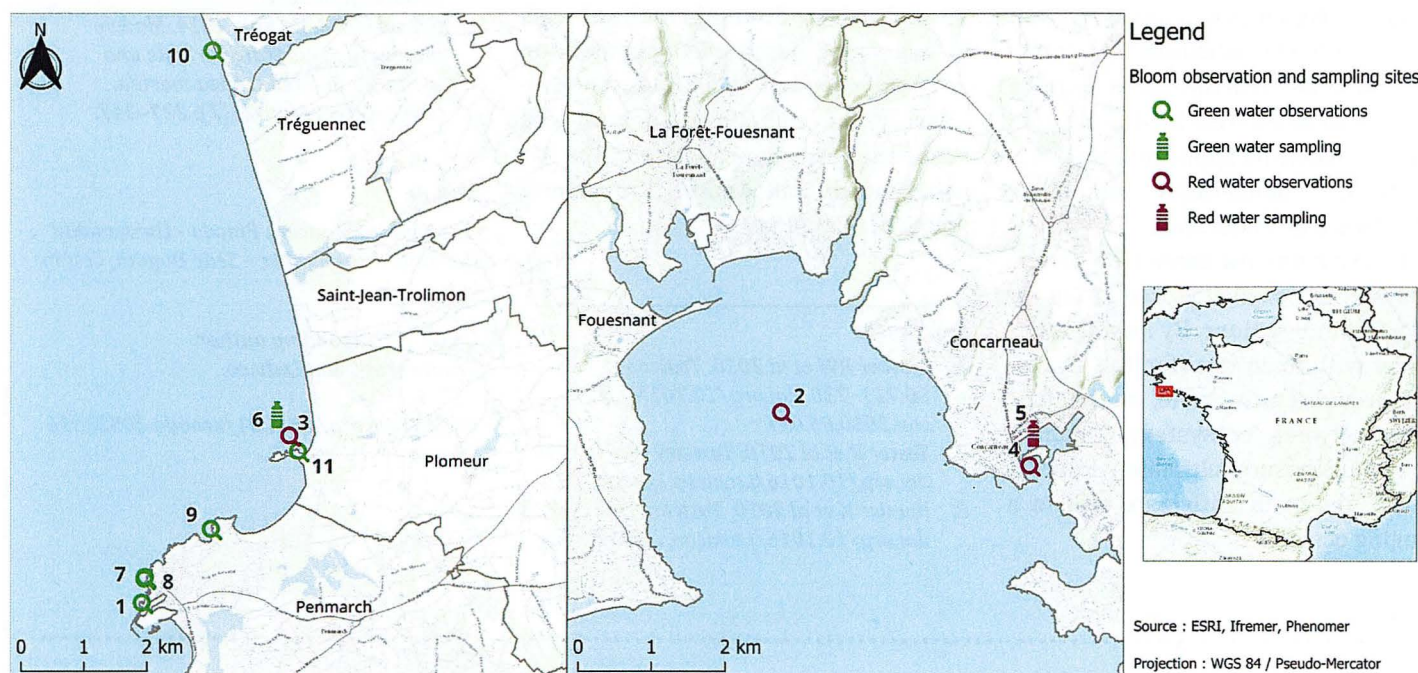


Fig. 1. Map of reported water discoloration events in southern Brittany (10–12 March 2026) based on PHENOMER observations and direct reports. Locations include the Bay of Audierne and the Bay of Concarneau.

Between 10 and 12 March 2026, multiple observations of discoloured seawater were reported along the southern coast of Brittany (France), particularly in the Bay of Audierne and the Bay of Concarneau. A total of eleven reports were collected through the citizen observatory Phenomer [1–2] and direct communications, describing both red (“wine-red”) and green water patches [3]. The spatial clustering and rapid succession of these observations indicated a regional-scale bloom event affecting several coastal sectors of southern Finistère (Fig. 1).

