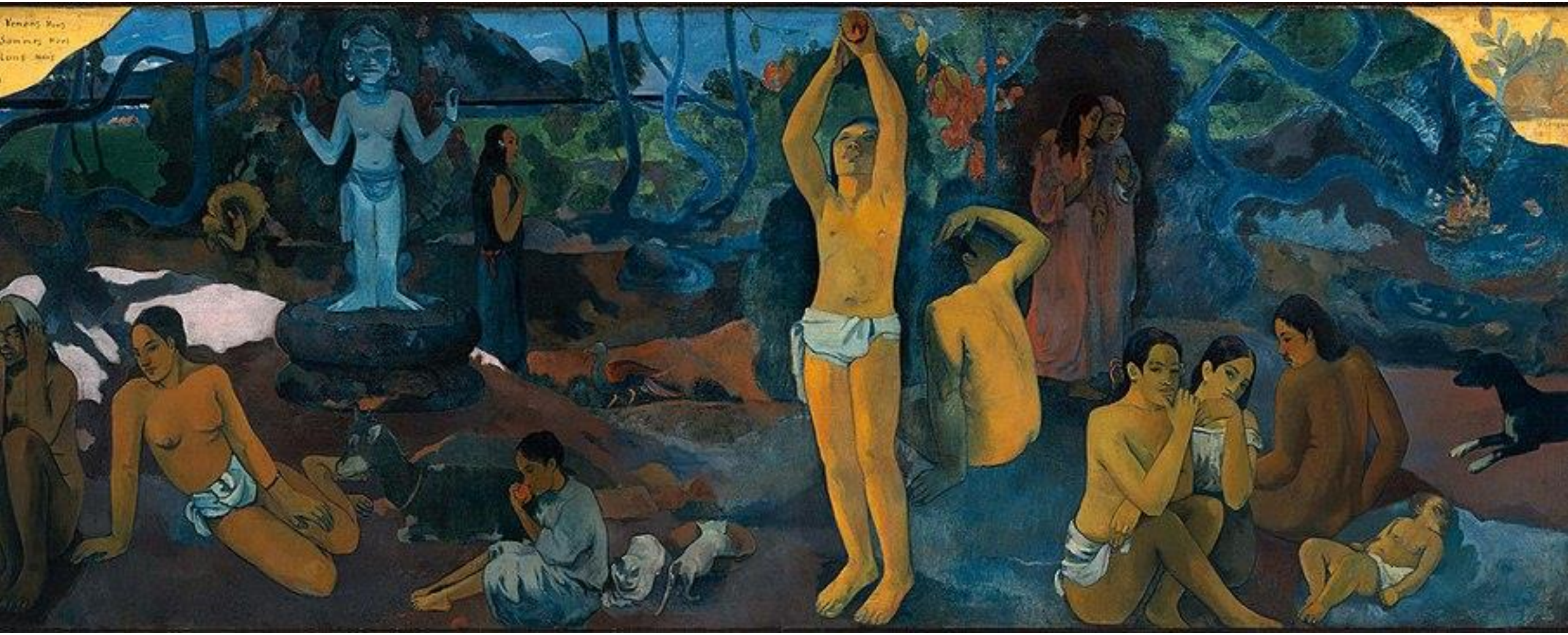
What have we done and where should we go? The role of PICES for the North Pacific marine science and human well-being

Hiroaki Saito AORI The University of Tokyo

D'où venons-nous ? Que sommes-nous ? Où allons-nous ?



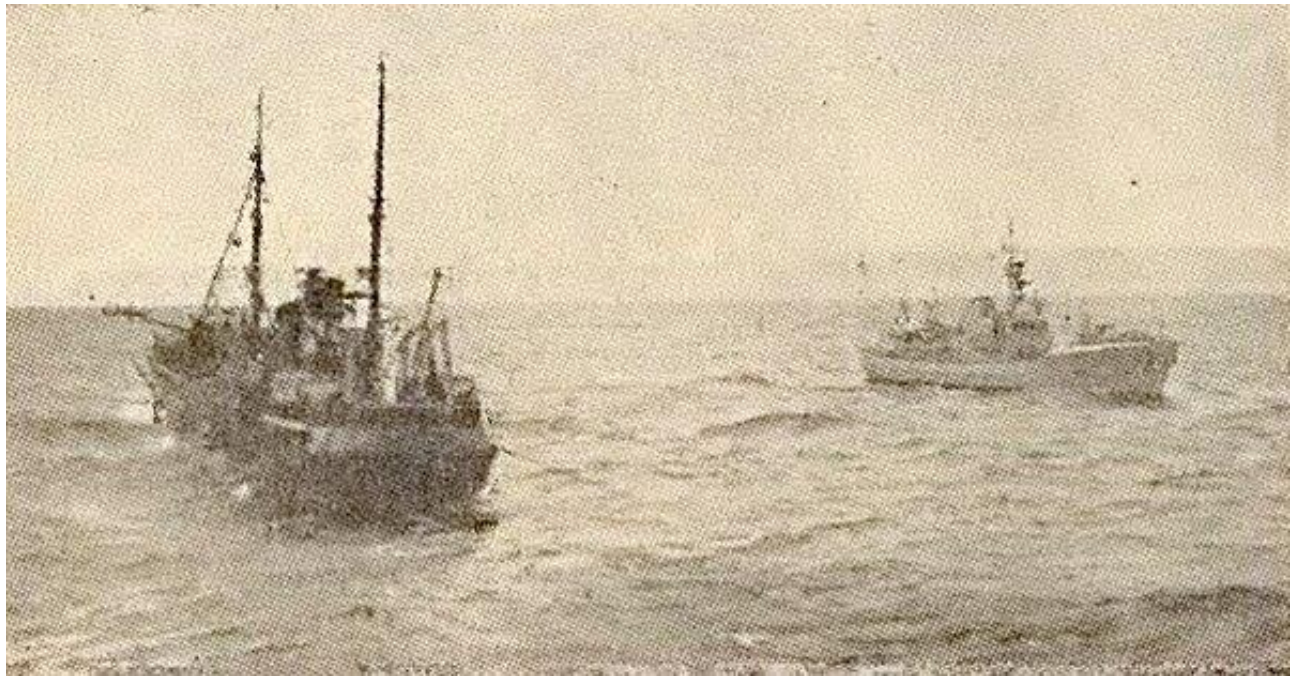
Who we are? What is PICES?

The North Pacific Marine Science Organization (PICES), an intergovernmental science organization, was established in 1992 to promote and coordinate marine research in the North Pacific and its adjacent seas.

Dr. Warren S. Wooster

- A Giant in international marine affair
- Significant contribution to promote international infrastructure of marine science, including UNESCO/IOC, ICES, SCOR and many others
- Primary founder of PICES

Leading up to the establishment of PICES



1970s=

- Long negotiation at the third UN Convention on the Law of the Sea (UNCLOS III 1973-82) including a 200-mile EEZ
- Emergent needs on fisheries management under UNCLOS

  Extended national jurisdiction to the continental shelf

  US extended its EEZs in 1983.

  The idea of an EEZ entered into force in 1994
- Success and difficulty of ICES in fisheries management in the North Atlantic,, including 20-years “Cod Wars”
- Inefficient binational negotiation on fisheries management in the N.Pacific. Impediments of exchange and the use of scientific knowledge and data in the negotiation processes.

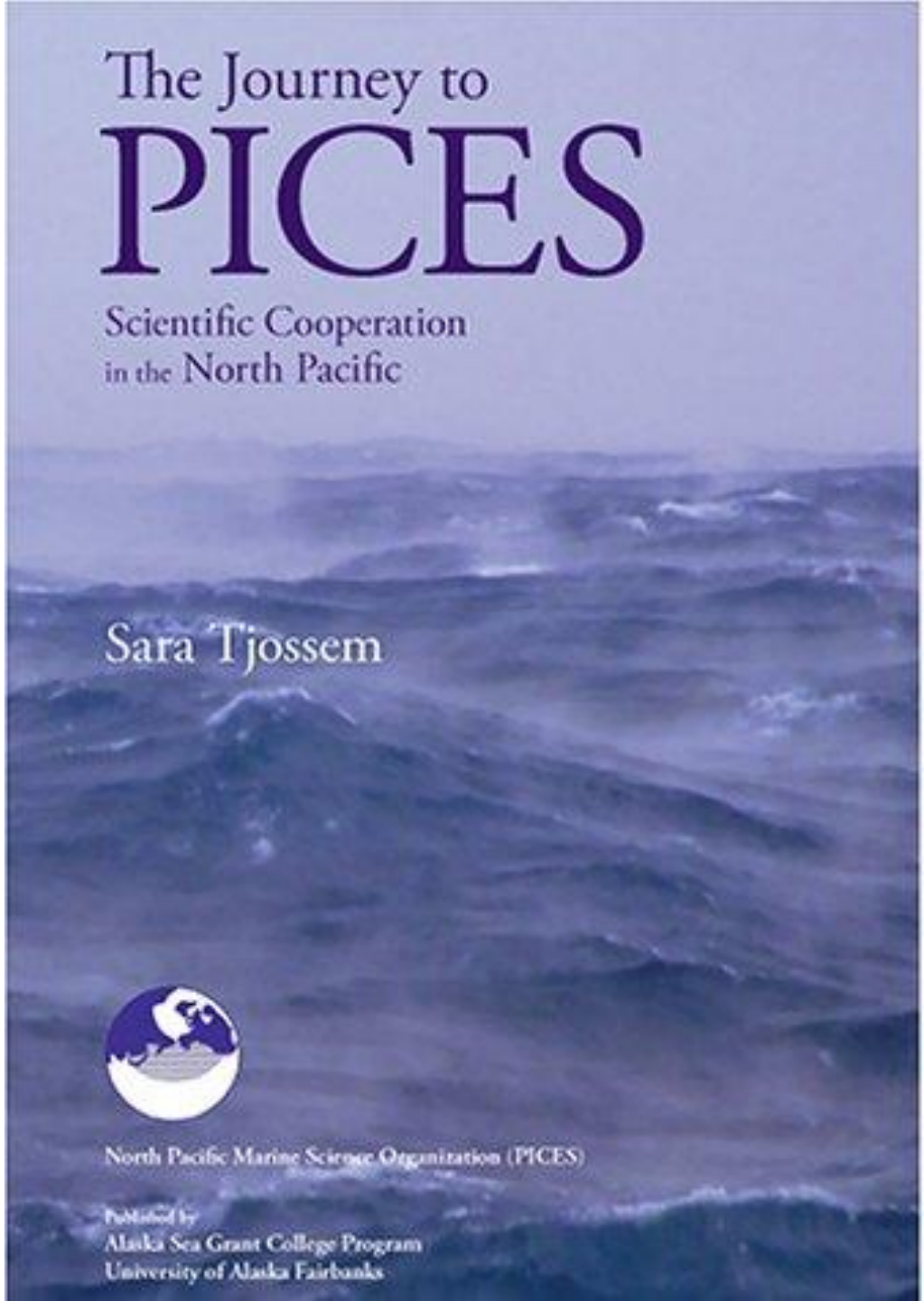
Leading up to establishment of PICES

It was natural coming up the idea of establishing “International Council for Scientific Investigation of the North Pacific”, or PACIFIC ICES (i.e., PICES) for efficient scientific discussion, data exchange and use of scientific knowledge for issues Pacific nations faced.

