

Latest Developments in Chile's Algal Bloom

- PRESENTER ADOLFO ALVIAL | CORPORACION DE FOMENTO DE LA PRODUCCION (CORFO)

GLOBAL OUTLOOK FOR AQUACULTURE LEADERSHIP

GUANGZHOU, CHINA | DAY 3

HEALTHY FISH | HEALTHY PEOPLE | HEALTHY PLANET



Adolfo Alvial

- Adolfo Alvial is regional director of the Chilean National Agency for Economic Development (CORFO) and vice president of the Natural Resources Research Center (CIREN).
- He is the former director and co-owner of Adolfo Alvial Asesorias, a company providing assistance to the aquaculture sector, with emphasis in salmon farming.
- Previously, Alvial was president of INER Los Lagos, technical director of Marine Harvest Chile, director of the Technological Institute of Salmon (INTESAL), director of the aquaculture division of Fundación Chile, and secretary general and director of the Marine Science Department of the University Arturo Prat.



LATEST DEVELOPMENT IN CHILE'S ALGAL BLOOM

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▶ I AM COMING FROM A BEAUTIFUL REGION OF CHILE FOCUSED ON FOOD PRODUCTION AND TOURISM



A REGION THAT HAS FACED SEVERE CHALLENGES OF NATURE ...



STRONGEST EARTHQUAKE IN HISTORY

AND A DEVASTATING TSUNAMI



AND A NEW EVENT JUST LAST YEAR



VIEW FROM OUR HOME

STRONG AND SPECTACULAR



▶ WE ARE EXPERIENCING LARGE SCALE OCEANIC CHANGES



OUR COASTAL SEA ECONOMIC ACTIVITIES HAVE BEEN ALERTED



PORT INFRASTRUCTURE



COASTAL TOURISM

...AND CERTAINLY SEAFOOD PRODUCTION



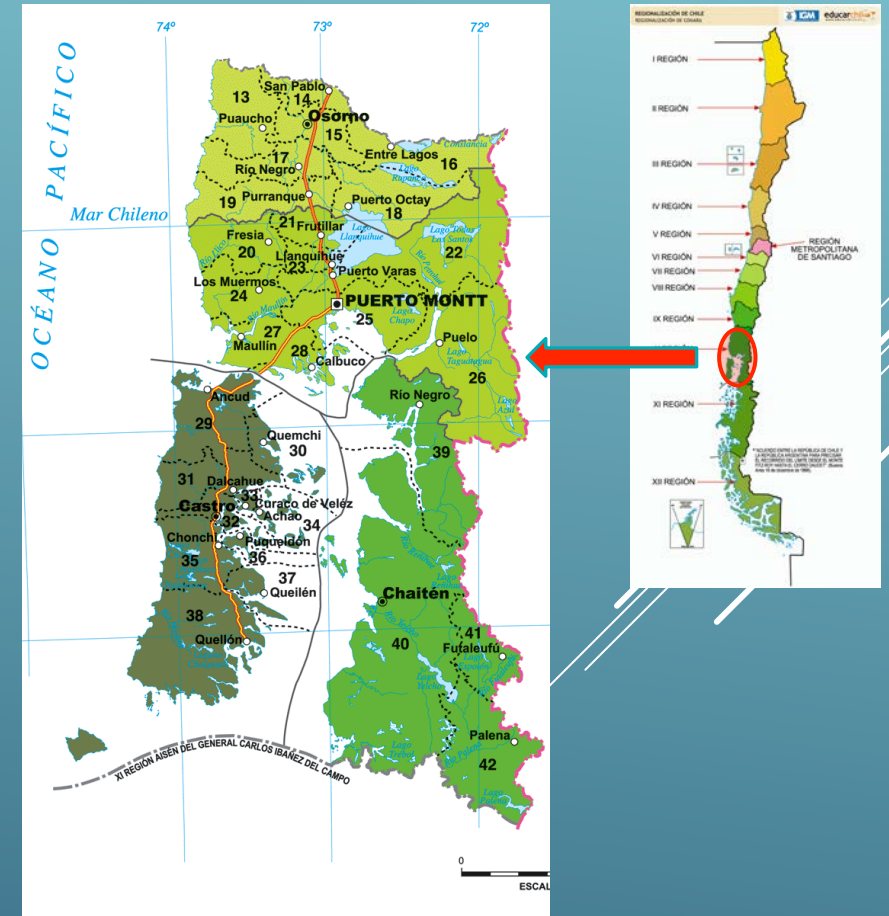
SALMON, MUSSEL, SEAWEED AND OTHER RESOURCES ARE CRUCIAL FOR THE REGIONAL ECONOMY

Salmon production 955,000 MT (2014)/ 834,000 MT (2015); 4,4 billion dollars export (2014)/3,6 billion(2015), 30,000 direct jobs and 40,000 indirect jobs (region is app. 40%).

