

FOCA

(Ferries Observando los Canales Australes)

Towards a Chilean SOOP operational monitoring facility

Chile's Marine Territory

- ★ Chile's Pacific coastline stretches from 18S to 54S.
- ★ The Chilean EEZ is ranked 10th in size, and is 4 x the land surface area
- ★ Ocean resources are fundamental to Chilean economy and society
- ★ Chile ranked 5th for pelagic fish extraction, 2nd for farmed salmon production
- ★ ~2% of national workforce directly employed in marine resource extraction, including a large artisan fisherman population
- ★ Cultural significance



Marine resource management

Jurel, congrio dorado, raya, anchoveta y merluza común y del sur son las especies sobre las que recaerán restricciones:

Gobierno aplicará recorte de CUOTAS DE CAPTURA en seis tipos de pesca

MINISTERIO DE ECONOMÍA TRABAJA EN UNA ESTRATEGIA DE CUATRO EJES, QUE BUSCA FIJAR CUOTAS SOBRE LA BASE DE CRITERIOS TÉCNICOS Y DE LARGO PLAZO, AL TIEMPO DE AUMENTAR LA FISCALIZACIÓN.

Hubo políticas de administración pesquera cortoplacistas en los últimos años, que han terminado minando la esencia del sistema".

JUAN ANDRÉS FONTAINE
MINISTRO DE ECONOMÍA

Cuota global de captura debe:

- Bajarse significativamente**
 - Jurel** (De la XV a la X Región)
 - Congrio dorado** (De la X a la XII Región)
 - Raya** (De la VIII a la X Región)
- Bajarse**
 - Anchoveta** (De la XV a la II y de la V a la X Región)
 - Merluza común** (De la IV a la X Región)
 - Merluza del sur** (De la X a la XII Región)
- Mantenerse**
 - Anchoveta** (De la III a la IV Región)
 - Sardina común** (De la V a la X Región)
 - Merluza de cola** (De la V a la XII Región)

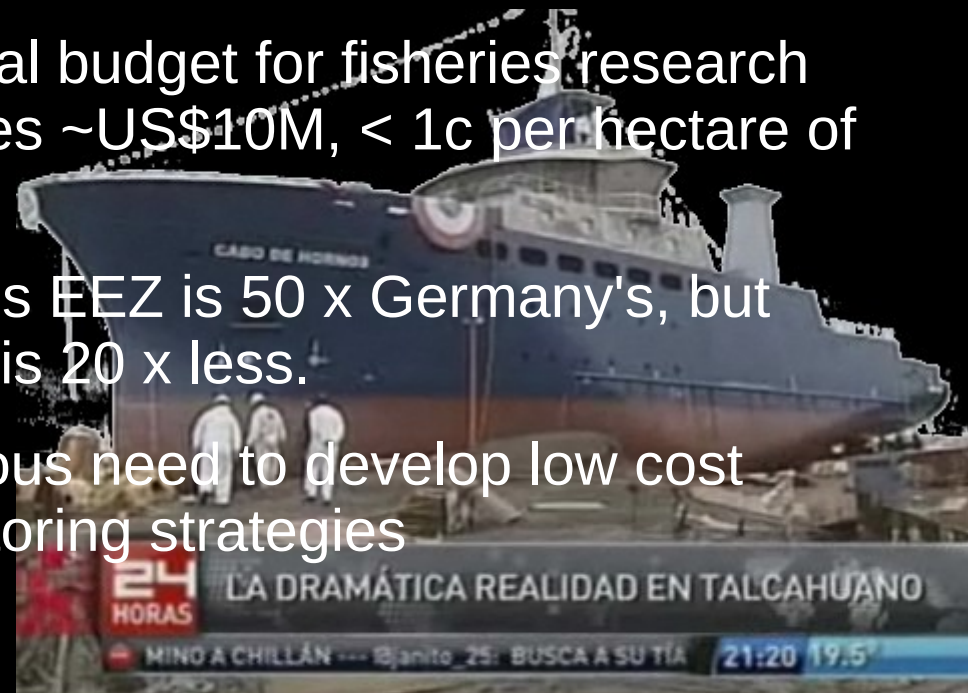
ALFREDO CÁCERES

EL MERCURIO
Fuente: Subsecretaría de Pesca

- ★ the various societal benefits derived from the ocean are threatened by overexploitation of the resources
- ★ e.g. 2010 collapse of jurel fishery, ongoing sanitary problems in salmon industry
- ★ desperate need for a) informed management strategies and b) enforcement
- ★ in both cases improved observational capacity is essential

