INACH
Ministerio de Relaciones Exteriores
Gobierno de Chile

The Chilean Antarctic Program: An opportunity for Chilean-Korean collaboration

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Instituto Antártico Chileno, **INACH**

Scientific – Logistics – Project Funding organization.

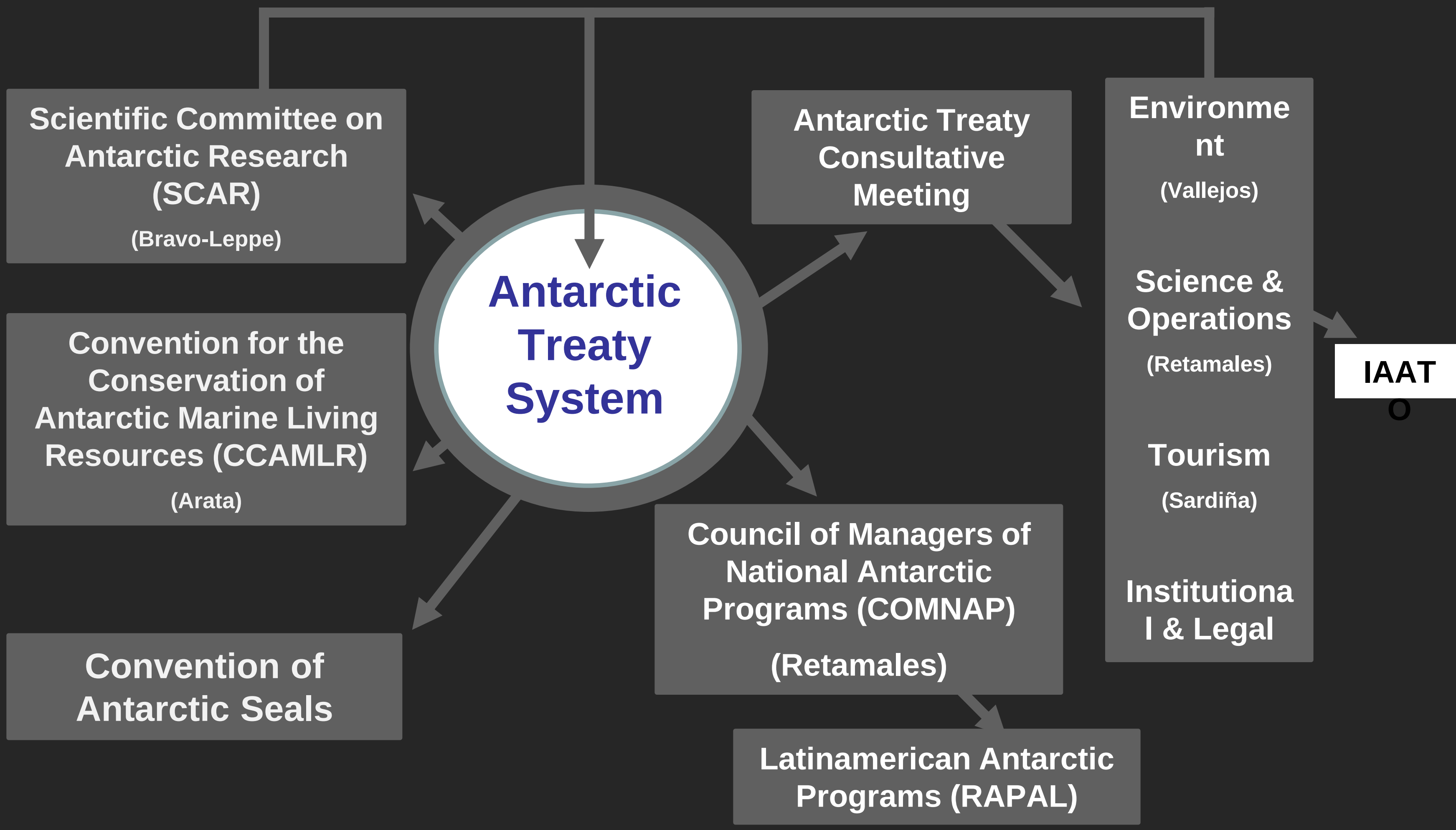
Planning, Coordination, Assessment and Control of Chilean scientific activities in Antarctica.

Organizes the Chilean Scientific Antarctic Expedition (50), to carry out projects field activities.

50 people, in Punta Arenas - since 2003.

Chilean Antarctic Science budget US$MM 9;
Total annual expenditure US$MM 22-24.

INACH **INTERNATIONAL**

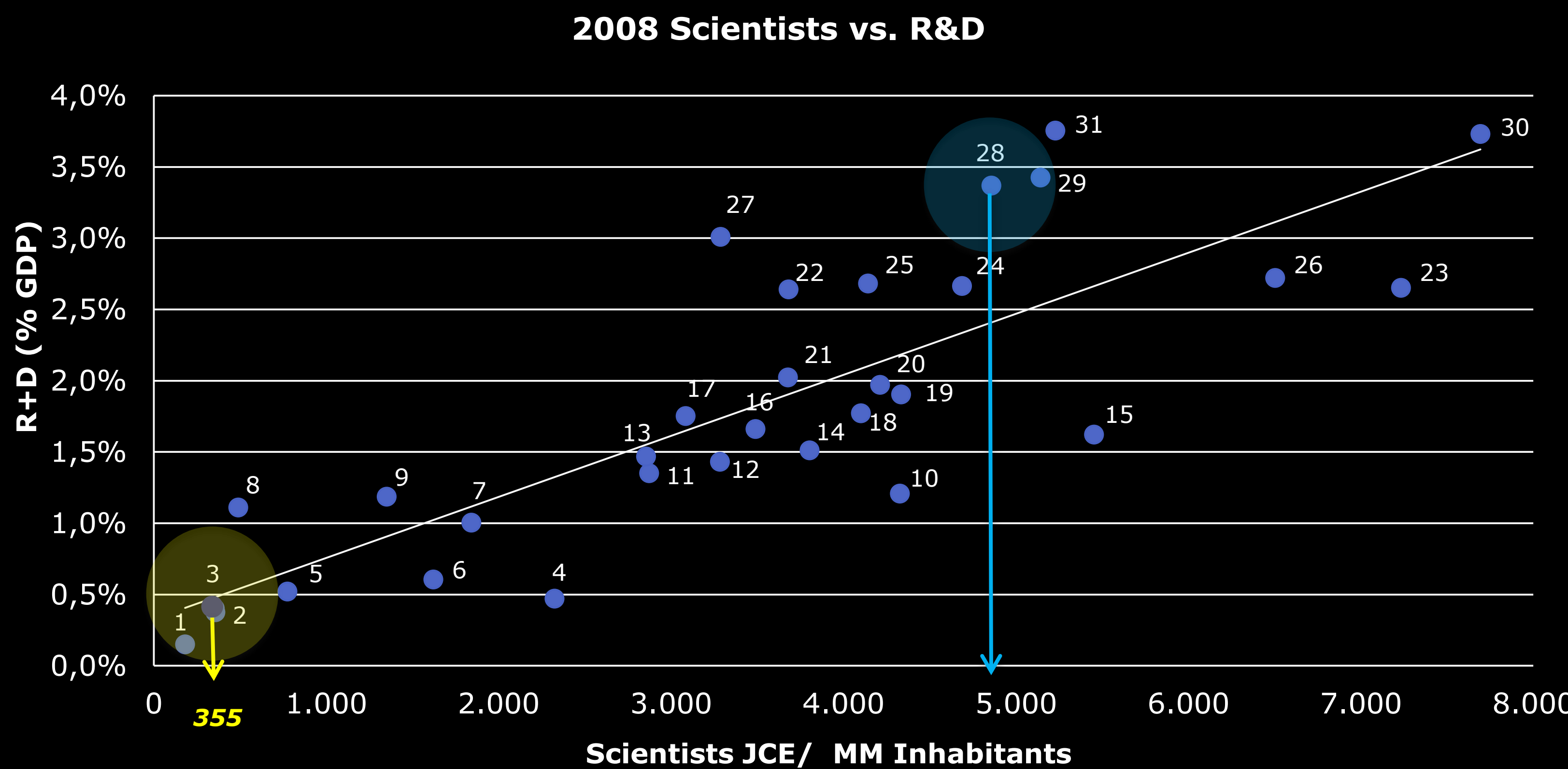


Universities | Antarctic Programs

Antarctic Peninsula Scientific Programs

COUNTRY	STATIONS	AIRFIELDS	VESSELS every 1-2 years	AIRPLANES every year
Argentina	X	X	X	X
Brazil	X		X	X
Bulgaria	X			
Chile	X	X	X	X
China	X		X	
Ecuador	X			
Germany	X		X	
Peru	X			
Poland	X			
R. of Korea	X		X	
Russia	X		X	
Spain	X		X	
Ukraine	X			
United Kingdom	X	X	X	X
United States	X		X	
Uruguay	X		X	X
Netherlands	X			
Czech Republic	X			
Portugal				X
Venezuela				
20	18	3	11	6

