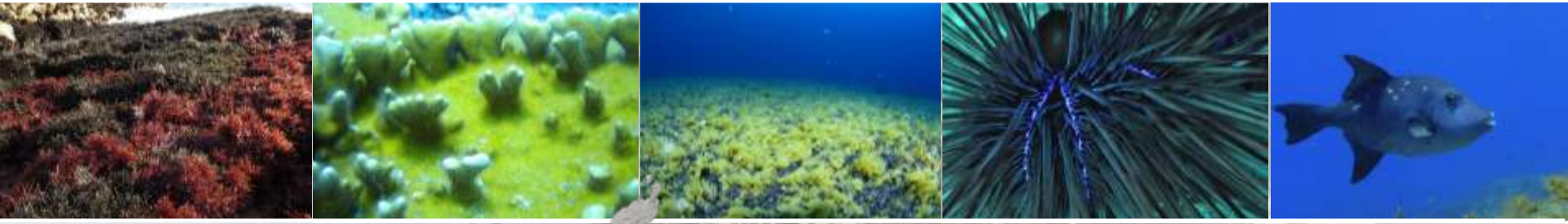
Efectos del cambio climático en el medio marino de las islas Canarias

José Carlos Hernández

Dpto. Biología Animal, Edafología y Geología
Universidad de La Laguna
Tenerife



Madrid, Mayo 2016

Universidad de La Laguna
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Efectos del cambio climático en el medio marino de las islas Canarias

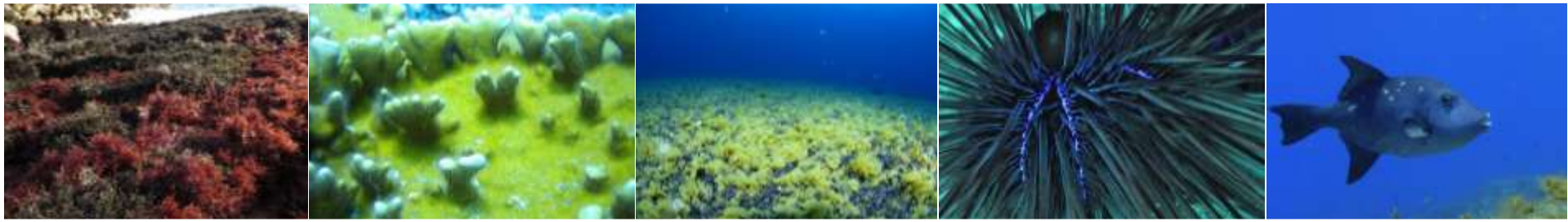
GUIÓN

1. Cambios recientes a nivel físico-químico.

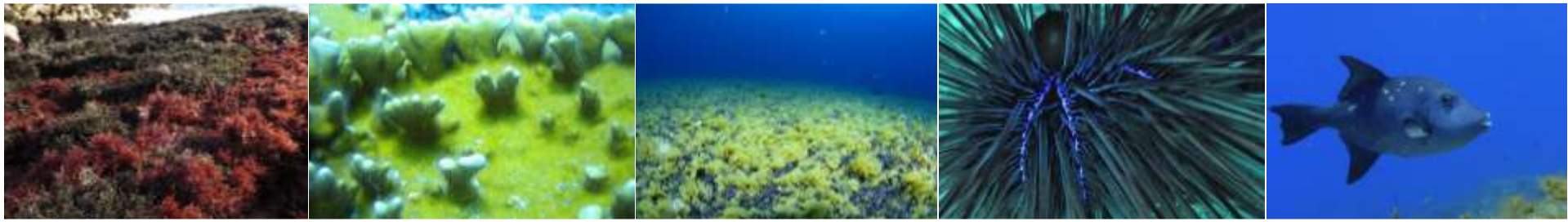
2. Tropicalización de la biota: aparición de nuevas especies.

3. Efectos sobre las poblaciones residentes: ganadores y perdedores.

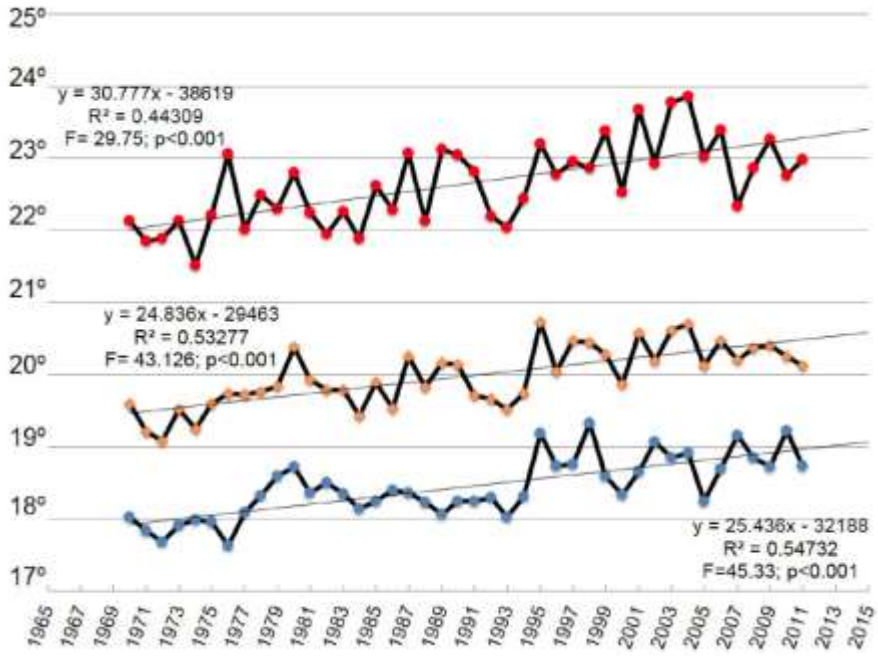
4. Acciones para mitigar los efectos negativos a nivel local.



1. Cambios recientes a nivel físico-químico.



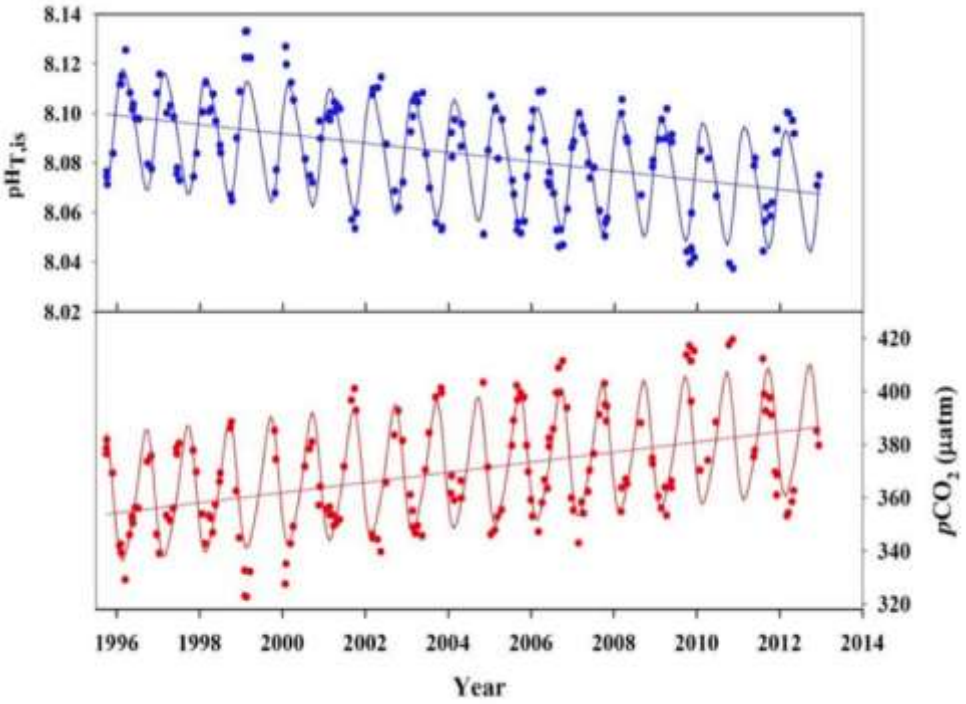
Calentamiento



0,25-0,5 °C década

Últimos 40 años

Acidificación

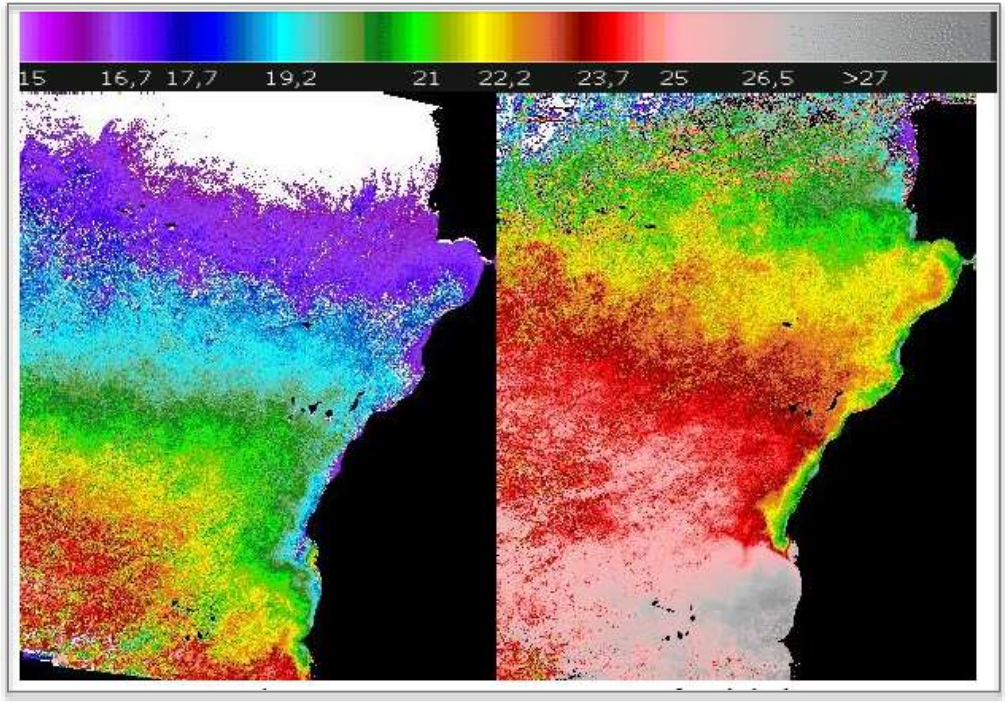


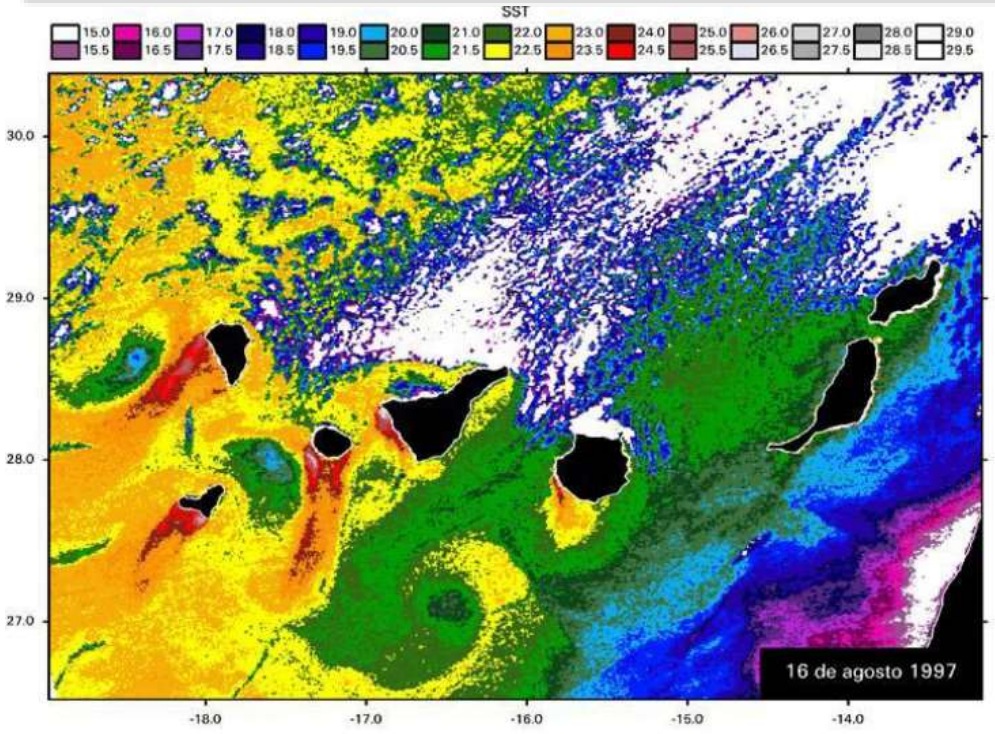
0,01 pH década

Últimos 25 años

Hernández, 2015 ; Santana-Casiano & González-Dávila, 2015; Vélez-Belchí et al., 2015

Canarias, vigía del Atlántico.

