

Large scale distribution of tuna and billfishes in a warming ocean

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Erauskin-Extramiana, M., Arrizabalaga, H., Hobday, A., Cabré, A., Ibaibarriaga, L., Arregui, I., . . . Chust, G. (2019). **Large-scale distribution of tuna species in a warming ocean.** *Global Change Biology*, 25(6), 2043-2060.

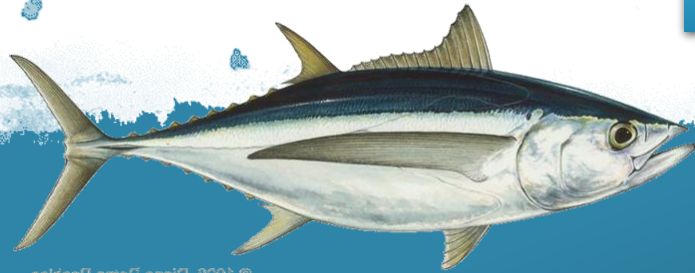
Context



Target species



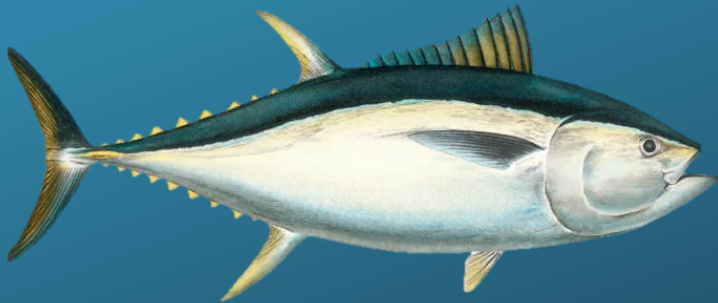
TUNA



Albacore (*Thunnus alalunga*)



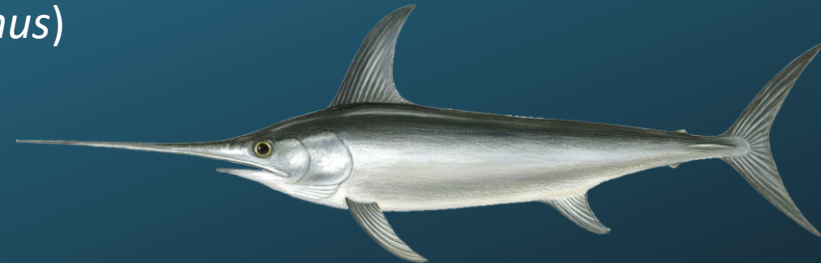
Atlantic bluefin tuna (*Thunnus thynnus*)



Southern bluefin tuna (*Thunnus maccoyii*)



Yellowfin tuna (*Thunnus albacares*)



Swordfish (*Xiphias gladius*)



Bigeye tuna (*Thunnus obesus*)



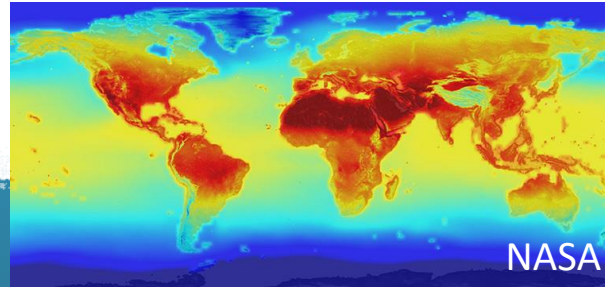
Skipjack tuna (*Katsuwonus pelamis*)

BILLFISH

Goals



PRESENT



FUTURE

3

🎯 Explore the potential impact in different countries' EEZ

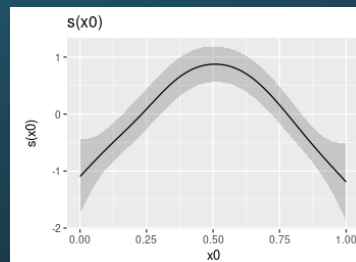
2

🎯 Built tuna distribution models

🎯 Predict changes in the future (2050 and 2100) under RCP8.5 climate change scenario

1

🎯 Analyze historical trends (1958-2004)