The red water in Concarneau and the green water in La Torche were sampled on 11 March 2026 and analysed using inverted light microscopy on fresh material. The red water observed in the port of Concarneau corresponded to a dense bloom of the *Mesodinium rubrum*/*Mesodinium major* complex [4], with an abundance of at least 4.4×10^6 cells·L⁻¹ [3]. This planktonic ciliate is well known for forming intense red tides, resulting from the retention of cryptophyte-derived kleptoplastids; depending on the ingested prey species, these plastids may be rich in phy-

coerythrin (yielding a red coloration) or lack phycoerythrin and appear green (e.g., following ingestion of *Hemiselmis* spp.) [5–7]. In the analysed sample, other phytoplankton groups, including diatoms and dinoflagellates, were present only in low abundances. Among these, the non-toxic dinoflagellate *Scrippsiella* spp. had previously been recorded at moderate concentrations (3.6×10^4 cells·L⁻¹) in the area during observations of the French phytoplankton observation and monitoring program (REPHY [11]) suggesting that the discoloration was not associated with a typical harmful dinoflagellate bloom (Fig. 2A, Fig. 4).

Green discoloration events, notably observed at La Torche (Audierne Bay), showed distinct characteristics, including foam formation and occasional unpleasant odours [3]. Microscopy revealed large amounts of degraded organic material and weakened or lysed *Mesodinium* cells. These observations indicate that the green waters represent a post-bloom stage following the collapse of *Mesodinium* populations. The rapid shift from red to green coloration is explained by pigment dynamics during cell degradation: phycoerythrin is rapidly degraded after cell lysis, revealing chlorophylls *a* and *c*₂, which



Fig. 2. (A) Red “wine-coloured” water associated with a *Mesodinium* spp. bloom in Concarneau Harbour (12 March 2026). (B) Green discoloured water at La Torche (11 March 2026), corresponding to a post-bloom stage with degraded cells and organic material.

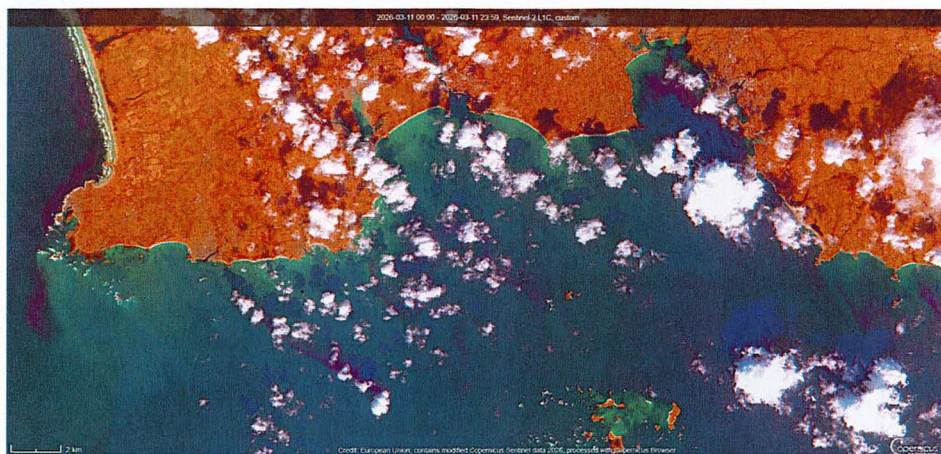


Fig. 3. Sentinel-2 satellite image (11 March 2026) showing the spatial extent of the bloom in southern Finistère, with burgundy-red patches indicative of high *Mesodinium* surface concentrations.

are more stable and impart a green coloration. This transformation can occur within minutes, explaining the coexistence of red and green patches within the same coastal system (Fig. 2B, Fig. 5–6).