At the same time, it was easy to imagine how difficult to reach the consensus of the establishment between North Pacific states, which have different idea of the use of fisheries resources, scientific data and knowledge, and the use of scientific institution for the benefit of each state.

US and Canadian scientists took the lead of the development of the idea, in mid 1970s Dr. Wooster led the discussion and fostering environment but it needed tremendous efforts for 20-years

..for more in details of the establishment history



The establishment of PICES

As Intergovernmental Marine Science Organization of the North Pacific

Founders ruled PICES do not carry out fisheries management but prepare knowledge and advice to member countries and RFMO

for the full use of scientific knowledge to actions, with avoiding acrimonious disputes over national fishery allocation

First PICES workshop in 1991

First Annual Meeting in 1992 in Victoria

MEMBER COUNTRIES INITIAL CONVENTION IN OTTAWA ON DECEMBER 12, 1990

From left to right:
Dr. J.B. Morrissey(Can.) Mr. S. Takahashi(Japan) Prof. Y.K. Xu(China)
Mr. V.L. Minin(Russia) Mr. A.A. Elizarov(Russia) Mr. J.S. Jia(China)
Mr. B. Valcourt(Minister of Fisheries and Oceans, Can.) Dr. S. Earle(USA)
Dr. W.S. Wooster(USA) Dr. B.S. Muir(Can.)

Delegates who endorsed PICES Convention, Dec. 12, 1990

PICES Press Vol. 1 1993

Scientific Committees of PICES

Responsible for the planning, direction, and overseeing of major themes within the Organization's general scientific aims:

POC: Physical Oceanography and Climate,

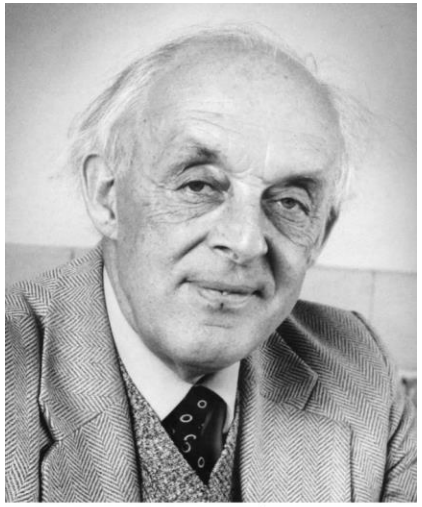
BIO: Biological Oceanography

FIS: Fisheries Science

MEQ: Marine Environmental Quality

The composition of the committee suggests that the PICES's general aims are formulated by scientific disciplines.

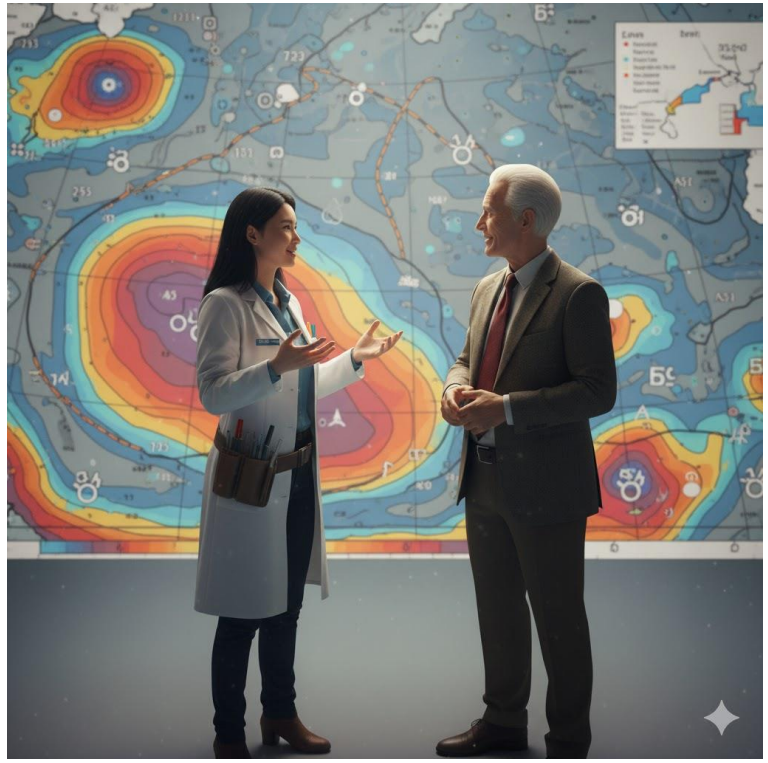
Movement for interdisciplinary sciences: Wind and Fishery



David H. Cushing Climate and Fisheries (1982)

Tsuyoshi Kawasaki Global synchronization in fish-species alternation (1983)

Climate and fishery scientists started discussing on their emergent mutual interests



Interdisciplinary marine sciences under the umbrella of international projects

Global Ocean Ecosystem Dynamics (**GLOBEC**): how global change will affect the abundance, diversity and productivity of plankton and fishes (1995- merged with IMBER in 2009)

The Joint Global Ocean Flux Study (**JGOFS**) **:** understanding the ocean's role in the global carbon cycle and its response to climate change. Merging biological oceanography and BGCs. (1987-2003)

World Ocean Circulation Experiment (WOCE) : establish the role of the world ocean in the Earth's climate system (1990-2002)

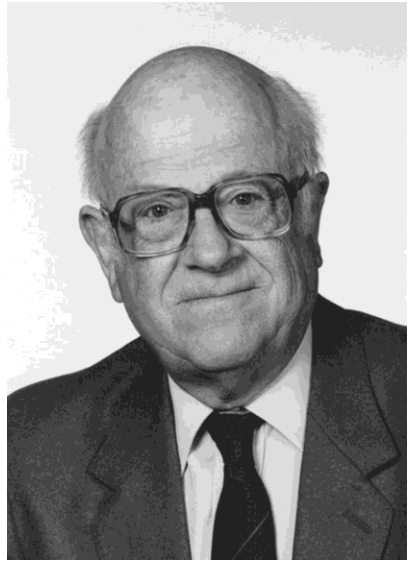
PICES: Incubator of interdisciplinary sciences

- From the first annual meeting, active discussion for conducting interdisciplinary sciences under the influence of global movement of interdisciplinary sciences.
- Annual Meeting prepared irreplaceable opportunity of exchange key issues of each Committee, or, of different disciplines
- Various working groups for interdisciplinary sciences

Two WGs with the task of thinking collaborated study with GLOBEC program, 1993

Climate Change and Carrying Capacity (CCCC)

- 1st planning meeting in 1994 with approval of the science plan, established in 1997.
- First co-chairperson: Dan Ware & Warren Wooster



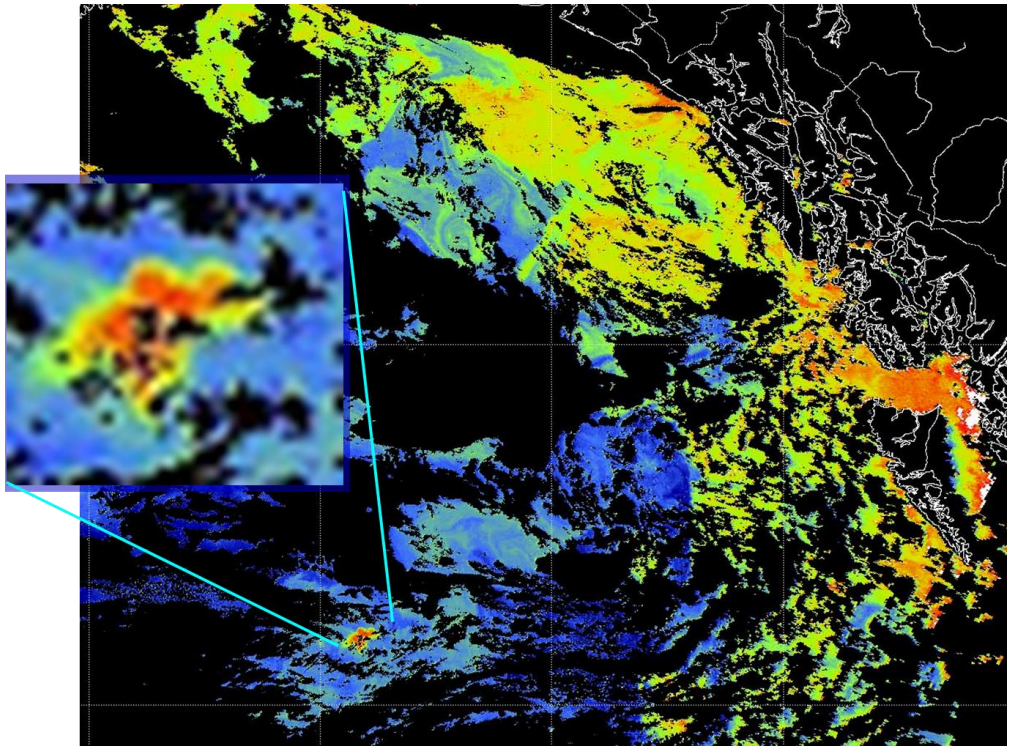
Climate Change and Carrying Capacity (CCCC)

- The first major interdisciplinary initiative undertaken by PICES, and a regional program of GLOBEC.
- The goal is to forecast the consequences of climate variability on the ecosystems of the subarctic Pacific.
- Direct collaboration of physical oceanographers, biological oceanographers, fisheries scientists and scientists of other disciplines
- TORs include 1) Integrate and stimulate national activities; 2) Determine how the work of PICES Scientific Committees and Working Groups can support the program; 3) Identify national/international research programs with which the CCCC Program could coordinate; 4) Provide scientific direction of PICES.
- The dissemination of scientific findings from the North Pacific has contributed to strengthening the linkages between PICES scientists and scientists around the world.