Rafi Segal and Yonatan Cohen

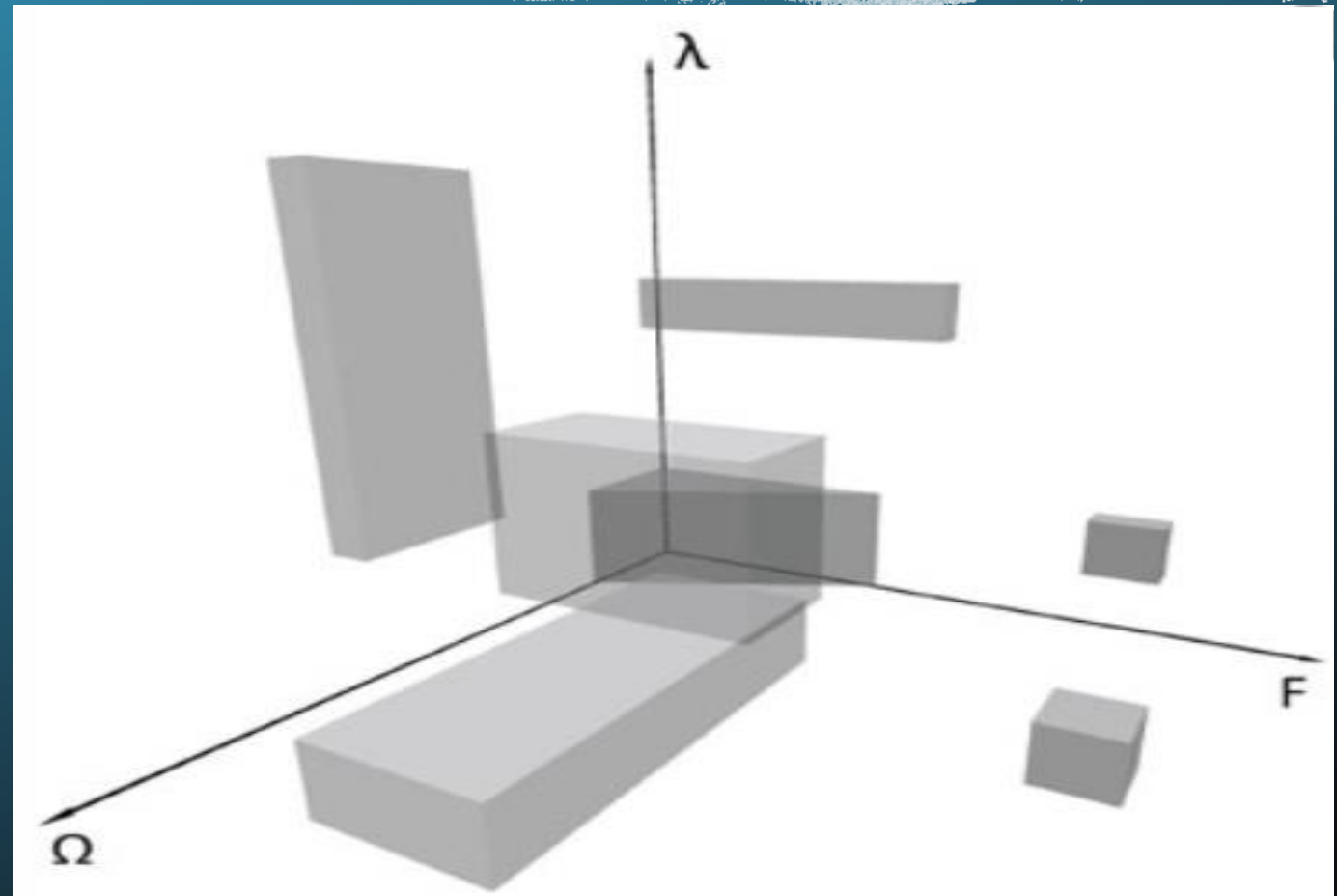
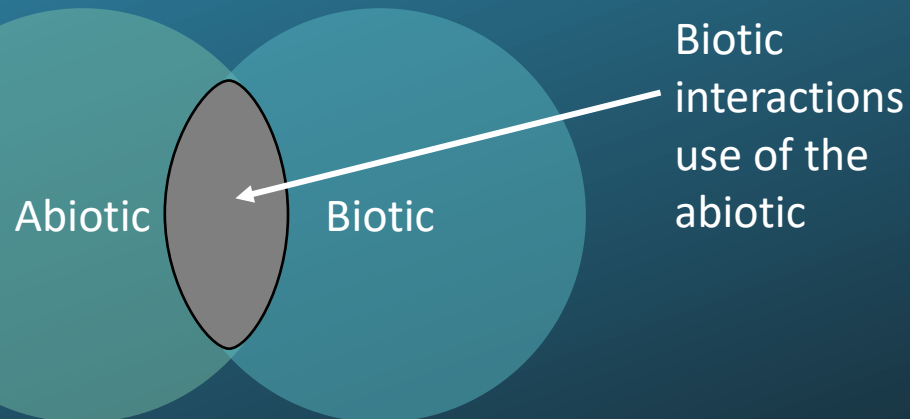
Habitat and ecological models



Fundamental approaches

Niche-based models

Hutchinsonian niche concept (1957)



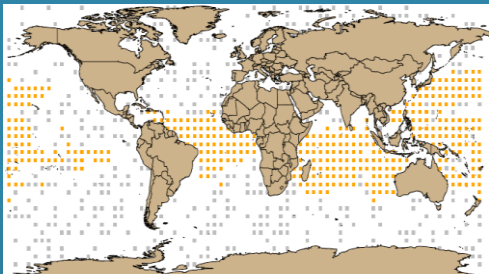
Habitat and ecological models



Generalized Additive Models

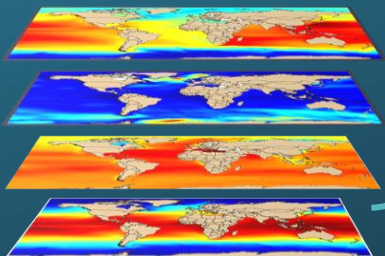
Inputs

■ Catches (presences)

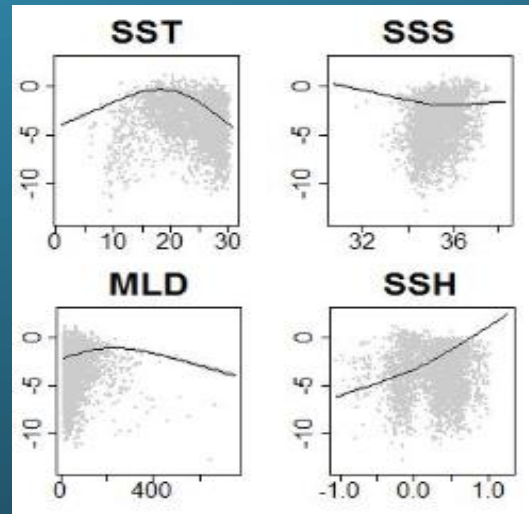


■ Pseudoabsences
(randomly generated)

Predictors (PISCES)

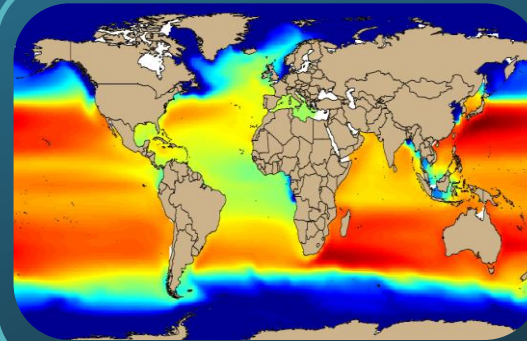


Ecological niche (GAMs)



