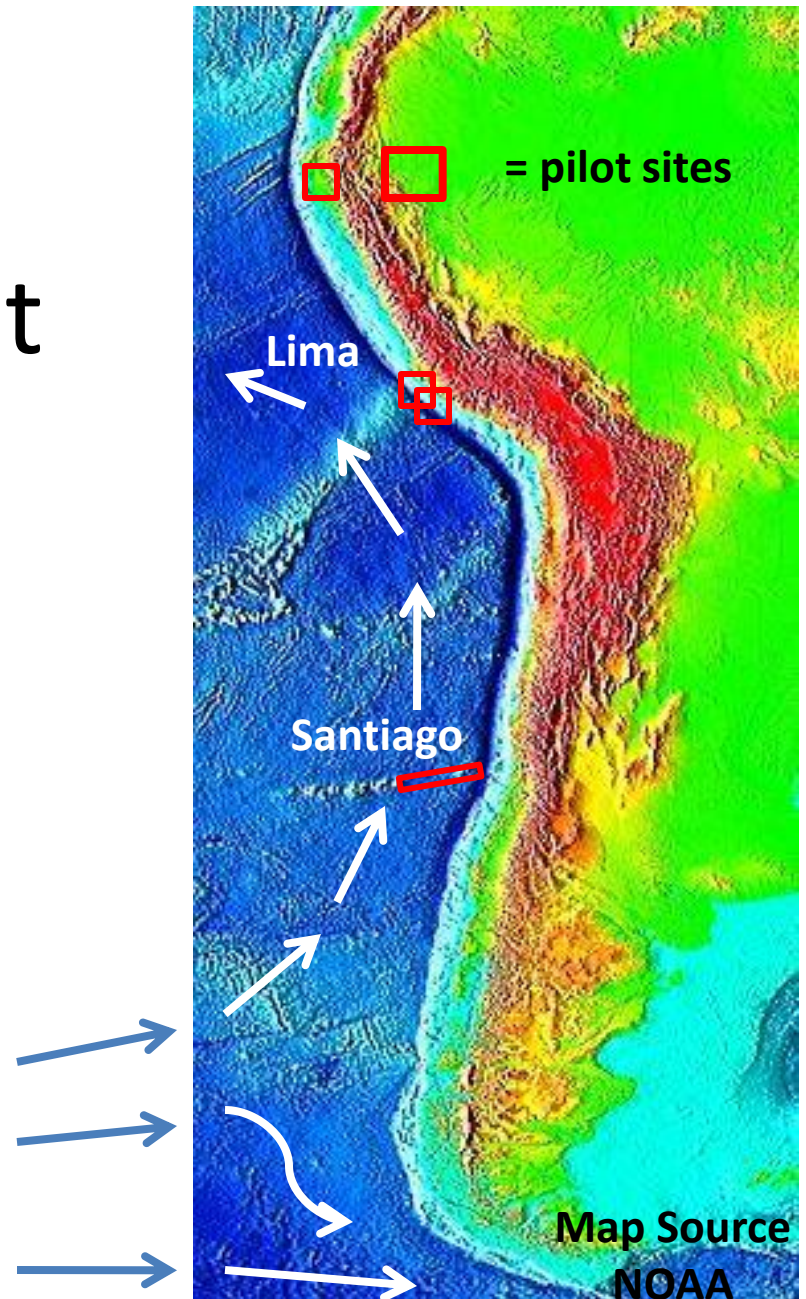


Variability of Humboldt Current Biomass During Climate Change

MICHAEL J. AKESTER

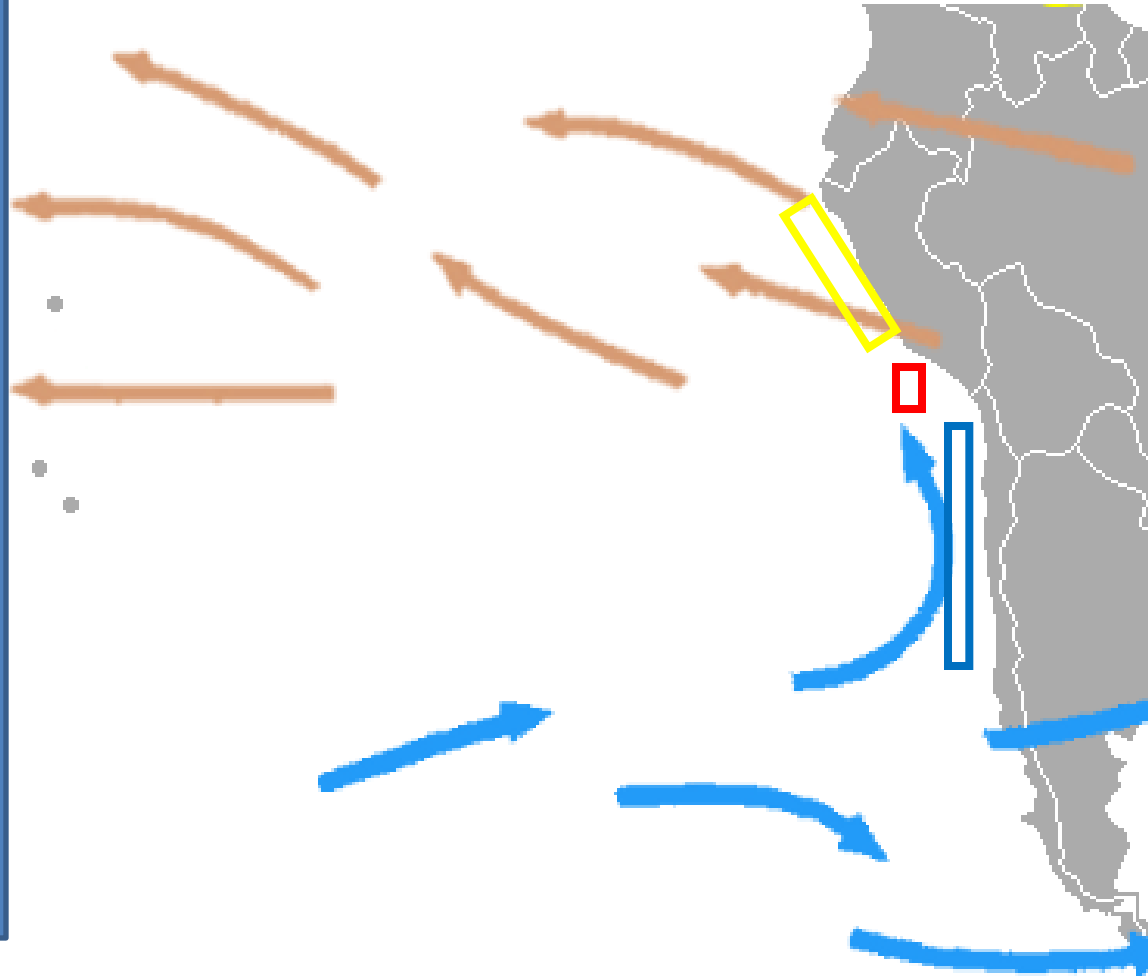
Regional Project
Coordinator