PICES: Incubator of interdisciplinary sciences

IFEP (Iron Fertilization Experiment Panel)

- Led by C. S. Wong and Shigenobu Takeda
- Conducting 3 mesoscale iron fertilization experiments in the western and eastern N. Pacific



A Mesoscale Iron Enrichment in the Western Subarctic Pacific Induces a Large Centric Diatom Bloom

Atsushi Tsuda,[1*†] Shigenobu Takeda,[2] Hiroaki Saito,[3] Jun Nishioka,[4] Yukihiro Nojiri,[5] Isao Kudo,[6] Hiroshi Kiyosawa,[7] Akihiro Shiomoto,[8] Keiri Imai,[5,9] Tsuneo Ono,[1] Akifumi Shimamoto,[10] Daisuke Tsumune,[4] Takeshi Yoshimura,[4] Tatsuo Aono,[11] Akira Hinuma,[12] Masatoshi Kinugasa,[13] Koji Suzuki,[12] Yoshiki Sohrin,[13] Yoshifumi Noiri,[6] Heihachiro Tani,[6] Yuji Deguchi,[10] Nobuo Tsurushima,[14] Hiroshi Ogawa,[15] Kimio Fukami,[16] Kenshi Kuma,[6] Toshiro Saino[9,12]

We have performed an in situ test of the iron limitation hypothesis in the subarctic North Pacific Ocean. A single enrichment of dissolved iron caused a

The decline and fate of an iron-induced subarctic phytoplankton bloom

Philip W. Boyd[1], Cliff S. Law[2], C.S. Wong[3], Yukihiro Nojiri[4], Atsushi Tsuda[5], Maurice Levasseur[6], Shigenobu Takeda[7], Richard Rivkin[8], Paul J. Harrison[9,10], Robert Strzepek[11], Jim Gower[3], R. Mike McKay[12], Edward Abraham[2], Mike Arychuk[3], Janet Barwell-Clarke[3], William Crawford[3], Michelle Hale[8], Koh Harada[13], Keith Johnson[3], Hiroshi Kiyosawa[14], Isao Kudo[15], Adrian Marchetti[16], William Miller[17], Joe Needoba[9], Jun Nishioka[18], Hiroshi Ogawa[19], John Page[3], Marie Robert[3], Hiroaki Saito[20], Akash Sastri[21], Nelson Sherry[3], Tim Soutar[3], Nes Sutherland[3], Yusuke Taira[15], Frank Whitney[3], Shau-King Emmy Wong[3] & Takeshi Yoshimura[18]

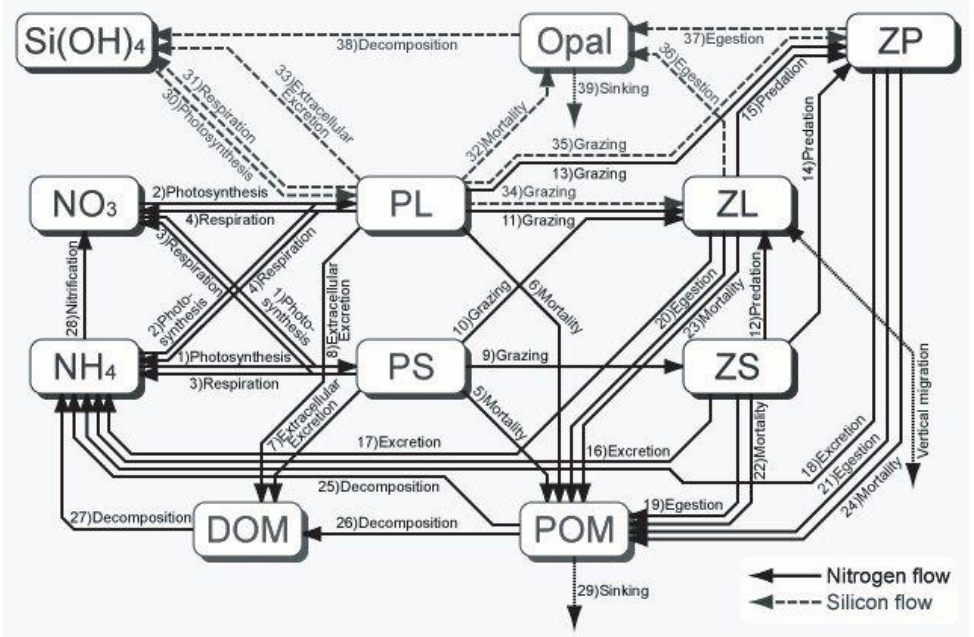
remineralization and mesozooplankton grazing. The depletion of silicic acid and the inefficient transfer of iron-increased POC below the permanent thermocline have major implications both for the biogeochemical interpretation of times of greater iron supply in the geological past[6,7], and also for proposed geo-engineering schemes to increase oceanic carbon sequestration[3,8].

The magnitude of iron supply to the oceans has changed over geological timescales[6,9], and the increased export of carbon from iron-stimulated phytoplankton blooms is one of several mechanisms proposed for past reductions in atmospheric CO_2 concentrations[6]. Mesoscale *in situ* iron enrichments have resulted in diatom blooms, demonstrating that phytoplankton growth in high-nitrate low-chlorophyll (HNLC) waters is controlled by the iron supply[1–5]. The deliberate iron enrichment of HNLC regions has therefore been considered as a potential strategy to mitigate the current rise in atmospheric CO_2 (refs 3 and 8). However, mesoscale iron enrichments have not studied the decline of a bloom [1–5], or

PICES: Incubator of interdisciplinary sciences

Model task team

- Workshops to build a lower trophic level ecosystem model NEMURO
- Extend version of NEMURO.FISH
- NEMURO and NEMURO.FISH are powerful platforms to know the North Pacific marine ecosystems, difference in eastern and western N. Pacific, and other oceans. Engaging scientists of different disciplines and regions.
- Developed further collaboration with ICES



Advantages of PICES: Size and regular annual meetings

- Good size for tackling broader scientific issues but not “too big”
- Agora for “regular” in person meeting, data exchange, scientific discussion
- Nurturing tight human networks, or PICES family

Article X : The working and official language of the Council shall be English.
Regular remind of the nature of PICES, composed by many non-native English speaker, by Skip McKinnell, Deputy Executive Secretary, also nurtured the atmosphere of the organization/activities

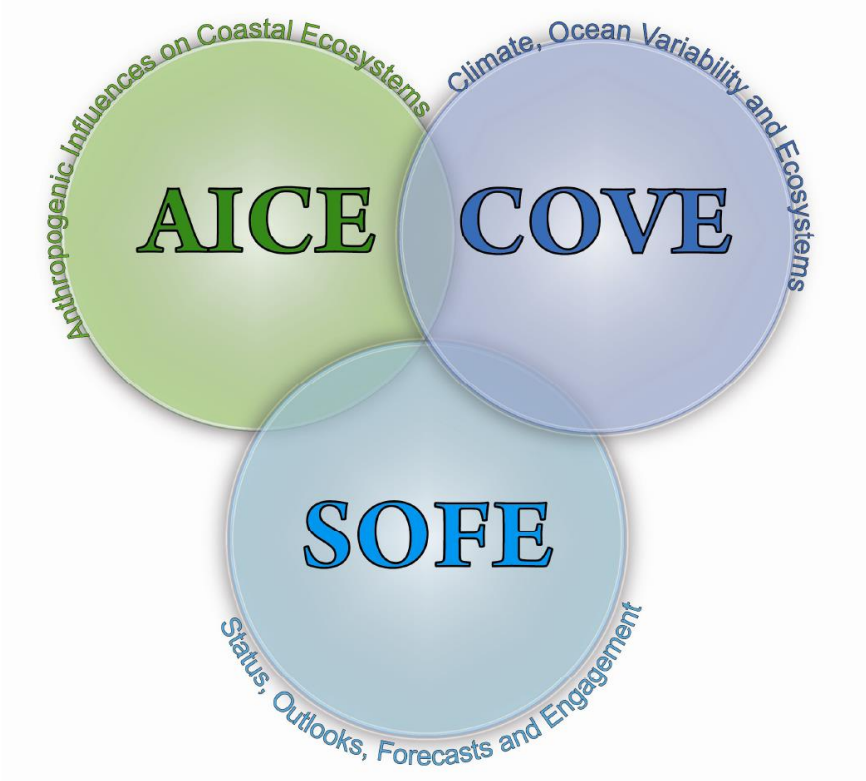
PICES is a good incubator for ECOP, esp. for non-native English speakers, or a kind a place of *Debutant*

Section (Advisory Panel) MBM

- Gathering scientists with mutual interest on marine birds and mammals
- PICES does not carry out any “stock management”, place for scientific discussion, not for political debate.
- MBM made it possible to have discussion and data exchange without being influenced by different stances on utilization and conservation of marine birds and mammals among member states.
- Regular meet of the Section members nurtured tight human network
- Good balance of scientific issues across the North Pacific

CCCC to FUTURE (2014-)

Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems



AICE: Anthropogenic Influences on Coastal Ecosystems
COVE: Climate, Oceanographic Variability and Ecosystems–
SOFE: Status, Outlooks, Forecasts, and **Engagement**