The ocean monitoring problem

- ★ Despite the importance of its marine resources, Chile's EEZ remains grossly undersampled
- ★ Presently just one operational ocean-going research vessel for ~5000 km of coastline
- ★ Principal limitation for improving ocean monitoring capacity is funding
- ★ Annual budget for fisheries research cruises ~US\$10M, < 1c per hectare of EEZ!
- ★ Chile's EEZ is 50 x Germany's, but GDP is 20 x less.
- ★ Obvious need to develop low cost monitoring strategies



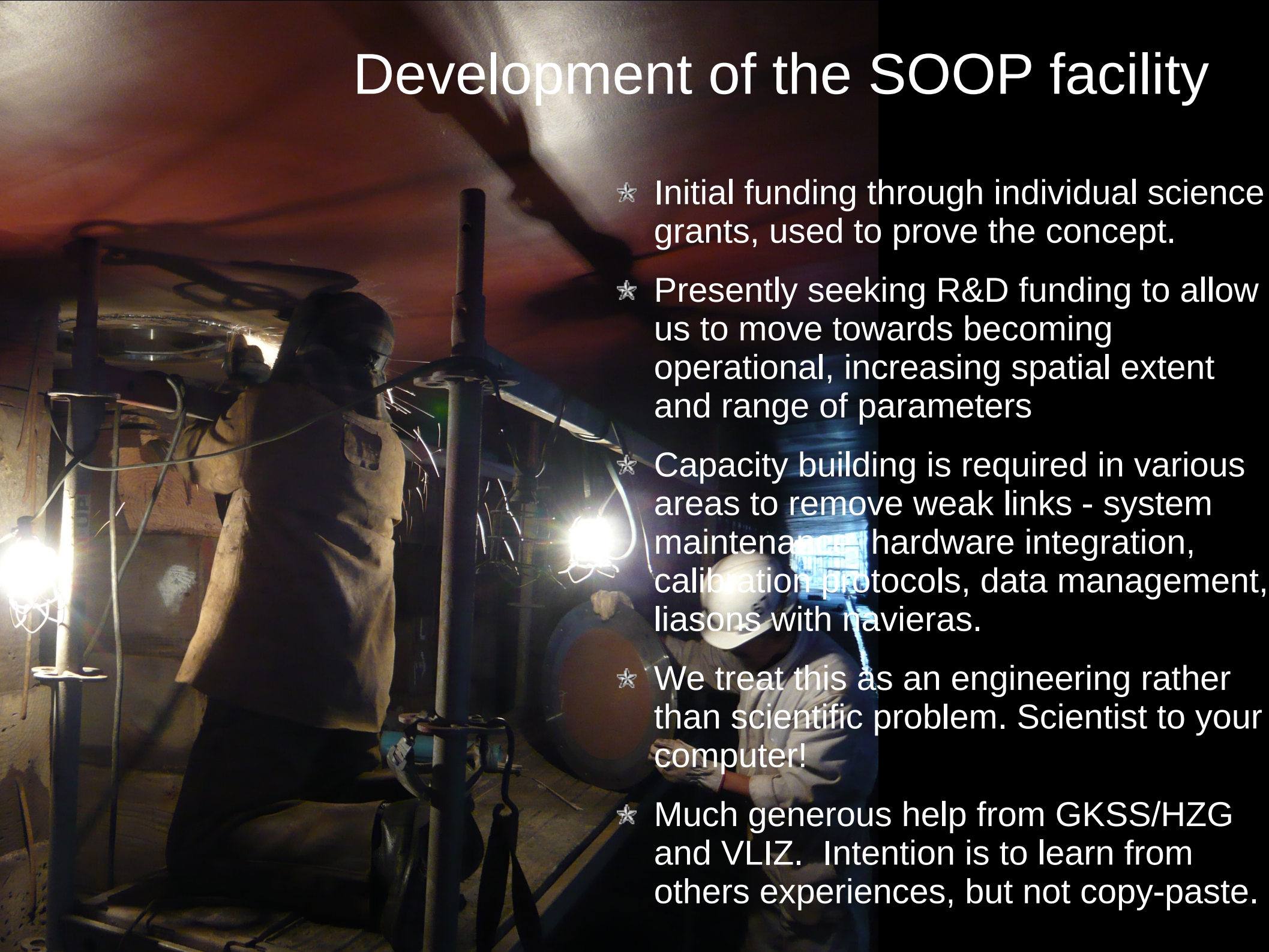


Chilean SOOP network

- ★ SOOP have great potential to significantly augment Chile's observational capacity, but barely used
- ★ With FOCA (Ferries Observando los Canales Australes) and MORSA (Mercantes Observando la Region Sud Americana) we set out to fill the gap
- ★ Our goal is to develop a **reliable** and **financially sustainable** SOOP monitoring network for the Chilean EEZ
- ★ Emphasis on keeping costs low (not enough to be cost effective), by using technology, standardisation, and operational efficiency
