



Environmental Effects of Offshore Energy: International Knowledge and the Chilean Perspective

Chile Riding the Blue Energy Wave
April 2021





Technical Notes for Zoom

 Keep your video off, but consider turning it on for the breakout groups



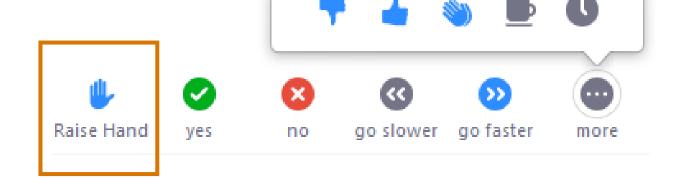


Stay muted unless you are speaking





• To ask a question, raise your hand



Or enter it into the chat box:





Agenda

International knowledge
Chilean perspective
Instructions for the breakout session
Breakout session
Report out
Wrap up







Environmental Effects of Offshore Energy: International Knowledge

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Pacific Northwest National Laboratory





Why study environmental effects of marine energy

- Drivers for marine energy are clear, but
 - Stakeholders and regulators have concerns
 - Regulatory processes not well established
- These concerns are driven by:
 - New, unknown technologies, unknown potential for harm
 - New use of ocean space and many other uses
 - Insufficient knowledge of environment in high energy areas
 - Concerns about marine species already under stress
- Improved information can:
 - Simplify/shorten time to consent and deploy devices & arrays
 - Decrease scientific uncertainty
 - Share information internationally







OES-Environmental







Ocean Energy Systems – Environmental

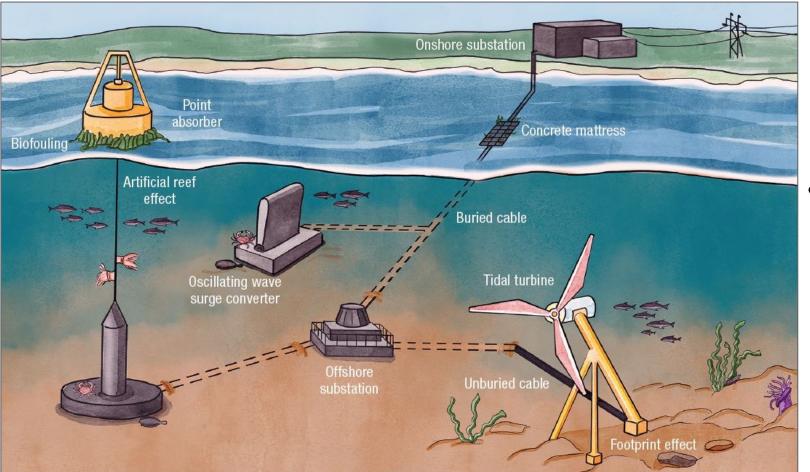


Figure 6.1 in the 2020 State of the Science Report

- International initiative aimed at coordinating research and information to progress the marine energy industry in an environmentally responsible manner
- 16 OES nations currently participating
 - Australia, Canada, China,
 Denmark, France, India, Ireland,
 Japan, Mexico, Monaco, Portugal,
 Singapore, Spain, Sweden,
 United Kingdom, United States

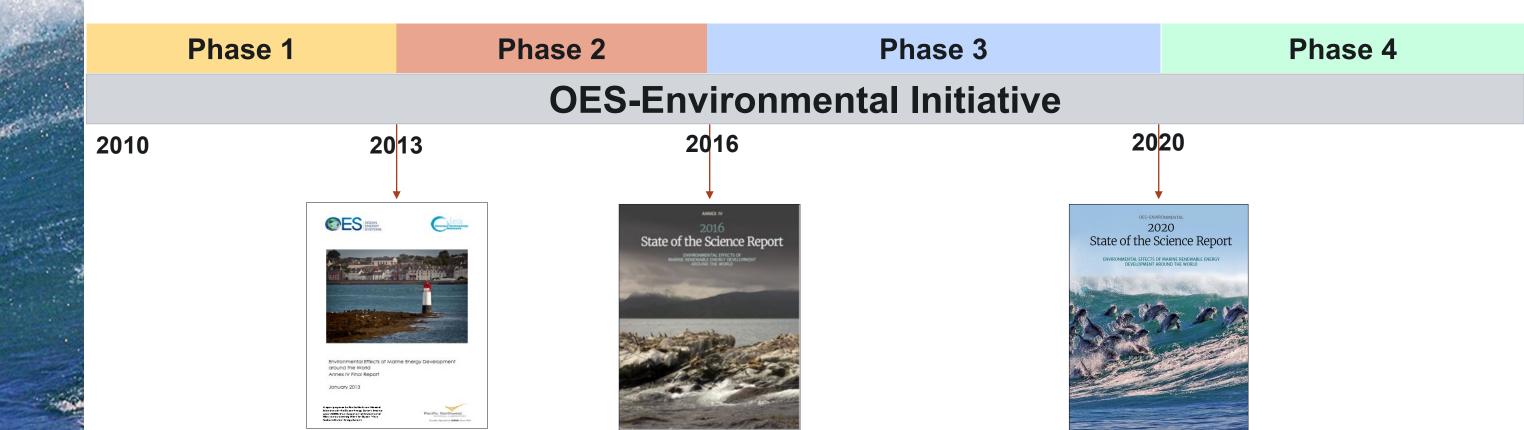


OES-Environmental











Environmental Effects of Marine Energy: Stressors and Receptors

- Stressors marine energy devices, systems that may cause harm
- Receptors marine animals, habitats, ecosystem processes

