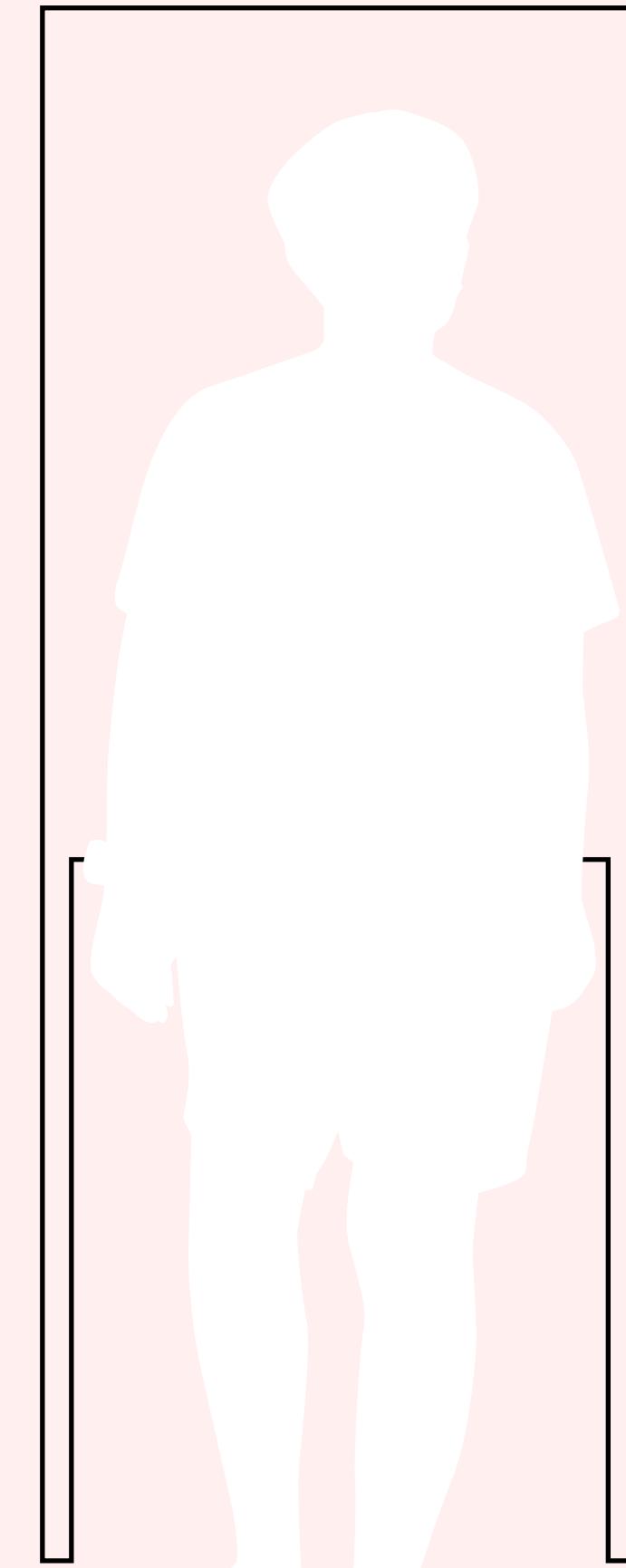


Report
06–11 October 2025
Summer School

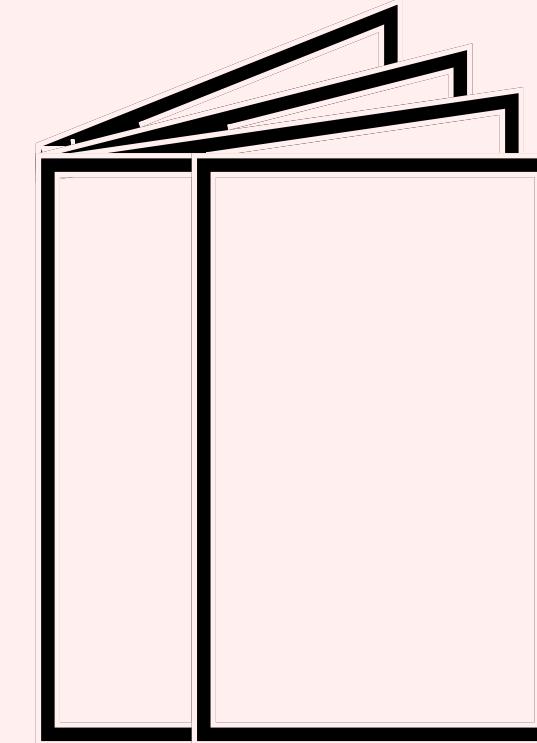
**6 days of work, 20 students involved, 2
hours of administration, 40 people involved**

20 students
7 groups
7 panels



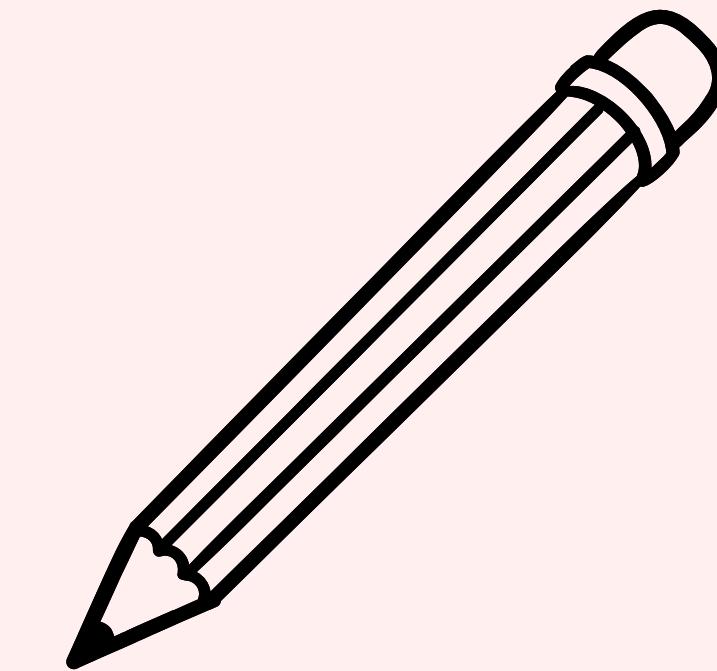
Each panel invites participants to guess data related to phytoplankton and climate change, co-creating a visualization of the responses from everyone who takes part.

1 booklet

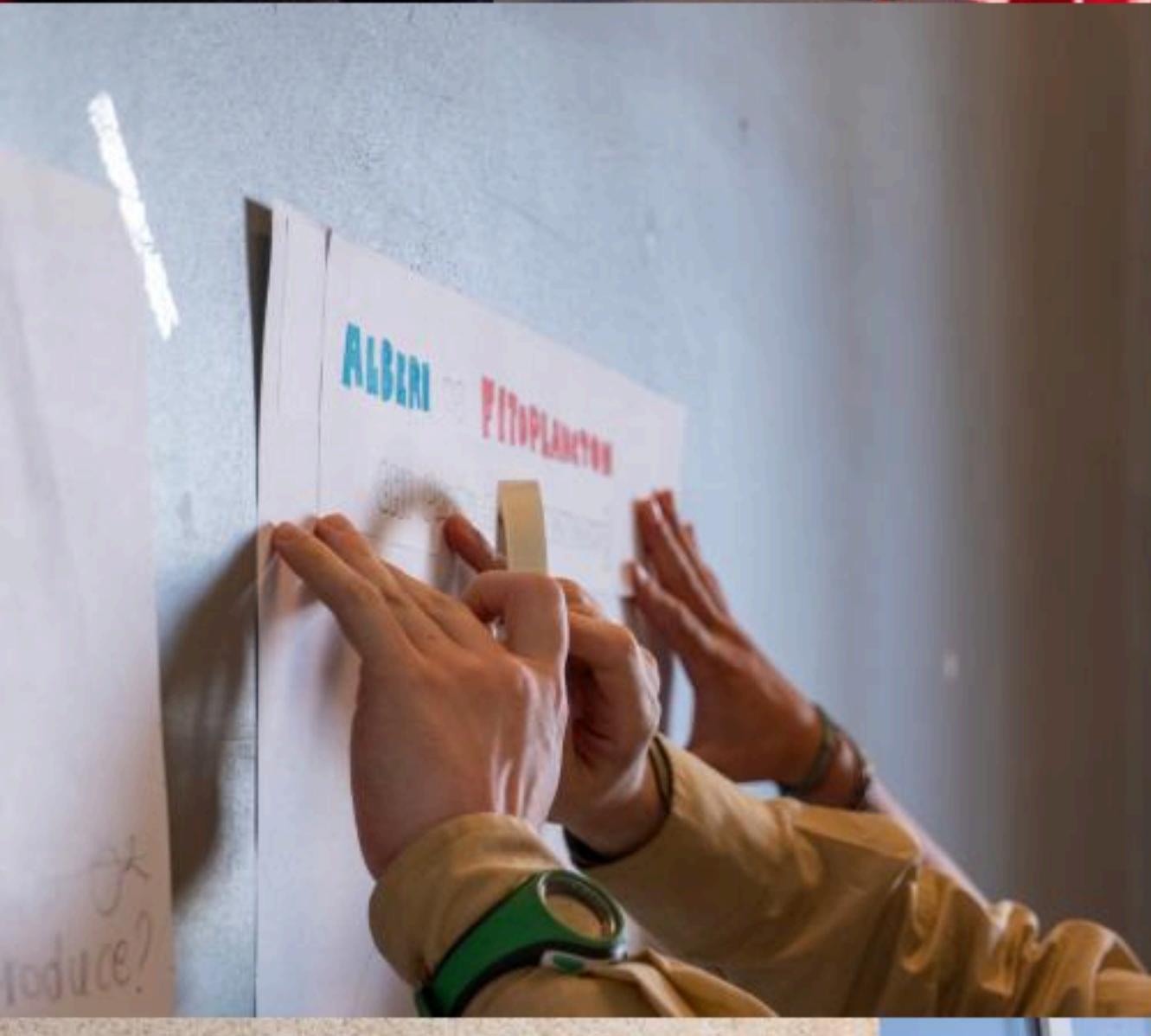


The act of guessing sparks curiosity to discover the correct answers. These are available in a booklet designed specifically for the occasion.