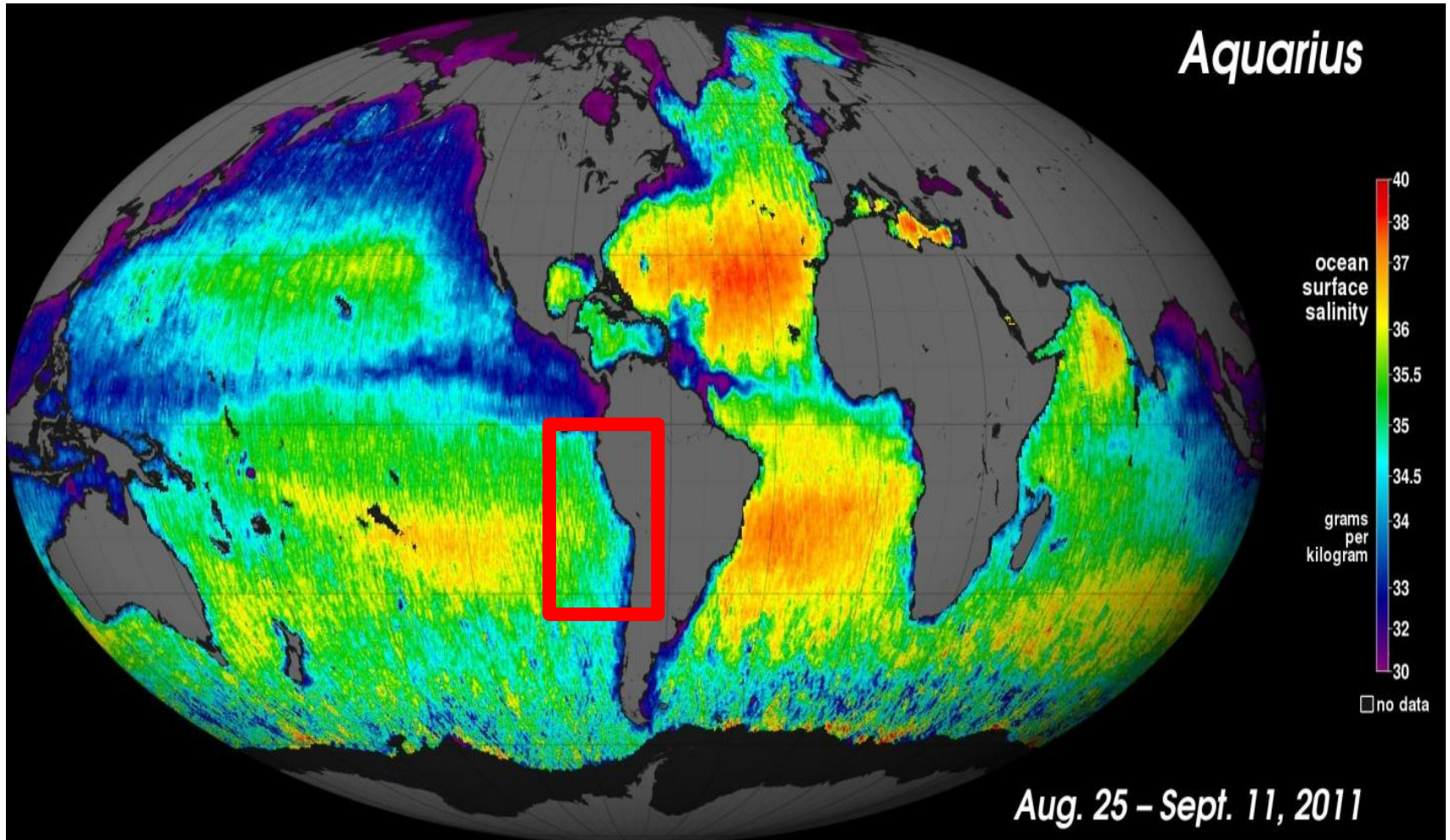
Humboldt Current: cold, low salinity, flow with associated nutrient rich upwelling fronts driven by westerly trade winds

Three main upwelling fronts:

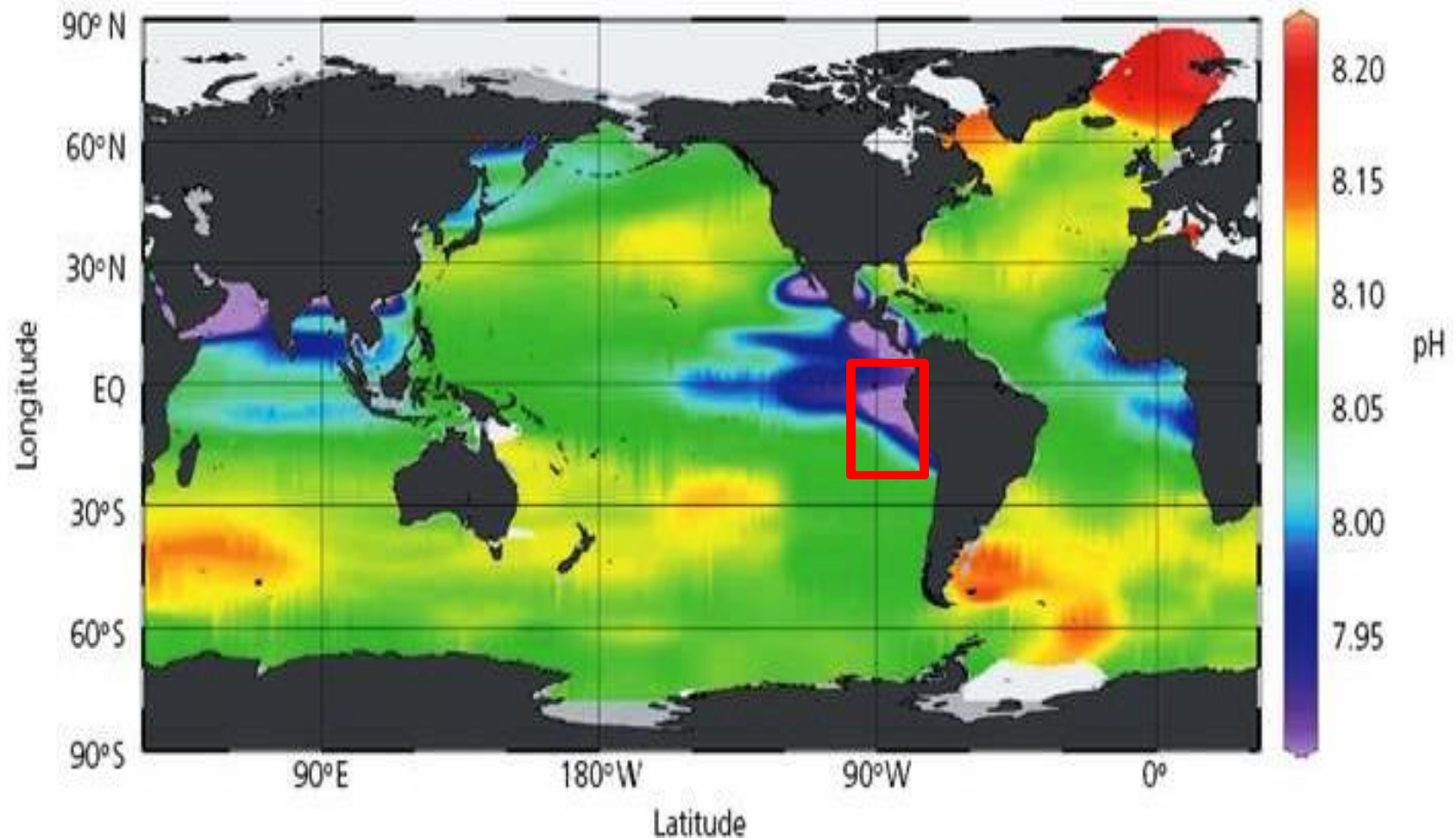
- 1) Chilean Shelf Slope Front (blue)
- 2) The Nazca Front (red)
- 3) The Peruvian Upwelling Front (yellow)