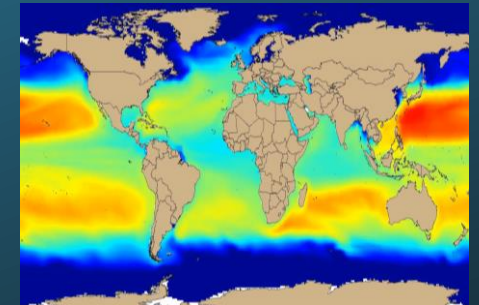
Response curves

Predictions

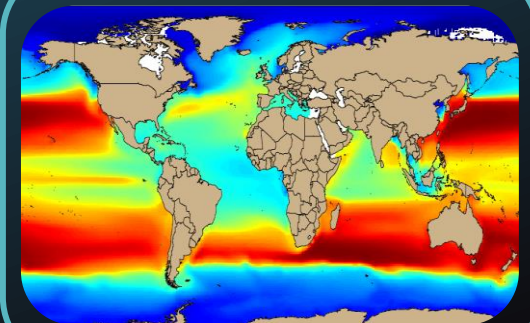


Present

Historical
(1958-2004)



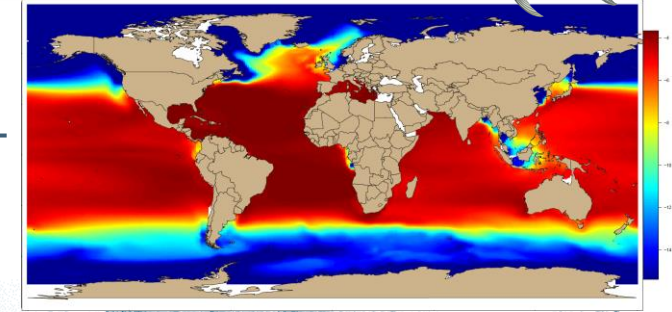
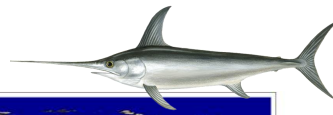
Future



Global distribution models

BILLFISH

Swordfish



Tuna and swordfish habitat models

TEMPERATE TUNA



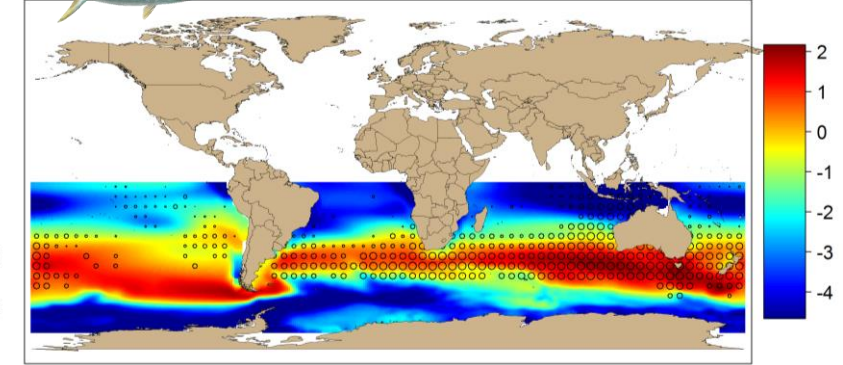
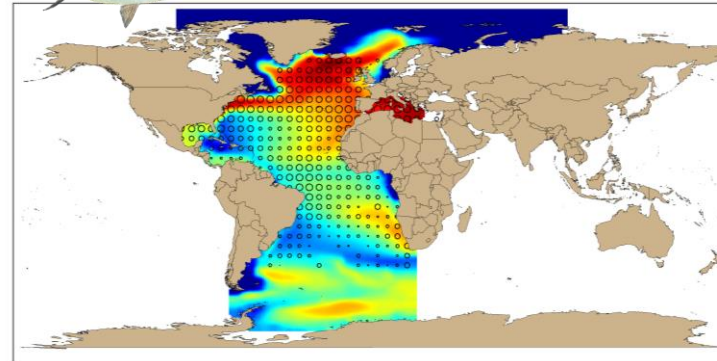
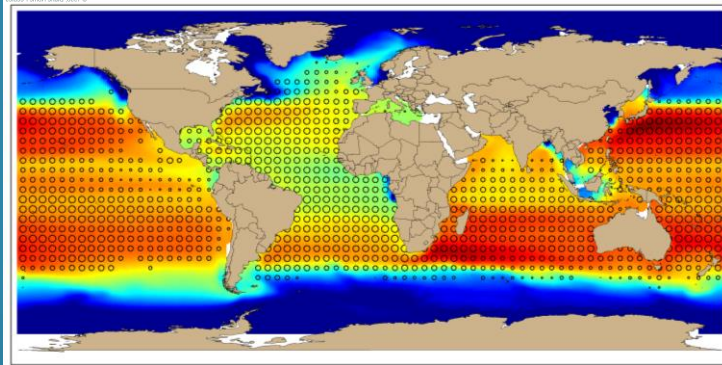
Albacore



