Principle 6 Graphic (Kaleigh Ballantine, Oregon State University for NOAA Education)
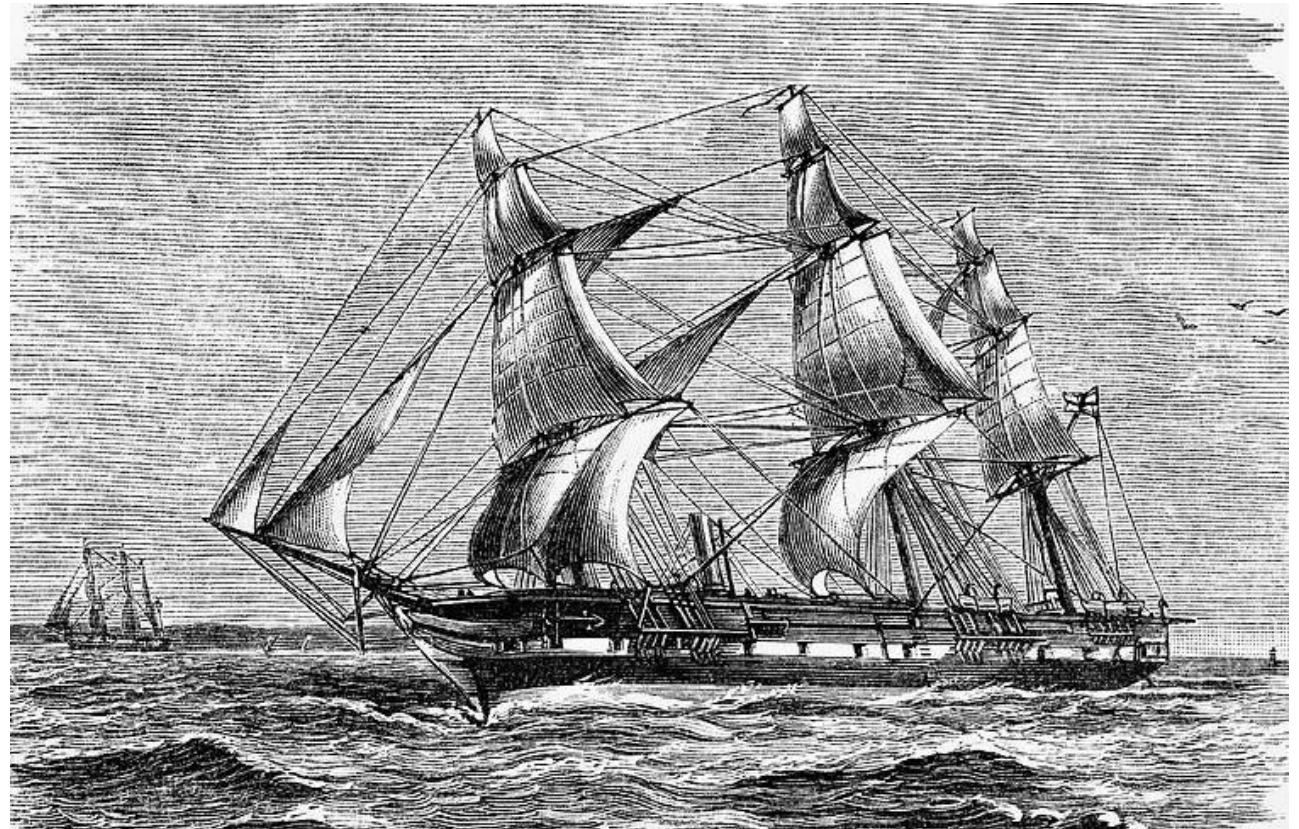
PRINCIPLE 7:

The ocean is largely unexplored (6 concepts)

Maria Cheimonopoulou, Hydrobiologist, Hydrobiological Station of Pella, Greek Ministry of Rural Development and Agriculture

PRINCIPLE 7

➢ **The ocean is the largest unexplored place on Earth—less than 20% of it has been mapped, observed, and explored. (Concept 7a)**

➢ **Oceanography** is an **interdisciplinary science** where **math, physics, chemistry, biology and geology intersect** in order **to study the ocean**.

➢ The foundation of **oceanography** was set by **"The Challenger expedition",** 1872–1876.