- ★ Provide raw data freely to all users, encourage value adding, operational and scientific

Development of the SOOP facility

- ★ Initial funding through individual science grants, used to prove the concept.
- ★ Presently seeking R&D funding to allow us to move towards becoming operational, increasing spatial extent and range of parameters
- ★ Capacity building is required in various areas to remove weak links - system maintenance, hardware integration, calibration protocols, data management, liasons with navieras.
- ★ We treat this as an engineering rather than scientific problem. Scientist to your computer!
- ★ Much generous help from GKSS/HZG and VLIZ. Intention is to learn from others experiences, but not copy-paste.



Routes and Parameters



FOCA began in 2007 with two Navimag ferries operating in the fjords, funding from study of Golfo de Penas

Measurement of T, S, DO and wind

MORSA involves the container ship “Condor” that operates between 33S and 54S, funding from study into larval dynamics

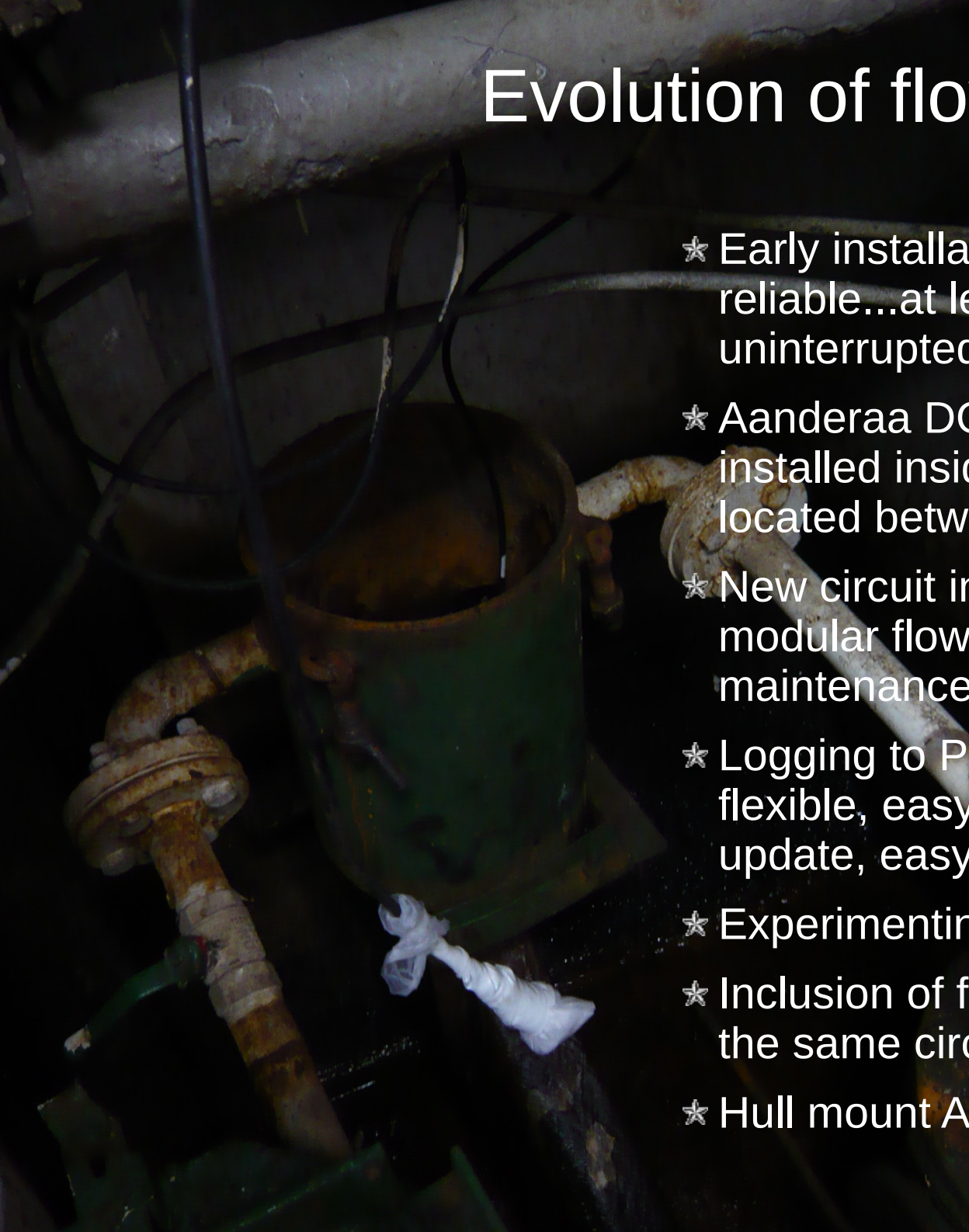
Will include T, S, DO, Chl-a, Turbidity, ADCP, plankton and wind