A. bluefin



S. bluefin



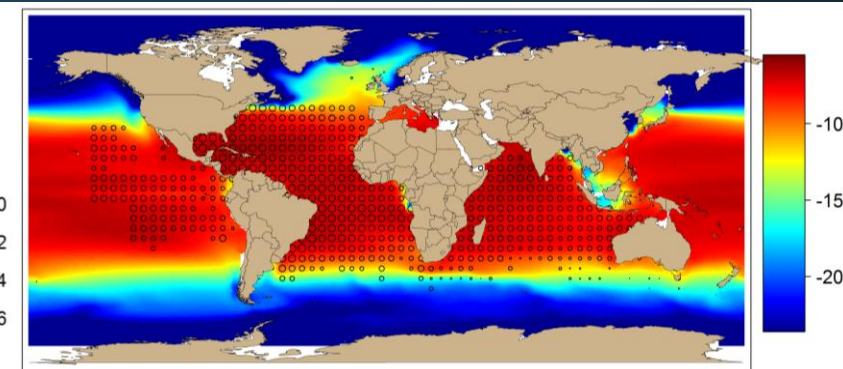
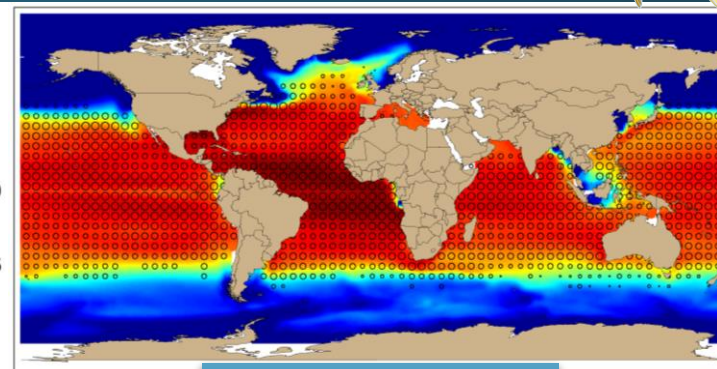
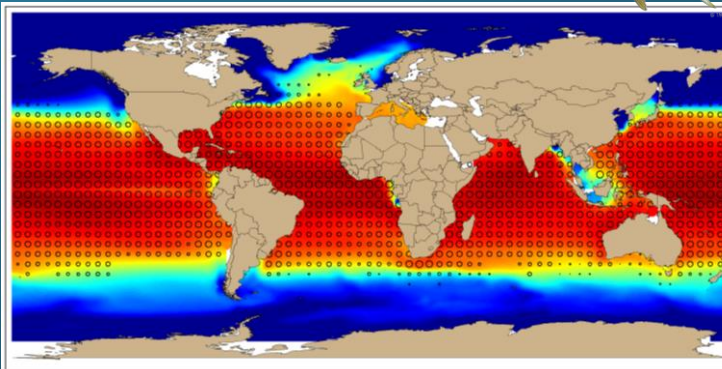
Bigeye



Yellowfin



Skipjack



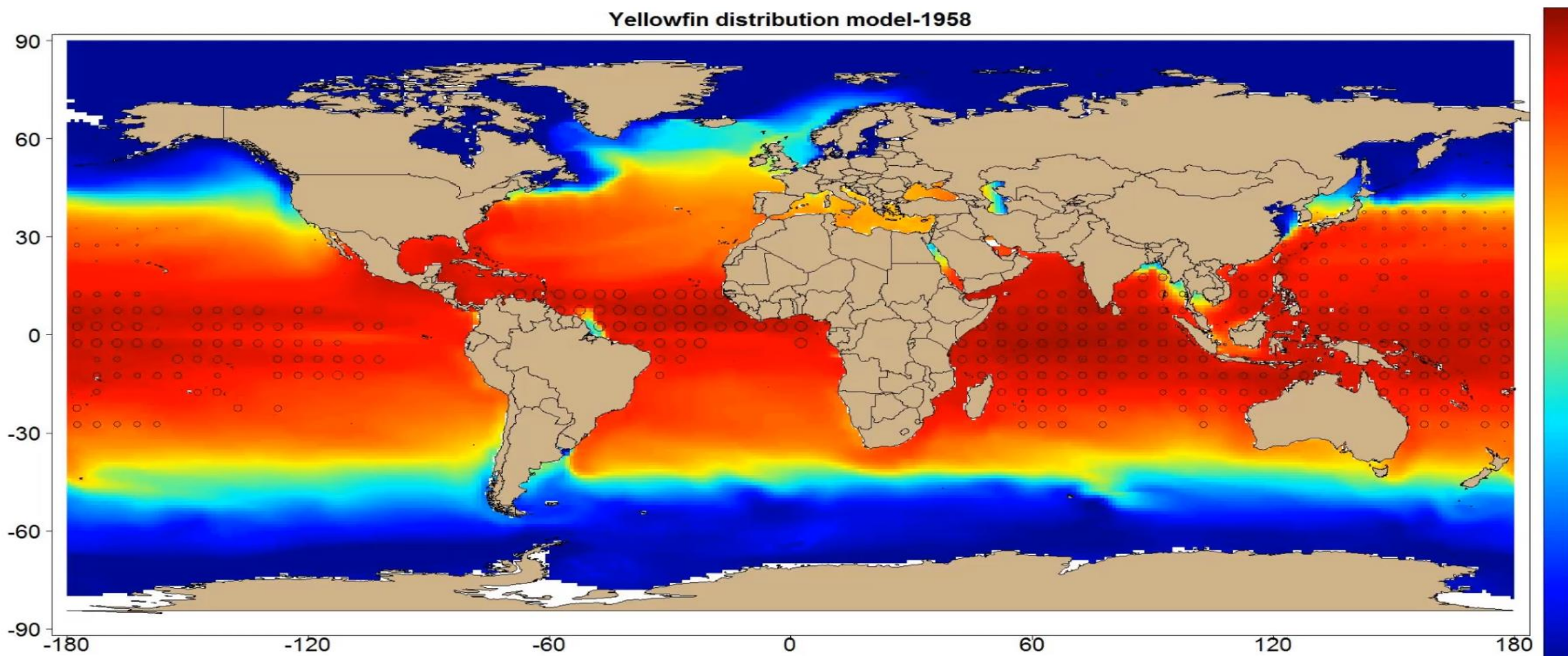
TROPICAL TUNA

What happened in the past?