➢ This expedition led to a new and overwhelming view of the ocean: full of life, complex, with unknown resources.
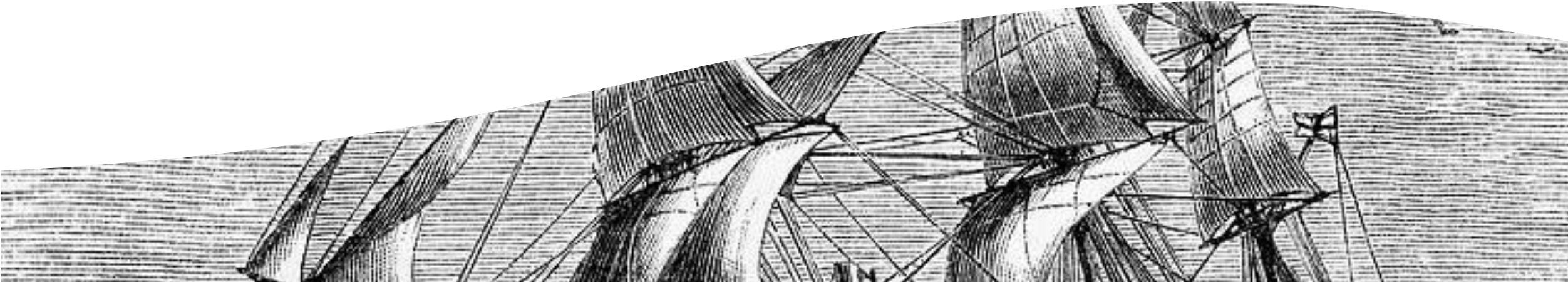

HMS Challenger Public Domain, https://commons.wikimedia.org/w/index.php?curid=7028789

PRINCIPLE 7

Have we progressed a lot in Ocean exploration since 1876?

Not really….Most of the ocean still remains unexplored….

➢ **Why is that?**

PRINCIPLE 7

➤ Ocean exploration technology has evolved the last few decades

➤ At great depths over 200 meters exploration conditions become extreme

➤ **Scientists know more about the surface of the Moon....**

By Montereypine - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=89317538

PRINCIPLE 7

Why do we need to explore the Ocean?

➢ Exploration, experimentation, and discovery are required to **better understand ocean systems and processes (concept 7b).**

➢ Exploration, helps us **learn more about various aspects of the ocean (concept 7b).**

© Fiona Crouch

Fiona Crouch

➢ Understanding and **managing sustainably the Ocean** we ensure the balance of all living systems on Earth.

➢ ***We can not manage the unknown…***

PRINCIPLE 7

➤ If we want to explore, **first we have to map**!

➤ As of 2023, 24.9% of the global seafloor had been mapped (**SEABED 2030, THE NIPPON FOUNDATION-GEBCO**)
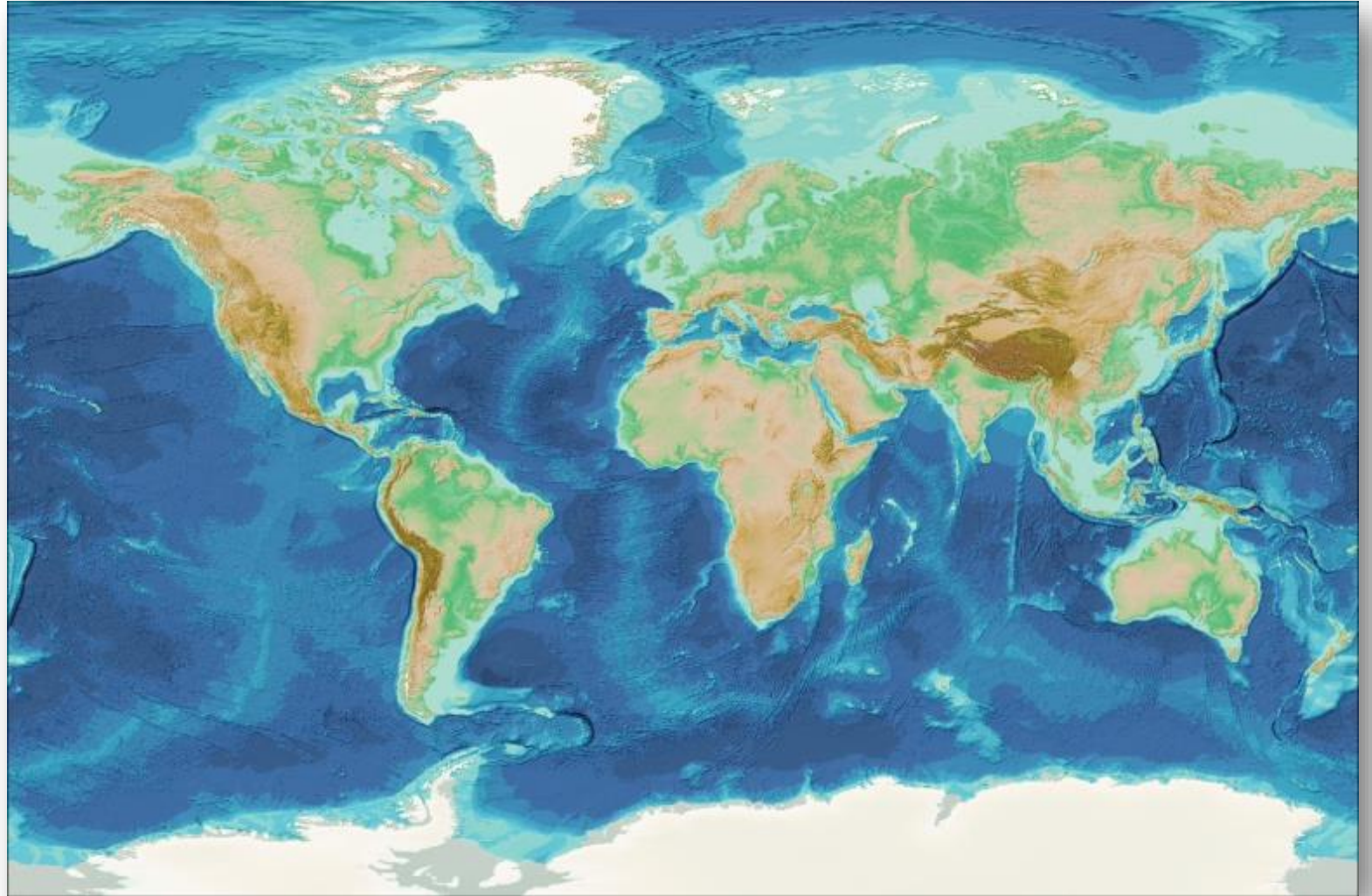
General Bathymetric Chart of the Oceans, GEBCO,
https://www.gebco.net/data_and_products/gebco_web_services/web_map_service/