Due to its distinctive “optical fingerprint”, *Mesodinium* red tides can often be detected using high-resolution satellite remote sensing; however, similar spectral signatures may also arise from other phycoerythrin-containing planktonic blooms, including occasional blooms of *Dinophysis* spp. and cryptophytes such as *Teleaulax* spp., and thus the signal is not entirely specific [5, 7–8]. Satellite imagery (Sentinel-2, 11 March 2026) confirmed the presence of an extensive surface bloom in southern Finistère [3], suggesting that the phenomenon extended well beyond the sampled locations (Fig. 3). These observations should be interpreted with caution in terms of pigment-based diagnostics, as similar colour shifts can also occur in other mixotrophic or plastid-bearing protists. In particular, laboratory and field studies on *Dinophysis* spp. have shown that starvation or physiological stress can lead to altered plastid function and a transition towards a greenish appearance, as demonstrated in experimental cultures of *D. caudata* and in field observations of *D. acuminata* populations [8–9]. This reinforces that green coloration in marine planktonic protists is not necessarily indicative of a single taxonomic or physiological state, but may reflect multiple underlying biological processes, including prey-dependent plastid composition, starvation, or cell degradation.

The development of such a bloom likely reflects a combination of favour-

able environmental drivers. Blooms of *Mesodinium* spp. are commonly associated with stratified conditions, high light availability, and sufficient densities of cryptophyte prey [10–12]. In early spring, increasing solar irradiance combined with episodic water column stabilisation—often following periods of calm weather—may promote rapid population growth. Additionally, nutrient-enriched coastal waters, influenced by riverine inputs or sediment resuspension, may indirectly support *Mesodinium* proliferation by sustaining cryptophyte populations. Normal salinity in Concarneau bay is 35, and it can decrease to 28–30 in winter depending on rainfall. Freshwater from the Loire River can reach as far as the Brittany peninsula, and depending on river discharge, it can further enhance desalination, as observed this year with salinity falling to 20 PSU in February. The current bloom was in sync with a significant higher discharge of the Loire river, lowering salinities to 20 psu in February.

Hydrodynamic conditions may also have played a key role in shaping the spatial distribution of the bloom. The retention of water masses in semi-enclosed areas such as the Bay of Concarneau, combined with local circulation patterns along the Audierne coast, could facilitate bloom accumulation and patchiness. The rapid appearance and disappearance of coloured waters suggest a transient event controlled by short-term physical forcing, such as wind-driven mixing or tidal advection.

The ecological dynamics of *Mesodinium* blooms are closely linked to their mixotrophic strategy, which relies on the acquisition and maintenance of

functional plastids from cryptophytes. This dependency enables rapid growth under optimal conditions but may also lead to abrupt bloom collapse when prey availability declines or environmental conditions shift [7]. The accumulation of organic material observed in green biomass is consistent with bloom senescence and the release of cellular contents, which may stimulate bacterial activity and influence local biogeochemical cycling.

Similar discoloration events attributed to *Mesodinium* spp. have previously been documented in the region, including a comparable episode in February 2023 [2]. Such recurrence suggests that these blooms may represent a characteristic, though episodic, feature of coastal ecosystem dynamics in southern Brittany. In a broader context, increasing frequency or visibility of such events could be linked to ongoing environmental changes, including shifts in stratification regimes, nutrient inputs, or plankton community composition, although further observations are required to assess long-term trends.

From a sanitary perspective *Mesodinium* spp. are not considered harmful but non-toxic [14], and no direct impacts on human health have been reported. Consequently, the March 2026 discoloration events were not expected to pose a risk to shellfish consumers. Nevertheless, the striking visual appearance of red or green waters, sometimes

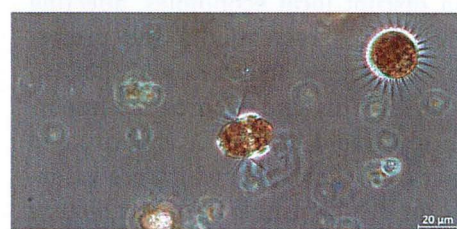


Fig. 4. Light microscopy images of live *Mesodinium* spp. cells observed in the red water (Concarneau). Cells exhibit characteristic morphology and pigmentation due to kleptoplasts.

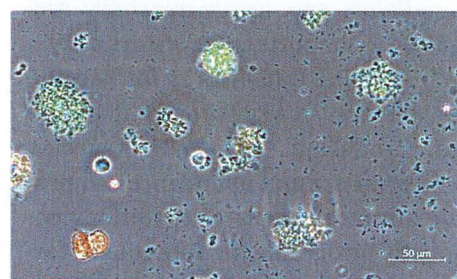


Fig. 5. Light microscopy images of degraded *Mesodinium* cells and organic aggregates observed in green water (La Torche), illustrating pigment loss and cellular disintegration.