Permission already granted to include many more vessels and routes in the network

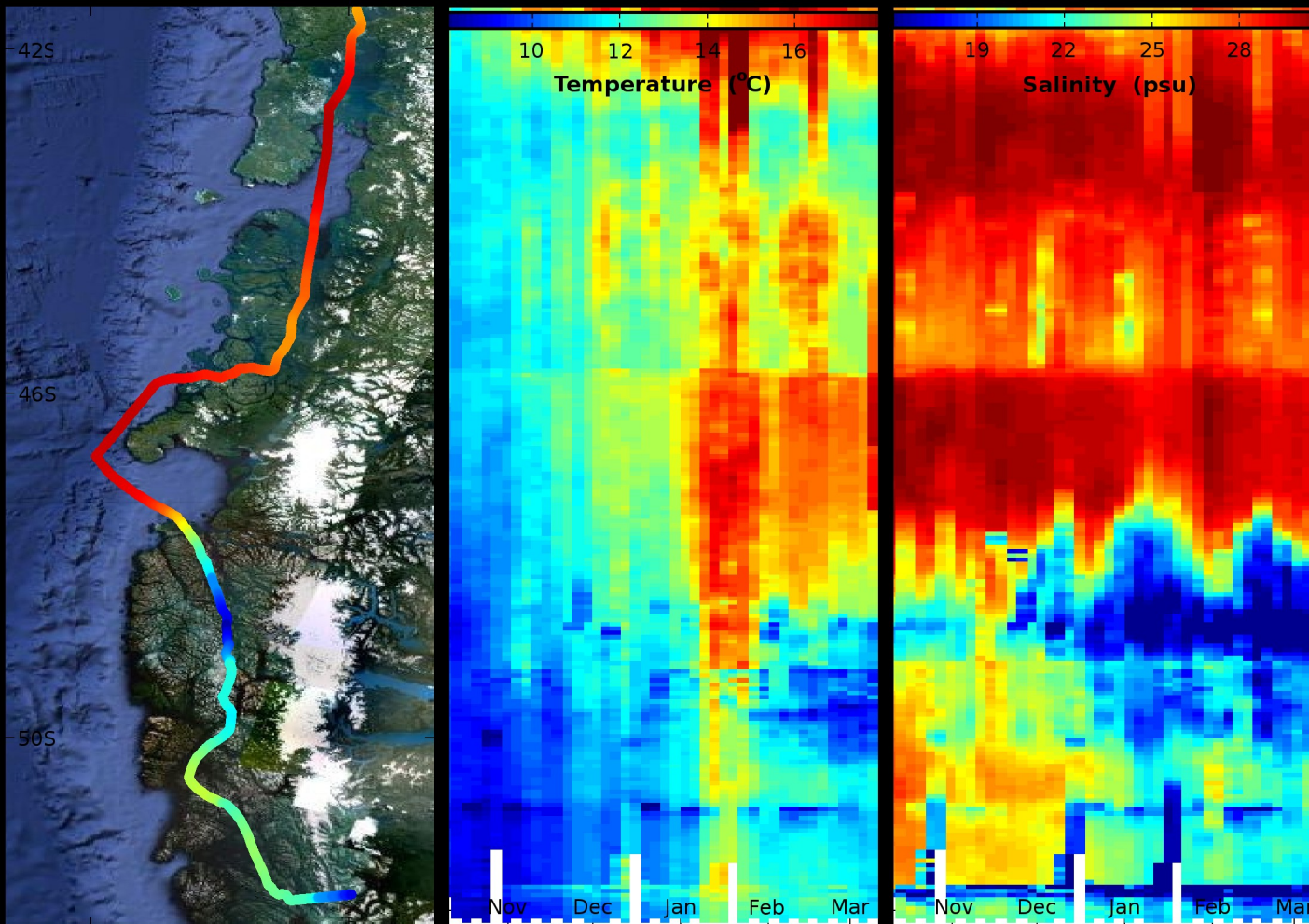
Threats from deregulation of cabotaje services, improved terrestrial connectivity