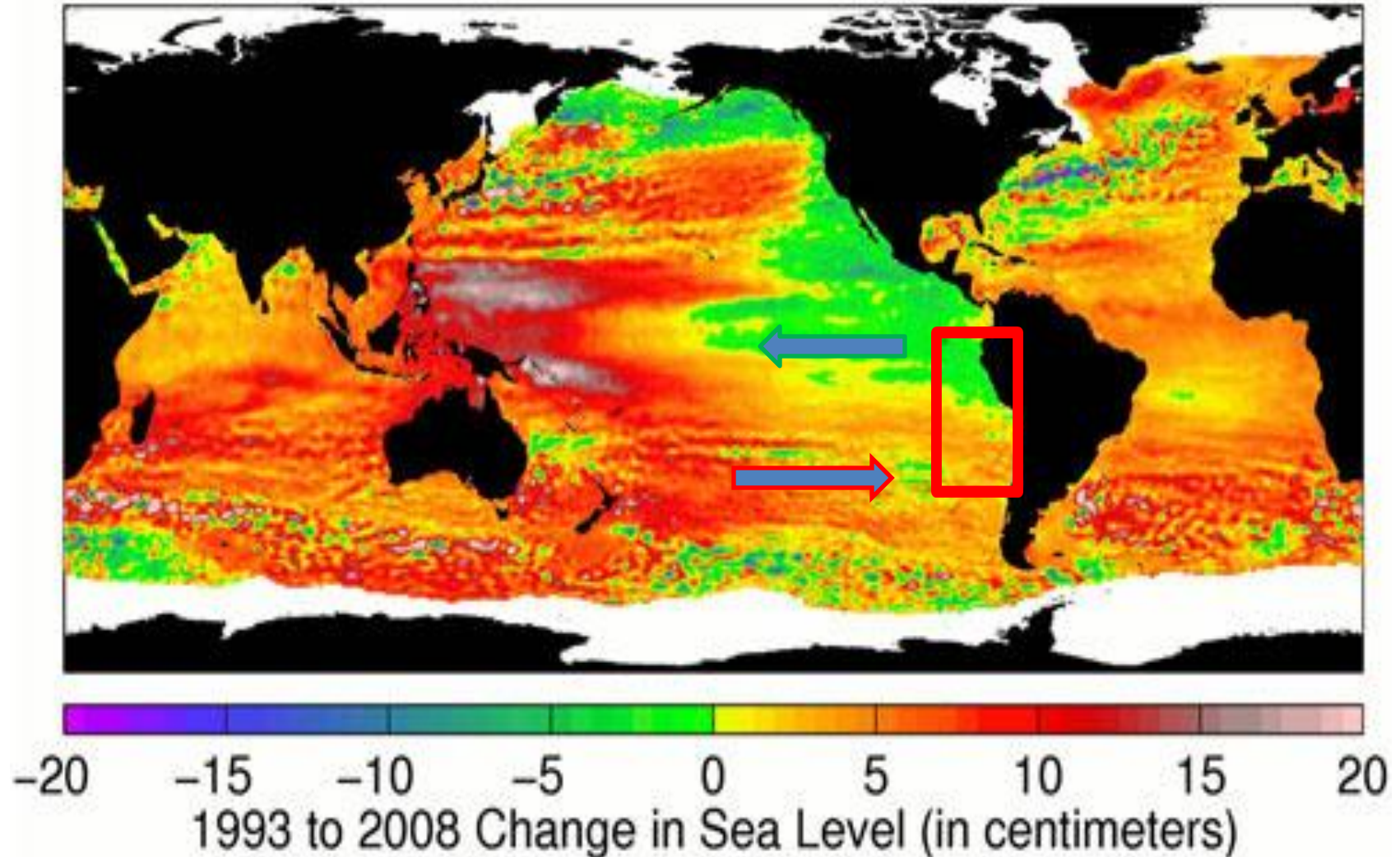
Relatively low salinity: 33ppt