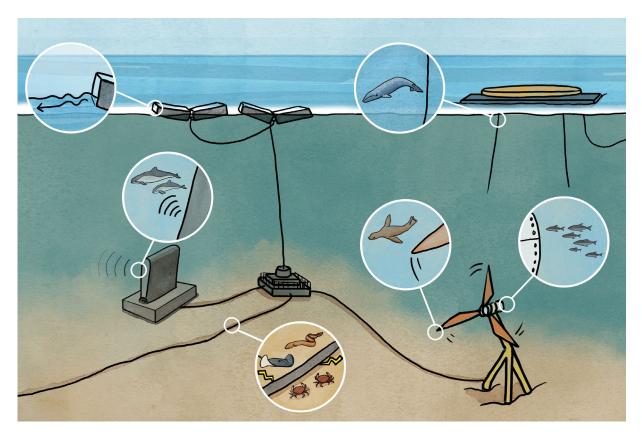


Figure 2.1 in the 2020 State of the Science Report

Priority stressors:



Collision risk



Mooring line encounter



Underwater noise



Changes in oceanographic systems



Electromagnetic fields



Displacement / barrier effects



Collision Risk Around Tidal and Wind Turbines

- Concerns are for marine mammals, fish, seabirds
- Few observations of animals around turbines
- Marine mammals and fish for tidal turbines, seabirds for floating OSW turbines
- Models of collision risk are improving but not validated
- Perceived risk remains high due to:
 - Uncertainties about probability of collisions
 - Consequences may be great if collisions occur



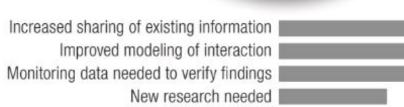
Increased sharing of existing information
Improved modeling of interaction
Monitoring data needed to verify findings
New research needed



Risk from Underwater Noise

- Marine animals use sound in water to communicate, navigate
- Sound levels unlikely to cause physical harm
- Behavioral effects most likely but difficult and costly to investigate
- Important tools:
 - International standard (TC114)
 - US regulatory action thresholds for underwater sound
 - Measurements of some tidal turbines and WECs, below these guidelines
- Floating OSW turbines thought to be less of a noise problem







Risk from Electromagnetic Fields

- Only some marine species are sensitive
- Lab and field studies show changes, but not expected to be harmful
- Will need to examine effects with larger arrays
- No thresholds or standardized methods for measurement
- Relatively low risk



Increased sharing of existing information
Improved modeling of interaction
Monitoring data needed to verify findings
New research needed

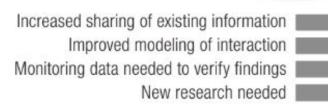


Changes in Habitats

- Concerns about loss of benthic and pelagic habitats
- Similar to effects of other offshore industries
- Marine energy projects need to be sited in avoidance of rare/unusual habitats
- Reefing of fish, settling of benthic organisms (biofouling)
- Theoretical potential for introduction of non-native species
- Relatively low risk







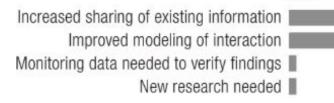


Changes in Oceanographic Systems



- Changes in oceanographic processes:
 - Circulation, wave height, sediment transport patterns, water quality, and marine food webs
- For small numbers of marine energy devices, changes are too small to measure
- Computer models indicate there could be changes from very large arrays
- Models need to be validated
- Based on modeling studies, this risk is very low







Encounters with Moorings & Cables

- Entrapment or entanglement in mooring lines or cables
- Concerns based on loose fishing gear, old submarine cables
- Concerns for large marine mammals (whales)
- No loose ends to marine energy lines or cables, no loops
- Risk from this stressor is very low

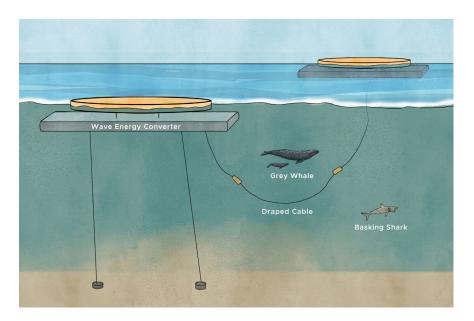
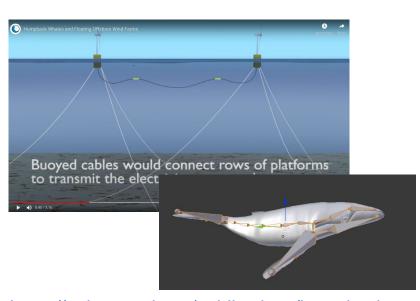
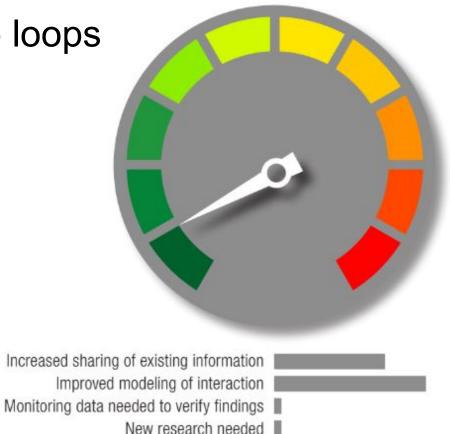


Figure 8.1 in the 2020 State of the Science Report



https://tethys.pnnl.gov/publications/humpback-whales-floating-offshore-wind-farm-animation



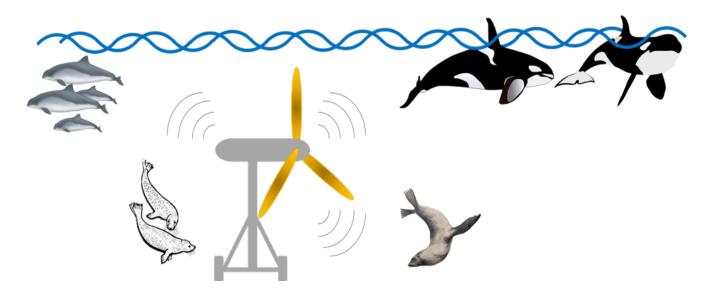




Bottom Line and Path Forward

Overall, it appears that the likely risk to marine animals is small (except possibly for collision risk), for small numbers of marine energy devices.