PRINCIPLE 7

➢ Over the last 50 years, **use of ocean resources has increased significantly (concept 7c),**

➢ We need to use ocean resources sustainably

➢ Therefore, we need to understand the "functioning" of the resources and their potential **(concept 7c)**

➢ **New technologies, sensors and tools** (e.g. **satellites**, drifters, buoys, subsea observatories and unmanned submersible vehicles**) are expanding our ability to explore the Ocean (concept 7d)**

Inspiration for a blue school project

"Adopt a Float" (https://adoptafloat.com/), Educational Program

School subjects: STEM (Science, technology, engineering and math)

GO-BGC floats
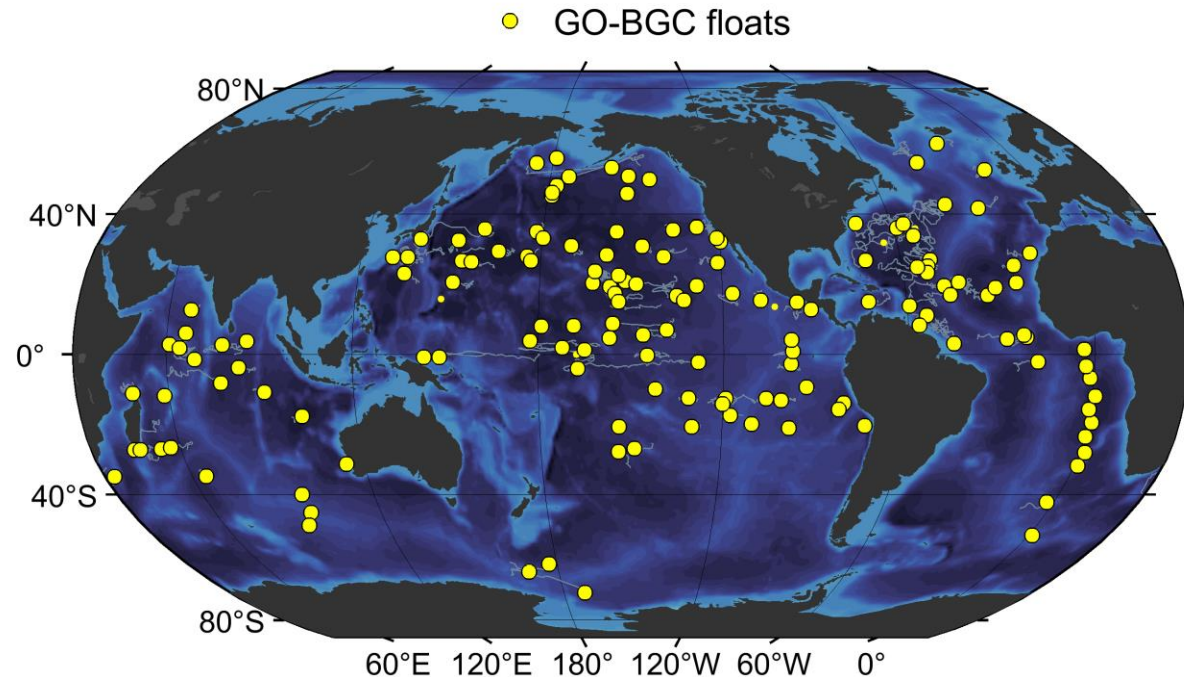
Non-operational floats denoted by small circles   [01-Apr-2024]