1 reward

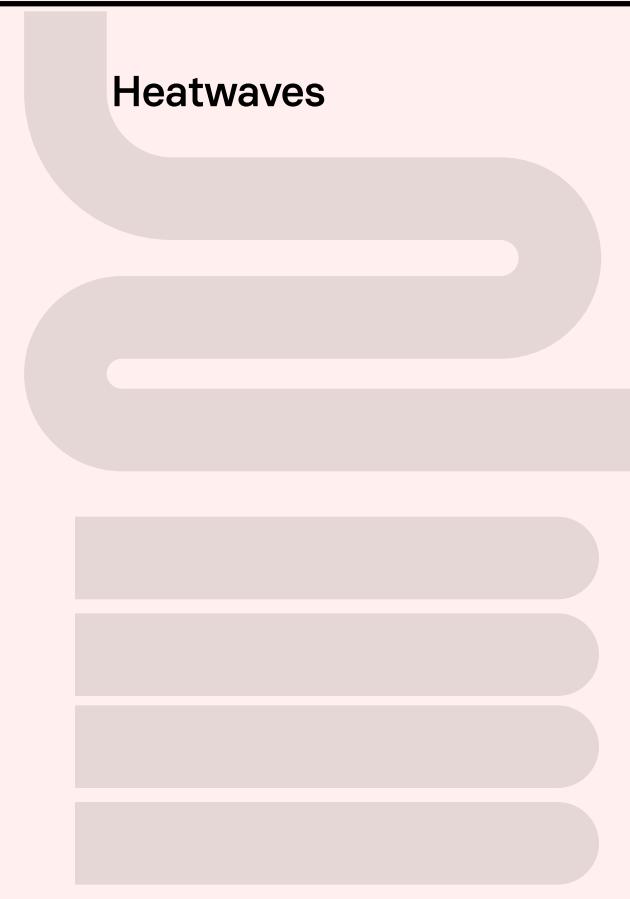


At the end of the experience, participants are gifted a sprout pencil.

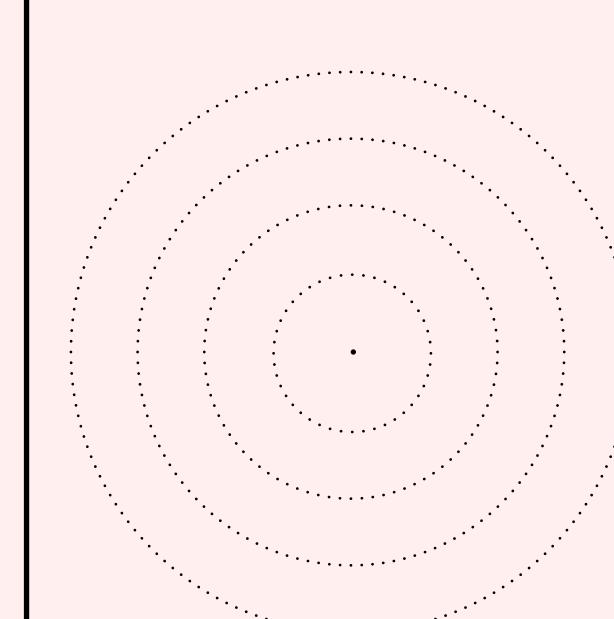


Panels

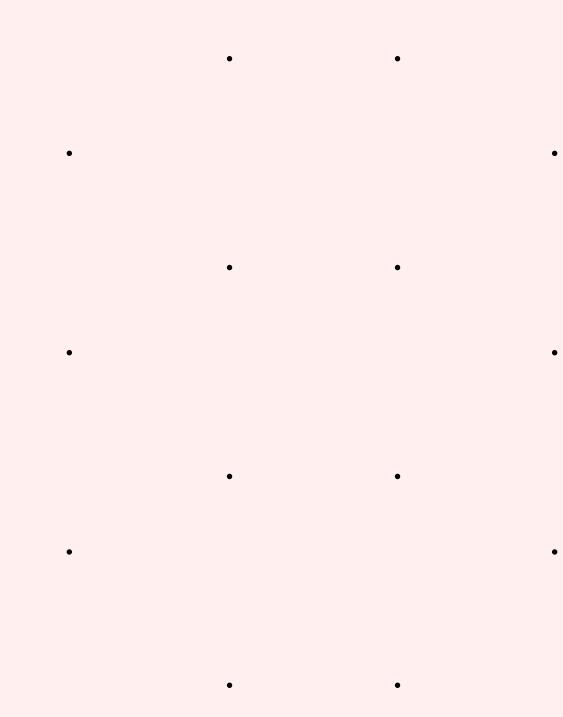
Heatwaves



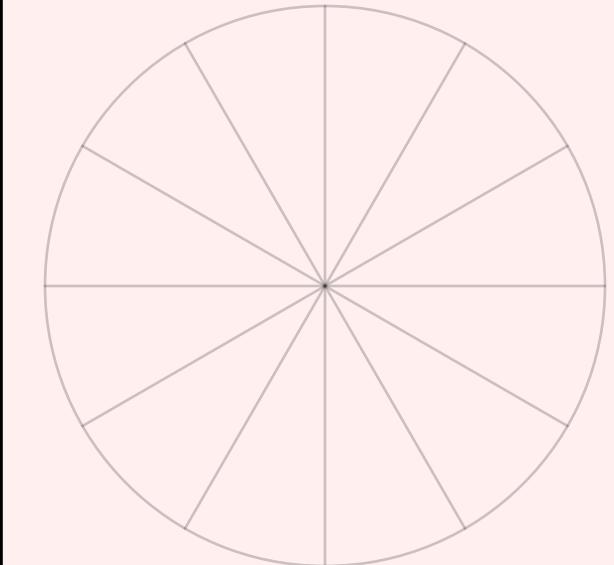
Temperature vs.
precipitation



Do you know
phytoplankton?