- 1. Data collection for consenting needs to be proportionate to risk
- 2. Need sufficient evidence of risk or likely risk for regulators to rely on
- 3. Transfer of data and information from consented projects and other studies
- 4. Move to retire risks that are not significant, revisit for larger arrays

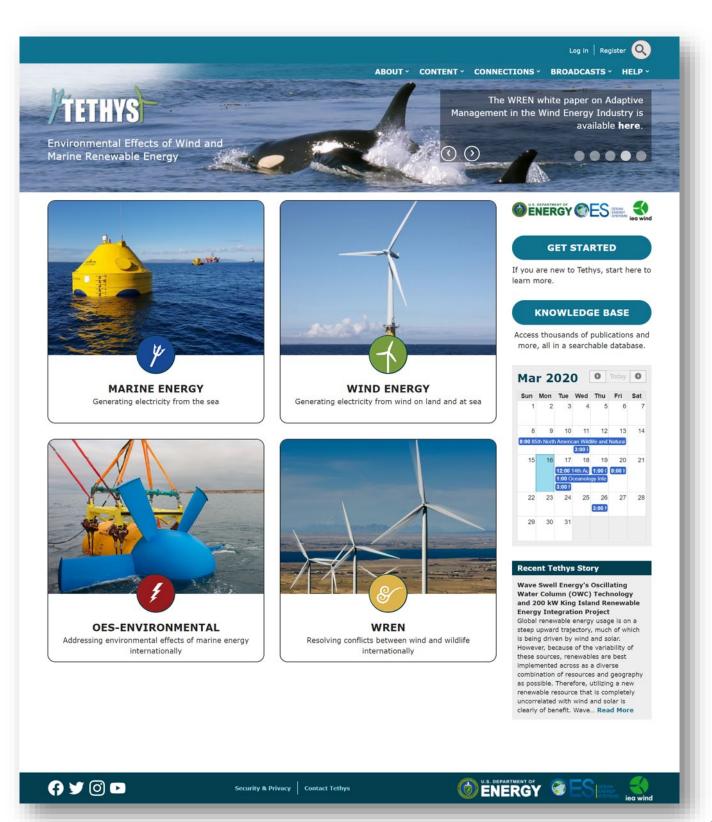




Tethys

- Online Knowledge Base, marine and wind energy
- Hosts over 7,700 scientific papers, grey literature reports, and other documents
- Map Viewer
- Tethys Blasts
- Tethys Stories
- Events Calendar
- OES-Environmental Metadata

https://tethys.pnnl.gov/

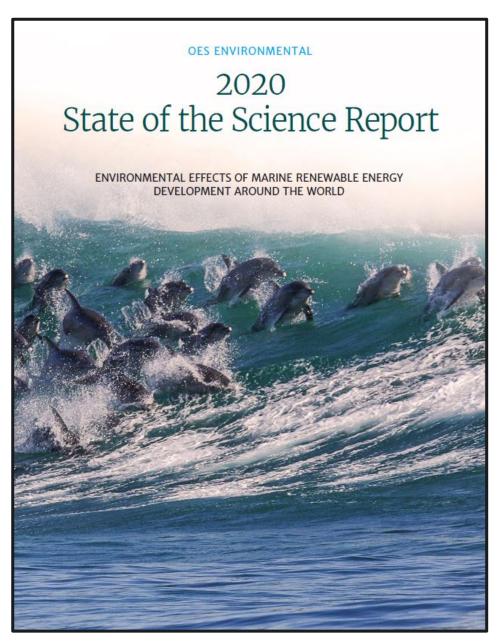




The OES-Environmental 2020 State of the Science Report



- The most up-to-date compilation of scientific research and evidence associated with environmental effects of marine energy
- 40 authors & contributors
- Extensive reviewing process
- 14 chapters, 300+ pages
 - Key device interactions with the marine environment
 - Environmental monitoring technologies
 - Strategies for accelerating consenting
 - Summary & path forward



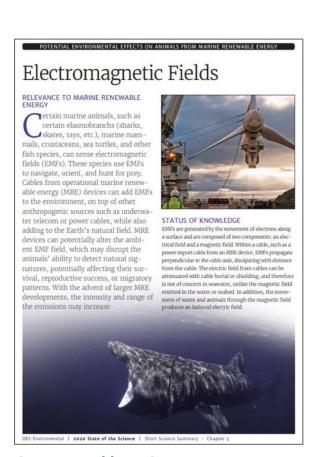


The OES-Environmental 2020 State of the Science Report



Additional material:

- Executive summary
- Short science summaries
- Supplementary material for some chapters



