

Phytoplankton aggregation & turbidity induced sinking losses

laurin.steidle
@uni-hamburg.de
&
johannes.pein
@hereon.de



Methods

We use a **particle tracking model** called **oceantracker** to predict the trajectories of **phytoplankton aggregates** in the **Elbe estuary**.

It is a full **3D model** based on **unstructured grids** that support several key physical processes such as stranding, (re-)suspension, dynamical dispersion and, most importantly, **aggregation**. By aggregating with suspended inorganic particles, their size and buoyancy change, and consequently their settling velocities.

Coagulation between particles follows Burd 2013 and Jokulsdottir and Archer 2016 while settling follows Krist 2002

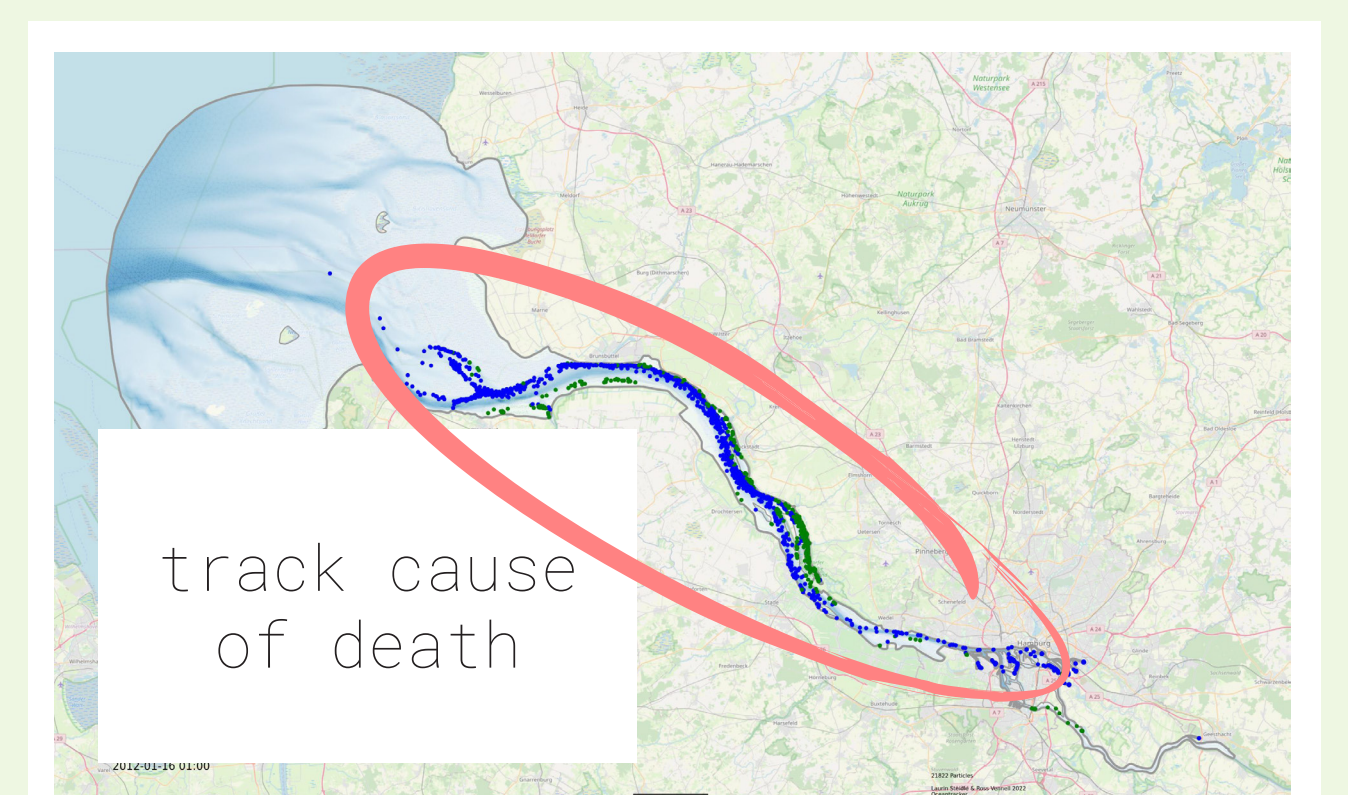
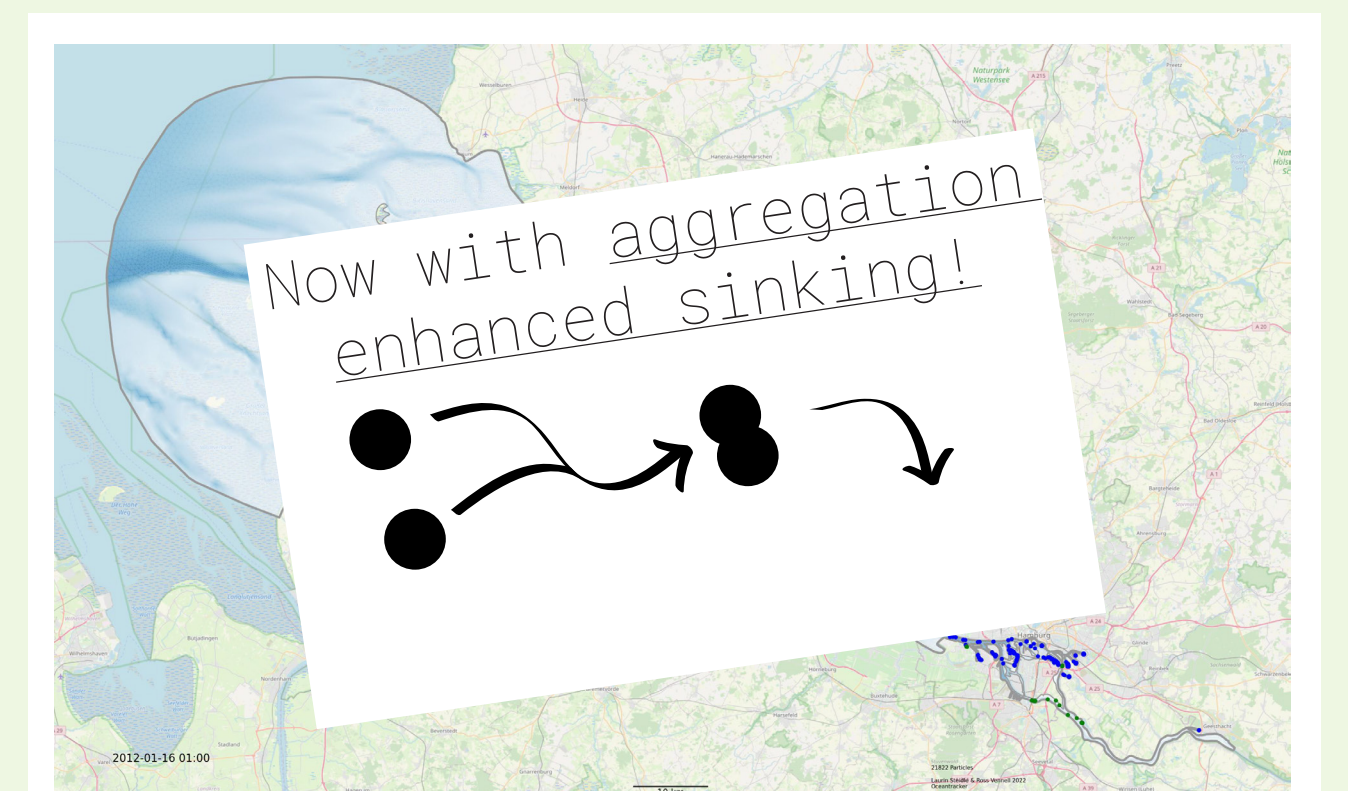
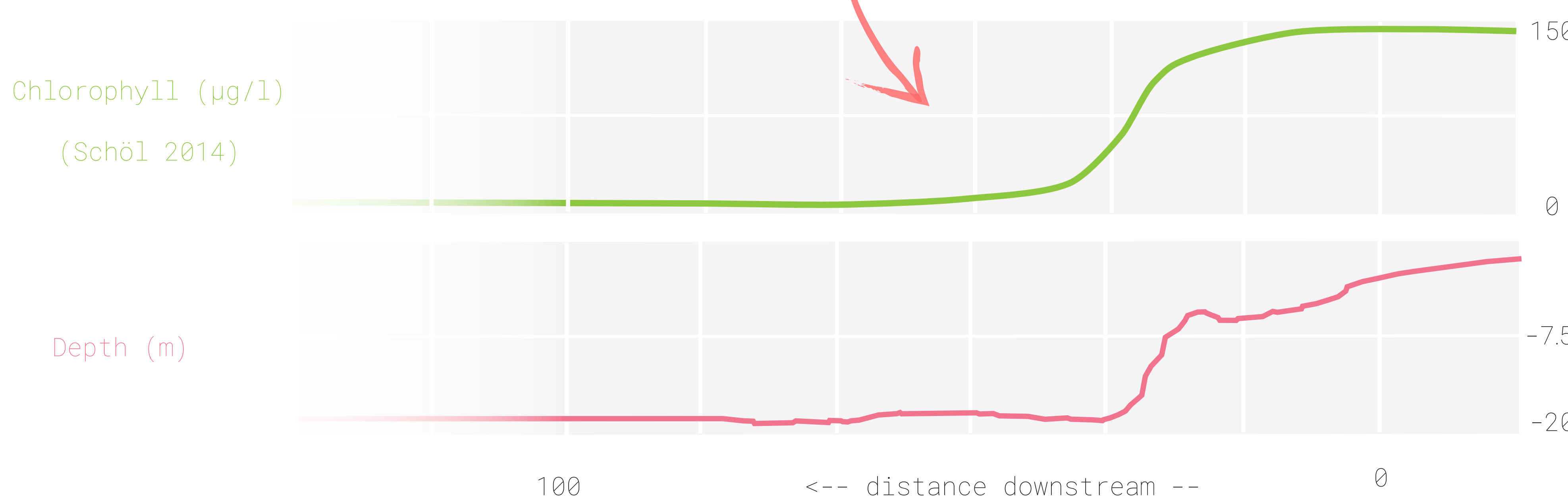
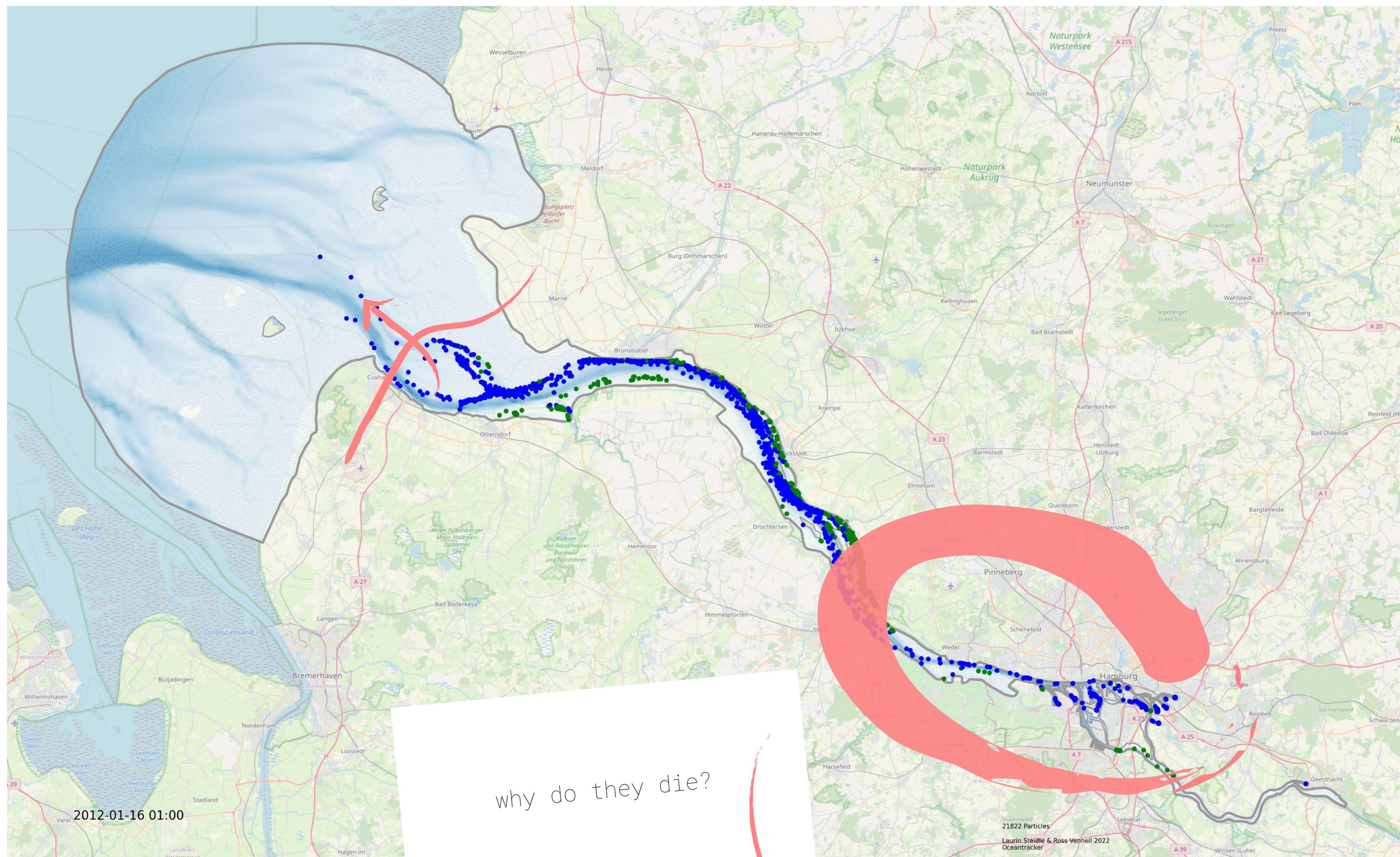
$$\beta_a^c = \left(\frac{8\pi\epsilon}{15\nu} \right) \left(1 - \frac{1+5p+2.5p^2}{(1+p)^3} \right) (r_1+r_2)^3$$

