At the interface of deep-sea science – cross-sector research collaboration to study the world's most famous deep-sea wreck during the OceanGate 2022 Titanic Expedition

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OceanGate EXPEDITIONS

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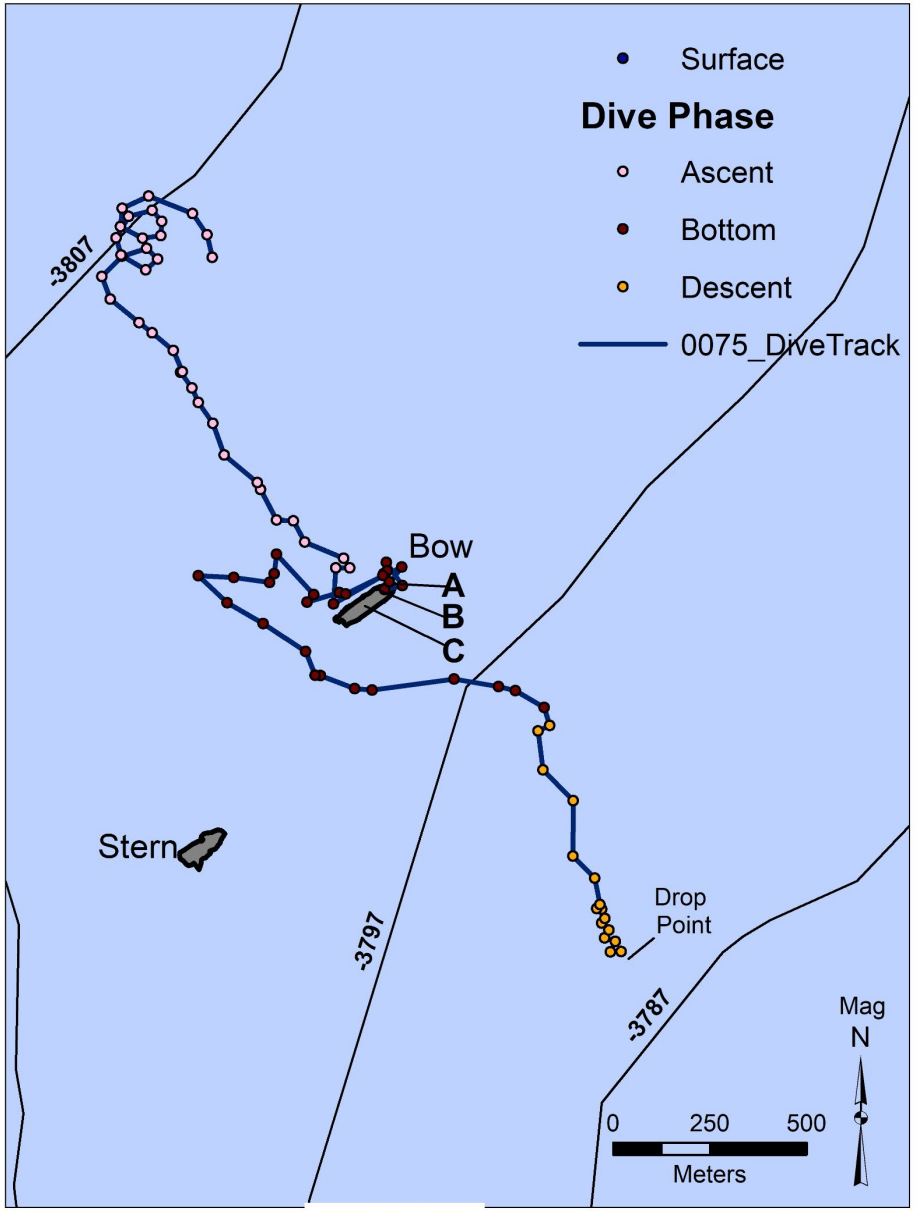
Presentation overview

- 2022 Titanic Expedition in numbers
- Biological research of the Titanic wreck – state of knowledge
- Scientific program of the expedition
- First insights
- Next steps

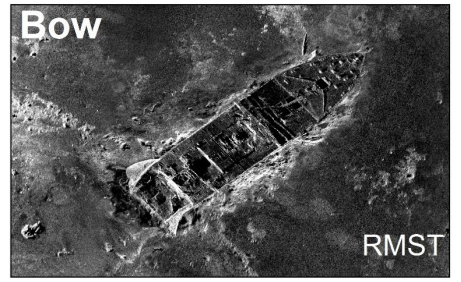
2022 Titanic Expedition

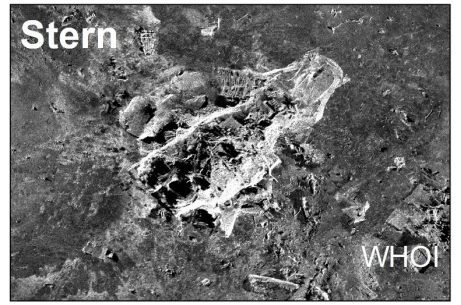
- **5 Missions** in Summer 2022
- **13 dives** of the manned submersible *Titan* during the 2022 expedition
- **7 successful dives to the *RMS Titanic*** wreck (approximately 3,800 m depth)
- **23 mission specialists** and **7 scientists** & archaeologists took part in filed missions, 20 individuals dove to RMS *Titanic*
- **> 100 hours** of video footage obtained from and near the wreck, as well as water samples and environmental data