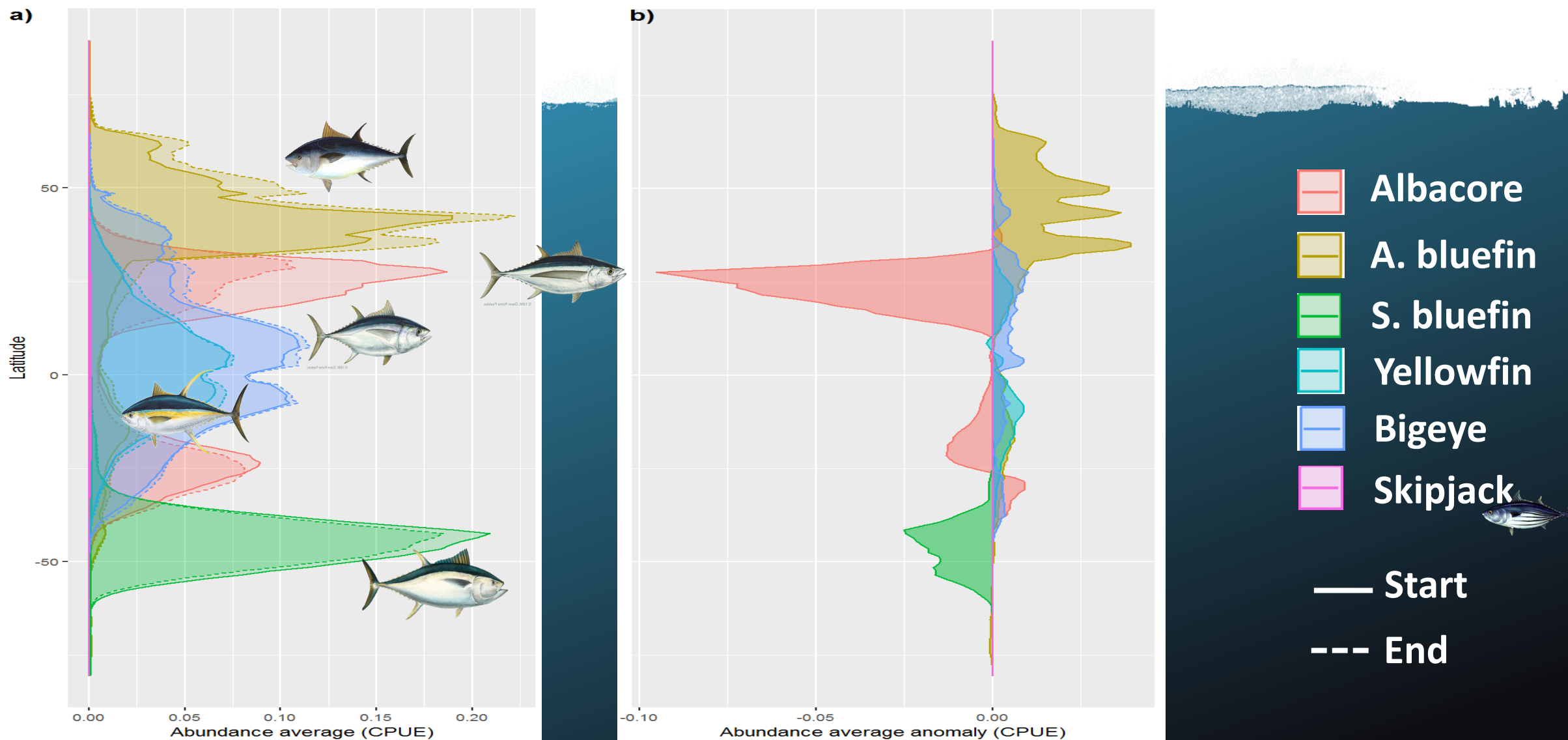


Historical tuna habitat model reconstruction (1958-2004)