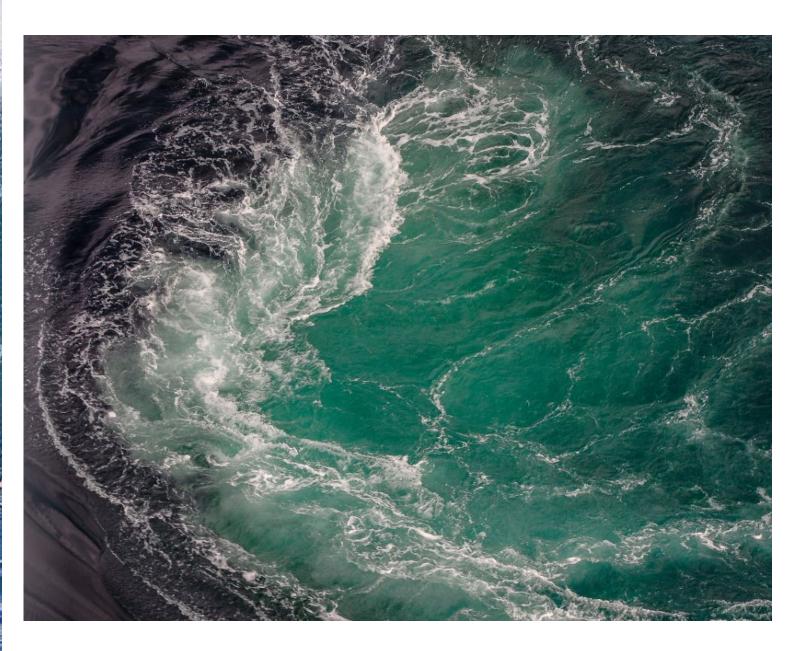








Future Work for OES-Environmental



- Continued international outreach, engagement, sharing of data & information for research gaps
- Workshops, conferences
- Online webinars and expert forums
- Extend more into tropical areas, southern hemisphere
- Inform regulators involved with regulatory processes
- 2024 State of the Science Report



What is Needed to Succeed in Marine Energy Development

- Regulatory process in place
- Ocean observations
- Clear communication with stakeholders
- Local expertise and international collaborations







Thank You!

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Environmental Effects of Offshore Energy: The Chilean Perspective

Dr. Sergio Navarrete
Pontificia Universidad Católica
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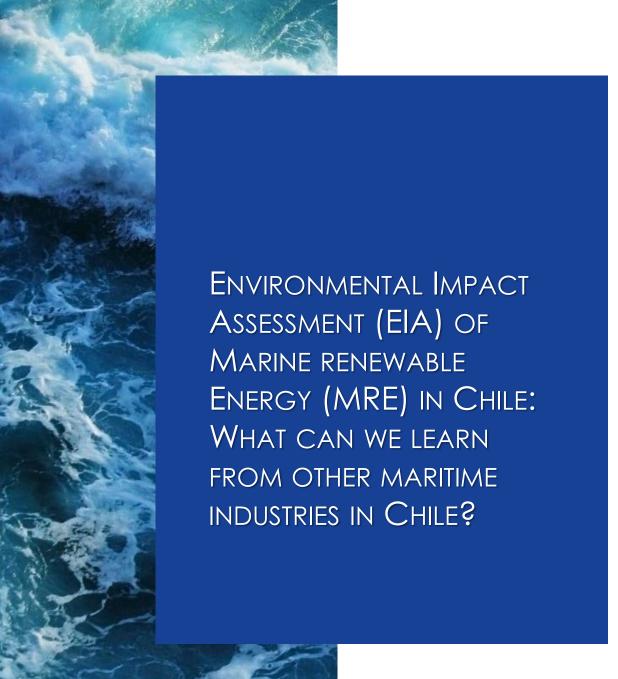
Environmental Effects of Offshore Energy: The Chilean Perspective

Dr. Sergio A. Navarrete



- ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF MARINE RENEWABLE ENERGY (MRE) IN CHILE: WHAT CAN WE LEARN FROM OTHER MARITIME INDUSTRIES IN CHILE?
- MAIN THREATS TO DEPLOY AN MRE PROJECT IN CHILE
- OPPORTUNITIES AND STRENGTHS IN THE CHILEAN MARINE ECOSYSTEMS
- MAJOR GAPS OF KNOWLEDGE AND WEAKNESSES
 IN THE CHILEAN MARINE ECOSYSTEMS
- WHAT COULD MAKE CHILEAN MARINE ECOSYSTEMS SUBSTANTIALLY DIFFERENT?





There are no Commercial MRE projects in Chile and only few developers have installed experimental devices

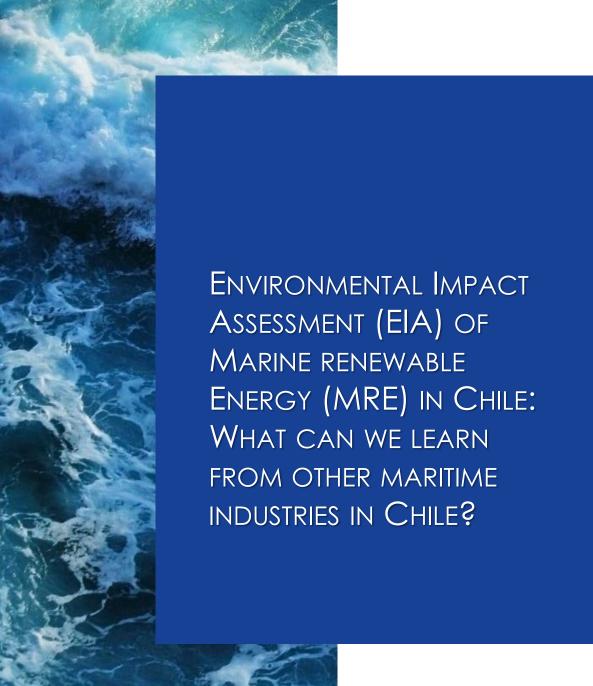


NO EIA studies in Chile

CAN WE LEARN FROM OTHER MARITIME INDUSTRIES IN CHILE?

very little





Salmon Aquaculture Industry

- Probably among the worst example of EIA in the world
- Only recently started to monitor impacts on water quality
- Virtually no assessment of the impacts of anchoring systems, plastic garbage on shores, marine mammals (seen as threat), escaped 'wild' salmon, etc.