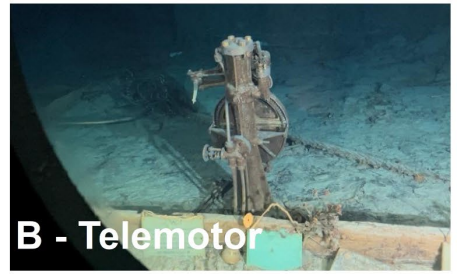


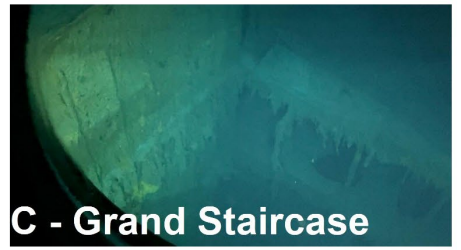
Map of Dive 0075 to the Titanic, generated on board

Photos by OceanGate and Chelsea Kellogg
Map by Chris McCabe and Anna Gebruk

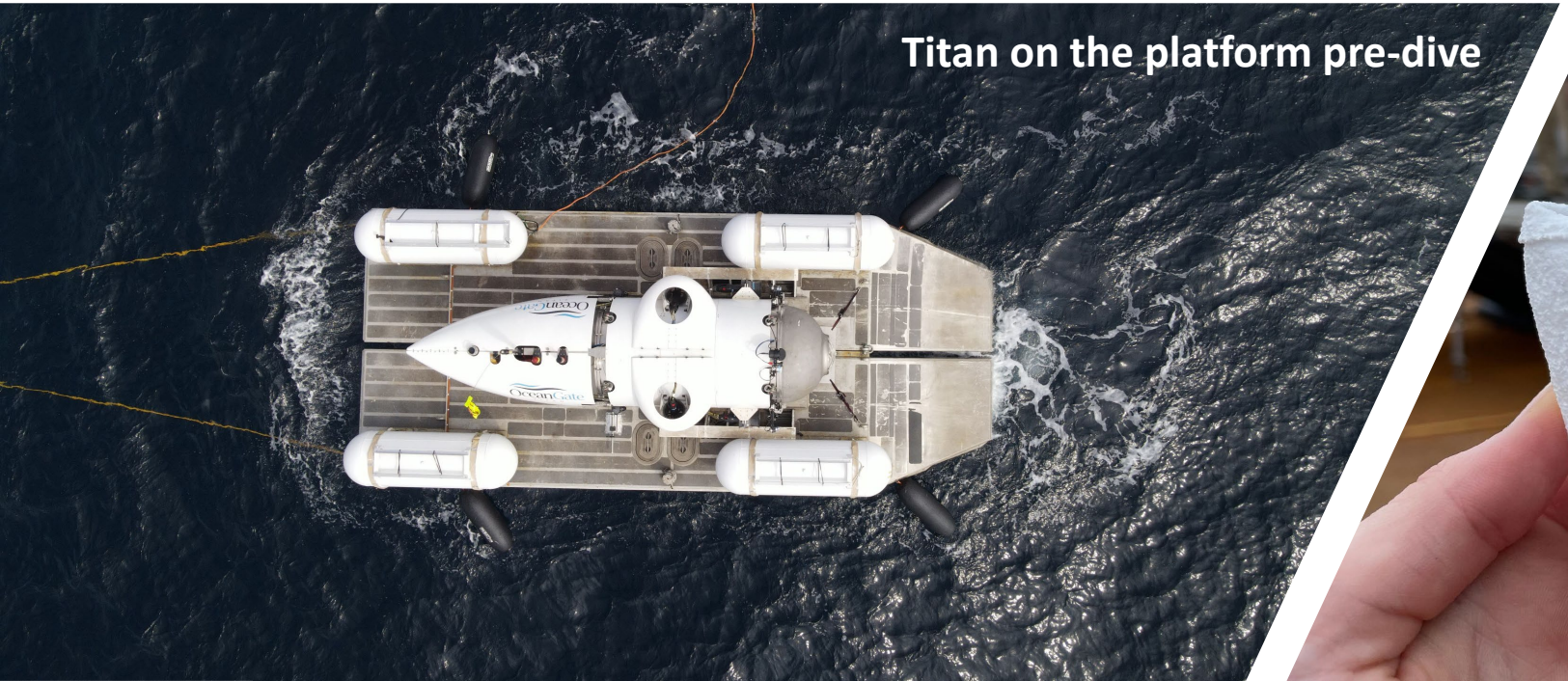








R/V *Horizon Arctic*



Titan on the platform pre-dive

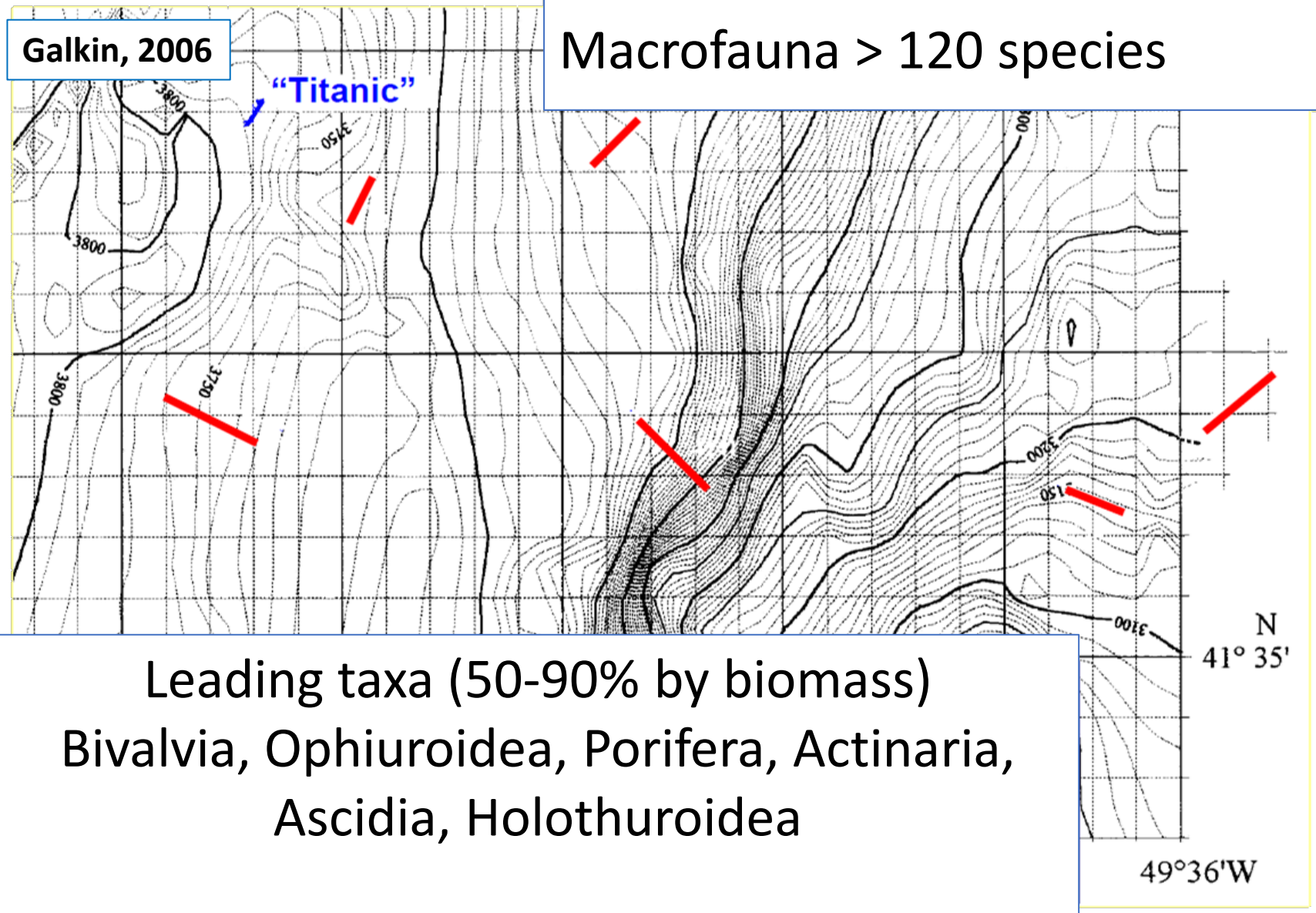
Bringing scientists, explorers, engineers, and deep-sea enthusiasts together!

Biodiversity on / near the Titanic wreck – state of knowledge

Galkin, 2006

- Since the discovery of the Titanic wreck in 1985, over 20 expeditions carried out in the area, with main contributions to the knowledge on biodiversity by the launches of deep-sea submersibles DSRV Mir from RV *Akademik Mstislav Keldysh* in the 1990-2000-s
- A small number of research publications on the biology of the wreck site include: Vinogradov, 2000; Galkin, 2002; Galkin, 2006; Galkin et al., 2002 (macrobenthos on and near the wreck); Vinogradov, Vinogradov, 2002 (zooplankton above the wreck); Evseenko et al., 2002 (fish communities in the water column above the wreck) - studies based on observations or trawl sampling
- No eDNA studies were previously conducted in the wreck area