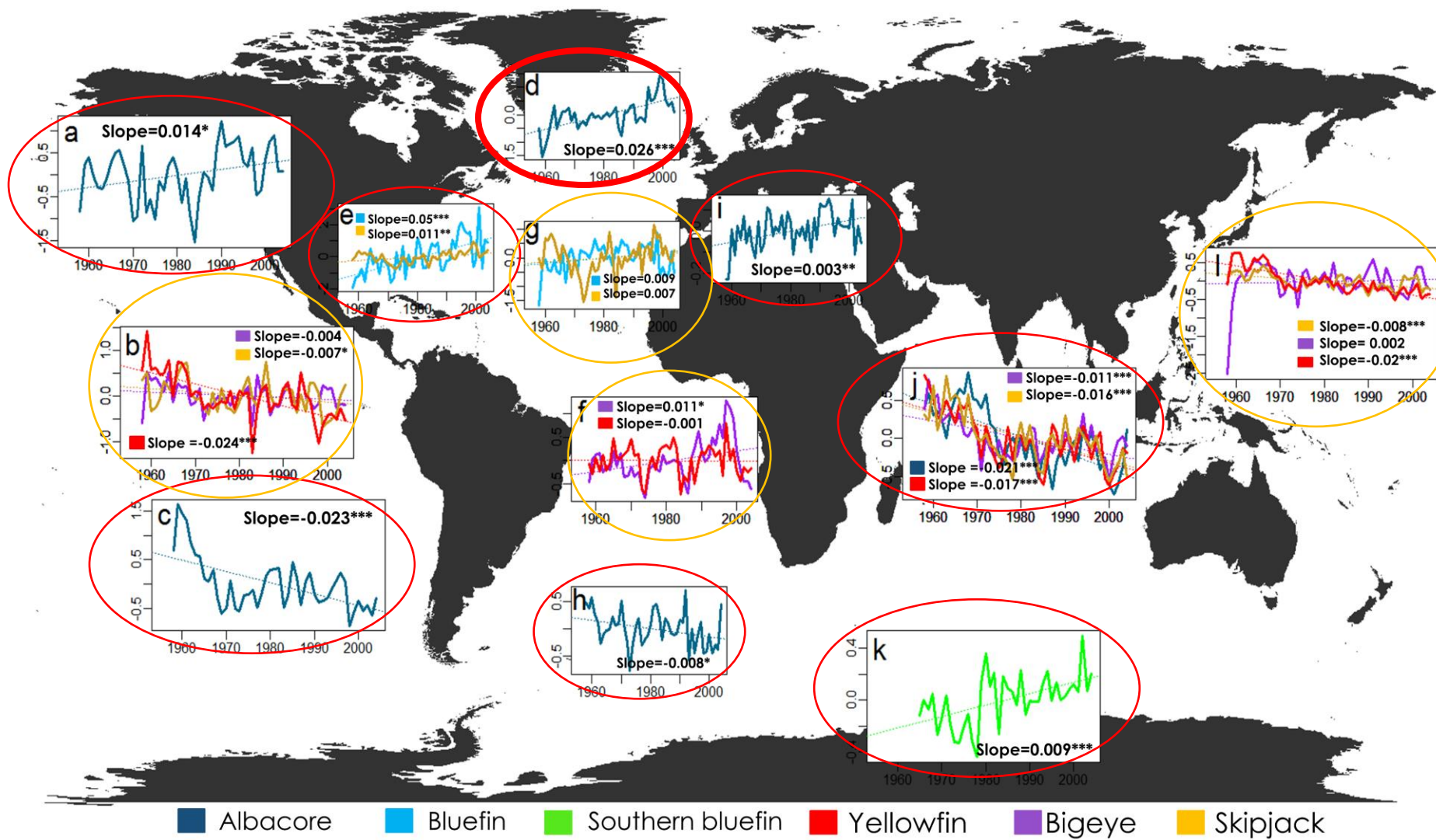
Yellowfin distribution model-1958



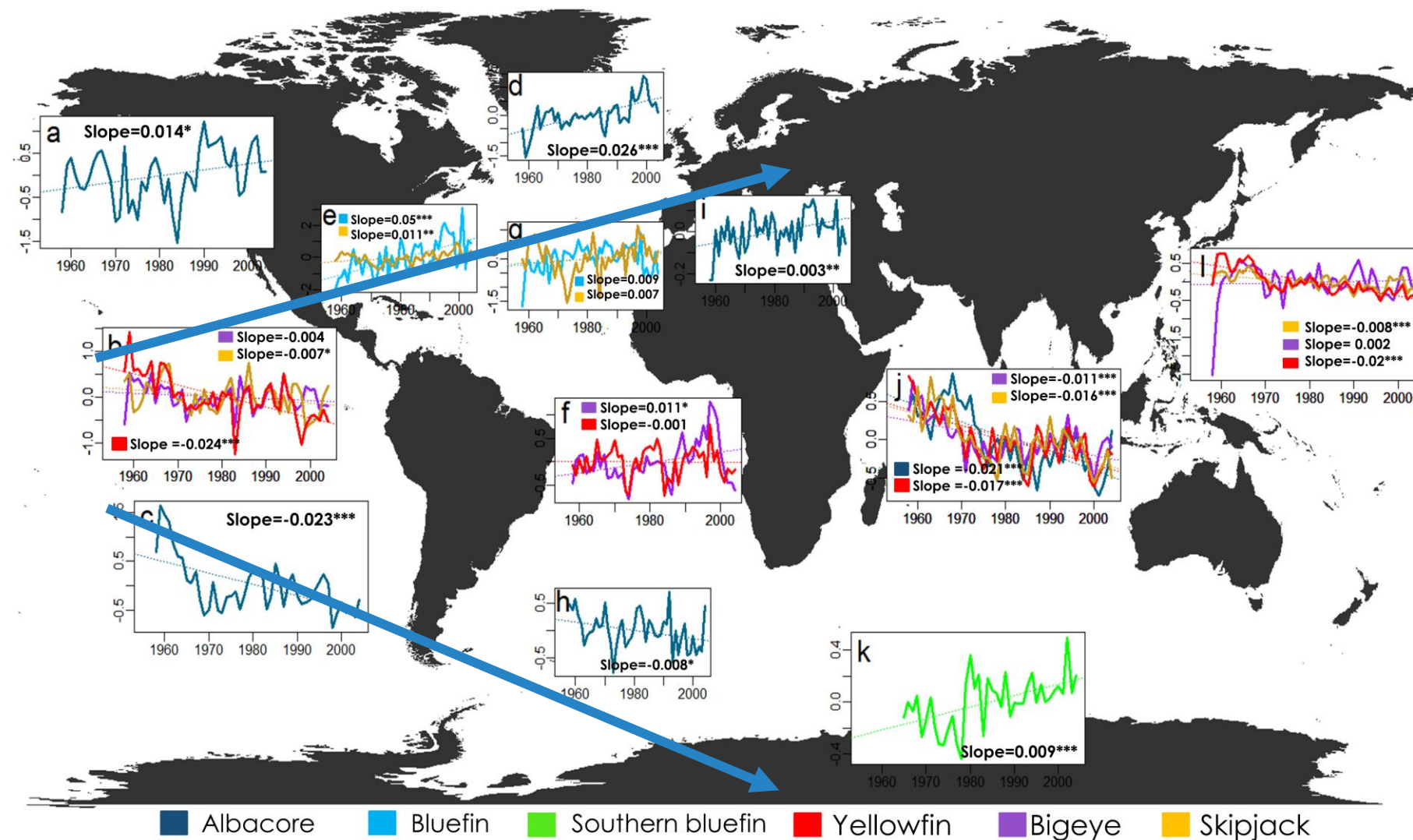
What happened in the past?



What happened in the past?



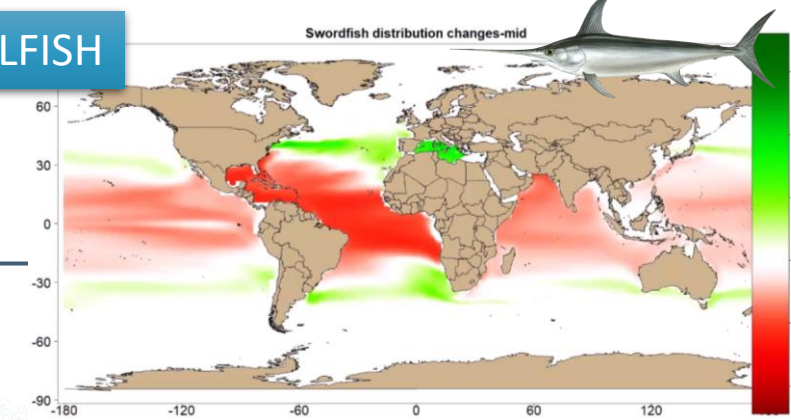
What happened in the past?