Evolution of flow through system

- ★ Early installations were quite low tech but reliable...at least for a while - over 8 months of uninterrupted data until pump failure
- ★ Aanderaa DO and conductivity sensors installed inside a “cacerola”, circuit in steel, located between filter and pump
- ★ New circuit in PVC (between steel valves) with modular flow chambers facilitates maintenance, adaptation and independence
- ★ Logging to PC instead of dedicated logger, flexible, easy to debug, easy to adapt, easy to update, easy to repair
- ★ Experimenting with wipers for optical sensors
- ★ Inclusion of flow through plankton recorder on the same circuit
- ★ Hull mount ADCP with pressure sensor



Results: Golfo de Penas



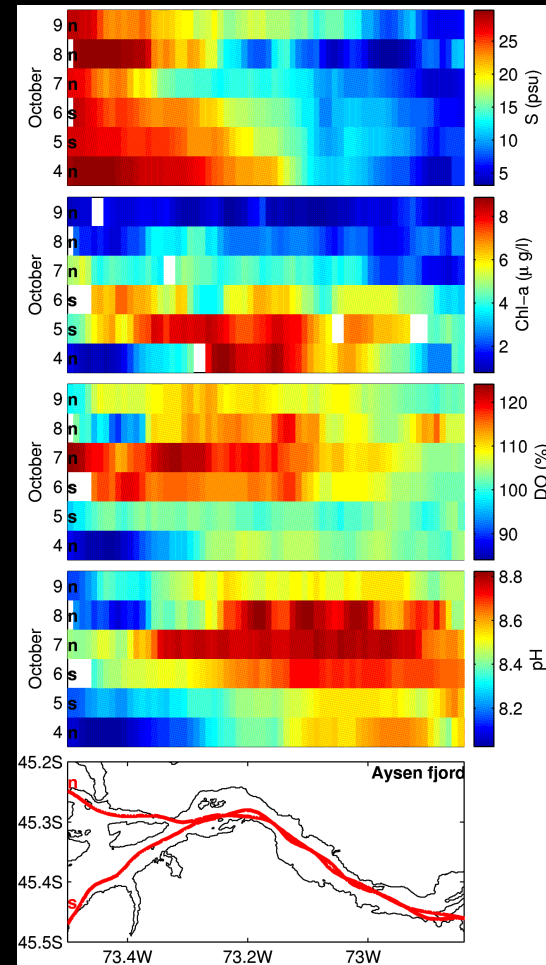
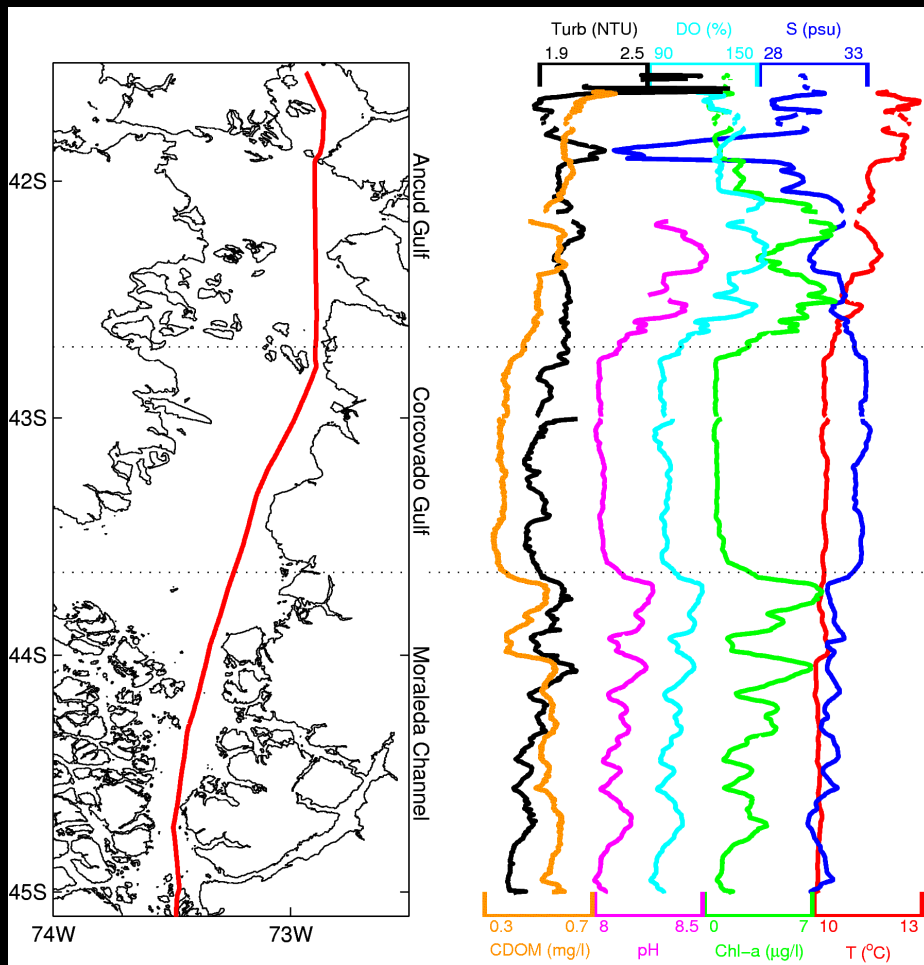
- ★ Not just a learning experience, also some interesting data
- ★ Surface S, T and density provide evidence for exchange with the Baker Channel
- ★ Large fluctuations in SSS on scales of weeks within Golfo de Penas
- ★ Not linked to river fluctuations, so possibly a wind driven reorganisation of the plume
- ★ Short-scale fluctuations are possibly an artifact of changing ship draft