Mussel production 250,000 ton (2014)/300,000 (2015), app 200 million dollars export, 12,000 permanent jobs and 5,000 temporary jobs. (region 100 %)

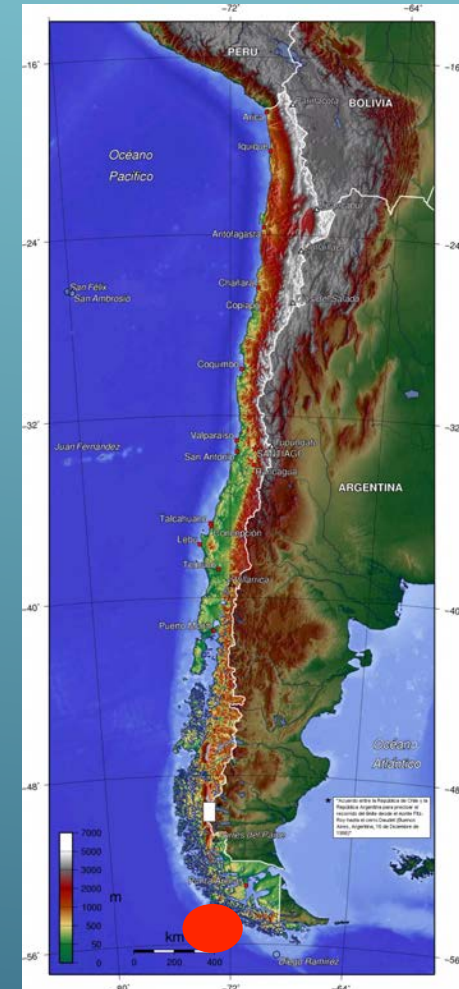
Seaweed production around 183 million dollar export, more than 20,000 people involved in seaweed harvest (region is app. 40%). Only 2% farmed.

Artisanal fishery represents around 35% of the country.



HARMFUL ALGAE BLOOMS DURING THE LAST 30 YEARS IN CHILE

- Phytoplankton blooms are common along the Chilean coast in spring and summer.
- Sometimes red tides and brown tides are also present, lasting for a couple of weeks
- HABs dominated by *Alexandrium catenella* started 30 years ago in Magallanes and advanced towards the north.
- Harmful algae blooms (HABs) remained almost stationary in large sectors of the Magallanes and Aysen regions until present.



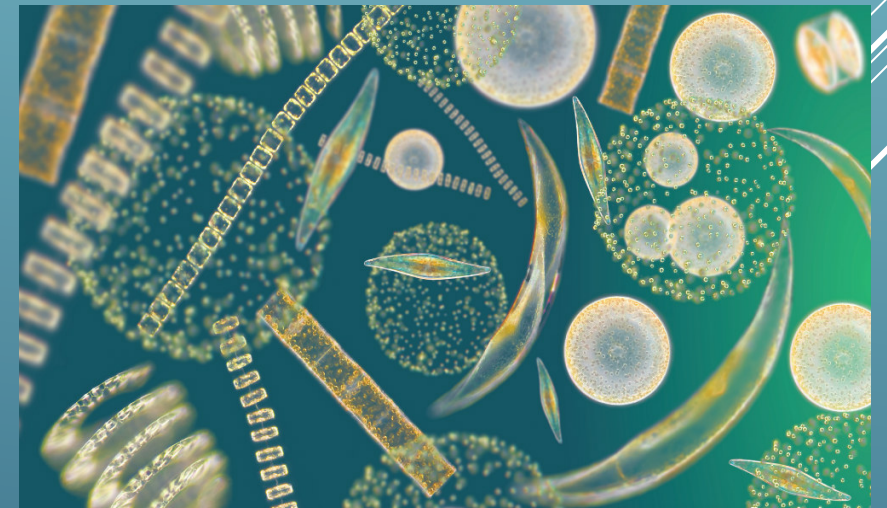
THEN...HAB "ARRIVED" TO THE LAKES REGION

- First significant HAB in 1988, caused by *Heterosigma akashiwo* affecting salmon.
- A training course and a manual were produced, supported by FCh and assisted by the best experts at that time.
- A monitoring program in the salmon industry was initiated.