$$\beta_a^s = \frac{1}{2} \pi r_1^2 |v_1 - v_2|$$

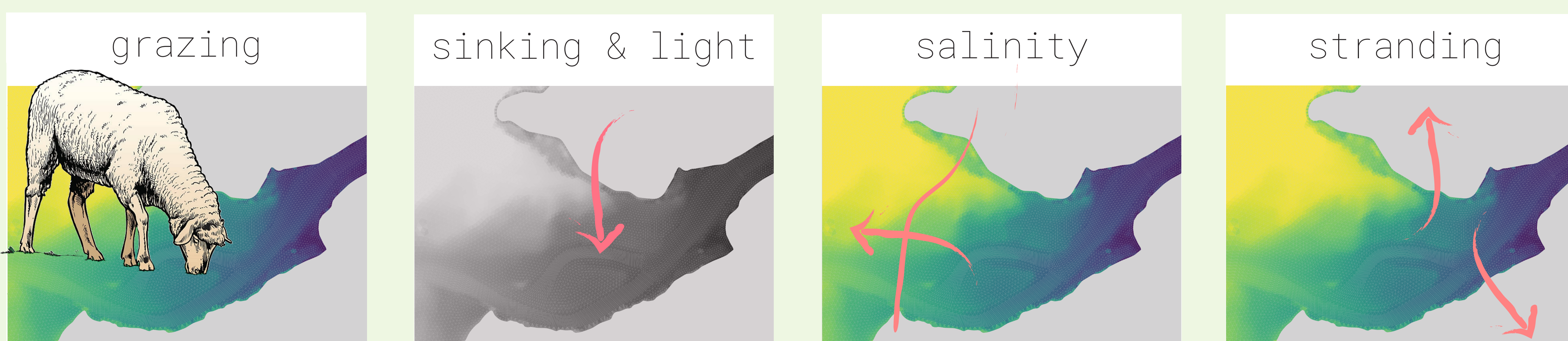
$$\beta = \alpha_1 \frac{V_p}{V_f} (\beta_a^c + \beta_a^s)$$

Due to the **high turbidity** in the Estuaries, these larger, denser aggregates are thought to be more likely to be **light-limited**, causing them to die more frequently than non-aggregating phytoplankton cells.

