Cambios globales y sus efectos sobre la capacidad de carga en fiordos.

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IDEAL
Centro de Investigación: Dinámica de Ecosistemas Marinos de Altas Latitudes.

Objetivo: Revisar la relación entre los estresores globales y la capacidad de carga de los fiordos.

Capacidad de carga (un buen concepto?)

Estresores globales. (que ya son irreversibles a escala humana)

- Cambio Climático.
- Acidificación del Océano.
- otros

Estresores locales.

- MO, contaminantes (MO, patógenos, químicos), ruido, sobrepesca.

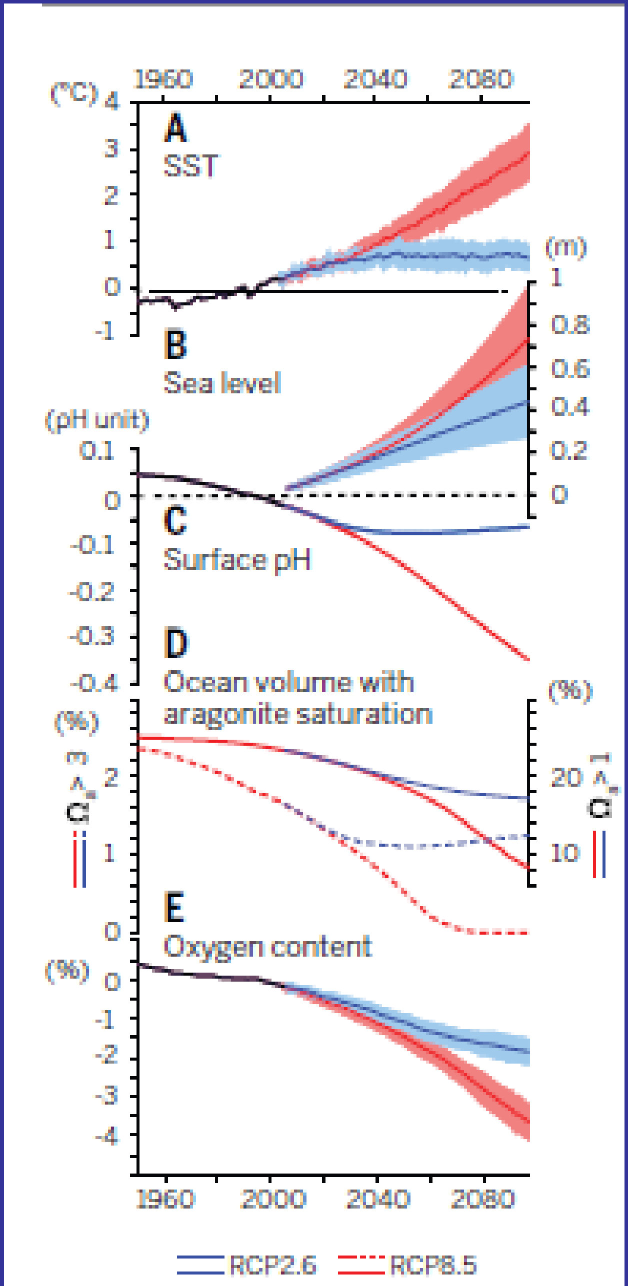
Integrando la acidificación del océano/calentamiento global a las consideraciones para uso del sistema de fiordos y canales.

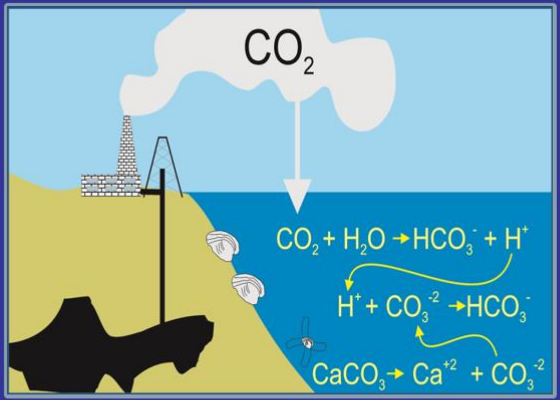
- generación de proteína.
- toxinas/FAN.

Situación actual – predicciones – áreas particularmente vulnerables.

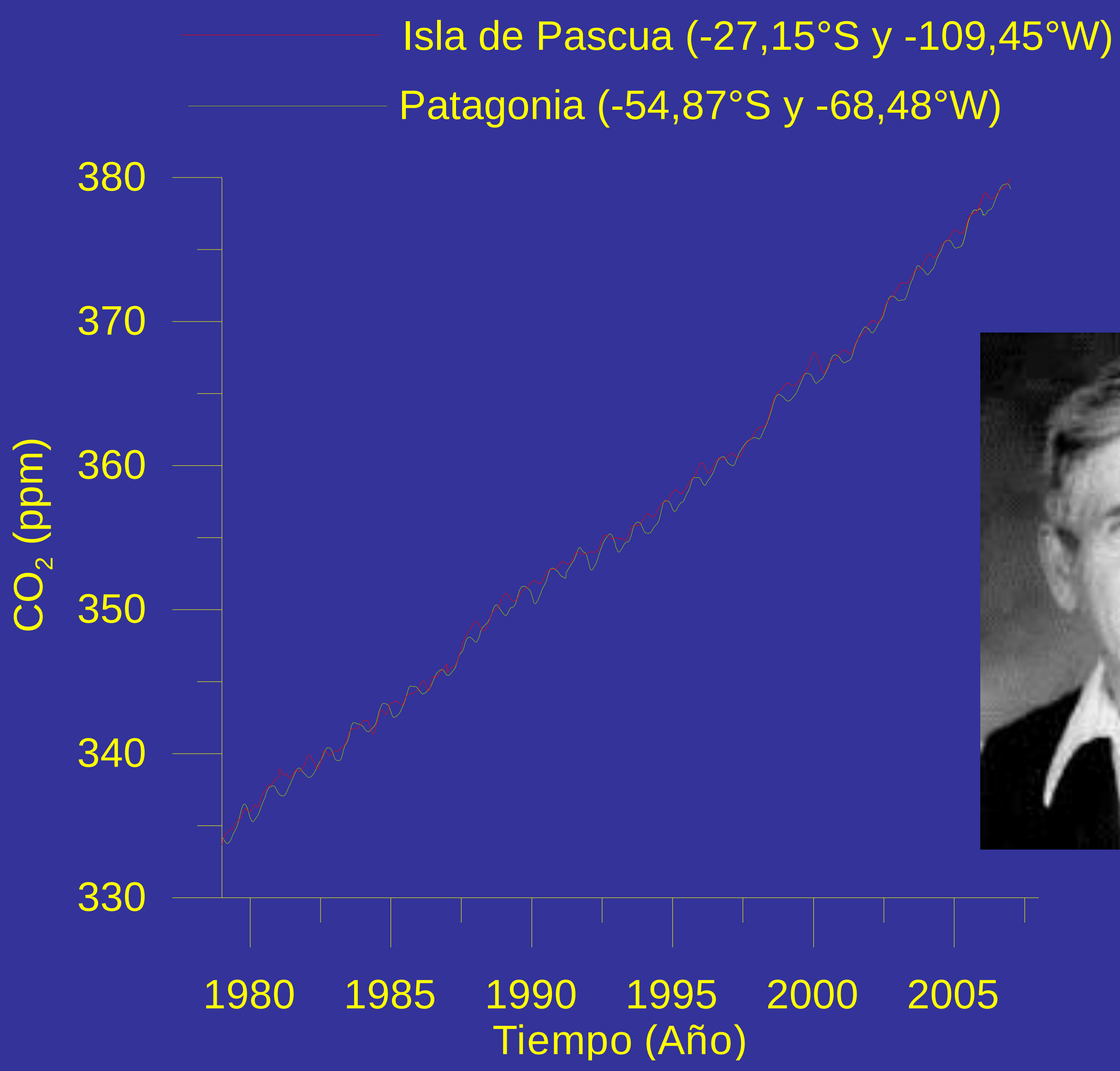
- Cuantos?