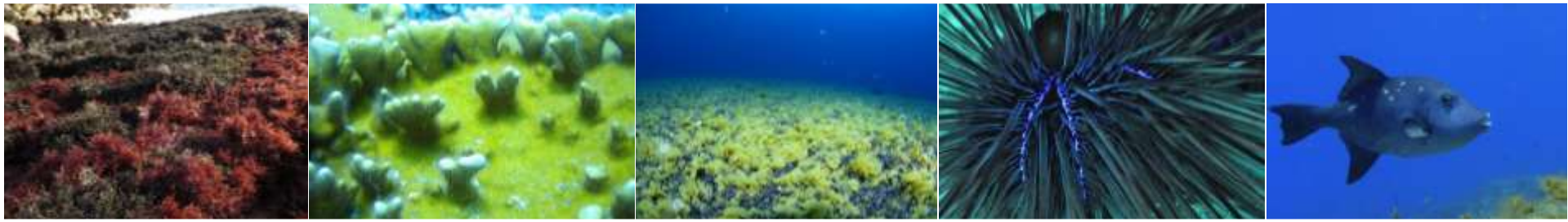




SAT Union System, ULPG

Sinergias importantes.

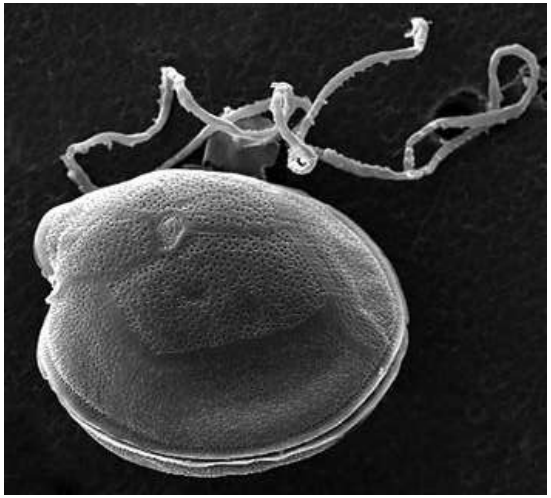
2. Tropicalización de la biota: aparición de nuevas especies.



Cianobacterias

Trichodesmium erythraeum

Dinoflagelado



Gambierdiscus toxicus

Microorganismos

Ramos et al., 2005; Pérez-Arellano et al., 2005

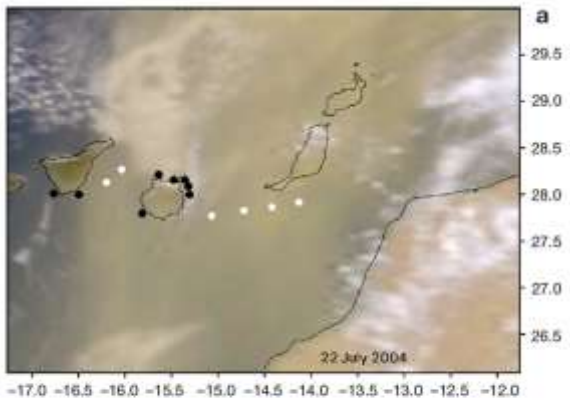
Vol. 301: 303–305, 2005 | MARINE ECOLOGY PROGRESS SERIES Mar Ecol Prog Ser | Published October 11

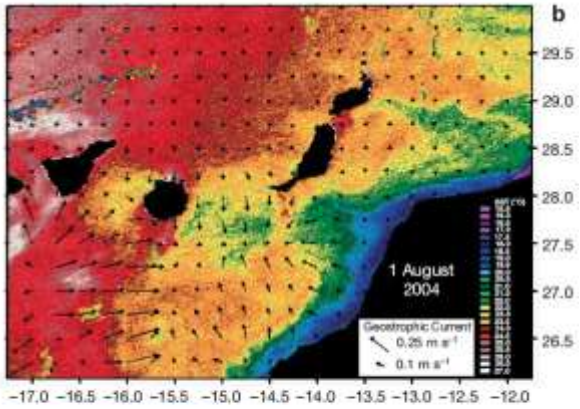
NOTE

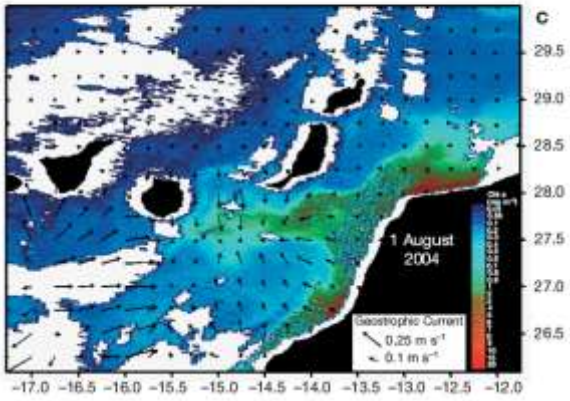
Bloom of the marine diazotrophic cyanobacterium *Trichodesmium erythraeum* in the Northwest African Upwelling

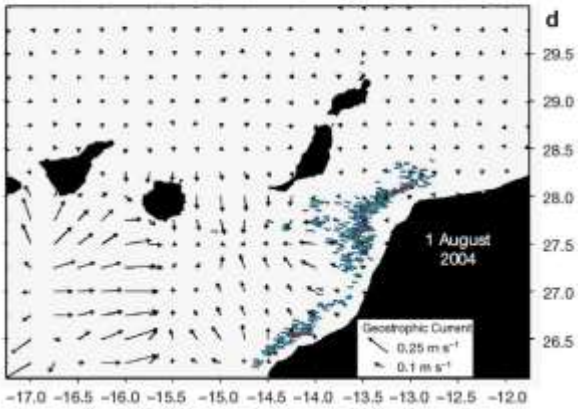
Antonio G. Ramos[1,*], Antera Martel[2], Geoffrey A. Codd[3], Emilio Soler[2], Josep Coca[1], Alex Redondo[1], Louise F. Morrison[3], James S. Metcalf[3], Alicia Ojeda[4], Sonia Suárez[2], Michel Petit[5]

OrbView-2 SeaWIFS







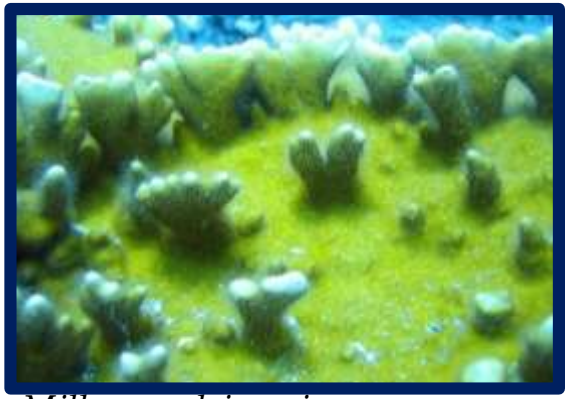


Caulerpa racemosa var. *cylindracea*

Pseudotetraspora marina

Macroalgas

Micromelo undatum



Millepora alcicornis

Invertebrados

Gnatholepis thomsoni

Canthidermis sufflamen

Peces

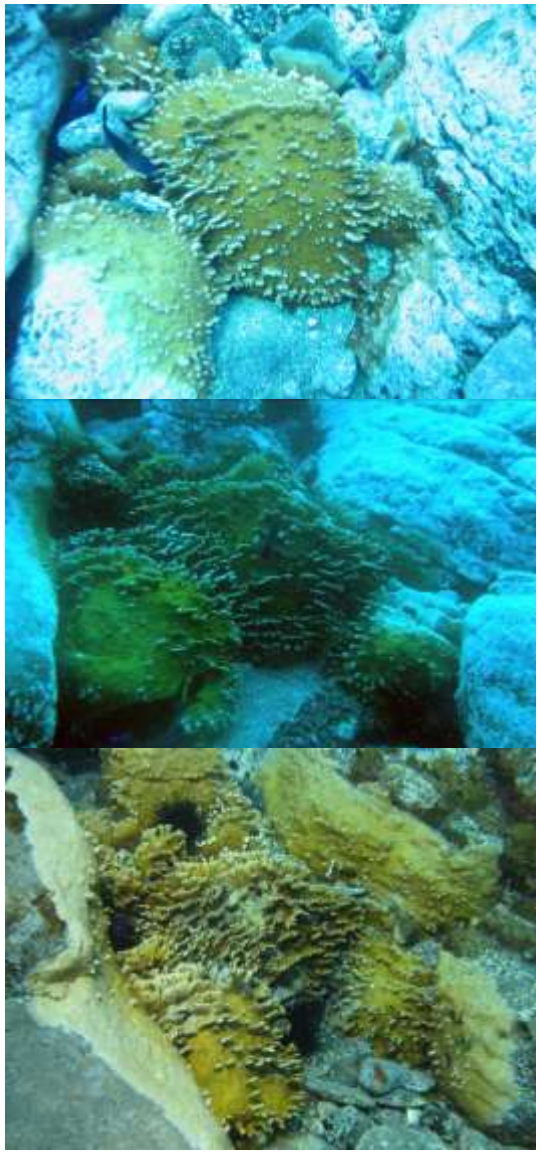
Brito et al., 1995; Verlaque et al., 2004 ; Brito et al., 2006; Brito, 2008; Clemente et al., 2011; Sangil et al., 2012

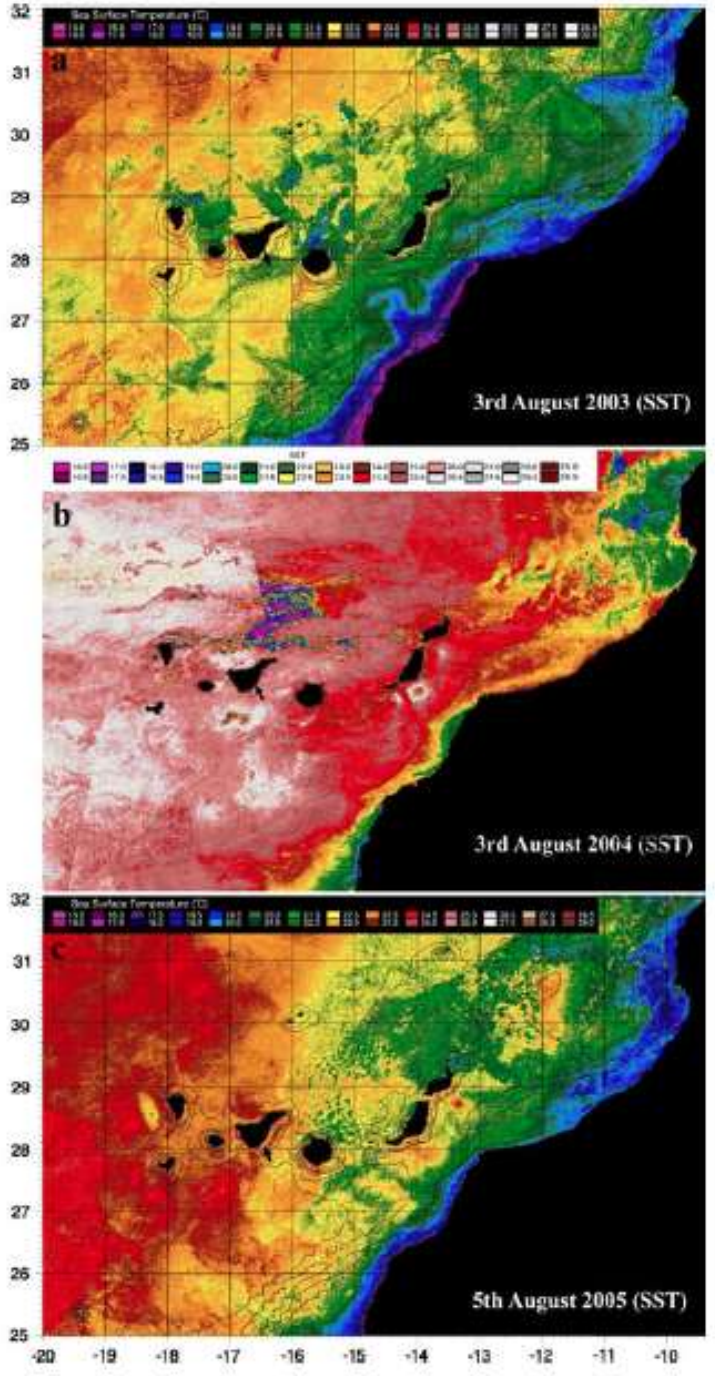
Coral Reefs (2011) 30:237–240
DOI 10.1007/s00338-010-0681-7

NOTE

On the occurrence of the hydrocoral *Millepora* (Hydrozoa: Milleporidae) in the subtropical eastern Atlantic (Canary Islands): is the colonization related to climatic events?