GDP invested in R&D vs Number of Scientists

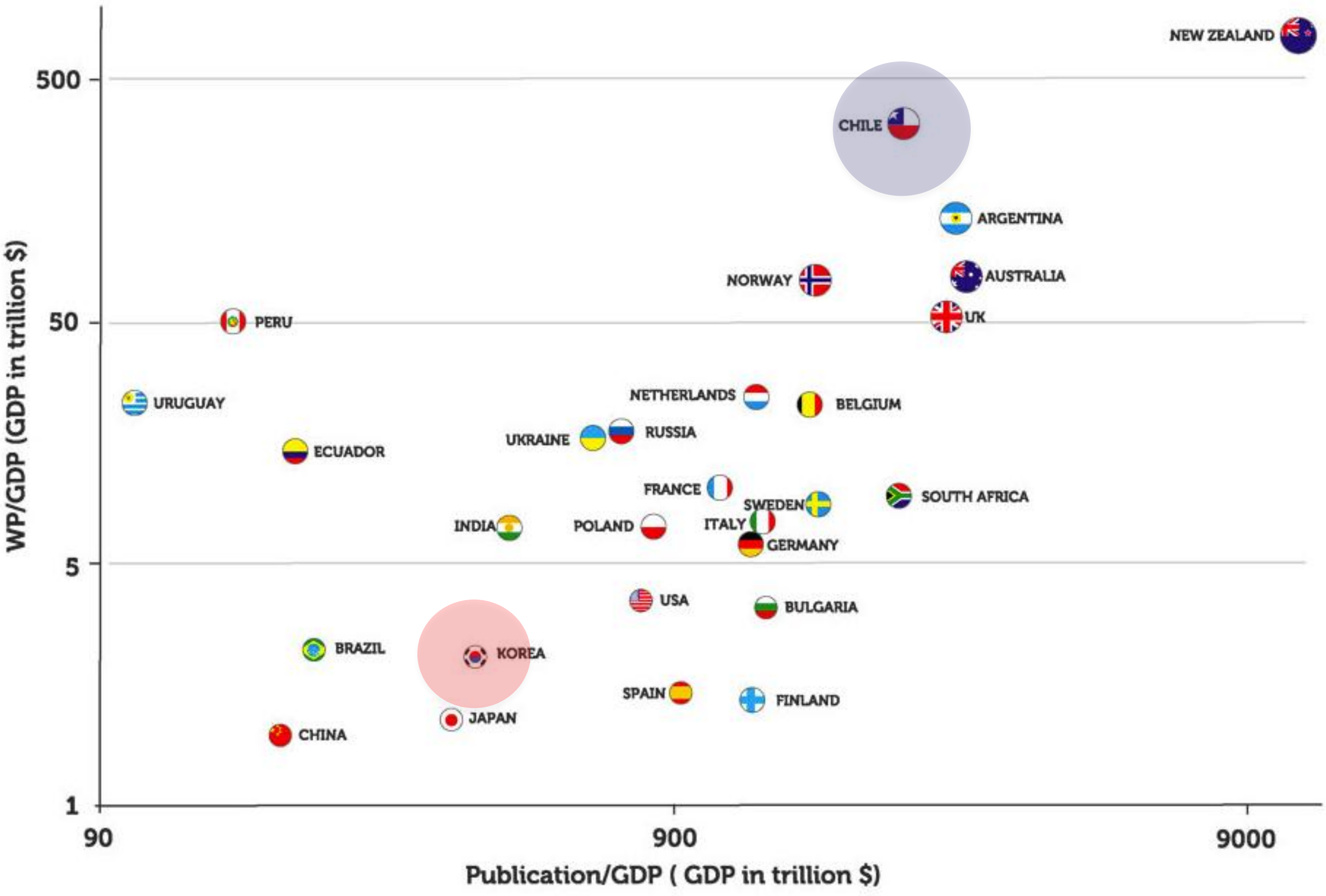


, OECD
Mineco
Source
Aguiler

1 Colombia	6 Poland	11 Spain	16 Slovenia	21 France	26 Denmark
2 México (07)	7 Hungary	12 Ireland	17 Netherlands	22 Germany	27 Switzerland
3 Chile	8 Brasil	13 Czech R.	18 United Kingdom	23 Island	28 Korea
4 Slovakia	9 Italy	14 Portugal	19 Canada (07)	24 United States (07)	29 Japan
5 Argentina	10 New Zealand	15 Norway	20 Australia (06)	25 Austria	30 Finland

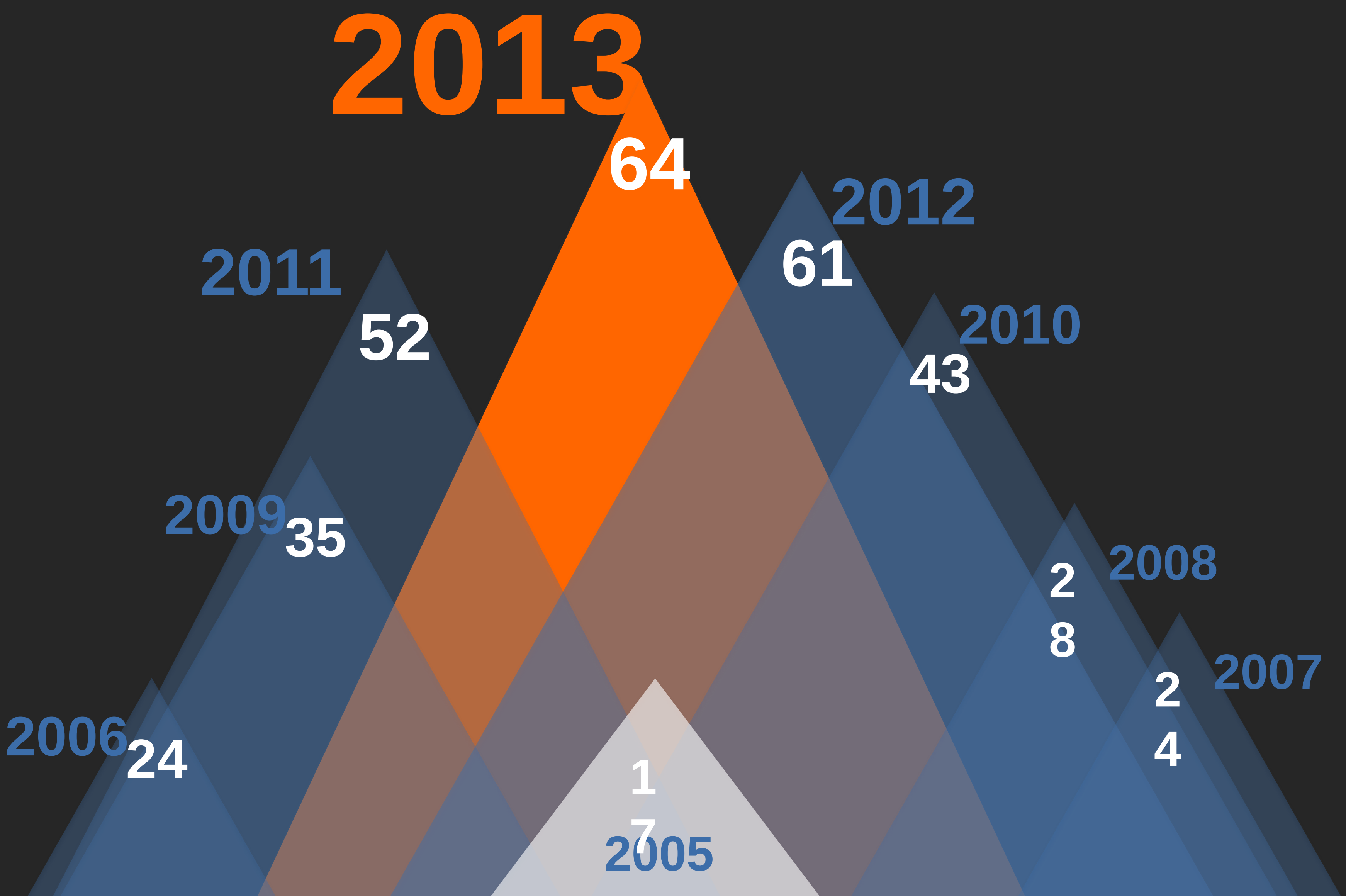
“Leadership in the Antarctic Treaty System”

