Vulnerability to climate change of essential habitats for fishery resources of economic importance in Chile

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ECOSYSTEM-BASED FISHERIES MANAGEMENT

ECOSYSTEM — Broad concept, without clear limits, difficult to define.

DATA — Must cover the spatio-temporal variability of ecosystem components, from the fishery to oceanographic conditions.

MONITORING AND MODELING OF THE HABITAT OF SPECIES

Can replace the broad and imprecise representation of the ecosystem.

Models assess habitat preferences from biological responses to changing environmental conditions in space and time.

Habitat Suitability Index (HSI)
Modelling integrated with GIS provides maps and information for decision making [1].

$$HSI = \frac{1}{n} \sum_{i=1}^{n} SI_i$$

HABITAT SUITABILITY MODELING OF FISHERY RESOURCES

Historical biological fishing and environmental data

SIG
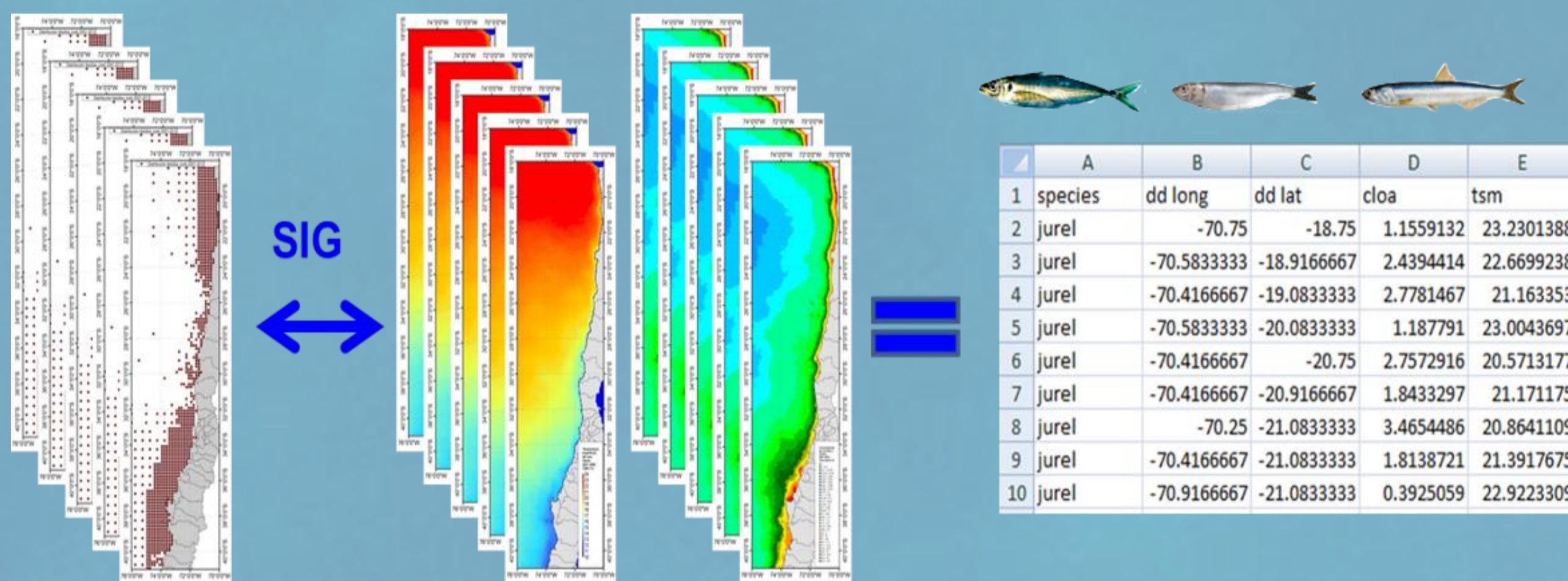
|	A	B	C	D	E
1	species	dd long	dd lat	cloa	tsm
2	jurel	-70.75	-18.75	1.1559132	23.2301388
3	jurel	-70.5833333	-18.9166667	2.4394414	22.6699238
4	jurel	-70.4166667	-19.0833333	2.7781467	21.163353
5	jurel	-70.5833333	-20.0833333	1.187791	23.0043697
6	jurel	-70.4166667	-20.75	2.7572916	20.5713117
7	jurel	-70.4166667	-20.9166667	1.8433297	21.171175
8	jurel	-70.25	-21.0833333	3.4654486	20.8641105
9	jurel	-70.4166667	-21.0833333	1.8138721	21.3917675
10	jurel	-70.9166667	-21.0833333	0.3925059	22.9223305
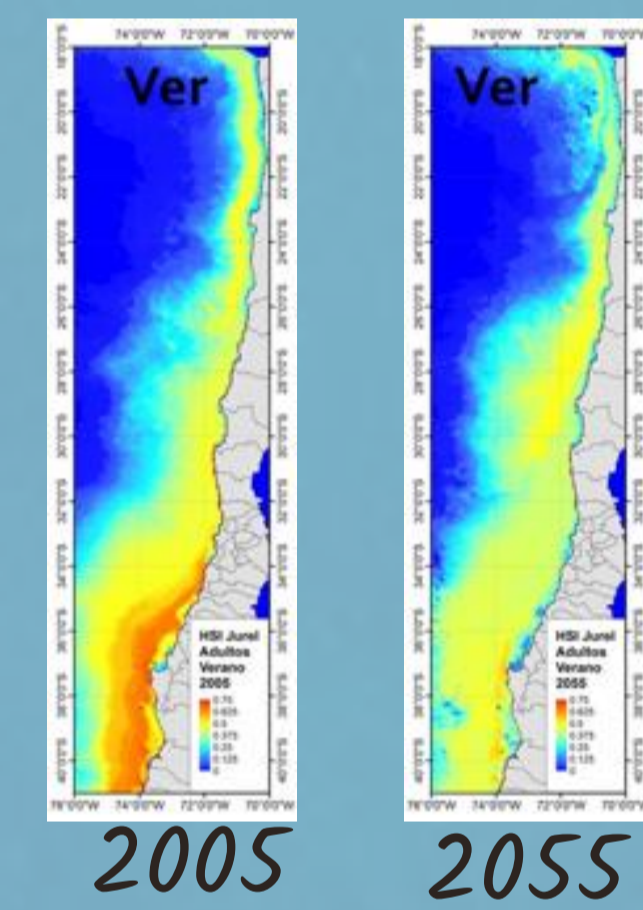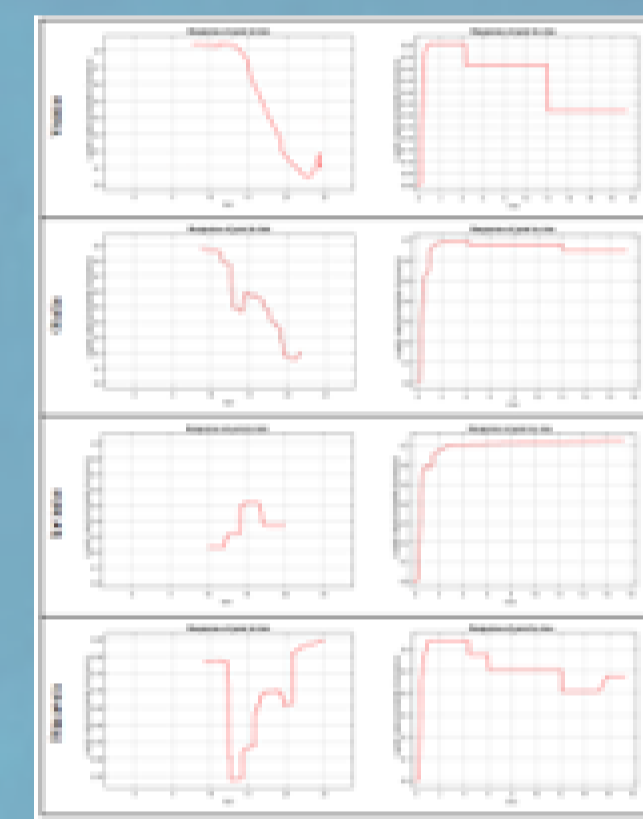
2005   2055
HSI modeling
(GAM, GLM, ANN, Maxent...)