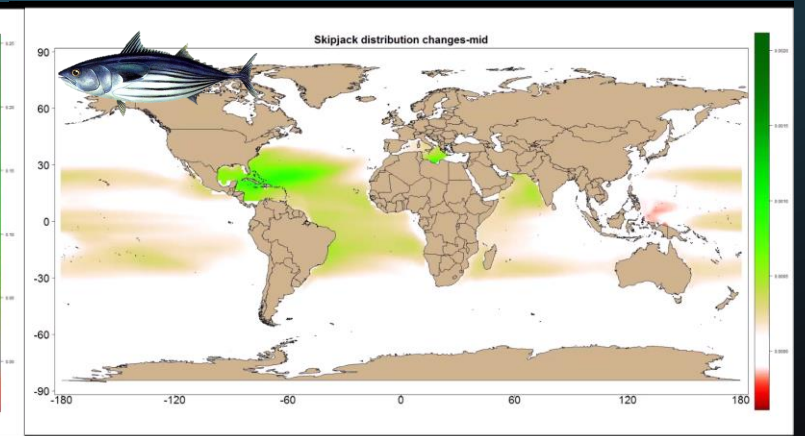
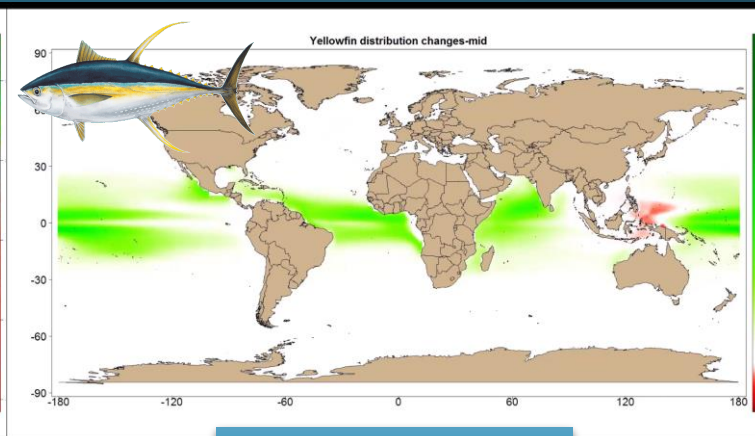
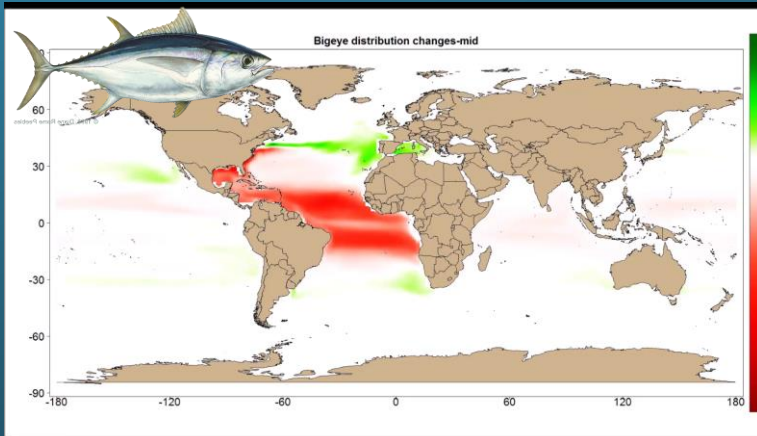
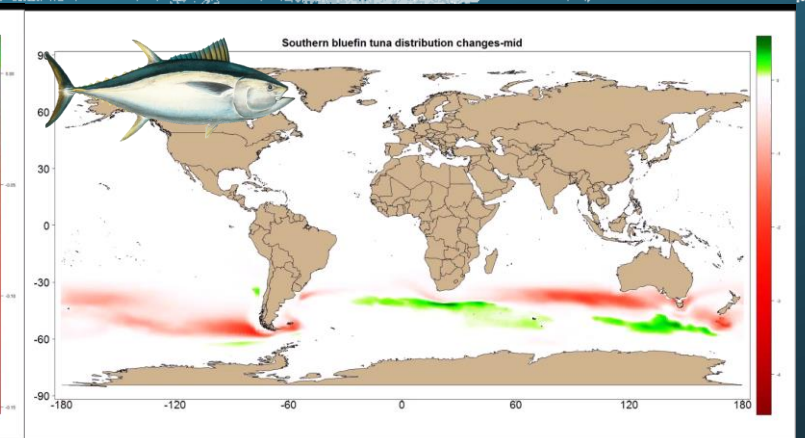
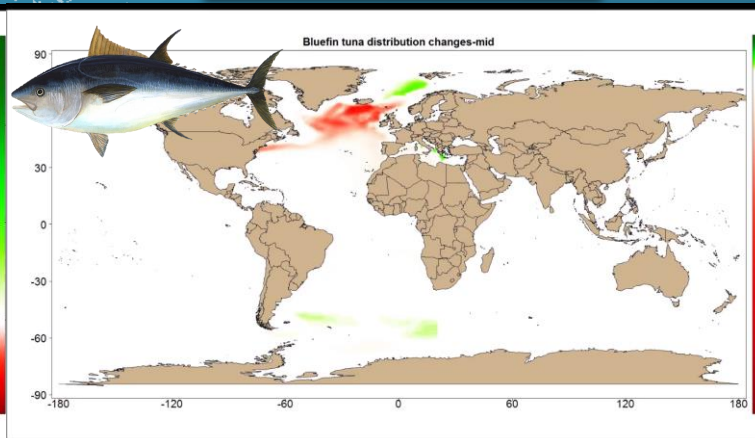
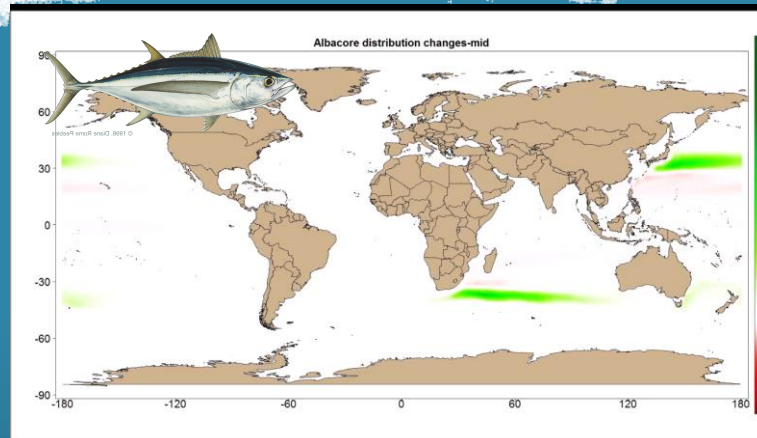
What is expected in the future?