Offshore Gas and Oil (Magallanes)

Almost no EIA conducted and publicly available

Dredging and Sediment Disposal

 EIA required, but normative precludes any realistic assessment of impacts

Submarine Emissaries

 No assessment of Pipe impacts. Only concerns about water pollution

by ENERGIAMARINAS DA



Most EIA studies have focused on chemical contamination, such as oil spills, which are very different in nature to potential MRE impacts

The existence of the OES-Environmental 2020 State of the Science Report is therefore extremely important to guide future EIA in Chile



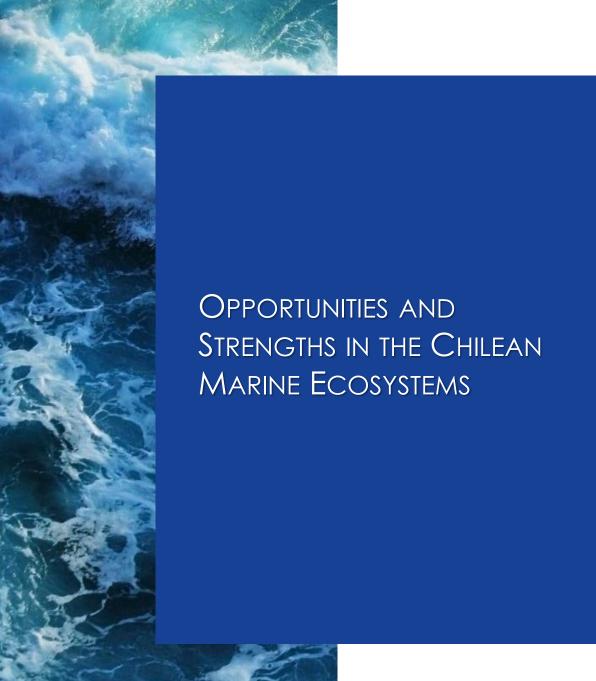


Extremely Weak Legislation and virtual Absence of Useful Normative for any Maritime Industry

The MRE Industry must internalize that the only sustainable 'market' for MRE is the environmentally-responsible energy production:

We must fulfill the promise of "zero" biodiversity Impacts





The **OES- Environmental 2020** Report summarizes existing information, established clear guidelines, and allow us to set priorities for studies on potential EI of MRE projects in Chile

There is comparatively Good to Excellent knowledge of coastal ecosystems:

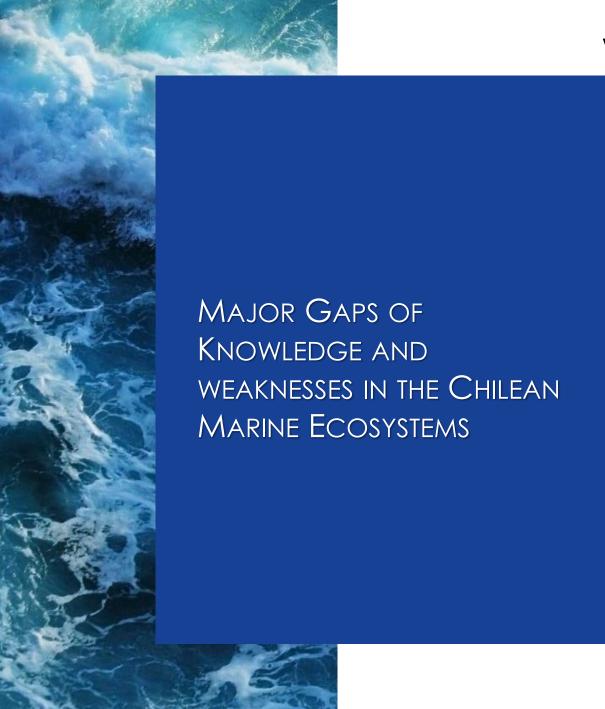
- Biodiversity
- Main Biotic and Abiotic forcing
- Socio-ecological systems

There is comparatively Good knowledge of Oceanographic Processes in the Coastal Ocean:

- Main forcing processes
- Dominant Scales of variability
- Generally good characterization of hydrographic variability

Comparatively large scientific community in marine sciences and high-level training of students

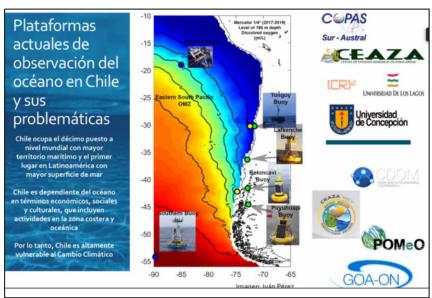




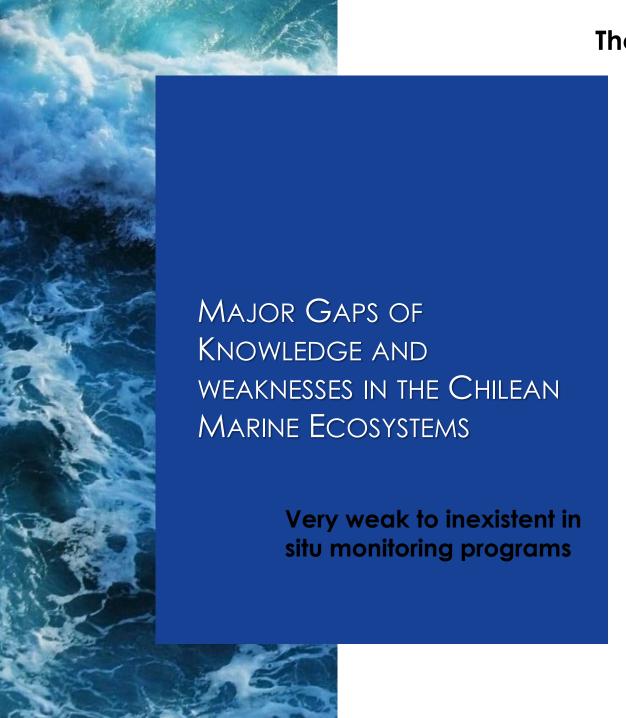
Very weak to inexistent in situ monitoring programs

