Toward the Establishment of a Latin-American Ocean Acidification Network (LAOCA): The Chilean Experience

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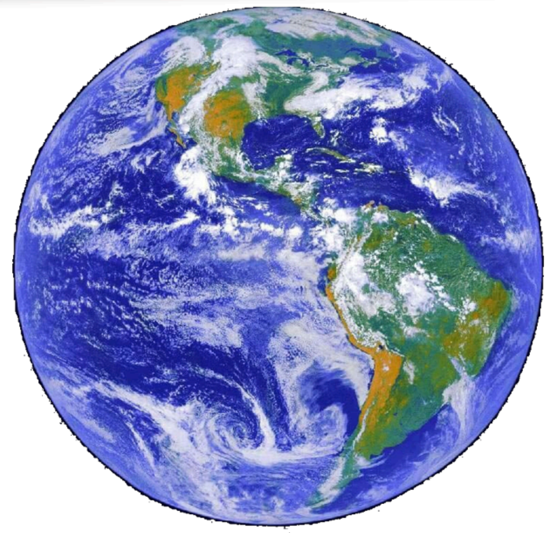
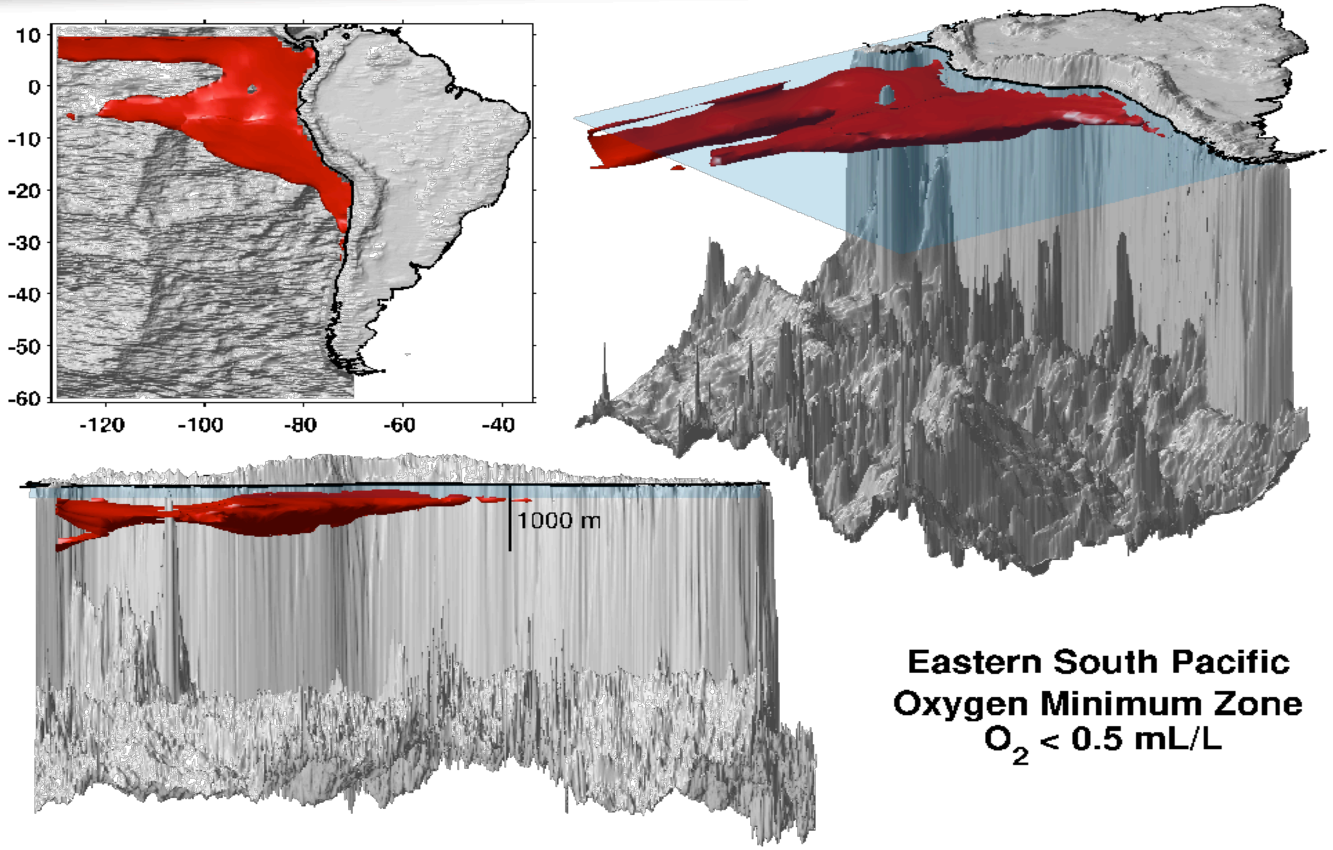
The Humboldt Current System (HCS) off Chile

The eastern South Pacific exhibits intense hydrographic, biogeochemical, and ecological gradients from the highly productive Humboldt Current System (HCS) waters to the highly oligotrophic South Pacific Subtropical Gyre waters.



Mesoscale eddies populate the HCS and connect coastal upwelling with offshore oligotrophic waters, and the meso- and epipelagic realms.

Chilean coast: A natural laboratory for OA research



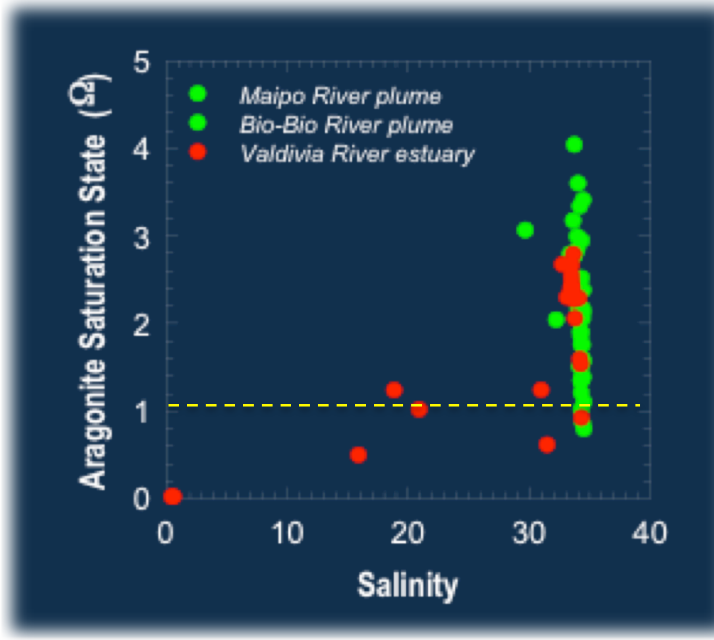
Coastal-ocean exchanges, and one of the major Oxygen Minimum Zones (OMZs) in the oceans (low O_2/low pH waters).

Natural laboratories for studying ocean functioning and predicting how future ocean ecosystems might respond to global change.

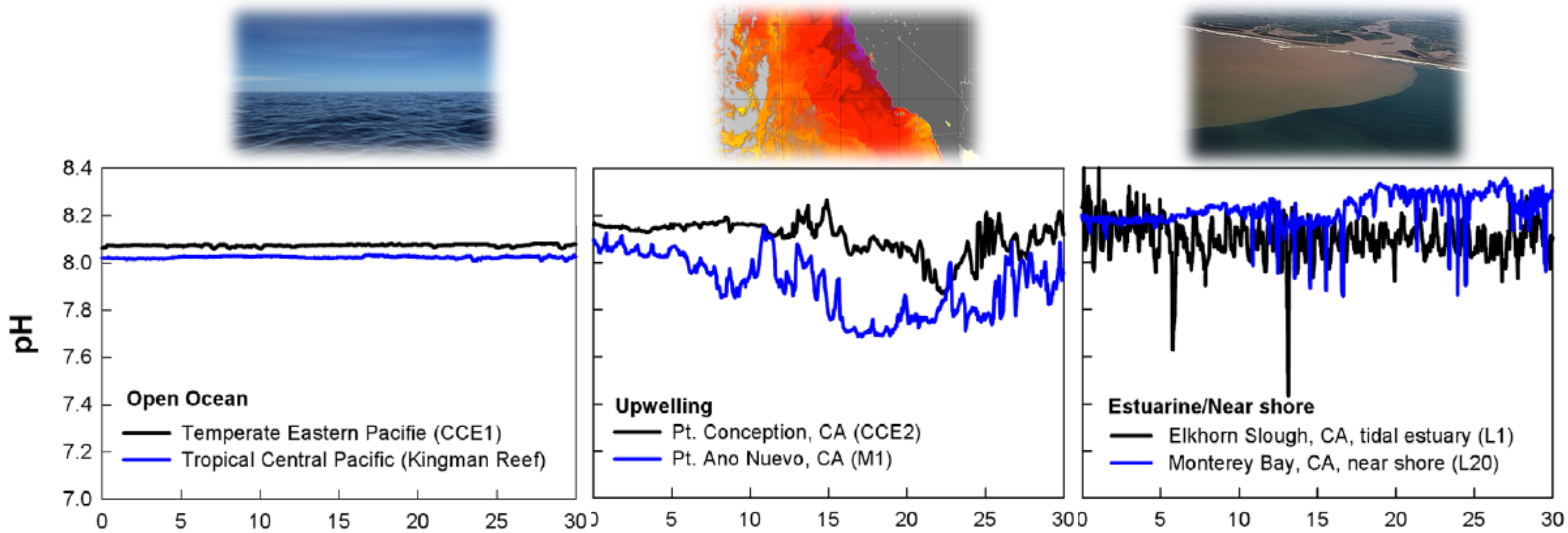
Chilean coast: A natural laboratory for OA research

Most rivers in Chile are relatively short, born in the Andes and discharge their waters through estuaries, or directly in the coast.

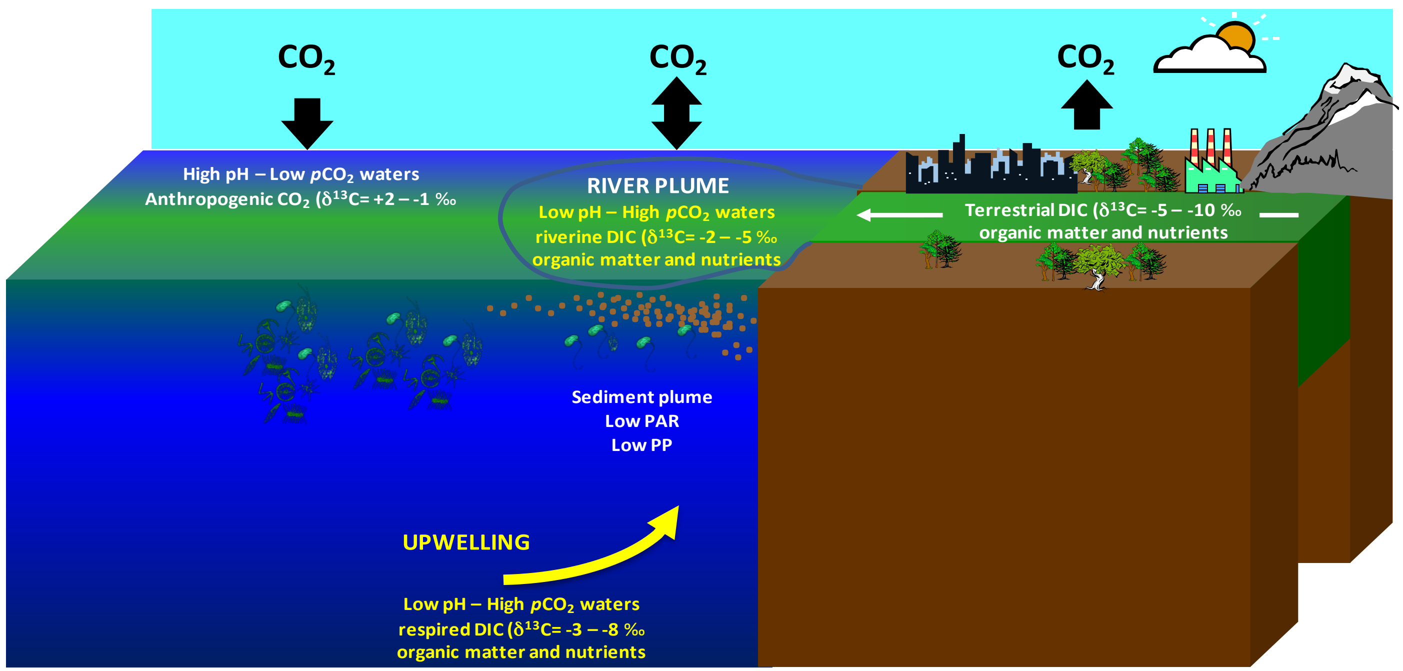
Rivers represent an important DIC source to coastal ocean, as a result of rock weathering and respiration of terrestrial OM (natural and /or anthropogenic), and river plumes area can be $CaCO_3$ subsaturated.



Variability in exposition life history



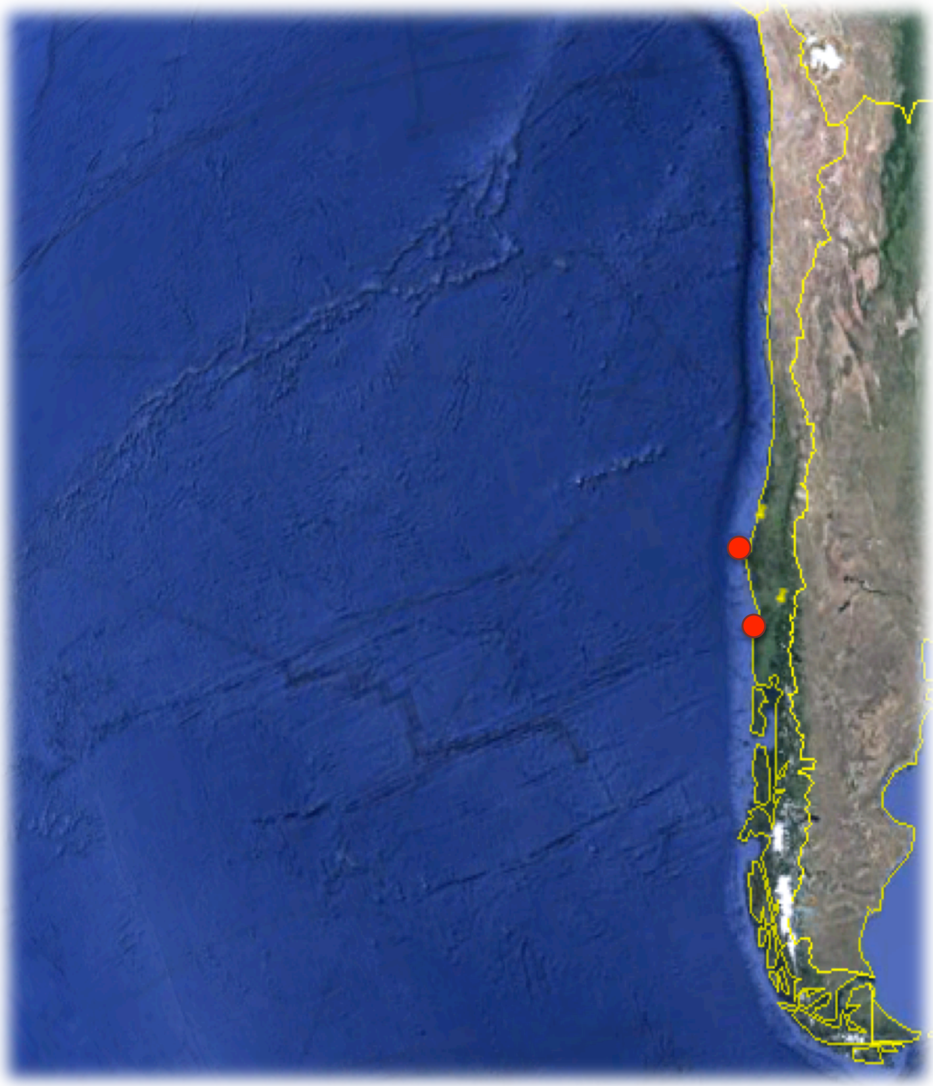
Modified from Hoffmann et al. 2011

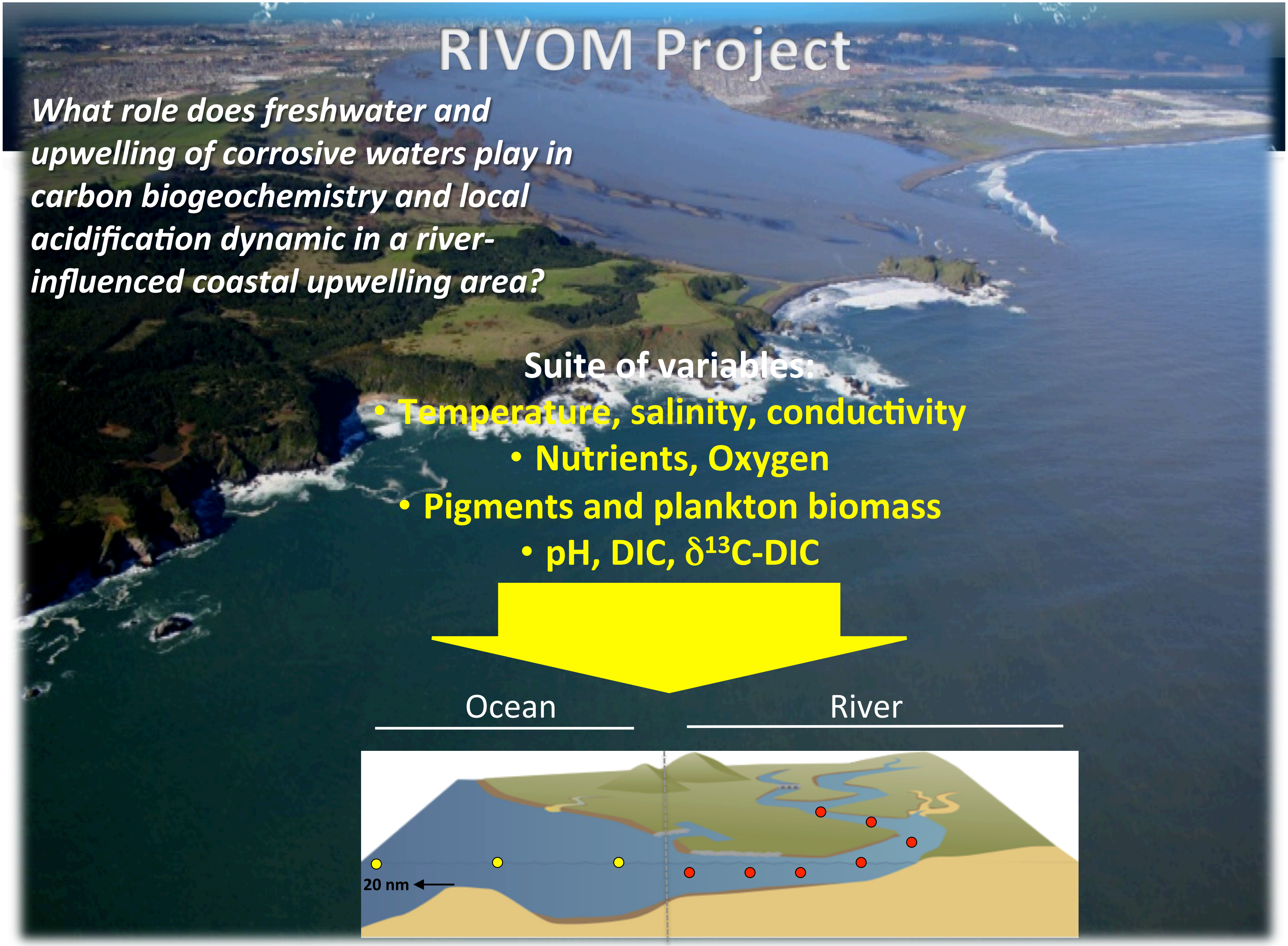


The Chilean Experience in OA research (1999)