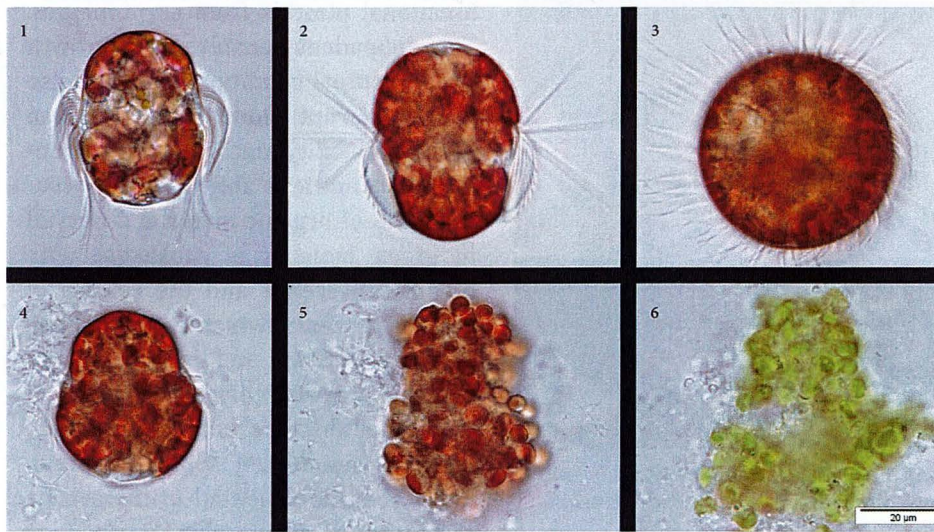


Fig. 6. Cells of *Mesodinium major*. 1–3. Different views of living cells. 4–6. Representation of pigment dynamics during *Mesodinium* cell degradation: transition from phycoerythrin-dominated red coloration to chlorophyll-dominated green coloration following cell lysis. All images to scale.

accompanied by unpleasant odours, can generate concern among the public and stakeholders. During this event, local management responses included a municipal decree in Tréguennec temporarily prohibiting bathing and nautical activities as a precautionary measure in response to the observed water discoloration and associated uncertainties. These restrictions were subsequently lifted once no health risk was identified. Such measures illustrate how visually conspicuous but non-toxic blooms may nevertheless trigger short-term access limitations and management interventions. While posing no direct threat to human health or marine life, the presence and degradation of these blooms can disrupt local economies, affecting tourism and recreational and professional maritime activities, and shellfish fisheries. This underscores the importance of rapid diagnostic capacity and clear communication, which are essential for distinguishing harmless blooms from harmful algal blooms involving toxin-producing species and for guiding appropriate management responses. Beyond their visual impact, blooms of *Mesodinium* spp. are increasingly recognised as important indicators within early warning frameworks for harmful algal blooms. As a key prey for diarrhetic toxin-producing *Dinophysis* species, their presence and abundance can provide advance signals of conditions potentially favourable for subsequent toxic events [15]. However, recent studies emphasise that high *Mesodinium* densities alone are not sufficient predictors of *Dinophysis* blooms, as successful

development depends on the spatial and temporal coupling of predator and prey populations, as well as appropriate water column structure facilitating encounter rates [15]. This highlights the need for integrated monitoring approaches combining biological observations with physical oceanographic context. In this perspective, conspicuous *Mesodinium* blooms such as the one described here may serve as valuable early indicators within coastal surveillance systems, particularly when combined with high-frequency observations and emerging imaging technologies capable of resolving trophic interactions *in situ*.

This event shows the importance of combining citizen observations, monitoring observations, targeted sampling, microscopy, and satellite imagery to rapidly identify and interpret coastal discoloration phenomena. Such integrative approaches are increasingly valuable for coastal monitoring programmes and for improving our understanding of transient and visually striking plankton dynamics.

Acknowledgements

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