Global Ocean Biogeochemistry Arrray https://www.go-bgc.org/
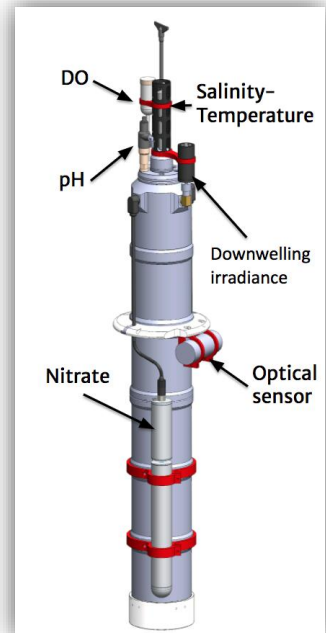
Autonomous robotic float

Image credit: Kyle Grindley, UCSD IDG Lab, https://www.go-bgc.org/floats

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PRINCIPLE 7

> **MATE <u>Underwater Robotics Student Competition NASA</u>, WORLD CHAMPIONSHIP 2024**

> Design and build a remotely operated vehicle (ROV) and the necessary sensors, tooling, and complementary technologies to monitor the health of marine habitats
> **Challenges for 2024**
> Data collection, **reimagining the utility of telecommunications cables**, **administering probiotics for diseased coral**, identifying healthy habitats for lake sturgeon, and deploying **GO-BGC floats to monitor ocean health**. https://materovcompetition.org/get-started

PRINCIPLE 7

> New technologies, sensors and tools are expanding our ability to explore the ocean system **(concept 7d).**
>
> e.g. **submarine cables**

SUBMERSE project aims to **utilize underwater fiber optic telecommunications cables as "sensors" that can track mammals, monitor earthquakes, volcanoes, and ocean waves**.

Submarine cable map,
https://poseidon.hcmr.gr/news/project-submerse#lg=2&slide=0
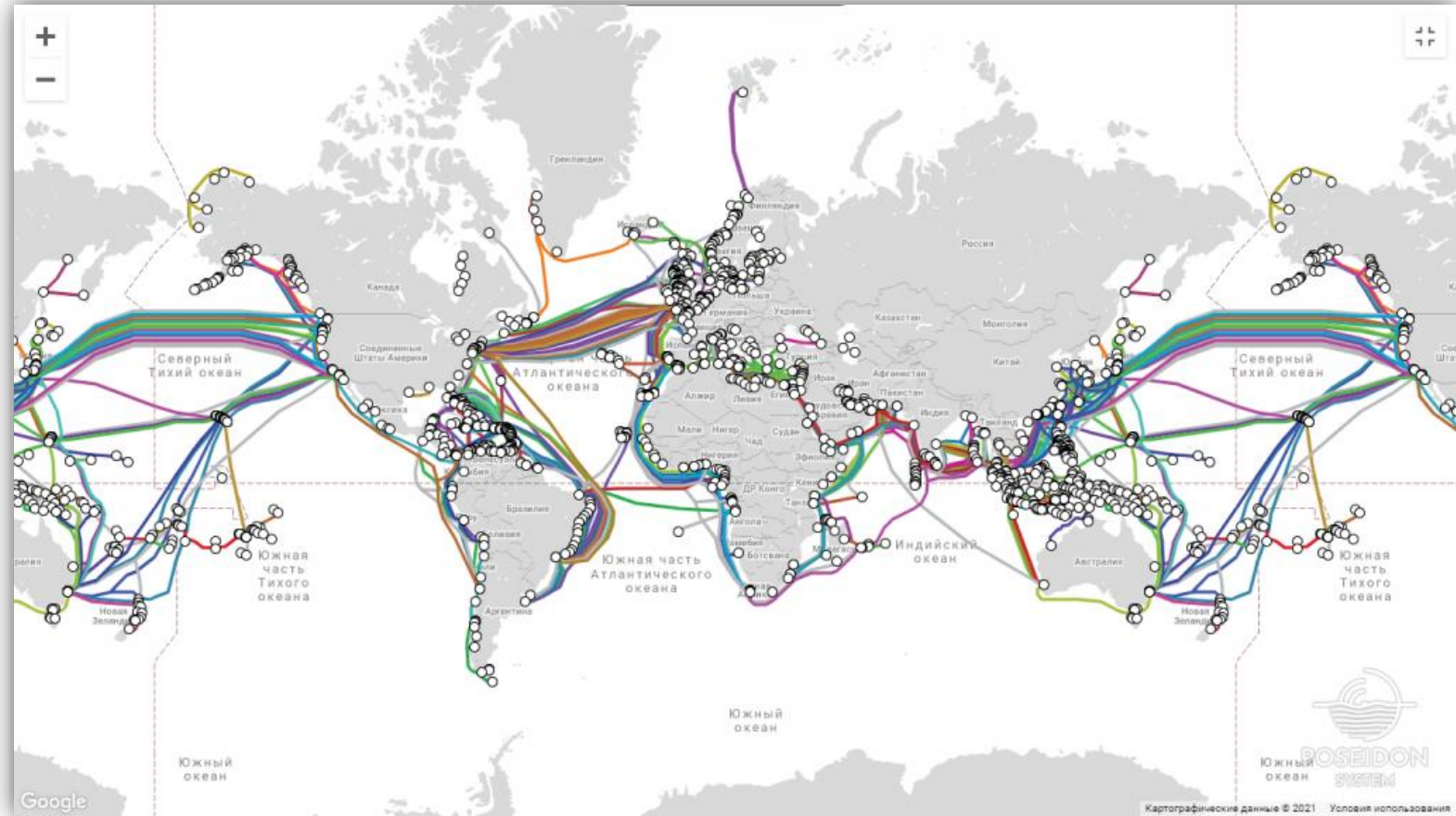
PRINCIPLE 7

➢ **<u>Use of mathematical models is an essential part of the ocean systems</u> (concept 7e).**

➢ An ocean model is a mathematical description of the ocean.