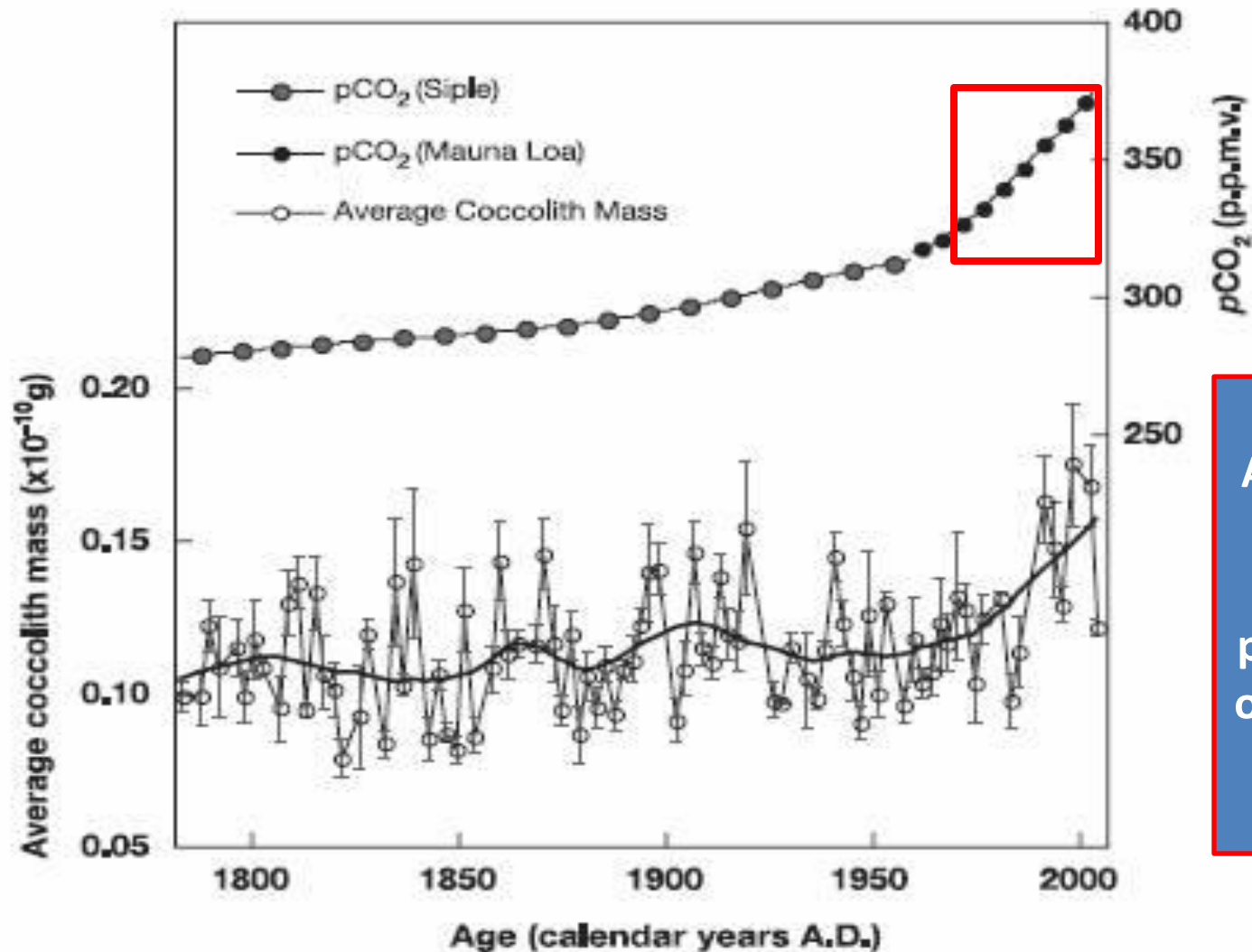
Low pH <8 in the Peruvian Upwelling Front area