Trees vs. phytoplankton



Pathogens

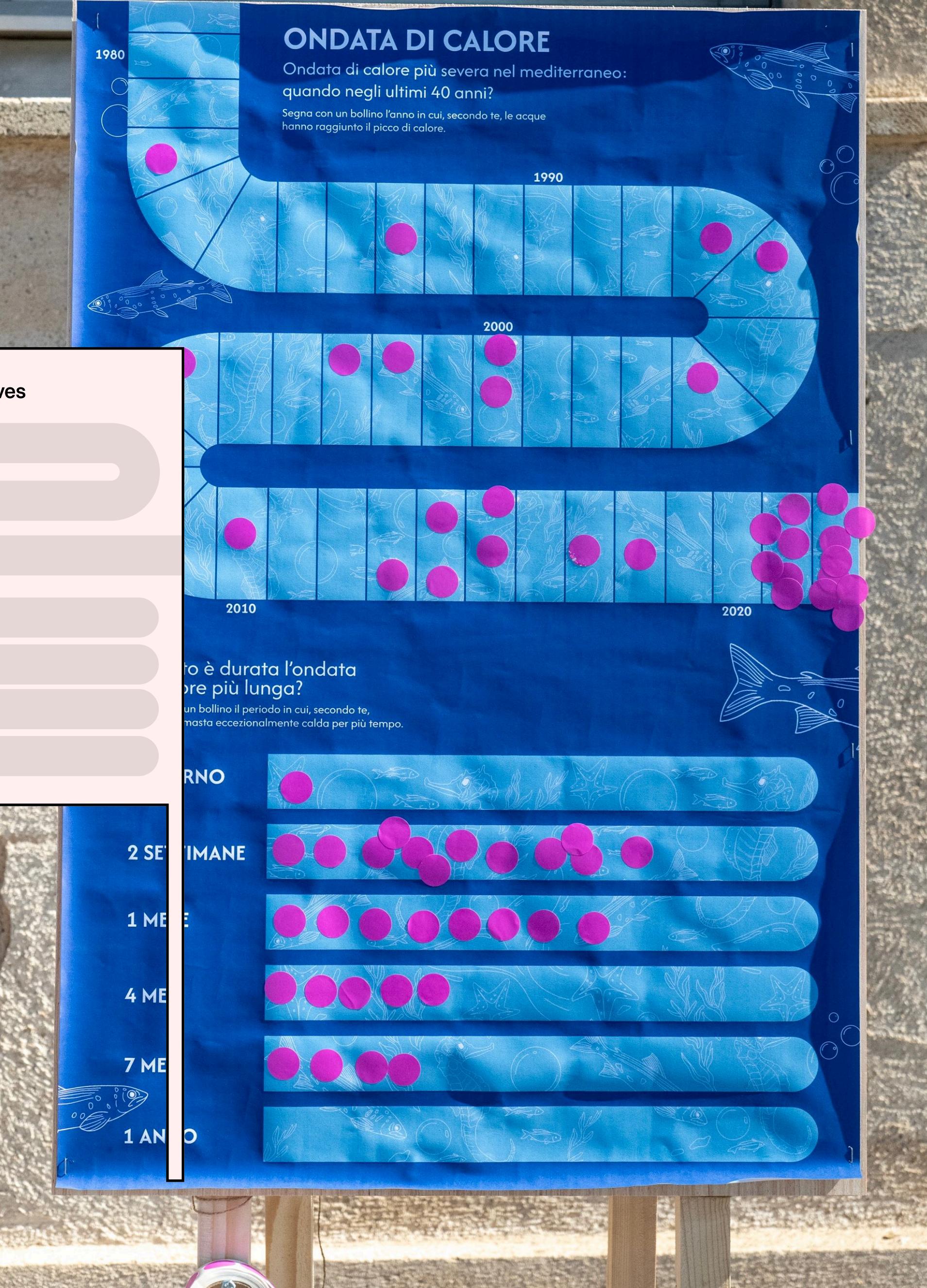


Marine fauna size

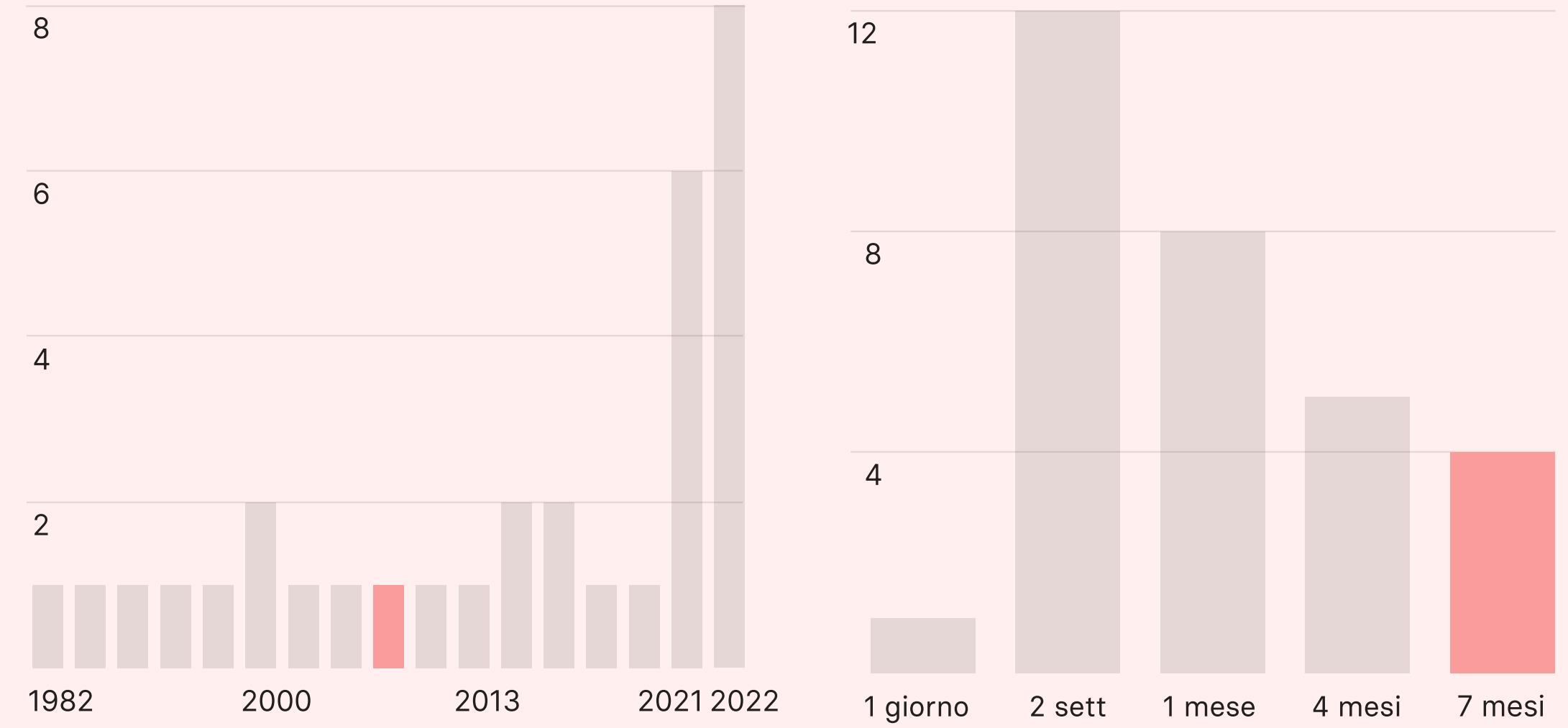


What remains down there?



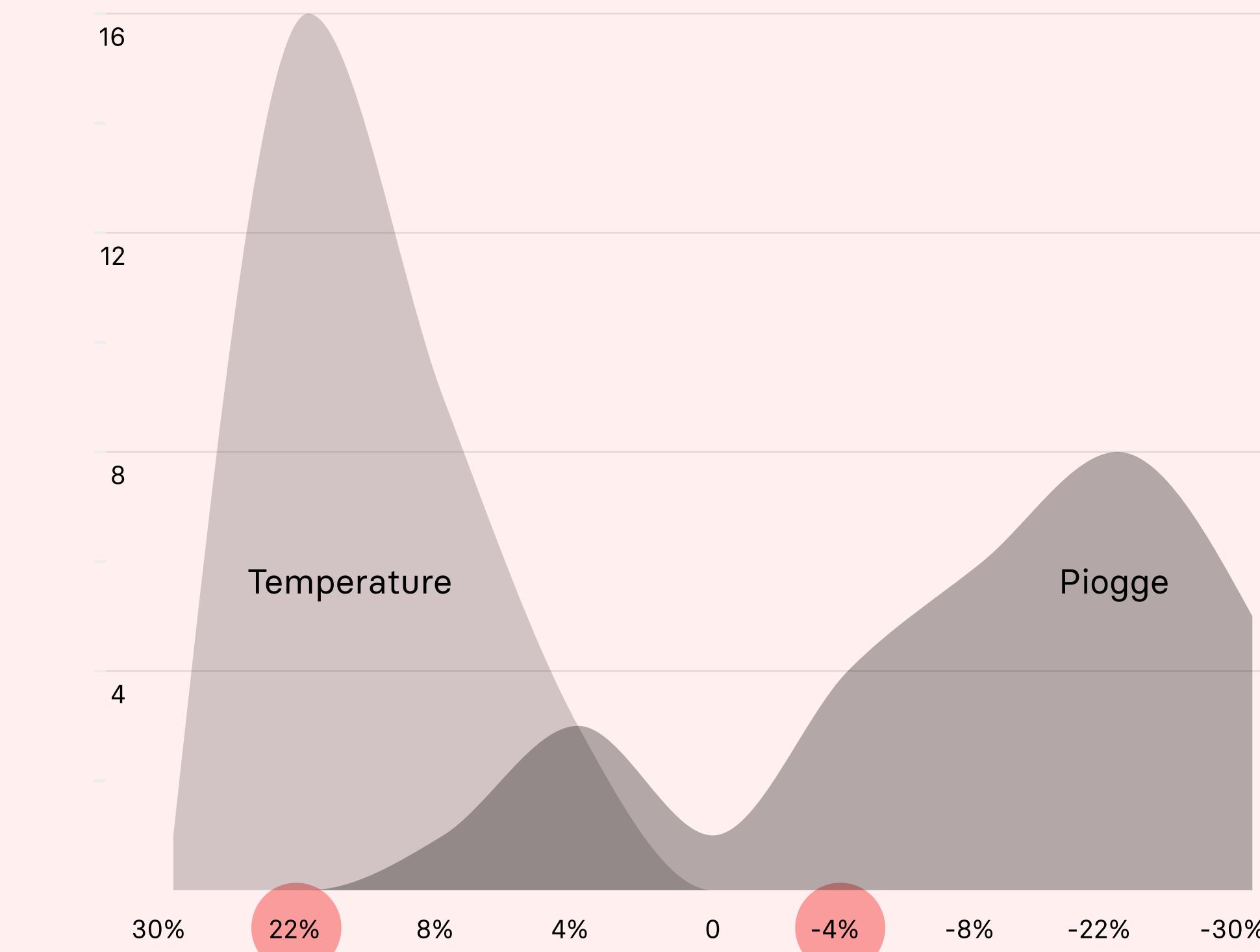


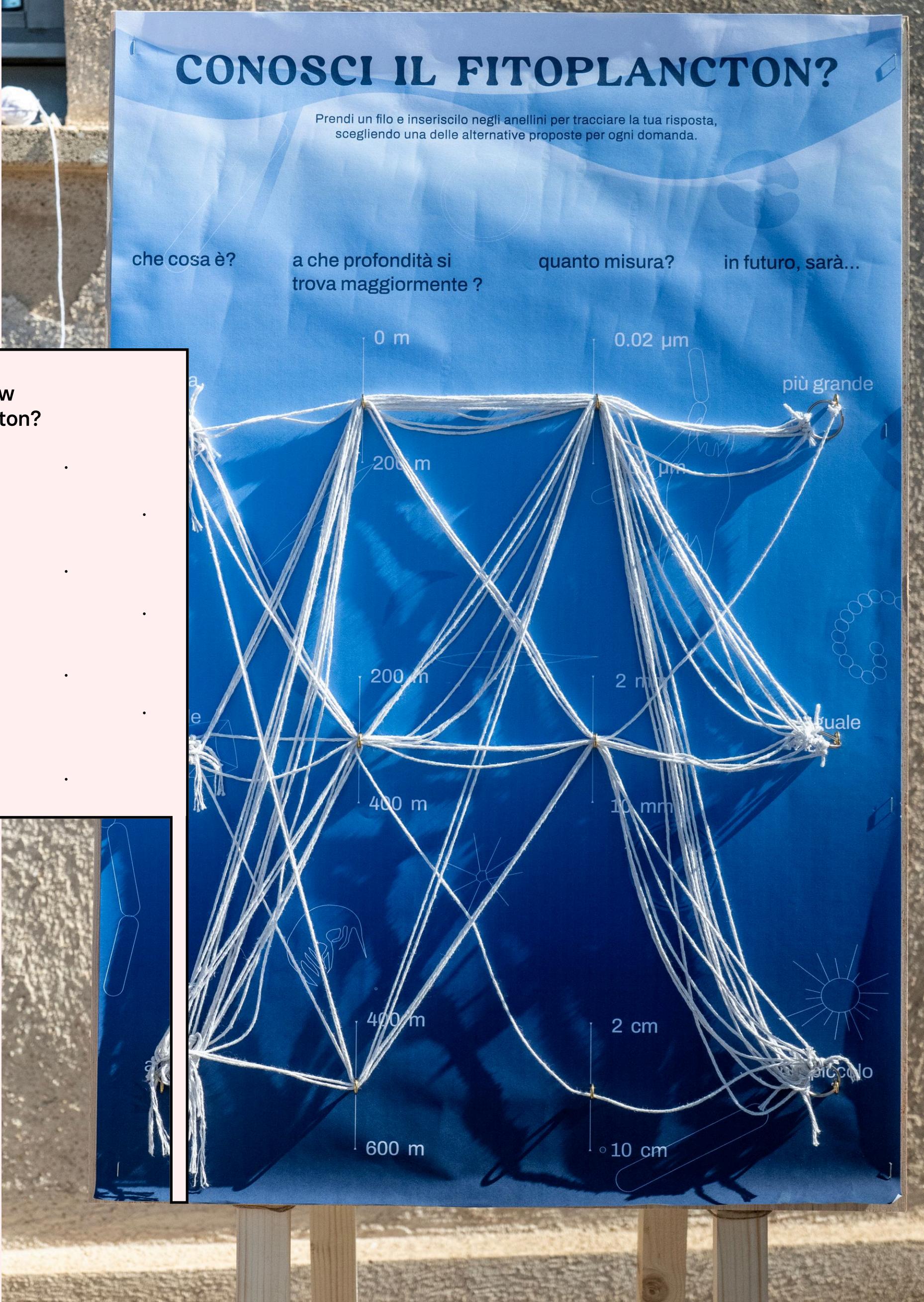
The first panel of the route introduces one of the main protagonists of the summer school: heatwaves. It invites people to guess when they began to become significant and how long the longest one lasted.
30 responses collected; the correct one is highlighted in red.