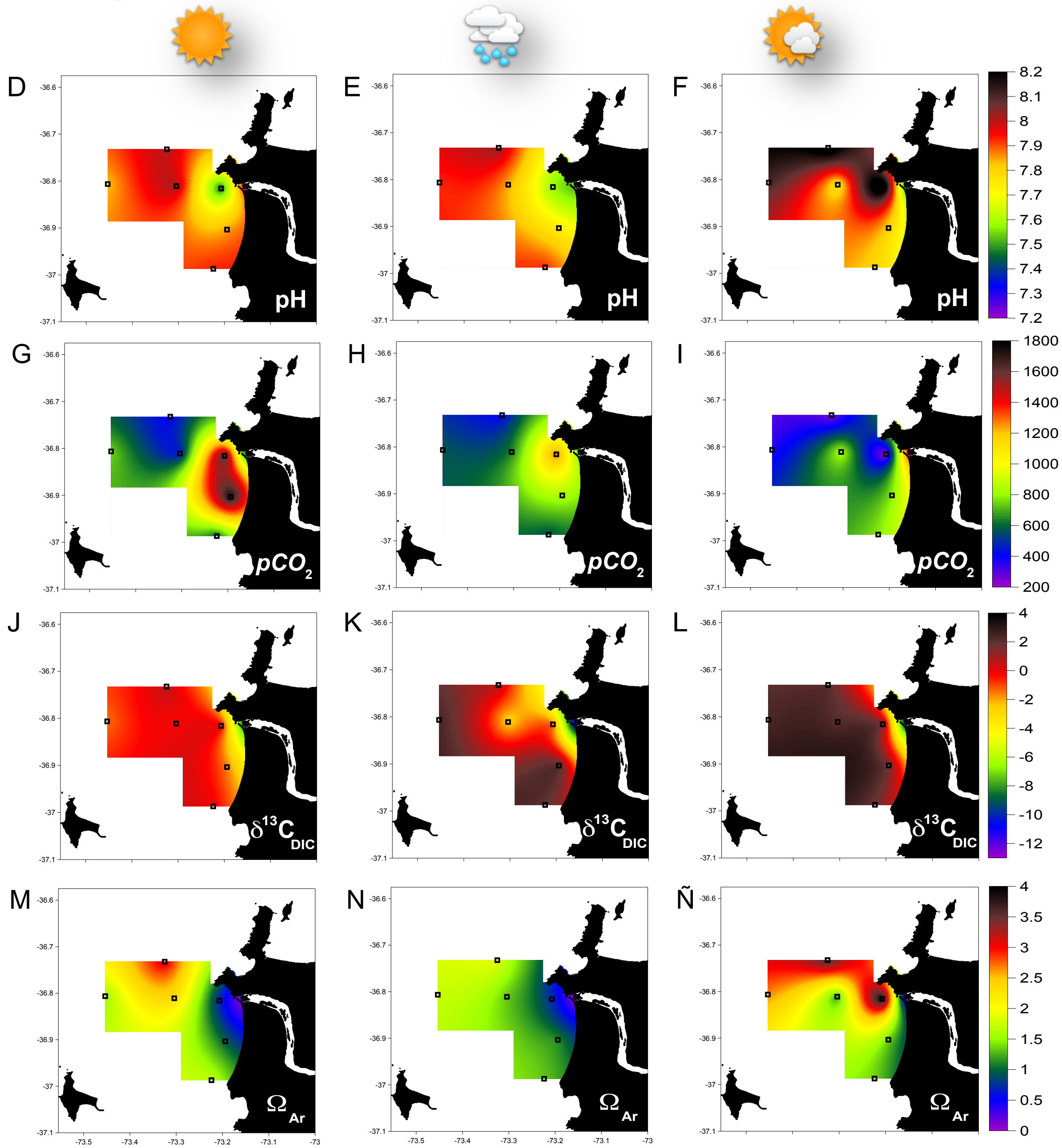
Fondecyt 1195069
Impact of freshwater discharges in the carbonate system of a river-influenced cosastal upwelling area

Proyecto Anillos ACT132
Ocean Acidification impact on commercial invertebrate species along Chilean coasts




RIVOM Project
What role does freshwater and upwelling of corrosive waters play in carbon biogeochemistry and local acidification dynamic in a river-influenced coastal upwelling area?
Suite of variables:
• Temperature, salinity, conductivity
• Nutrients, Oxygen
• Pigments and plankton biomass
• pH, DIC, δ13C-DIC
Ocean
River
20 nm

Impact on local acidification events



- Runoff can produce local acidification events.
- River plume area might experience high CO_2 outgassing.
- Different DIC sources as evidenced by isotope signature.
- Subsaturation of $CaCO_3$ ($\Omega < 1$) in the coastal domain.

Importance of land uses on carbonate system

JOURNAL OF GEOPHYSICAL RESEARCH
Biogeosciences
AN AGU JOURNAL

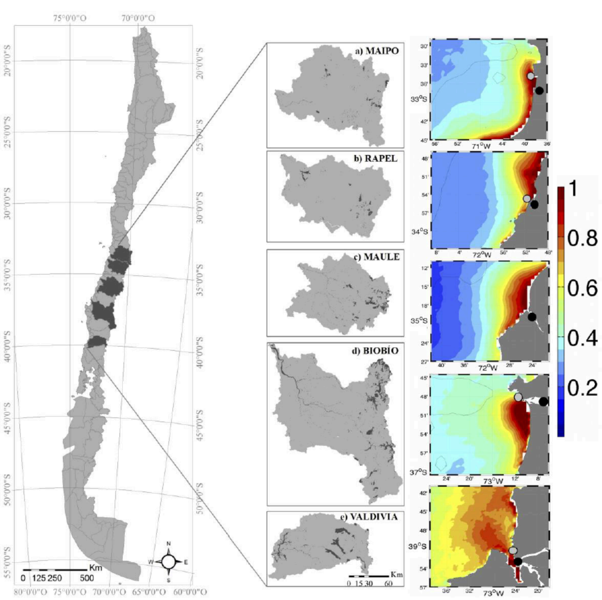
Research Article

Influence of climate and land use in carbon biogeochemistry in lower reaches of rivers in Central –Southern Chile: implications for the carbonate system in river-influenced rockyshore environments†

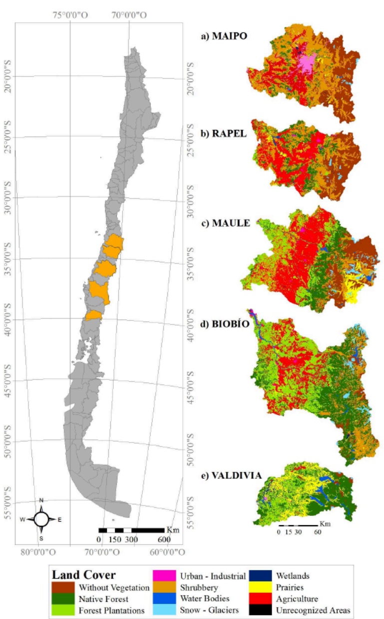
Claudia A. Pérez[1,6], Michael D. DeGrandpre[2], Nelson A. Lagos[3], Gonzalo S. Saldías[4], Emma-Karin Cascales[5] and Cristian A. Vargas[6,*]

DOI: 10.1002/2014JG002699

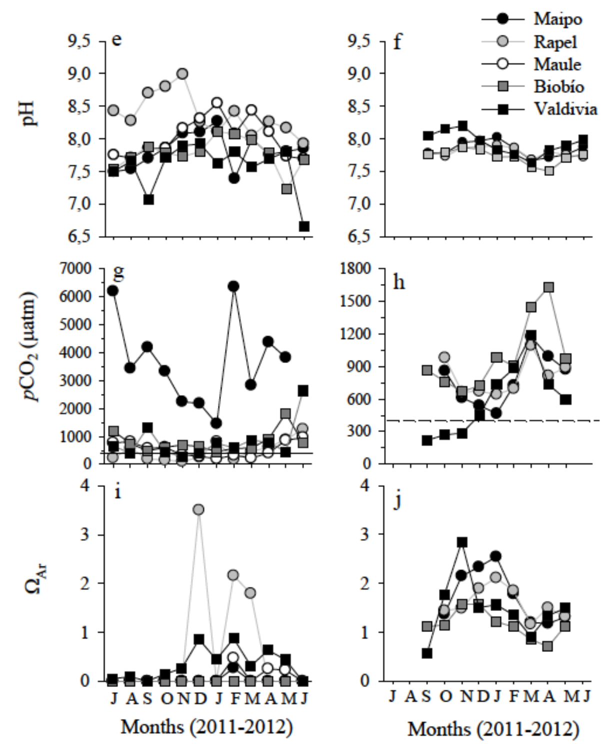
Ms.Claudia Pérez
PhD Student



Different river-plume dynamic

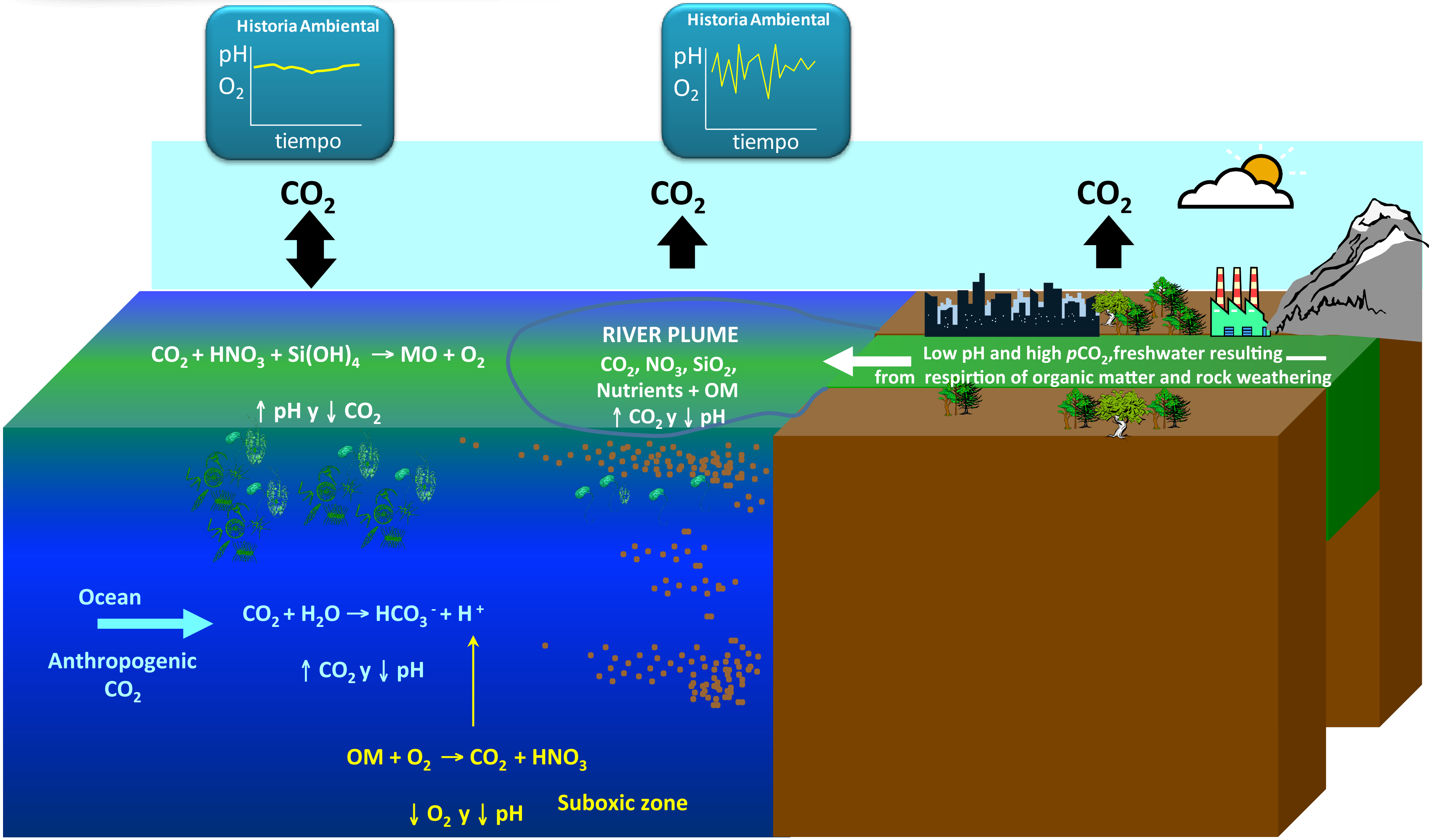


Different land-uses



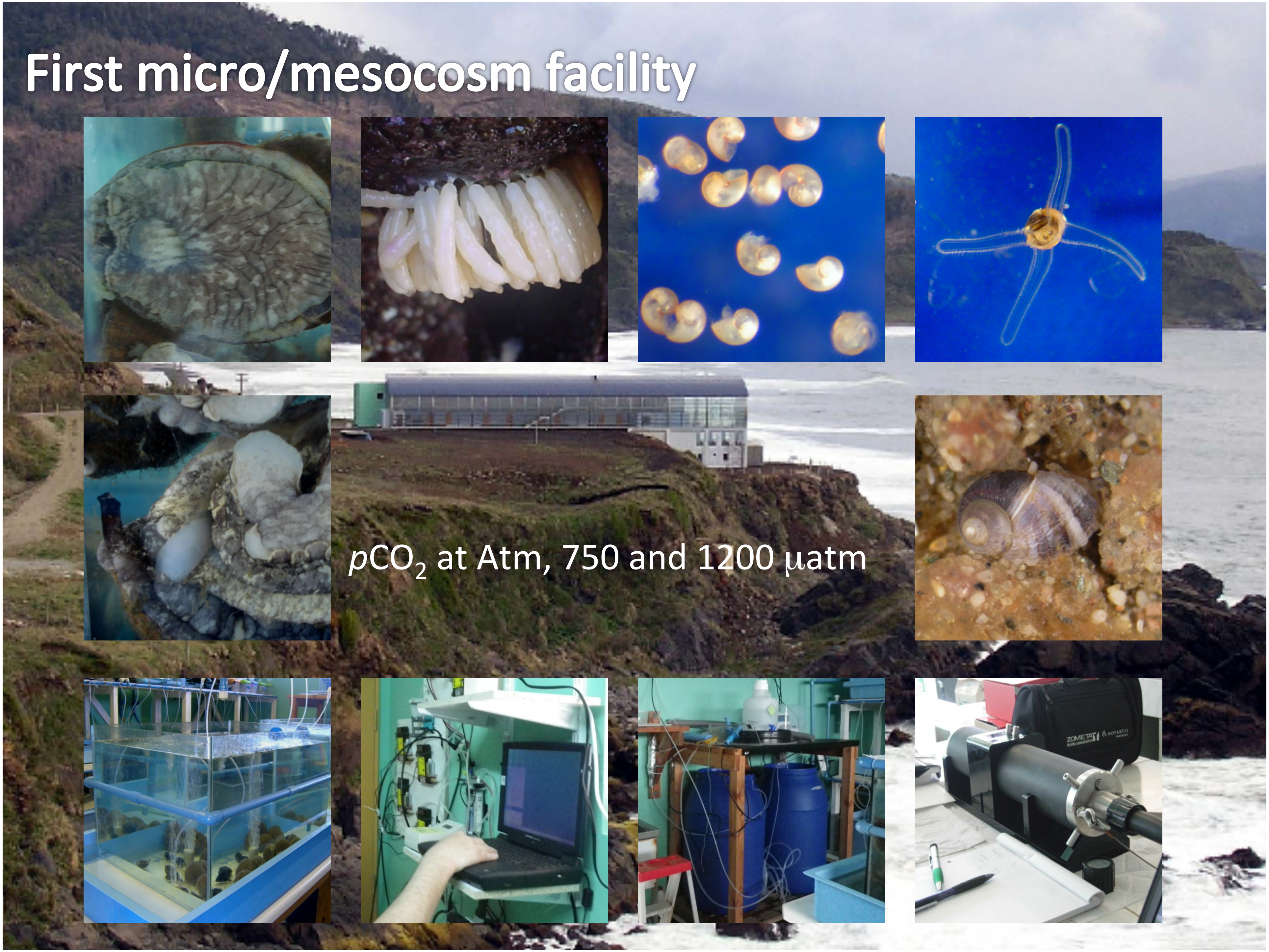
Different carbon chemistry both in the river and river-influenced coastal areas

River discharge vs. coastal upwelling



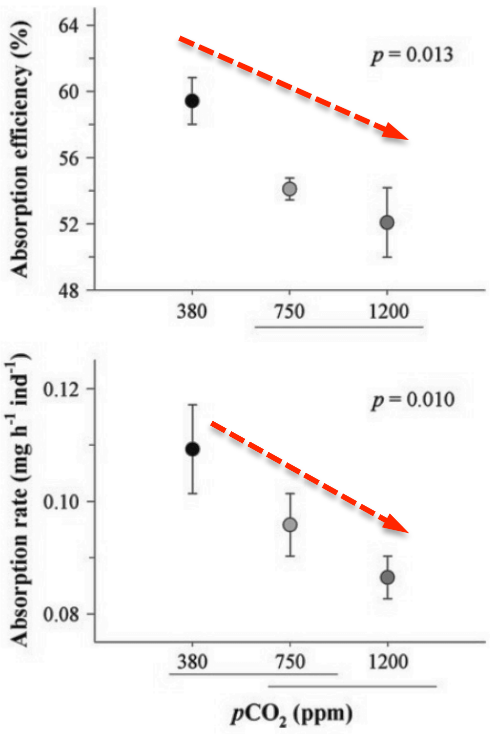
2009: First ocean acidification program in Chile