David Walton & John Dudeney’s, Polar Research, Feb 2012

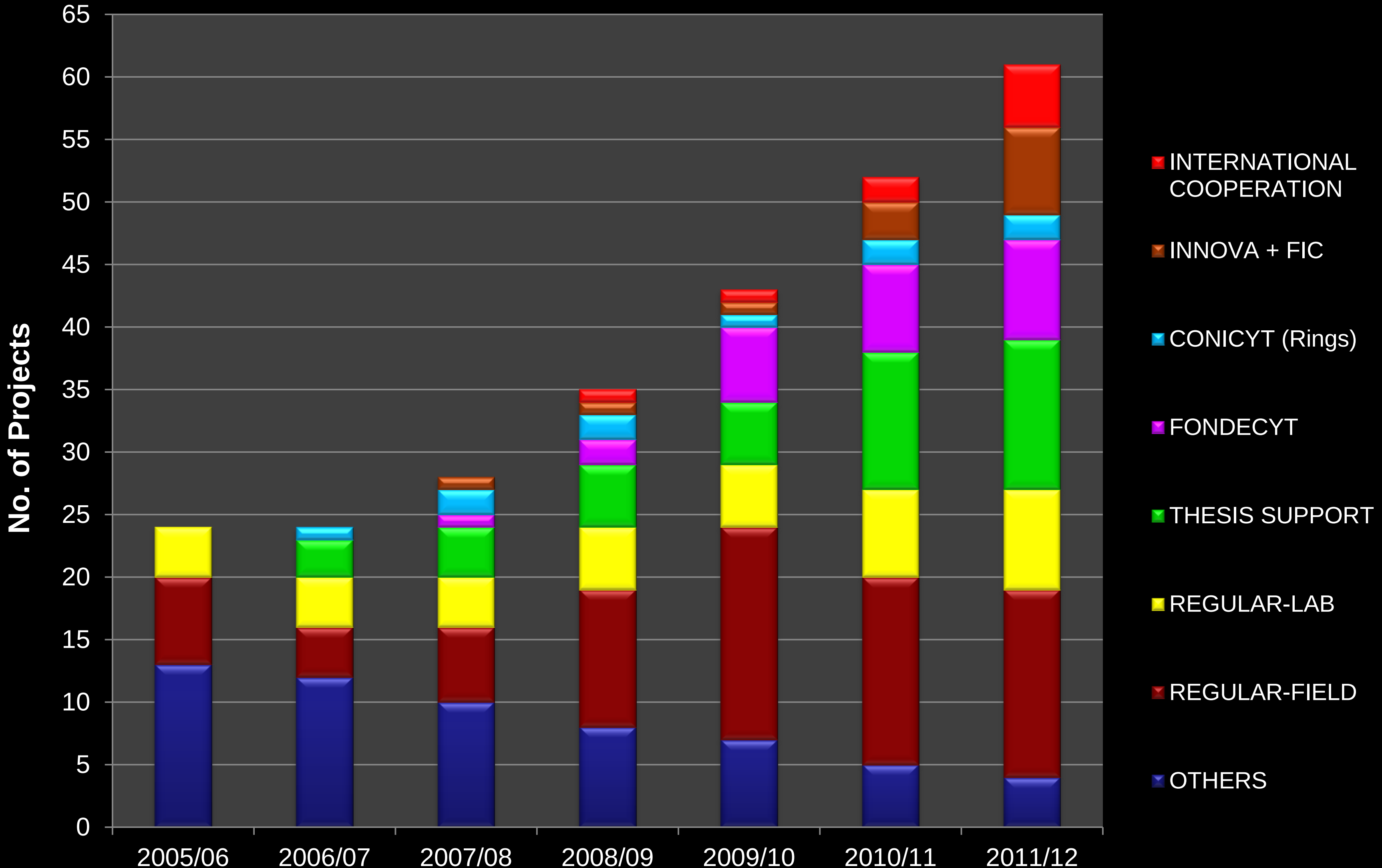


Chilean Antarctic Science Program

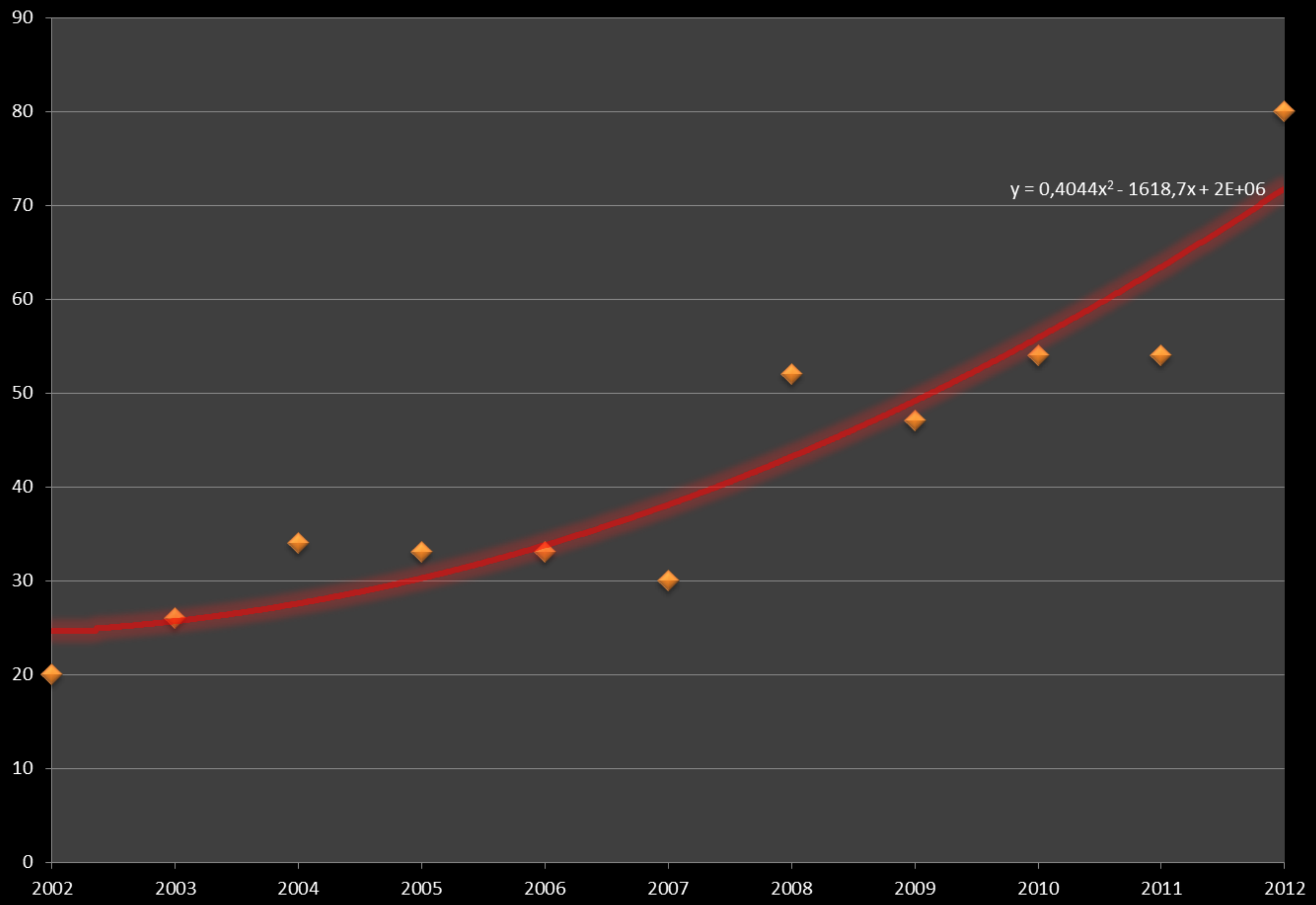
Number of Scientific Projects - **Growing** -



Number of projects per year/cycle



ISI Publications. Evolution of Chilean Antarctic productivity since 2002-2012



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The Chilean Antarctic Science Program:

LINES OF RESEARCH

FINANCING SOURCE	I. RELATIONSHIPS BETWEEN SOUTH AMERICA AND ANTARCTICA	II. ADAPTATION MECHANISMS IN ANTARCTIC ORGANISMS	III. ABUNDANCE AND DIVERSITY IN ANTARCTIC ORGANISMS	IV. GLOBAL WARMING AND CLIMATE EVOLUTION	V. ENVIRONMENT AND OTHER INITIATIVES
INACH FIELD PROJECTS (18)	I.8 GENOMIC RESEARCH INTO *NACELLA*	II.7 SECONDARY METABOLITES II.8 NANOPARTICLE SYNTHESIZING MICROORGANISMS II.11 BIOTECHNOLOGICAL POTENTIAL IN ACTINOBACTERIA II.15 MICROBES WITH ACIDOGENIC PROPERTIES II.17 EVOLUTIONARY ADAPTATION IN *NACELLA*	III.2 DIAZOPOLARSEA III.3 EUKARYOTE ECOLOGY III.5 MARINE BIRD LICE III.6 MACROALGAE DIVERSITY III.10 MEIOFAUNA DIVERSITY III.11 BIOLOGICAL SOIL CRUSTS	IV.4 PARA-ICE IV.5 AEROSOL CHEMICAL FOOTPRINT AND SNOW AT LACLAVERE PLATEAU IV.7 RESPONSES TO SNOW PERTURBATIONS IV.12 BIOLOGICAL SOIL WEATHERING	V.2 COPS IN THE AQUATIC FOOD CHAIN V.3 RESISTANT GENES IN WASTEWATER
INACH LAB PROJECTS (7)	I.4 HISTORICAL CLIMATE CHANGE AND ADAPTATION IN PENGUINS I.5 DWARFISM IN MOLLUSCS I.9 *NACELLA* PHYLOGEOGRAPHY	II.9 BIOTECHNOLOGICAL METABOLITES IN YEASTS II.10 ANTARCTIC THERMOPHYLLIC LIPASES		IV.13 FUNGUS IN VASCULAR PLANTS	V.7 ASTRONOMICAL OBSERVATION SITE
THESIS SUPPORT (9)		II.12 NITRILASE PURIFICATION II.13 BACTERIAL MICROFLORA IN *DISSOSTICHUS* II.18 BIOSYNTHESIS IN *DESCHAMPSIA* II.19 PROTEOMICS AND METABOLOMICS IN *DESCHAMPSIA* II.20 ANTARCTIC BACTERIA AND FISH LARVAE	III.4 BACTERIAL COMMUNITY III.7 PENGUIN GENETIC STRUCTURE	IV.14 PARASITIC FUNGUS IN *DESCHAMPSIA ANTARCTICA*	V.4 HEAVY METALS IN PENGUINS
INACH SPECIAL PROJECTS (3)					V.5 ENVIRONMENTAL MONITORING CENTER V.8 WEATHER OBSERVATIONS V.9 NEUTRON MONITORING
PIA-INACH (4)	I.6 GEOLOGICAL EVOLUTION			IV.6 GLOBAL IMPACT ON MACROALGAE IV.9 UV RADIATION AND ENDEMIC SPECIES IV.10 ECOPHYSIOLOGY OF ANTARCTIC PLANTS	
CORFO INNOVACHILE (3)		II.1 ANTIBACTERIAL PEPTIDES II.2 ANTINEOPLASTIC MOLECULE IN *DESCHAMPSIA*			V.1 ATMOSPHERIC CORROSIVITY MAP
FONDECYT-INACH (14)	I.1 DIVERSITY IN MICROALGAE I.2 CYANO ASSOCIATION IN LICHEN I.7 PHYLOGEOGRAPHY AND EVOLUTION IN *NEOBUCCINUM*	II.4 GENOMICS IN MICROORGANISMS II.6 BIOACTIVE COMPONENTS II.16 INVERTEBRATES AND THERMAL STRESS	III.1 DIAZOSPRING III.8 BIO-OPTICAL MODELING III.9 FRESH WATER AND PRIMARY PRODUCTIVITY	IV.1 CLIMATE CHANGE AND UV RADIATION IV.2 CLIMATE RECONSTRUCTION IV.3 SEISMIC FACIES AND SEDIMENTATION IV.11 PLANT-MOSS INTERACTIONS	V.6 MAGNESTOSPHERE DYNAMICS
CONICYT INTEGRATION OF ADVANCED HUMAN CAPITAL (1)		II.5 NATURAL COMPOUNDS IN ACTINOMYCETES			
FONDEF-INACH (1)		II.3 ANTIBACTERIAL ACTIVITY IN LICHENS			
INTERNATIONAL COOPERATION (3)	I.3 INVERTEBRATES AND PALEOFLORA OF TORRES DEL PAINE	II.14 CYANOBACTERIA		IV.8 THERMAL STRESS IN ECHINODERMS	

Chilean Antarctic Science Program 2013

1-. Relationships between South America and Antarctica

2-. Adaptation mecanisms of the Antarctic organisms

3-. Abundance and diversity of Antarctic organisms

4-. Global warming and climate evolution

5-. Environment

Line I. Relationships between South America and Antarctica

The projects in this line of research are uncovering a pattern of similarities in the rocks, fossils, and living organisms of two continental land masses that are now separated: South America, and Antarctica. Using a scale of tens of millions of years, it is possible to trace the origins of the southern continental biota all the way to the end of the Age of Dinosaurs. On a more precise scale, a close linkage has been demonstrated for invertebrates and algae from the two regions up until just a few million years ago, when the land connection no longer existed between South America and Antarctica.

Line I. Relationships between South America and Antarctica

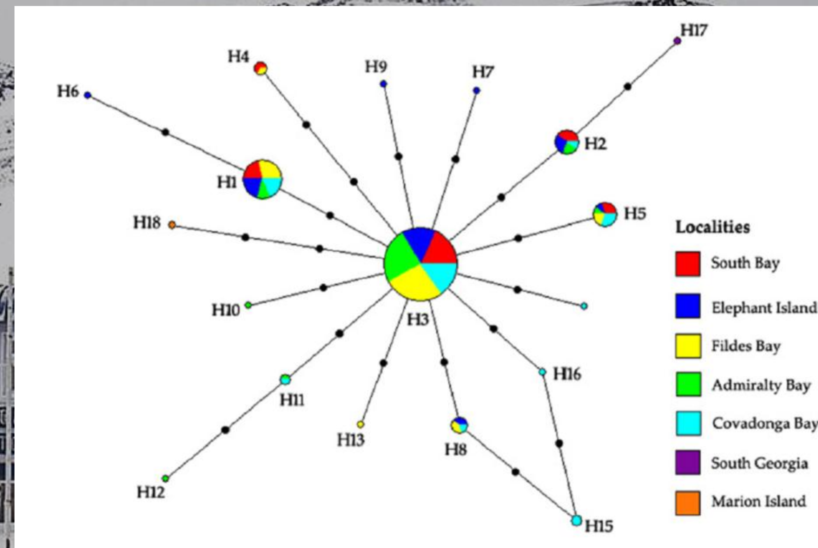
Evolution and origins of the Southern biota

Geological evolution of Southern landmasses

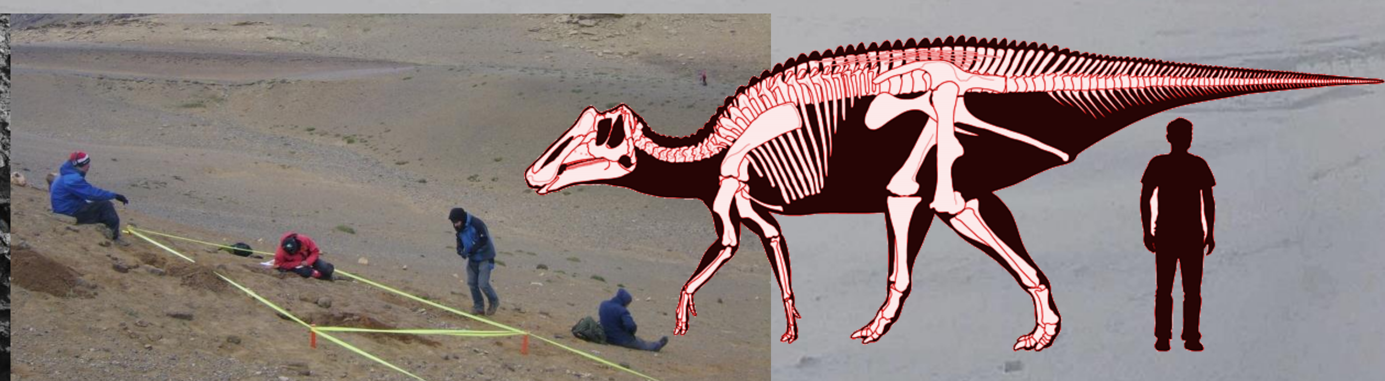
Phylogenetic studies on marine invertebrates

Evolution and origins of the Southern biota

Reconstruction of biogeographic sceneries related to origin and diversification of marine invertebrates and macroalgae in sub Antarctic and Antarctic regions using taxonomic, ecophisiologyc and molecular tools