MONITORING WAS ESTABLISHED AS AN INDUSTRY EFFORT (1988); FORECAST WAS ATTEMPTED JUST IN 2004 -2005; SOME MITIGATION METHODS HAVE BEEN APPLIED.

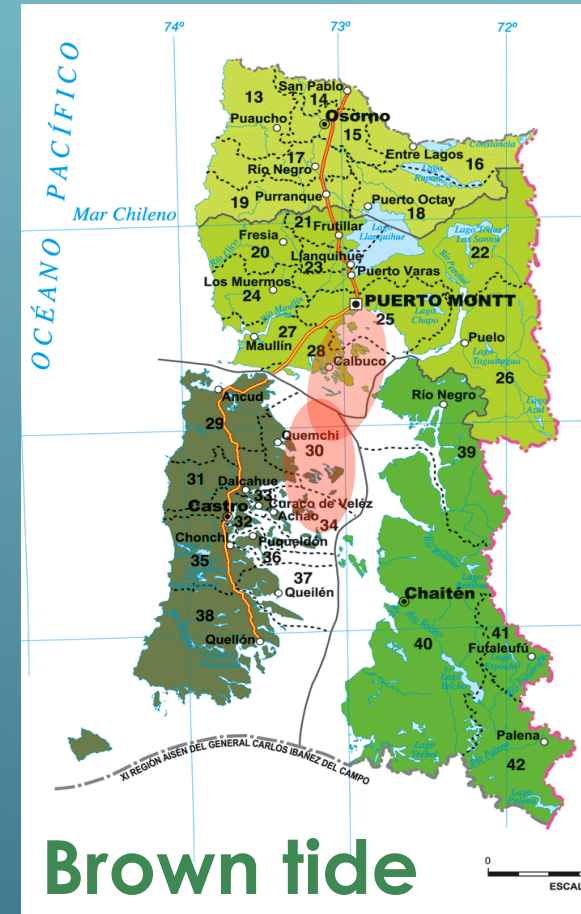
- Monitoring has continued as Private service (Plancton Andino). In addition IFOP and University Austral have developed their own monitoring plans.
- Forecast program was ended in 2007
- Mitigation applications have rested on air and oxygen supply in sea cages and in some few curtains Systems. Some innovations have been done in instant diffusers and upwelling systems.



UNPRECEDENTED HARMFUL ALGAE BLOOMS IN 2016.

2 SEQUENTIAL BLOOMS IN A MATTER OF 4 MONTHS: ONE BROWN TIDE FOLLOWED BY A RED TIDE

- Conditioning factors: El Niño, high radiation, drought, wind calm, penetration of oceanic waters, strong stratification, cysts of noxious species in the area, ready to bloom.
- In February, *Pseudochattonella* started blooming, then moving in the way showed in the figure.
- In a matter of few days the Brown tide was dispersed in Chiloé inland sea, impacting 33 Farms, killing 30 million fish (8% of the inventory), equivalent to 40 thousand ton. Total loss was estimated in 600 million dollars.