Página web:
http://www.eula.cl/anillos_acidificación


First micro/mesocosm facility
pCO_2 at Atm, 750 and 1200 µatm

Impact of OA on commercial species

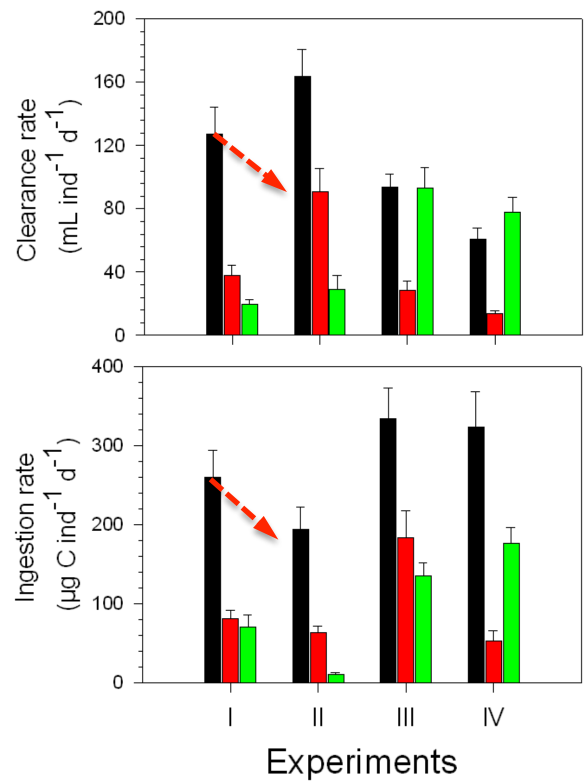
Mytilus chilensis

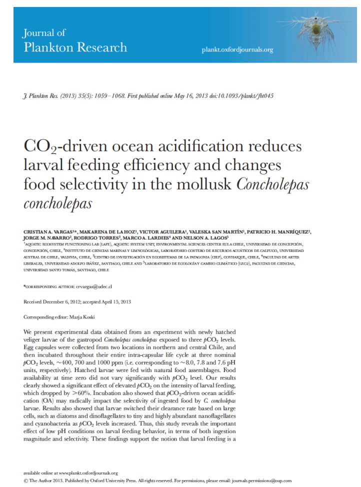


Chemosphere

Impact of medium-term exposure to elevated pCO_2 levels on the physiological energetics of the mussel *Mytilus chilensis*

Concholepas concholepas





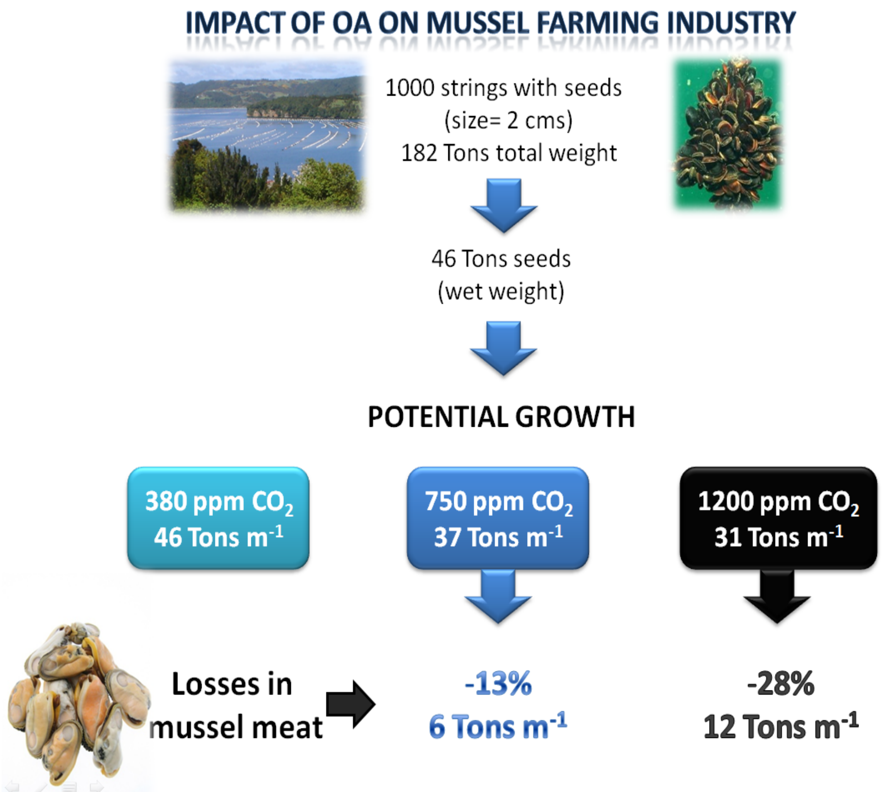
Journal of Plankton Research

CO_2-driven ocean acidification reduces larval feeding efficiency and changes food selectivity in the mollusk *Concholepas concholepas*

Chemosphere 90: 1242–1248 , **Navarro et al. 2013**

Journal of Plankton Research 35: 1059–1068 , **Vargas et al. 2013**

Socio-economic impact on shellfish farming industry



Navarro et al. 2013. *Chemosphere*

- ✓ Growing interactions with other users and willing to grow and develop under the principles of sustainable development.
- ✓ The aquaculture is already experiencing effects of multiple environmental and anthropogenic stressors

e.g. Seed mussel production, scallop larval mortality

Intraspecific variaibility in local populations

Estuaries and Coasts
DOI 10.1007/s12237-014-9845-y

Intraspecific Variability in the Response of the Edible Mussel *Mytilus chilensis* (Hupe) to Ocean Acidification

Cristian Duarte · Jorge M. Navarro · Karin Acuña · Rodrigo Torres · Patricio H. Manríquez · Marcos A. Lardies · Cristian A. Vargas · Nelson A. Lagos · Víctor Aguilera

Received: 24 July 2013 / Revised: 28 May 2014 / Accepted: 1 June 2014

Abstract Ocean acidification (OA) has been shown to affect significantly the net calcification process and growth rate of many marine calcifying organisms. Recent studies have shown that the responses of these organisms to OA can vary significantly among species. However, much less is known concerning the intraspecific variability in response to OA. In this study, we compared simultaneously the responses of two populations of the edible mussel *Mytilus chilensis* (Hupe) exposed to OA. Three nominal CO_2 concentrations (380, 700, and 1,000 μatm of CO_2) were used. Negative effects of CO_2 increase on net calcification rate were only found in individuals from Huelmo Bay. However, no effects were found in individuals from Yaldad Bay. Moreover, OA had not significant effects on the shell dissolution rate in individuals from both localities. This suggests that the negative effect of the OA on the net calcification rate of this species is explained by shell deposition, but not by the shell dissolution processes. We do not know the specific underlying mechanisms responsible for these differences, but some possibilities are discussed. These results highlight that the responses of marine organism to OA can be highly variable even within the same species. Therefore, more studies across the distribution range of the species, considering environmental variability, are needed for a better understanding of the consequences of OA on marine organisms. Finally, because mussels exert influence on their physical and biological surroundings, the negative effects of a CO_2 increase could have significant ecological consequences.

Keywords Ocean acidification · Mussel · Calcification · Growth rate

Communicated by Alberto Vieira Borges

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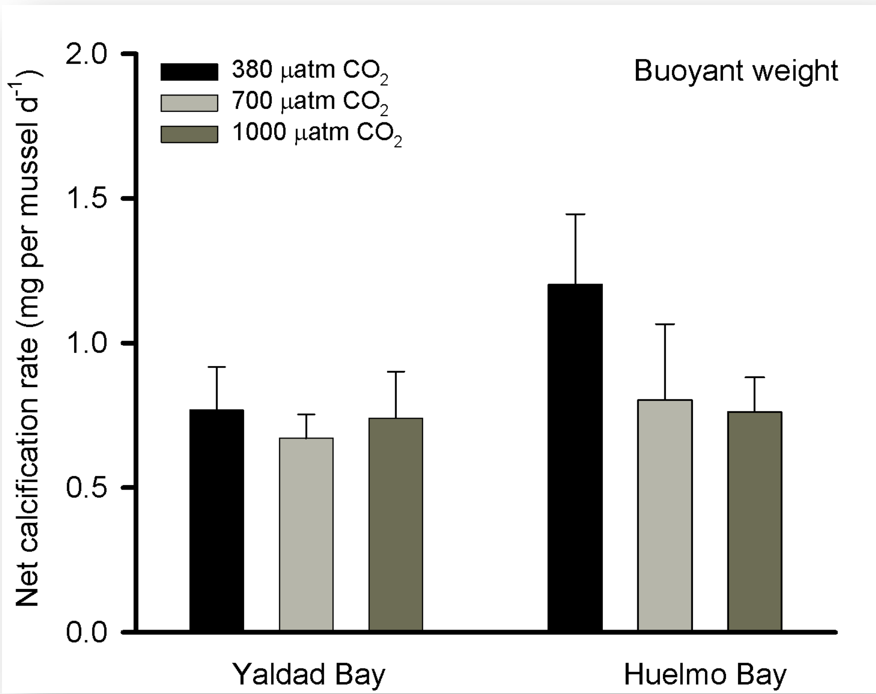
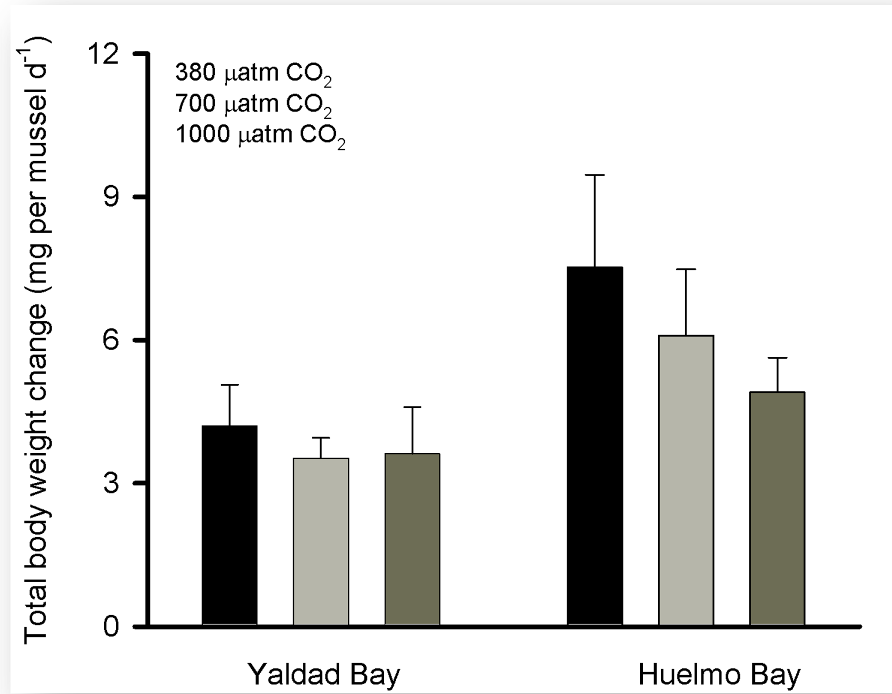
Mytilus chilensis
Chile, Los Lagos, Chiloé Island, Quellon
NMR 17162. Actual size 55 mm

Intraspecific variaibility in local populations

Calcification



Growth

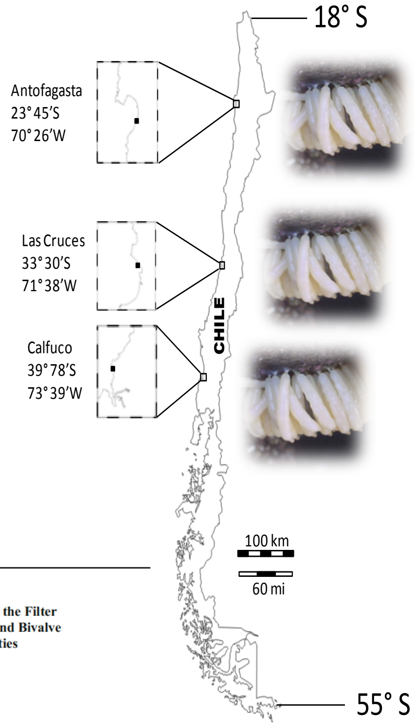


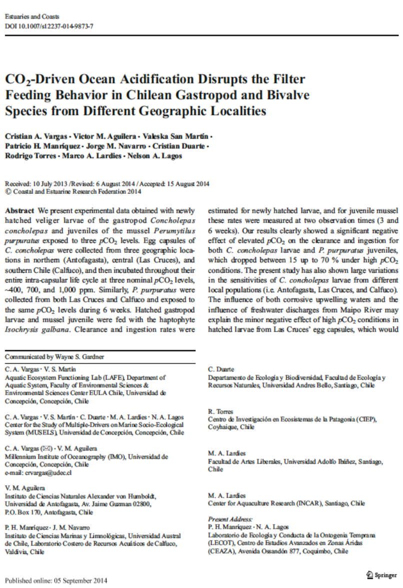
Yaldad = pH 7.2 - 7.4
Huelmo= pH 8.0 – 8.2

- Individuals from two different populations respond differently to changes in pH and/or pCO_2, which can be associated with different life histories of exposure to low pH.

Estuaries & Coasts, ***Duarte et al. 2014***

Phenotipic plasticity of mussels under OA





Estuaries and Coasts
DOI 10.1007/s12237-014-9873-7

CO_2-Driven Ocean Acidification Disrupts the Filter Feeding Behavior in Chilean Gastropod and Bivalve Species from Different Geographic Localities

Cristian A. Vargas · Victor M. Aguilera · Valeska San Martín · Patricio H. Manríquez · Jorge M. Navarro · Cristian Duarte · Rodrigo Torres · Marco A. Lardies · Nelson A. Lagos

Received: 10 July 2013 /Revised: 6 August 2014 / Accepted: 15 August 2014

Abstract We present experimental data obtained with newly hatched veliger larvae of the gastropod *Concholepas concholepas* and juveniles of the mussel *Perumytilus purpuratus* exposed to three pCO_2 levels. Egg capsules of *C. concholepas* were collected from three geographic locations in northern (Antofagasta), central (Las Cruces), and southern Chile (Calfuco), and then incubated throughout their entire intra-capsular life cycle at three nominal pCO_2 levels, ~400, 700, and 1,000 ppm. Similarly, *P. purpuratus* were collected from both Las Cruces and Calfuco and exposed to the same pCO_2 levels during 6 weeks. Hatched gastropod larvae and mussel juvenile were fed with the haptophyte *Isochrysis galbana*. Clearance and ingestion rates were estimated for newly hatched larvae, and for juvenile mussel these rates were measured at two observation times (3 and 6 weeks). Our results clearly showed a significant negative effect of elevated pCO_2 on the clearance and ingestion for both *C. concholepas* larvae and *P. purpuratus* juveniles, which dropped between 15 up to 70 % under high pCO_2 conditions. The present study has also shown large variations in the sensitivities of *C. concholepas* larvae from different local populations (i.e. Antofagasta, Las Cruces, and Calfuco). The influence of both corrosive upwelling waters and the influence of freshwater discharges from Maipo River may explain the minor negative effect of high pCO_2 conditions in hatched larvae from Las Cruces' egg capsules, which would

Communicated by Wayne S. Gardner

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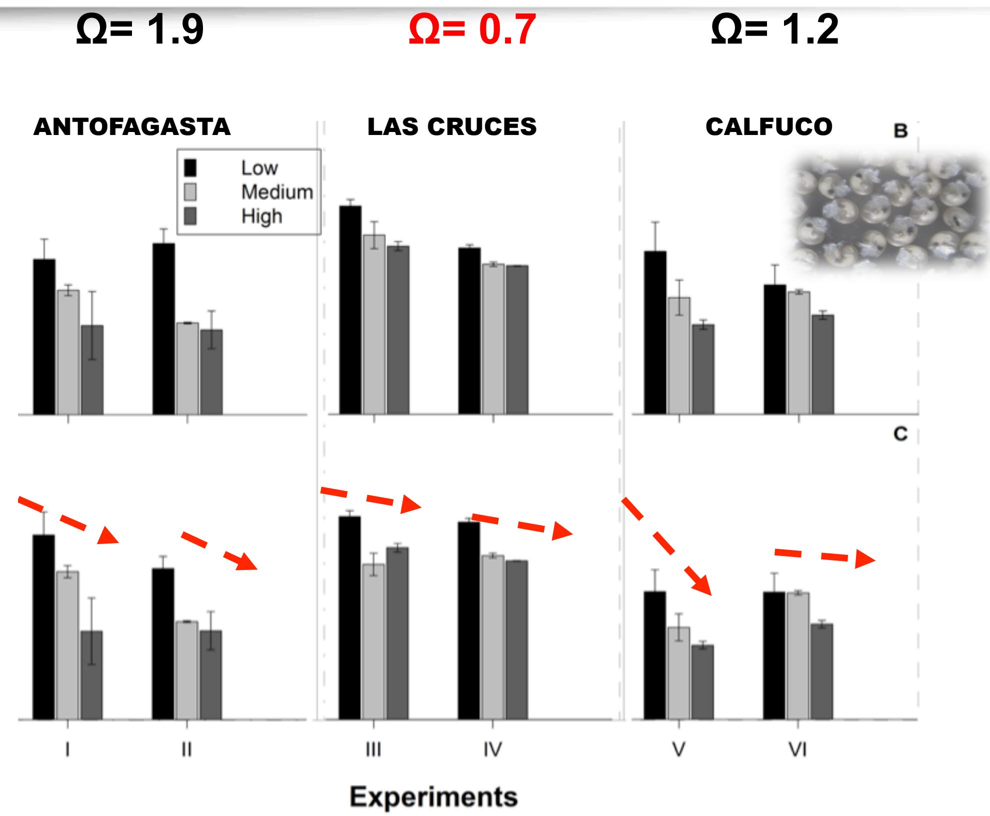
Published online: 05 September 2014

Springer



Planktonic larvae of *C. concholepas* capsules from different localities, respond differently to high pCO_2. Environmental life history of exposition to different pH levels in nature.