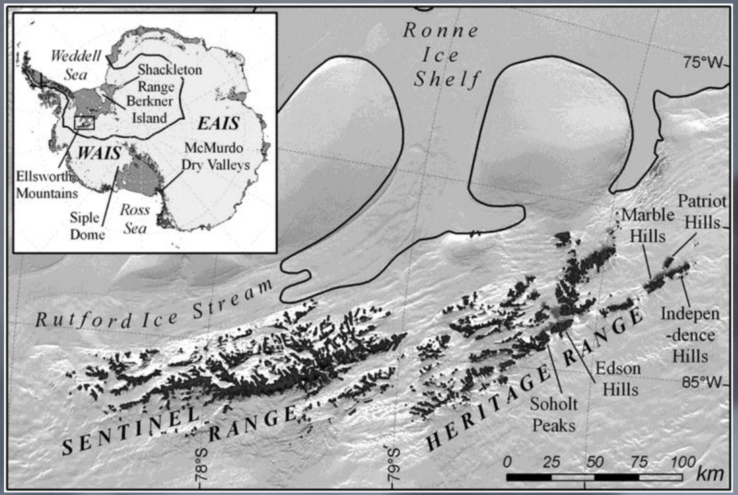


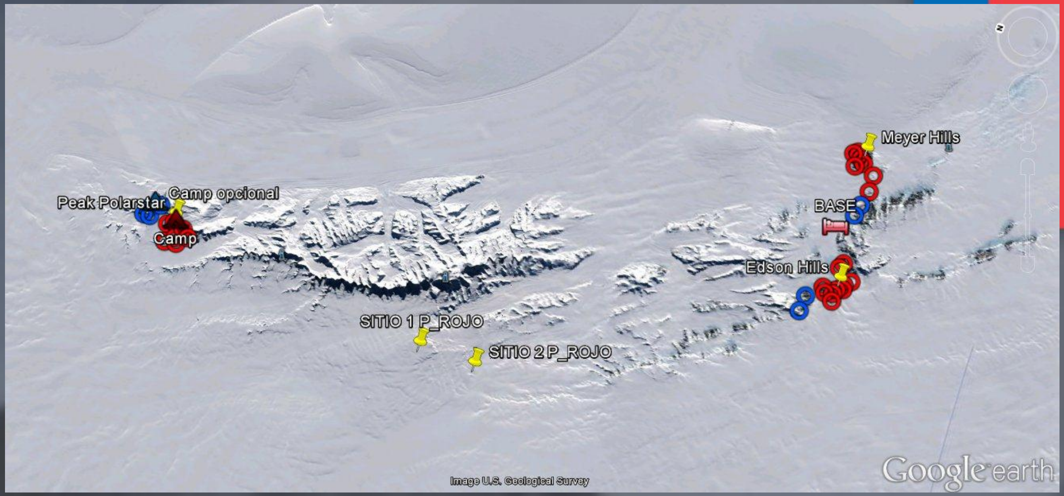
A paleontological approach to understand the history of the Cretaceous sedimentary units from Antarctic Peninsula and Southern Patagonia



Compare the geological and paleontological evolution of Patagonia and Antarctica.

Geological evolution of Southern landmasses

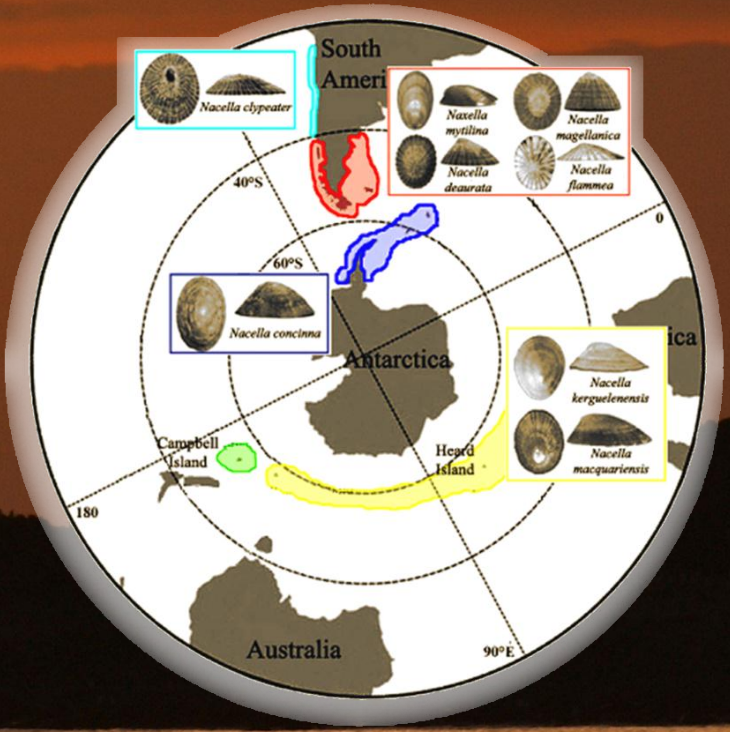




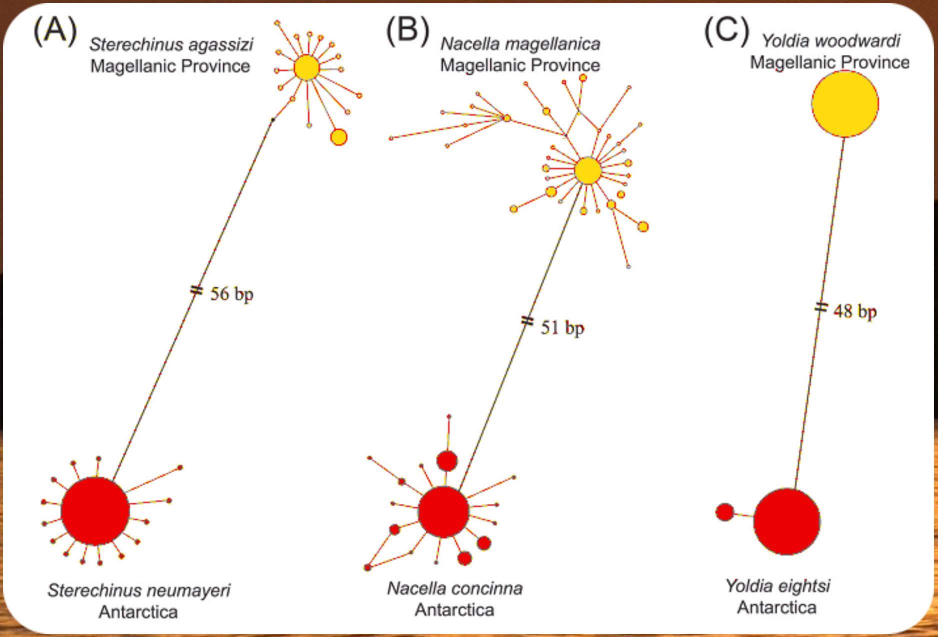
Discovering the Geological evolution of Ellsworth Mounts, a key area for the understanding of Gondwana breakup

Phylogenetic studies on marine invertebrates

Look at evolutionary relationships between the Antarctic and Sub Antarctic areas, focusing on genera such as *Sterechinus, Nacella* and *Ixodes*, using nuclear and mitochondrial molecular markers.



Haplotype Networks constructed using COI sequences from Antarctic and Magellanic congeneric species of: A) Sterechinus (n = 150), B) Nacella (n = 191); C) Yoldia (n = 10). Each haplotype is represented by a circle whose size is proportional to its frequency.



Line II. Adaptation mechanisms in Antarctic organisms

The extreme climatic conditions of Antarctica require that the organisms that live on that continent develop strategies to survive low temperatures, extremely dry conditions, high salinity, and intense ultraviolet radiation, at times enduring several of these environmental conditions at the same time.


Line II. Adaptation mechanisms in Antarctic organisms
Microorganisms diversity and ecological role
Bioresources and functionality
Biochemical response to stressing conditions
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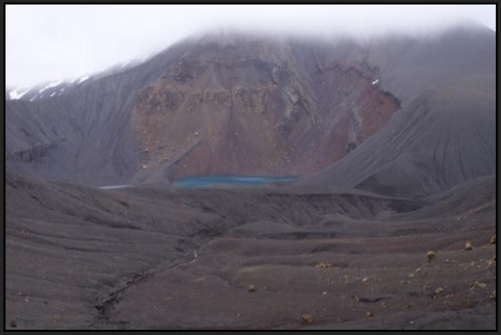
Microorganisms diversity and ecological role

Psychrophiles
T <15° C,
(min. -18° C)

Thermophiles
Hyperthermophiles
T= 60° C-80° C.
T > 80° C
(max. 113° C).

Halophiles
[NaCl] > 3,5%

Xerophiles
aw, < 0,85.