Establishment of Human Dimension Committee

The founders of PICES once avoid to establish committee on social science

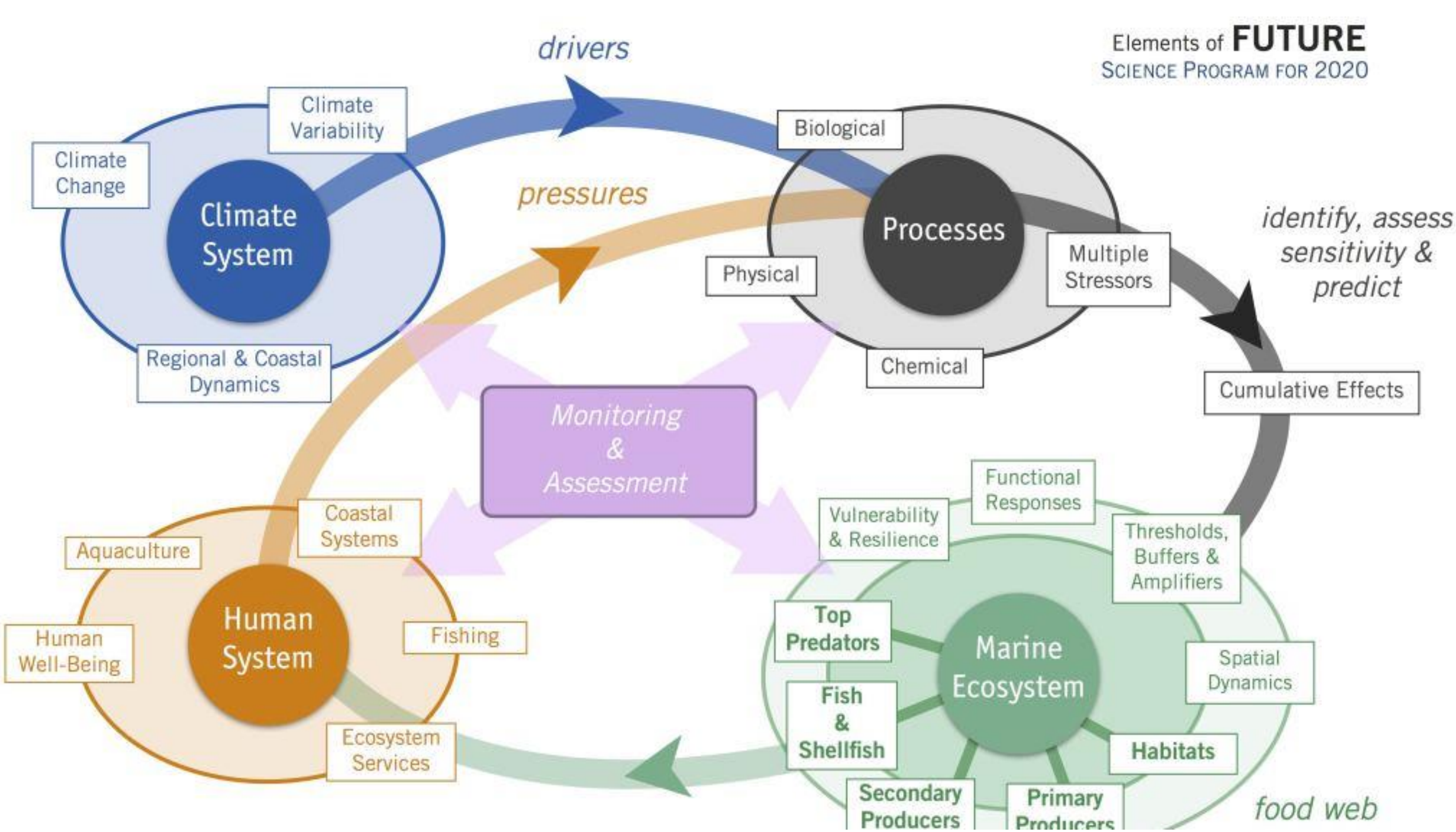
Establishment of HD Committee in 2016

To promote and coordinate interdisciplinary research that leads to increased understanding of the relationship between North Pacific marine ecosystems and the people, communities, and economies that are part of those systems.

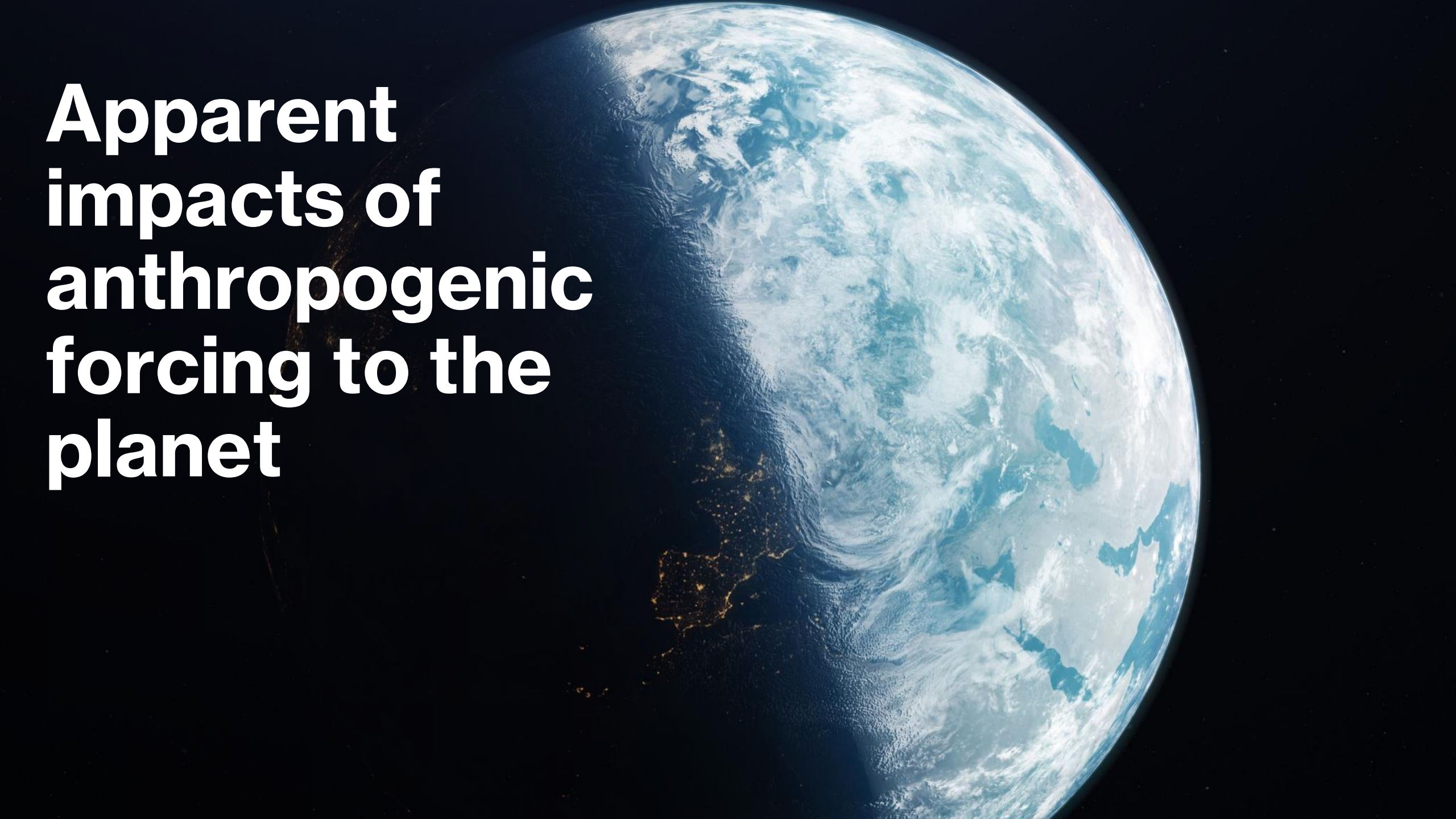
Social Science is now one of the main aims of PICES

From disciplinary and interdisciplinary sciences to transdisciplinary sciences

The 1st HD Committee meeting in PICES-2017


Elements of FUTURE
SCIENCE PROGRAM FOR 2020
drivers
pressures
identify, assess sensitivity & predict
food web
Climate Variability
Climate Change
Climate System
Regional & Coastal Dynamics
Biological
Physical
Processes
Chemical
Multiple Stressors
Cumulative Effects
Monitoring & Assessment
Coastal Systems
Aquaculture
Human System
Human Well-Being
Fishing
Ecosystem Services
Functional Responses
Vulnerability & Resilience
Thresholds, Buffers & Amplifiers
Top Predators
Marine Ecosystem
Spatial Dynamics
Fish & Shellfish
Habitats
Secondary Producers
Primary Producers