➢ Models help us understand the complexity of the ocean and of its interaction with Earth's interior, atmosphere, climate and land masses **(concept 7e).**

https://marine.copernicus.eu/explainers/operational-oceanography/monitoring-forecasting/models
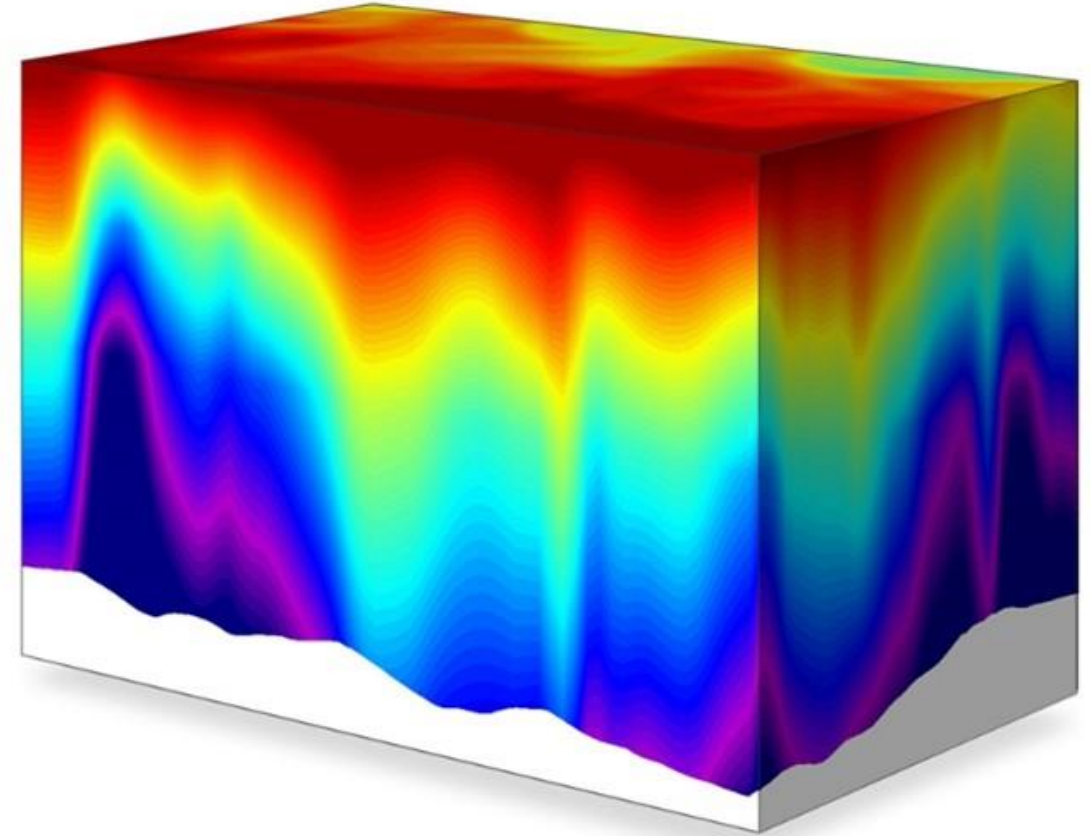
PRINCIPLE 7

➤ Mathematical Models can describe interactions within ecological food webs and help predict and prevent future species extinctions

➤ No need to measure phytoplankton diversity, quantitative modelling can do that!!!

Planktonic organisms
Copyright © 2011-2024 Okinawa Institute of Science and Technology Graduate University

PRINCIPLE 7

Marine mammal morphometrics: 3D modeling and estimation validation

➢ **Ocean exploration is truly interdisciplinary (concept 7f)**.