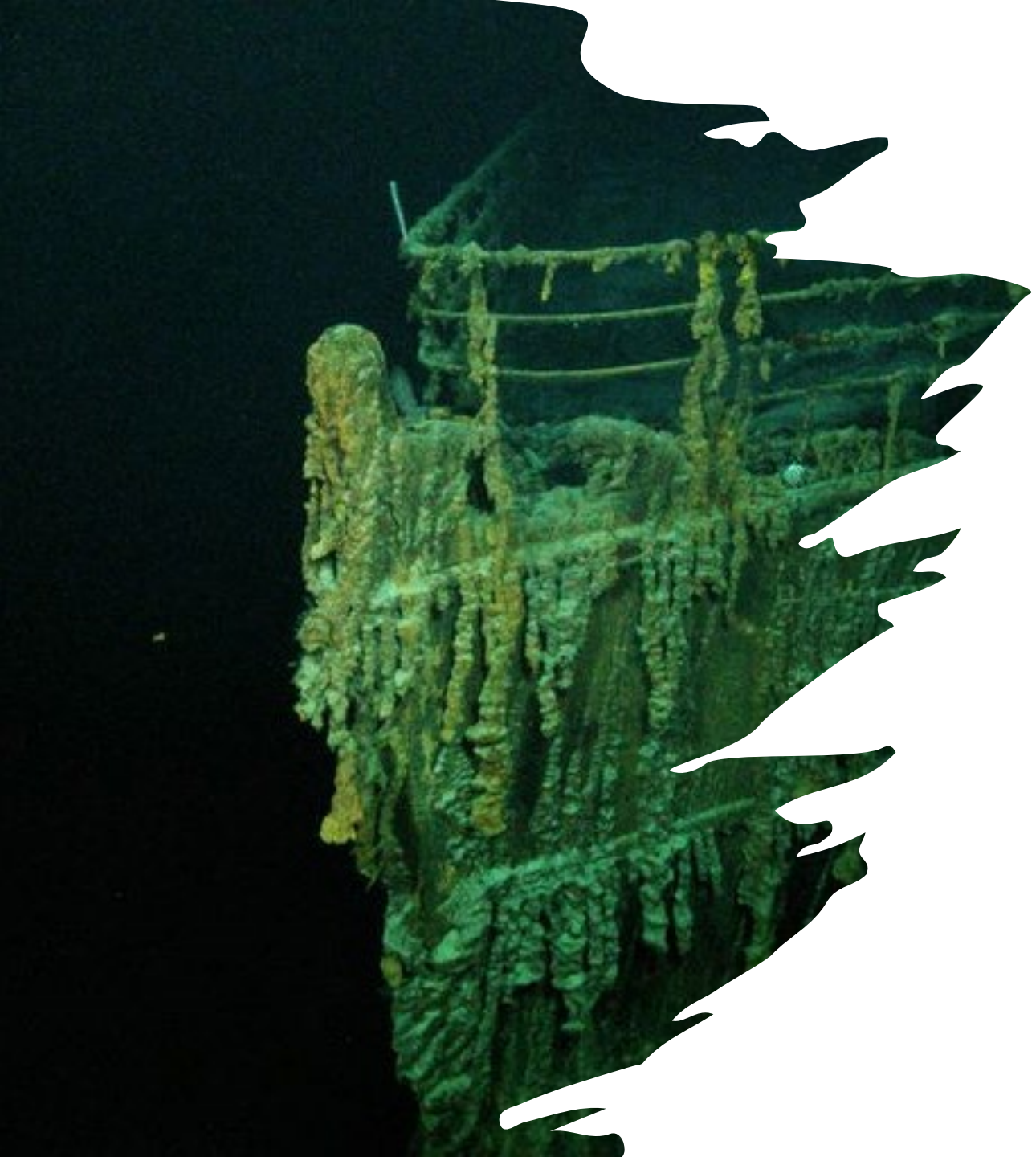
Galkin, 2006



Macrofauna > 120 species

Leading taxa (50-90% by biomass)
Bivalvia, Ophiuroidea, Porifera, Actinaria, Ascidia, Holothuroidea

- Over 120 deep-sea benthic species described near the wreck, based on trawl sampling from RV *Akademik Mstislav Keldysh* (Galkin et al., 2002; Galkin, 2006).

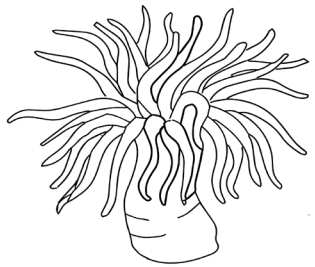
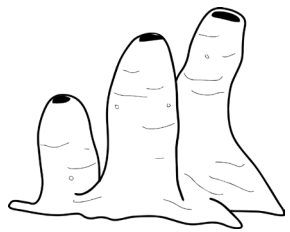
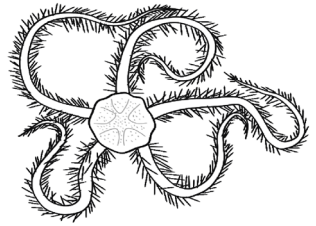


Why is studying biology of Titanic important?

- Improving our knowledge of **biodiversity** of deep-sea organisms in the region.
- Improving our knowledge of the **development** of deep-sea organisms in time through continues observations (building time-series).
- Improving models of larval dispersal, better understanding of deep-sea **biogeography** in the North Atlantic.
- Understanding impacts of **human debris** on deep-sea ecosystems.

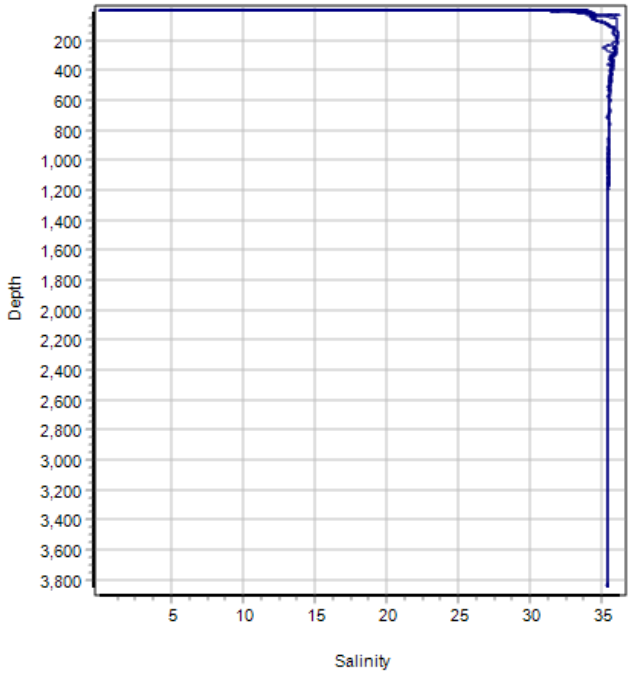
Science Objectives of 2022 Titanic Expedition

- Describe (identify & count) fauna on and near the wreck.
- Document how fauna use the various habitats.
- Construct detailed Geographic Information System (GIS) maps of bottom structure and fauna.
- Enhance visual observations with environmental DNA analyses.
- Collect physical oceanographic data.
- Collect data on water chemistry to evaluate changing oceans.
- Model larval dispersal from wreck.