- Satellite information of limited use for EIA
- Government-sponsored Biodiversity monitoring is restricted to HABs, mussels, and few others
- POAL-program run by the navy considers physicchemical variables at ports of interests
- SHOA's tide and wave instruments are still sparsely distributed along the country

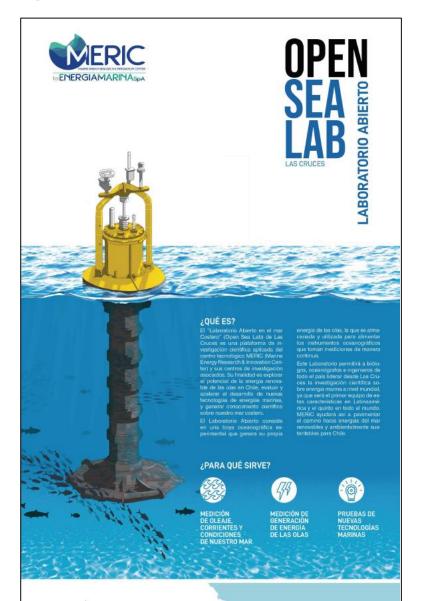
The five University-sponsored Oceanographic Buoys are therefore critically important



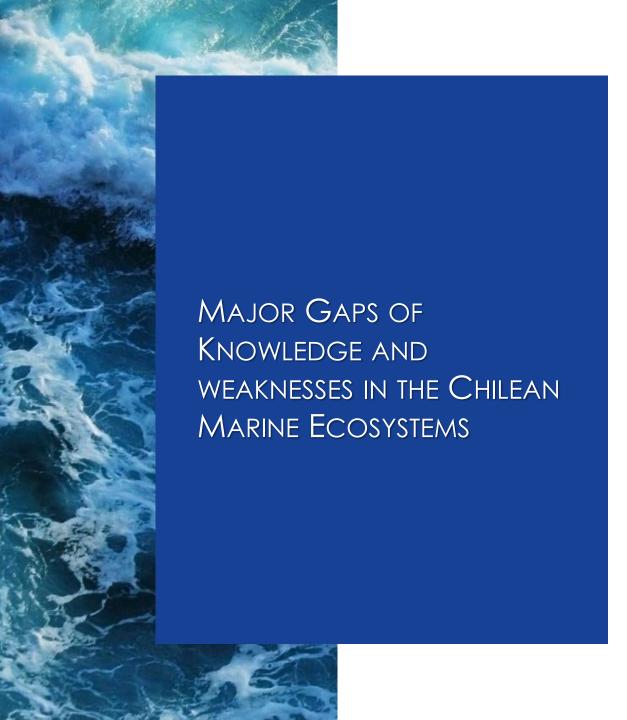




The Open Sea Lab of Las Cruces represents a Major Milestone in Chilean Observing Capabilities of its Coastal Ocean



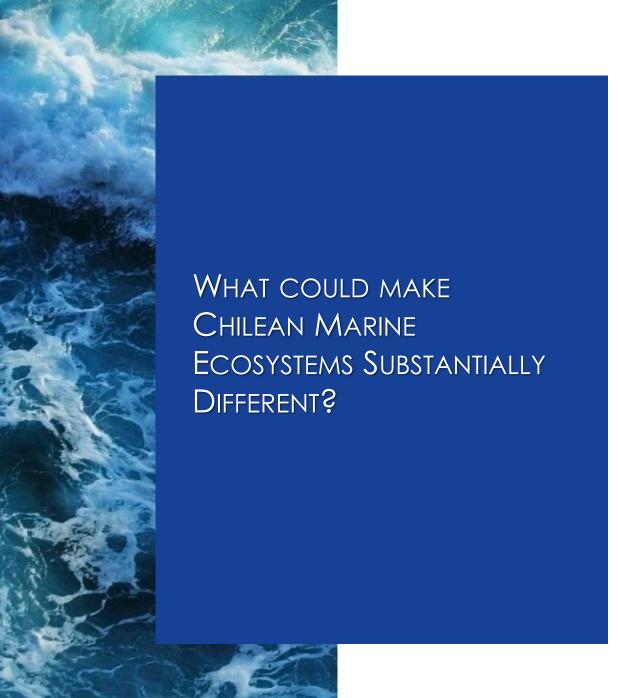




Lack of expertise in specific areas

- As in other parts of the world, there are lots of marine mammal conservationists but few scientists.
- NOISE/SOUND: Most oceanographers are not trained in underwater sound measurements or modeling
 - Need to improve capacities in oceanographic and marine biology schools
 - Need for ecologists to assess impacts on marine fauna
- Good consulting companies in marine habitats, but still far less sophisticated than needed
 - Few PhD-trained people in consulting firms
 - Weak legislation does not incentivize upgrade in consulting work