S. Clemente · A. Rodríguez · A. Brito · A. Ramos · Ó. Monterroso · J. C. Hernández





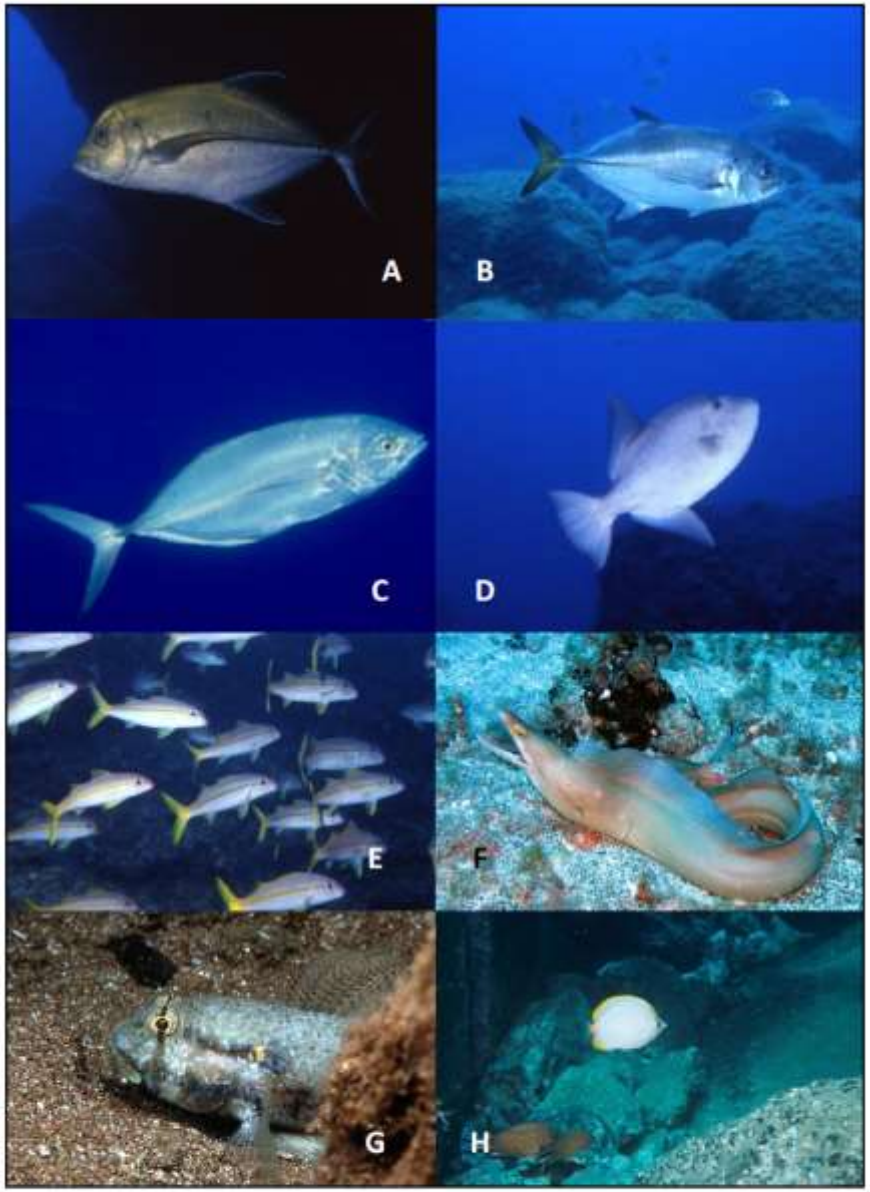


Lámina 7. Diferentes especies de peces implicados en el proceso de tropicalización. A: *Caranx lugubris*; B: *Caranx latus*; C: *Caranx crysos*; D: *Canthidermis sufflamen*; E: *Mulloidichthys martinicus*; F: *Gymnothorax vicinus*; G: *Gnatholepis thompsoni*; H: *Chaetodon sanctaehelenae*. Autoría de las fotos: P. Wirtz (F), C.L. Hernández-González (G) y J.M. Falcón (A, B, C, D, E y H).

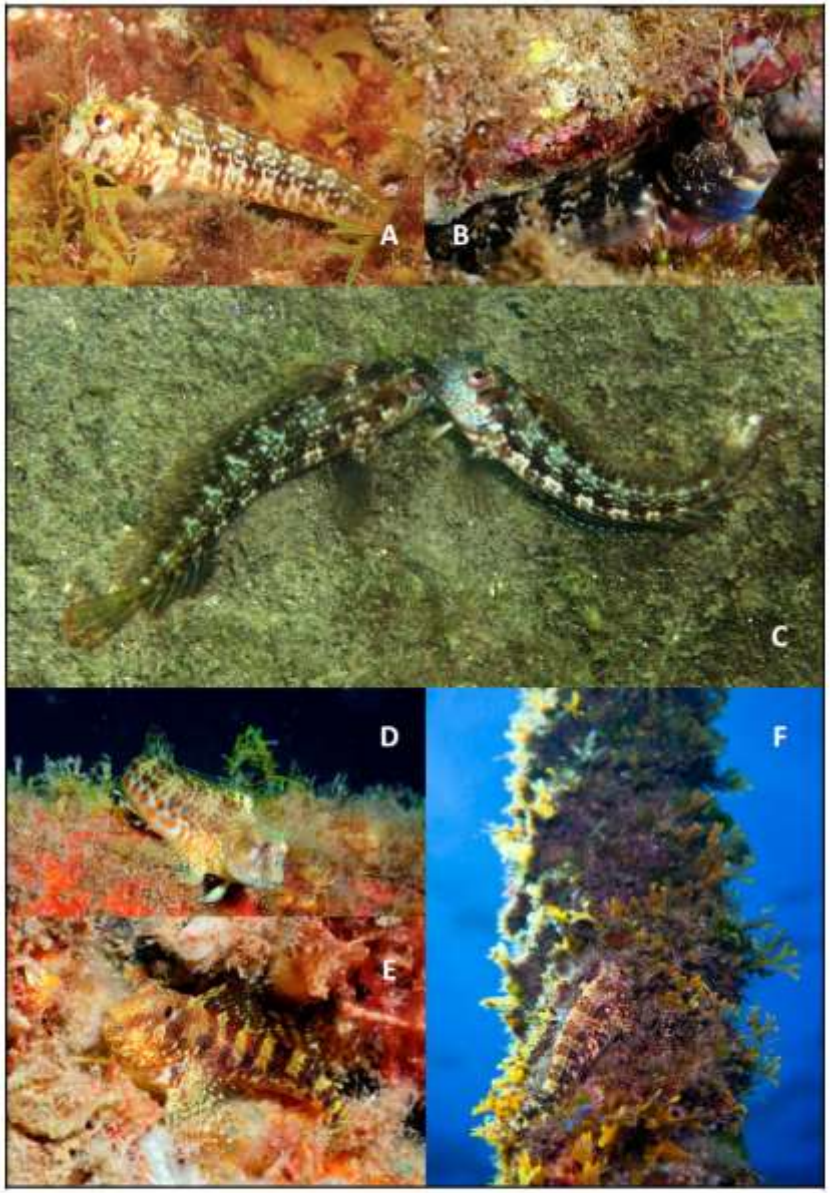


Lámina 8. Dos especies de blénidos implicados en el proceso de tropicalización. A y B. hembra y macho (éste cuidando puesta) respectivamente de *Parablennius goreensis*; C: machos de la misma especie peleando; D y E: macho y hembra respectivamente de *Hypleurochilus pseudoaquipinnis*; F: ejemplar de esta última especie sobre cabo de fondeo de una boya de amarre. Tomado de Falcón *et al.* (2015).

Falcón, 2015

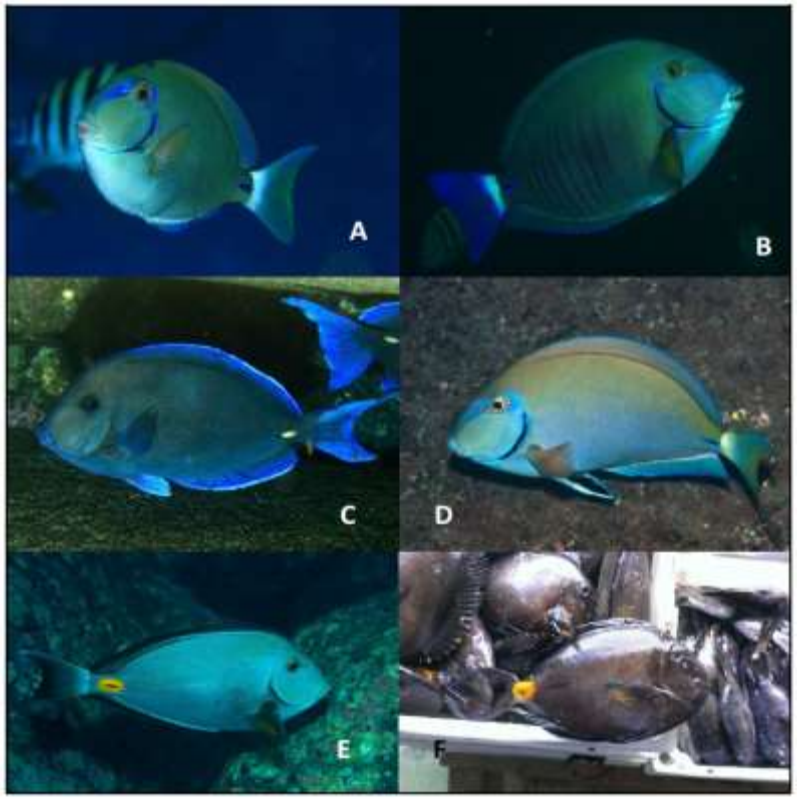


Lámina 9. Diferentes especies de acantúridos implicados en el proceso de tropicalización. A: *Acanthurus bahianus*; B: *Acanthurus chirurgus*; C: *Acanthurus coeruleus*; D: *Acanthurus tractus*; E: *Acanthurus monroviae*; F: captura de *Acanthurus monroviae* en Gran Canaria. Tomado de Falcón *et al.* (2015).

Lámina 10. Diferentes especies de peces implicados en el proceso de tropicalización. *Abudefduf hoefleri*; B: *Abudefduf sordidus*; C: *Chromis multilineata*; D: captura de *Paranthias furcifer* y *Kyphosus* sp. en el puerto de Las Palmas de Gran Canaria; E: *Cephalopholis cf. cruentata* capturado junto a *Epinephelus marginatus*; F: *Pomacanthus paru*; G: *Chaetodontoplus septentrionalis*. Tomado de Falcón *et al.* (2015).