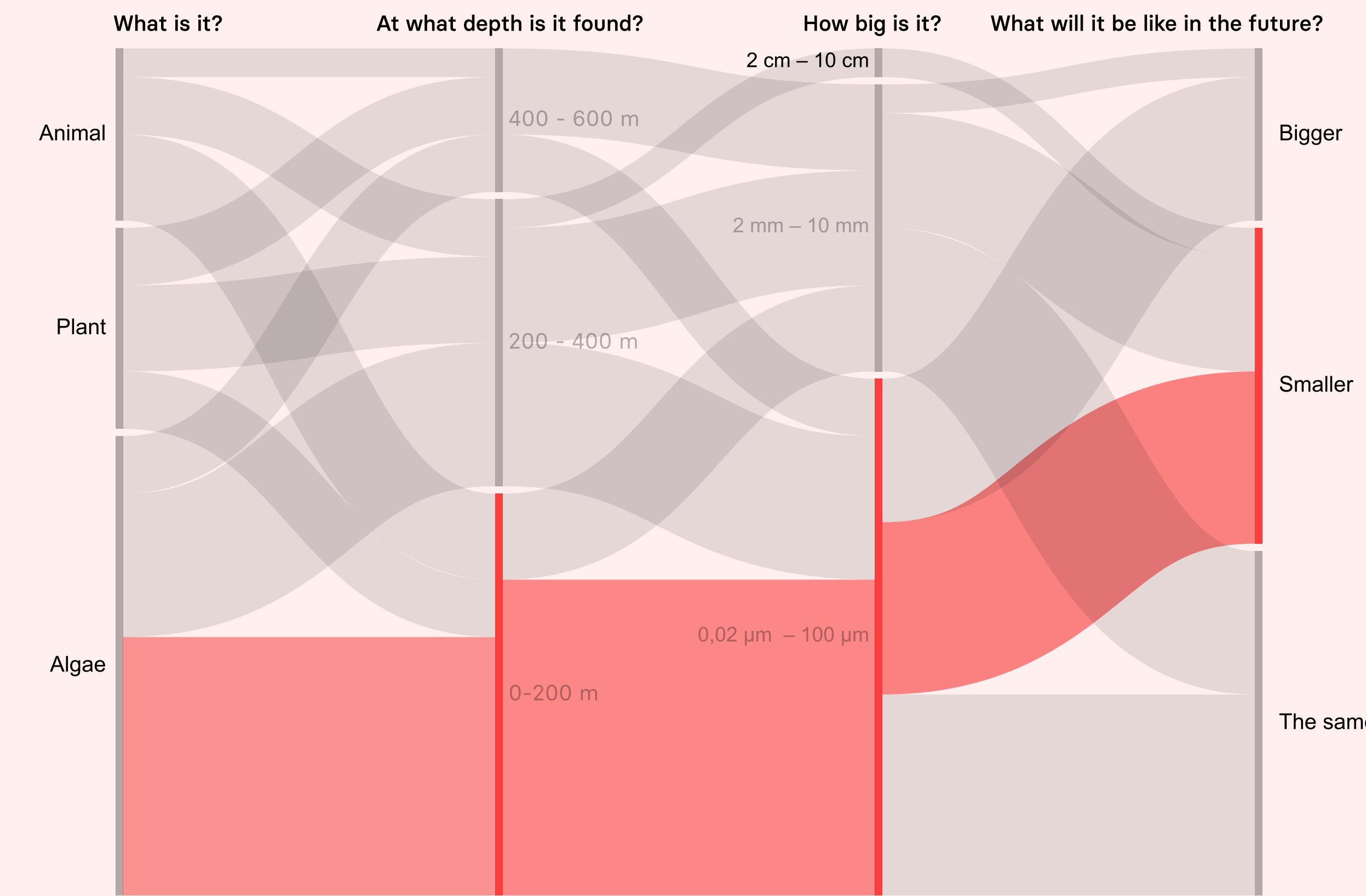
The second panel relates temperature and precipitation, inviting participants to indicate how these values have increased or decreased, and suggesting a possible connection between the two phenomena. 29 responses collected; the correct one is highlighted in red.

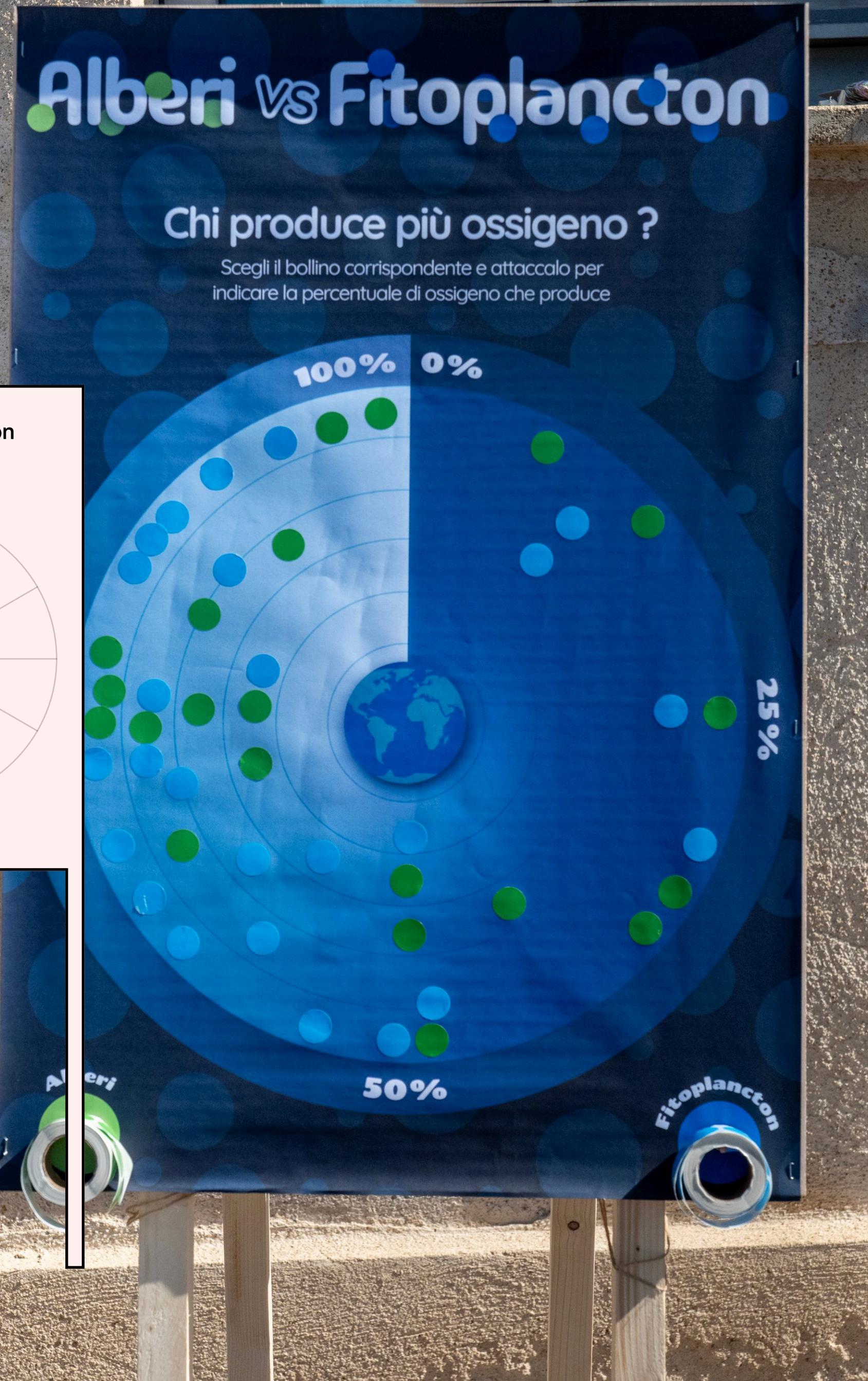
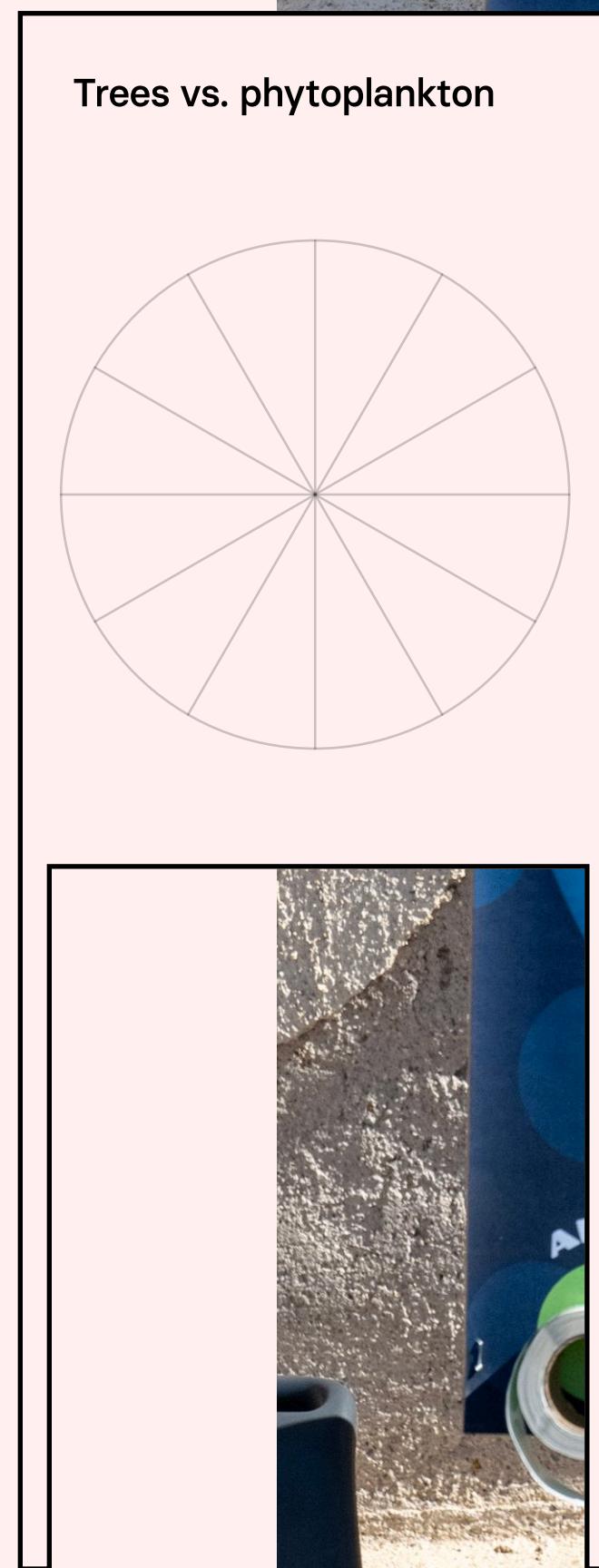




