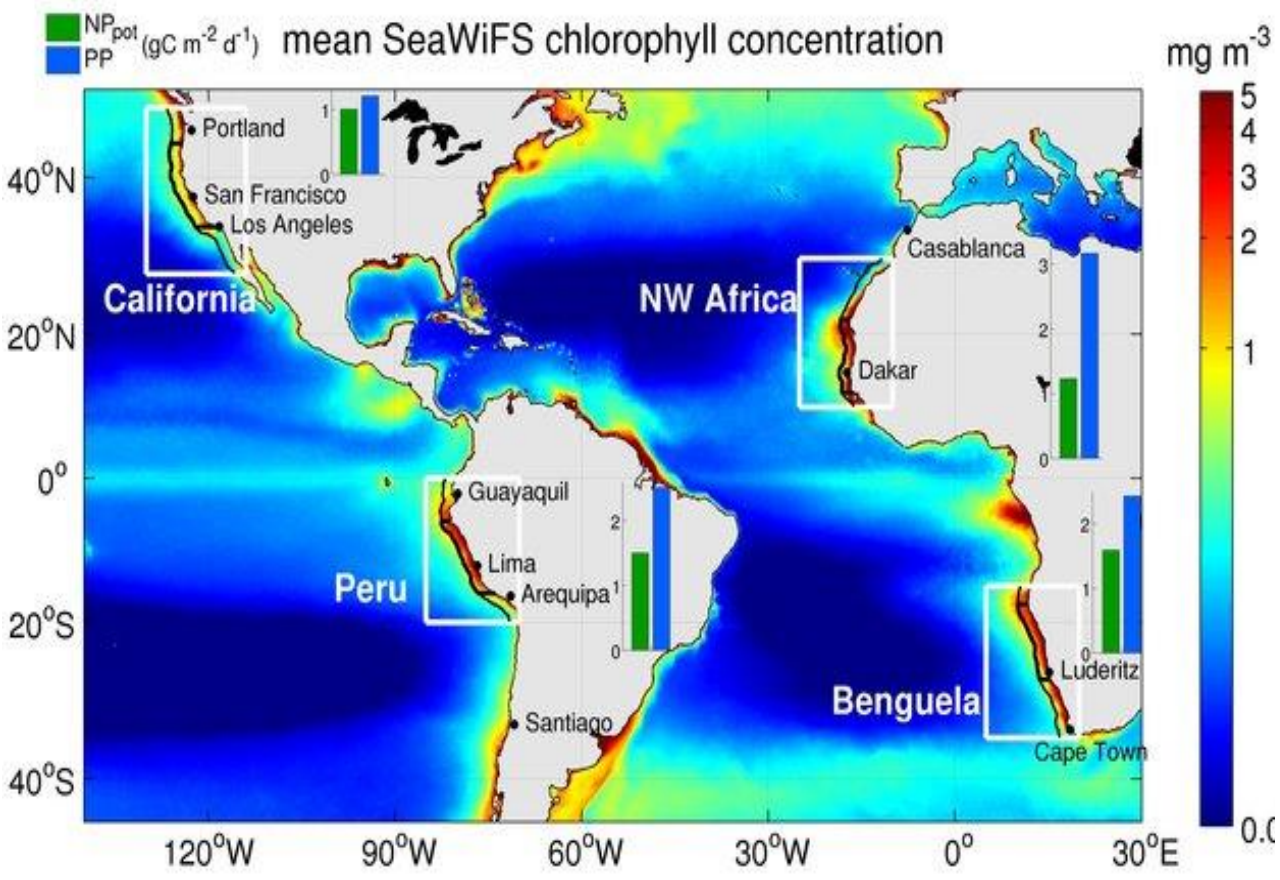
Dealing with the climate variability on fisheries: examples and experiences in Peru

Paul Tacuri
Instituto del Mar del Perú (IMARPE)