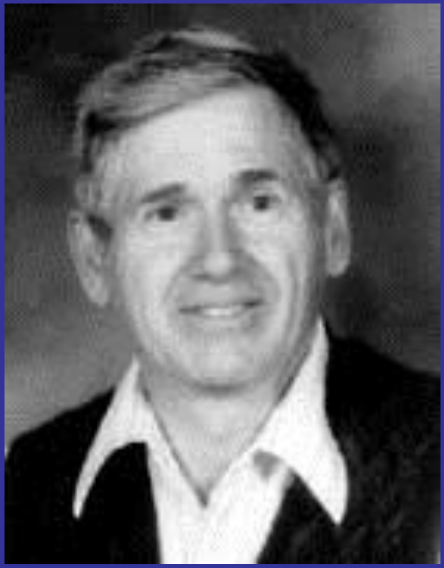
- Ecosistema





Gattuso et al., Science 2016


Isla de Pascua (-27,15°S y -109,45°W)
Patagonia (-54,87°S y -68,48°W)
CO_2 (ppm)
380
370
360
350
340
330
1980
1985
1990
1995
2000
2005
Tiempo (Año)



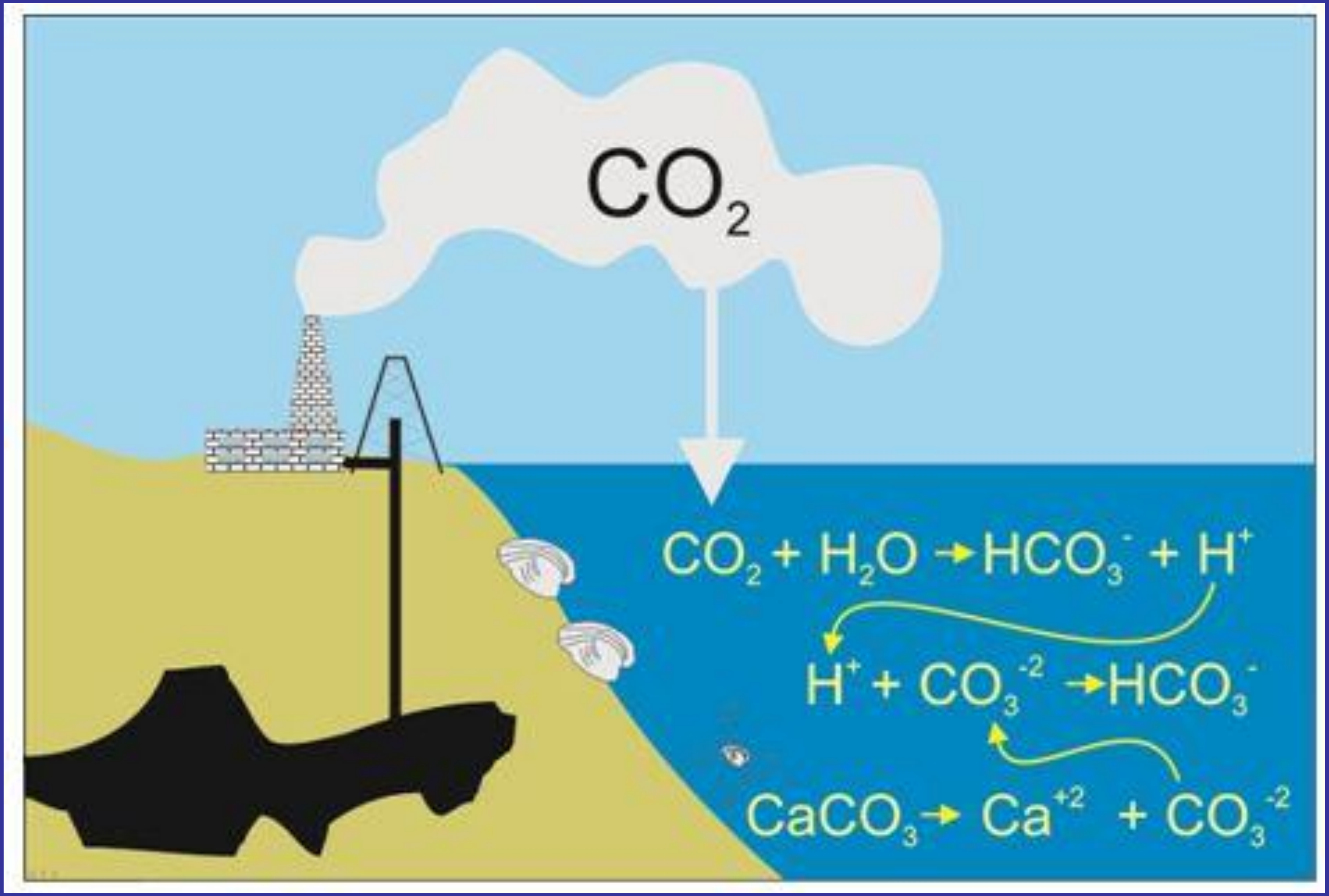
Cambio climático

(balance radiativo de la Tierra)