Apparent impacts of anthropogenic forcing to the planet



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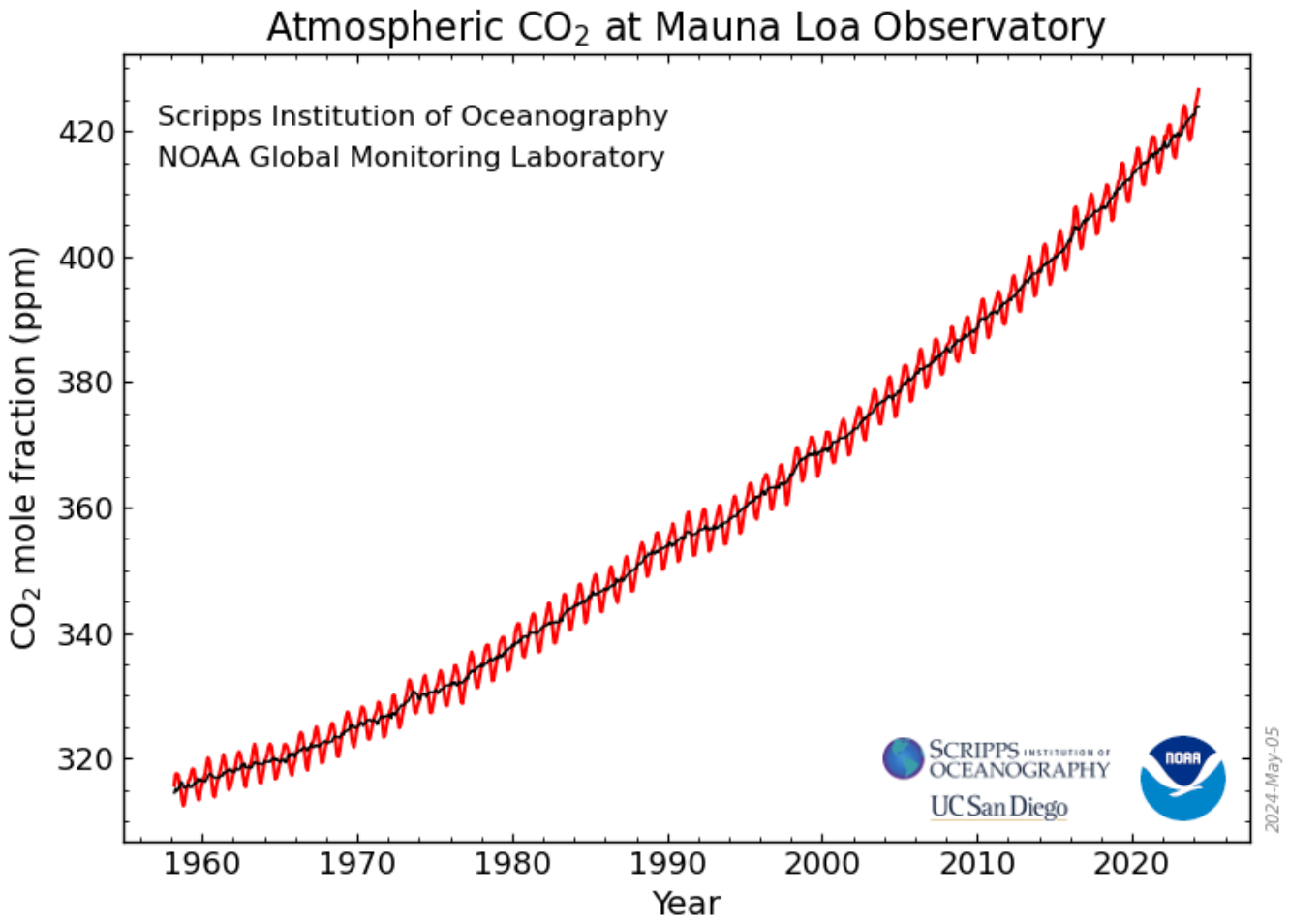
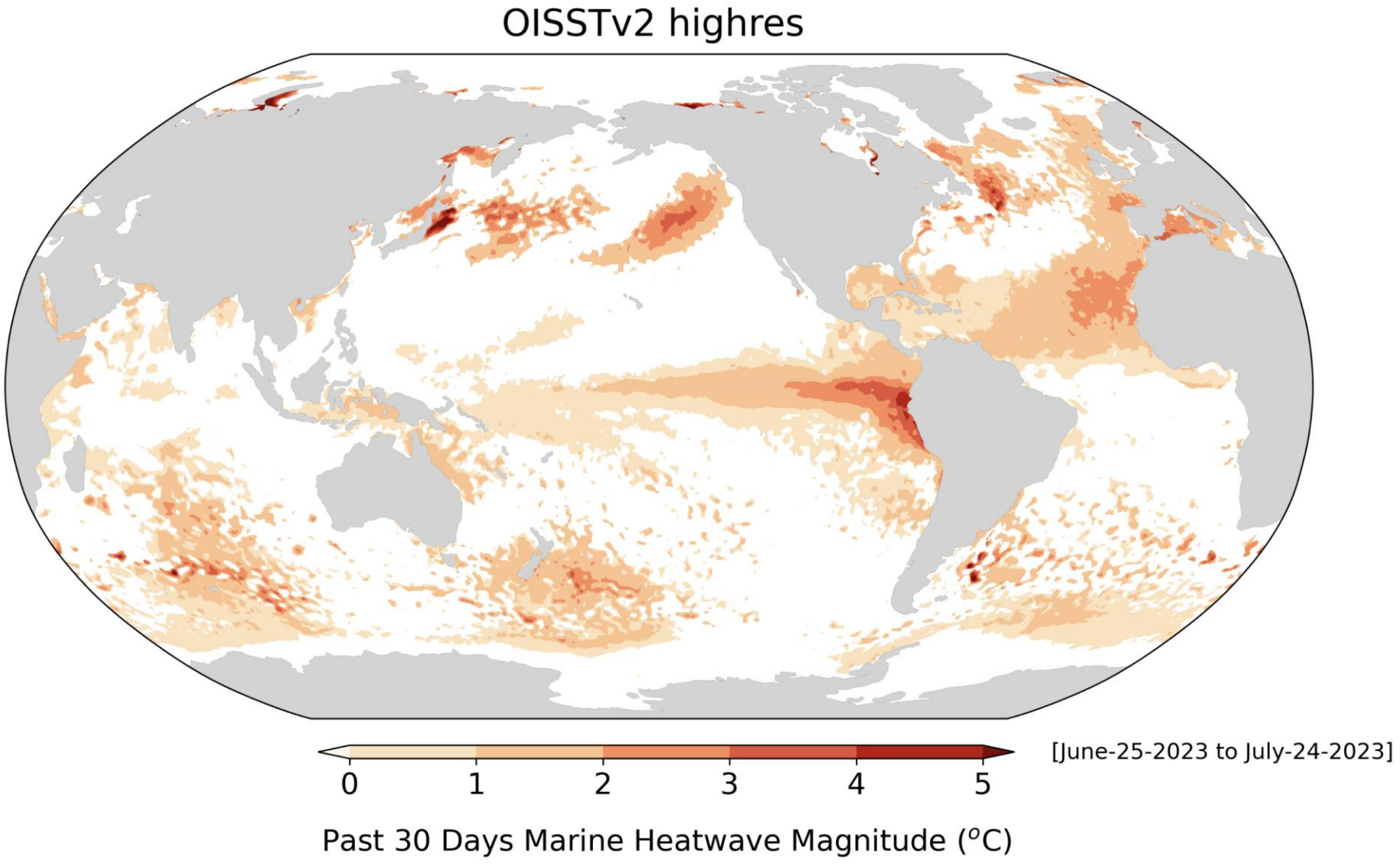
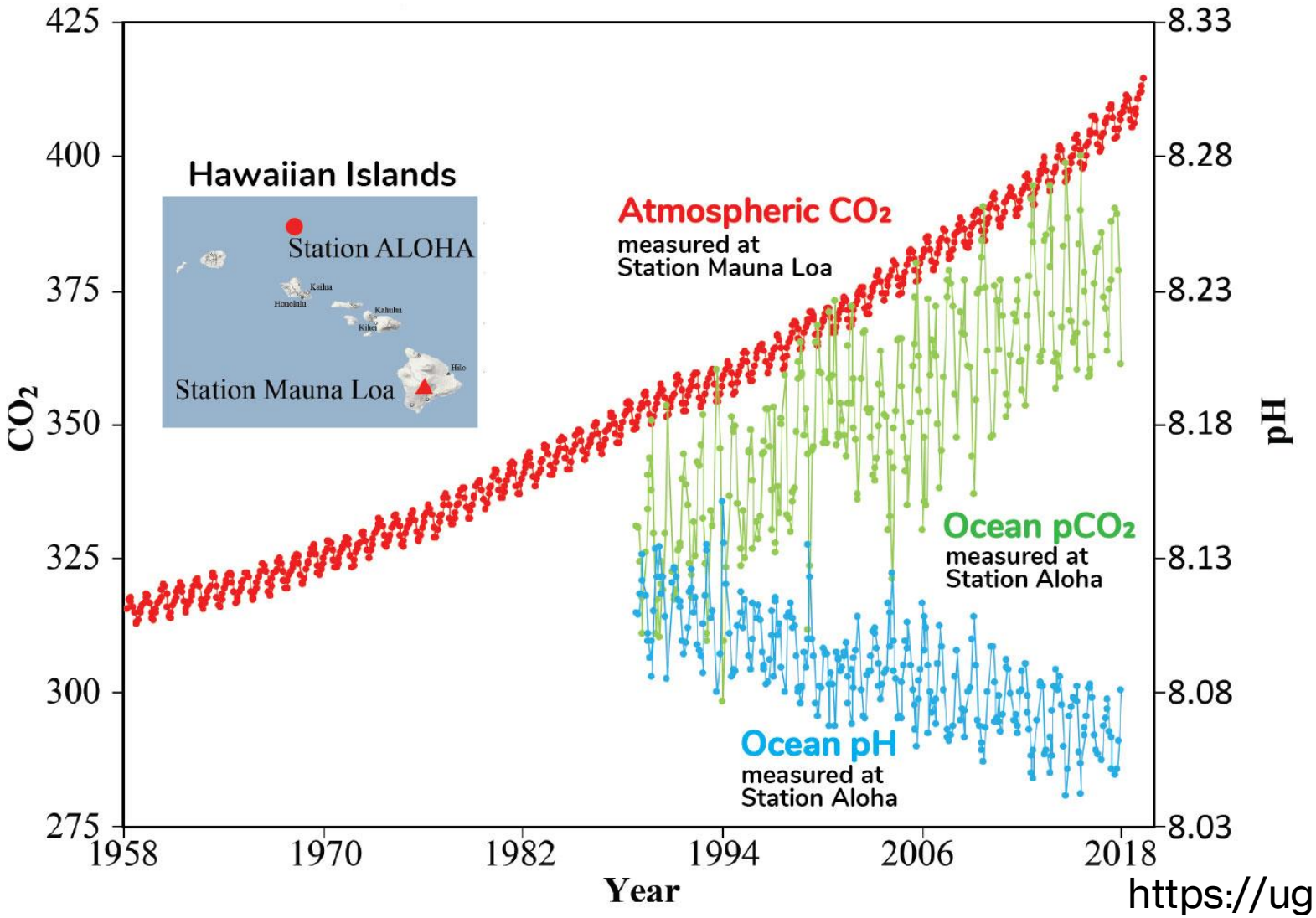