The Northern Humboldt Current System

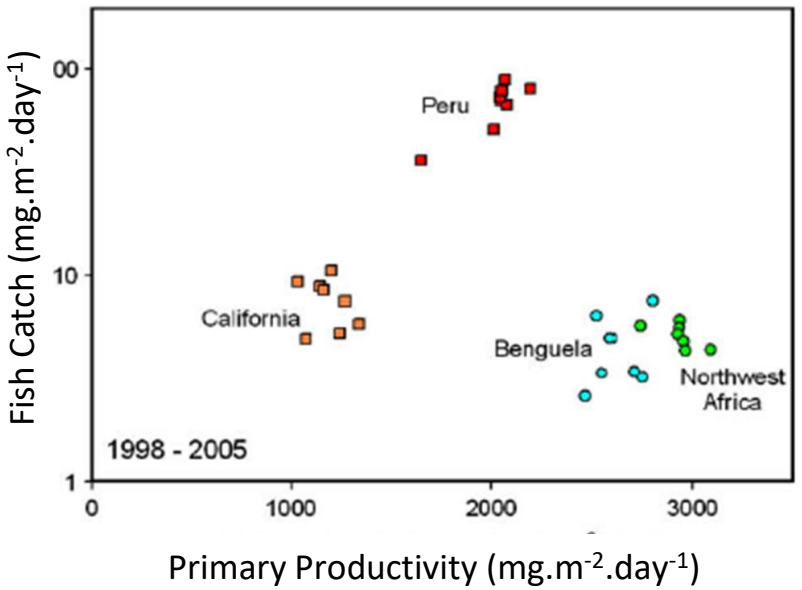
The Northern Humboldt Current System

One of the most productive EBUS



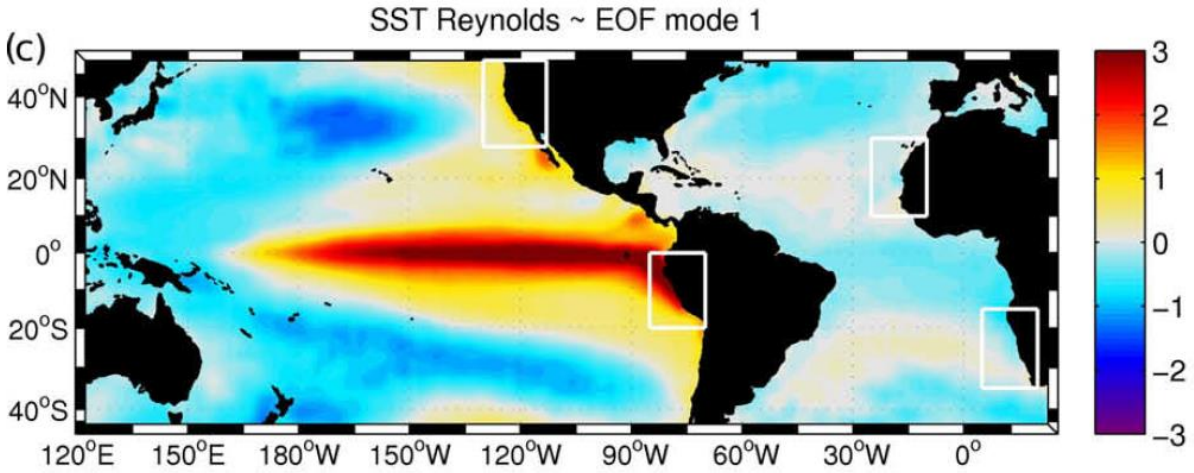
Messié & Chavez 2014.

NHCS produces ~5% of the world's catch



Chavez et al. (2008)