➢ It requires close collaboration among biologists, chemists, climatologists, computer programmers, engineers, geologists, meteorologists, physicists, animators and illustrators **(concept 7f).**

➢ Data and technologies from many knowledge domains, such as computer science, engineering, biology, geology, chemistry, physics are used **(concept 7f).**

➢ And these interactions foster new ideas and new perspectives for inquiries **(concept 7f).**
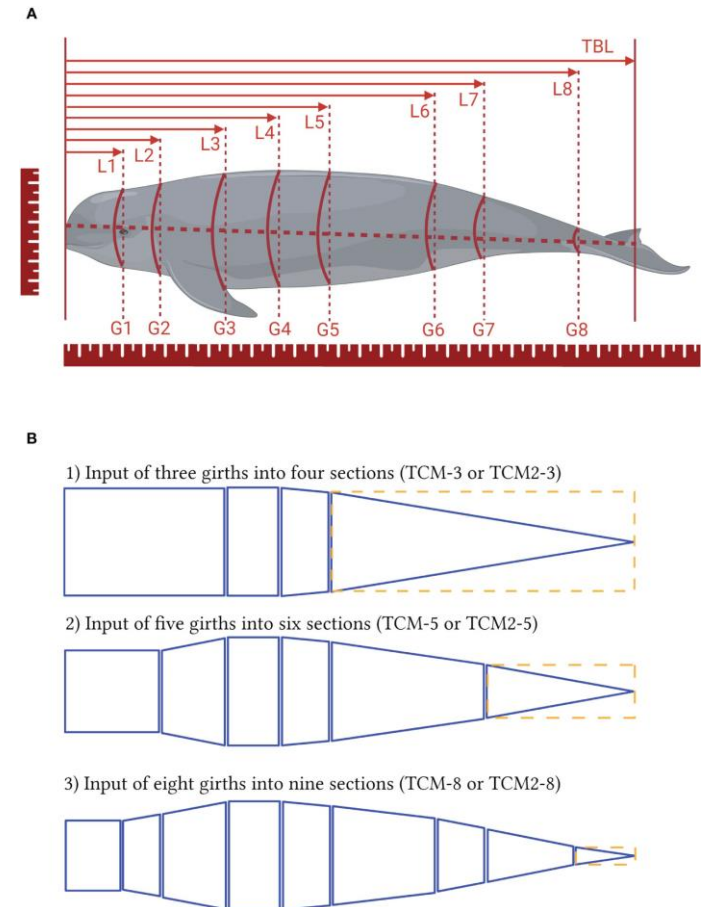
PRINCIPLE 7

➤ **Only around 1% of the high seas currently enjoy protected status** (national economic exclusive zone)

➤ **"The High Seas Treaty"**, also known as the agreement on "**Biodiversity Beyond National Jurisdiction" or 'BBNJ',** was signed in New York on 20 September 2023.

➤ **Common governance of about half of the Earth's surface and 95% of the ocean's volume**,

➤ Opportunity for **establishment of new marine protected areas**

➤ This treaty **complements the United Nations Convention on the Law of the Sea (UNCLOS),** which provides the legal framework under which all human activities in the ocean take place.

Proposed marine protection areas

■ Exclusive economic zones (EEZ*) ■ High seas ● Proposed protection zones in the high seas

The Lost City
Emperor Seamount Chain
Sargasso Sea and Corner Rise
Costa Rica Dome
Arabian Sea
Gulf of Guinea
Mascarene Plateau
Salas y Gomez and Nazca ridges
Walvis Ridge
Lord Howe Rise and Tasman Sea
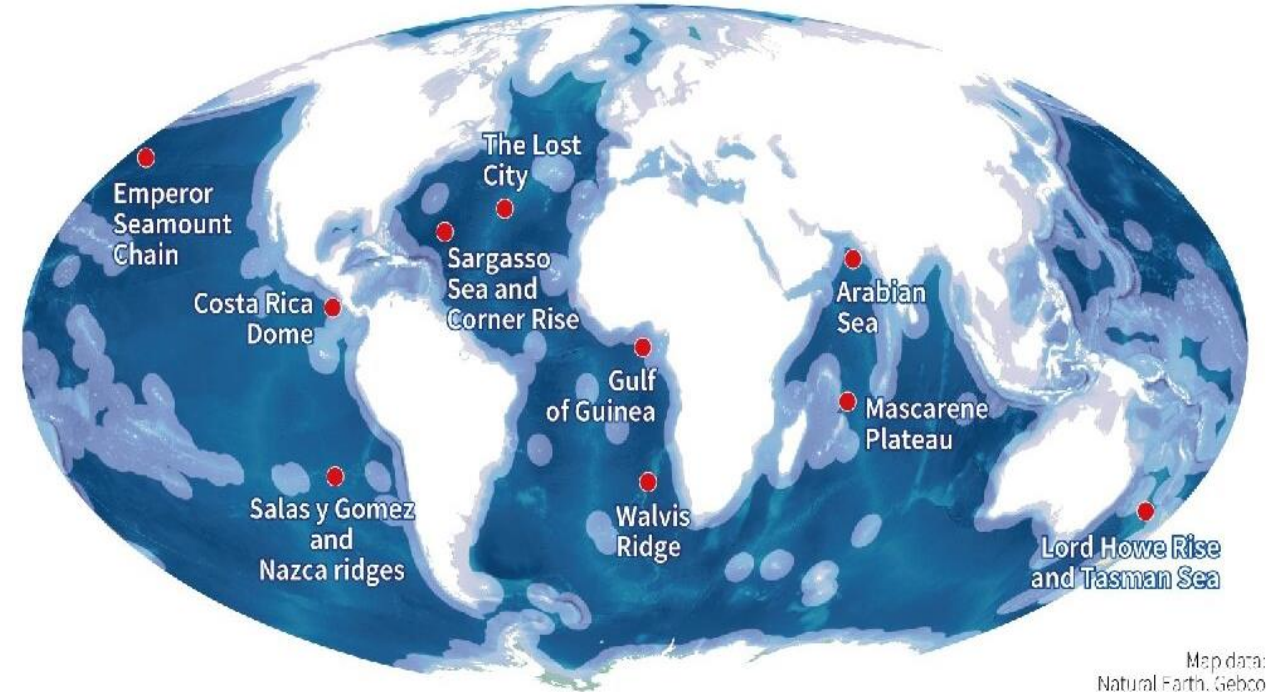
Sources: NGOs Pew and High Seas Alliance, Chilean authorities, Marine regions