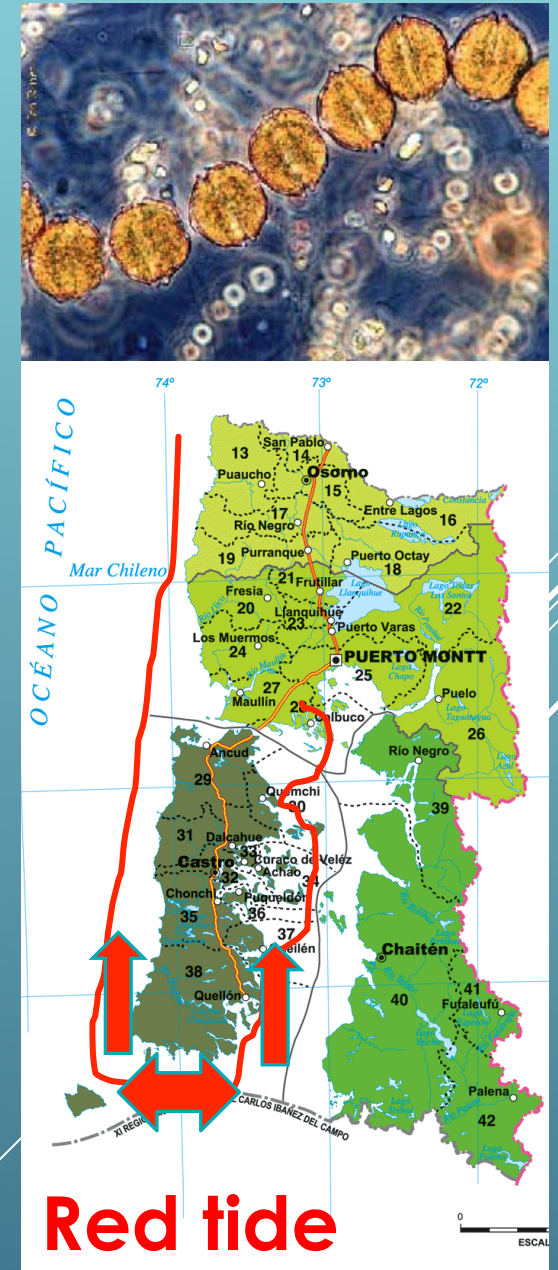
AN EXTRAORDINARY EVENT

- At the end of January, an extraordinary concentration of cells were observed, reaching 25,000 cel/mL (reported by some companies).
- Mitigation measures in few farms resisted massive kills but until cells reached concentrations around 15,000 cel/mL.
- 2 things should be stressed: Dead salmon disposal 75 miles offshore North of Chiloé and the firing of workers of the salmon industry. Both provoked public reaction.



AND THEN...THE UNPRECEDENTED RED TIDE...

- The red tide caused by *A. catenella* started in South of Chiloé and evolved in the way indicated in the Figure (fortunately). This impacted essentially mussel producers and benthic artisanal fisheries.
- Areas had to be closed for shellfish harvest following the spatial movement of the red tide due to PSP (Paralytic Shellfish Poison)
- Levels of cells concentration observed in the water have no precedent and PSP concentration reached up to 6,000 to 9,000 ug/100 g of edible parts. Tolerance level is 80 ug/100 g edible parts.
- The Government reaction was judged slow by artisanal fisheries organizations. A social movement was initiated affecting activities in Chiloé and some places in the continent.
- So, an environmental large scale problem, of multi sectorial character was aggravated by a social movement, ...a perfect storm.



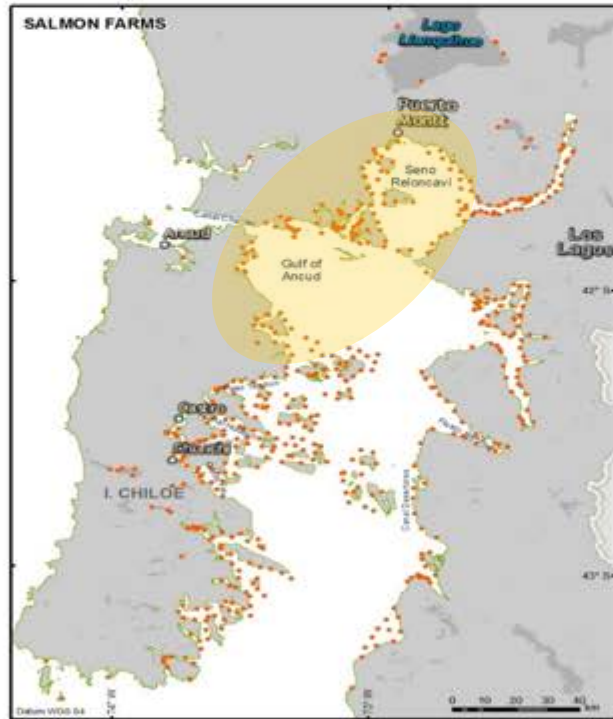
DISTRIBUTION OF THE 3 AFFECTED ACTIVITIES