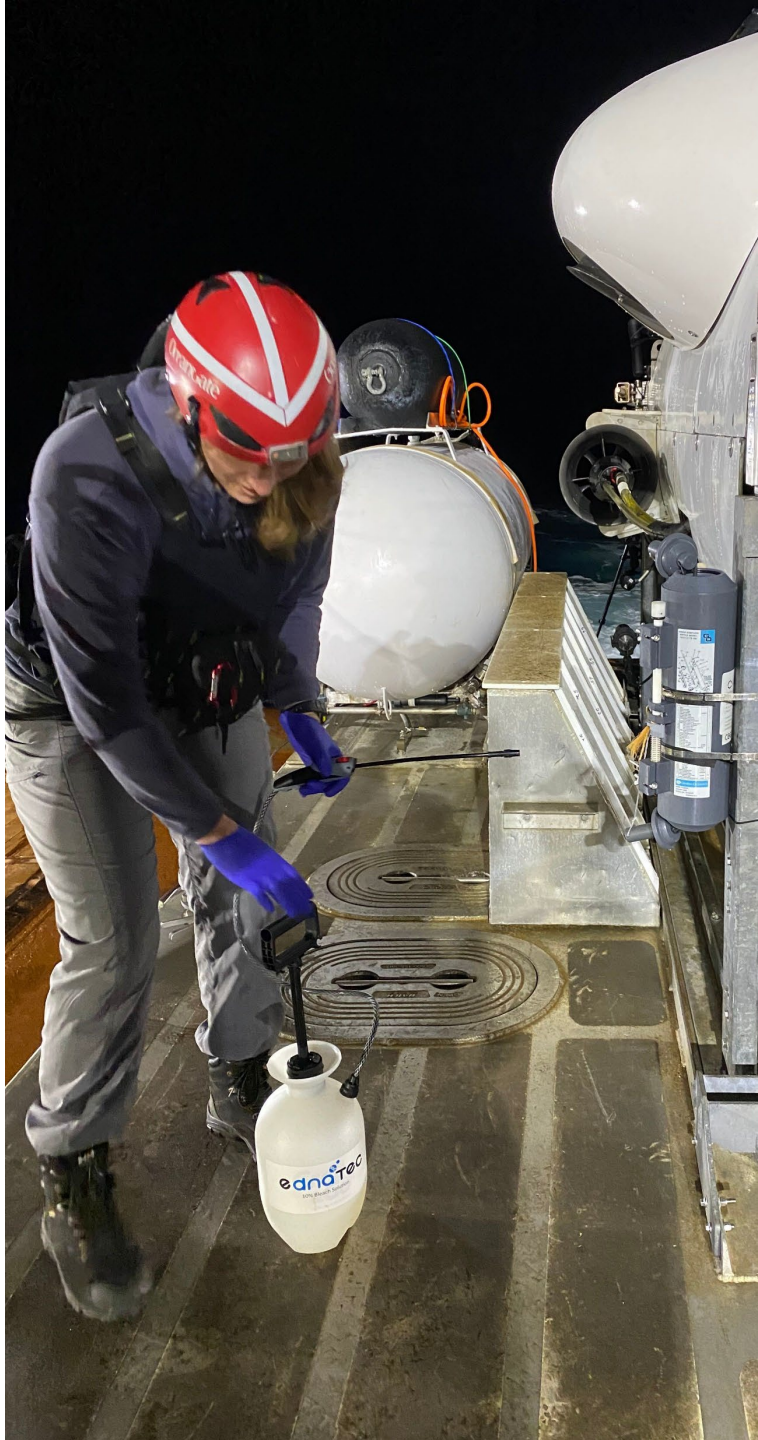




Expedition outcomes – first insights

- **CTD and DVL data** recorded for all dives
- **Water samples** collected for eDNA and carbonate chemistry analysis (Niskin bottles) from 7 dives
- **Video footage** obtained for image analysis of biodiversity and archaeology of the wreck and debris field
- **The discovery of a previously unknown deep-sea sponge and coral garden habitat** on exposed rock formations likely to be formed by relict pillow lavas and igneous dykes