by ENERGIAMARINAS DA



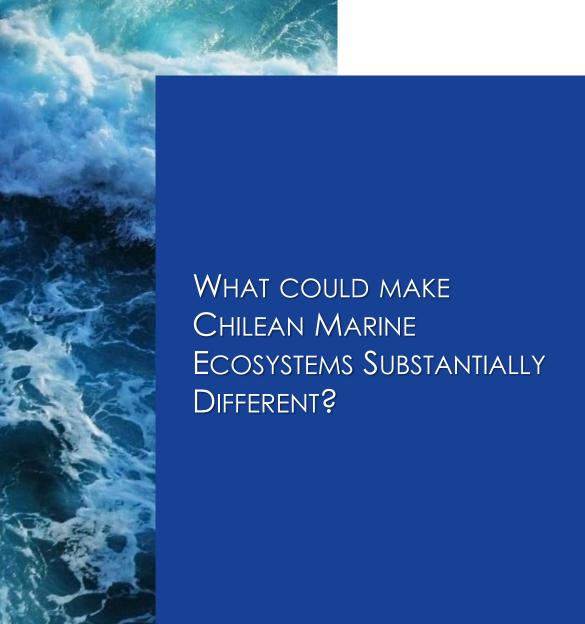
Local Fauna and Flora will always modulate responses to stressor and be a source of surprises when anticipating Env. Impacts of MRE projects

High Productivity of Humboldt Coastal Waters could either ameliorate or amplify the impacts observed in other regions of the world

Extreme conditions of the Chilean coastal habitats (earthquakes and tsunamis, narrow continental shelf) could interact with MRE devices in unsuspected ways

Weak(er) Enforcing Agencies (than in developed countries) can make it very difficult to detect changes and impacts early on

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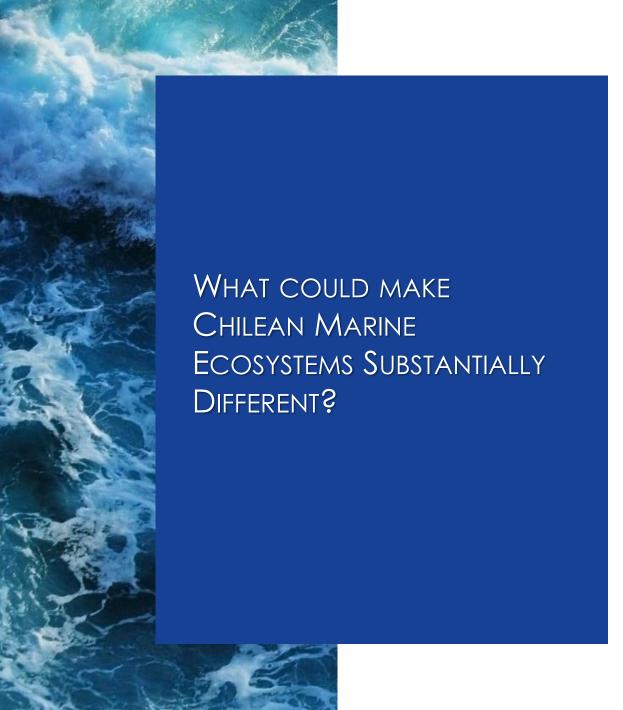


But probably most of all...

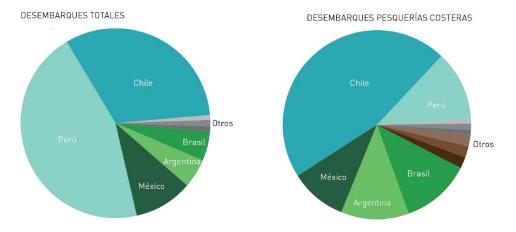


Coastal Fisheries and Fishers' Perceptions and well-being





Coastal Fisheries in Chile







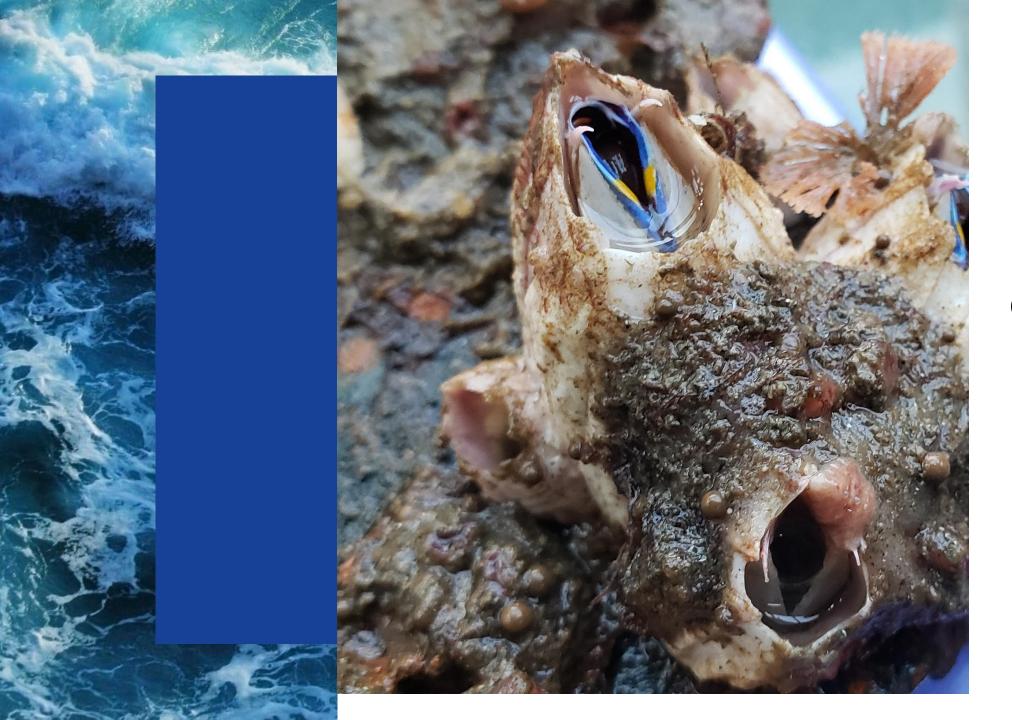


Any MRE project and its EIA must integrate coastal fisheries and the fishers' communities