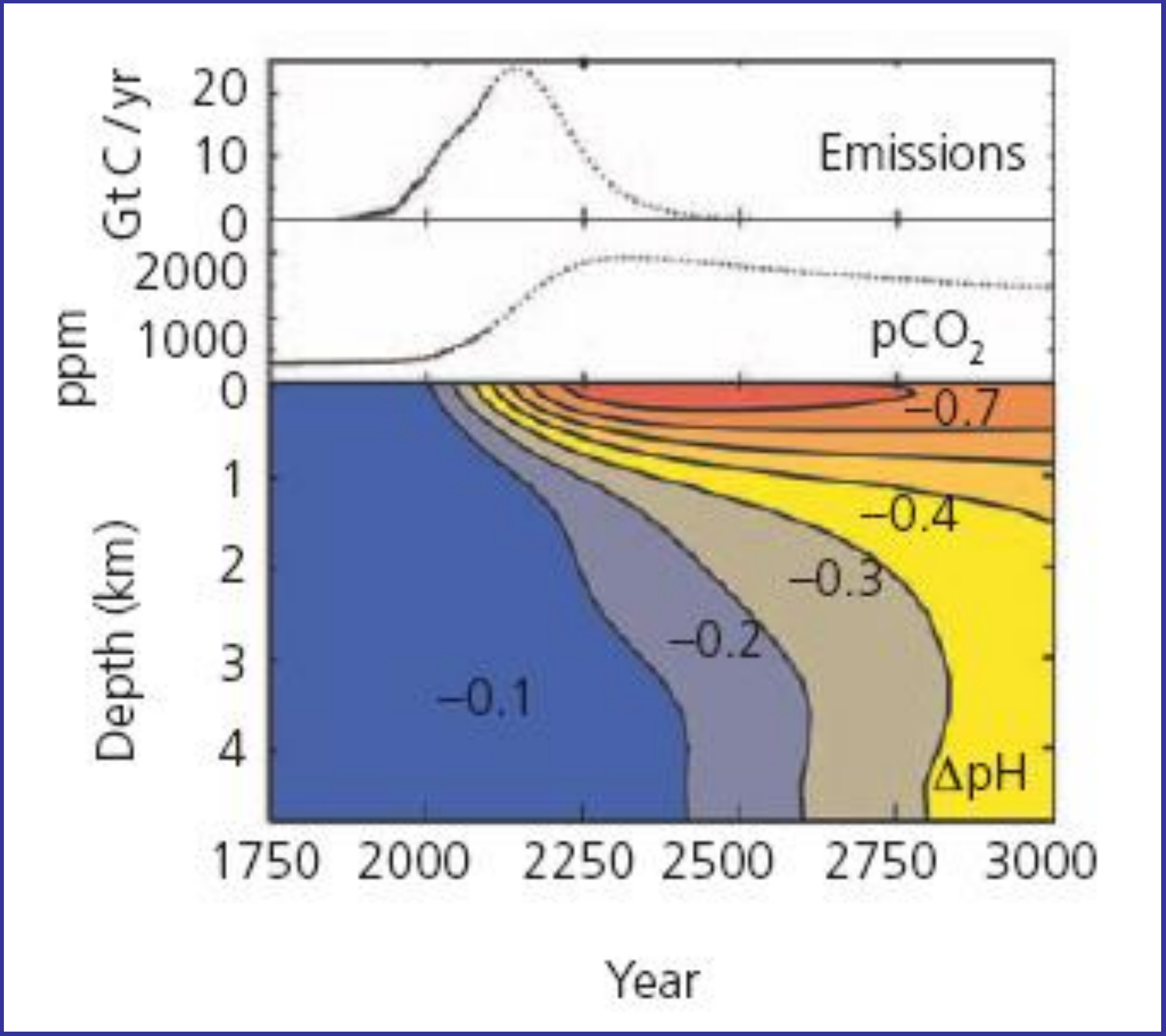
Acidificación del océano

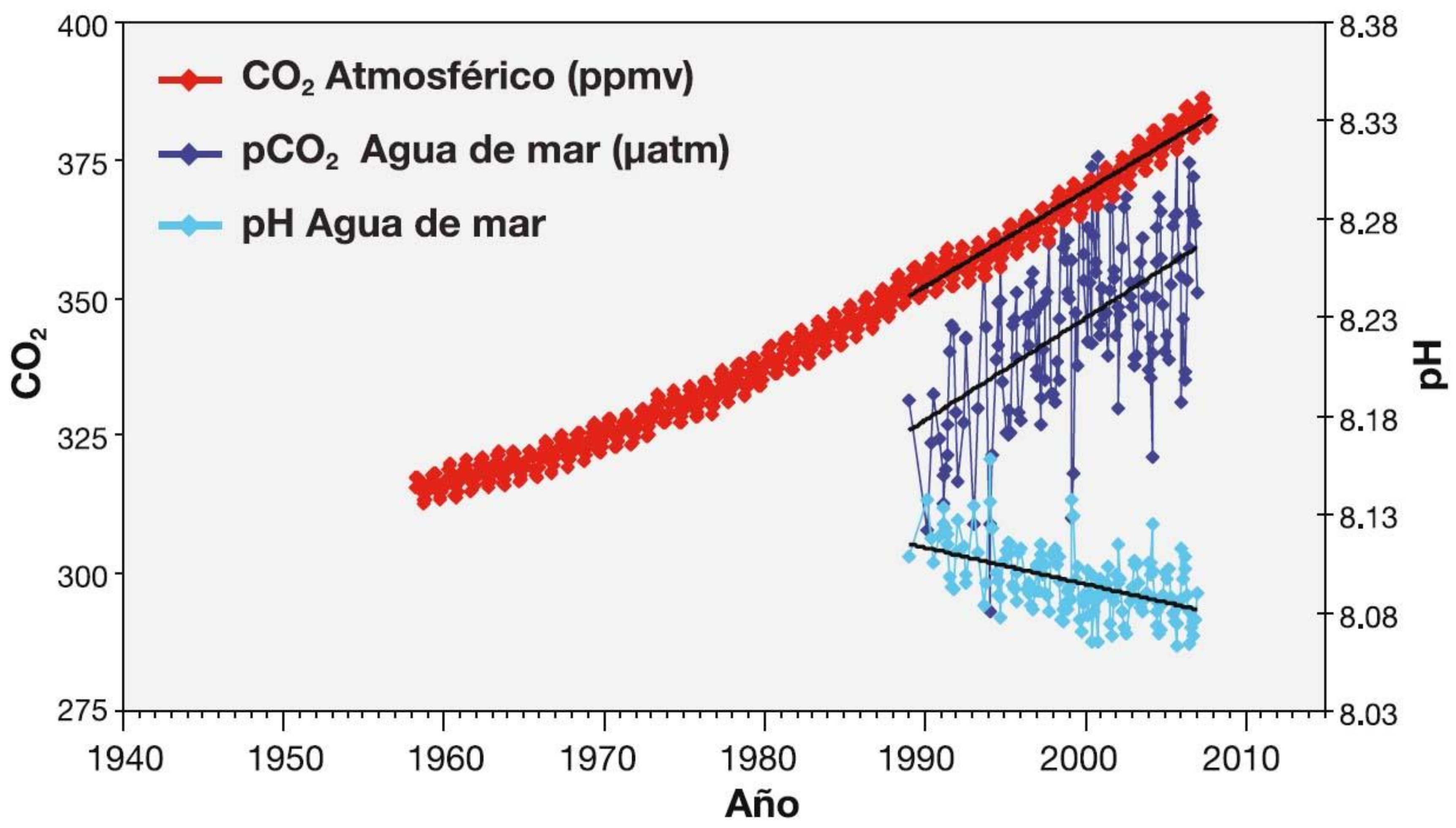
(disolución CO_2)

Acidificación del océano



Cambio **rápido** e **irreversible** a escala humana





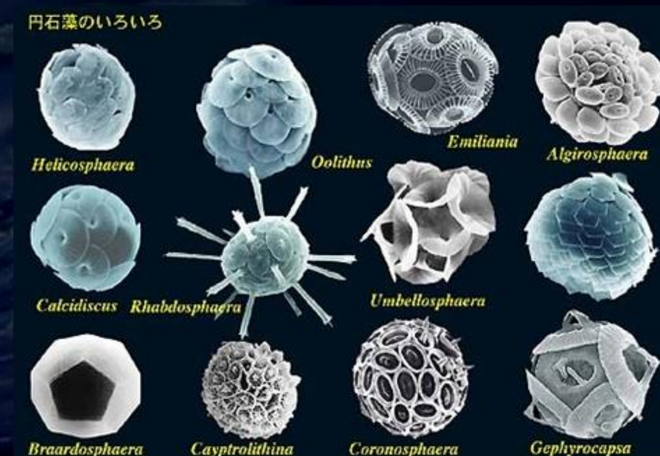
Datos de pCO_2 atmosférico: Dr. Pieter Tans, NOAA/ESRL

Datos HOTS/Aloha: Dr. David Karl, University of Hawaii (modificado de Feely, 2008)

- CO_2 is corrosive to the shells and skeletons of many marine organisms

Corals

Calcareous plankton



Organisms	**Photosynthetic or non-photosynthetic**	**Form of calcium carbonate**	**Habitat**
Foraminifera	Some photosynthetic	Calcite	Benthic
	Non-photosynthetic	Calcite	Planktonic
Coccolithophores	Photosynthetic	Calcite	Planktonic
Macroalgae*	Photosynthetic	Aragonite or calcite	Benthic
Corals: warm water	Photosynthetic	Aragonite	Benthic
cold water	Non-photosynthetic	Aragonite	Benthic
Pteropod molluscs	Non-photosynthetic	Aragonite	Benthic
Non-pteropod molluscs*	Non-photosynthetic	Aragonite + calcite	Benthic or Planktonic
Crustaceans*	Non-photosynthetic	Calcite	Benthic or Planktonic
Echinoderms	Non-photosynthetic	Calcite	Benthic