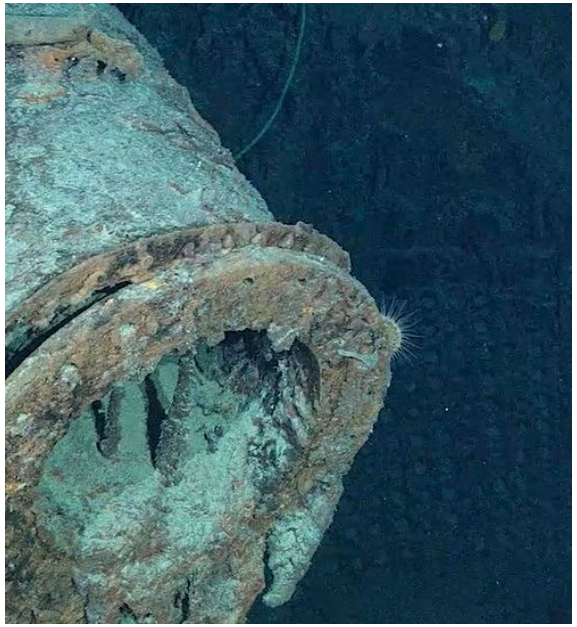


Dive 0076 to Titanic
Salinity against depth, m

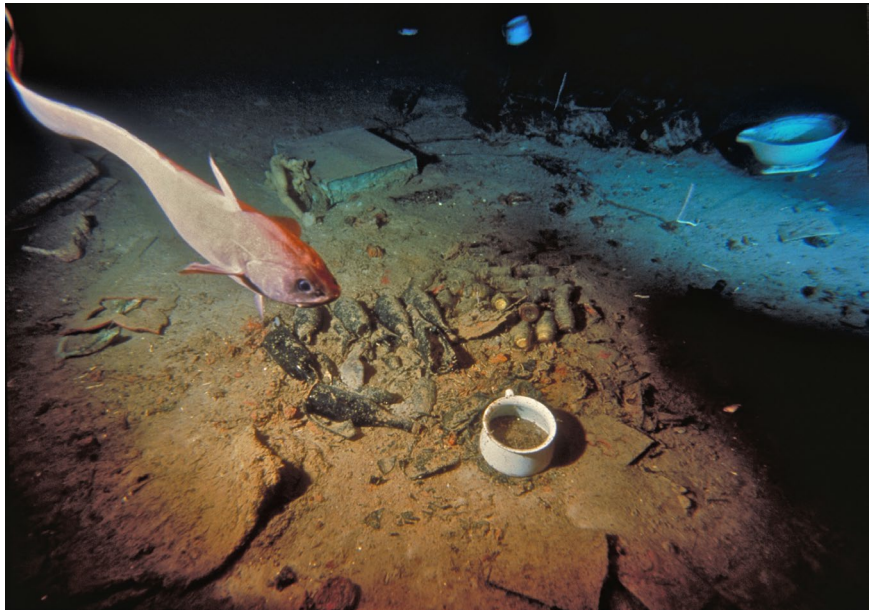


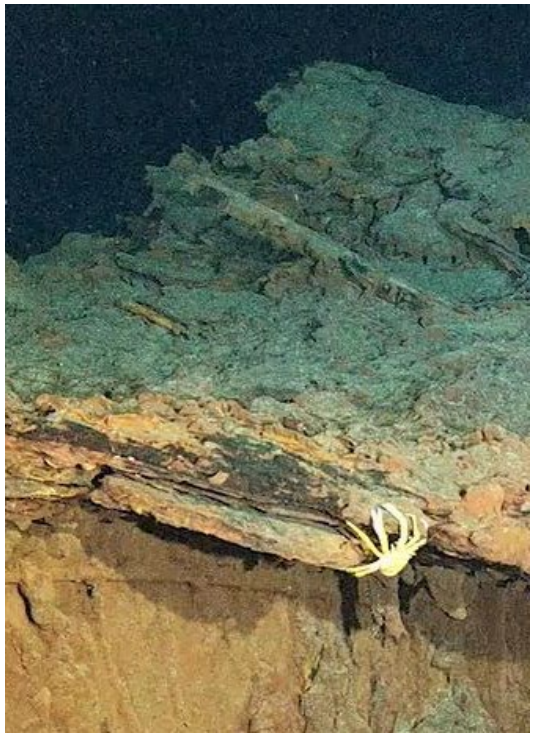
Commonly observed species in the vicinity of the wreck

- Brisingidae Gen. sp. (Brisingid starfish)
- *Lepidisis* sp. (bamboo coral)



Sicyonis sp. (anemone)





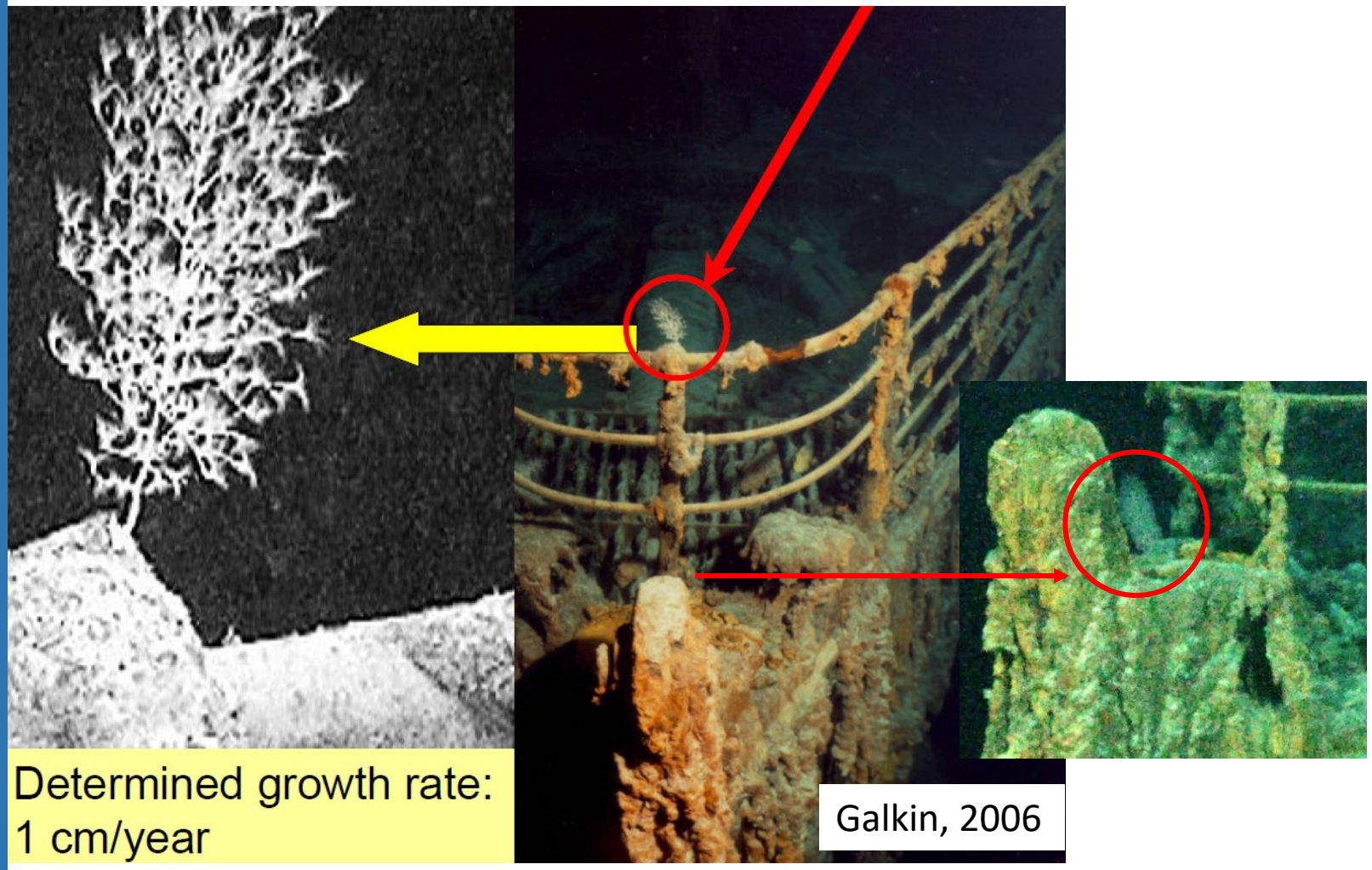
Munidopsis sp. (squat lobster)