**HCLME area sea level change over 15 years:
5cm lower 4-18Deg South : 5cm higher 18-40Deg South.
Trade Wind intensity ??**



HCLME increasing primary productivity



Accelerated increase in primary productivity over the last 50 years

Chile – Peru Environmental Performance Index (EPI) scores are similar

Country Indicator	Biome protection	Fisheries general	Trawling intensity	Climate change	Greenhouse gas per capita	Marine trophic index	EPI Score
Chile	67.0	93.6	87.2	60.7	61.7	100	73.3
Peru	86.3	88.6	77.1	70.2	79.3	100	69.3

<http://epi.yale.edu/Countries/Chile> <http://epi.yale.edu/Countries/Peru>

Figures are a percentage proximity to the set targets

Ranking: Chile & Peru both in top 20% for EPI ranking

Chile: 73.3 Ranked 16th

Peru: 69.3 Ranked 31st

USA: 63.5 Ranked 61st

EPI – 2010

- EPI ranks 163 countries on 25 performance indicators
- Ten policy categories covering both environmental public health and ecosystem vitality.
- Indicators provide a gauge at a national government scale of how close countries are to established environmental policy goals.
- The EPI's proximity-to-target methodology facilitates cross-country comparisons as well as analysis of how the global community is doing collectively on each particular policy issue.

EPI scores 2010: top 25% [41/163]

EPI SCORES

100–85

1Iceland93.5
2Switzerland89.1
3Costa Rica86.4
4Sweden86.0

EPI SCORES

85–70

5Norway81.1
6Mauritius80.6
7France78.2
8Austria78.1
9Cuba78.1
10Colombia76.8
11Malta76.3
12Finland74.7
13Slovakia74.5
14United Kingdom74.2
15New Zealand73.4
16Chile73.3
17Germany73.2
18Italy73.1
19Portugal73.0
20Japan72.5
21Latvia72.5
22Czech Republic71.6
23Albania71.4
24Panama71.4
25Spain70.6

EPI SCORES

70–55

26Belize69.9
27Antigua and Barbuda69.8
28Singapore69.6
29Serbia and Montenegro69.4
30Ecuador69.3
31Peru69.3
32Denmark69.2
33Hungary69.1
34El Salvador69.1
35Croatia68.7
36Dominican Republic68.4
37Lithuania68.3
38Nepal68.2
39Suriname68.2
40Bhutan68.0
41Luxembourg67.8

Biomass yield variability

1. Decadal: trends show overall primary productivity rise
2. Increased CO₂ levels have lowered pH by 0.1 unit = 30% more acidic since Industrial Revolution but also increased primary (Coccolithophore) production
3. Trade Wind (TW) speeds vary with climate change and as they drive surface ocean currents these also vary. Under climate change scenarios TW speed is supposed to be decreasing yet coastal upwelling intensity is increasing bringing continued high nutrient flows hence more constant primary production and less biomass yield variability <http://wattsupwiththat.com/2009/02/17/the-trade-winds-drive-the-enso/>
4. Variability in HCLME biomass yields during climate change is linked to its characteristics (cold, low pH, low salinity, high nutrients, O₂ depletion zone) & complicated by a range of anthropogenic activities
5. Biodiversity is declining due to: fishing / extraction impact, pollution and habitat destruction
6. Fishing has removed many food competitors (hake & tuna) and predators hence species like jellyfish and giant squid populations are increasing