*up to 200 nautical miles maximum from the coasts (370 km)

Map data: Natural Earth, Gebco

AFP

World map showing exclusive economic zones and priority marine zones to protect, according to non-government organizations, the Pew Research Centre and the High Seas Alliance © Sophie RAMIS / AFP

https://phys.org/news/2023-06-historic-high-seas-treaty.html

PRINCIPLE 7 & SDG 14

➢ Target 14.8 **Increase scientific Knowledge, research and technology for ocean health**

PRINCIPLE 7 & EU PRIORITIES FOR 2019-2024

➢ EU Priority 1: A European Green Deal (Preservation of Europe's natural environment)

PRINCIPLE 7 & EU Missions

➢ EU Mission: Restore our Ocean and Waters. **Protection and restoration of the health of our ocean and waters through research and innovation**

PRINCIPLE 7 & UN Decade 2021-2030

➢ UN Decade on Ecosystem Restoration (halt the degradation of ecosystems, and restore them to achieve healthy ecosystems)

PRINCIPLE 7

> **Inspiration for blue school projects, Handbook of European Blue schools**

> **Climate and ocean** (Use the European Atlas of the Seas to describe the state of the coastline in your country.)
>
> https://ec.europa.eu/maritimeaffairs/atlas/maritime_atlas/

> **Building your own turbidimeter**
>
> https://github.com/sciencemakersSE/Turbiditetsmatare
>
> European Maritime Day projects
>
> https://maritime-day.ec.europa.eu/my-country_en

377 Applications submitted

311 Certificates issued

285 Schools certified

277 Projects conducted in coastal regions

91 Projects conducted in inland regions

9 Projects connecting coastal and inland regions

https://maritime-forum.ec.europa.eu/theme/ocean-literacy-and-blue-skills/ocean-literacy/network-blue-schools_en

PRINCIPLE 7, Conceptual Flow Diagram, Grades 3-5

Principle 7:
The ocean is largely unexplored.