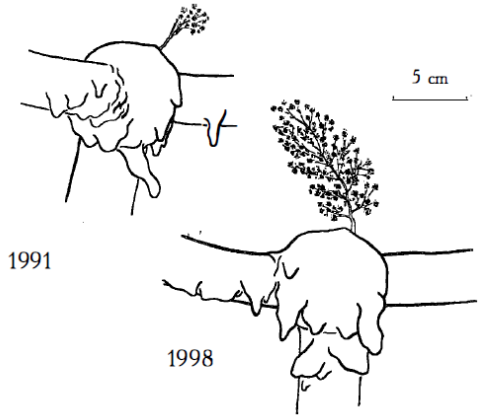
Chrysogorgia agassizii (Gorgonian coral)

Coryphaenoides cf rudis (rattail)

Case study 1 – Continuing observations of development of cold-water corals

Chrysogorgia agassizii



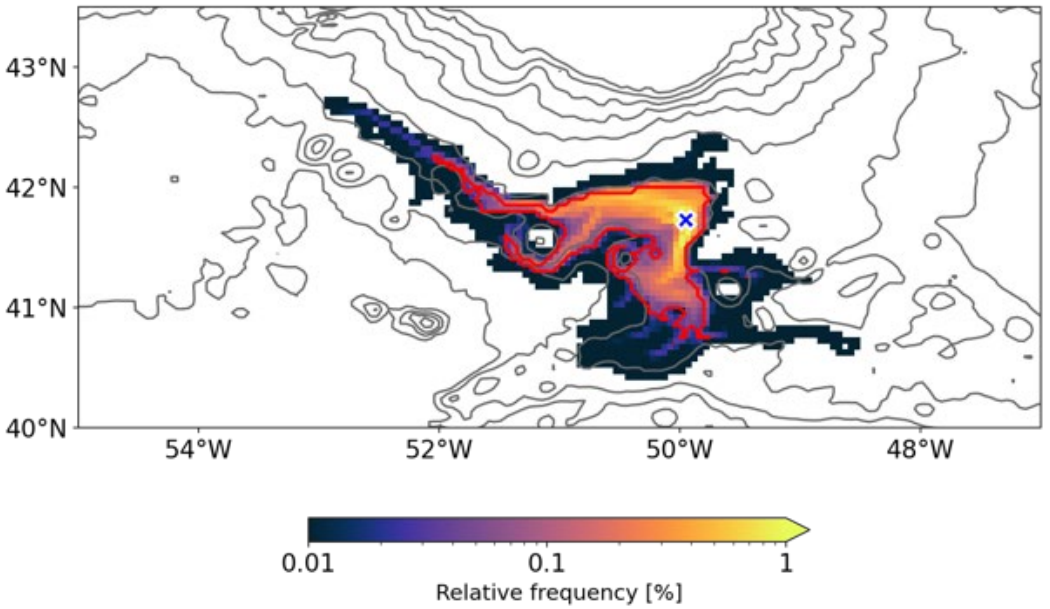


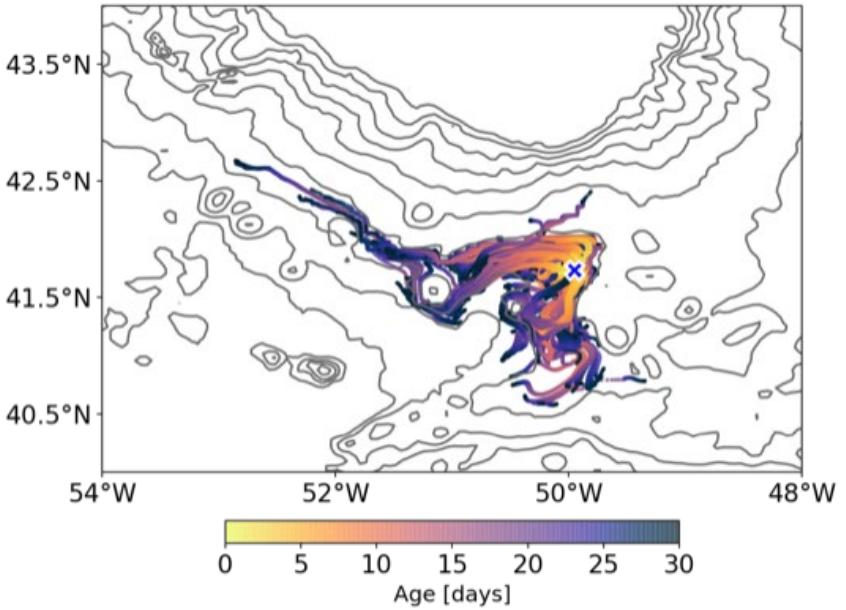
Sketch drawing of the *Chrysogorgia agassizii* colony growth (Vinogradov, 2000)

In 2022 this colony was dead with only stem remaining, but new colony of *C. agassizi* was noticed below the railing. Size and growth rate to be determined.