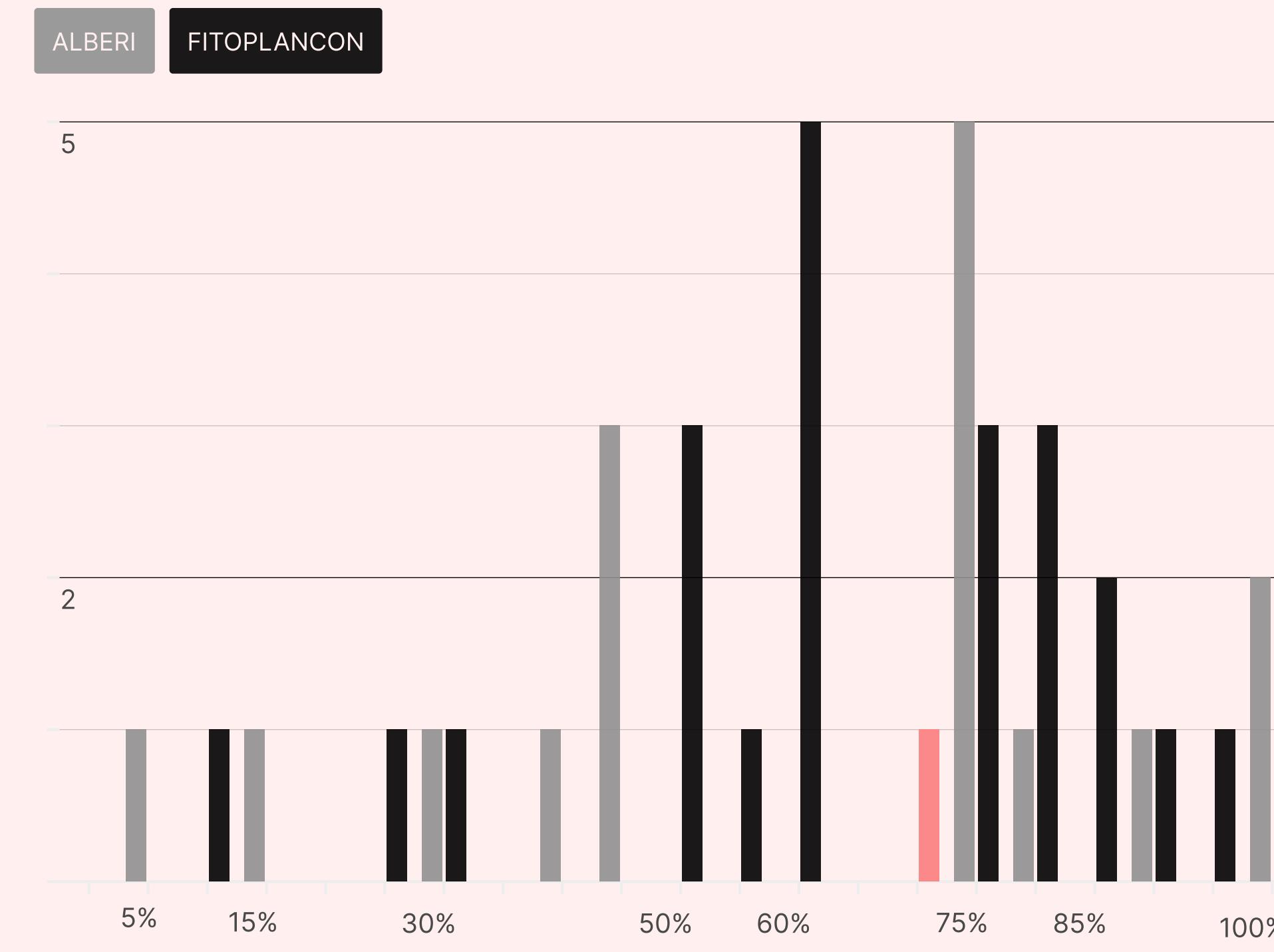
The third panel is dedicated to phytoplankton and invites the audience to reflect on its nature, habitat, size, and possible future development.

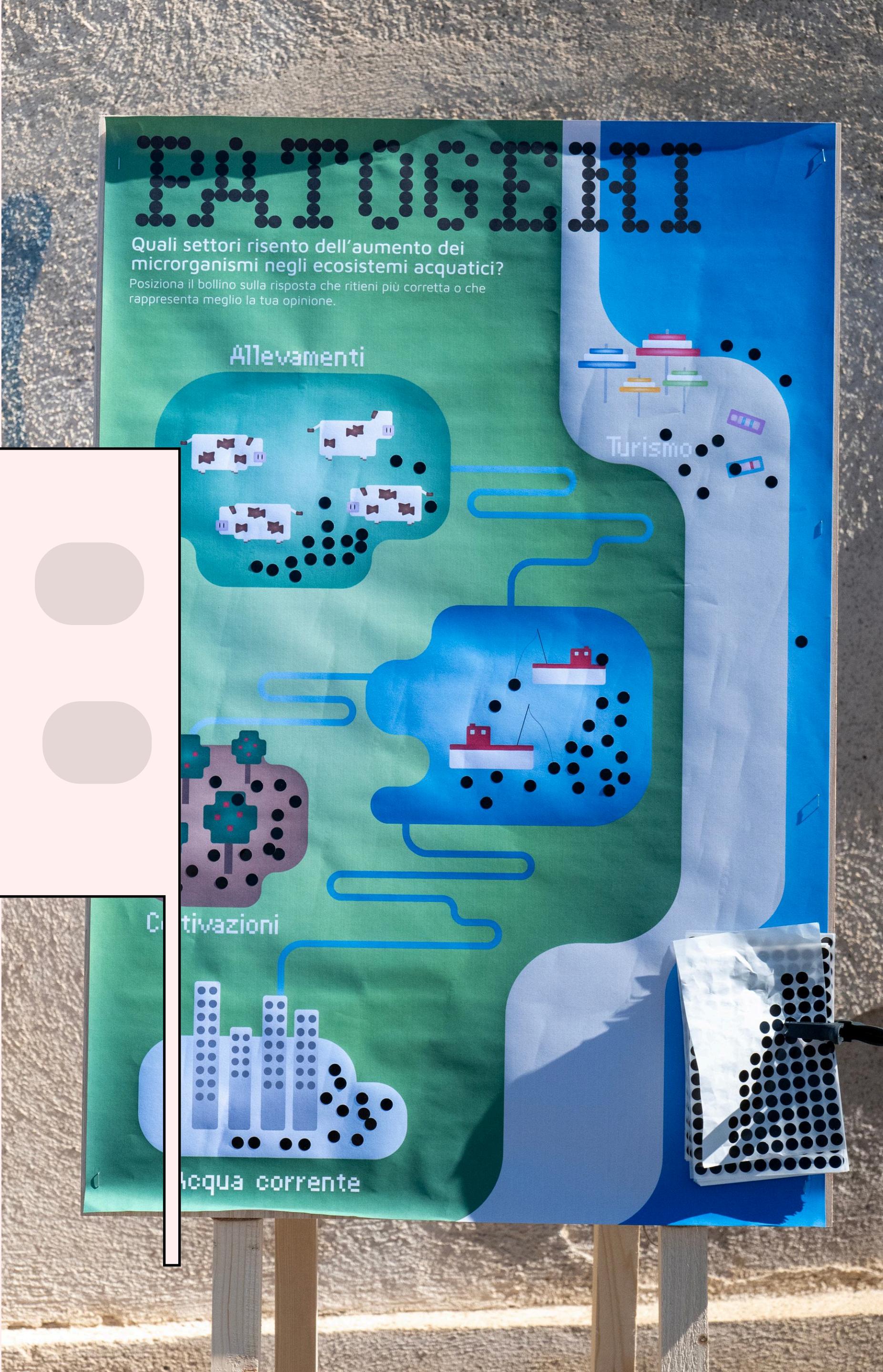
29 responses collected; the correct one is highlighted in red.