**Not all members of the group are calcified.*

$$CaCO_3\,(s) \longrightarrow Ca^{++} + CO_3^{=}$$

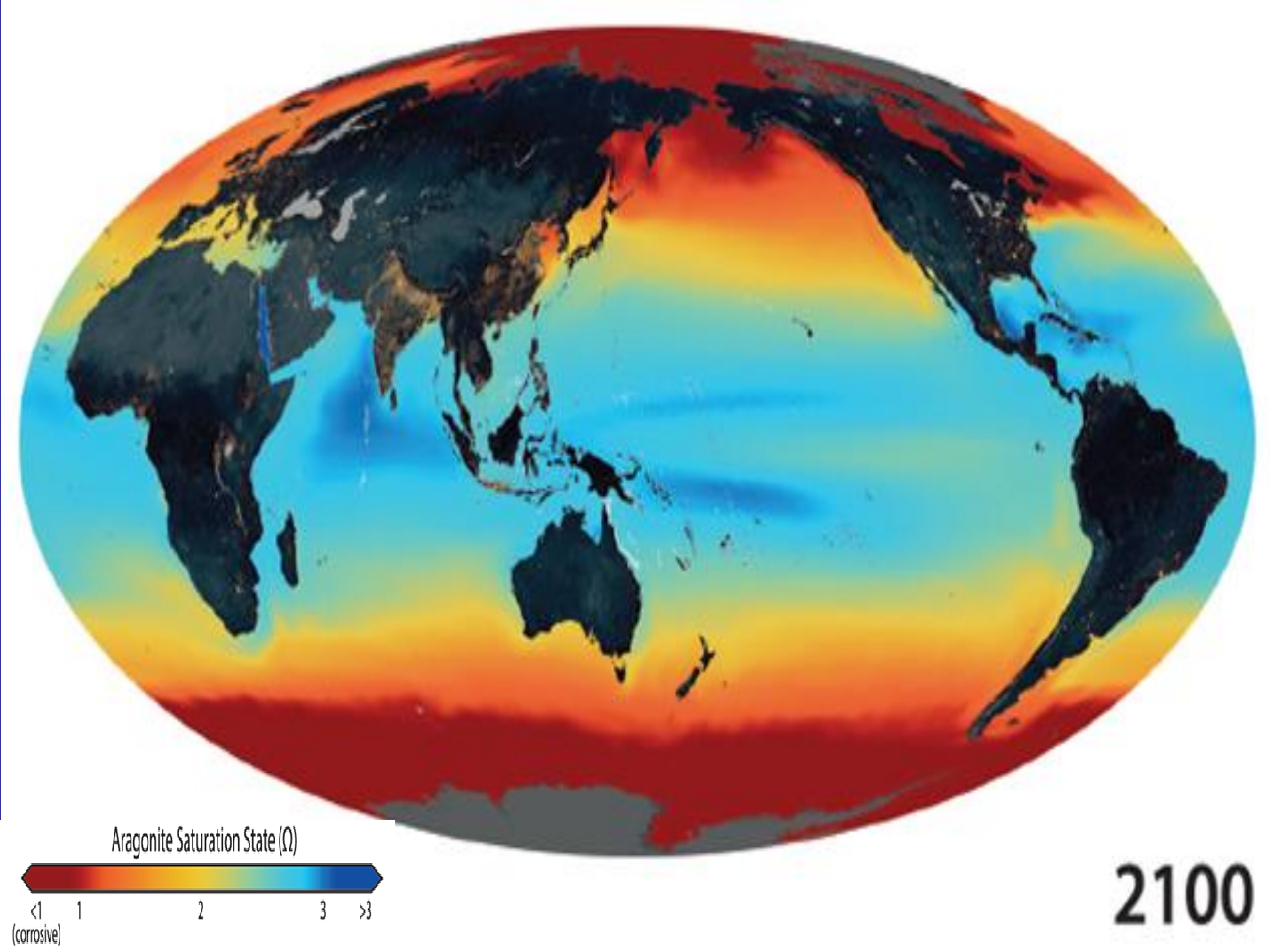
$$Kps \;=\; [Ca^{++}]\,x\,[Co_3^{=}]$$

$$Omega \;=\; \frac{[Ca^{++}]\,x\,[Co_3^{=}]}{Kps}$$

Omega = 1, Saturación

Omega < 1, sub-Saturación

Omega > 1, sobre-Saturación


Aragonite Saturation State (Ω)
<1
1
2
3
>3
(corrosive)
2100

Oecologia
DOI 10.1007/s00442-015-3459-3
CrossMark
PLANT-MICROBE-ANIMAL INTERACTIONS - ORIGINAL RESEARCH

Ocean acidification induces changes in algal palatability and herbivore feeding behavior and performance

Cristian Duarte[1,2] · Jorge López[3] · Samanta Benítez[1,2,4] · Patricio H. Manríquez[5] · Jorge M. Navarro[3] · Cesar C. Bonta[3] · Rodrigo Torres[6] · Pedro Quijón[7]

Vol. 514: 87–103, 2014
doi: 10.3354/meps10951
MARINE ECOLOGY PROGRESS SERIES
Mar Ecol Prog Ser
Published November

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],

Vol. 502: 157–167, 2014
doi: 10.3354/meps10703
MARINE ECOLOGY PROGRESS SERIES
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Published April 1

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],

ELSEVIER
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],

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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],

ELSEVIER
Chemosphere
journal homepage: www.elsevier.com/locate/chemosphere

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

Jorge M. Navarro [a,*], Rodrigo Torres [b], Karin Acuña [a], Cristian Duarte [a,f], Patricio H. Manriquez [a],

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Biologists

RESEARCH ARTICLE

Effects of elevated carbon dioxide and temperature on locomotion and the repeatability of lateralization in a keystone marine mollusc

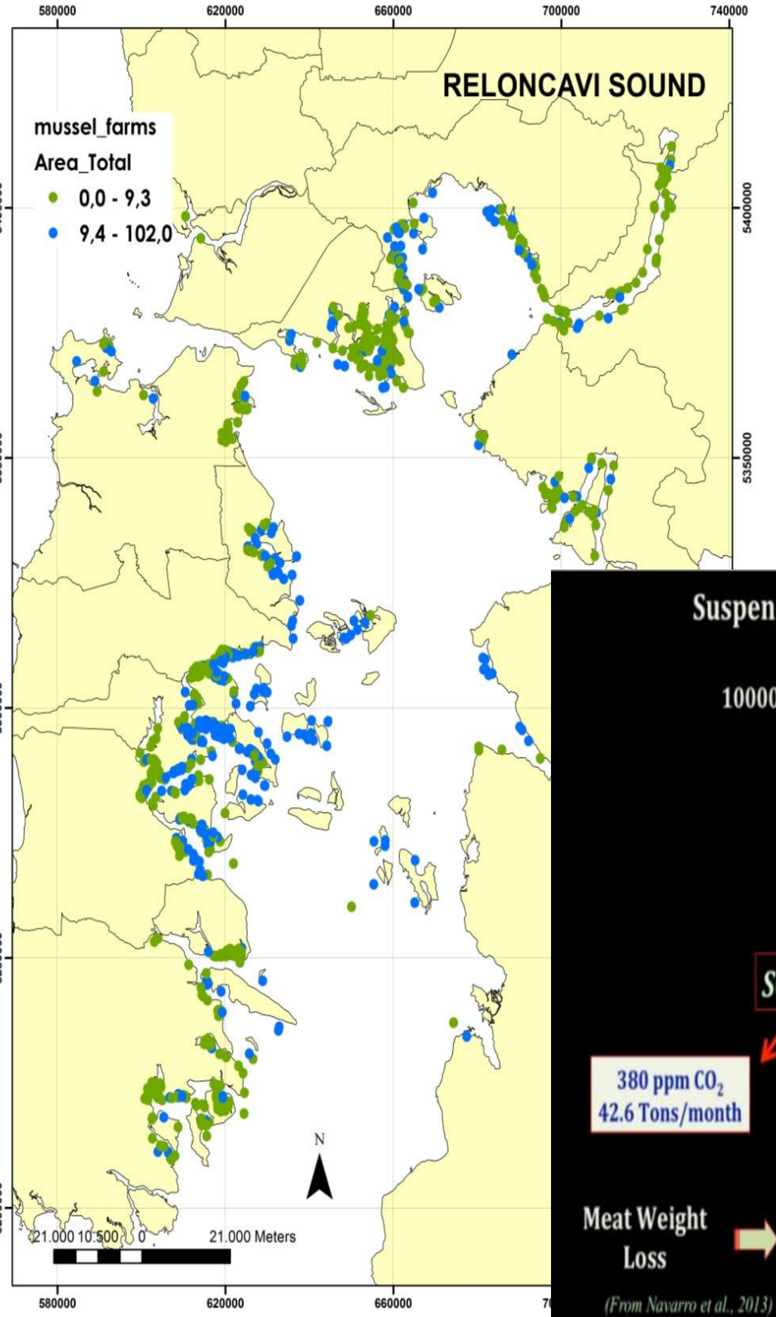
Paolo Domenici[1,*], Rodrigo Torres[2,3] and Patricio H. Manríquez[4]

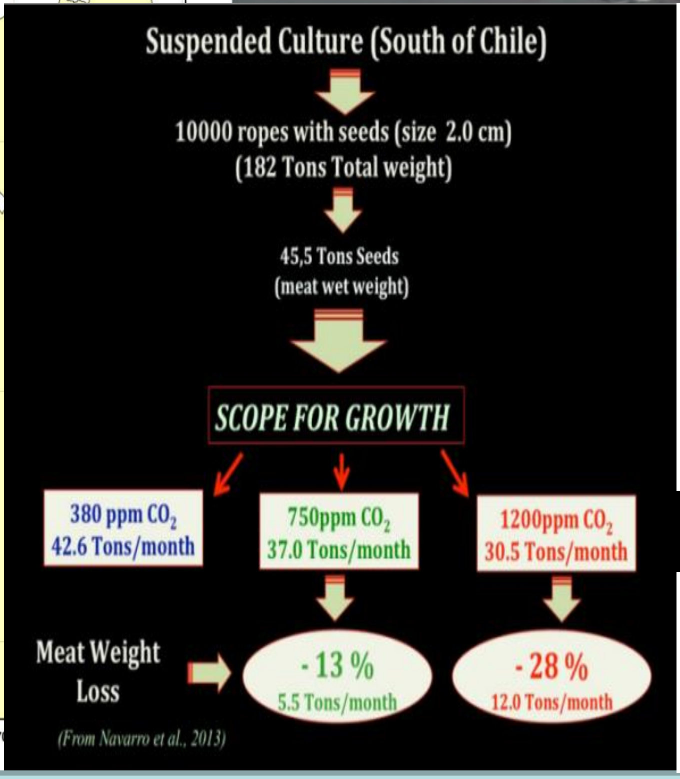
Contribution to Special Issue: 'Towards a Broader Perspective on Ocean Acidification Research'