Falcón, 2015

Brito et al., 2005; Falcón et al., 2015; Falcón, 2015

Biol Invasions (2011) 13:2185–2189
DOI 10.1007/s10530-011-0049-0

INVASION NOTE

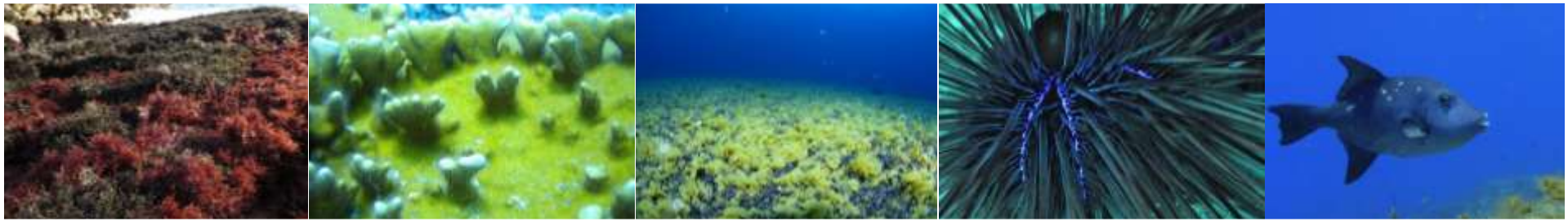
On the occurrence of the African hind, *Cephalopholis taeniops*, in the Canary Islands (eastern subtropical Atlantic): introduction of large-sized demersal littoral fishes in ballast water of oil platforms?

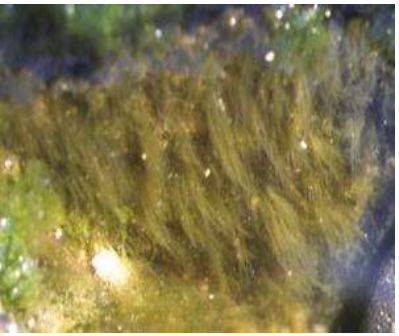
Alberto Brito · Sabrina Clemente · Rogelio Herrera

Año 1993

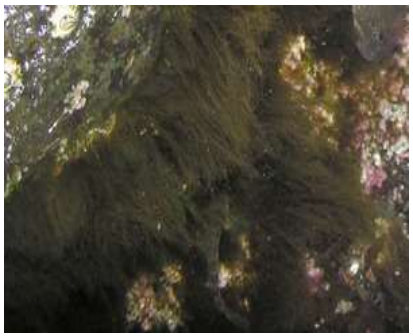
Brito et al., 2005

3. Efectos sobre las poblaciones residentes: ganadores y perdedores.





Blennothrix lyngbyacea



Schizothrix calcicola

Schizothrix mexicana

Lyngbya majuscula

Cianobacterias

Fucus guiryi

Cystoseira abies-marina

Gelidium canariense

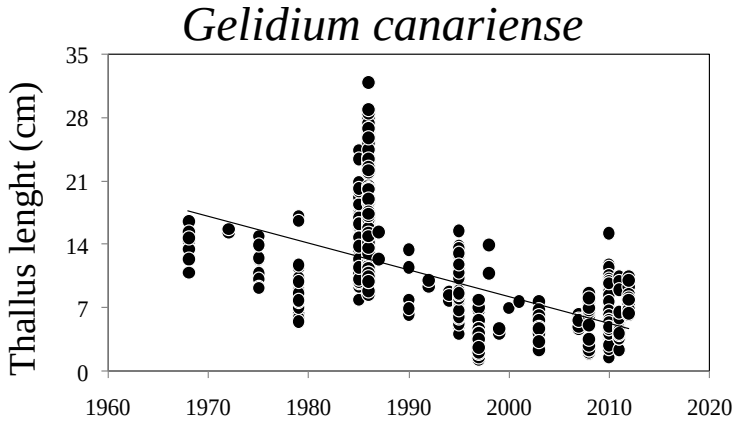
Macroalgas

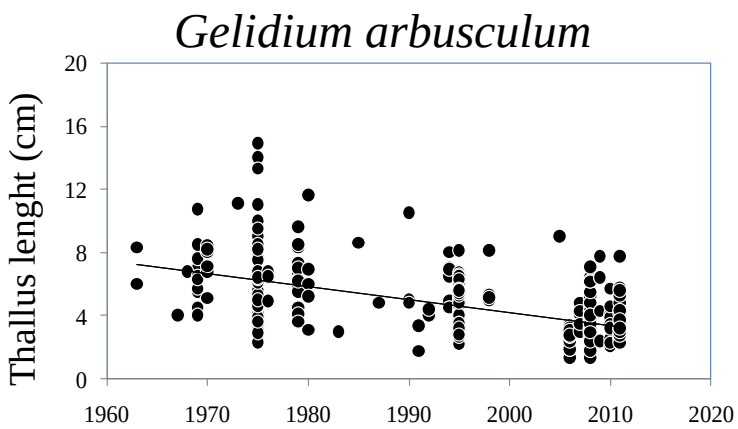
Cymodocea nodosa

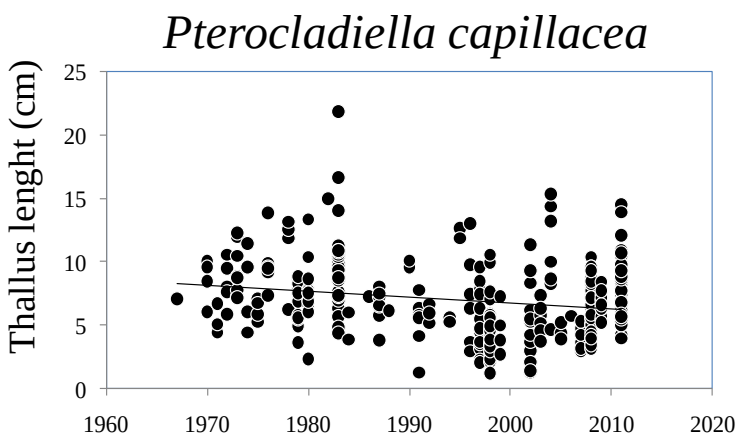
Fanerógama

Sangil et al., 2012; Anadón et al., 2014; Martín-García et al., 2014; Riera et al., 2015; Fabbri et al., 2015; Sangil et al., in prep

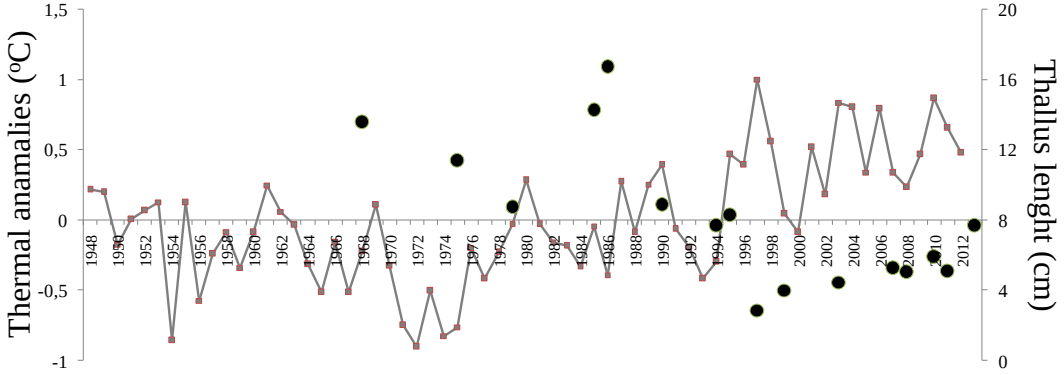
Sangil et al., in prep.