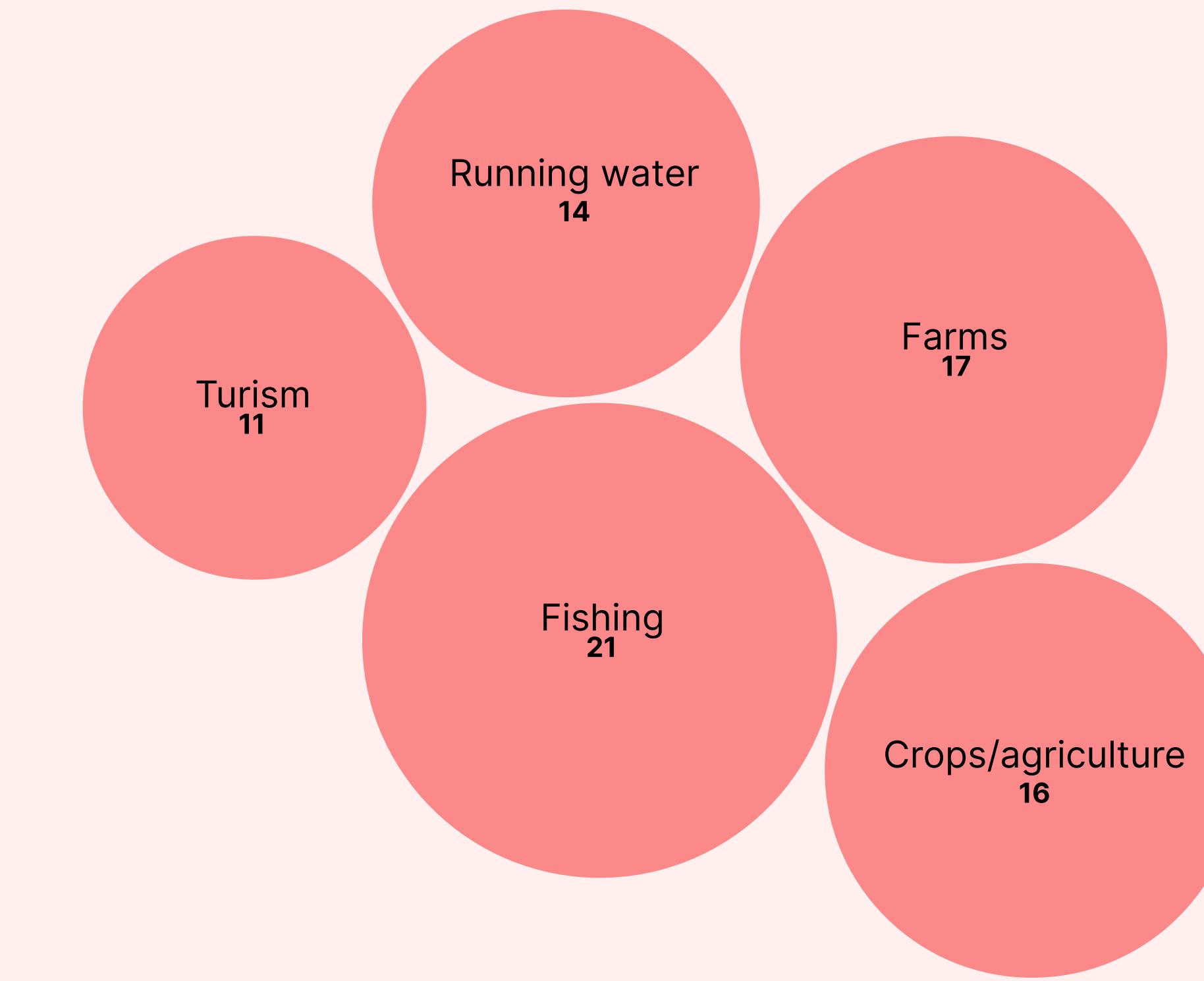


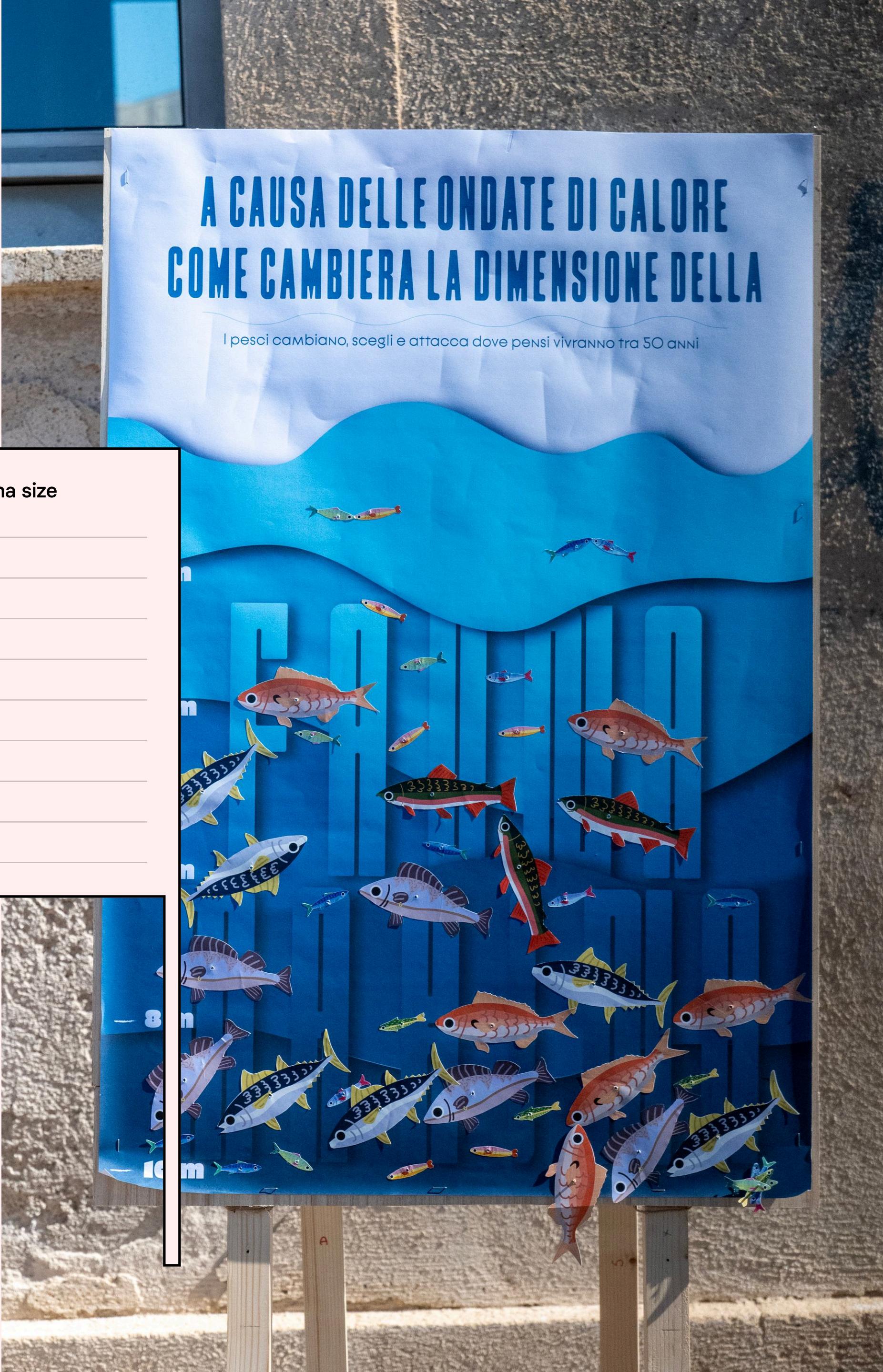
The fourth panel aims to establish a relationship between phytoplankton activity and life on the planet, inviting the audience to guess what percentage of oxygen is produced by these organisms compared to that generated by trees.
23 responses collected; the correct one is highlighted in red.