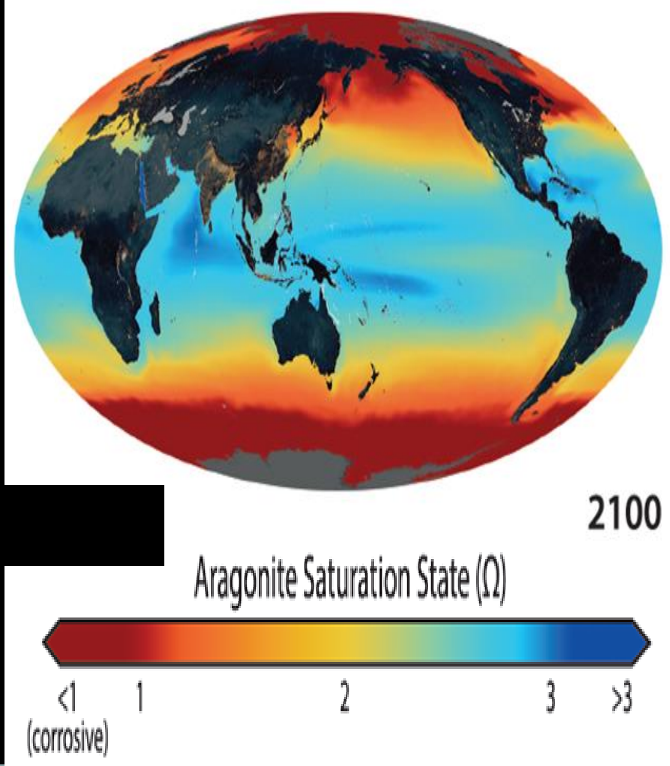
Original Article

Ocean warming and elevated carbon dioxide: multiple stressor impacts on juvenile mussels from southern Chile

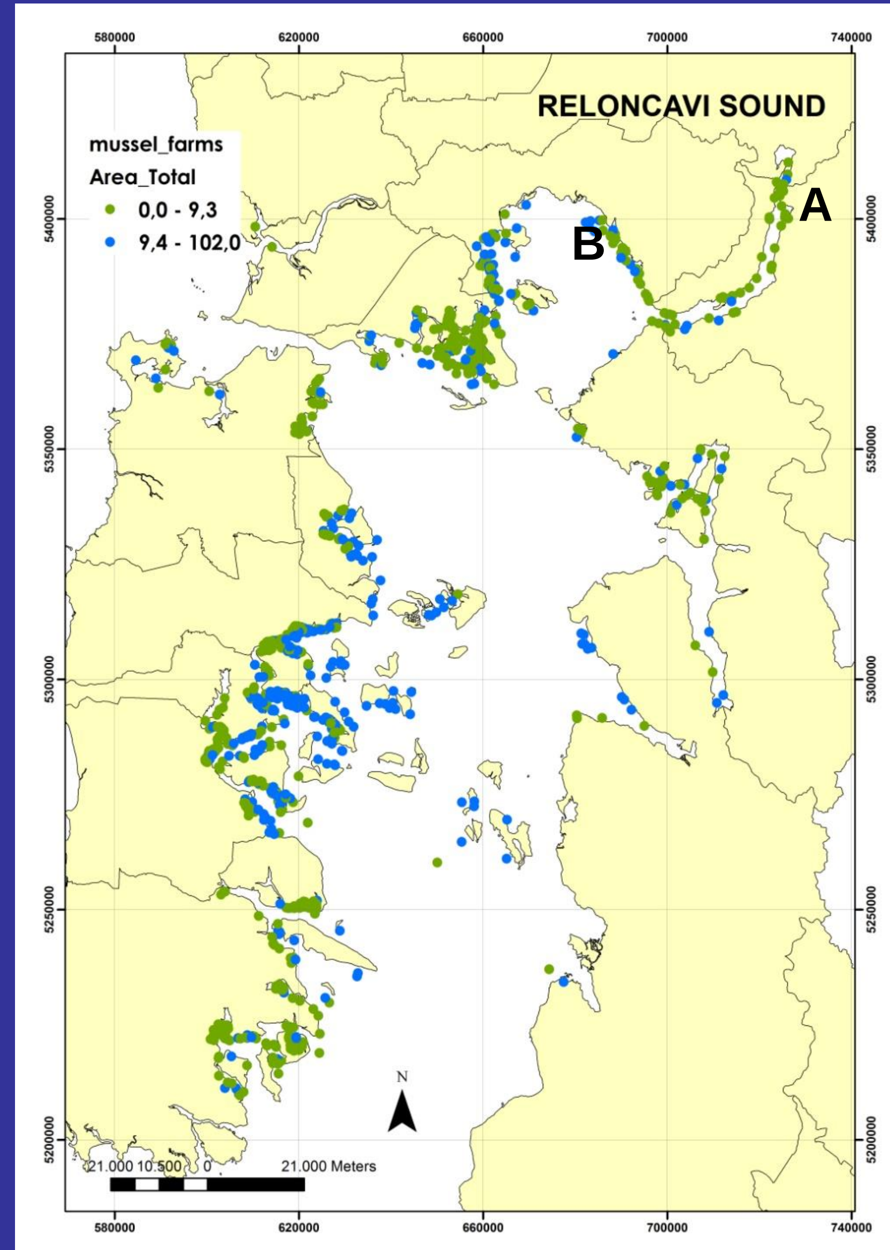
Jorge M. Navarro[1,2*], Cristian Duarte[3,4], Patricio H. Manríquez[5], Marco A. Lardies[6], Rodrigo Torres[7],





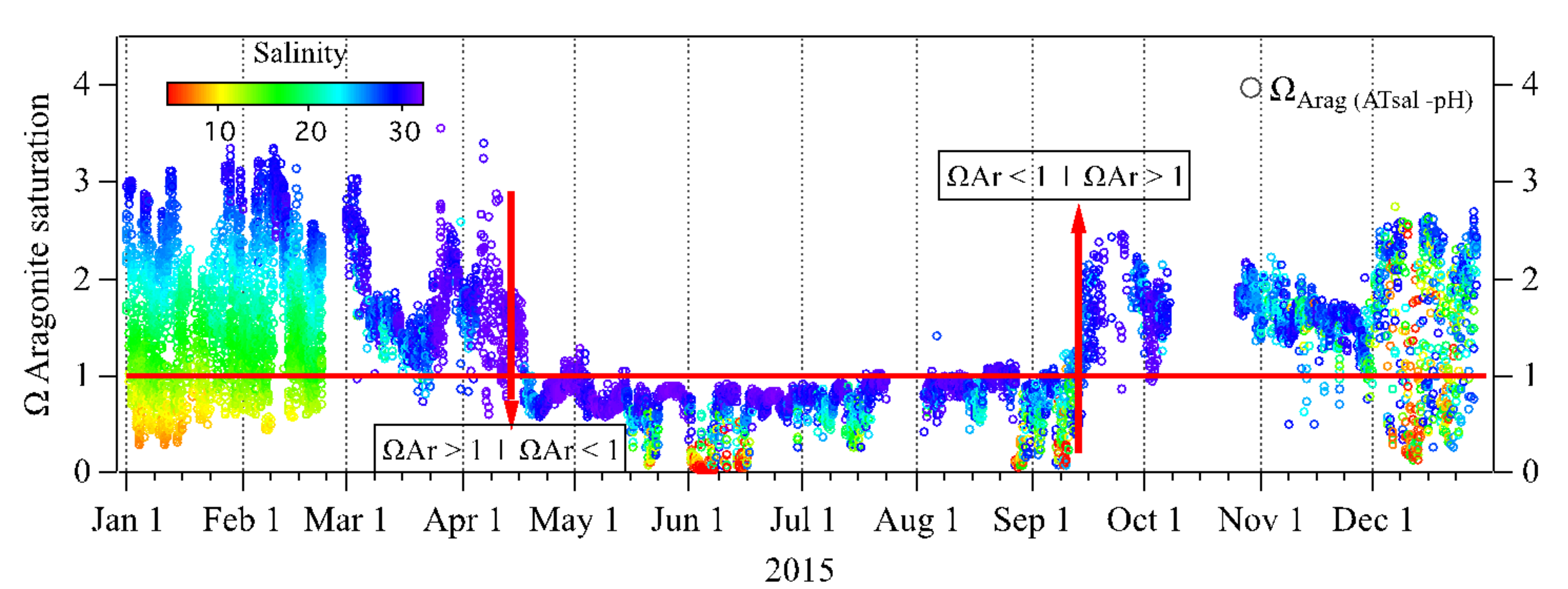


Navarro et al., 2013 (Chemosphere)