Estuaries & Coasts, **Vargas et al. 2014**

Different studies in hatching traits and benthic behaviour under ocean acidification scenarios

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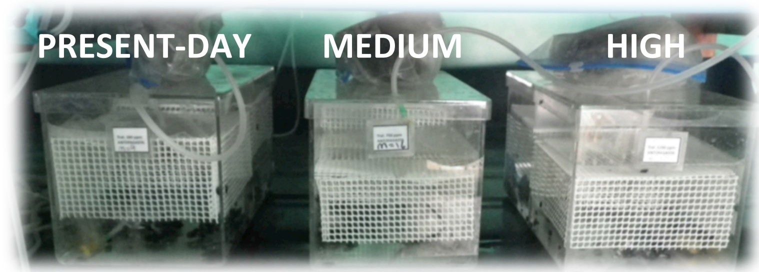
Vol. 514: 87–103, 2014
doi: 10.3354/meps10951

MARINE ECOLOGY PROGRESS SERIES
Mar Ecol Prog Ser

Published November 6

Effects of ocean acidification on larval development and early post-hatching traits in *Concholepas concholepas* (loco)

Patricio H. Manríquez[1,*], María Elisa Jara[1], Rodrigo Torres[2], María Loreto Mardones[3], Nelson A. Lagos[4], Marco A. Lardies[5], Cristian A. Vargas[6], Cristián Duarte[7], Jorge M. Navarro[3]



1. Hatching time
2. Hatching success
3. Early survival
4. Larval size at hactching
5. Shell tickness at hatching

Different studies in hatching traits and benthic behaviour under ocean acidification scenarios

OPEN ACCESS Freely available online PLOS | ONE

Ocean Acidification Disrupts Prey Responses to Predator Cues but Not Net Prey Shell Growth in *Concholepas concholepas* (loco)

Patricio H. Manríquez[1]*, María Elisa Jara[1], María Loreto Mardones[1], Jorge M. Navarro[1], Rodrigo Torres[2], Marcos A. Lardies[3], Cristian A. Vargas[4], Cristian Duarte[5], Stephen Widdicombe[6], Joseph Salisbury[7], Nelson A. Lagos[8]

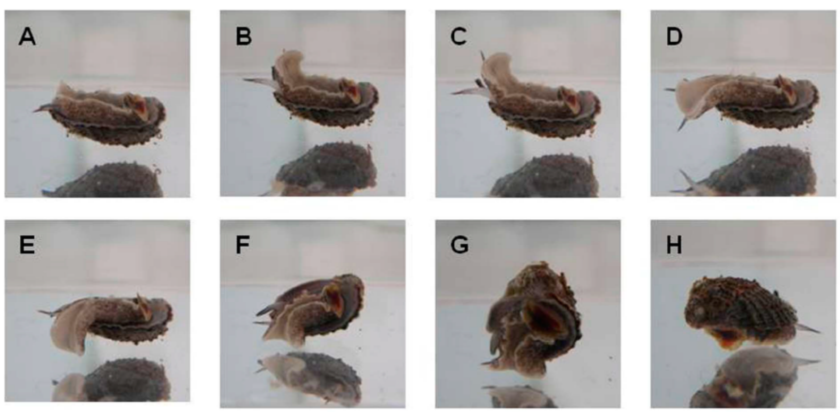
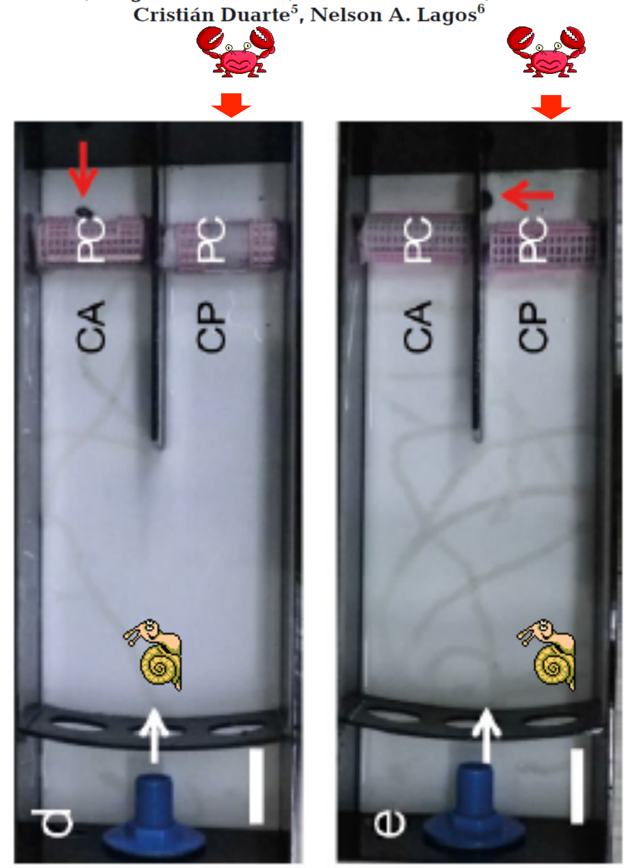


Figure 2. Photographic sequence (A–H) illustrating self-righting behavior in the gastropod *Concholepas concholepas*.
doi:10.1371/journal.pone.0068643.g002

Vol. 502: 157–167, 2014
doi: 10.3354/meps10703
MARINE ECOLOGY PROGRESS SERIES
Mar Ecol Prog Ser
Published April 15

Ocean acidification affects predator avoidance behaviour but not prey detection in the early ontogeny of a keystone species

Patricio H. Manríquez[1,*], María Elisa Jara[1], María Loreto Mardones[1], Rodrigo Torres[2], Jorge M. Navarro[1], Marco A. Lardies[3], Cristian A. Vargas[4], Cristián Duarte[5], Nelson A. Lagos[6]



Patricio Manríquez©

Other on-going research grants

Carbonate budget, secondary production and CO_2 fluxes in intertidal barnacles experiencing natural variability in Temperature and Ocean Acidification along the Southeastern Pacific Coastal Ecosystems

NELSON A. LAGOS (FONDECYT 1040938; 2014-2017)

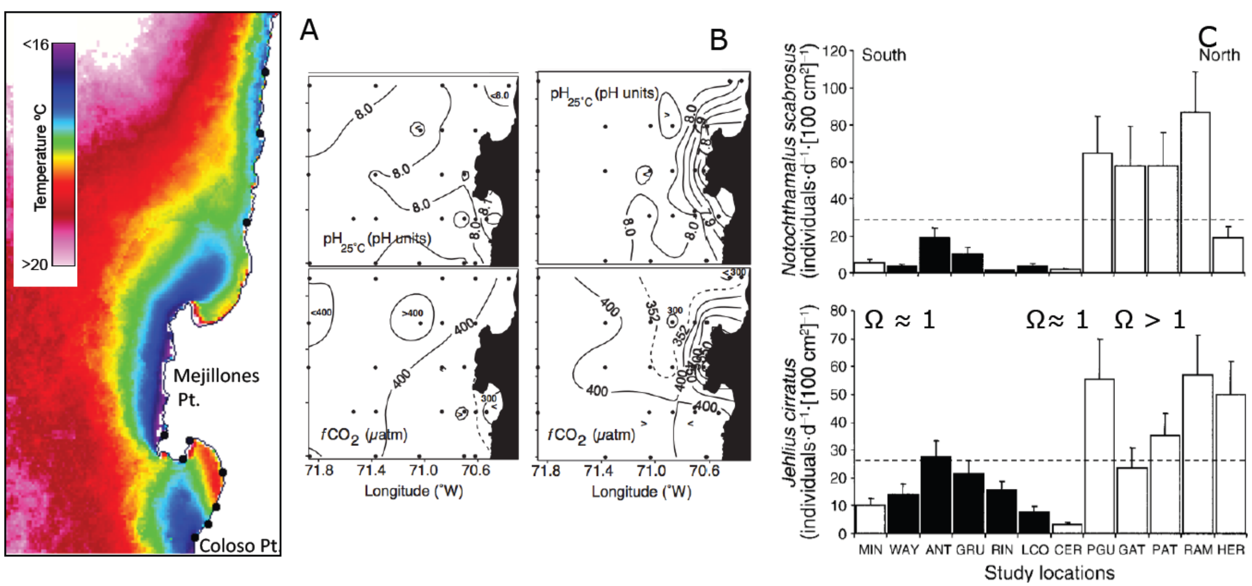


Fig. 1. A) SST distribution in the northern Chile upwelling systems (21–24ºS) observed trough AVHRR images (average 2000-2001 austral spring-summer, Lagos et al 2002); (B) Spatial distribution of pH and *f*CO_2 during spring-summer 1997 (Torres et al. 2002); (C) spatial variation in recruitment of intertidal barnacles recorded in 2000-2001 (Lagos et al. 2008). In C are postulated saturation states, Ω ≈ 1 for sites located near to upwelling centers; and Ω > 1 for areas far from the upwelling center.

Topics:

- Carbonate production and shell cycling in upwelling ecosystems
- Benthic ecosystems as CO2 sources.
- Intertidal carbon budget and cycling

The Chilean Experience in OA research (2013)

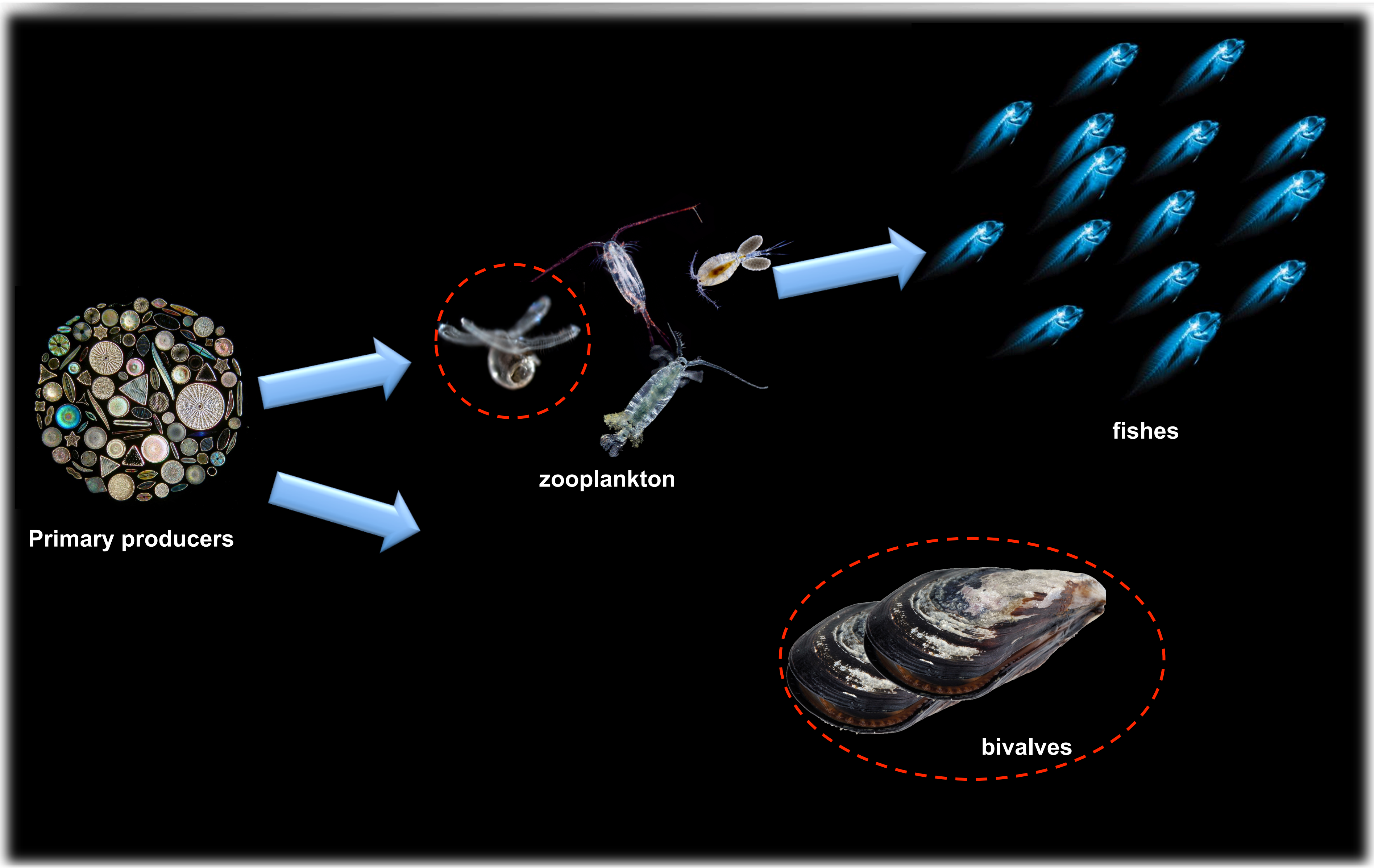
Fondecyt 1195069
Impact of freshwater discharges in the carbonate system of a river-influenced cosastal upwelling area

Proyecto Anillos ACT132
Ocean Acidification impact on commercial invertebrate species along Chilean coasts

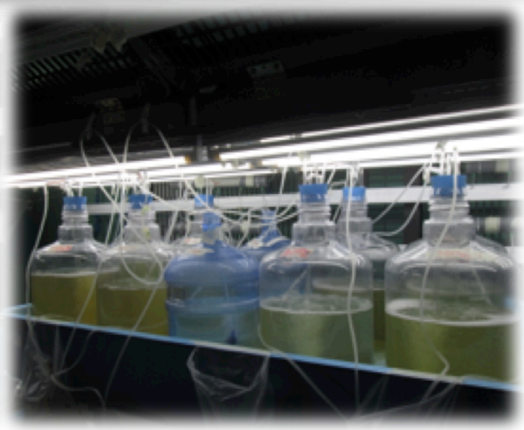
Fondecyt
Fondo Nacional de Desarrollo Científico y Tecnológico

Fondecyt 1130254 (2013 – 2017)
The combined effect of OA and corrosive acidified coastal waters for plankton productivity (COA-CAP)

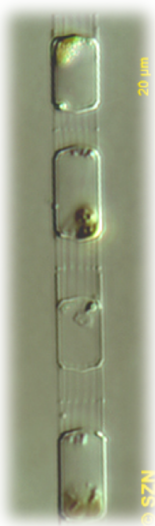
New challenges



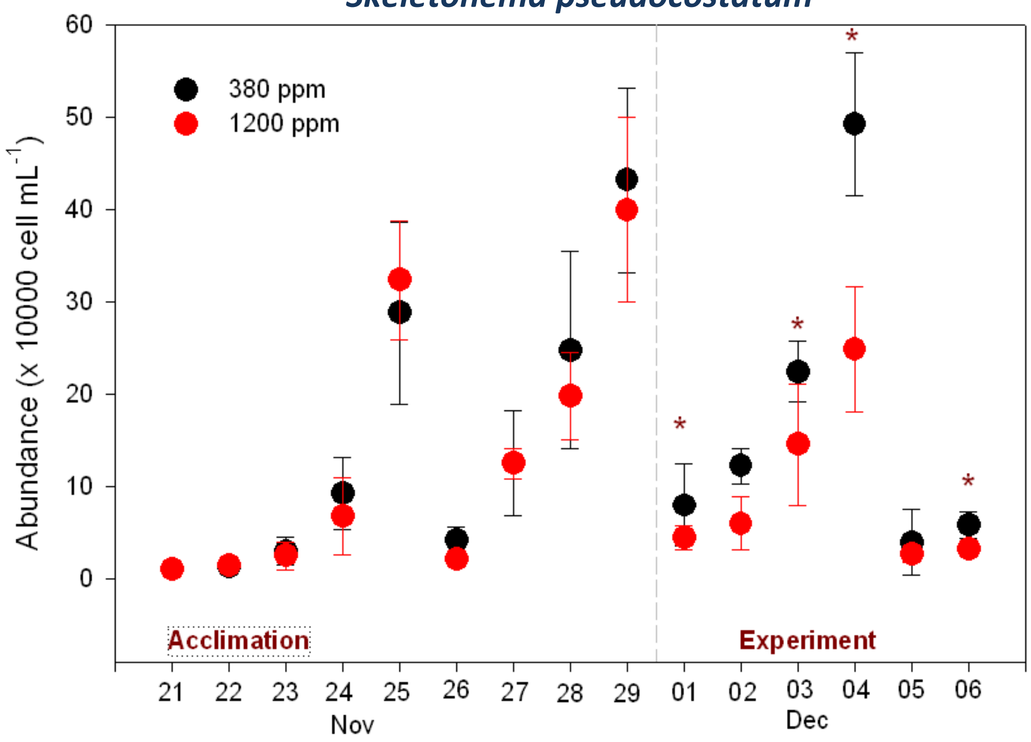
First experiments: OA effects on diatom species



Dr. Bárbara Jacob
PostDoc LAFE

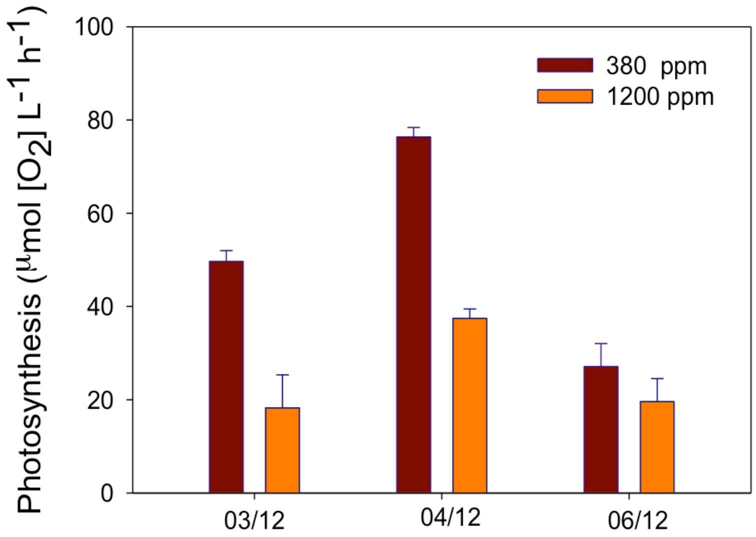


Skeletonema pseudocostatum

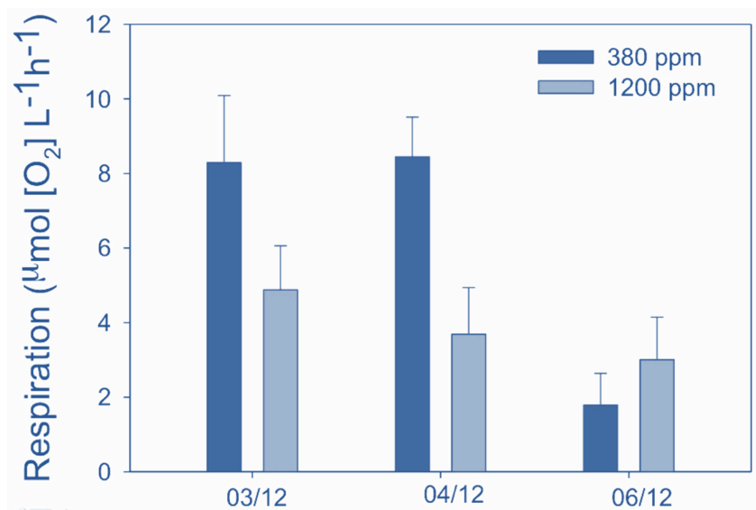


Reduction in 50% of primar yproduction

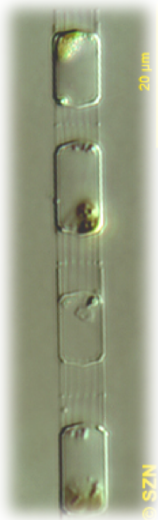
Mean photosynthetic rate was 51% higher at ambient *p*CO_2 levels compared to 1200 µatm.