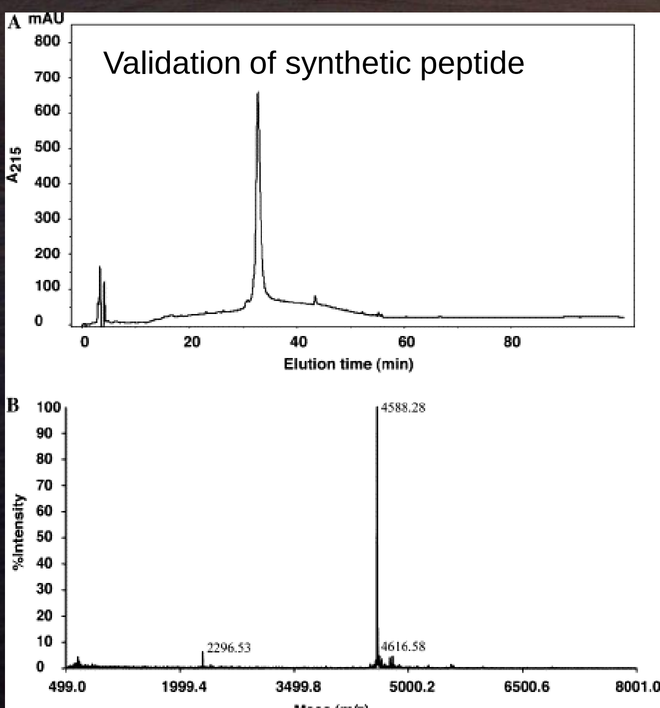


Alcalophiles
pH 9
(max. pH 10,5).

Acidophiles
pH < 5
(min. pH < 1)

Bioresources and functionality

Scientific platform to facilitate the study of Antarctic Biorresources

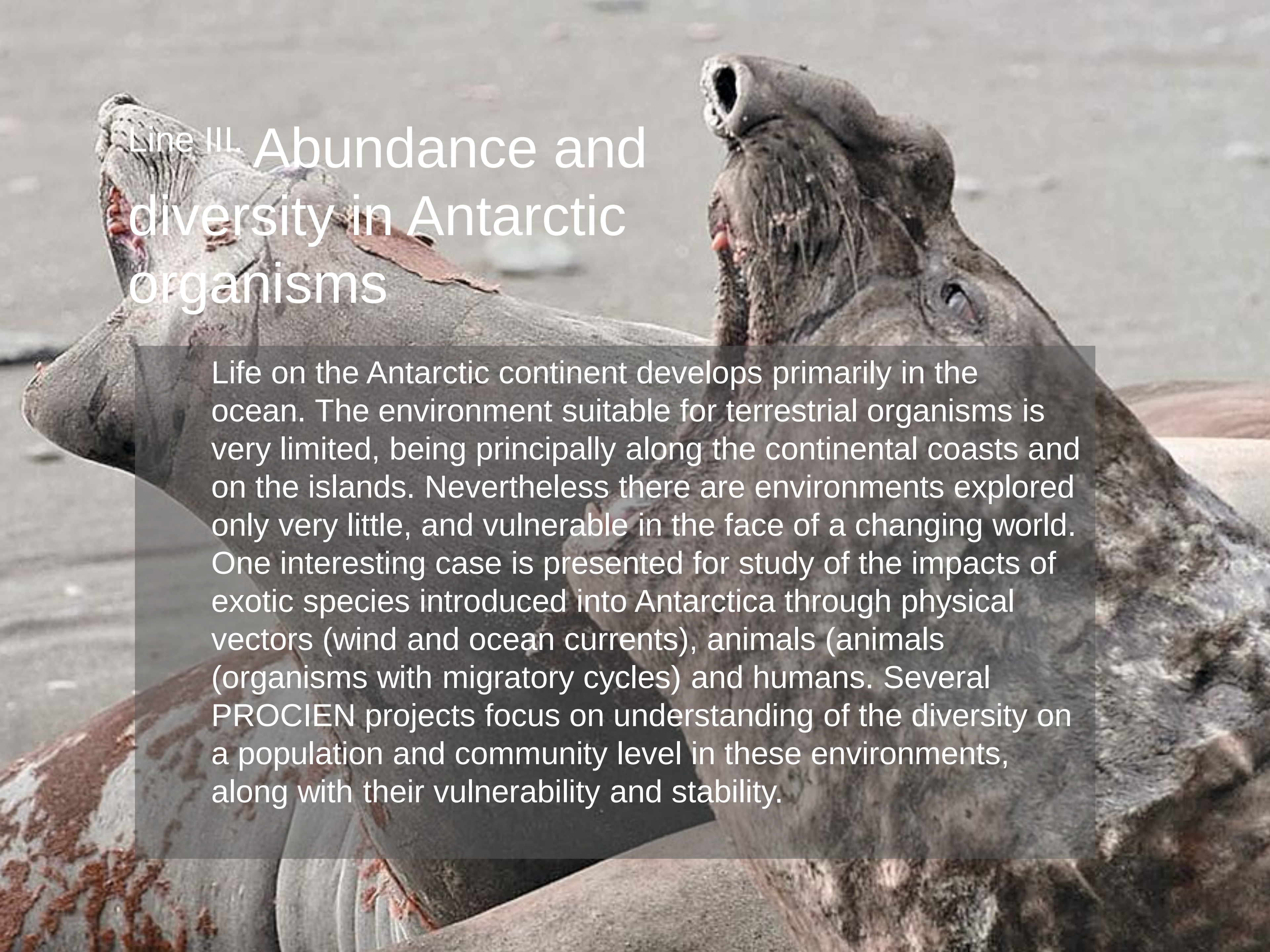


Bacterial culture

Field sampling

Biochemical response to stressing conditions

The special adaptations to the extreme enviromental conditions of Antarctica are the main focus of a series of projects. The aim is to uncover the complex mechanisms that regulate those biochemical responses.



Line III. Abundance and diversity in Antarctic organisms

Life on the Antarctic continent develops primarily in the ocean. The environment suitable for terrestrial organisms is very limited, being principally along the continental coasts and on the islands. Nevertheless there are environments explored only very little, and vulnerable in the face of a changing world. One interesting case is presented for study of the impacts of exotic species introduced into Antarctica through physical vectors (wind and ocean currents), animals (animals (organisms with migratory cycles) and humans. Several PROCIEN projects focus on understanding of the diversity on a population and community level in these environments, along with their vulnerability and stability.

Line III. Abundance and diversity in Antarctic organisms

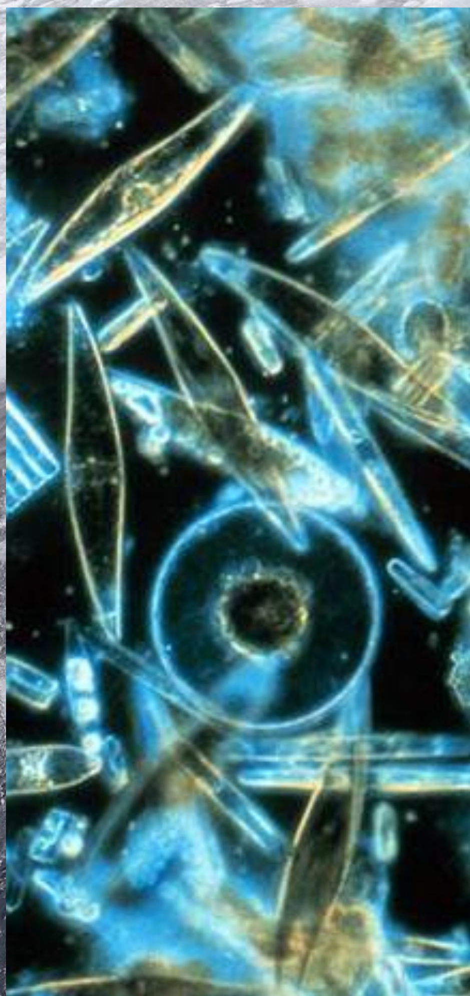
Ecological studies at community level

Ecological studies at population level

Interactions with the physical dimension

Ecological studies at community level

Defining the abundance and the taxonomic and functional composition of phytoplanktonic eukaryotes in Antarctic seawater.