HSI (future – present)

Ver

2005-2055

Ver
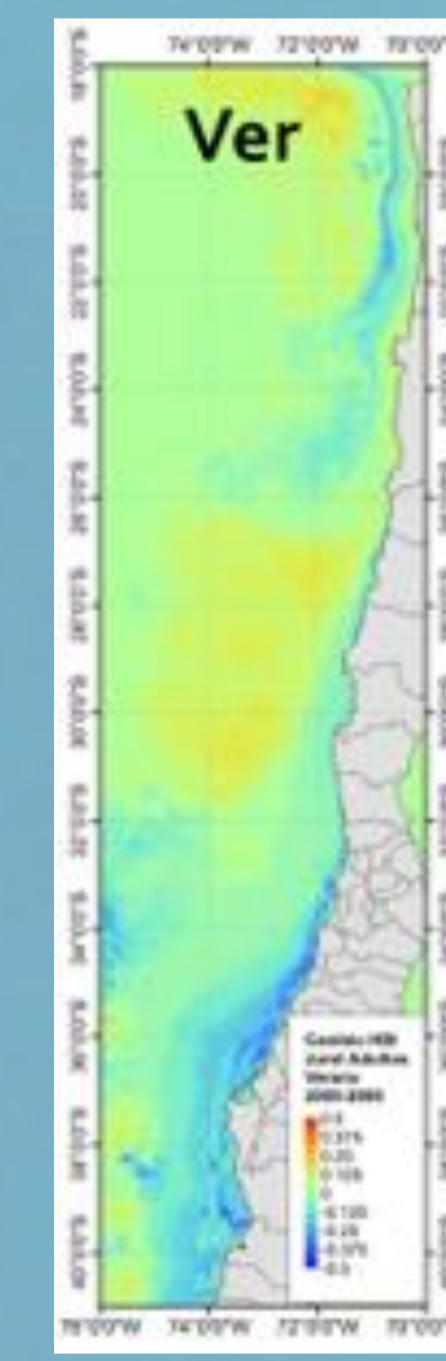