Case study 2 - Cold-water Coral Larvae Dispersal Modelling

To what extent is the wreck of the Titanic now acting as a source of larvae for natural populations of cold-water corals?





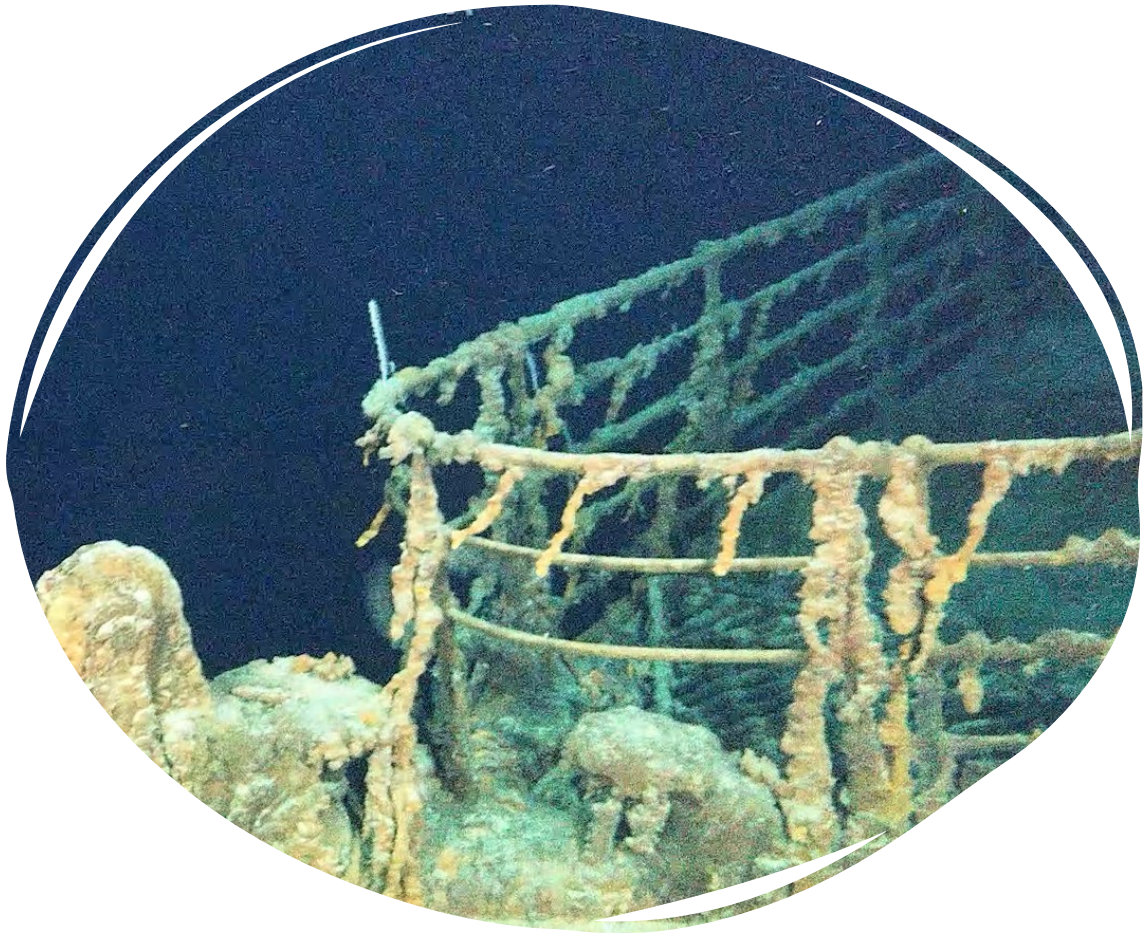
- Blue cross is the Titanic wreck.
- Biophysical modelling by Prof. Arne Biastoch and Tobias Schulzki, GEOMAR.

Graphics show major pathways for virtual particles released from the Titanic. Oceanographic data from the site will help better constrain the modelling of cold-water coral larval dispersal to/from the wreck.

Next steps

1. Identify, and where possible quantify **densities of the megafaunal invertebrate and fish fauna** seen in all dive videos and archive this in a GIS geodatabase and Excel format.
2. Assess the **similarity and dissimilarity** of the megafaunal invertebrate and fish fauna between Titanic and the newly discovered sponge and coral garden habitat.
3. Carry out **the total alkalinity and dissolved inorganic carbon (TA/DIC) analysis** for all survey water chemistry samples.
4. Prepare environmental data from the expedition (CTD, carbonate chemistry and any other environmental datasets) for **archiving in PANGAEA**.
5. Document (identify and count) all **non-wreck anthropogenic influences** (trash, nets, etc.) in the Titanic site area and in any natural habitats.
6. Carry out **eDNA analysis** to assess whole ecosystem biodiversity and integrate with other biodiversity data.

Stay tuned for future updates!



Thank you for attention!

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