Extreme Ocean Heatwave

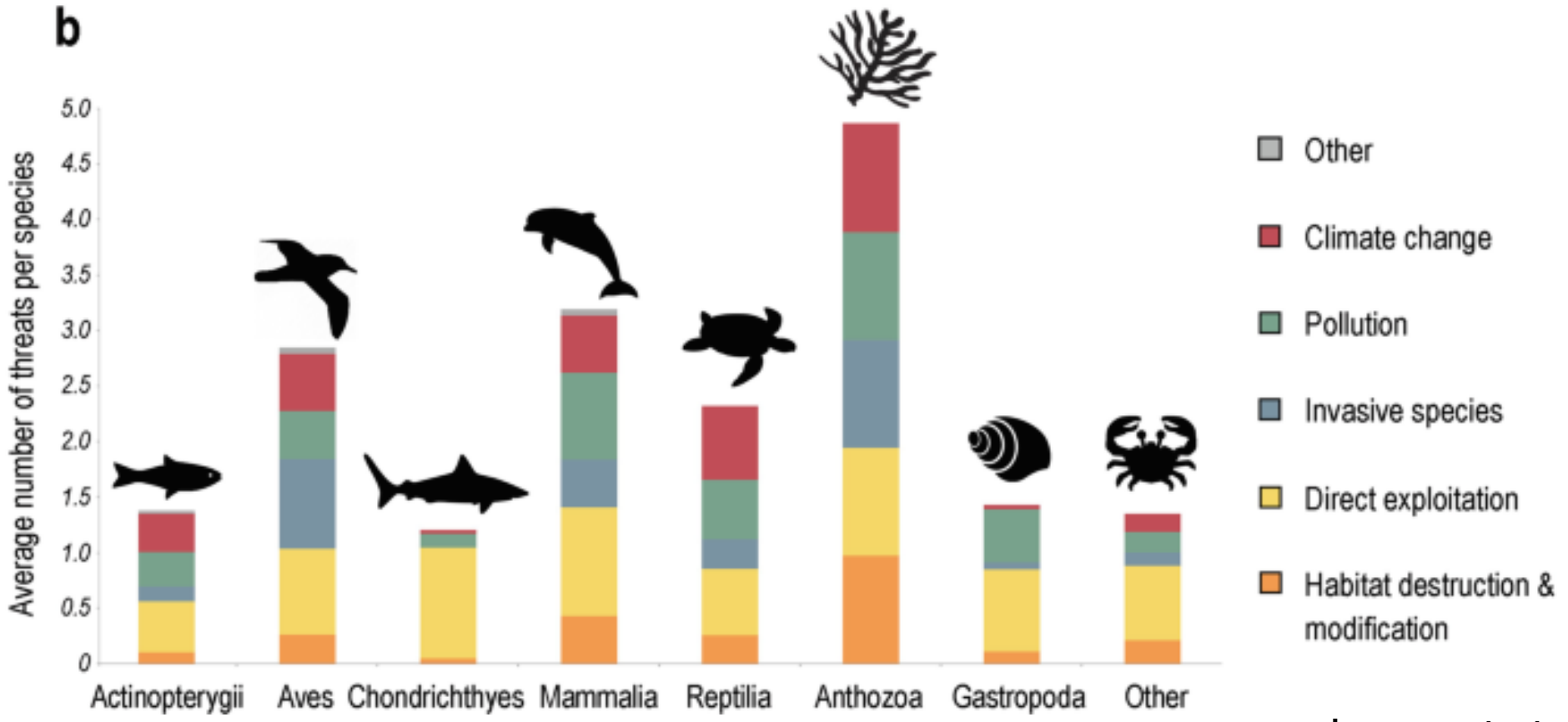


Apparent impacts of anthropogenic forcing to the planet



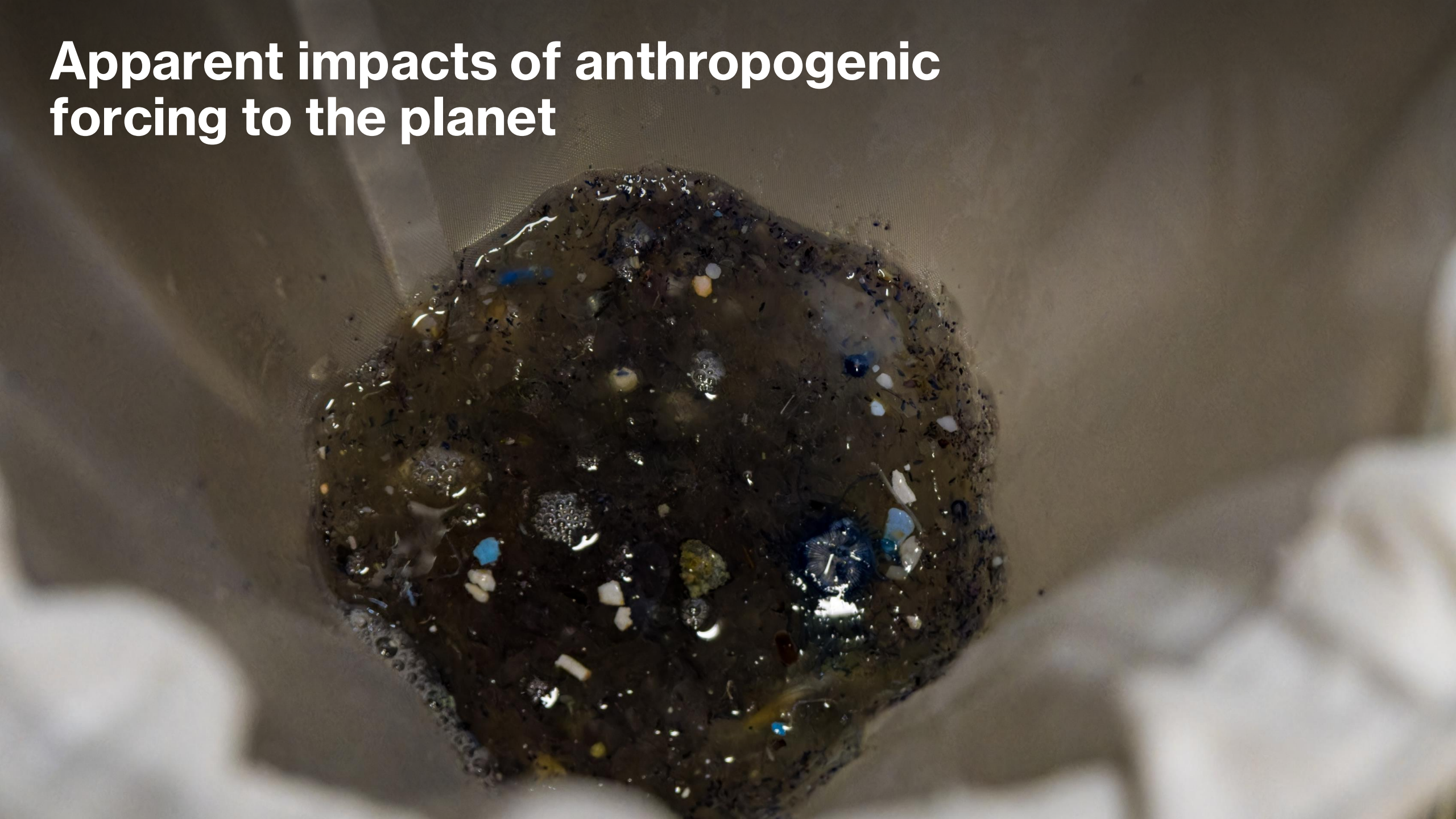
https://ugc.berkeley.edu/

Apparent impacts of anthropogenic forcing to the planet



Luypaert et al. 2019

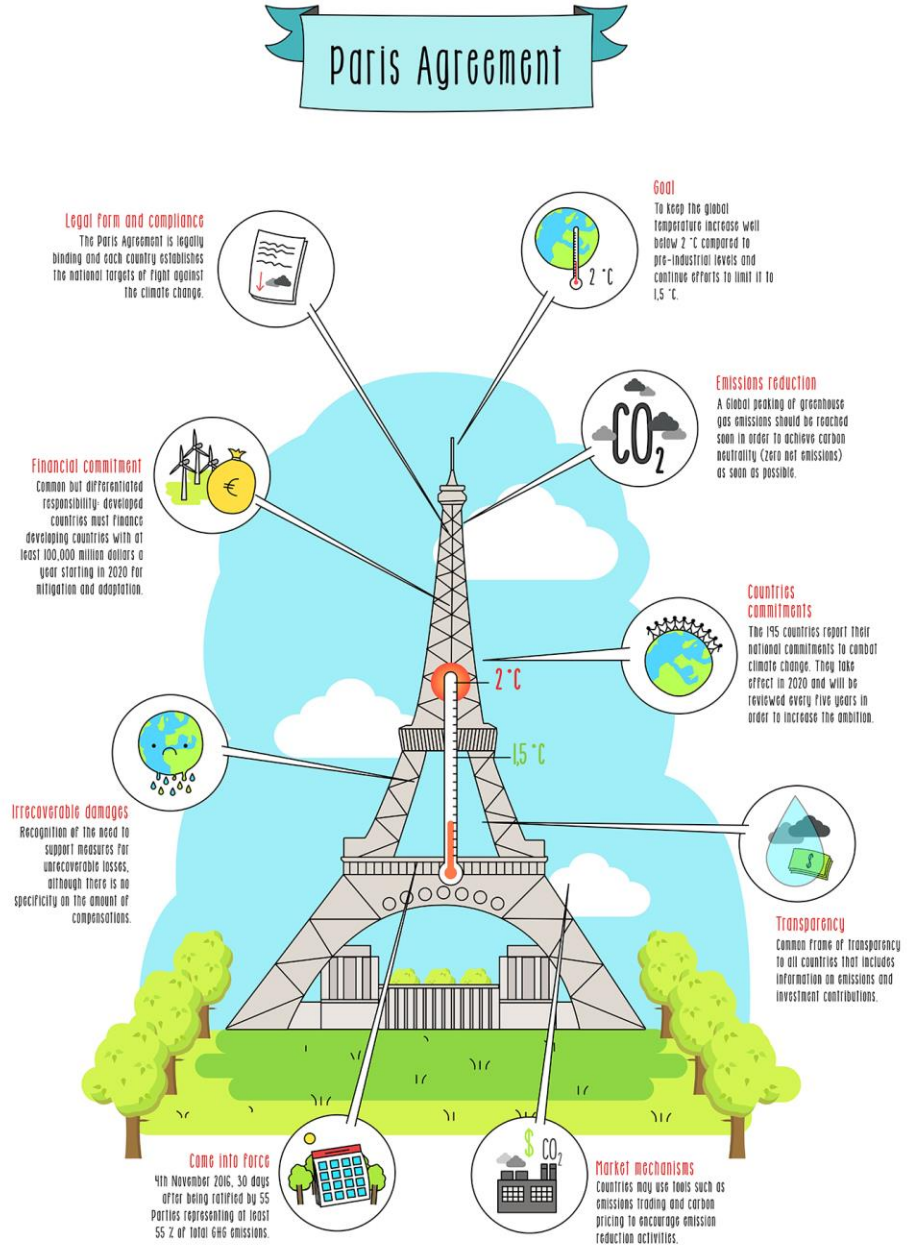
Apparent impacts of anthropogenic forcing to the planet



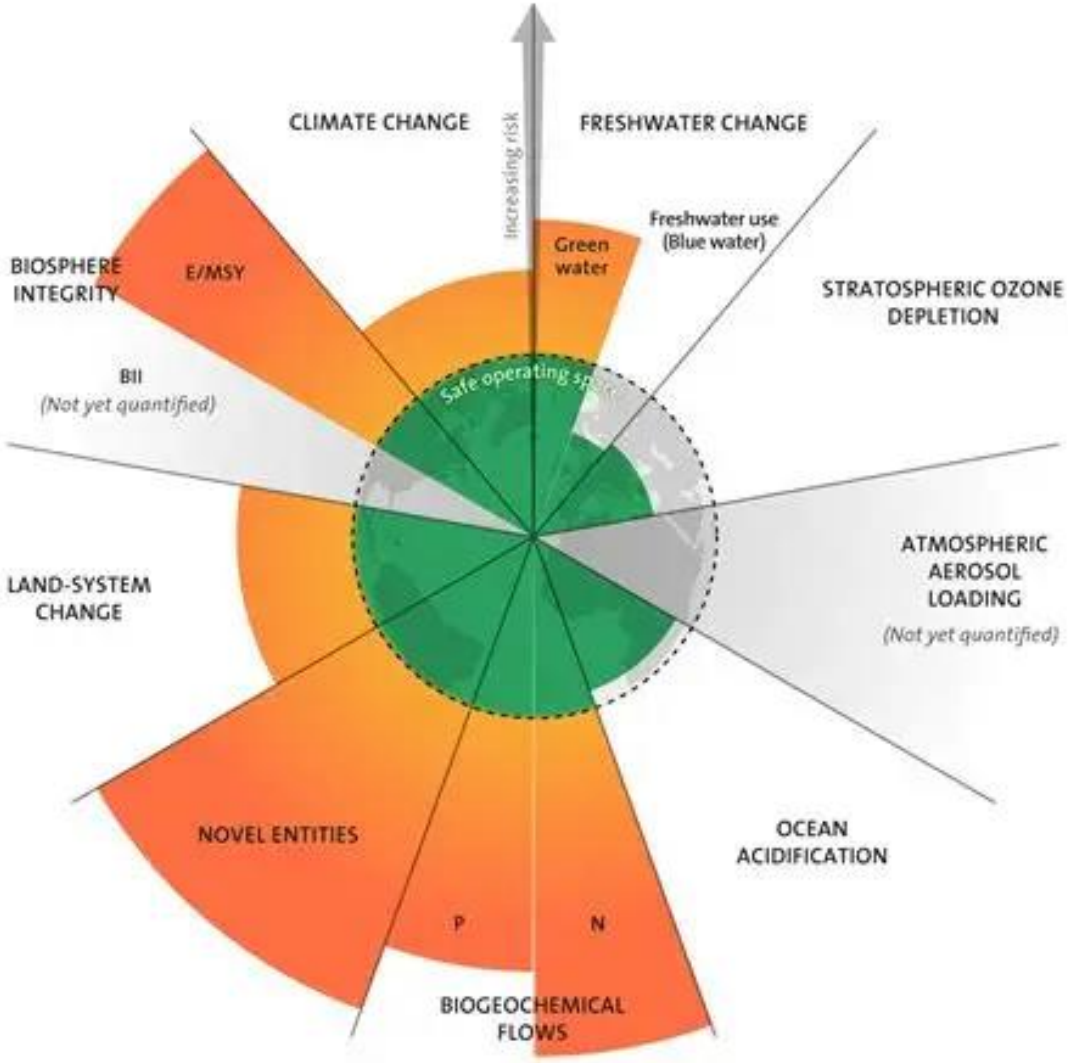
Management of oceans and commons

Natural resilience is not enough to recover the planet
Active human involvement is essential