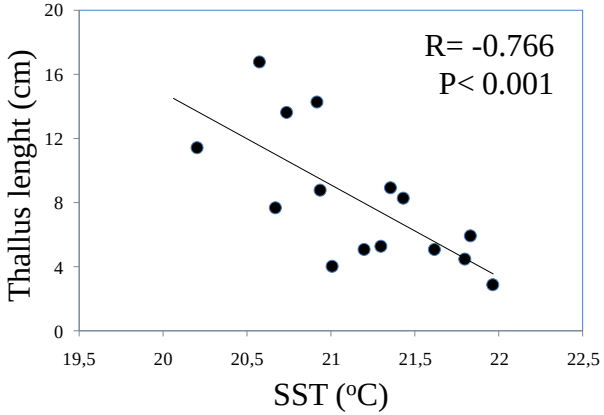




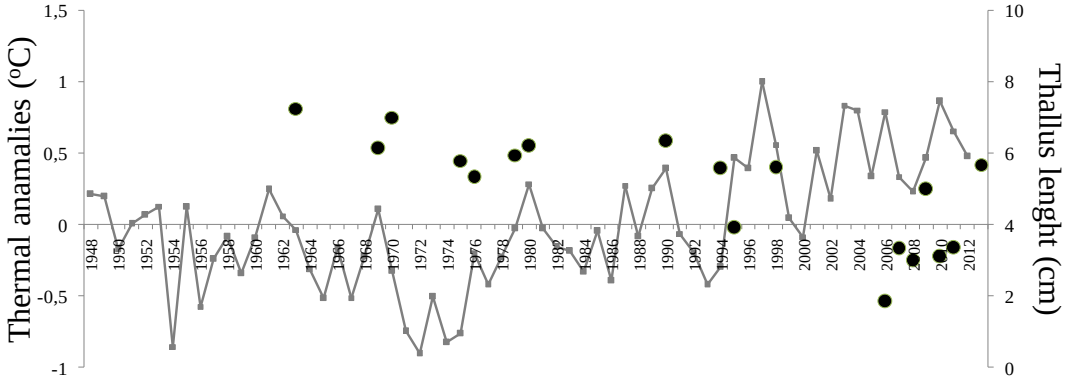


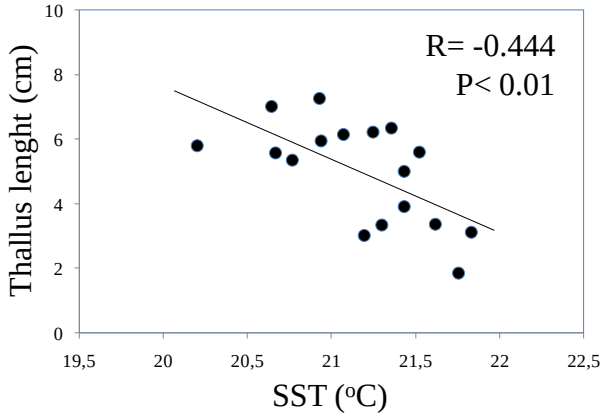
Gelidium canariense



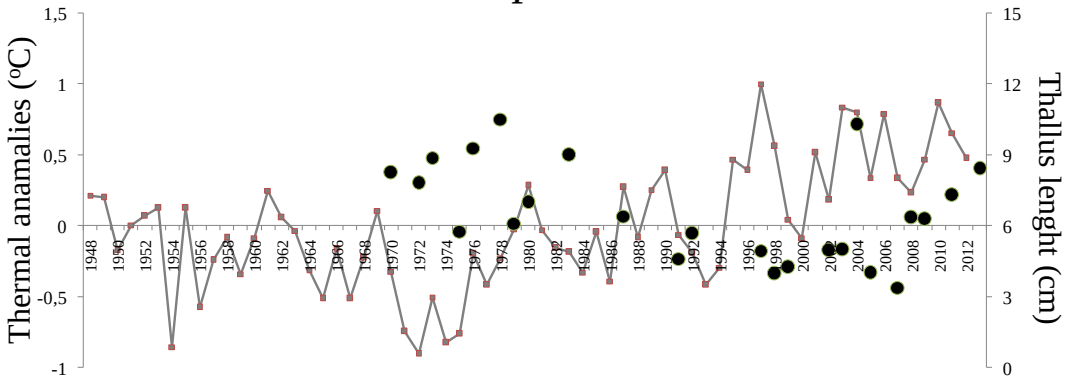


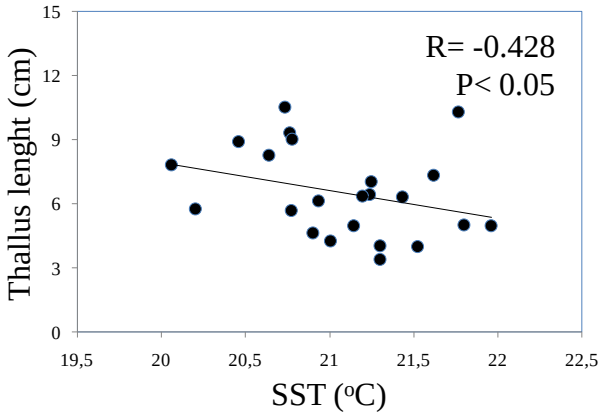
Gelidium arbusculum



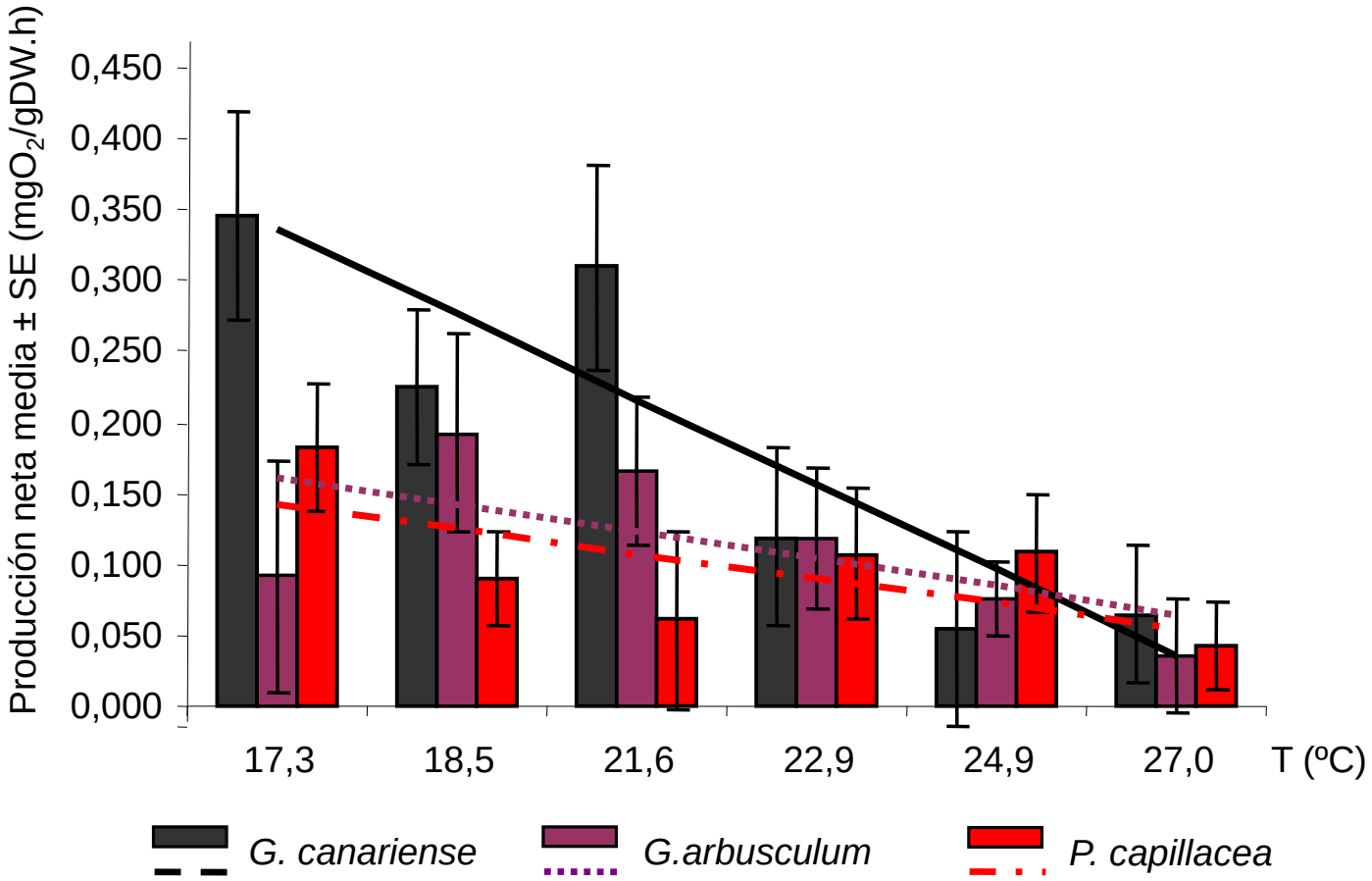


Pterocladiella capillacea





Sangil et al., in prep.



Sangil et al., in prep.

Diadema africanum

Dendrophyllia laboreli

Invertebrados

Paracentrotus lividus

Diadema africanum

Mortalidades masivas de equinoideos

2003 y 2010

Hernández et al., 2008; Ocaña et al., 2011; Girard et al., 2012; Clemente et al., 2014

Aluterus scriptus

Acanthocybium solandri

Aulostomus strigosus

Heteropriacanthus cruentatus

Peces

Brito, 2008

Odontaspis ferox

90s

Islas Orientales
Aguas Templadas

Islas Occidentales
Aguas cálidas

La Palma MPA
2004-2008

Hernández et al., 2008a; Hernández et al., 2008b; Sangil et al., 2012

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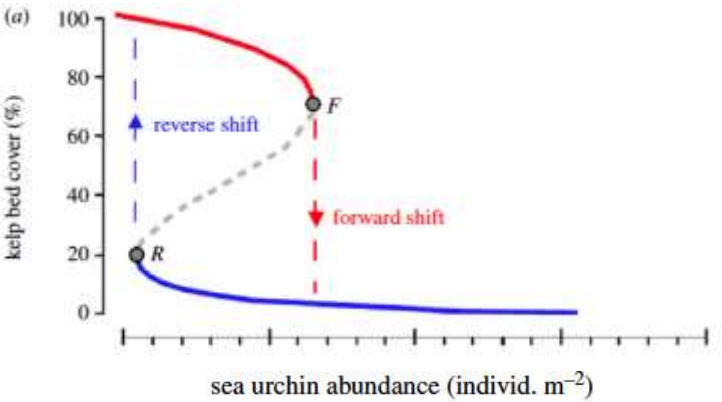
Research

Global regime shift dynamics of catastrophic sea urchin overgrazing

S. D. Ling[1], R. E. Scheibling[2], A. Rassweiler[3], C. R. Johnson[1], N. Shears[4], S. D. Connell[5], A. K. Salomon[6], K. M. Norderhaug[7], A. Pérez-Matus[8], J. C. Hernández[9], S. Clemente[9], L. K. Blamey[10], B. Hereu[11], E. Ballesteros[12], E. Sala[13], J. Garrabou[14], E. Cebrian[12], M. Zabala[15], D. Fujita[16] and L. E. Johnson[17]



Hernández et al., 2008

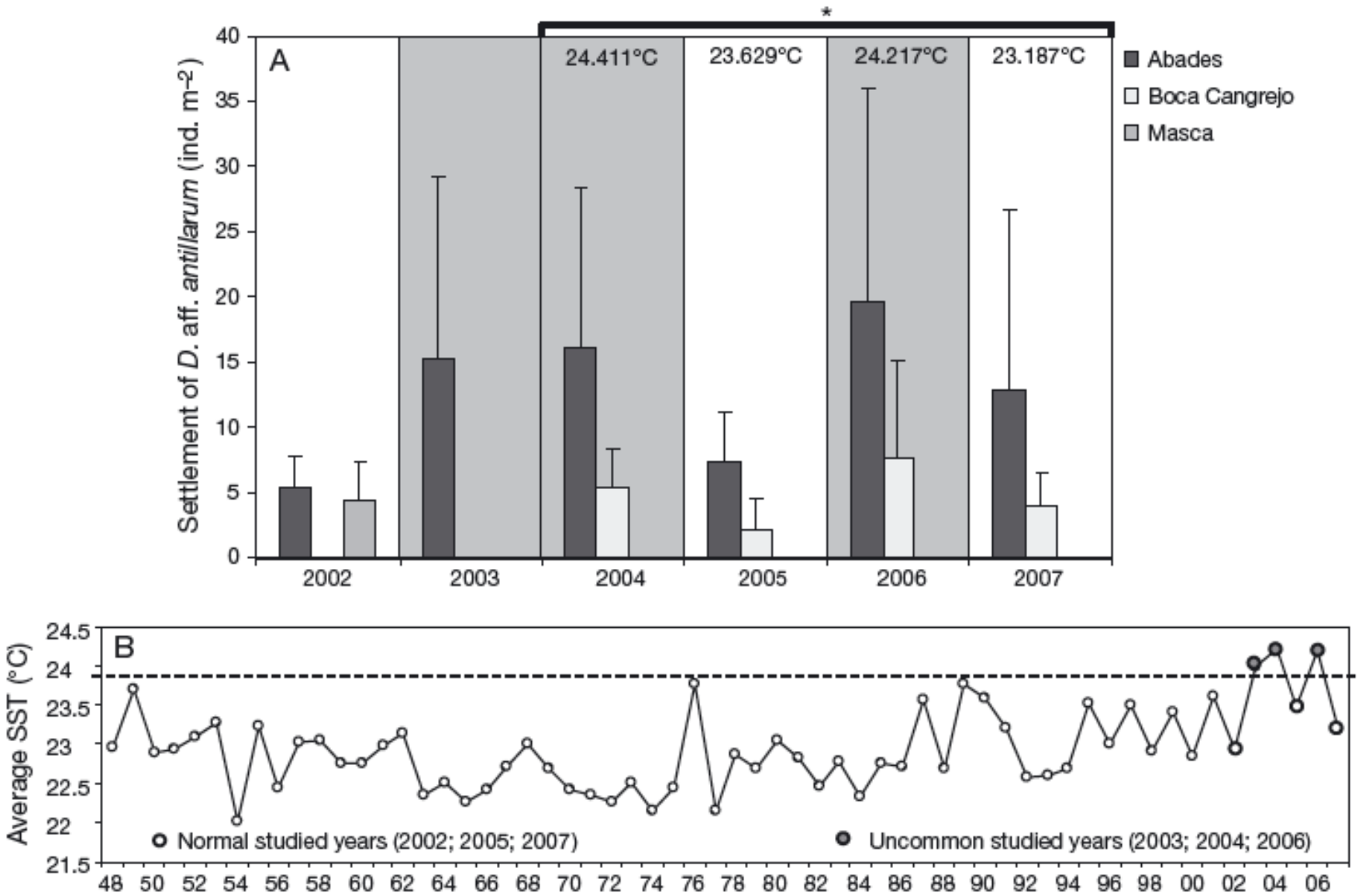
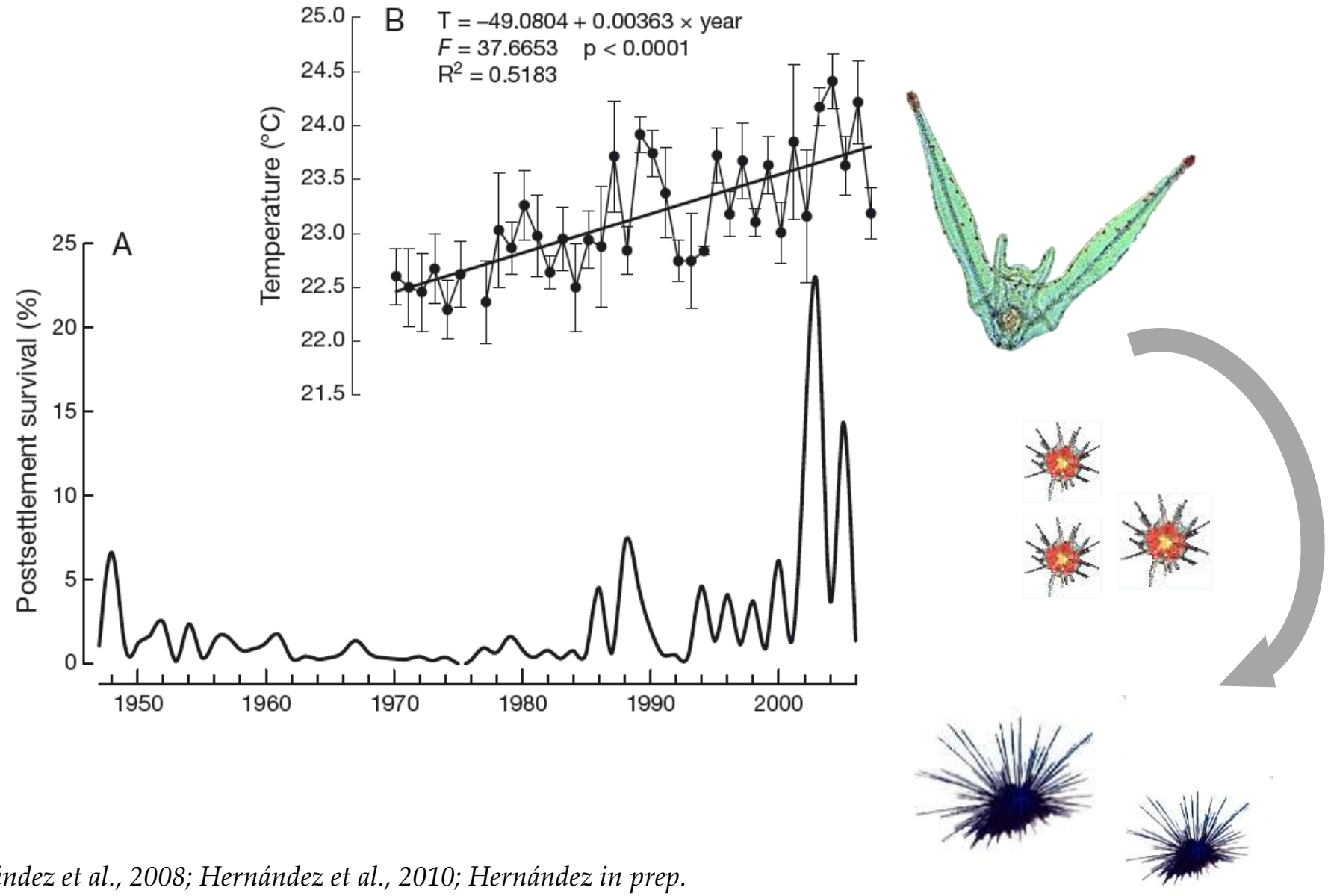