The idea of 'compensation' for fisheries or stock loss is anachronic and insufficient

We must assess the ecosystem-level value of the MRE project, together with the fisheries activities to define the viability of a MRE commercial deployment



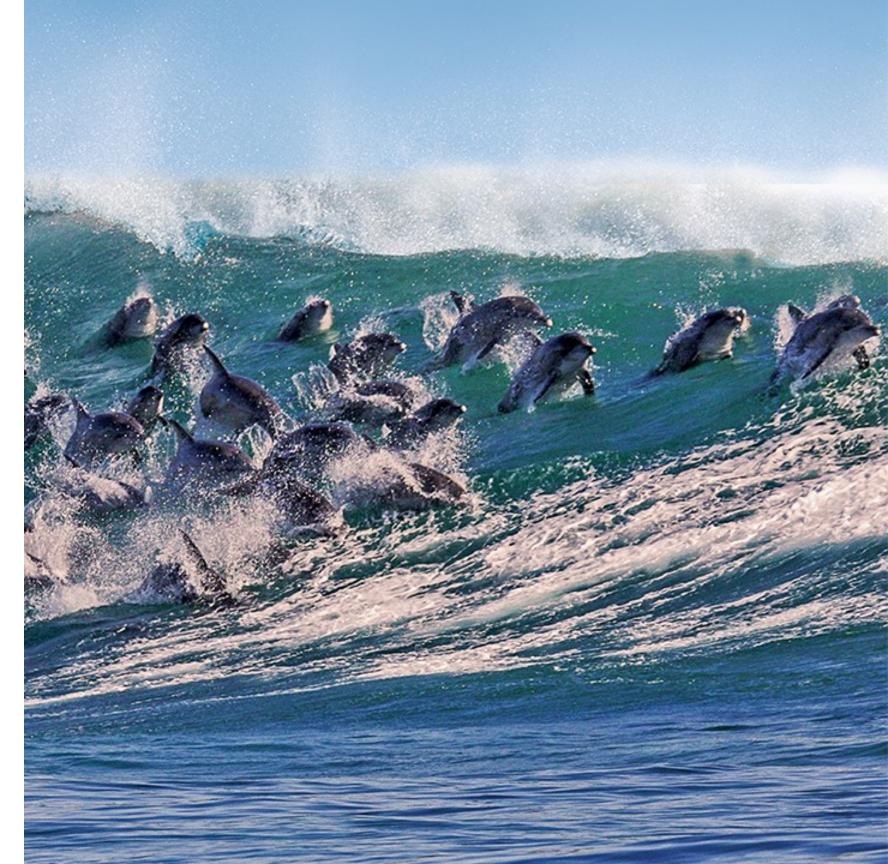


Gracias!





Breakout Session





Instructions for Breakout Groups

- You will be automatically moved to a breakout group, you do not need to do anything.
 - Group 1: Andrea Copping
 - Group 2: Lysel Garavelli
 - Group 3: Lenaïg Hemery
- While you are in a breakout group, do not click removed from the group discussion.



 We are going to use Jamboard for discussion. The link will be provided in the breakout group chat.

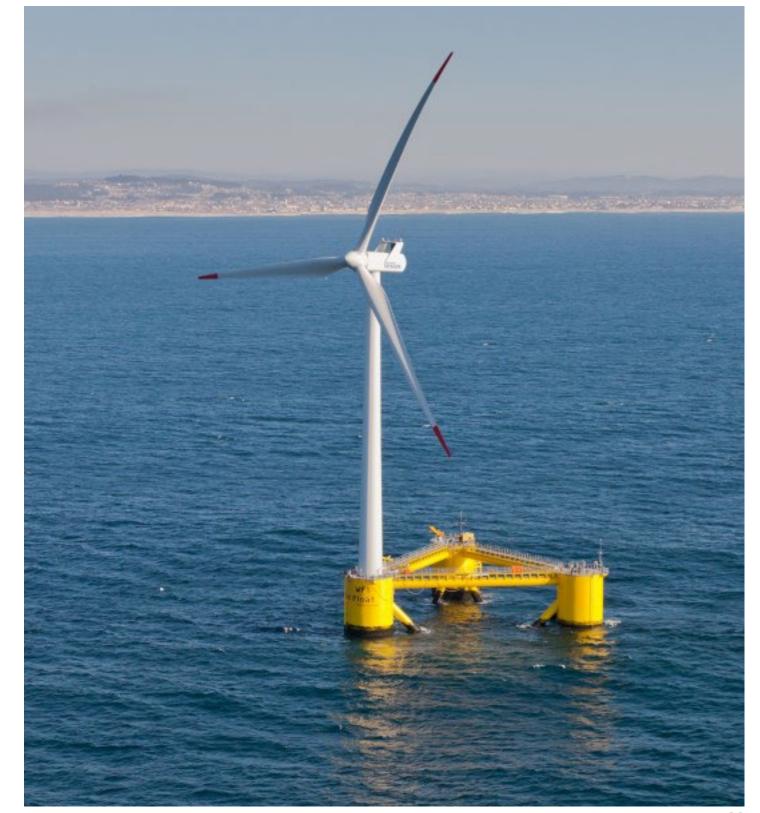


Report Out

Group 1: Andrea Copping

Group 2: Lysel Garavelli

Group 3: Lenaïg Hemery







Thank You!

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