- Aichi Biodiversity Targets: to address the global biodiversity crisis through 20 specific goals to be achieved by 2020.
- A series of IPCC reports
- The Paris Agreement: a legally binding international treaty on climate change



Management of oceans and commons



Our planet is on the edge of point of no return

Accelerating ecosystem degradation by anthropogenic forcings

UN SDGs and UN Ocean Decade

SDGs: An urgent call for action by all countries in a global partnership

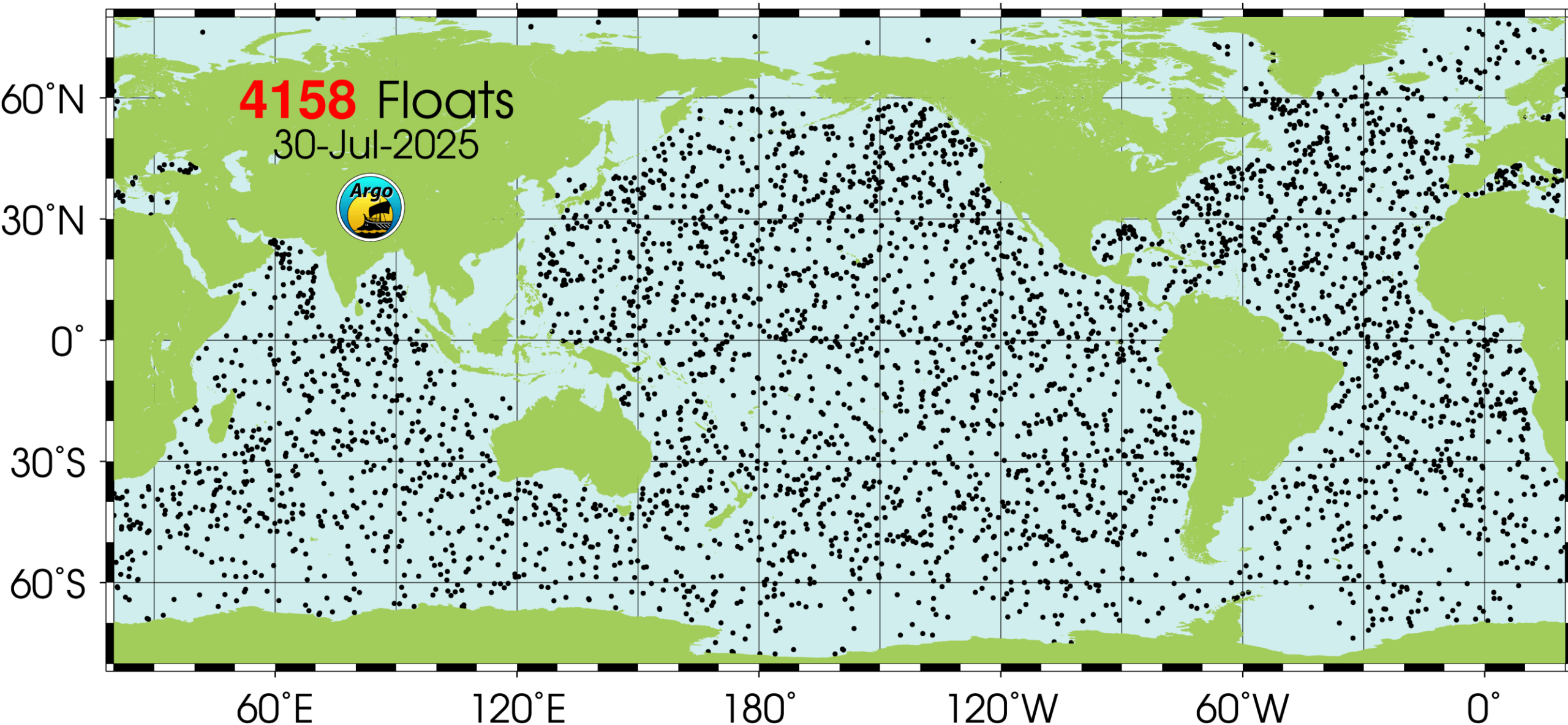
Ocean Decade: seeks to stimulate ocean science and knowledge generation ***to reverse the decline of the state of the ocean system***

The vision is ***'the science we need for the ocean we want'.***

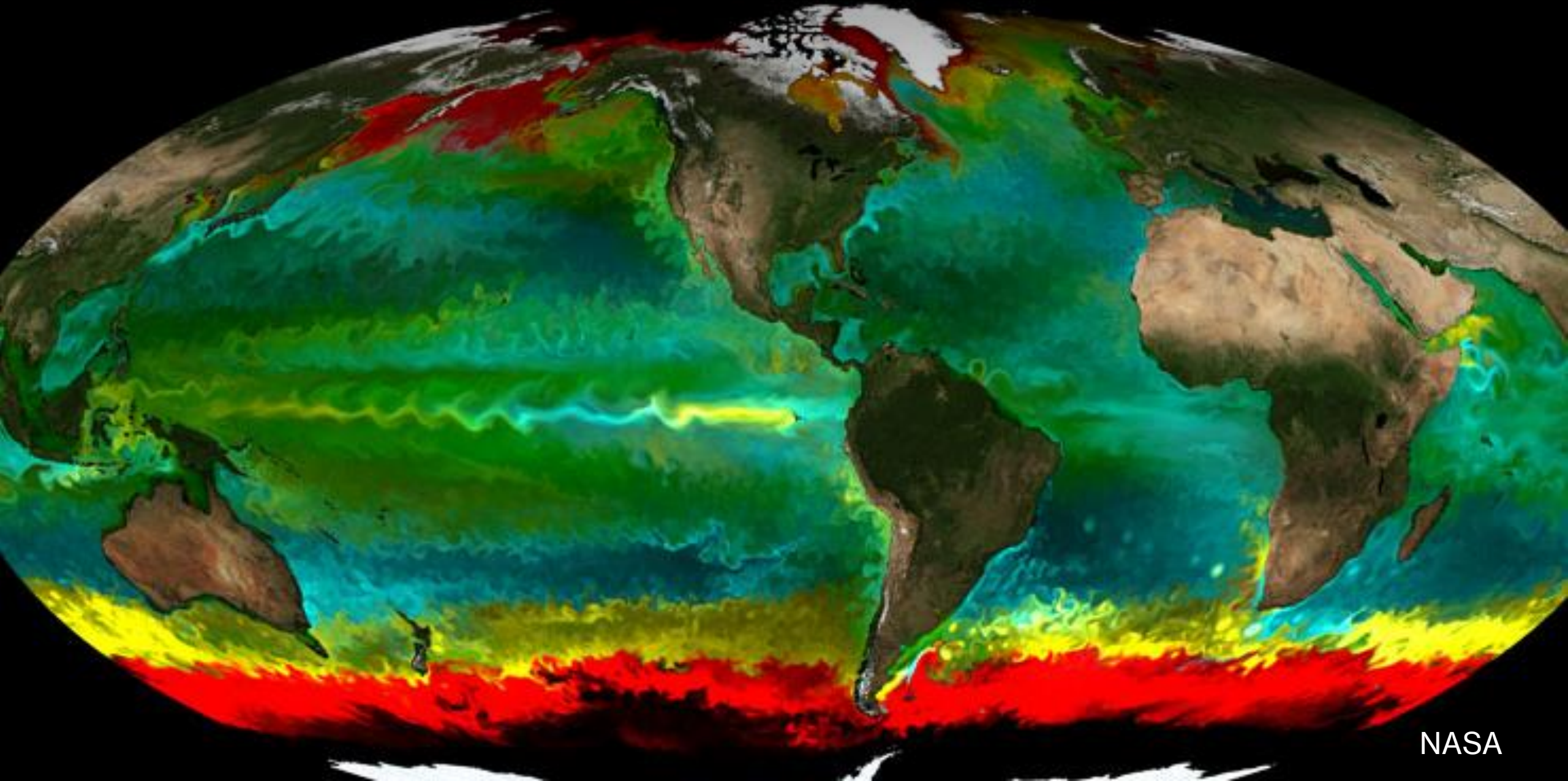
Requests from society to scientists and scientific organization to prepare best scientific knowledge in timely manner