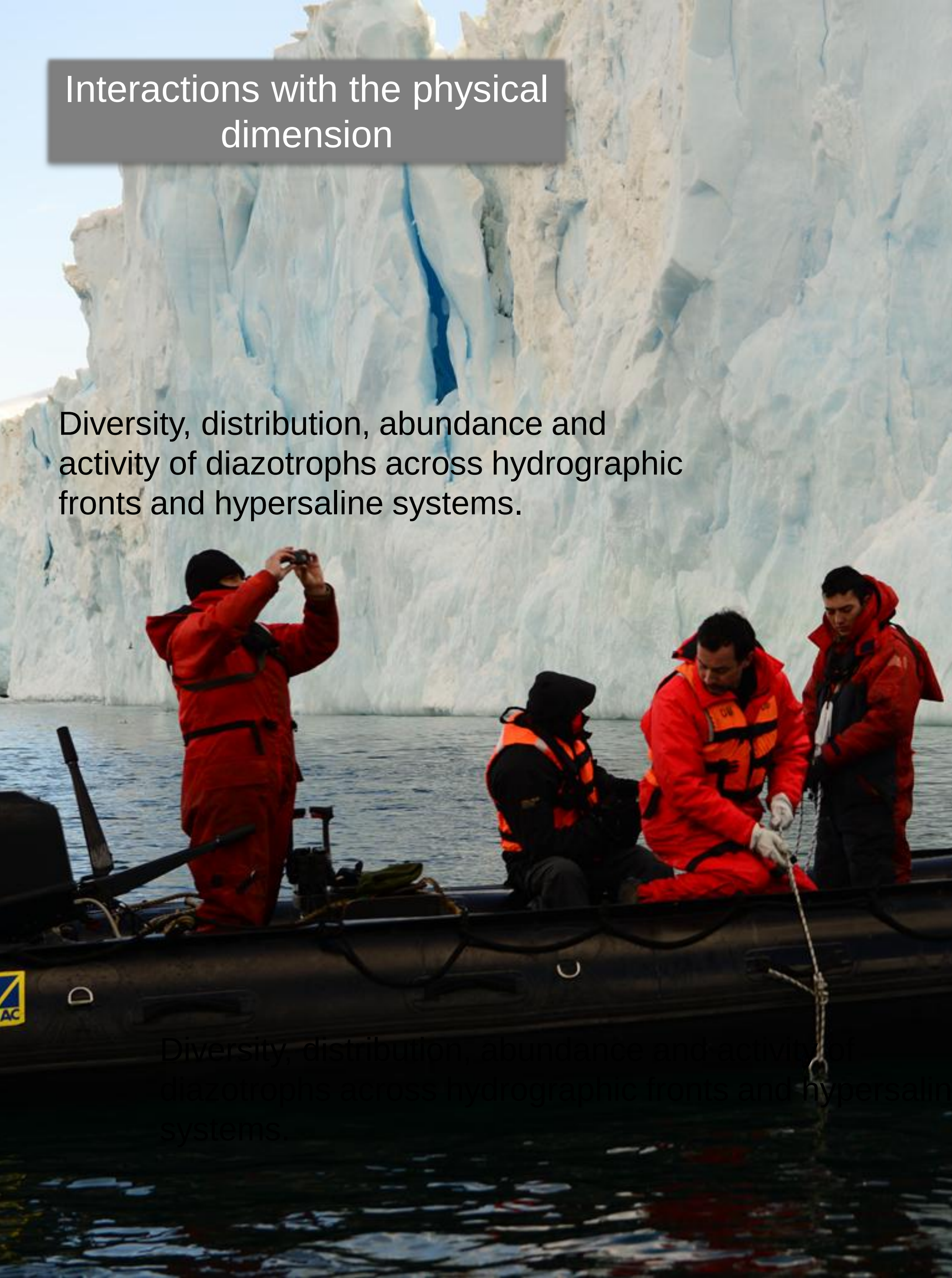
The role of Ixodes uriae in the health of penguins and how they vary in relation to the geographic location of the penguin colonies

Ecological studies at population level

There are contrasting conditions among summer and winter in Antarctica producing a drastic variation at population level, especially in the marine realm. A cluster of researchers are discovering these driving forces and the fitness of several organisms to the seasonally changing environment.

Limits of *Abatus agassizii* in the Antarctic Peninsula region. Analyzing its genetic diversity and determine the existence of a small scale genetic structure.

Interactions with the physical dimension



Diversity, distribution, abundance and activity of diazotrophs across hydrographic fronts and hypersaline systems.

Availability, specificity and selectivity in a cyano-lichen symbiotic association in Karukinka (Tierra del Fuego) and Livingston Island.

Diversity, distribution, abundance and activity of diazotrophs across hydrographic fronts and hypersaline systems.

Line IV. Global warming and climate evolution

Without doubt we find ourselves today under the influences of climate change that affects parts
of the planet unevenly. Recent reports highlight contrasts such as reduced marine ice in the Arctic while at the same time modest increases in Antarctic ice during the past three decades, as one proof of this. many questions are raised: What is responsible for these differences? how do these changes impact marine and terrestrial organisms? how do we go about obtaining information to reduce the uncertainty in projections for the coming decades? An endless number of other questions justify our redoubling of efforts to go forward with seeking knowledge on these matters that are of such great significance to humanity.

Line IV. Global warming and climate evolution

Effect over terrestrial organisms

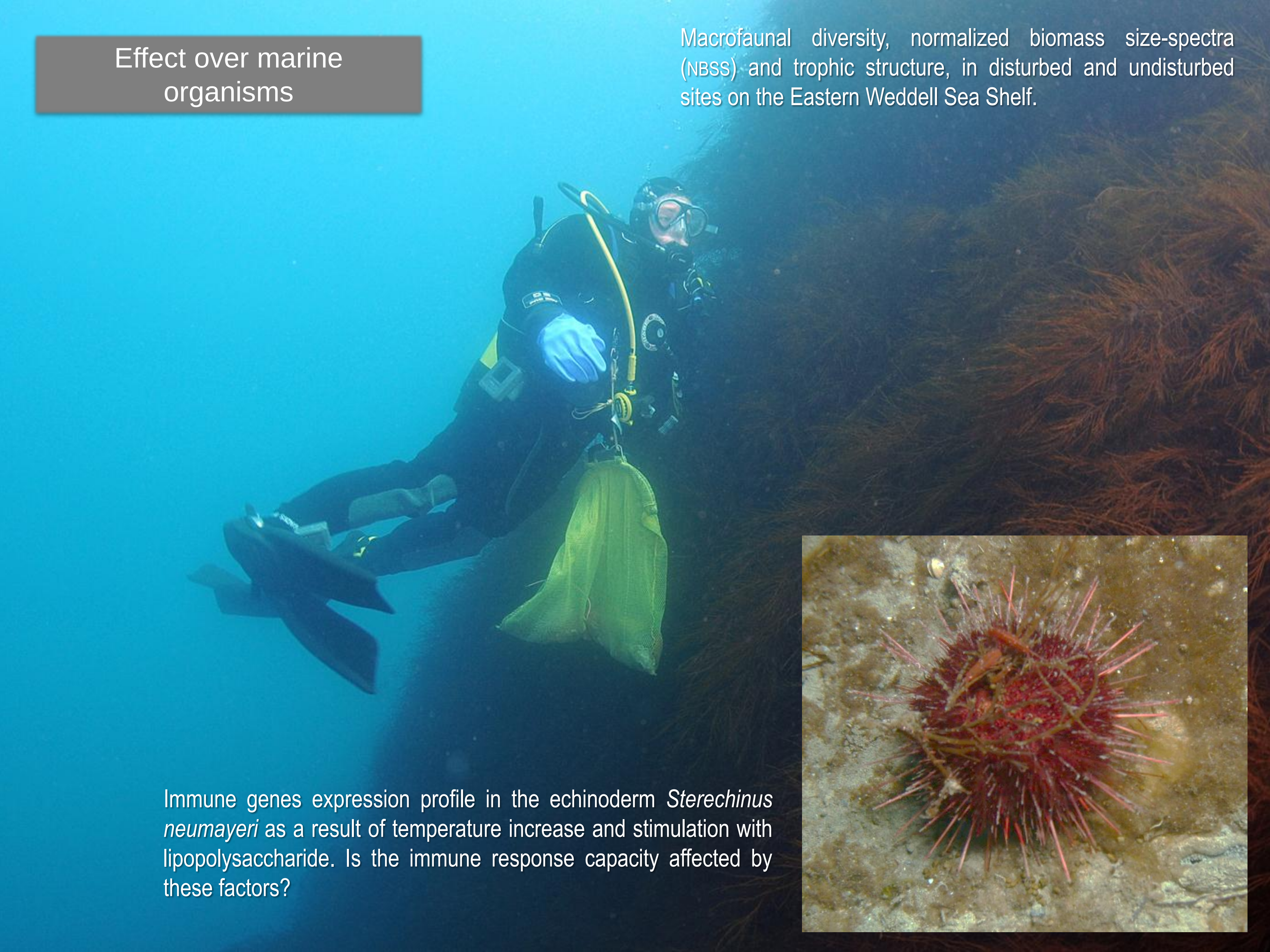
Effect over marine organisms

Physical variables: land, sea and atmosphere

Effect over terrestrial organisms

Dynamics of the constrain and expansion in the distribution of *Deschampsia antarctica*, *Colobanthus quitensis* and penguins.

Phenotypic plasticity under variations of temperature, nitrogen and water availability in populations of Colobanthus quitensis.


Effect over marine organisms
Macrofaunal diversity, normalized biomass size-spectra (NBSS) and trophic structure, in disturbed and undisturbed sites on the Eastern Weddell Sea Shelf.
Immune genes expression profile in the echinoderm *Sterechinus neumayeri* as a result of temperature increase and stimulation with lipopolysaccharide. Is the immune response capacity affected by these factors?

Physical variables: land, sea and atmosphere

Role of the Antarctic Intermediate Water (AAIW) in gas transporting and other physical properties to the eastern South Pacific Ocean. Discern between the biogeochemical and physical processes that transform these properties.