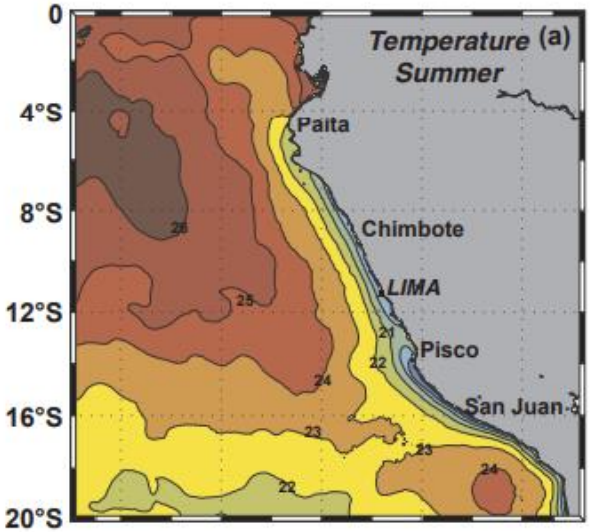
Trend in SST from 1981 to 2008

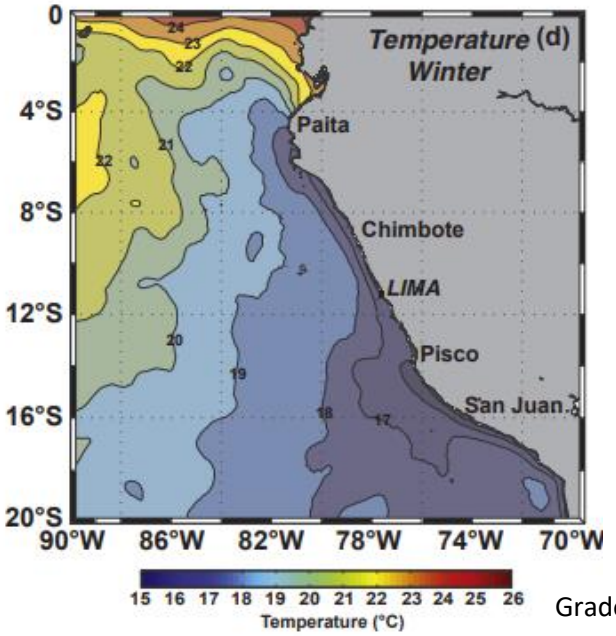


Chavez & Messie (2009)

Climate variability off Peru

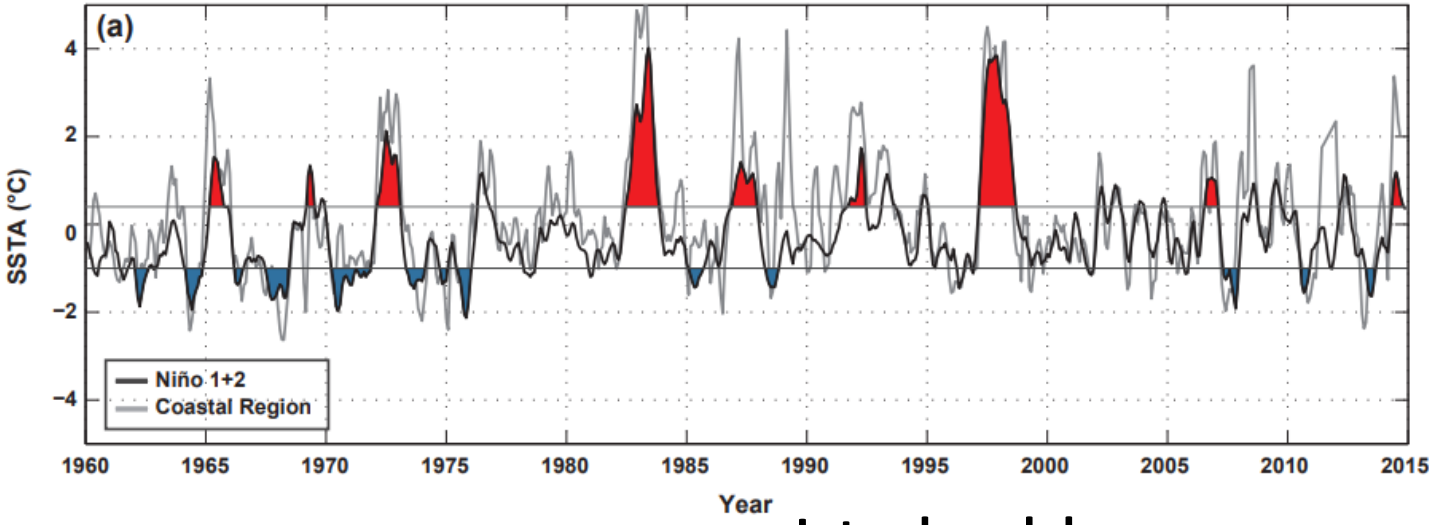
Seasonal





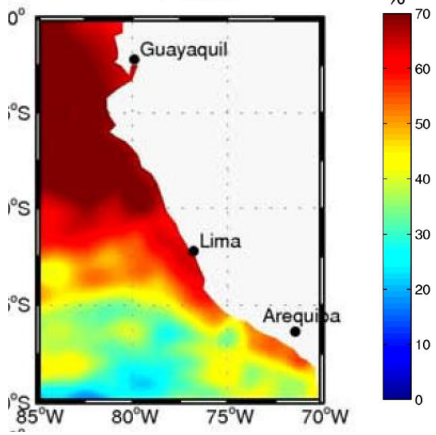
Grados et al. (2018)