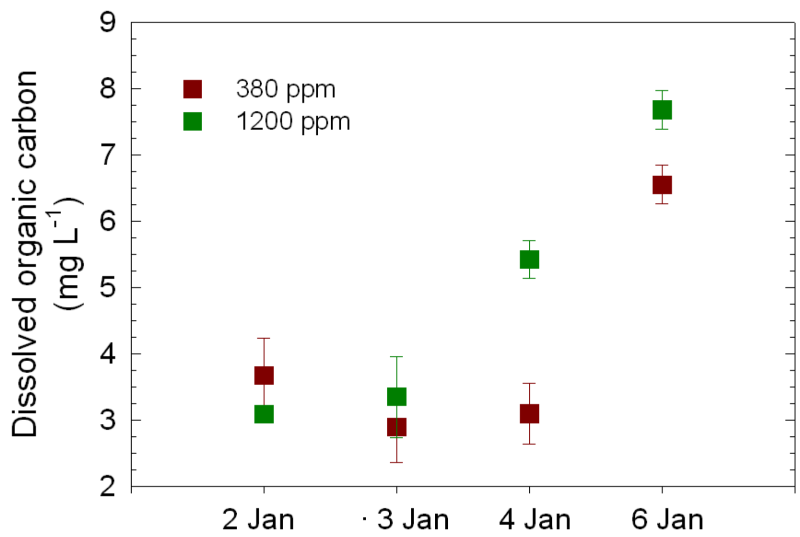


Mean respiration rate was 38% higher at ambient *p*CO_2 conditions.

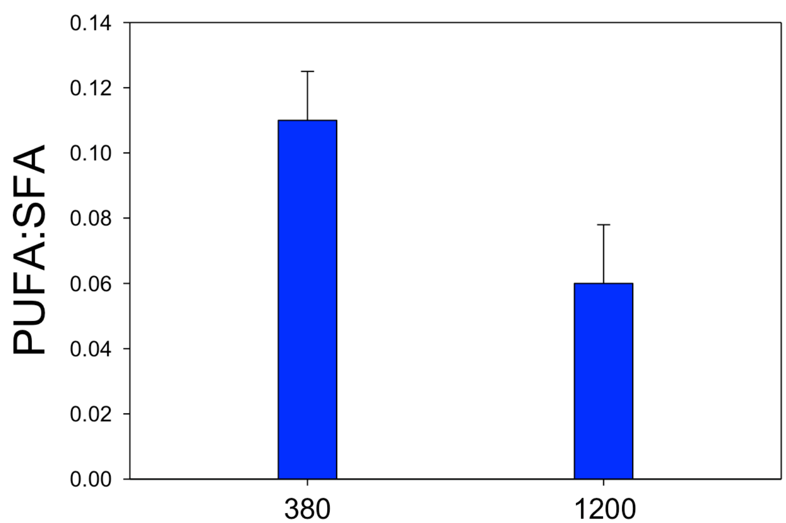


Impact on DOC production and algal quality





Increasing DOC production to higher pCO_2 levels, suggests an stressor effect on the algae.



Lower content of PUFA and HUFA fatty acids, in diatoms exposed to high pCO_2 levels.

Impact of OA on estuarine plankton assemblages: The Valdivia River Estuary

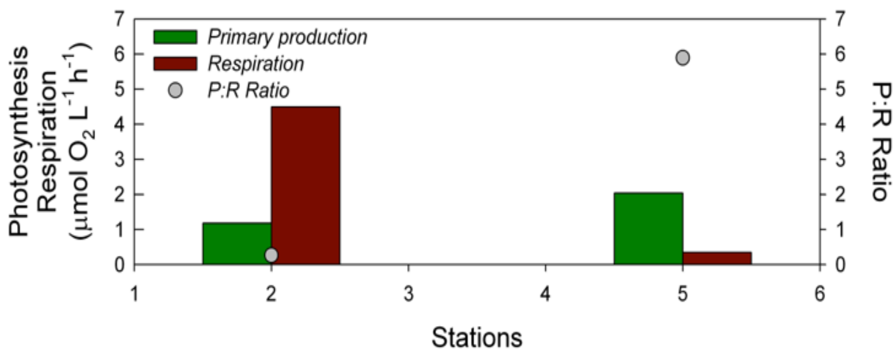
Estuarine ecosystems represent a natural laboratory for OA studies.

High flux of organic matter, high nutrient, low pH/high pCO_2 environment.

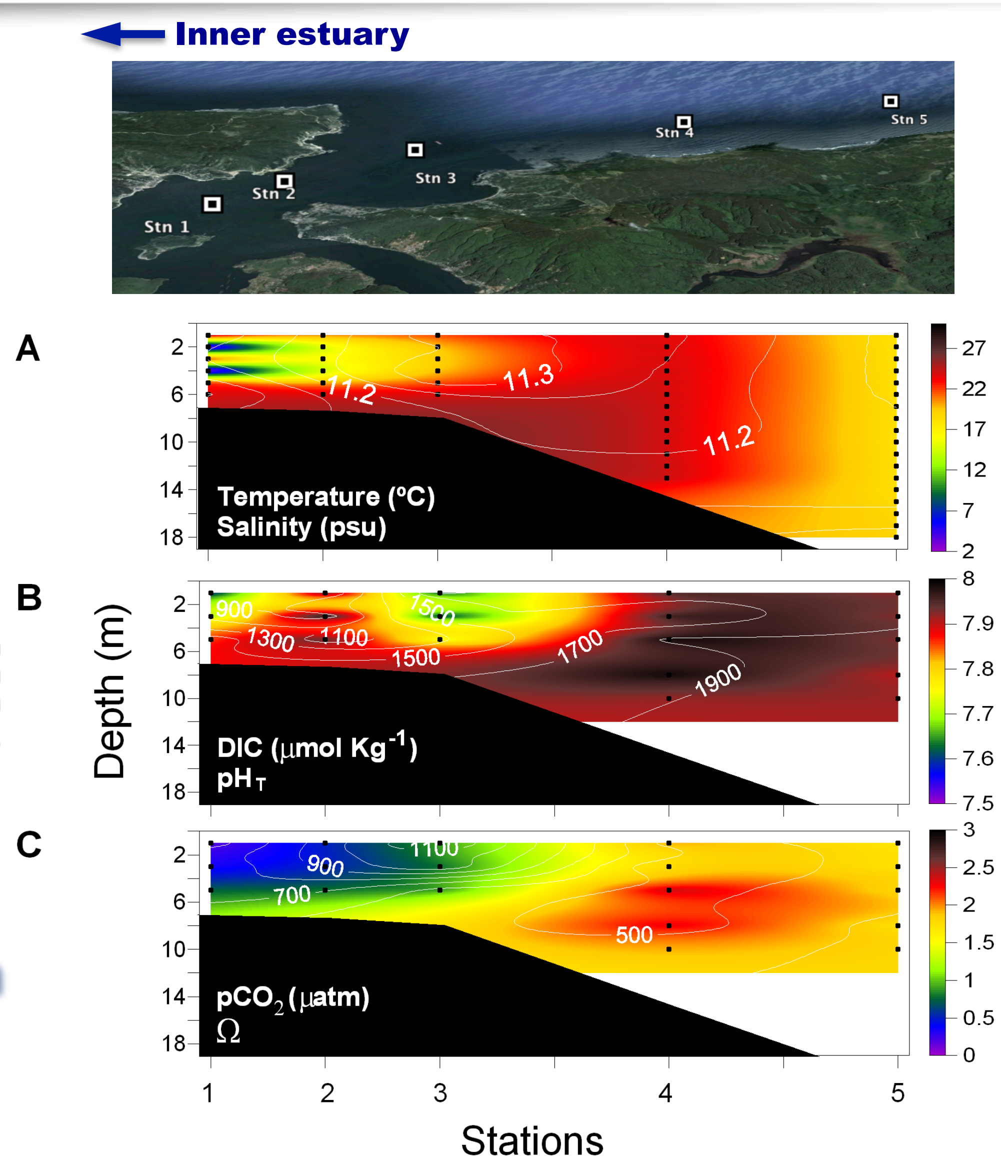
Many populations retained in tidal fronts inhabiting a corrosive environment (tolerance to OA?)

Experiments with natural phyto-assemblages

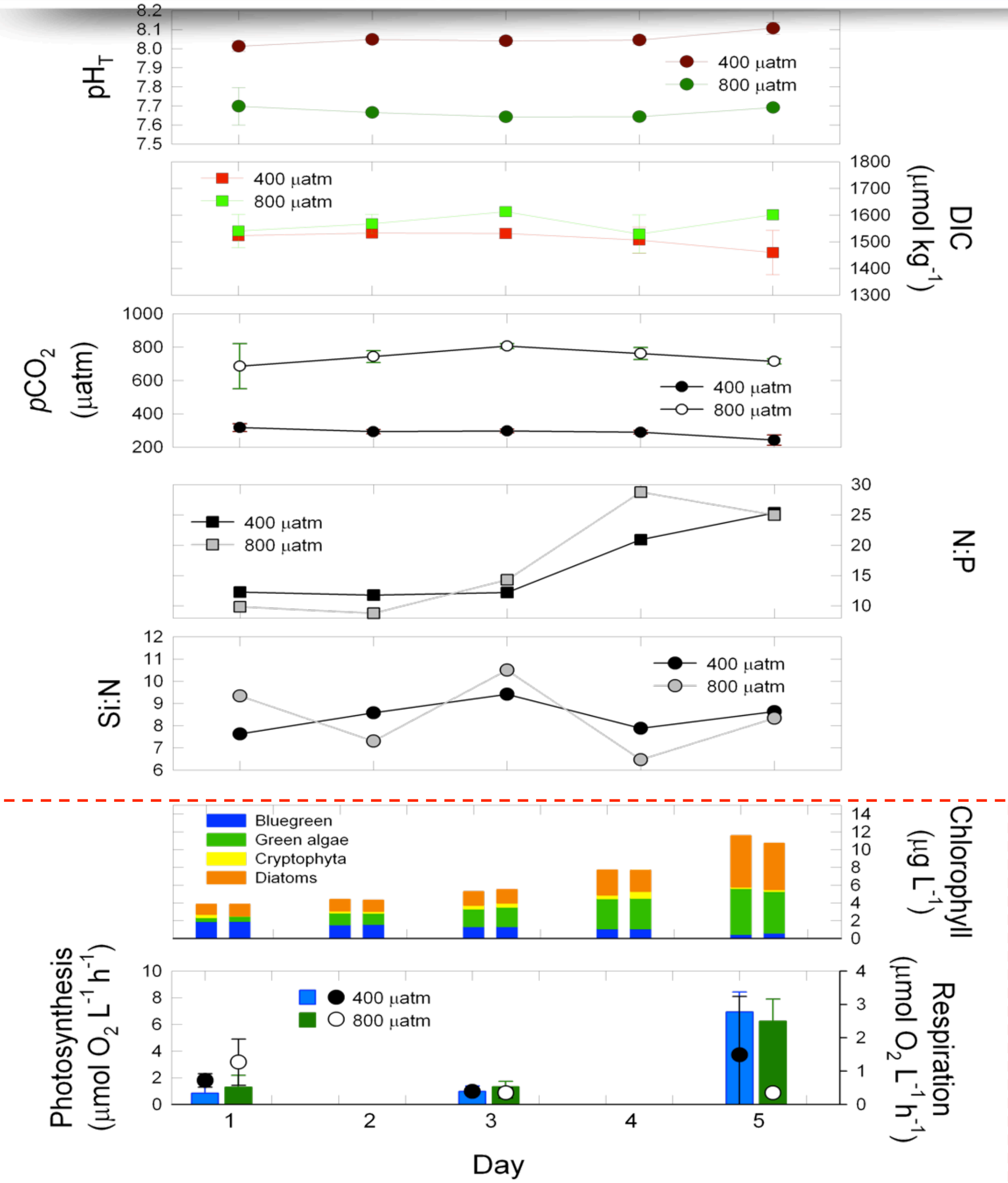
As many estuarine system worldwide, brackish waters are characterized by low pH (< 7.8), high pCO_2 (> 700 μatm) and $CaCO_3$ subsaturation (Ω).



High respiration/low production in the inner estuarine zone, results in high pCO_2.



Experiments with natural phyto-assemblages

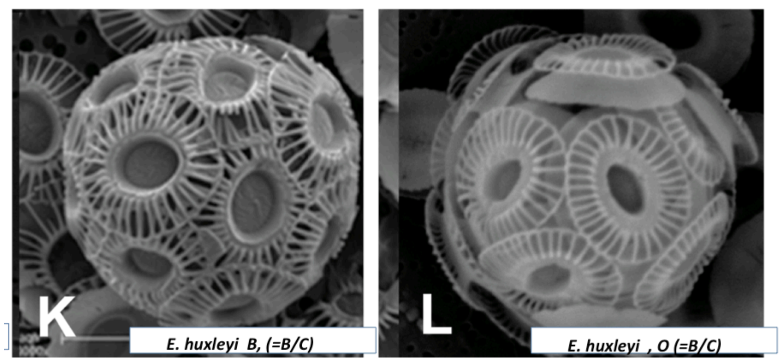


Experiments with natural phyto-assemblages from brackish high pCO$_2$ waters **did not experience changes in community structure** and photosynthetic rate under high pCO$_2$ lab conditions (800 µatm).

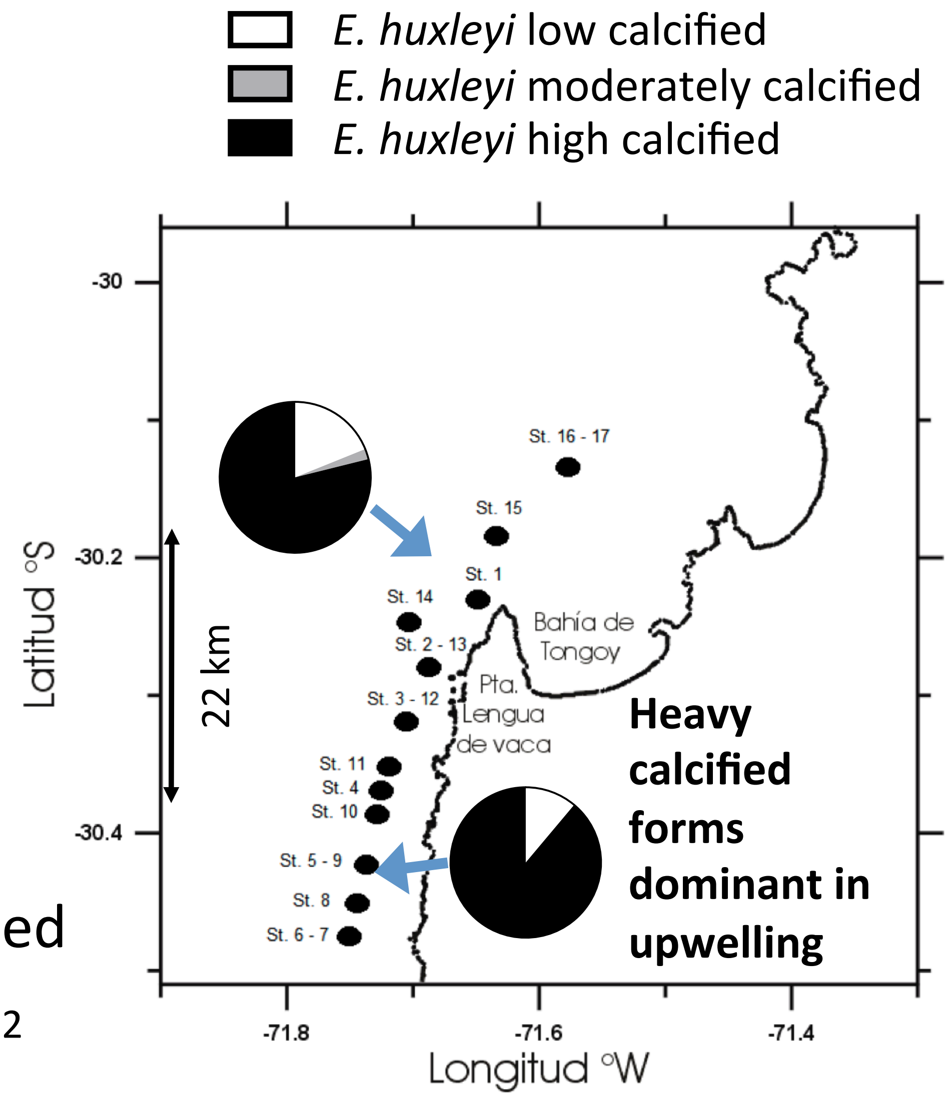
Similar experiments will be carried out with upwelling and open ocean phytoplankton communities.

Calcification of cocolitophores and carbonate chemistry in coastal upwelling off northern Chile

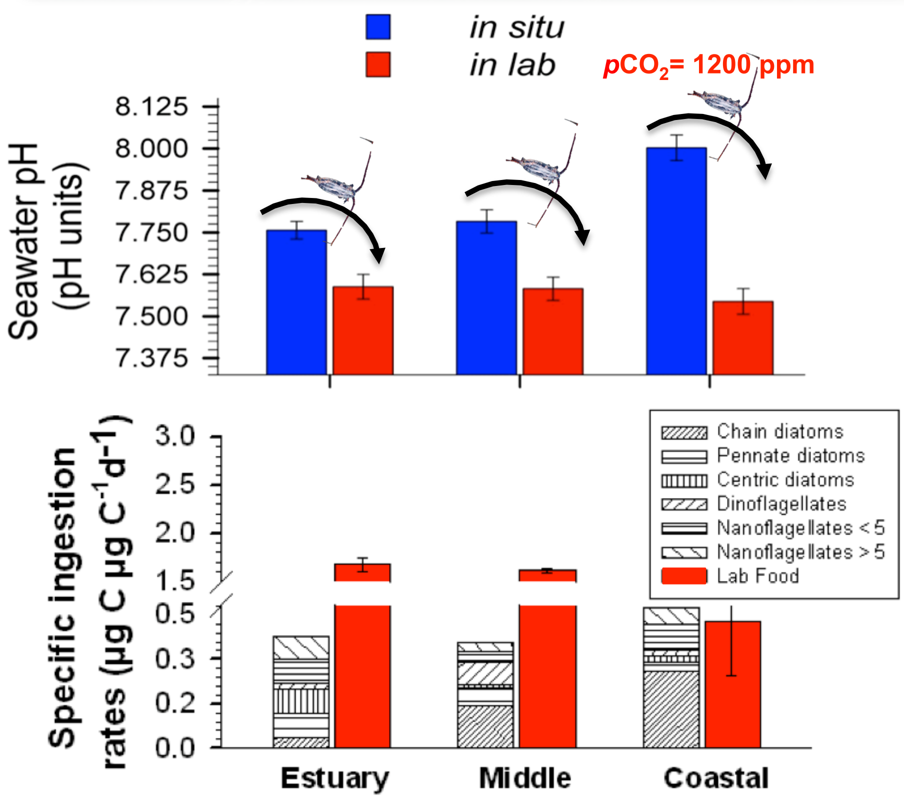
Dr. Peter Von Dasow
P. Universidad Católica de Chile



- *Emiliania huxleyi* high-calcified forms dominate in high pCO_2 environments



Copepods from estuarine environments



Local populations of estuarine environments (low pH), respond better when exposed to high levels of CO_2 (1200 µatm CO_2).