pFB data in the Chilean fjords



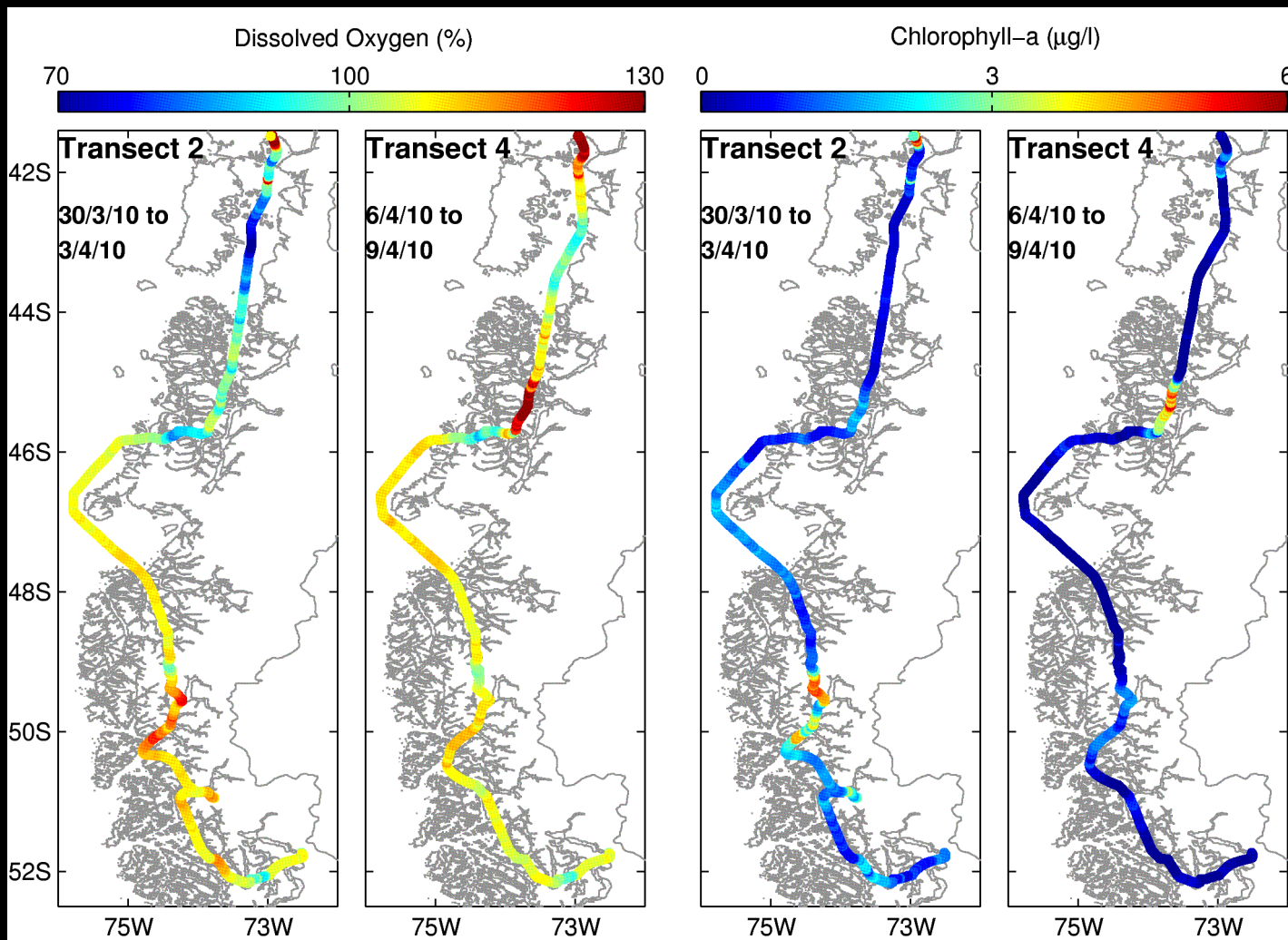
- ★ Two campaigns with GKSS/HZG using the pocket FerryBox on the Ro-Ro Evangelistas
- ★ Suite of automated sensors plus manual taking of samples for nutrients, HPLC and plankton count
- ★ Idea was to demonstrate the utility of the pFB for operational monitoring, even unmanned