Future habitat suitability changes

BILLFISH

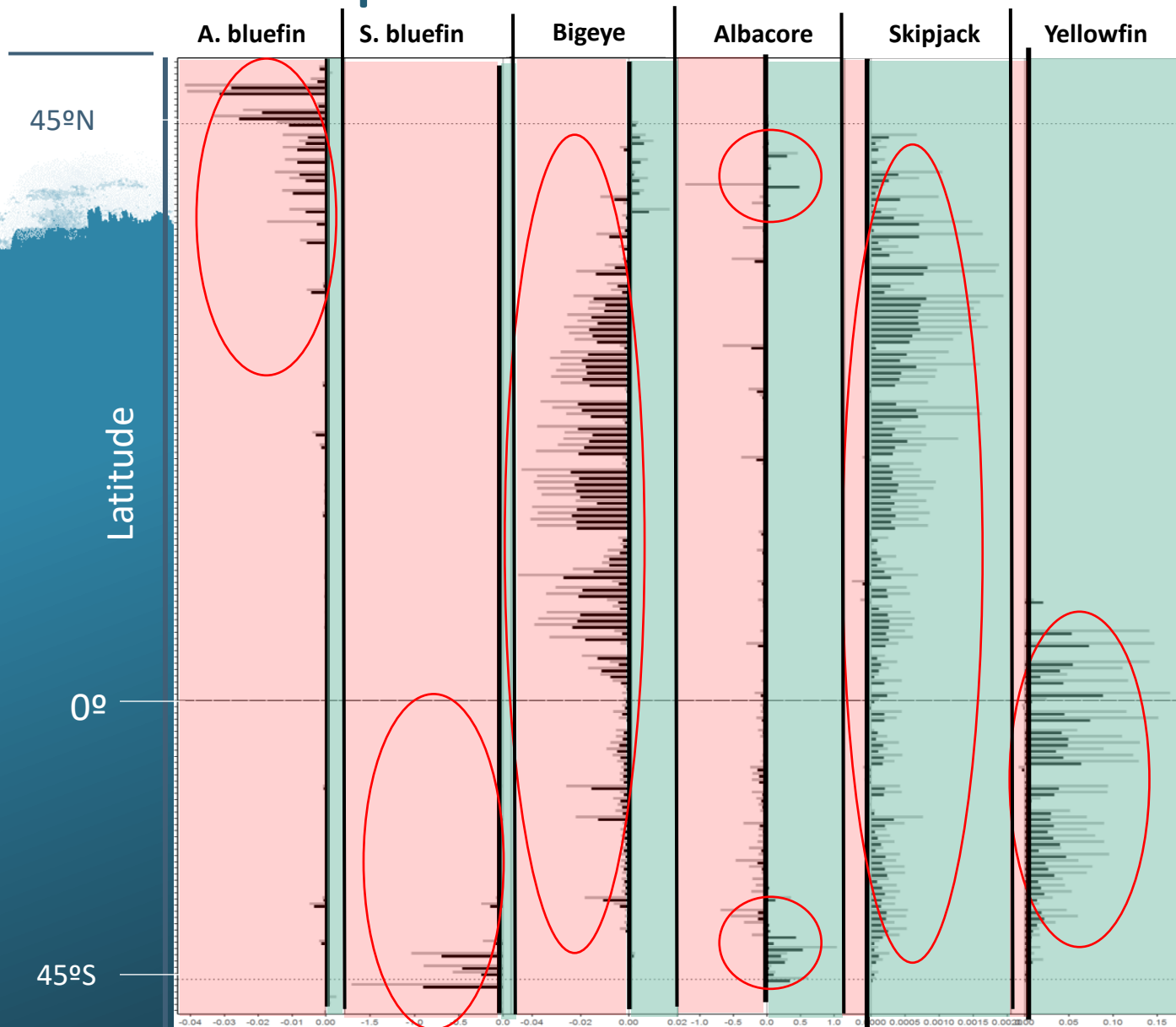


TEMPERATE TUNA



TROPICAL TUNA

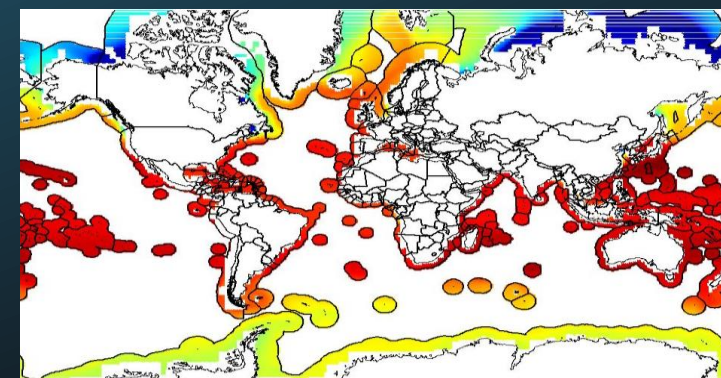
What is expected in the future?



Changes by:



Tuna redistribution
impact over the
Exclusive Economic
Zones



Conclusions



Past

- Poleward trends of many stocks' habitat between 1958-2004

Future

- Expansion of the distribution areas
- Habitat suitability and relative abundance changes:
 - Increase of skipjack and yellowfin
 - Decrease of S. bluefin, A. bluefin, bigeye and swordfish
- Changes in EEZs' (implications for the countries)

Erauskin-Extramiana, M., Arrizabalaga, H., Hobday, A.J., Cabré, A., Ibaibarriaga, L., Arregui, I., Murua, H. and Chust, G. (2019). "Large-scale distribution of tuna species in a warming ocean." Global Change Biology 25(6): 2043-2060

Erauskin-Extramiana, M., Arrizabalaga, H., Cabré, A., Coelho, R., Rosa, D., Ibaibarriaga, L., Chust, G. (2019). "Are shifts in species distribution triggered by climate change? Application to the swordfish global case." Deep-Sea Research Part II, Topical Studies in Oceanography

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