Fig. 3. *Diadema* aff. *antillarum*. (A) Settlement peaks (August–October) in different years and temperature regimes (mean ± SD). Shaded background: uncommon warm years (T > 24°C). White background: normal years (T < 24°C). (*) Site and years included in the analysis. (B) Average sea surface temperatures (SST) for the settlement period (August–October) from 1948 to 2007, showing the uncommon warm years studied (temperatures > 24°C)

Hernández et al., 2008; Hernández et al., 2010



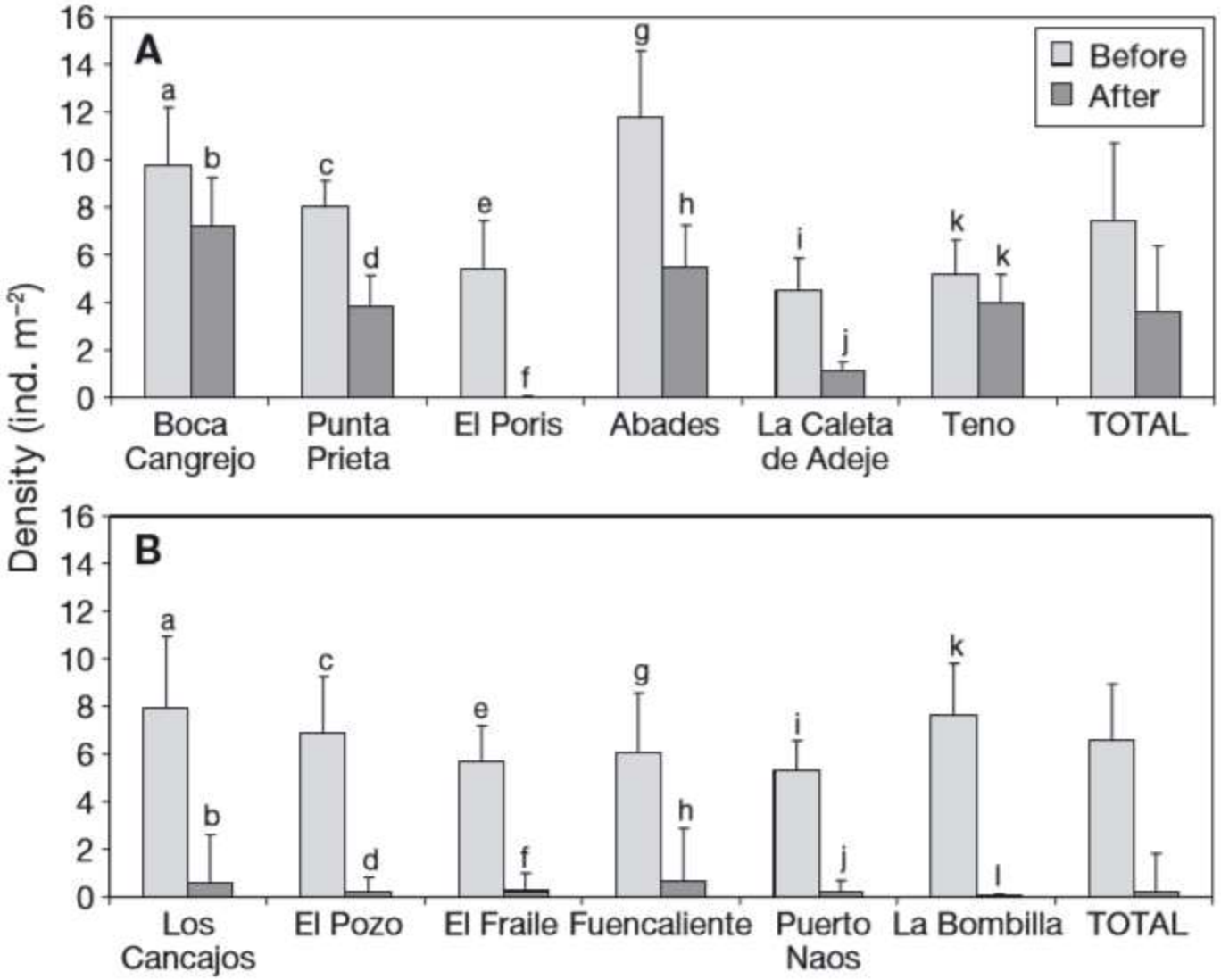
Hernández et al., 2008; Hernández et al., 2010; Hernández in prep.

1 · Noviembre 2009 Filipe Alves com. pers.

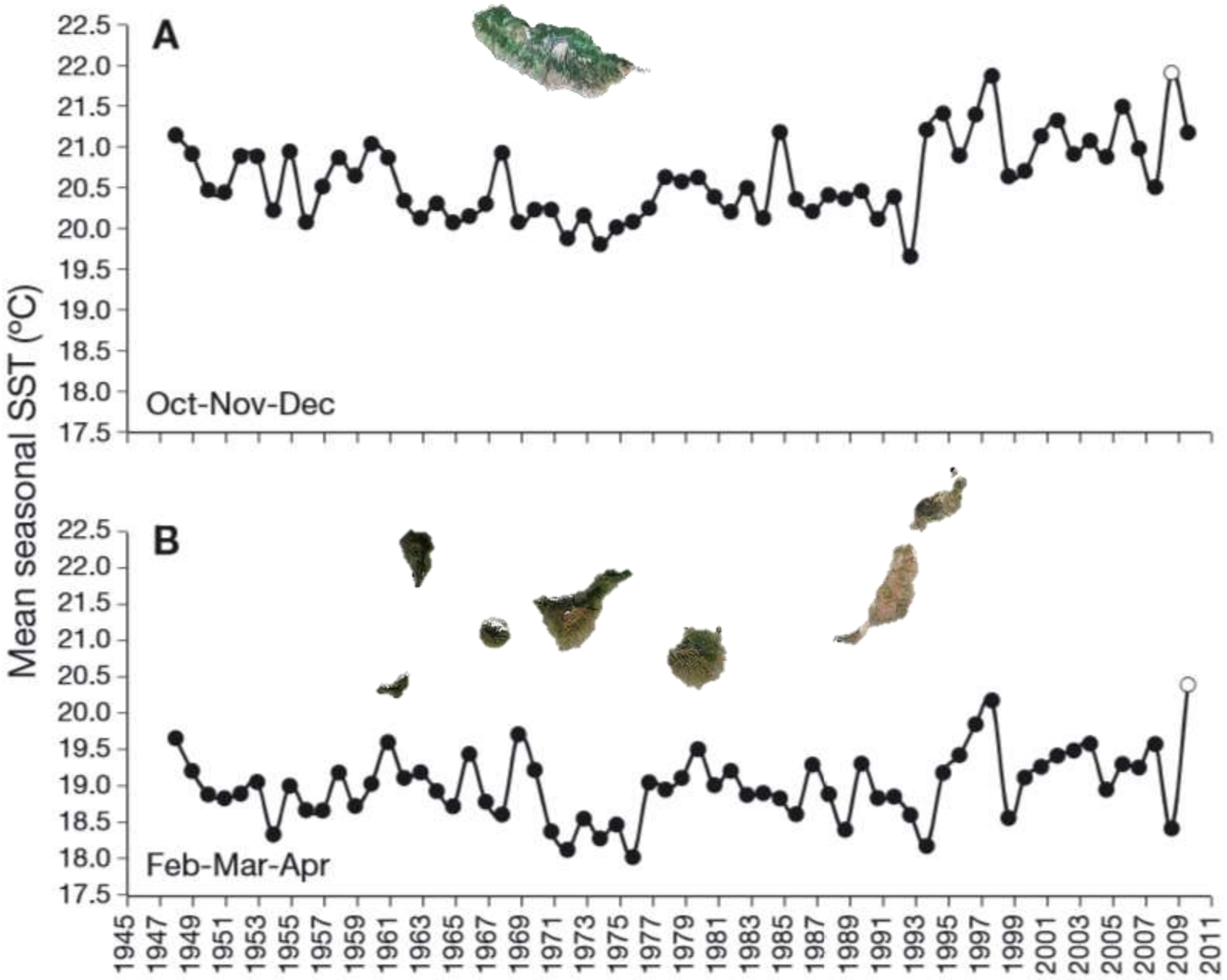
2 · Febrero 2010

Finaliza en March-April 2010

Clemente et al., 2014

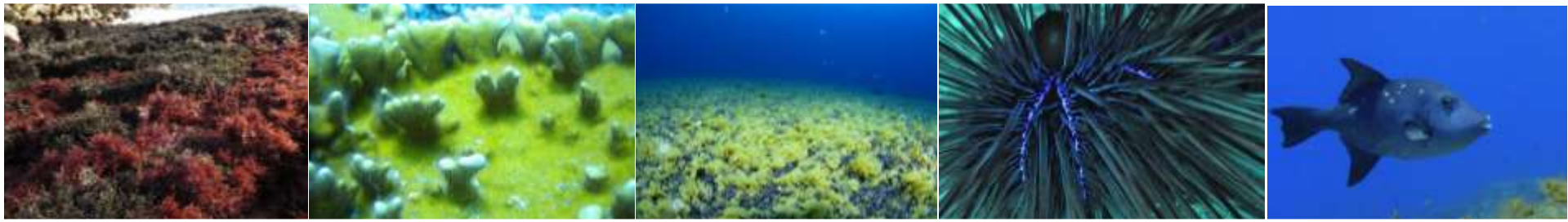


Clemente et al., 2014



Clemente et al., 2014

4. Acciones para mitigar los efectos negativos a nivel local.



Vol. 413: 69–80, 2010
doi: 10.3354/meps08684

MARINE ECOLOGY PROGRESS SERIES
Mar Ecol Prog Ser

Effect of temperature on settler postsettlement survival in a barre sea urchin

José Carlos Hernández[1,2,*], Sabrina Clemente[1,2]
Ángel Pérez-Ruzafa[3], Alberto B