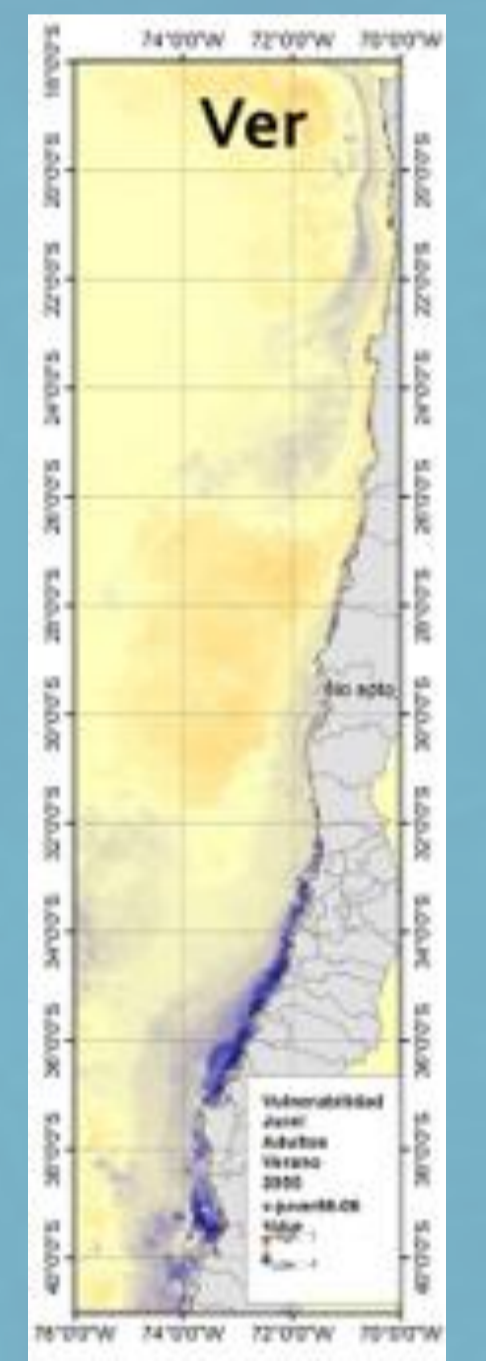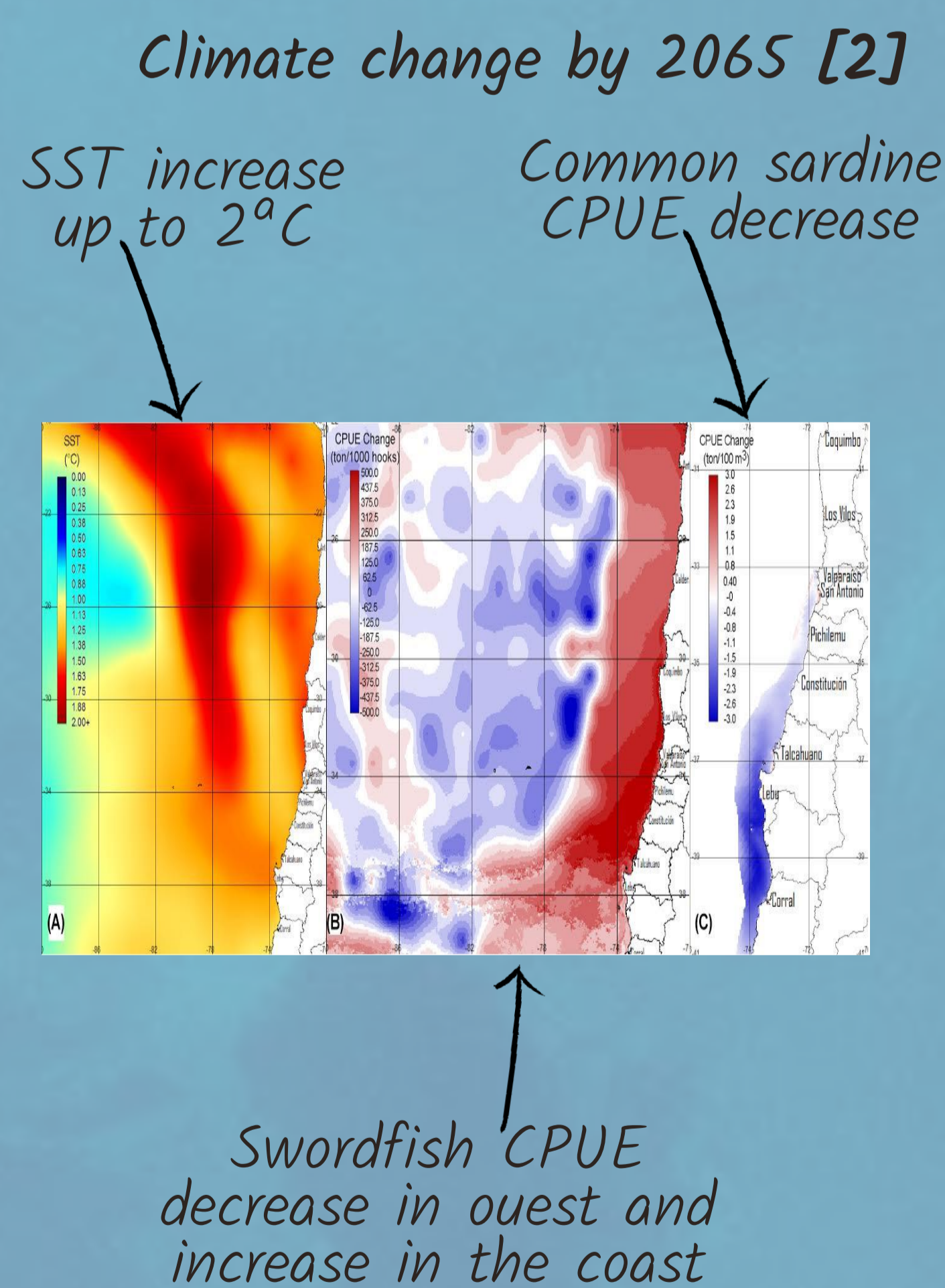