Progress in marine sciences

Progress in marine sciences: Observation

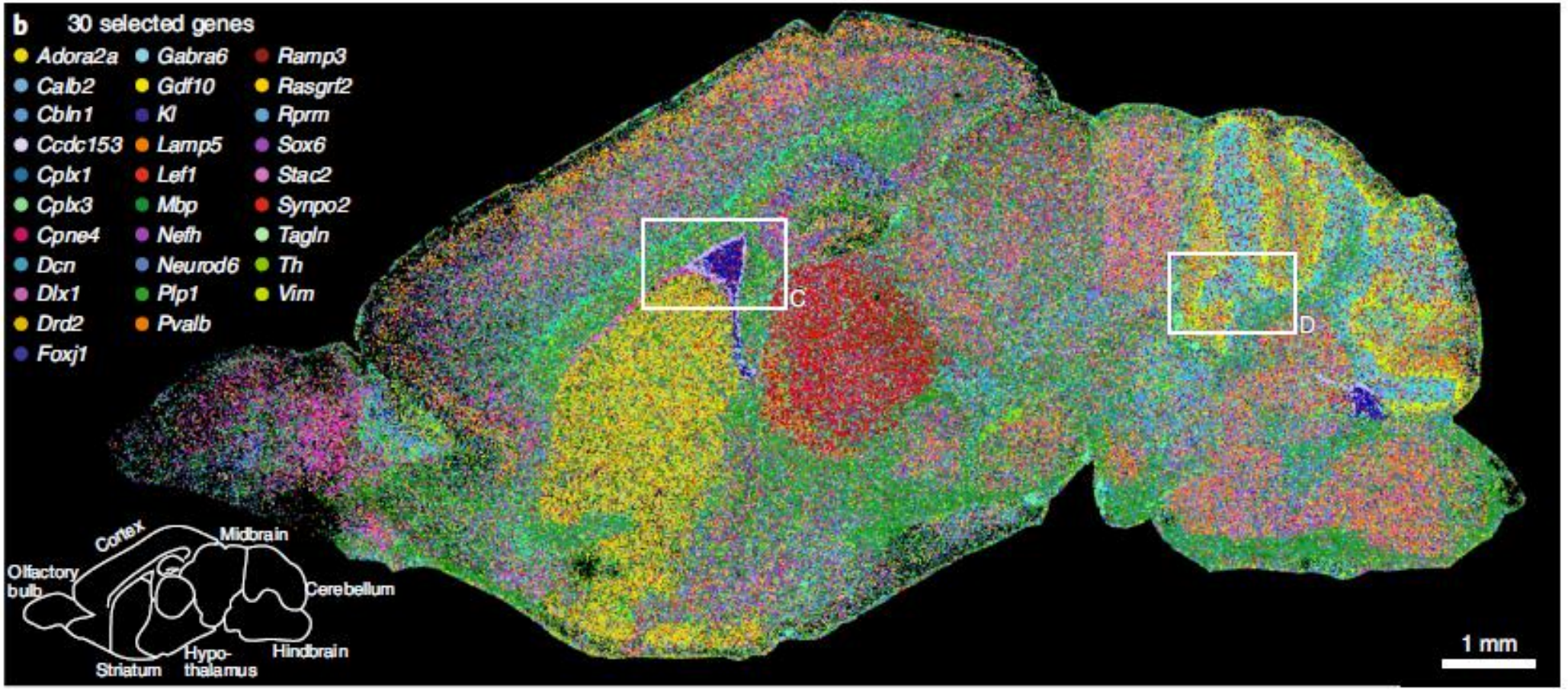


Progress in marine sciences: Model



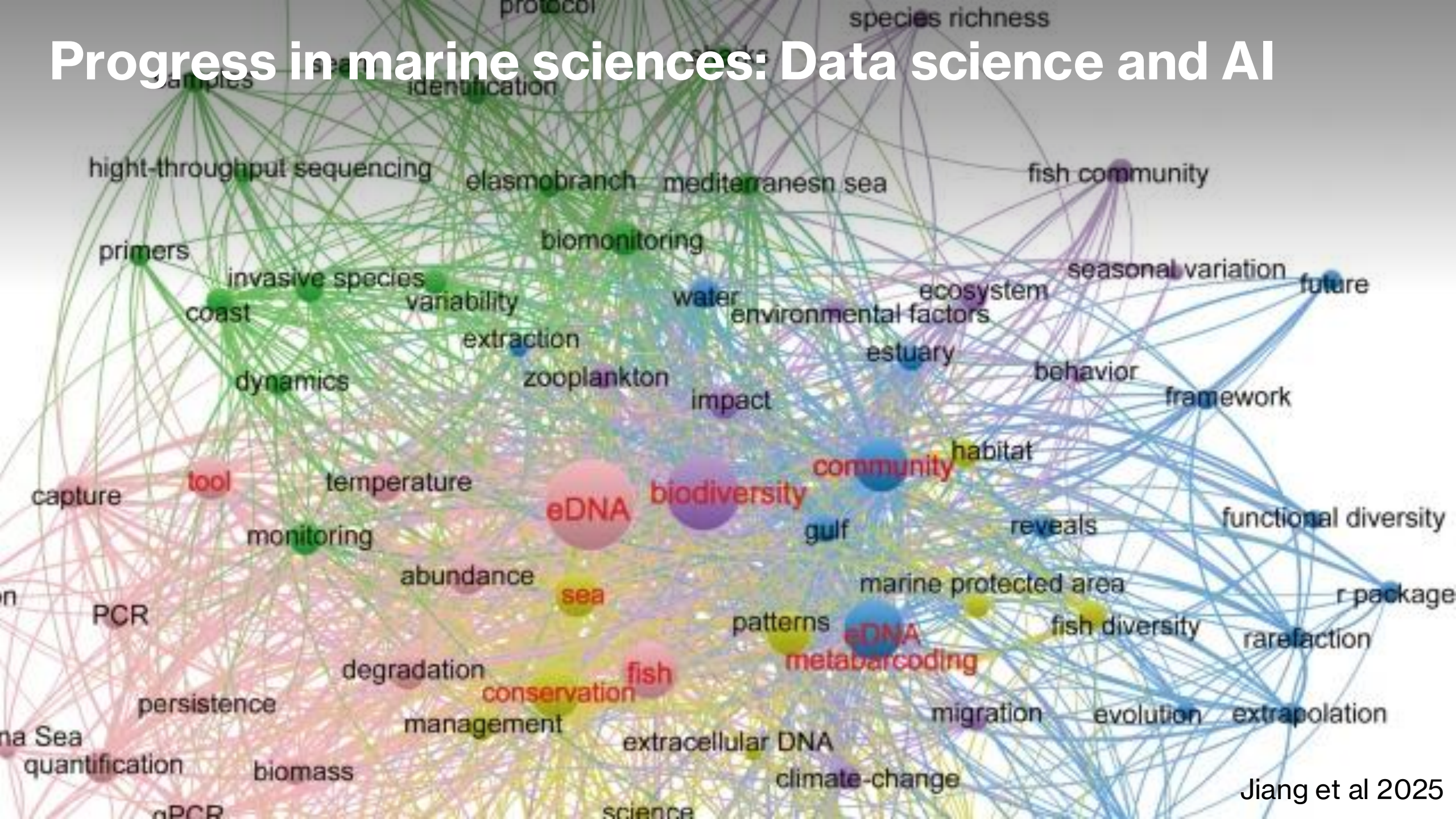
NASA

Progress in marine sciences: Molecular biology



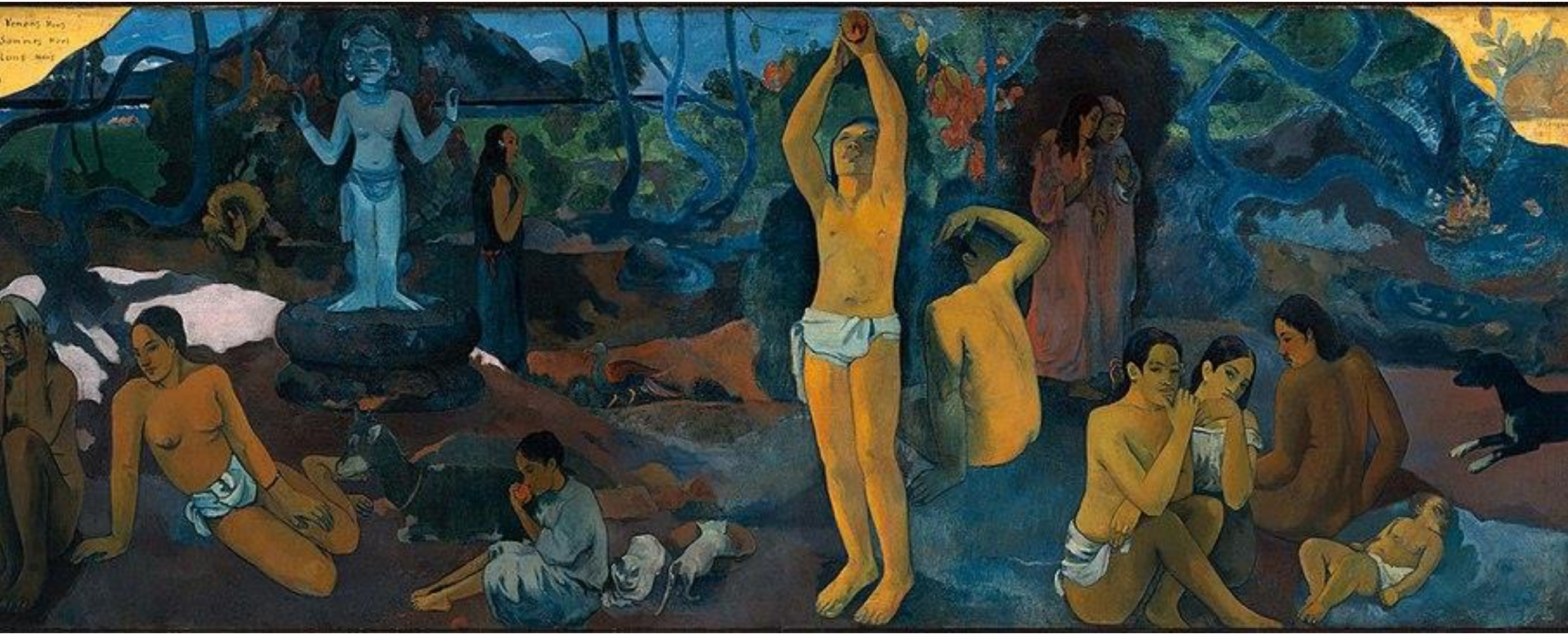
Borm et al 2022

Progress in marine sciences: Data science and AI



Jiang et al 2025

D'où venons-nous ? Que sommes-nous ? Où allons-nous ?



Where should PICES go?

PICES-2025

Nov 8-14, 2025 | Yokohama, Japan

Innovative Approaches and Applications to Foster Resilience in North Pacific Ecosystems

Ecosystems in the North Pacific have been significantly impacted by climate change and human activities. For over 30 years, PICES has established an international scientific network and conducted numerous projects to enhance our understanding of how North Pacific ecosystems respond to such impacts. However, with the recent intensification of climate change and the increase in unpredictable extreme events, previously held understandings may no longer be valid. There is a pressing need for discussions on integrating the latest scientific findings and by experts from diverse fields, including marine science, environmental conservation, engineering, economics, and social science. Equally important is the collaboration with local fishing communities, policymakers, NGOs, and other stakeholders to explore practical applications of scientific knowledge. PICES-2025 will serve as a crucial platform for exploring innovative approaches to understanding North Pacific ecosystems, helping to chart a path toward climate resilience and sustainable development. Contributions from experienced specialists, as well as groundbreaking ideas from Early and mid-Career Ocean Professionals, are highly encouraged.

Where should PICES go?

- Do science based on the interests of both scientists and government as Intergovernmental Science Organization
- Prepare best scientific knowledge and advices in timely manner
- Co-design the science program and expert groups communicating with the stake holders

Where should PICES go?

To be an organization of “diversity”

- Transdisciplinary and disciplinary sciences
- Encouraging attendance of scientists from government, academic, citizen, and students
- Generations, stronger ECOPs
- Local and indigenous knowledge, convergence knowledge
- Keep the door open


Let’s navigate the PICES cruise to the future