Interannual



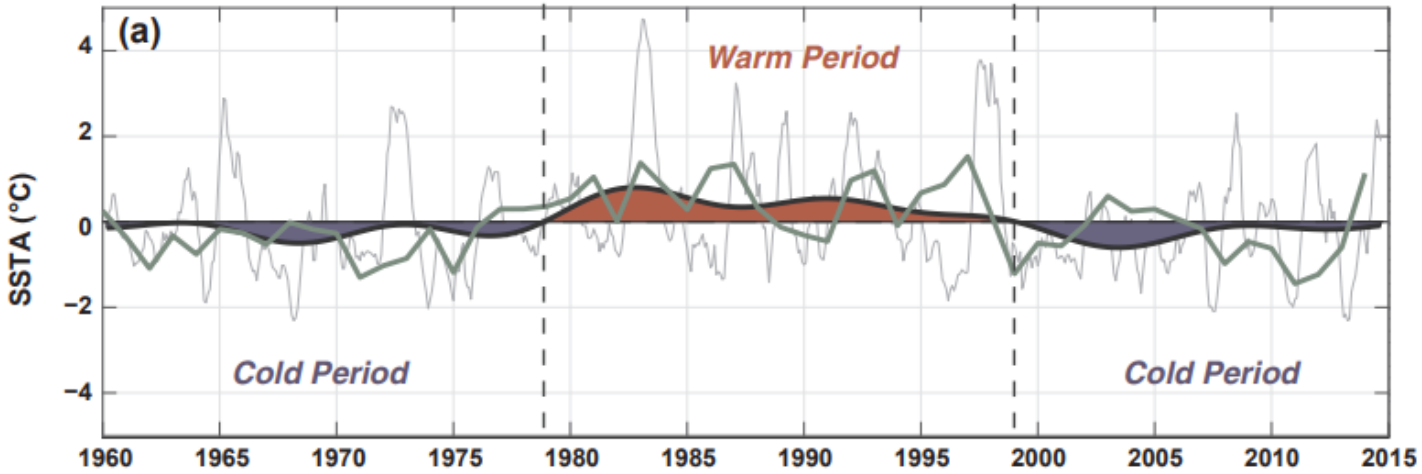
Percentage of variance

Peru (1993-2006)



Chavez & Messie (2009)