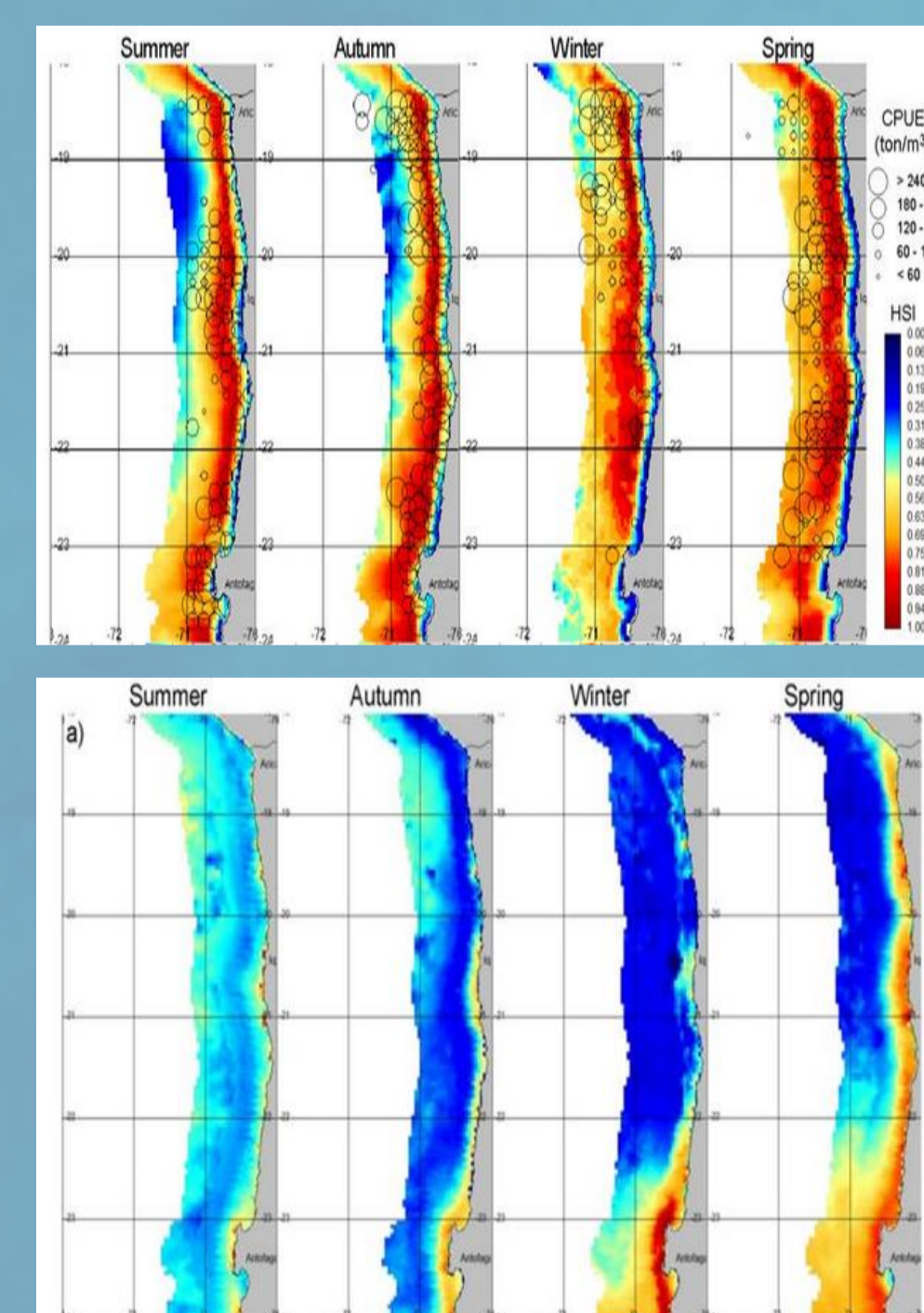
Impact of climate change on horse mackerel habitat