- ★ Also produced some interesting science

Plankton dynamics



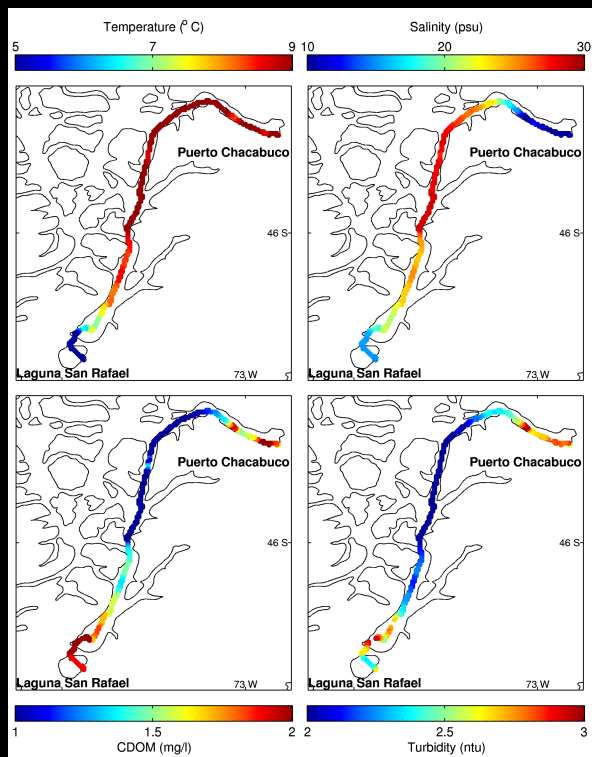
- ★ Fine structure in blooms not resolved by discrete monitoring
- ★ Often complex relationship between surface DO, pH and Chl-a
- ★ Possibly a symptom of stratification