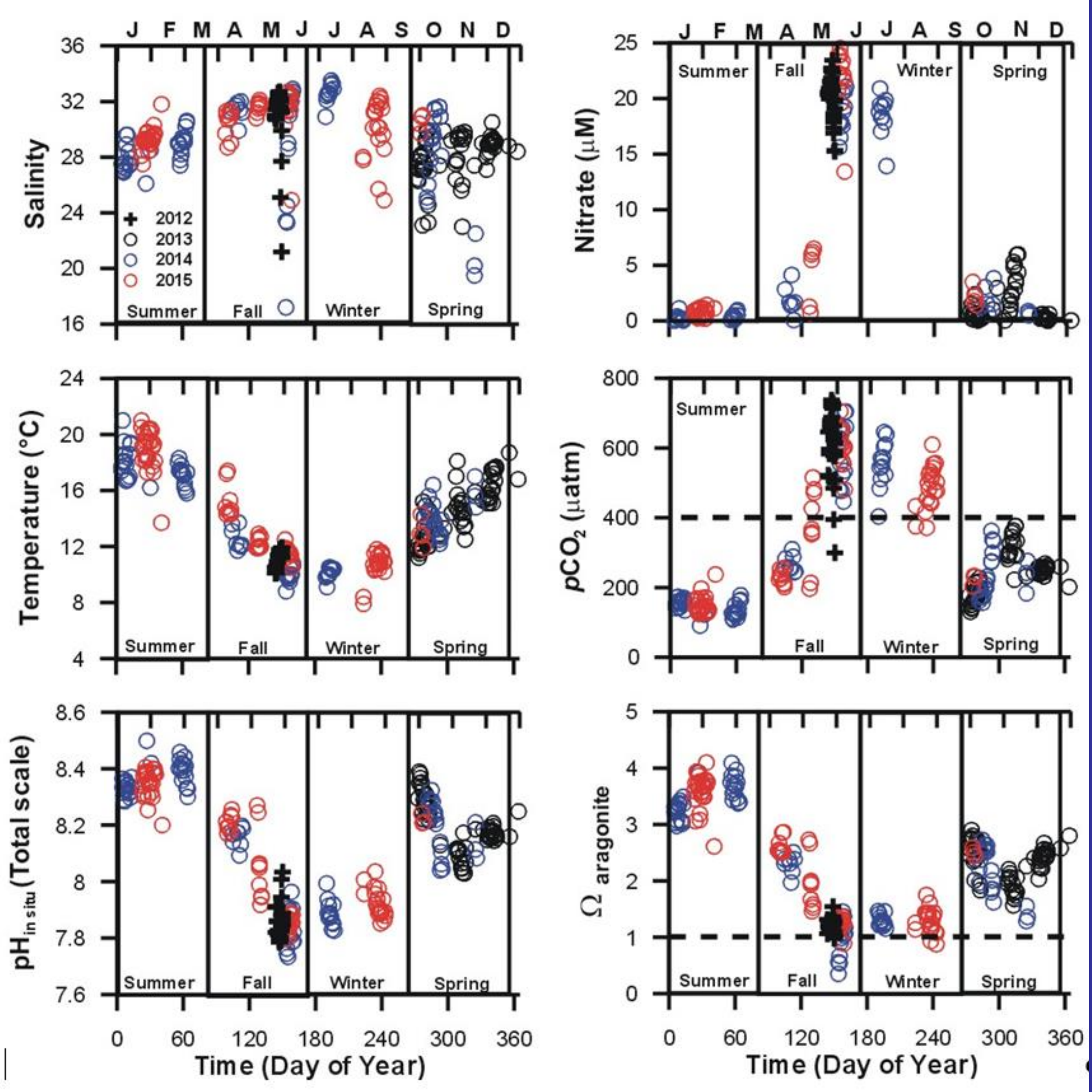
Torres et al. in prep.