ANALYSIS OF CHILEAN FISHERIES

1. Distribution of landings, fishing effort and CPUE abundance index, and sea surface temperature (SST), chlorophyll concentration, winds and sea height are analyzed.
2. Description of the essential habitat based on fisheries and satellite information, generating matrices with suitability ranges.
3. Matrices are used to generate maps of the essential habitat for the resources.
4. Conceptual models are elaborated, and predictive models are developed associated with regionalized climate change (CC)
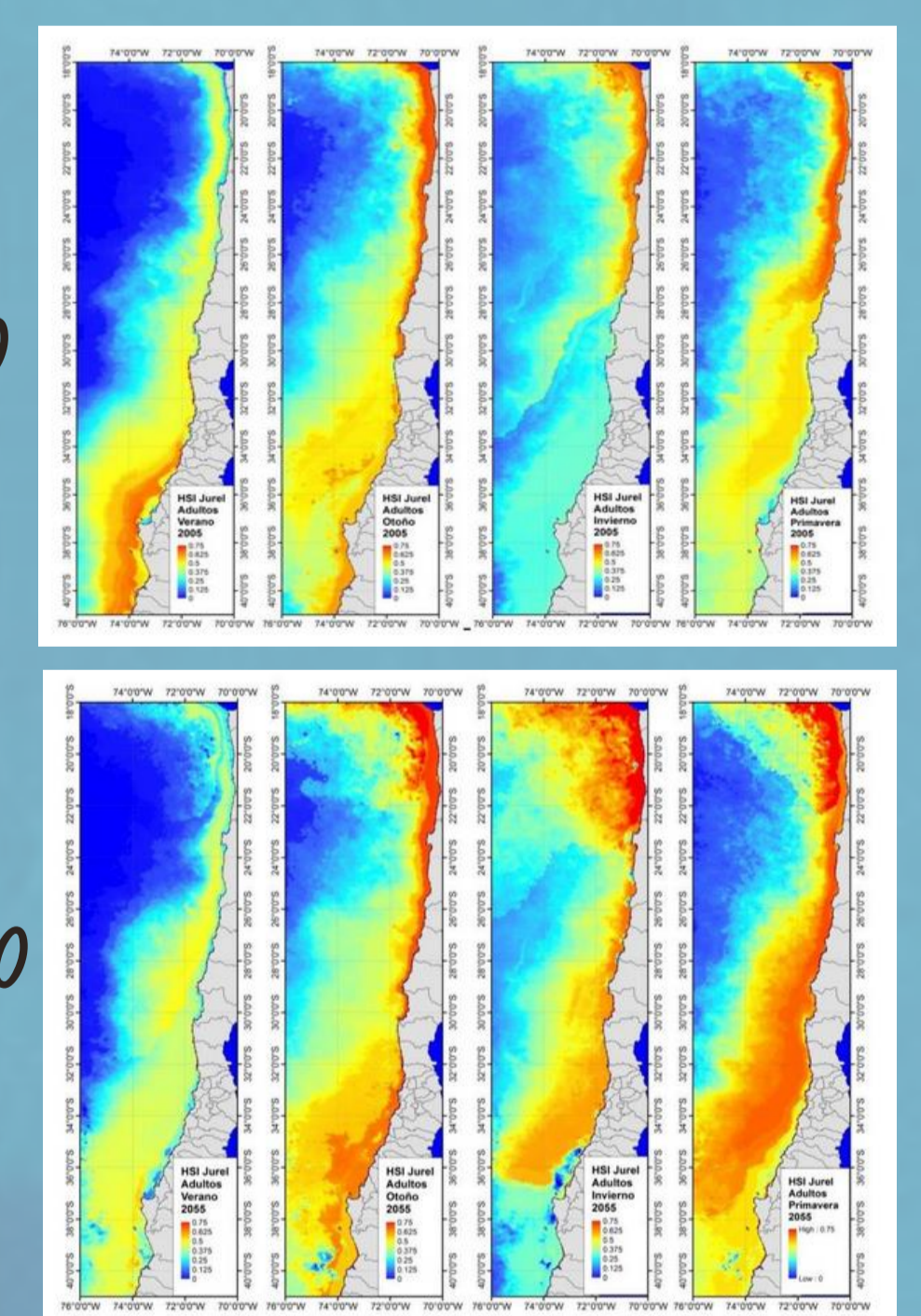
Climate change by 2065 [2]

SST increase up to 2°C

Common sardine CPUE decrease

Swordfish CPUE decrease in ouest and increase in the coast

Anchovy HSI in northen Chile [3]

2001-2010

2051-2060

Decrease in HSI for anchovy

Jack mackerel HSI

2001-2010

2051-2060

Increase in jack mackerel HSI in autumn, winter, spring

IN SUMMARY

- Swordfish (*Xiphias gladius*) would appear closer to the coast as the CC develops. While the jack mackerel (*Trachurus murphyi*) could be presenting more availability in the coastal zone, particularly in autumn, winter and spring.
- Anchovy (*Engraulis ringens*) would show a notable loss of HSI, the same would happen with the common sardine (*Strangomera bentinki*).
- It is necessary to refine the regionalization of climate change and consider its effect on the entire life cycle of species, within the framework of management with an ecosystem approach.

REFERENCES

[1] Cheung et al. (2016), Ecological Modelling 325: 57-66.
[2] Silva et al. (2015), Prog. Oceanogr. 134: 343-355.
[3] Silva et al. (2016), Prog. Oceanogr. 146: 159-174.