People Explore the Ocean

Ocean Exploration Requires Collaboration

Ocean Exploration Requires Technological Innovations

A. Human interest has led to the exploration of and research about the ocean and its resources. However, less than 20% of the ocean is mapped, observed, and explored.
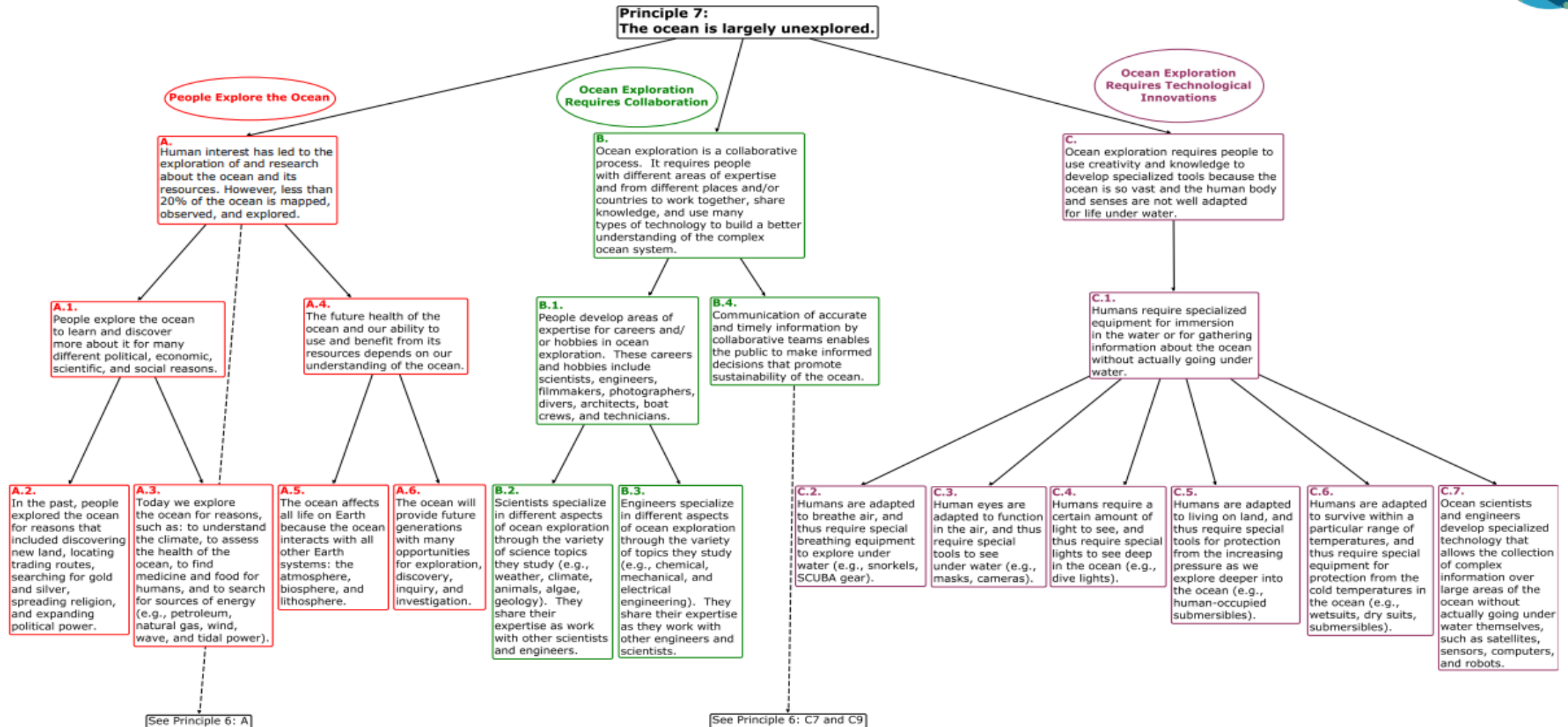
B. Ocean exploration is a collaborative process. It requires people with different areas of expertise and from different places and/or countries to work together, share knowledge, and use many types of technology to build a better understanding of the complex ocean system.

C. Ocean exploration requires people to use creativity and knowledge to develop specialized tools because the ocean is so vast and the human body and senses are not well adapted for life under water.

A.1. People explore the ocean to learn and discover more about it for many different political, economic, scientific, and social reasons.

A.4. The future health of the ocean and our ability to use and benefit from its resources depends on our understanding of the ocean.

B.1. People develop areas of expertise for careers and/or hobbies in ocean exploration. These careers and hobbies include scientists, engineers, filmmakers, photographers, divers, architects, boat crews, and technicians.

B.4. Communication of accurate and timely information by collaborative teams enables the public to make informed decisions that promote sustainability of the ocean.

C.1. Humans require specialized equipment for immersion in the water or for gathering information about the ocean without actually going under water.

A.2. In the past, people explored the ocean for reasons that included discovering new land, locating trading routes, searching for gold and silver, spreading religion, and expanding political power.

A.3. Today we explore the ocean for reasons, such as: to understand the climate, to assess the health of the ocean, to find medicine and food for humans, and to search for sources of energy (e.g., petroleum, natural gas, wind, wave, and tidal power).

A.5. The ocean affects all life on Earth because the ocean interacts with all other Earth systems: the atmosphere, biosphere, and lithosphere.

A.6. The ocean will provide future generations with many opportunities for exploration, discovery, inquiry, and investigation.

B.2. Scientists specialize in different aspects of ocean exploration through the variety of science topics they study (e.g., weather, climate, animals, algae, geology). They share their expertise as work with other scientists and engineers.

B.3. Engineers specialize in different aspects of ocean exploration through the variety of topics they study (e.g., chemical, mechanical, and electrical engineering). They share their expertise as they work with other engineers and scientists.

C.2. Humans are adapted to breathe air, and thus require special breathing equipment to explore under water (e.g., snorkels, SCUBA gear).

C.3. Human eyes are adapted to function in the air, and thus require special tools to see under water (e.g., masks, cameras).

C.4. Humans require a certain amount of light to see, and thus require special lights to see deep in the ocean (e.g., dive lights).

C.5. Humans are adapted to living on land, and thus require special tools for protection from the increasing pressure as we explore deeper into the ocean (e.g., human-occupied submersibles).

C.6. Humans are adapted to survive within a particular range of temperatures, and thus require special equipment for protection from the cold temperatures in the ocean (e.g., wetsuits, dry suits, submersibles).

C.7. Ocean scientists and engineers develop specialized technology that allows the collection of complex information over large areas of the ocean without actually going under water themselves, such as satellites, sensors, computers, and robots.

See Principle 6: A

See Principle 6: C7 and C9

BlueMinds4Teachers Online training course, 9 April 2024, session 2 (part 1)

A Handbook for Increasing Ocean Literacy

Thank you so much!!!

Maria Cheimonopoulou, Hydrobiologist, Hydrobiological Station of Pella, Greek Ministry of Rural Development and Agriculture