Recent high-resolution climate reconstruction for the northern Antarctic Peninsula

Mass balance, thickness and internal structure of the glaciers on the Antarctic Peninsula. State, dynamics and evolution of glaciers and ice shelves on the Antarctic Peninsula.

Line V. Environment and other initiatives

In addition to the projects
in the first four lines, there are several others perta
additional areas of polar research, which are suppo
INACH and which relate principally the Antarctic er

Line V. Environment and other initiatives

Space and Atmospheric Monitoring

Turbulence in space plasmas and its impact on magnetospheric dynamics and space weather

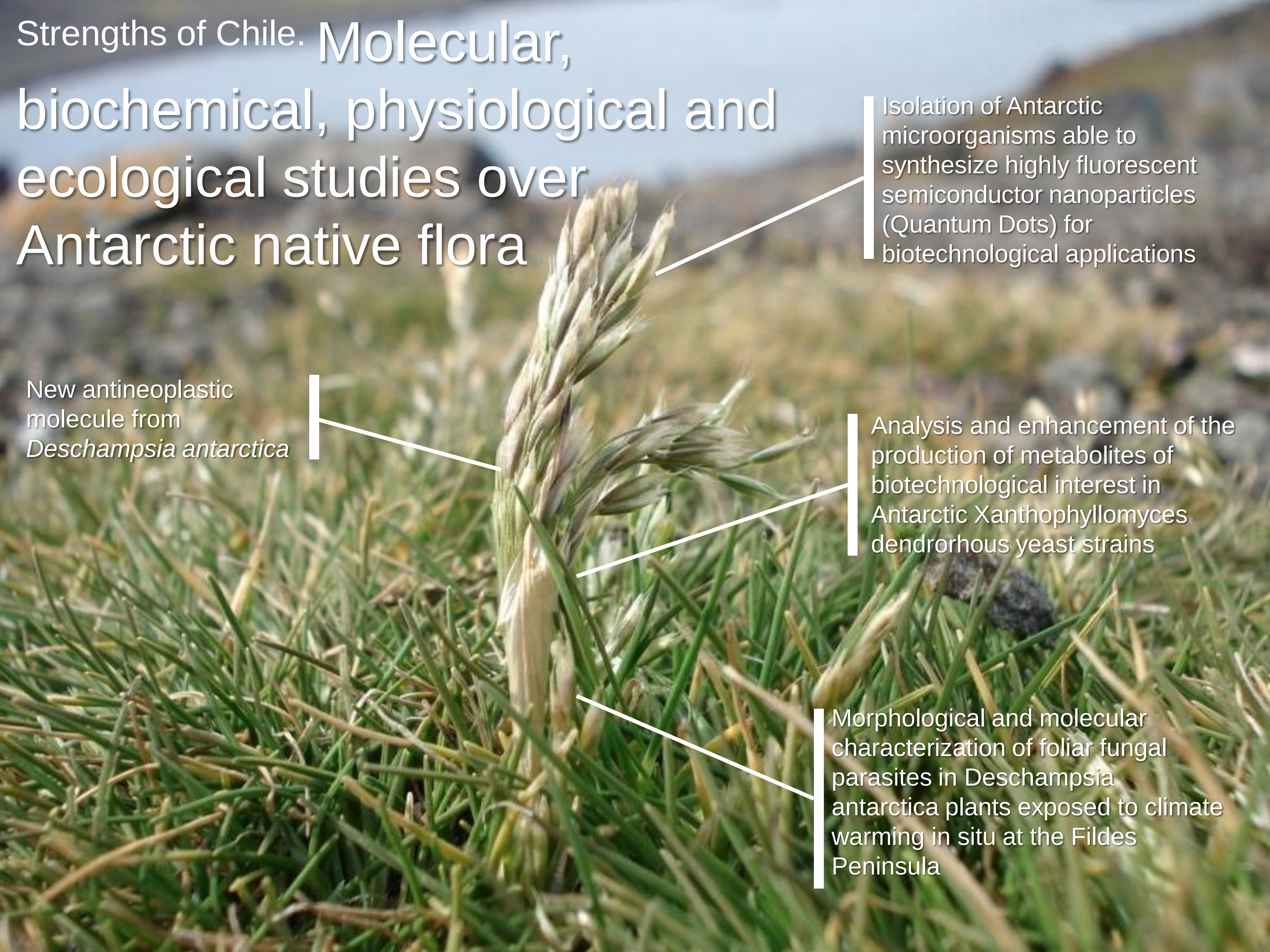
Organic compounds and environmental monitoring

Persistent organic compounds. Potential risk to the Antarctic environment

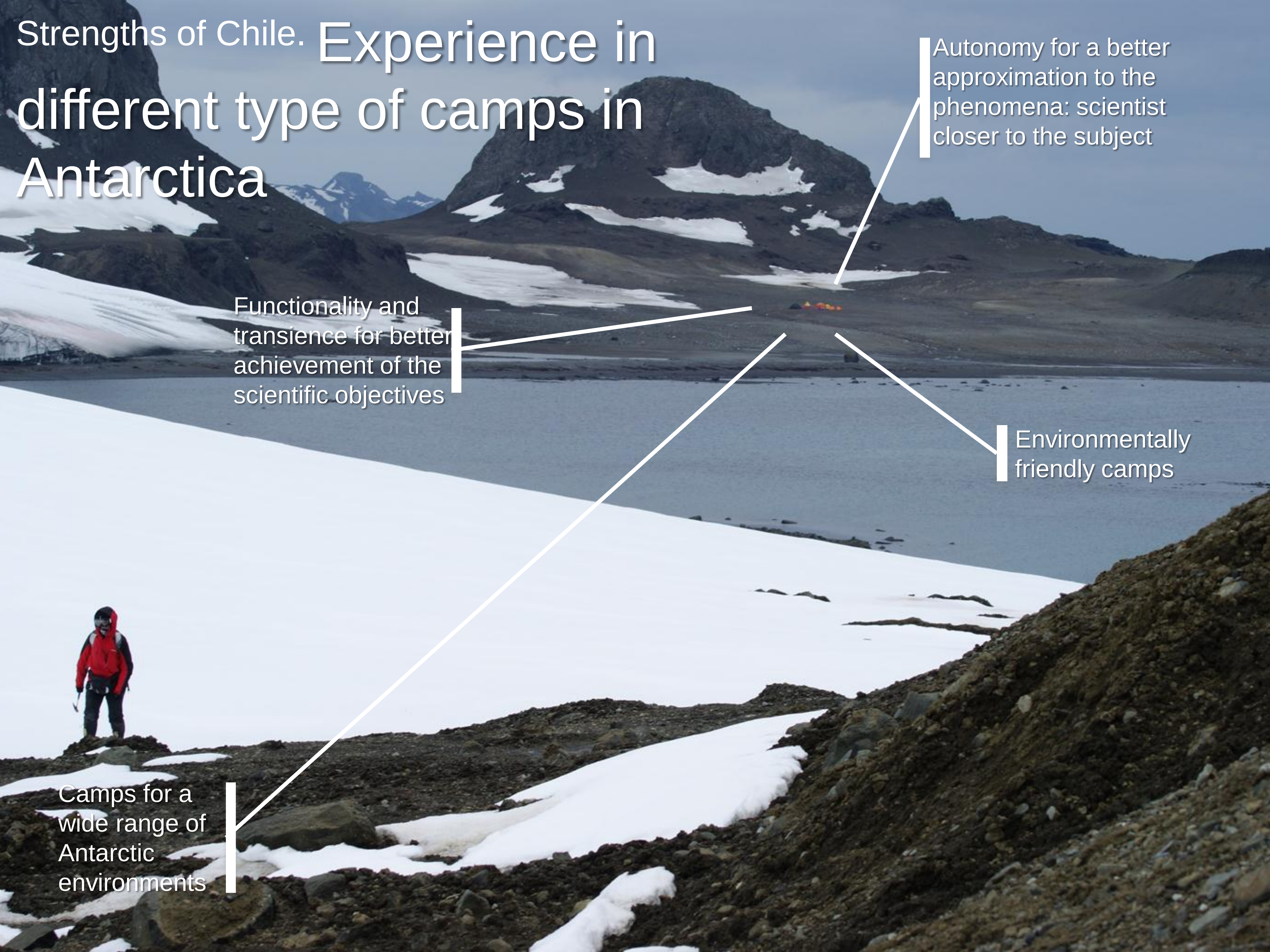
Effect of human contaminants in Antarctica. Identify key parameters

Strengths of Chile.

Molecular, biochemical, physiological and ecological studies over Antarctic native flora



Strengths of Chile. Experience in different type of camps in Antarctica



Thank you!

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Gracias!

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50 YEARS OF ANTARCTIC SCIENCE
2013