Submitted to PLOS One, **Aguilera et al. 2014**

MUSELS a new research program in Chile (2014)

Fondecyt 1195069
Impact of freshwater discharges in the carbonate system of a river-influenced cosastal upwelling area

Proyecto Anillos ACT132
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Fondecyt
Fondo Nacional de Desarrollo Científico y Tecnológico

Fondecyt 1130254 (2013 – 2017)
The combined effect of OA and corrosive acidified coastal waters for plankton productivity (COA-CAP)

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CENTRO PARA EL ESTUDIO DE FORZANTES MÚLTIPLES SOBRE SISTEMAS SOCIO-ECOLÓGICOS MARINOS

Iniciativa Científica Milenio (ICM) (2014-2017)
Center for the Study of Multiple-Drivers on Marine Socio-Ecological Systems (MUSELS)
NC120086
OA impact on shellfish farming industry

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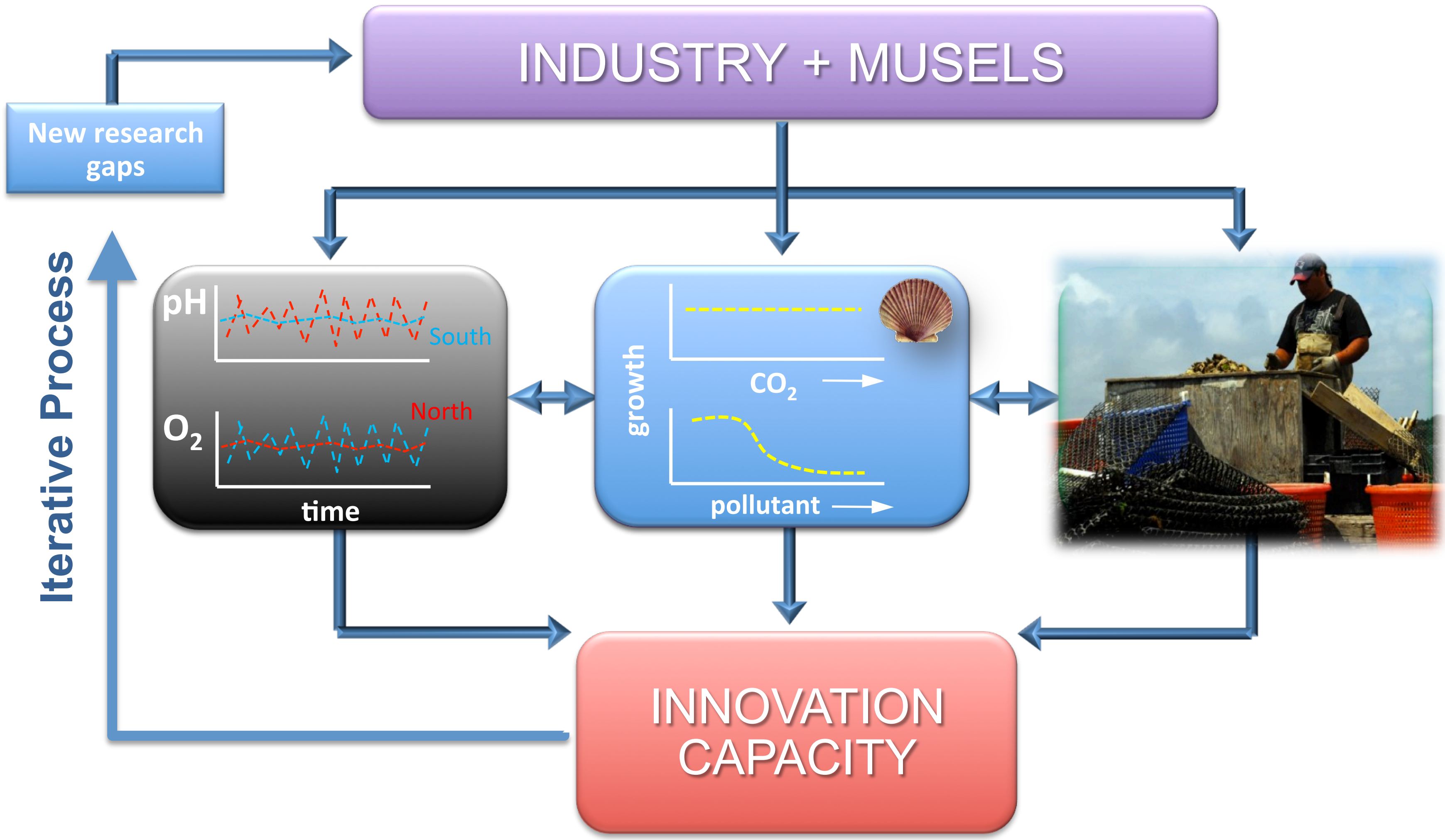
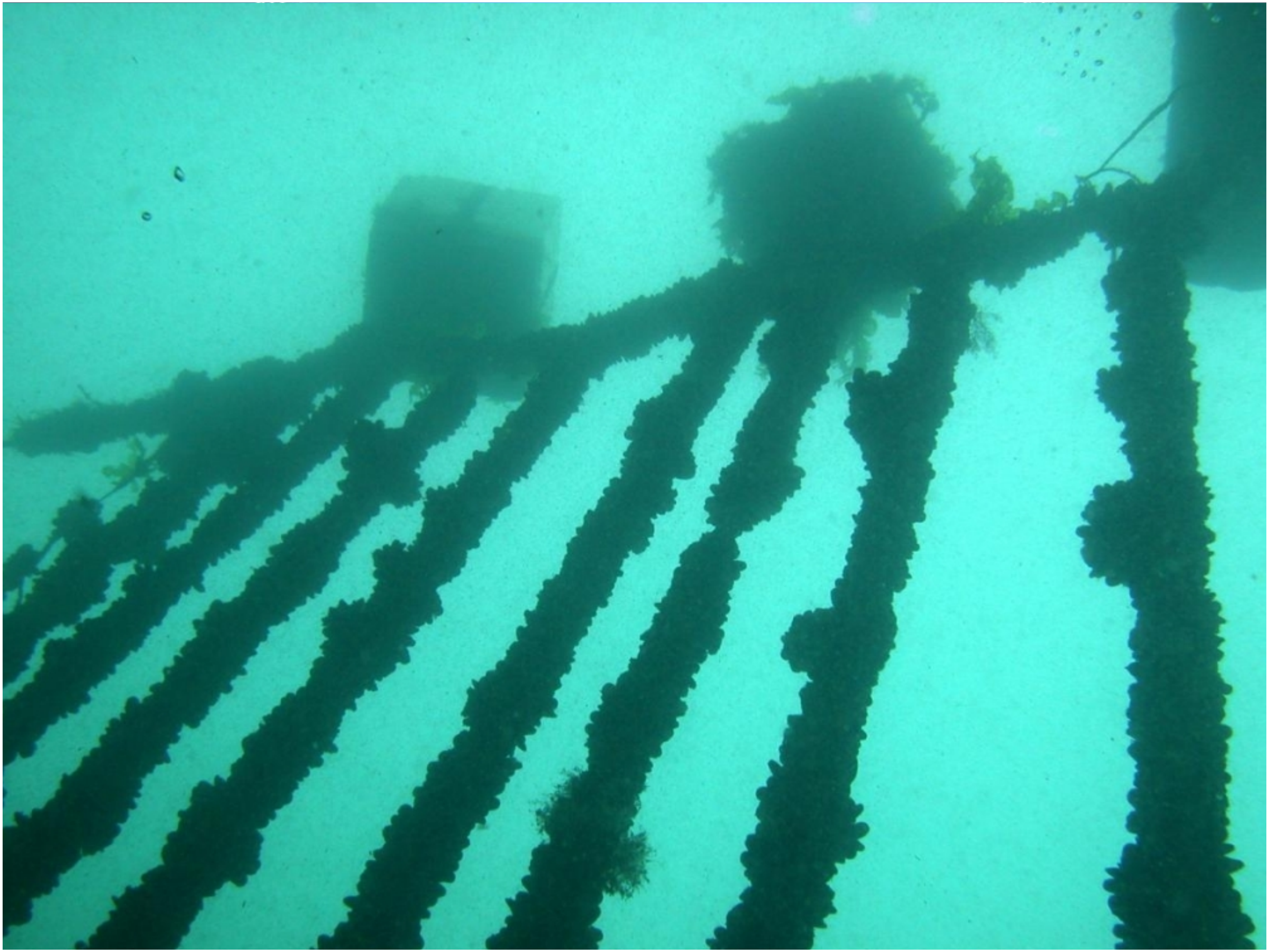
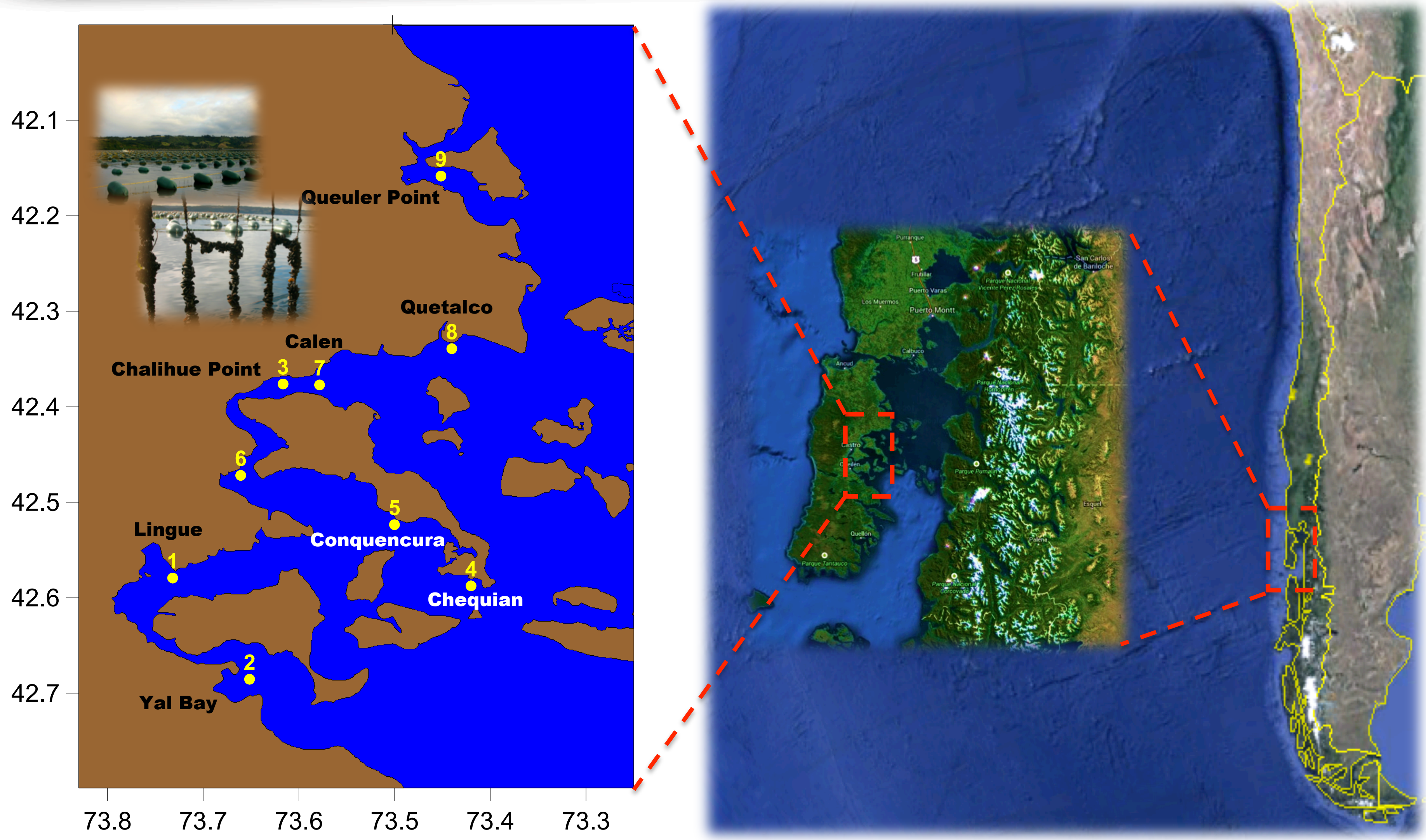
CENTER FOR THE STUDY OF MULTIPLE DRIVERS
ON MARINE SOCIO-ECOLOGICAL SYSTEMS

OA and shellfish farming socio-ecological system

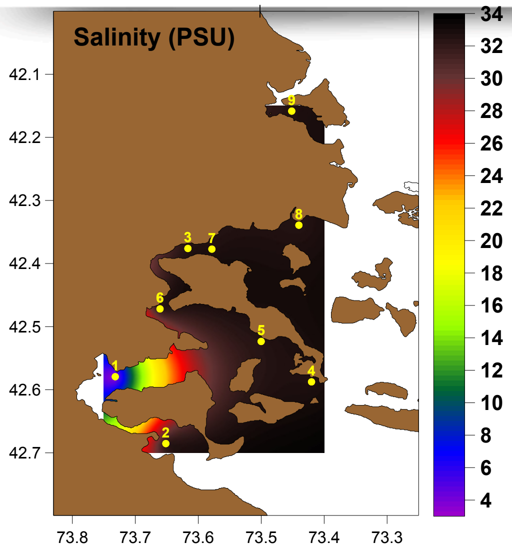


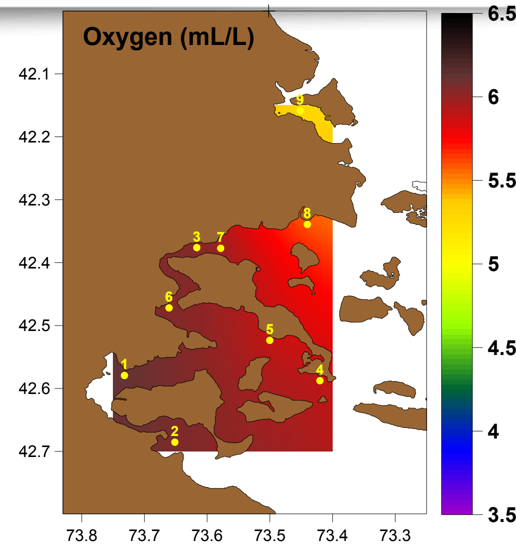


Multiple-stressors in shellfish farming areas

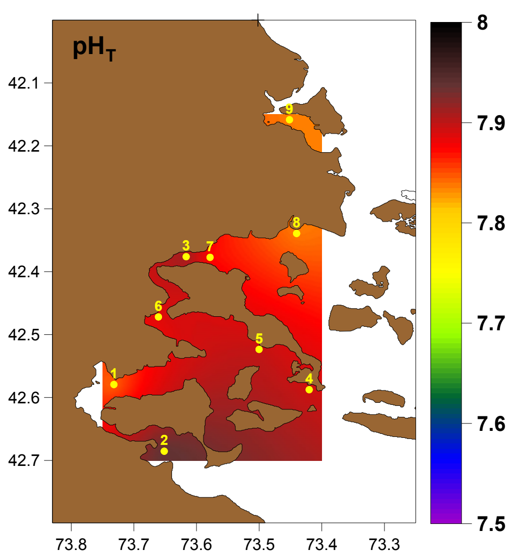


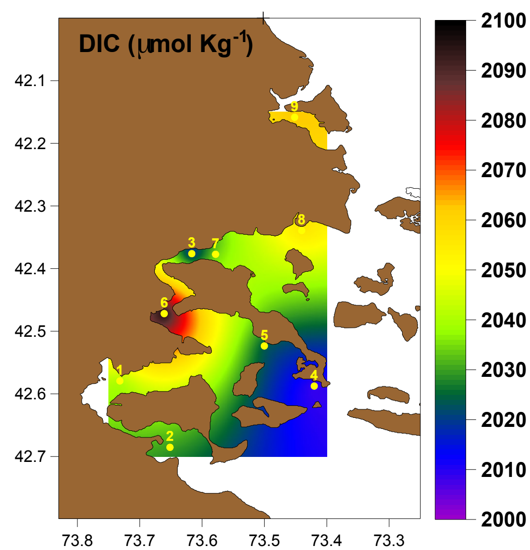
Multiple-stressors in shellfish farming areas

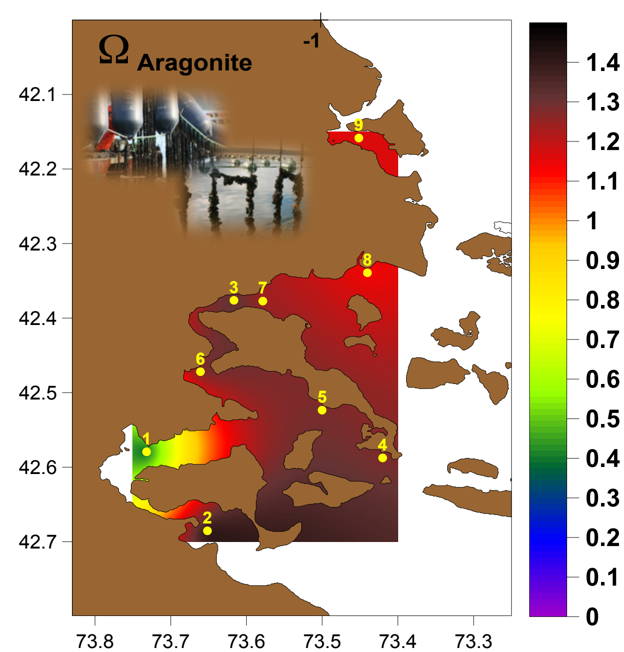




- Some farming areas with low salinity and lower pH.
- Mayor DIC does not necessarily coincide with areas of low pH.