A



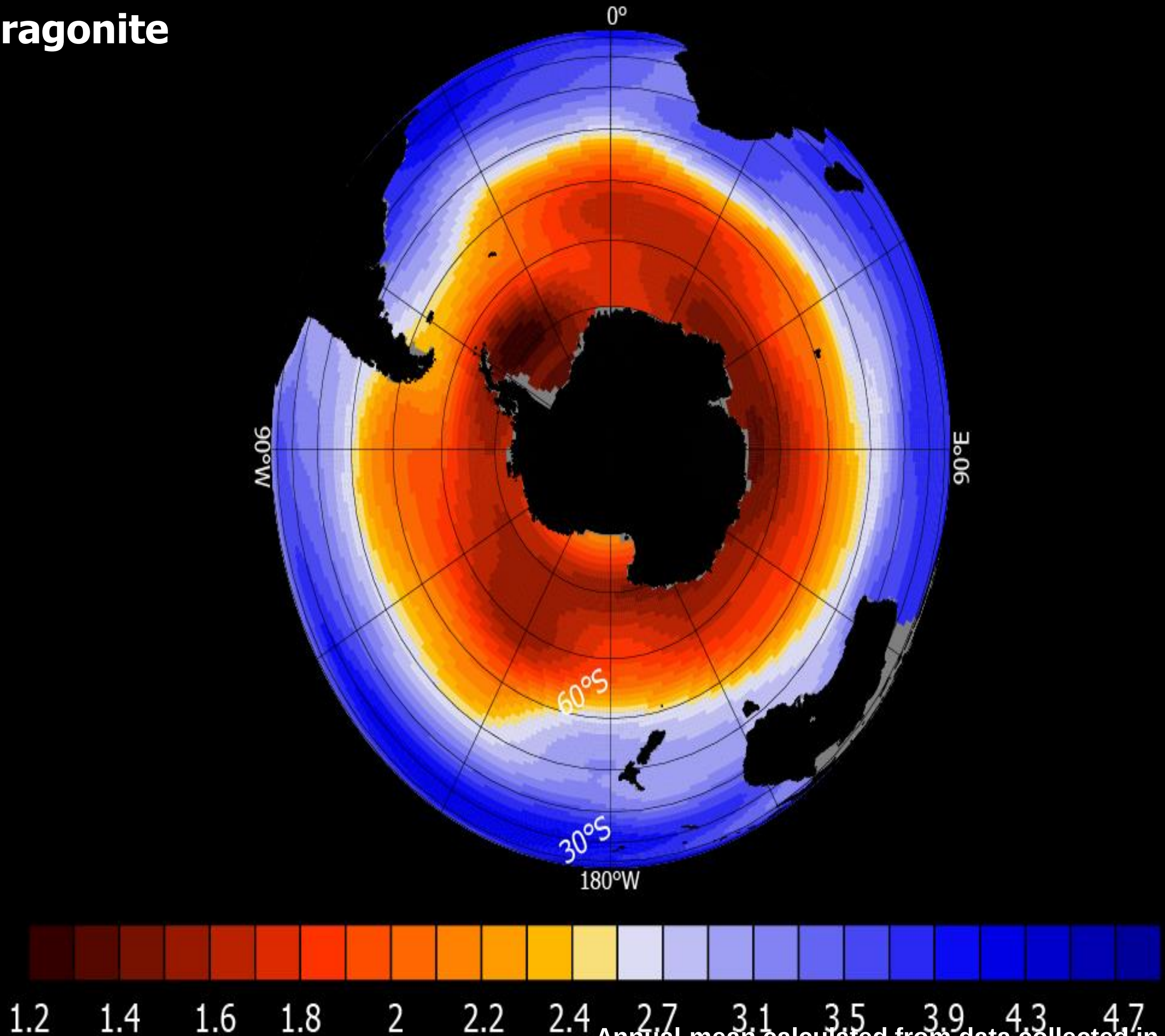
Jara et al., MS

B

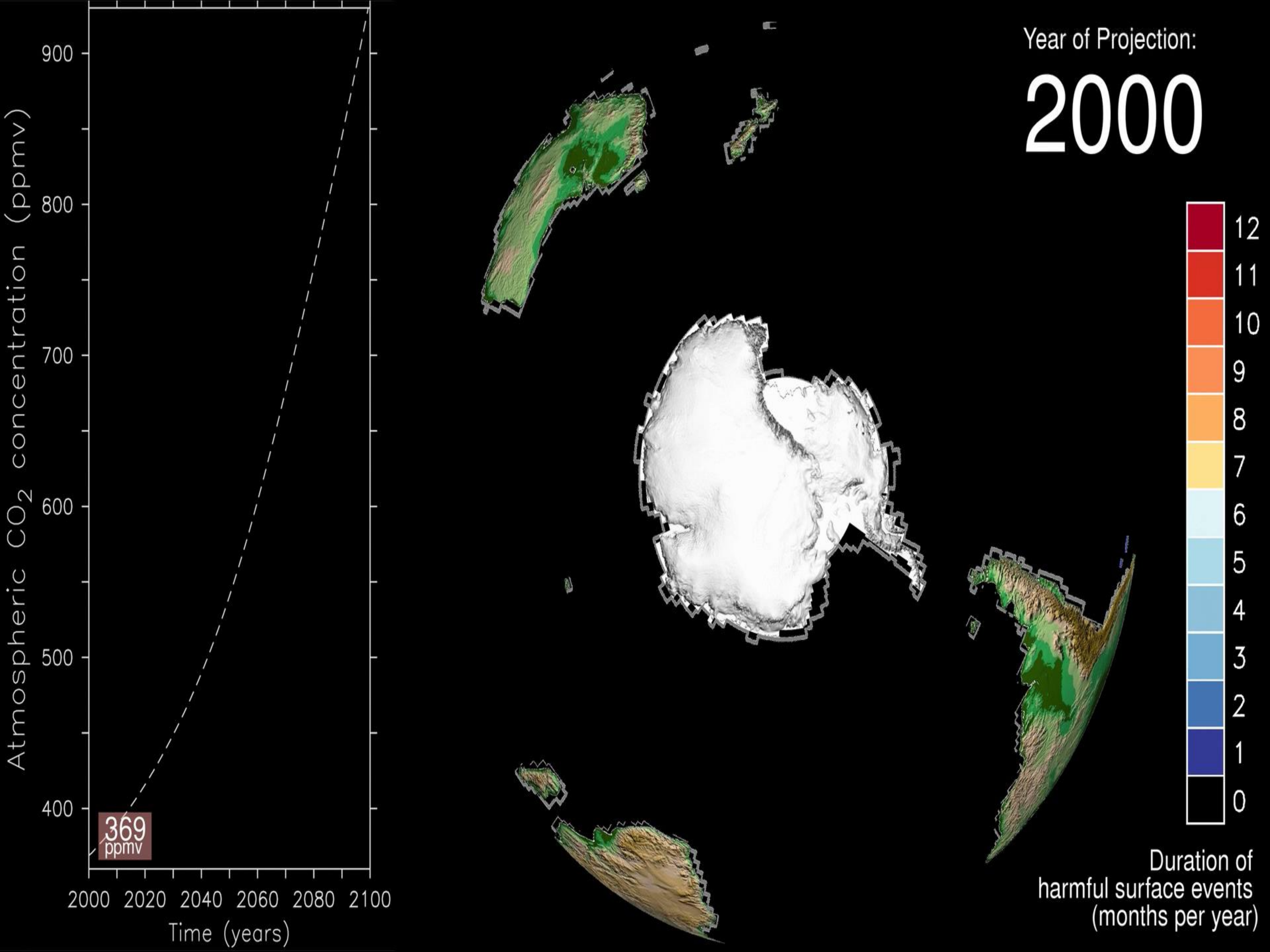


Alarcon et al., MS

$\Omega_{aragonite}$



Annual mean calculated from data collected in the 1990s, Key et


Atmospheric CO_2 concentration (ppmv)
900
800
700
600
500
400
369 ppmv
2000
2020
2040
2060
2080
2100
Time (years)
Year of Projection:
2000
12
11
10
9
8
7
6
5
4
3
2
1
0
Duration of harmful surface events (months per year)

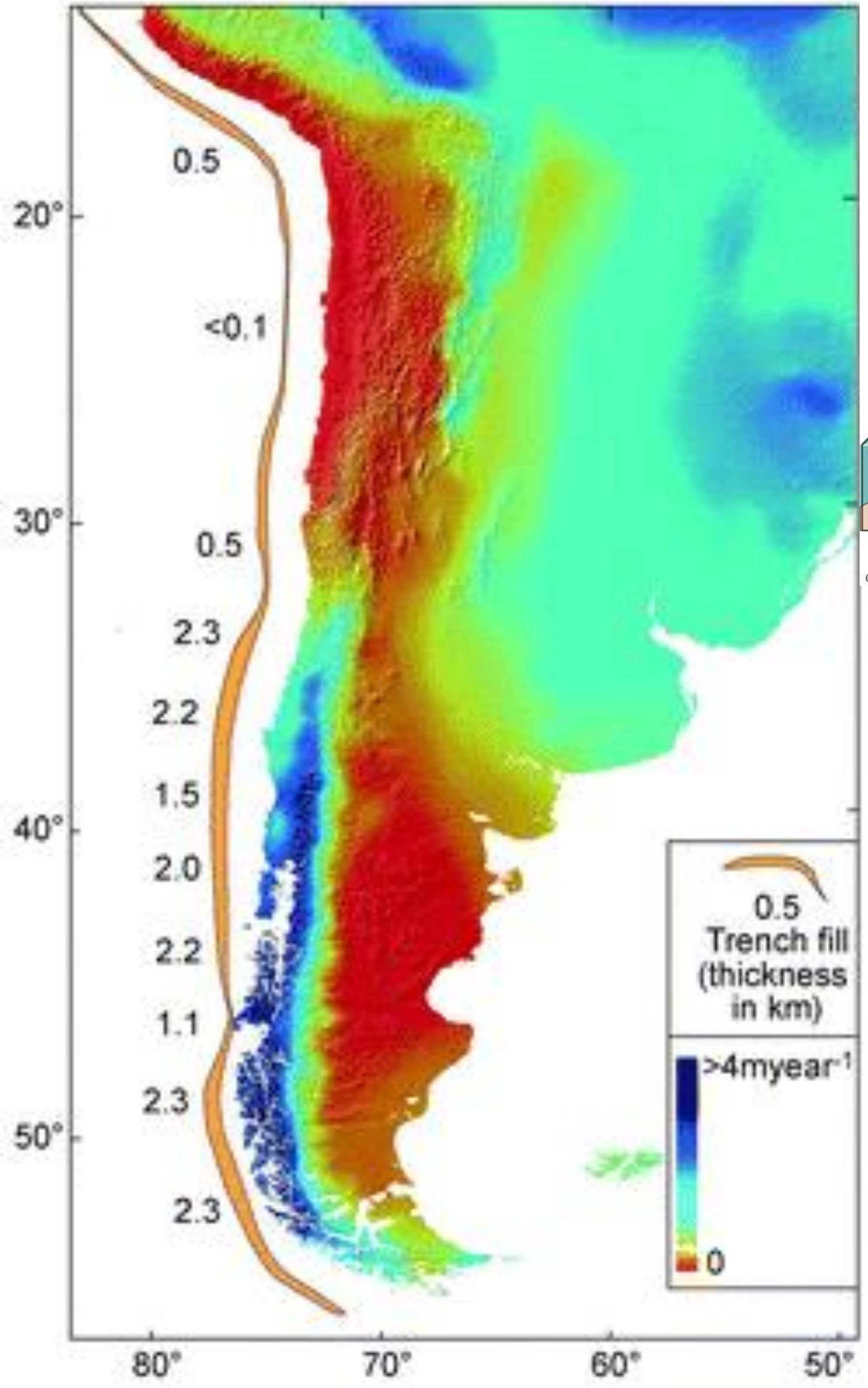
Las malas noticias

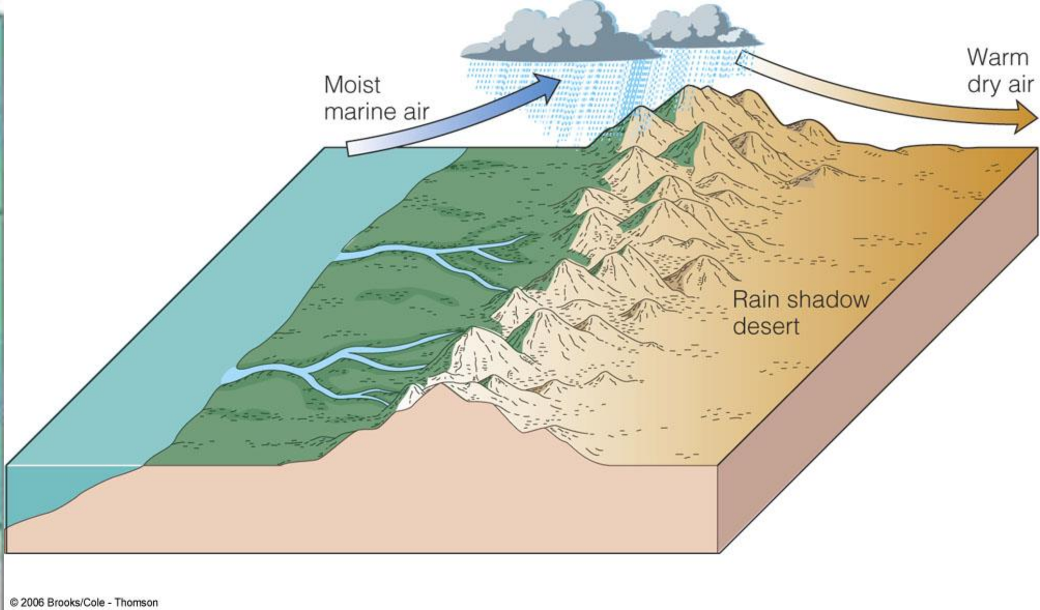
La acidificación del océano pude interaccionar con otros procesos y potenciarse.