33 affected farms. 40.000 MT loss

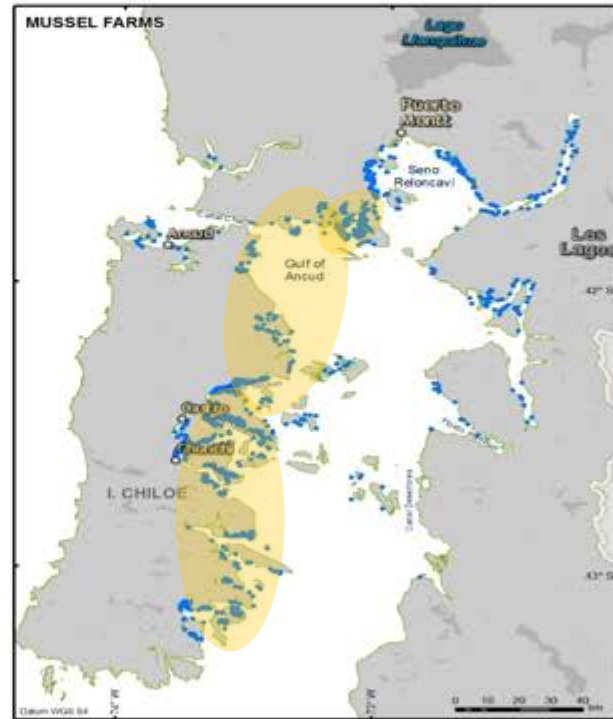
200 affected farms. App 15% reduction in harvest compared 2015

600 Km of benthic artisanal fishery affected & as an average: 4 months of closure

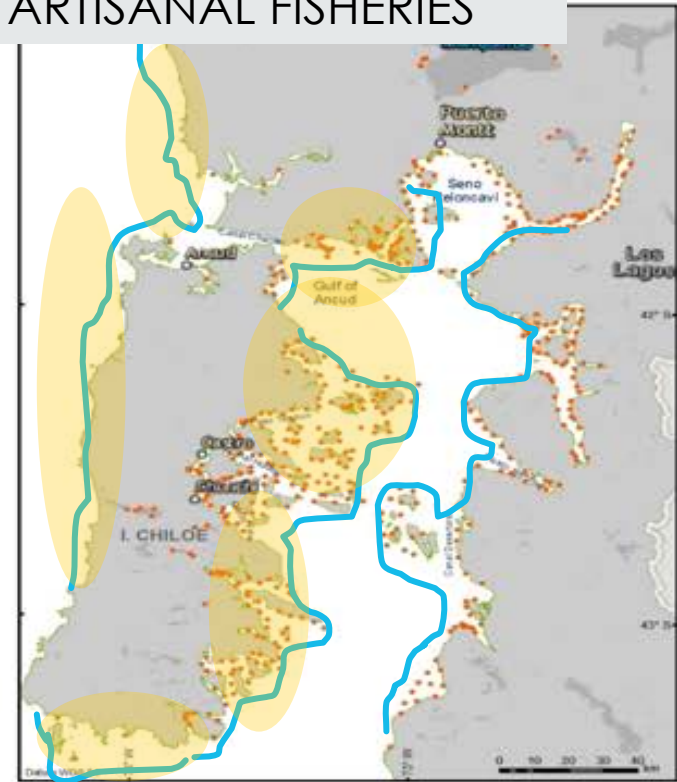
SALMON FARMS



MUSSEL FARMS



ARTISANAL FISHERIES



GOVERNMENTAL ACTION

5,000 workers of the salmon industry, 9000 fishermen, 600 small mussel farmers, and 2000 owners of small shellfish sale points and small restaurants have been affected.

Government signed agreements with organizations to end the conflict that include: Social help, fisheries regulation review, economic reactivation and 2 studies.

Red tide situation started to decline in the sea since June, but it will take longer time for shellfish show acceptable level of toxin.

In spite of the magnitude, extension and persistence of the red tide, nobody was killed due to shellfish consumption.

In 3 months there have been an impressive advancement in accomplishment of agreements in all aspects.

There are campaigns pursuing to reestablish trust to consume fish and shellfish duly certified and to invite tourist to visit the zone given the normalization of activities after the critical period: March – August 2016.

LESSONS

HABs will be an increased risk in the zone as the distribution of harmful species has covered a larger area of the region and climate change creates favorable oceanographic conditions for them.

Consequently, Monitoring, Forecast and Mitigation methods have to be updated and coordinated to serve all sectors and Government timely.

A Marine environment center for Aquaculture and Fisheries is necessary in the Chilean Patagonia. This center should study and monitor hydrodynamic conditions, HABs, carrying capacity and zoning in the aquaculture and fishing areas.

Coordination between agencies is fundamental and urgent to reach effectiveness in forecasting and mitigating HABs in the future.

Insurance cost has increased so it is important for the aquaculture industry to establish as soon as possible a complete plan to monitor, forecast and mitigate HABs.



THANK YOU