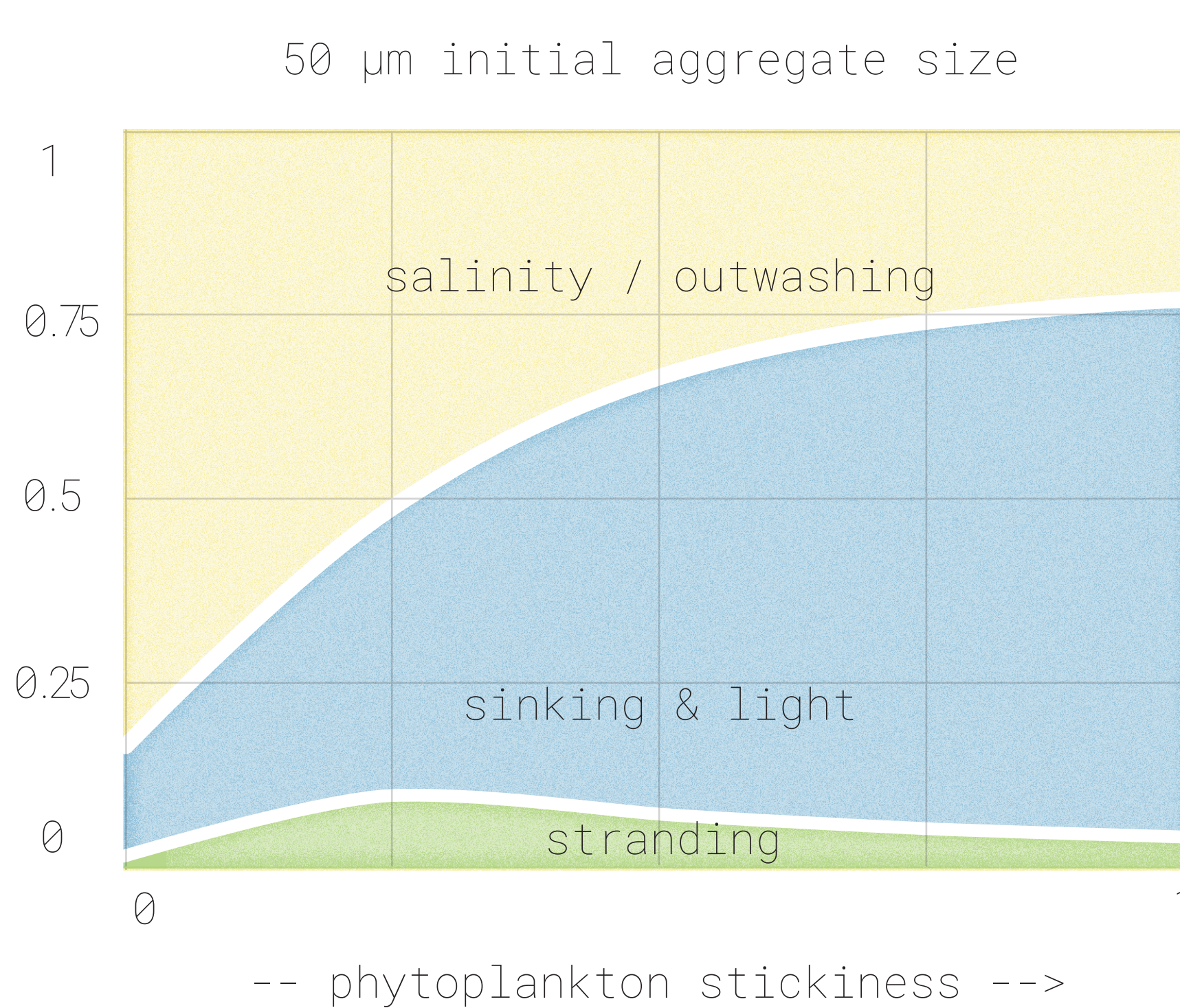
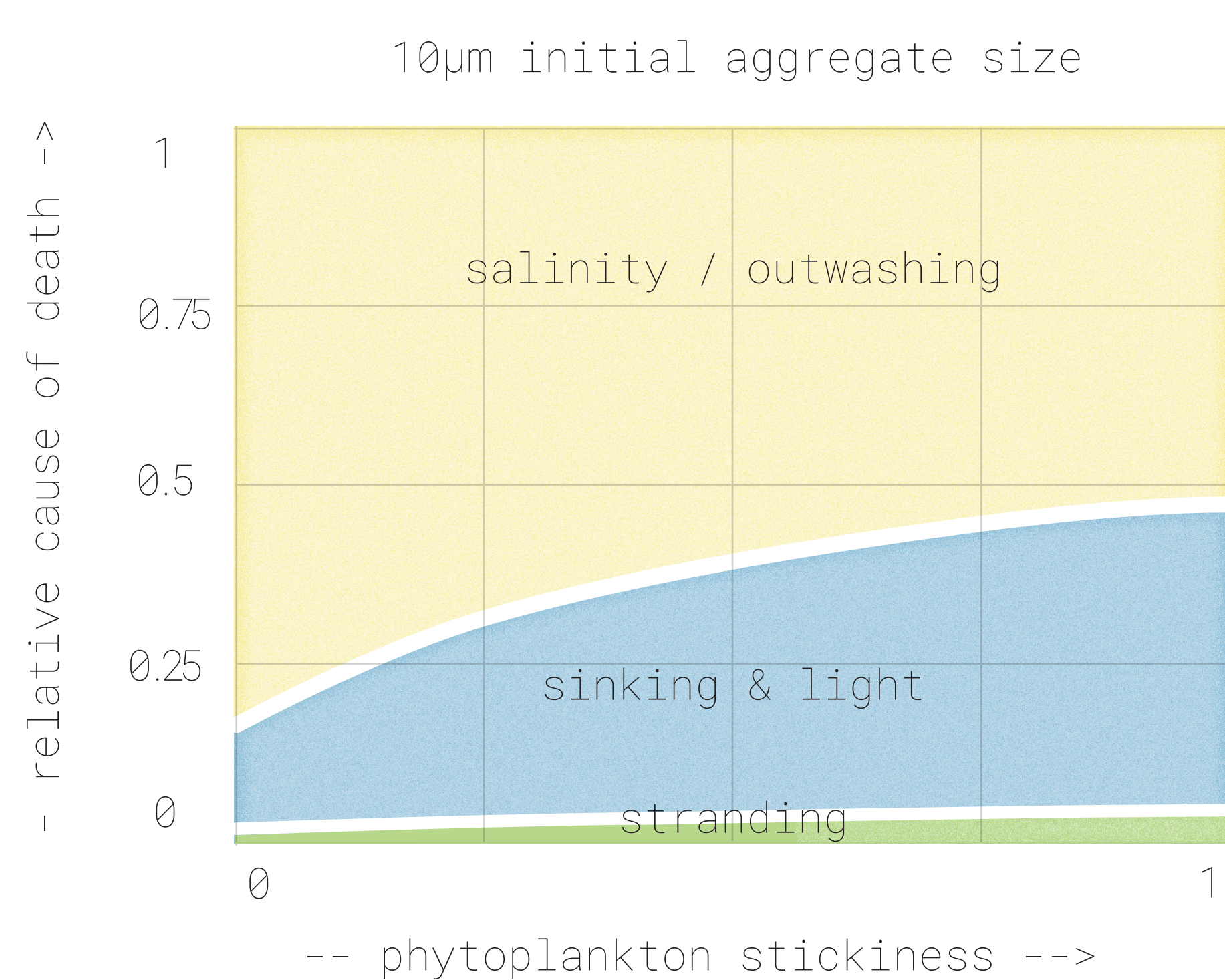
To estimate the relative importance of these mortality-causing processes, we track the causes of death of our simulated aggregates



they might be dying because of:



relative importance of these processes: (excluding grazing)



We find that aggregation enhanced settling and consequent light limitation might play an important role in the collapse of the phytoplankton community - a process that is currently not considered in any of the state-of-the-art models



meetingorganizer.copernicus.org/
EGU24/EGU24-11922.html