Dissolved oxygen variability

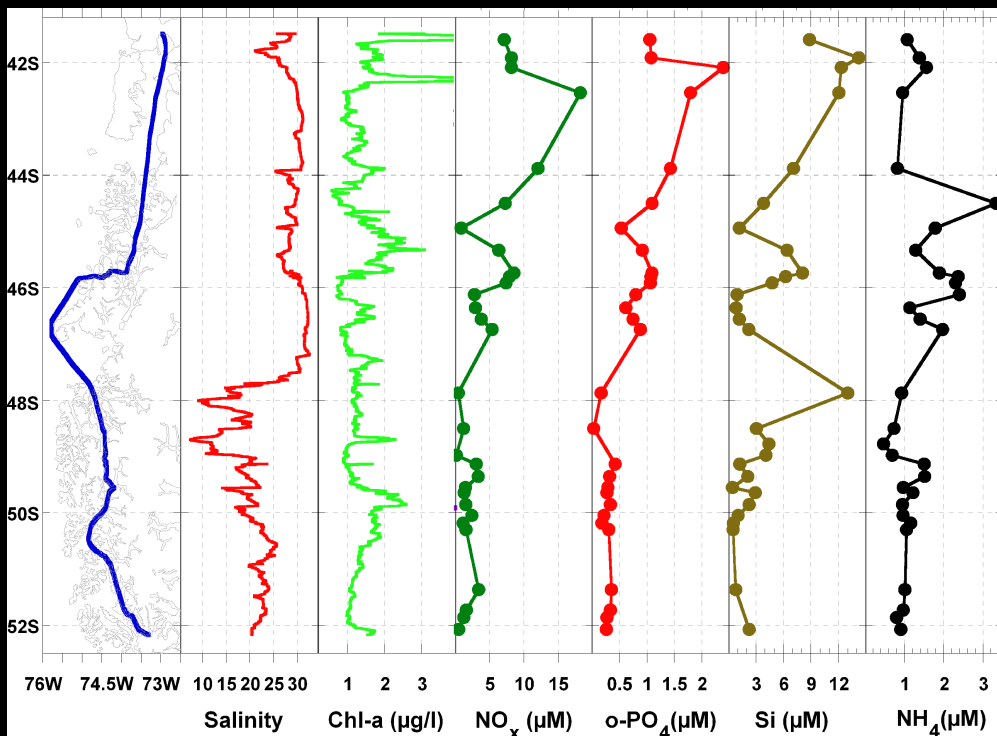


- ★ Low surface DO observed in Golfo de Corcovado and some channels
- ★ Timing suggestive of a vertical tidal mixing source
- ★ Despite intense salmon farming, little known of natural ventilation processes in Chilean Inland Sea

CDOM and Nutrients



- ★ Detection of CDOM peaks near river mouths in Aysen fjord and Laguna San Rafael
- ★ Linked to heavy rain the previous day
- ★ Relatively high N, P in northern fjords, nutrient poor in south
- ★ Silicate peak at 48S due to Baker River
- ★ High ammonia at ~45S, > 0 along Messier Channel





Conclusion

- ★ SOOP monitoring makes a lot of sense for Chile
- ★ Early efforts have been generally successful and indicate the way forward
- ★ Solution must be tailored to local reality, important to learn and not just copy
- ★ Must take full advantage of intrinsic low operating costs
- ★ Prioritizing efficiency will allow maximum benefit and greatest chance of long term sustainability
- ★ Still very early stages, slow process, but there are reasons for optimism