¿Cuales lugares son particularmente vulnerables?

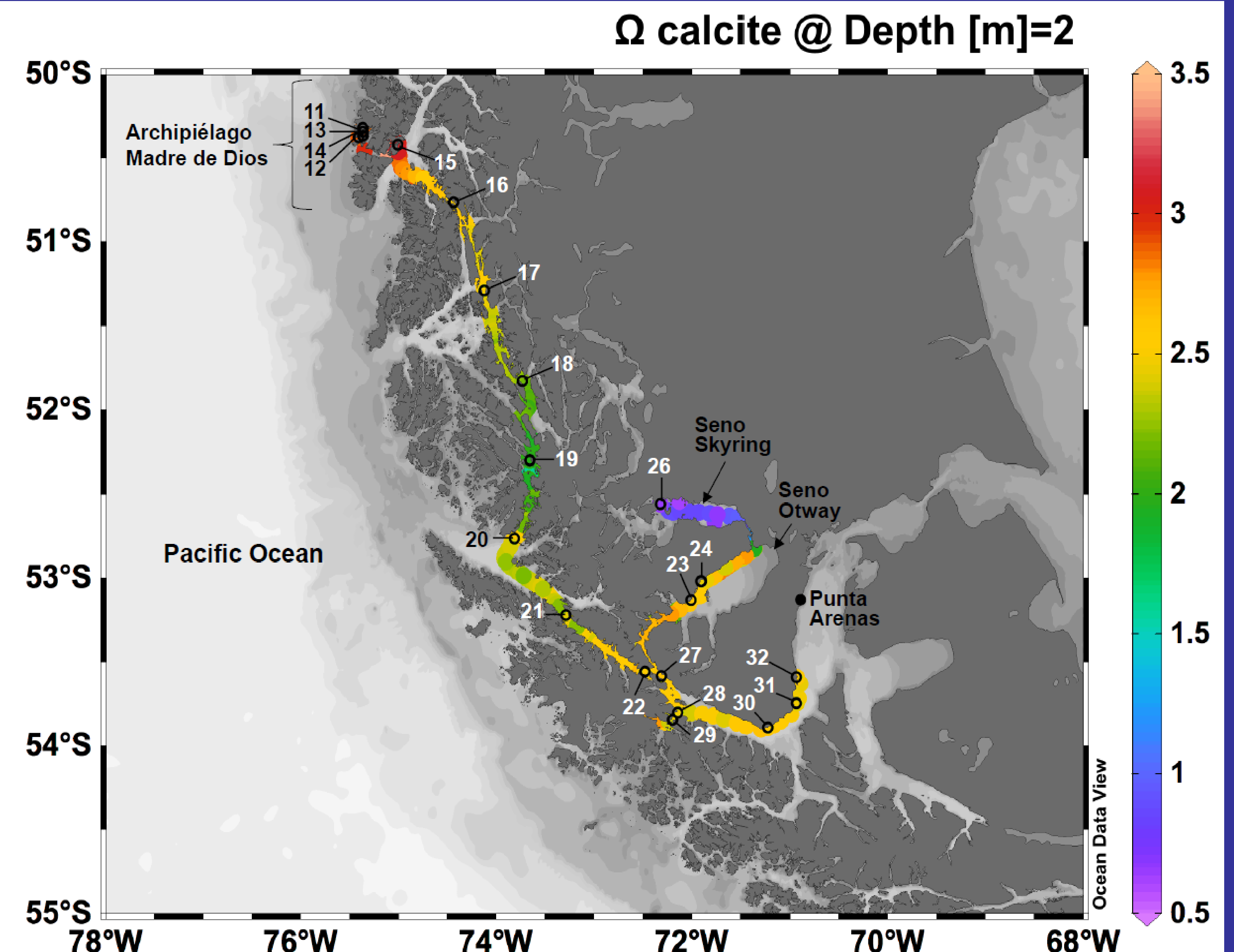
Aquellos donde el agua marina se diluye con aguas continentales.

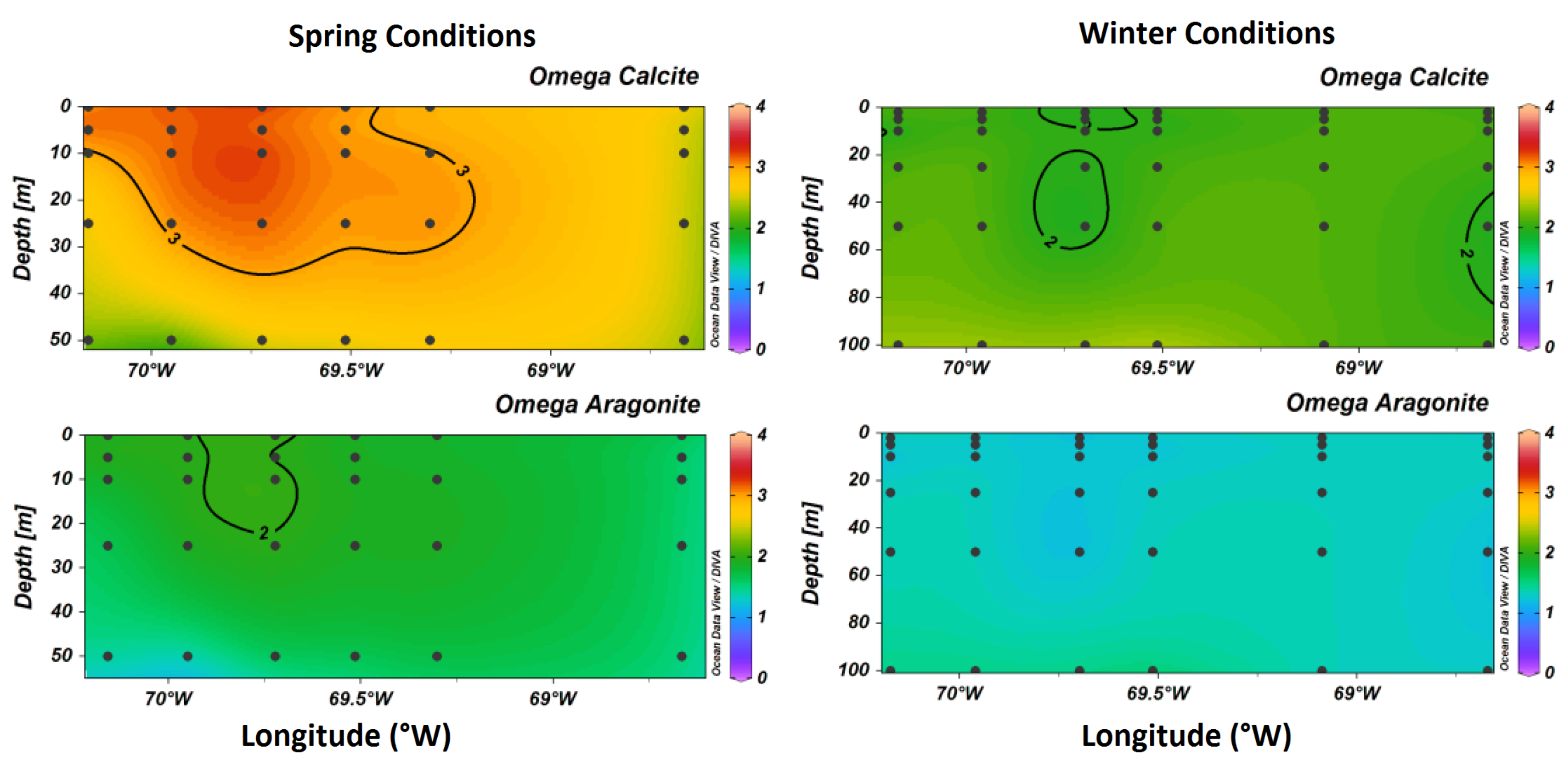
Los estuarios!





la Patagonia es vulnerable
a la acidificación del océano


Ω calcite @ Depth [m]=2
50°S
51°S
52°S
53°S
54°S
55°S
78°W
76°W
74°W
72°W
70°W
68°W
Archipiélago
Madre de Dios
11
13
14
12
15
16
17
18
19
20
21
22
23
24
26
27
28
29
30
31
32
Seno
Skyring
Seno
Otway
Punta
Arenas
Pacific Ocean
Ocean Data View
3.5
3
2.5
2
1.5
1
0.5



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Gracias

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