Multiple-stressors in mussels: OA and temperature

Journal of Sea Research 85 (2014) 308–314
Contents lists available at ScienceDirect
Journal of Sea Research
journal homepage: www.elsevier.com/locate/seares

Combined effects of temperature and ocean acidification on the juvenile individuals of the mussel *Mytilus chilensis*

C. Duarte [a,*], J.M. Navarro [b], K. Acuña [b], R. Torres [c], P.H. Manríquez [b,d], M.A. Lardies [e], C.A. Vargas [f], N.A. Lagos [g], V. Aguilera [f]

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[c] Centro de Investigación en Ecosistemas de la Patagonia (CIEP), Coyhaique, Chile
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[f] Laboratorio de Funcionamiento de Ecosistemas Acuáticos (LAFE), Unidad de Sistemas Acuáticos, Centro de Ciencias Ambientales EULA Chile, Universidad de Concepción, Concepción, Chile
[g] Facultad de Ciencias, Universidad Santo Tomas, Ejército 146, Santiago, Chile

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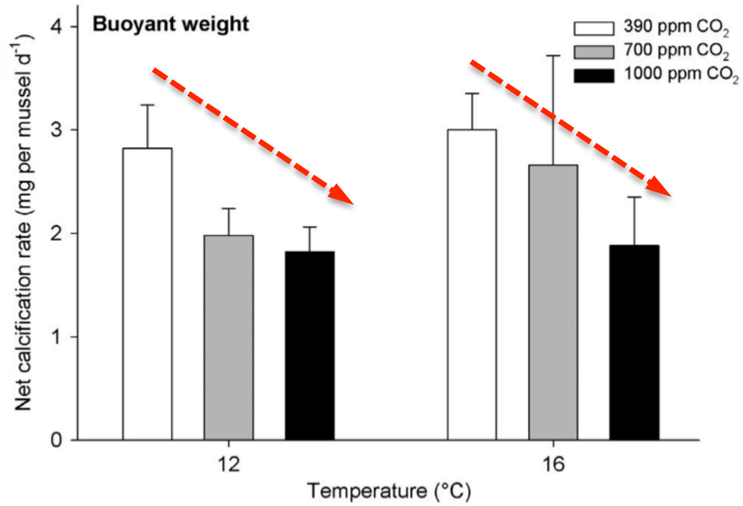
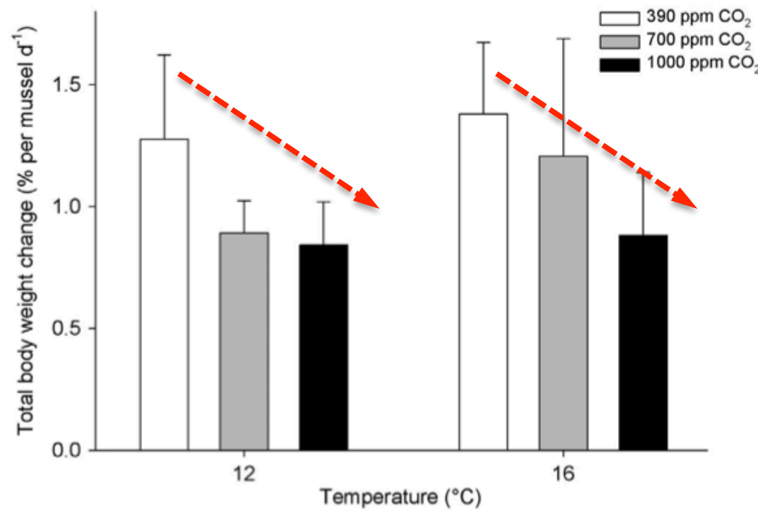
Mussel

ABSTRACT

Anthropogenic CO_2 emissions have led to increasing global mean temperatures (a process called global warming) and ocean acidification. Because both processes are occurring simultaneously, to better understand their consequences on marine species their combined effects must be experimentally evaluated. The aim of this study was to evaluate for the first time the combined effects of ocean acidification and water temperature increase on the total calcification rate, growth rate and survival of juvenile individuals of the mytilid mussel *Mytilus chilensis* (Hupe). Two temperature levels (12 and 16 °C) and three nominal CO_2 concentrations (390, 700 and 1000 ppm of CO_2) were used. We found that the net rate of calcium deposition and total weight were not significantly affected by temperature, but were negatively affected by the levels of CO_2. The interactive effects of temperature and CO_2 levels affected only the shell dissolution, but this process was not important for the animal's net calcification. These results suggest that individuals of *M. chilensis* are able to overcome increased temperatures, but not increments of CO_2 levels. It is well known that mussels influence their physical and biological surroundings. Therefore, the negative effects of a CO_2 increase could have significant ecological consequences, mainly in those habitats where this group is dominant in terms of abundance and biomass. Finally, taking into account that this species inhabit a wide geographic range, with contrasting environmental conditions (e.g., temperature, salinity and, pH), further studies are needed to evaluate the intraspecific variability in the responses of this species to different environmental stressors.

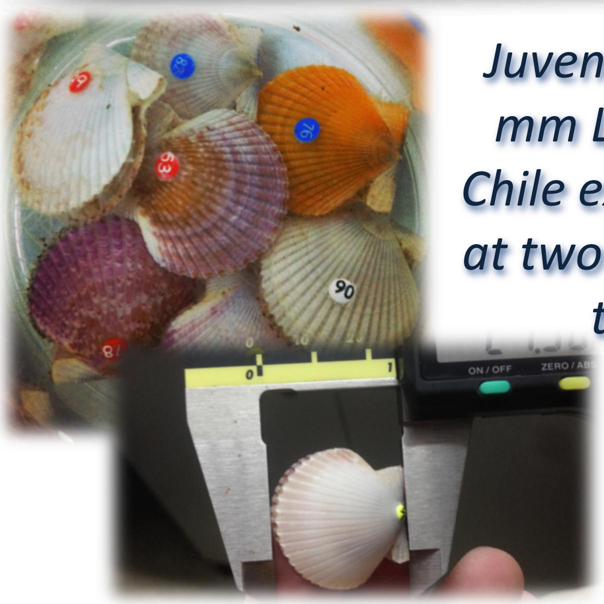




- Temperature does not have a negative effect on calcification rates or growth, but individuals are not able to overcome the negative effects of increased CO_2 and low pH

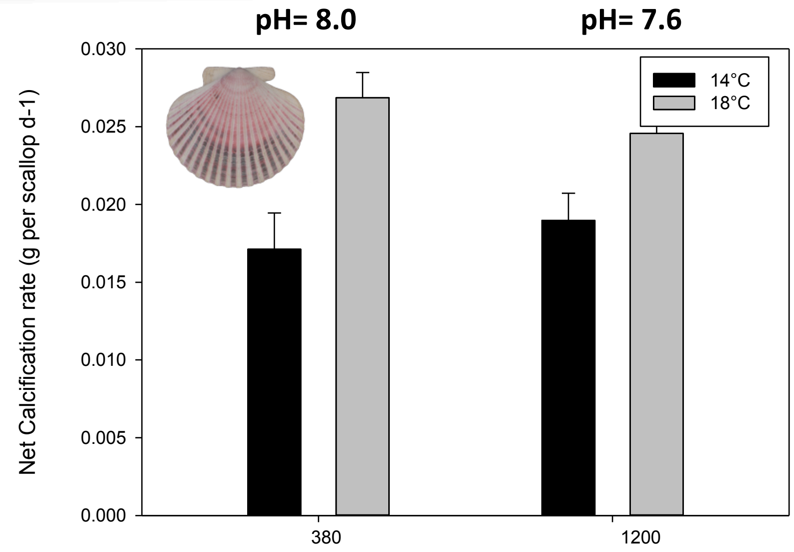
Journal of Sea Research 85: 308–314 , **Duarte et al. 2014**

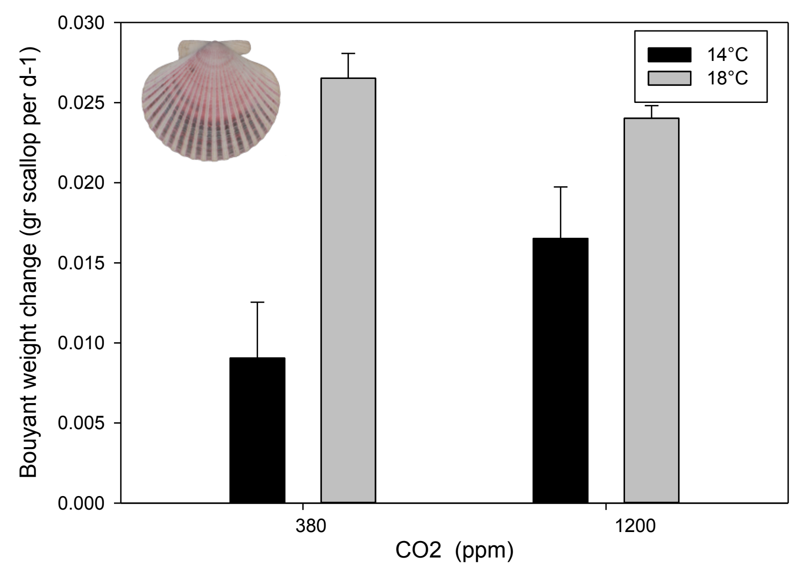
Multiple-stressors in scallops: OA and temperature



Juvenile individuals(3.5 mm LT) from northern Chile exposed for 20 days at two levels of pCO_2 and temperature.

- Temperature had an important effect on the rate of calcification and growth (buoyant weight), but no negative effect of high pCO_2/ low pH was observed..





The Chilean Experience in OA research (2014)

Fondecyt 1195069
Impact of freshwater discharges in the carbonate system of a river-influenced cosastal upwelling area

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Ocean Acidification impact on commercial invertebrate species along Chilean coasts

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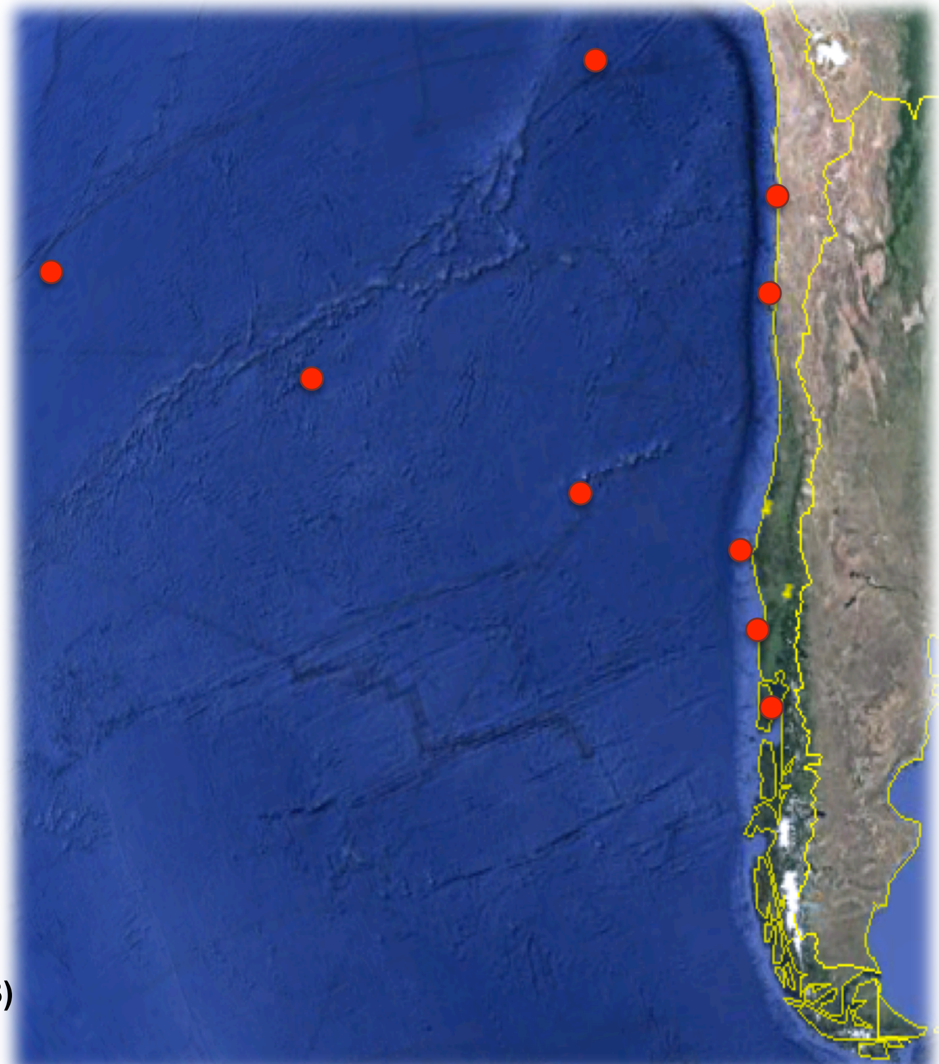
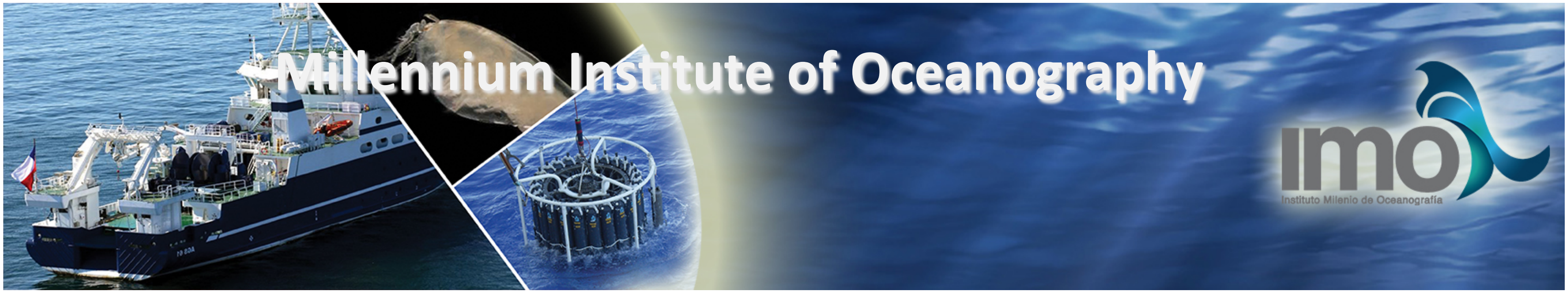
OA impact on shellfish farming industry

IMO
Instituto Milenio de Oceanografía

Iniciativa Científica Milenio (ICM) (2014 – 2023)
Millennium Institute of Oceanography (IMO)
IC120019
OA impact on key plankton functional groups in oceanic environments



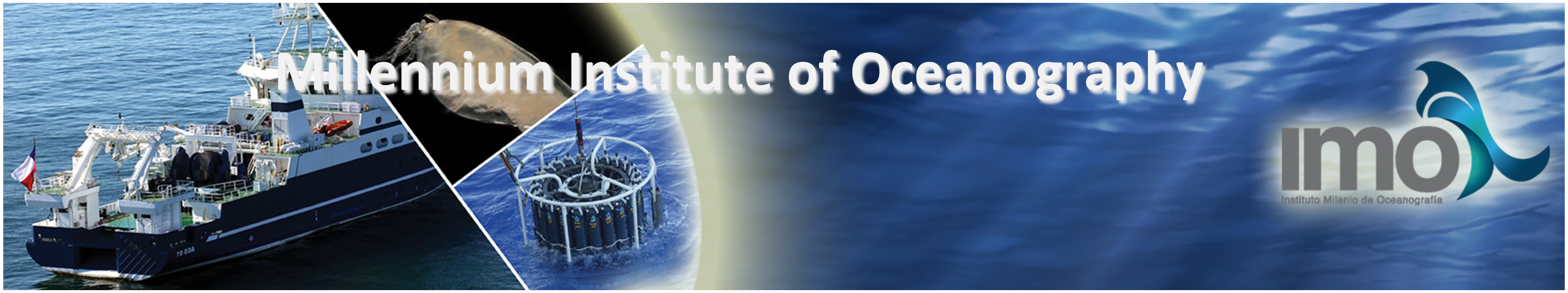


The new millennium Institute of Oceanography in Chile

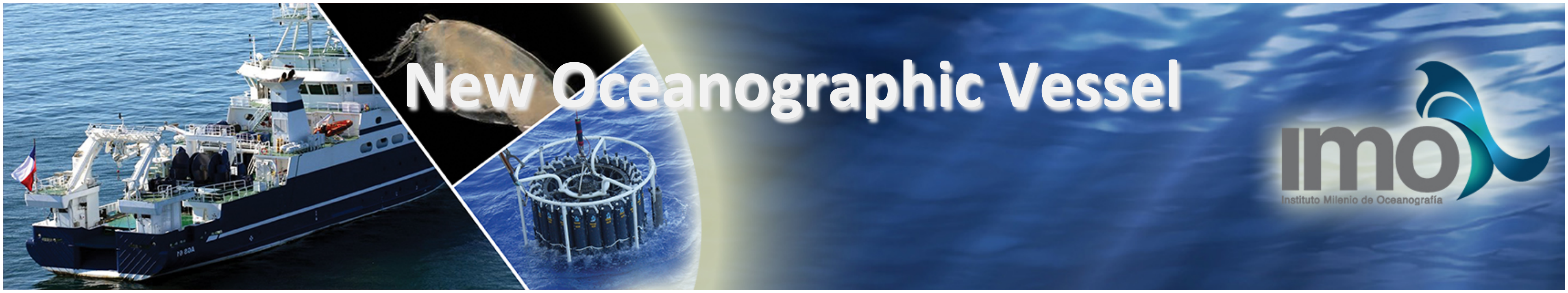
Blue Water challenges on the Eastern South Pacific Ocean

-Research plan 2014 to 2023-

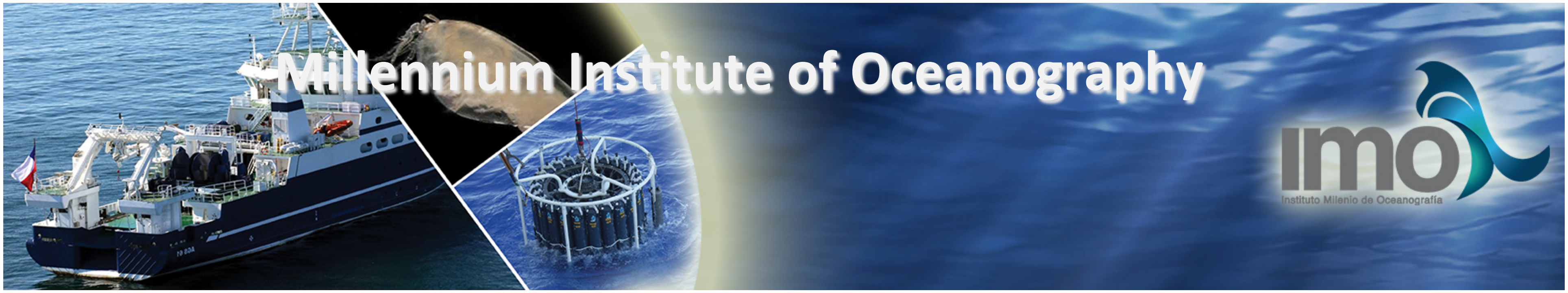
University of Concepción
Concepción, Chile



With the objective of leading exploration of the southeastern Pacific Ocean, IMO has a strong component of national and international collaboration and currently is planning diverse oceanographic expeditions oriented to discovery and proving hypothesis on board the new Chilean research vessel "Cabo de Hornos".