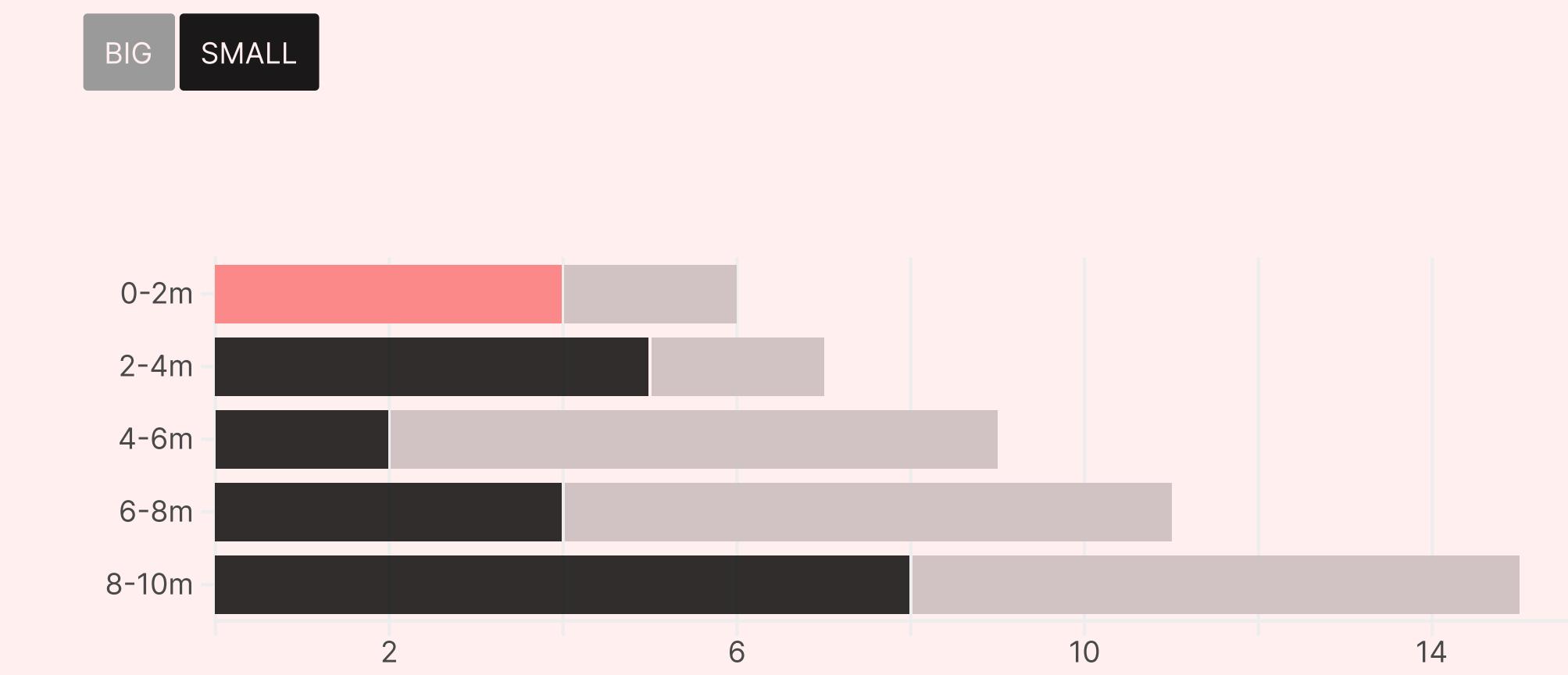


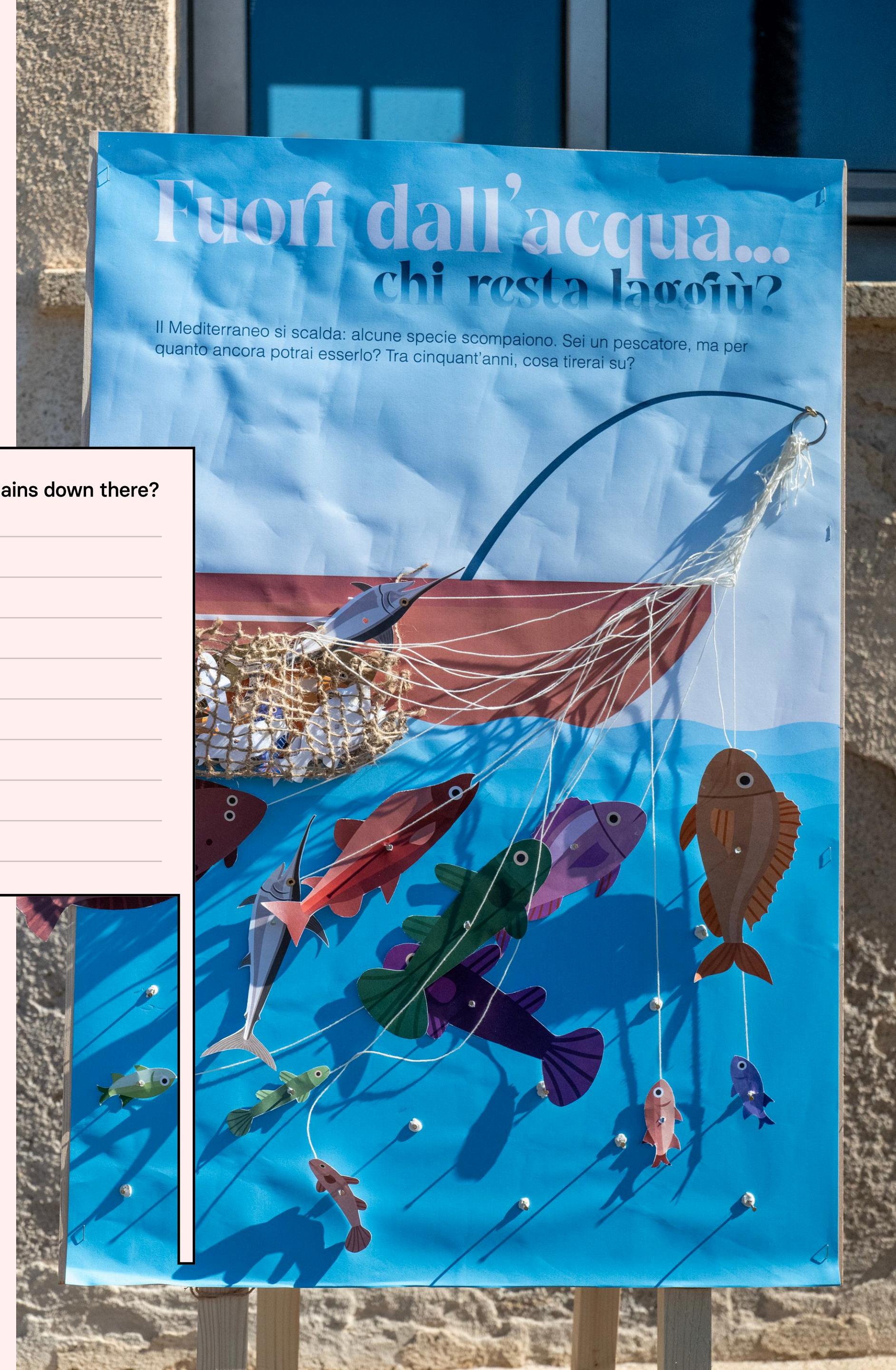
The fifth panel introduces a new element into the context: pathogens, which increase in response to heatwaves and rising temperatures, affecting all sectors, activities, and services related to water.
30 responses collected; the correct one is highlighted in red.





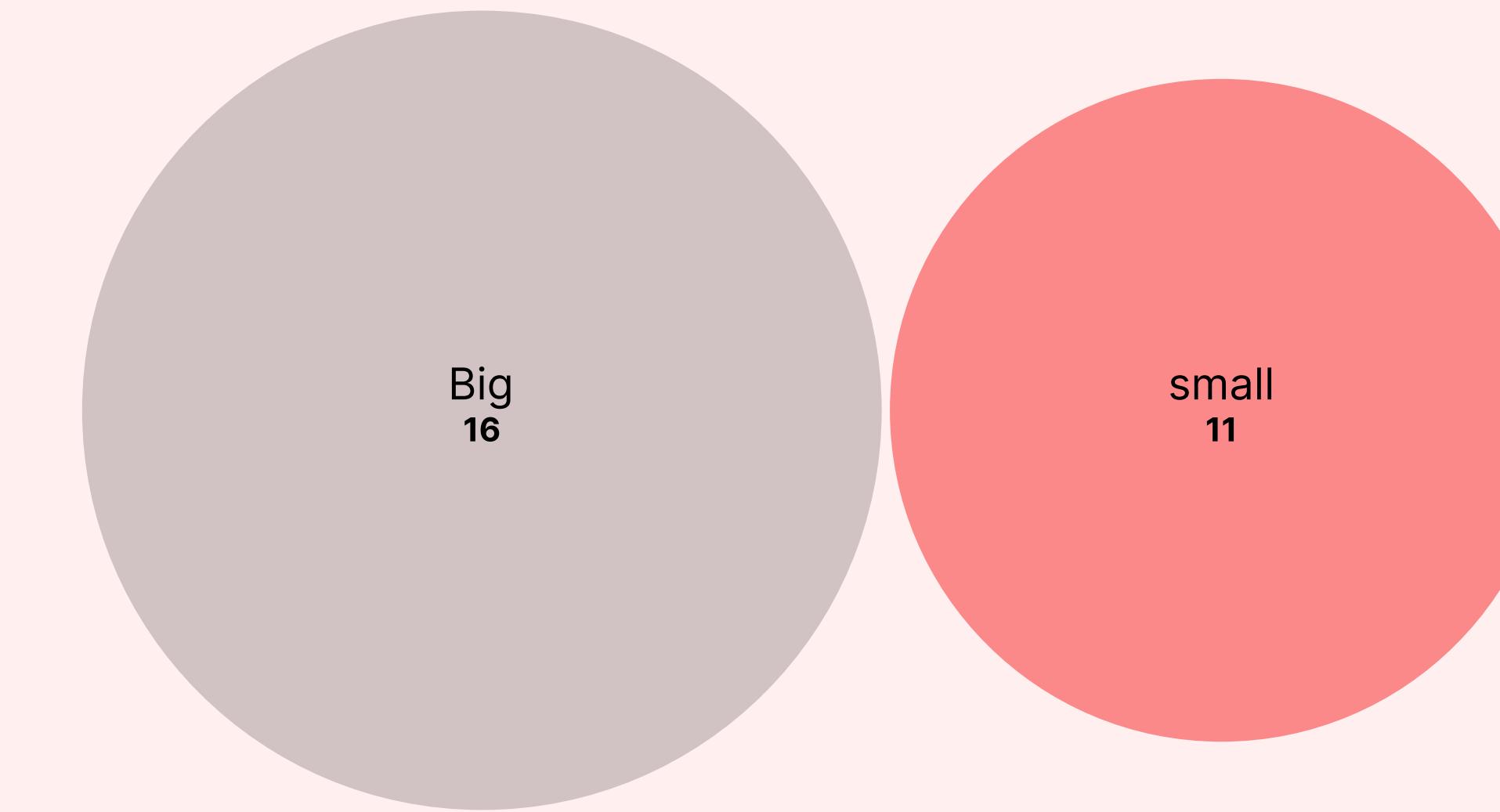
The sixth panel invites participants to predict how the size of marine fauna will change and where it will move as a result of heatwaves. 25 responses collected; the correct one is highlighted in red.





The seventh panel continues the discussion of the previous one, inviting the audience to imagine how the fishing sector will change in fifty years.

27 responses collected; the correct one is highlighted in red.



Booklet

At the end of the activity, each participant receives a small A5 booklet containing the correct answers to the questions and the sources from which they are drawn. As an additional keepsake from the event, a Sprout pencil with arugula seeds





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ONDATA DI CALORE

Il fitoplancton è alla base della vita sul pianeta. Invisibile a occhio nudo, produce oltre la metà dell'ossigeno che respiriamo e assorbe enormi quantità di anidride carbonica, contribuendo a regolare il clima terrestre. Eppure, è considerato un buon indicatore del cambiamento climatico in corso.

Quando la temperatura del mare aumenta, il delicato equilibrio che sostiene questi microrganismi si spezza: la produttività cala, la biodiversità si riduce, e l'intero ecosistema – dalle alghe ai pesci, fino a noi – ne subisce le conseguenze.

Questo booklet nasce per rendere visibile ciò che è invisibile, per tradurre in forme comprensibili e sensibili la complessità di un mondo microscopico ma vitale. Fa parte di Invisible Matters – Summer School 2025, un'iniziativa che unisce design e scienza per immaginare nuovi modi di comunicare e agire di fronte alla crisi climatica.

Alghero, 6-11 ottobre 2025

Università degli Studi di Sassari – Dipartimento di Architettura, Design e Urbanistica (DADU)

Docenti: Nada Beretic, Paola Dore, Matteo Moretti, Silvia Pulina.
Partner: Ministero dell'Università e della Ricerca; Fondazione Alghero
Comune di Alghero.



FITOPLANCTON E ONDATE DI CALORE NEL MEDITERRANEO

Il contributo del fitoplancton e le minacce del riscaldamento globale.