l rocky

Vol. 412: 55–67, 2010
doi: 10.3354/meps08700

MARINE ECOLOGY PROGRESS SERIES
Mar Ecol Prog Ser

Published August 26

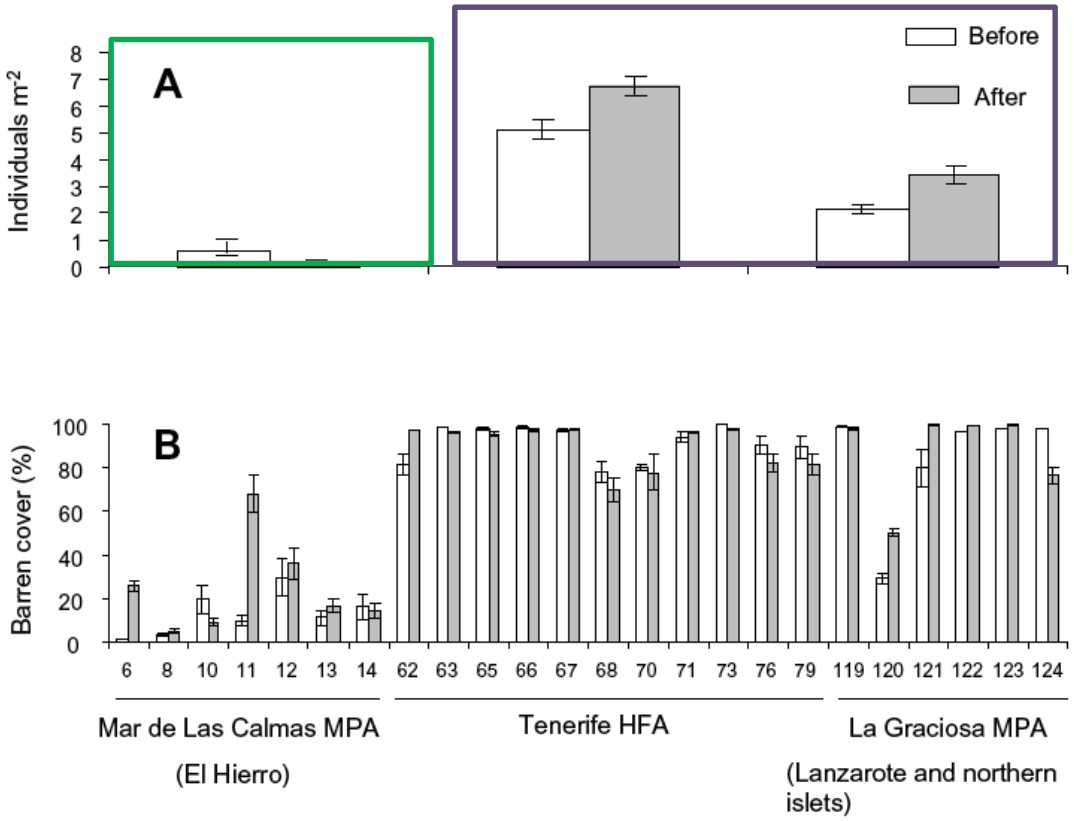
Identifying keystone predators and the importance of preserving functional diversity in sublittoral rocky-bottom areas

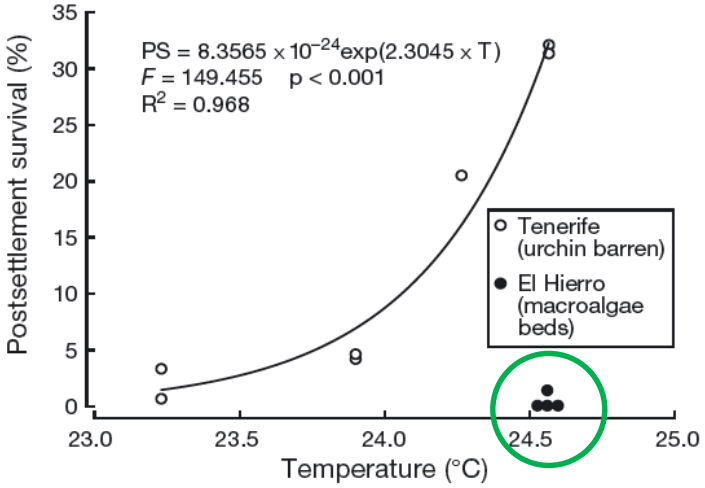
Sabrina Clemente[1,2,*], José Carlos Hernández[1,2], Adriana Rodrigue
Alberto Brito[1]

AQUATIC CONSERVATION: MARINE AND FRESHWA
Aquatic Conserv: Mar. Freshw. Ecosyst. (2007)
Published online in Wiley InterScience
(www.interscience.wiley.com) DOI: 10.1002/aqc.903

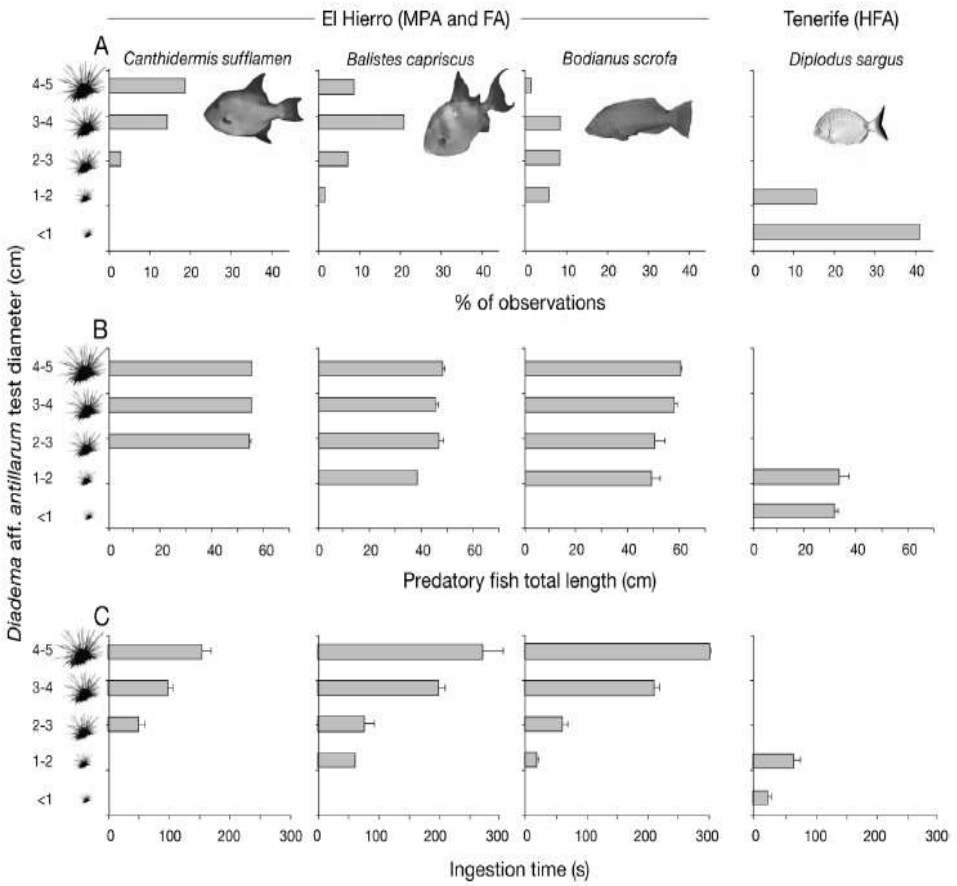
Actual status of the sea urchin Diadema aff. antillarum populations and macroalgal cover in marine protected areas compared to a highly fished area (Canary Islands—eastern Atlantic Ocean)

JOSÉ CARLOS HERNÁNDEZ[1,2,*], SABRINA CLEMENTE[1], CARLOS SANGIL[3] and ALBERTO BRITO[1]





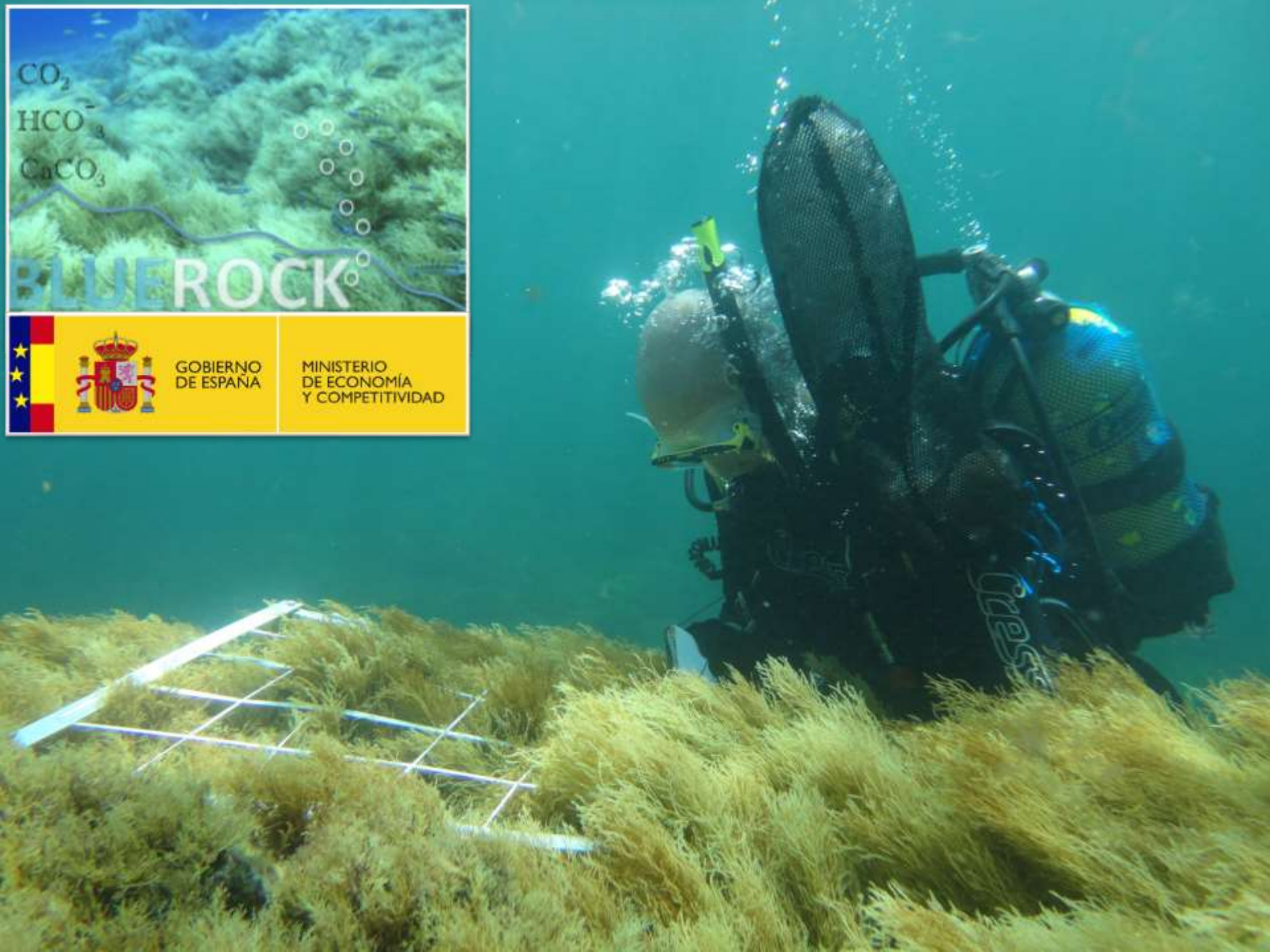
Hernández et al., 2008; Hernández et al., 2010.