New Oceanographic Vessel
IMO
Instituto Milenio de Oceanografía


CABO DE HORNOS



Mesoescale Processes

What is the role of mesoescale activity (e.g. eddies) in the dynamics of the open ocean?

Oceanic Variability

How planetary-scale perturbations impact the properties and functioning of the South Pacific?

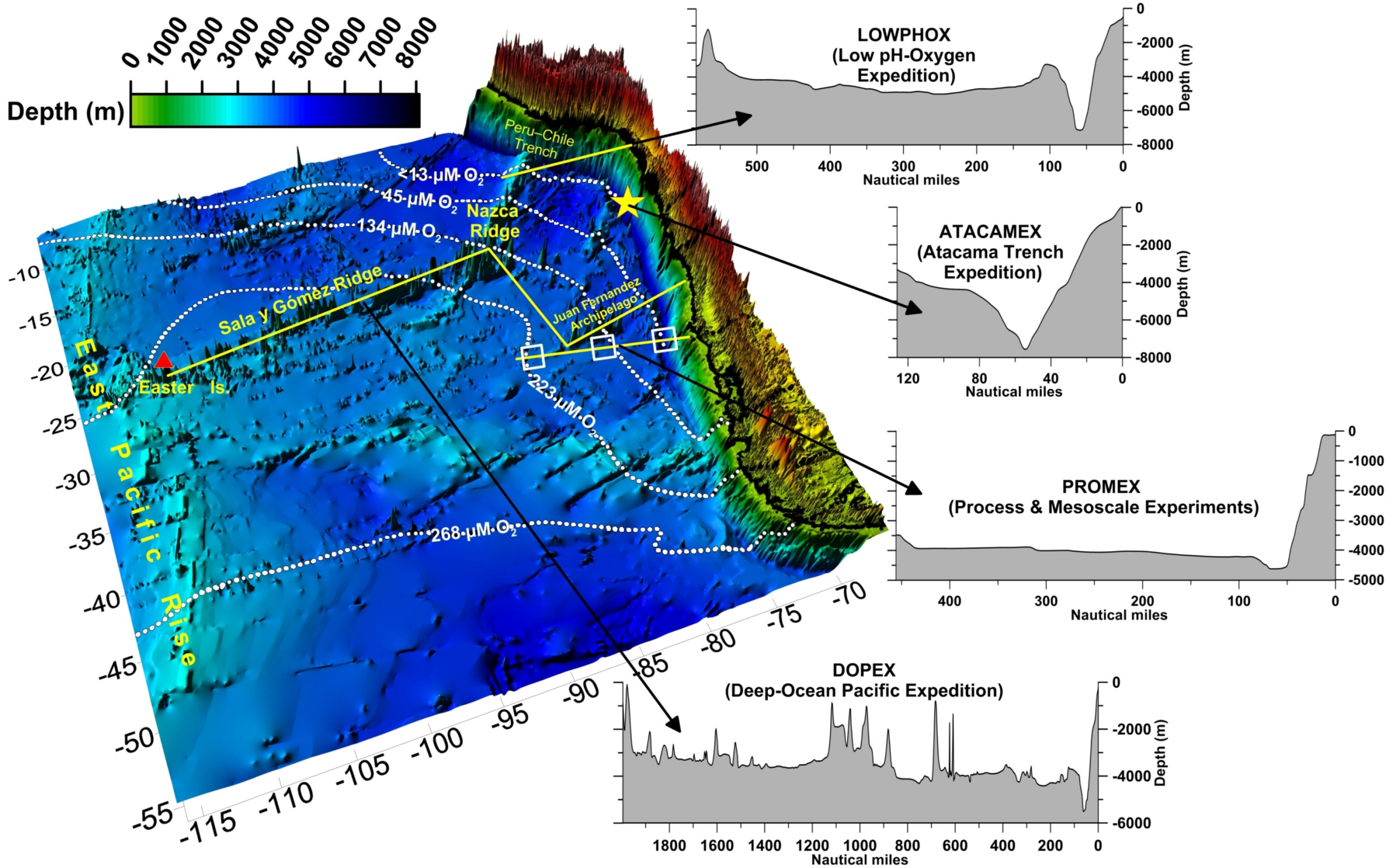
Adaptations to a Changing Ocean

How key organisms of the marine ecosystem become adapted to chemical changes going on (e.g. low O_2/pH)?

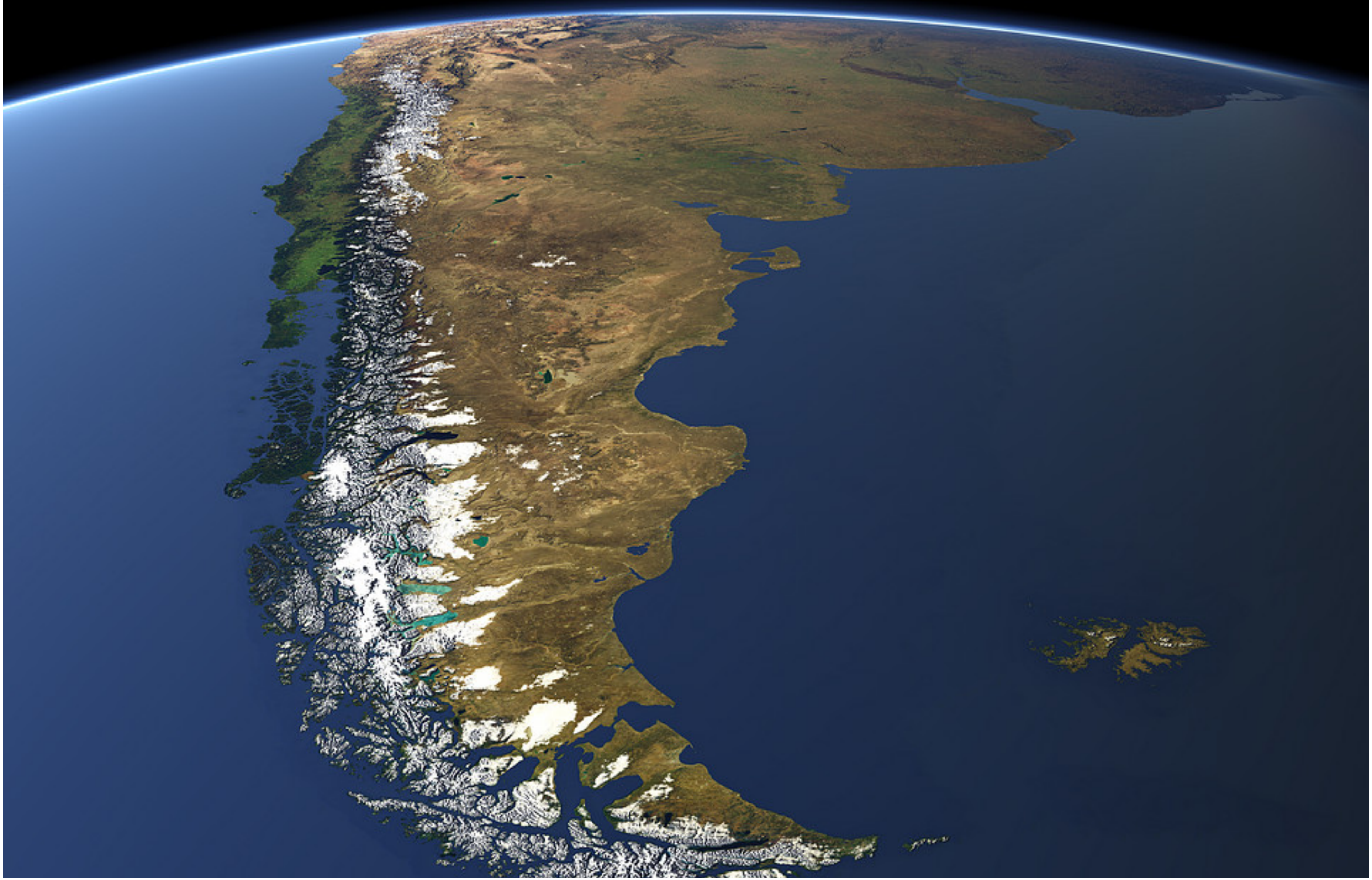
The Deep Ocean

What are the structures of communities and the biogeochemical characteristics of deep and abyssal waters?


Research Plan 2015 - 2023
IMO
Instituto Milenio de Oceanografía


Depth (m)
0 1000 2000 3000 4000 5000 6000 7000 8000
Peru-Chile Trench
<13 µM O2
45 µM O2
134 µM O2
223 µM O2
268 µM O2
Nazca Ridge
Sala y Gómez Ridge
Juan Fernandez Archipelago
Easter Is.
East Pacific Rise
-10 -15 -20 -25 -30 -35 -40 -45 -50 -55
-115 -110 -105 -100 -95 -90 -85 -80 -75 -70
LOWPHOX
(Low pH-Oxygen Expedition)
ATACAMEX
(Atacama Trench Expedition)
PROMEX
(Process & Mesoscale Experiments)
DOPEX
(Deep-Ocean Pacific Expedition)
Nautical miles
Depth (m)

What’s the current situation in Chile in OA research?

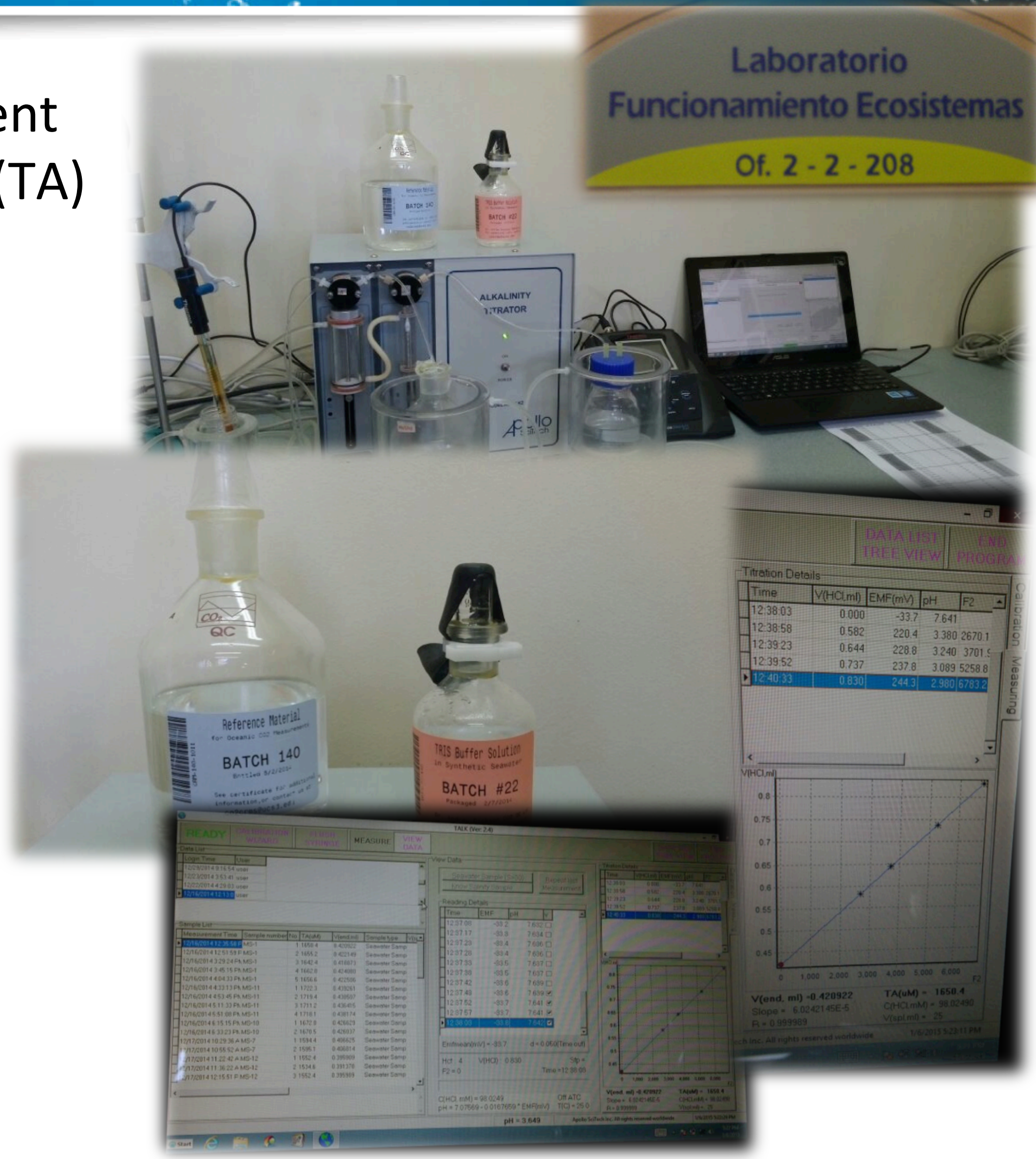


Chilean research groups working actively on ocean acidification issues

	Researchers	Field work	Main research themes
	***Dr. Víctor Aguilera***	Biologist/ Oceanographer	OA impact on copepod populations
	***Dr. Cristian Duarte***	Ecologist/Biologist	OA and multiple stressors on gastropods and bivalves
	***Dr. Stefan Gelcich***	Ecologist/ Sociologist	OA impact on socio-ecological systems
	***Dr. Nelson Lagos***	Benthic ecologist	OA impact on calcification and physiological traits in mollusks
	***Dr. Marco Lardies***	Ecophysiologist	OA impact on life history-traits, ecophysiology in mollusks and crabs
	***Dr. Patricio Manríquez***	Benthic ecologist	OA impact on physiological traits and behaviour in gastropods and seaurchin
	***Dr. Rodrigo Torres***	Oceanographer	Inorganic carbon chemistry in fjord ecosystems
	***Dr. Cristian A. Vargas***	Oceanographer	Carbon biogeochemistry in coastal and open ocean and OA impact on larval stages of marine invertebrates, and phyto- & zooplankton
	***Dr. Peter von Dasow***	Oceanographer	OA and Life cycles, evolution and genomic of cocolitophores.

Laboratory measurements of carbonate system
(*Aquatic Ecosystem Functioning Lab*, Dr. Vargas' Lab – Universidad de Concepción)

- Implementation of measurement techniques for Total Alkalinity (TA) and potentiometric and spectrophotometric pH.



- Use of reference material

(Dr. Andrew Dickson, *Scripps Institution of Oceanography*)

1. HCl 0.1 N

2. TRIS Buffer Solution for pH

3. Reference Material for CO_2 Measurements

- Precision levels:

pH = 0.010

Alkalinity = 2 - 3 µmol kg seawater

$\Omega_{aragonite}$ = 0.012

Micro/mesocosm facilities

- Currently, there are two micro/mesocosm facilities, one located in southern Chile, in the **Coastal Station Calfuco**, and another one at the **Marine Biology Station at Dichato** in Concepción.
- In the near future a micro/mesocosm within the industry (i.e. in a hatchery for scallops) at northern Chile will implemented.

Autonomous pH measurements

Three moorings along Chilean coast for pH monitoring:
WQS-WETLabs: Temperature, salinity, oxygen, chlorophyll & turbidity
SEAFET: pH

Capacity building, best practices and protocols in Latin-American countries

Other main problems/issues become evident for different regions during previous meetings are:

1. *There is no uniformity and standards appropriate for pH and alkalinity measurements that makes available reliable estimates of pCO_2 and Omega.*
2. *In some countries, there are no facilities and expertise for CO_2–system manipulation, for the realization of experiments with local species.*
3. *Although there some local initiatives in some countries, there are no standards for appropriate monitoring programs and time series of carbonate system, through both autonomous and/or manual protocols.*

Workshop "Ocean Acidifcation: Research in the Chile-Perú coastal upwelling system", 9-10 October 2014, Lima, PERÚ

Education

- The idea about a Latin American Network born during the Latin-American Workshop on Ocean Acidification (LAOCA)

- 19 students from 7 countries.
- 5 MSci and 4 PhD students
- 10 Postdocs/young researchers

- Funded by:

✓ 40% IAEA (OA-ICC)
✓ 30% Program REDOC-UdeC
✓ 15% Millennium Institute of Oceanography (IMO)
✓ 10% Millenium Nucleus MUSELS
✓ 5% Others

LAOCA 2014

- Theoretical and practical course, involving researchers from different disciplines working in different Ocean Acidification issues *(e.g. A. Dickson, L. Robbins, H. Findlay, S. Dupont, M. Hernández-Ayón*).

Our proposal: A Latin American Network

latin american
ocean acidification
network
LAOCA

The Latin American Ocean Acidification Network (LAOCA) is an international collaborative initiative aimed:

a) to document the stage and progress of ocean acidification research in open-ocean, coastal, and estuarine environments,

b) to understand and diseminate knowledge regarding the potential impact of ocean acidification on local species in Latin-American countries,

c) to exchange and sharing carbonate system data necessary to optimize modelling at regional scale in LatinAmerican countries, and

d) to generate instances of capacity building and education in LatinAmerican countries.

Next steps and potential activities

1. To invite members wishing to join this network and willing to share information, databases, protocols, and general expertise.

2. To organize a first meeting of members/local networks wishing to join this LAOCA network (i.e. Hosting institution in Brazil, Chile, Peru, or any other country).

3. To establish guidelines of this network, based on other similar programs.

4. To organize a training course (LAOCA 2015) for calibration, standardization and best practices for ocean monitoring in Latin American countries (i.e. based in GOA-ON protocols).

5. To work for developing an abbreviated manual of best practices for carbon chemistry measurements, in Spanish for Latin American countries.

6. To apply for funding in order to establish this network (e.g. Ibero-American program of science and technology for development, deadline 30 April).

Acknowledgments

- To Rodrigo Kerr for the kind invitation to participate in this workshop.
- To the PICES secretariat (Julia Yazvenko & Christina Chiu) and all the organizers of this PICES Symposium.
- To all our funding agencies:

1. Fondecyt Project 1095069 - RIVOM *"Influences of Riverine Organic Matter and Nutrients on the Coastal Ocean Food Web and Biogeochemistry: Implications under a Climate Change Scenario in Central Chile"*
2. ANILLO ACT132 *"Influence of the near-future ocean acidification on shellfish resources. Latitudinal variation and Fresh water inputs"*. Programa de CONICYT, Chile.
3. Millenium Nucleus, NC120086 *"Center for the Study of Multiple-Drivers on Marine Socio-Ecological Systems (MUSELS)"*, from MINECON, Chile.
4. Millenium Institute of Ocenaography, IC120019, from MINECON, Chile.
5. Fondecyt Project 1130254 – *"The combined impact of ocean acidification and corrosive acidified coastal waters for plankton productivity: A comprehensive analysis in contrasting aquatic environments"*

- ***But most especially, to all our staff and friends working in our Lab (LAFE)***
- ***AND MANY THANKS FOR YOUR ATTENTION !!!!***