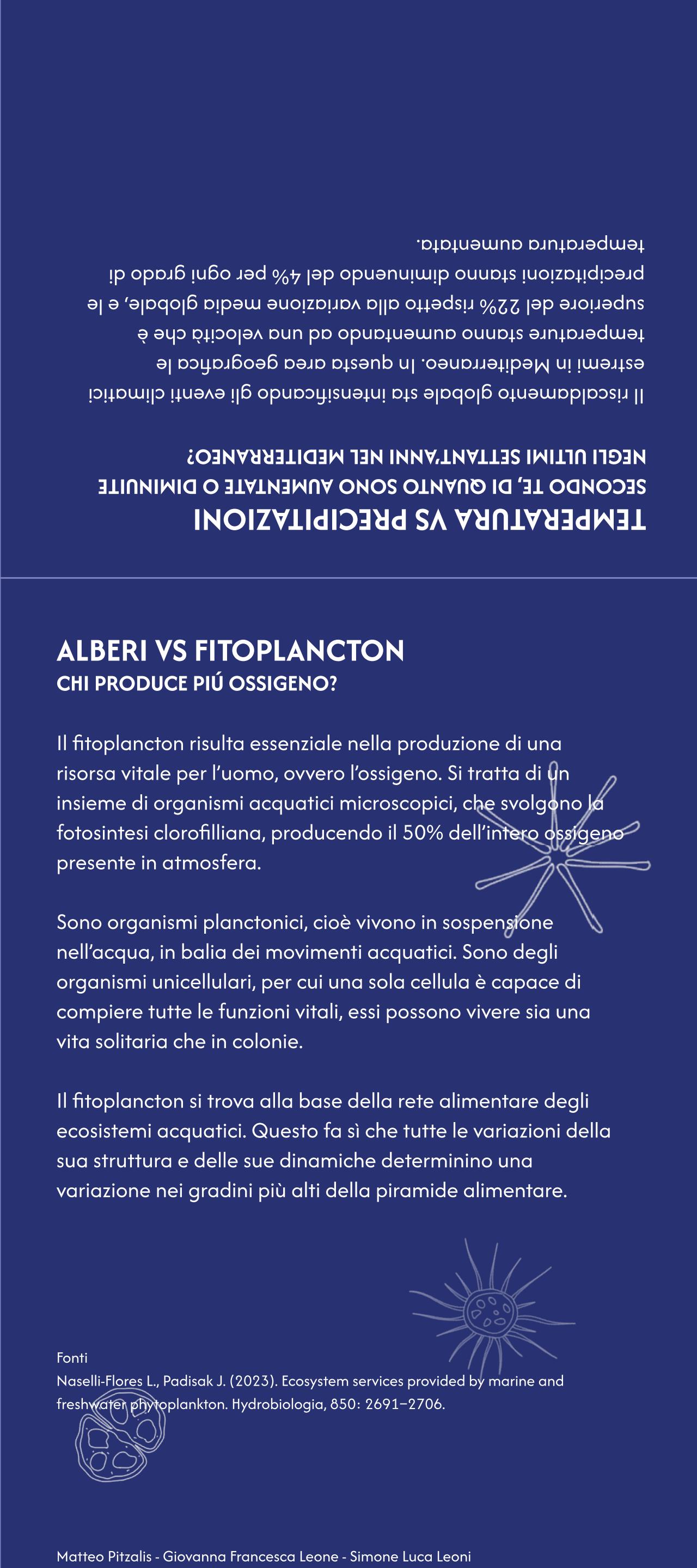
MICROORGANISMI PATOGENI

MICROORGANISMI PATOGENI | TEMPERATURA VS PRECIPITAZIONI

- Negli ultimi decenni il Mediterraneo sta vivendo un rapidoumento delle temperature acquisite, con eventi di ondate di calore sempre più frequenti, lunghi e intensi rispetto al passato. Questi fenomeni segnano un cambiamento profondo negli equilibri del mare.

Le ondate di calore acquisite osservate in Mediterraneo nel 2003 e nel 2022 sono state quelle più severe degli ultimi 30 anni, e erche più intense e più durature. In particolare, durante l'ondata di calore avvenuta nel 2003 si è osservato un picco anomalo di 7,19 °C rispetto alla media, mentre l'ondata di calore del 2022 è durata 7 mesi, da maggio a novembre.

Il riscaldamento globale sta intensificando gli eventi climatici estremi in Mediterraneo. In questa area geografica le temperature stanno aumentando ad una velocità che è superiore del 22% rispetto alla variazione media globale, e le precipitazioni stanno diminuendo del 4% per ogni grado di temperatura aumentata.



ALBERI VS FITOPLANCTON CHI PRODUCE PIÙ OSSIGENO?

Il fitoplancton risulta essenziale nella produzione di una risorsa vitale per l'uomo, ovvero l'ossigeno. Si tratta di un insieme di organismi acquatici microscopici, che svolgono la fotosintesi clorofilliana, producendo il 50% dell'intero ossigeno presente in atmosfera.

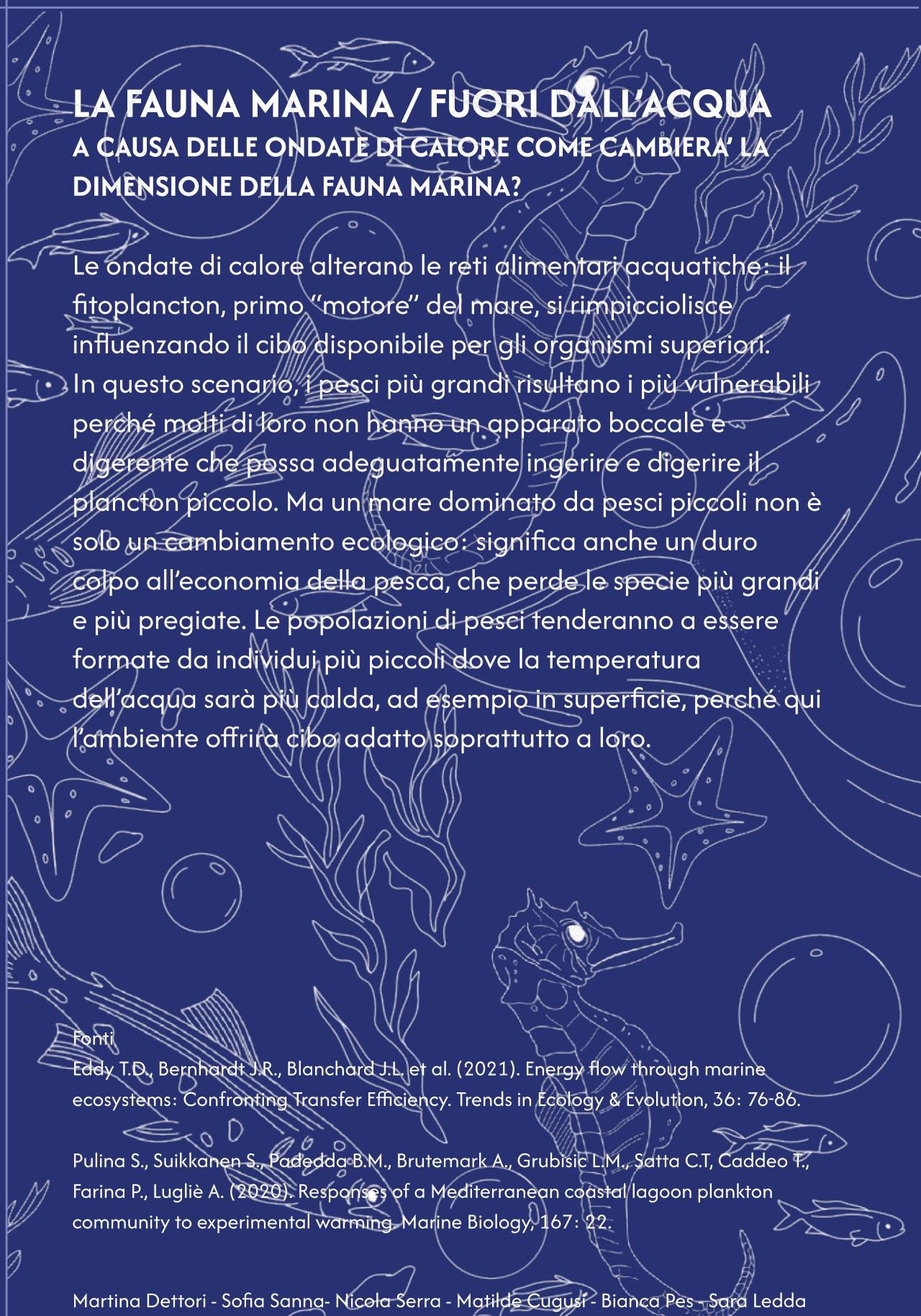
Sono organismi planctonici, cioè vivono in sospensione nell'acqua, in balia dei movimenti acquatici. Sono degli organismi unicellulari, per cui una sola cellula è capace di compiere tutte le funzioni vitali, essi possono vivere sia una vita solitaria che in colonie.

Il fitoplancton si trova alla base della rete alimentare degli ecosistemi acquatici. Questo fa sì che tutte le variazioni della sua struttura e delle sue dinamiche determinino una variazione nei gradini più alti della piramide alimentare.



For

Naselli-Flores L., Padisák J. (2023). Ecosystem services provided by marine and freshwater phytoplankton. *Hydrobiologia*, 850: 2691–2706.



**A FAUNA MARINA / FUORI DALL'ACQUA
CAUSA DELLE ONDATE DI CALORE COME CAMBIERA' LA
IMENSIONE DELLA FAUNA MARINA?**

e ondate di calore alterano le reti alimentari acquisite: il toplancton, primo "motore" del mare, si rimpicciolisce influenzando il cibo disponibile per gli organismi superiori. In questo scenario, i pesci più grandi risultano i più vulnerabili.

erché molti di loro non hanno un apparato boccale e
gerente che possa adeguatamente ingerire e digerire il
lancton piccolo. Ma un mare dominato da pesci piccoli non è
solo un cambiamento ecologico: significa anche un duro
colpo all'economia della pesca, che perde le specie più grandi
più pregiate. Le popolazioni di pesci tenderanno a essere
formate da individui più piccoli dove la temperatura
ell'acqua sarà più calda, ad esempio in superficie, perché qui
ambiente offrirà cibo adatto soprattutto a loro.

nti

dy T.D., Bernhardt J.R., Blanchard J.L. et al. (2021). Energy flow through marine ecosystems: Confronting Transfer Efficiency. *Trends in Ecology & Evolution*, 36: 76-86.

olina S., Suikkanen S., Padedda B.M., Brutemark A., Grubisic L.M., Saitta C.T., Caddeo F., Cirina P., Lugliè A. (2020). Responses of a Mediterranean coastal lagoon plankton community to experimental warming. *Marine Biology* 167: 22.

Martina Dottori, Sofia Sanna, Nicola Serra, Matilde Giugni, Bianca Ricci, Sara Ledda

Invisible Matters was the intensive summer school of the Bachelor's Degree in Design at DADU – University of Sassari, dedicated to design for scientific communication and civic participation. The initiative explored how design can help make complex scientific topics understandable through transdisciplinary approaches, participatory practices, and innovative data-representation tools.

The 2025 edition focused on plankton, an invisible yet vital world for the planet's balance. Participants investigated the role of these microscopic aquatic organisms in climate regulation and ecosystem equilibrium, with particular attention to the effects of global warming and heatwaves on waters that sustain essential resources such as drinking water and food, at the intersection of science and society.

Through workshops, hands-on experiences, and collaborative activities, the school made scientific content accessible and engaging, experimenting with physical and collective forms of data representation to stimulate dialogue and reflection on environmental issues.

The program integrated skills in product design, data visualization, communication, and interaction design, leading to the creation of experiential installations designed to raise awareness among the local community and a broader audience about the relationship between the environment.

Faculty

Nada Beretic, Nicolo Ceccarelli, Paola Dore, Matteo Moretti, Silvia Pulina.

Students

Manila Azzarelli, Eleonora Chelo, Matilde Cugusi, Elena Darakchy, Laura Delogu, Martina Dettori, Aurora Exana, Rachele Lai, Sara Ledda, Giovanna Francesca Leone, Simone Luca Leoni, Marta Marongiu, Stefano Mura, Bianca Pes, Stefano Pintus, Matteo Pitzalis, Giorgia Porcu, Sofia Sanna, Eleonora Sanna, Nicola Serra.

With the patronage and support of



Invisible Matters is a dissemination initiative presenting the results of the PRIN project “FUTURE – A warmer future world: effects on plankton communities and pathogens in Mediterranean vulnerable ecosystems”, carried out with the support of the Fondazione Alghero as part of the C4talent–URBACT project.

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