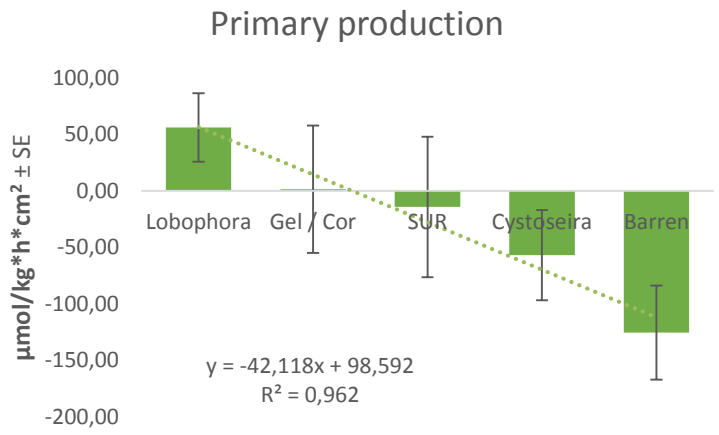


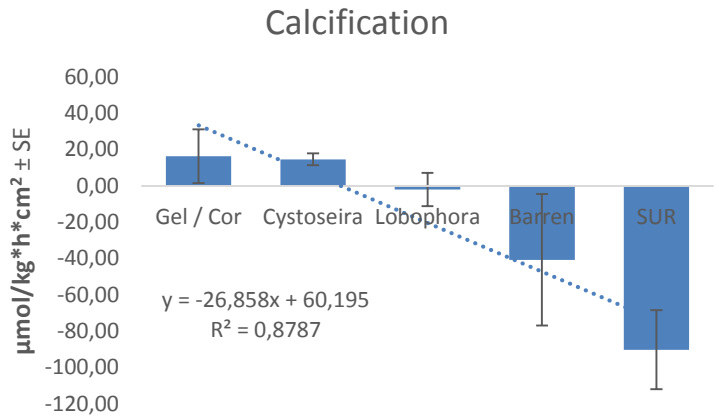
Clemente et al., 2010; Clemente et al., 2011

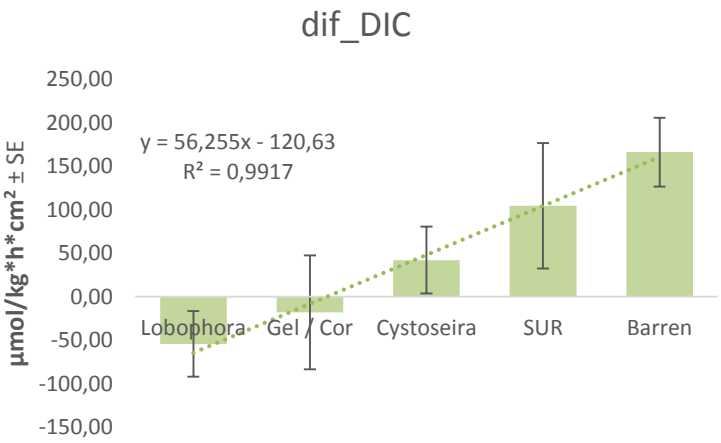

Balistes carolinensis
Canthidermis sufflamen


Bodianus scrofa


CO_2
HCO^-_3
$CaCO_3$
BLUEROCK
GOBIERNO DE ESPAÑA
MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD





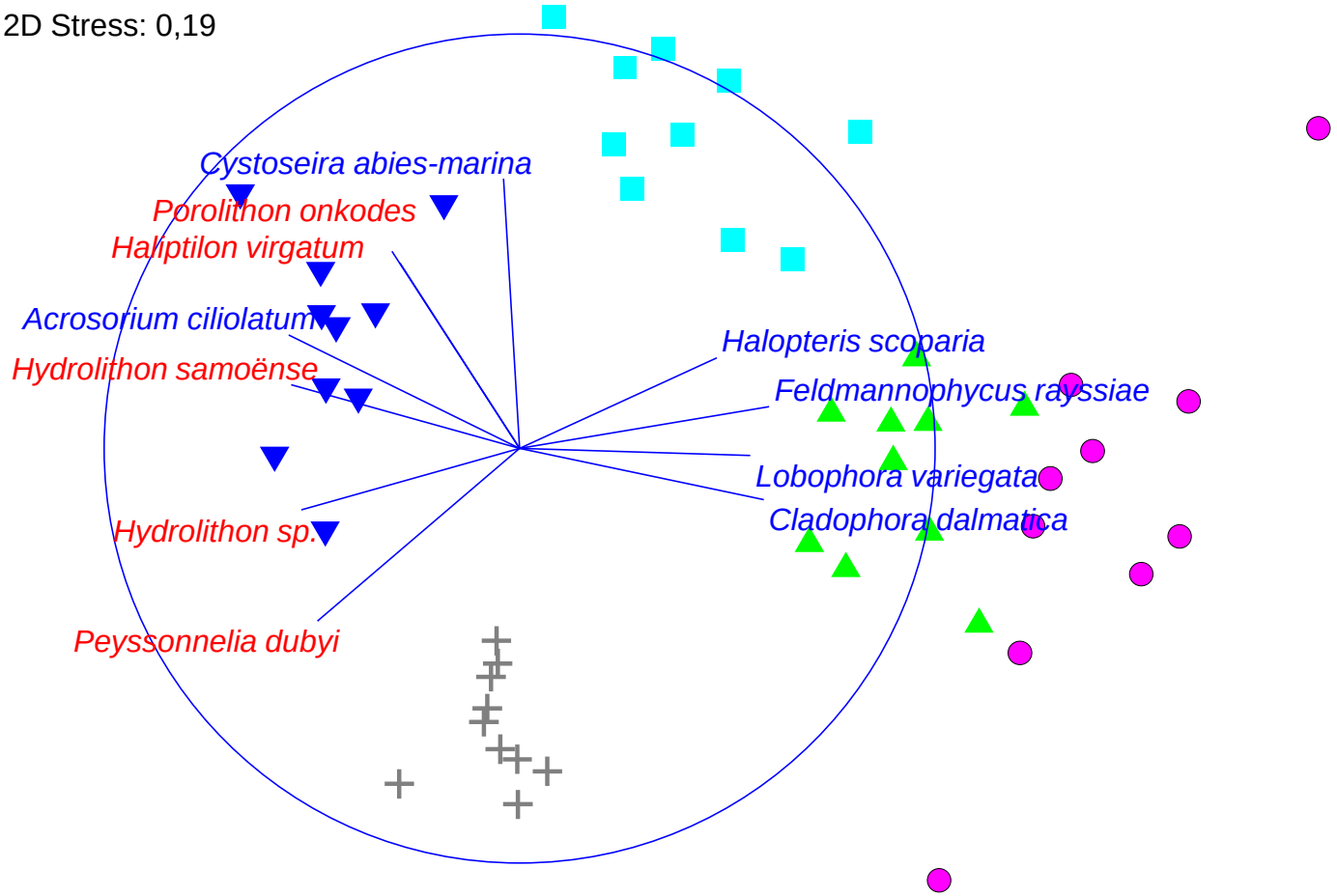


Hernández et al., in prep.

Transform: Square root

Resemblance: S17 Bray Curtis similarity

2D Stress: 0,19



LOBOPHORA

GELIDIALES

CYSTOSEIRA

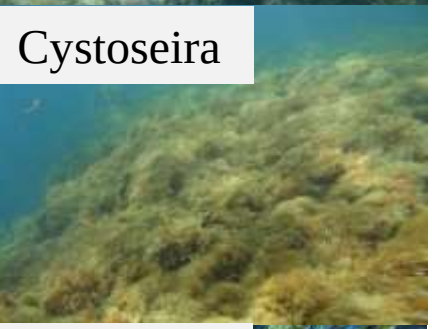
SUR

BARREN

Hernández et al., in prep.

Gelidiales/Corallina

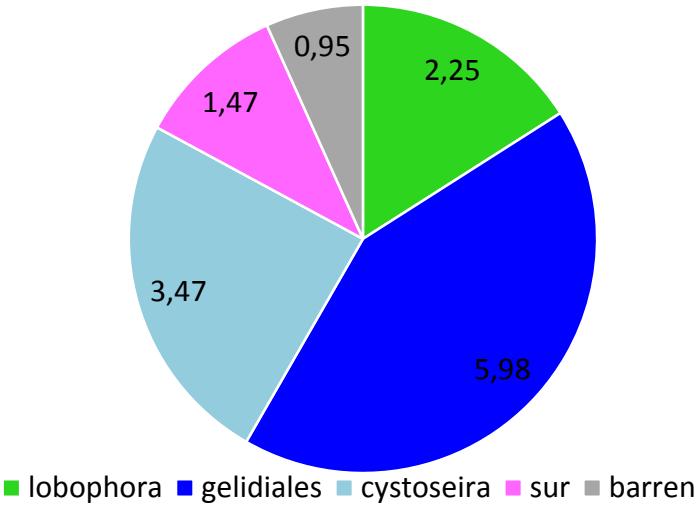
Cystoseira



Lobophora

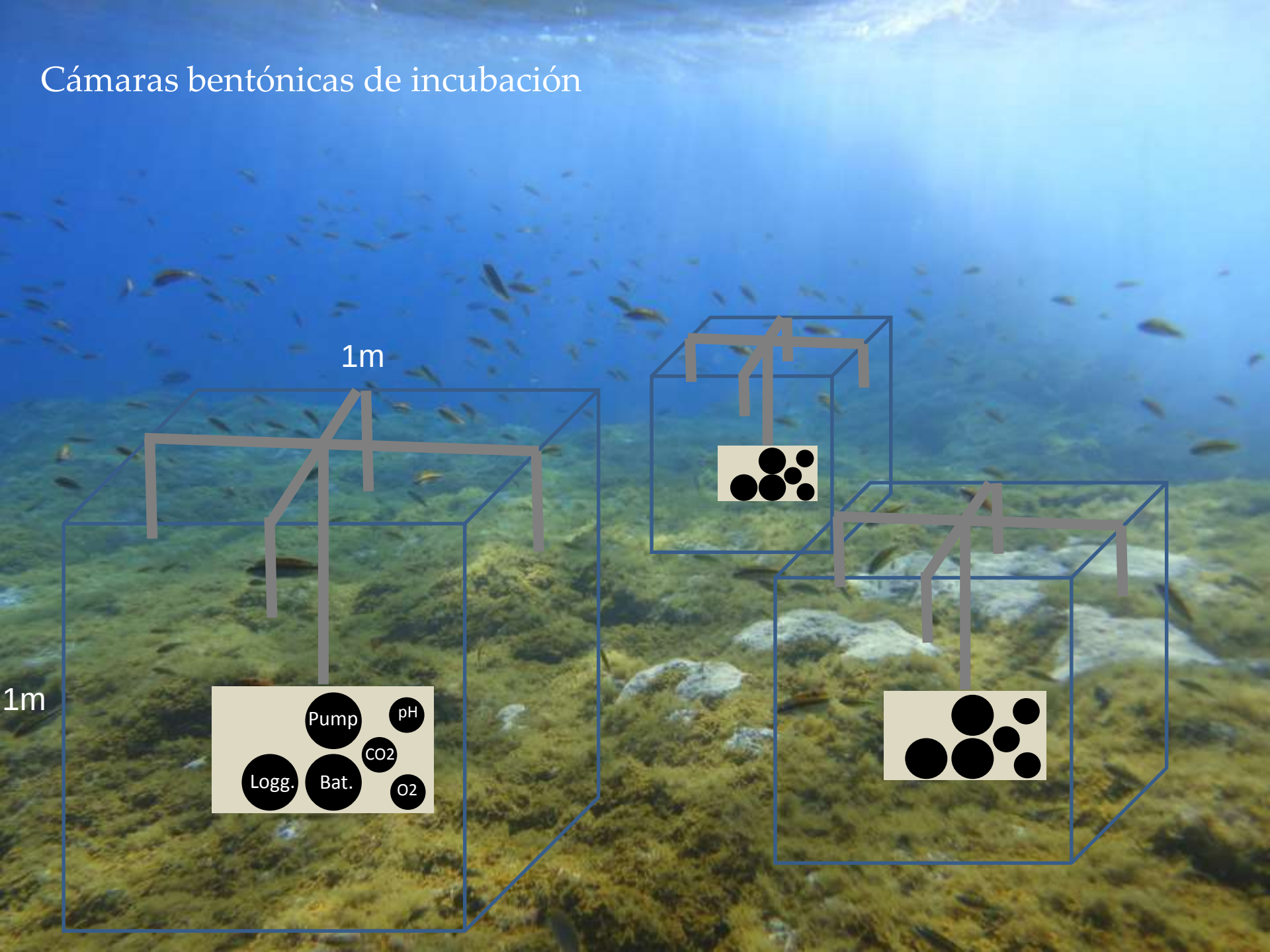
SUR

Barren



Hernández et al., in prep.

Cámaras bentónicas de incubación



Nuevo laboratorio natural para el estudio de los efectos de la acidificación del océano…

Marine Pollution Bulletin

journal homepage: www.elsevier.com

A new CO_2 vent for the study of ocean acidification in the Atlantic

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ARTICLE INFO

ABSTRACT

Financiación 2010 - hasta 2017

Fuencaliente, isla de La Palma