Interdecadal

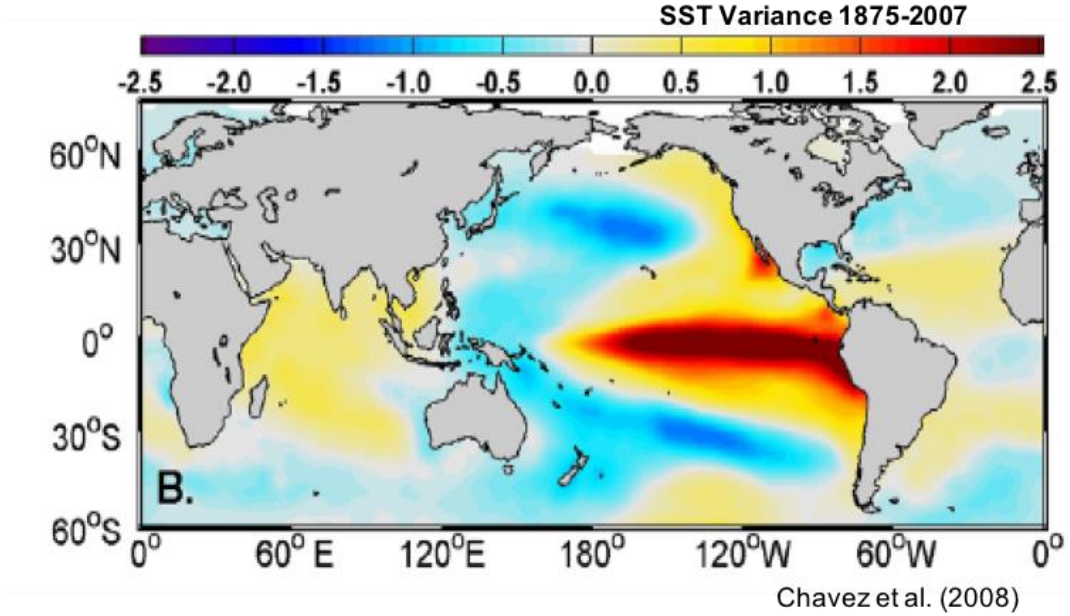


The variability is the normality off Peru

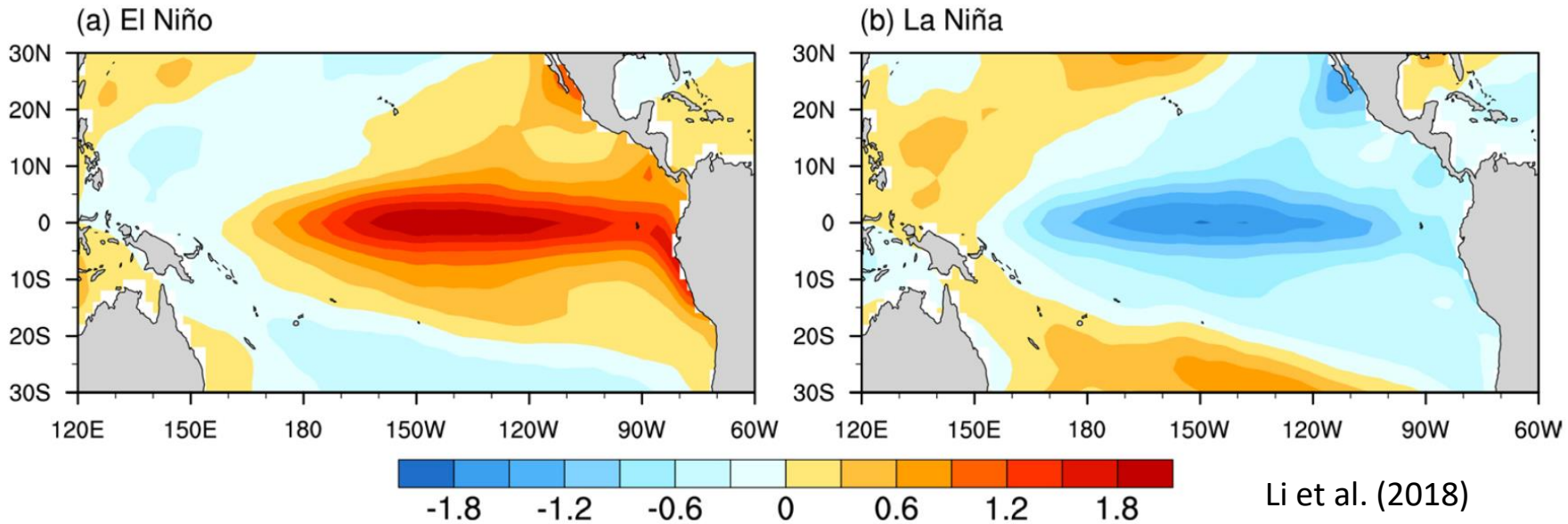
El Niño and La Niña events

The NHCS is the most affected area because of El Niño events

Strong Variability, El Niño events



Chavez et al. (2008)



Li et al. (2018)

Fisheries

Peruvian fisheries

Group	Total species	Catch species		Species with normativity	
Fishes	1070	438	(41%)	40	(9.1%)
Molluscs	1024	86	(8.4%)	14	(16.3%)
Crustaceans	480	39	(8.1%)	3	(7.7%)
Echinoderms	120	8	(6.7%)	1	(12.5%)
Macroalgaes	156	14	(9%)	8	(57.1%)
TOTAL	2694	585	(21.7%)	66	(11.3%)

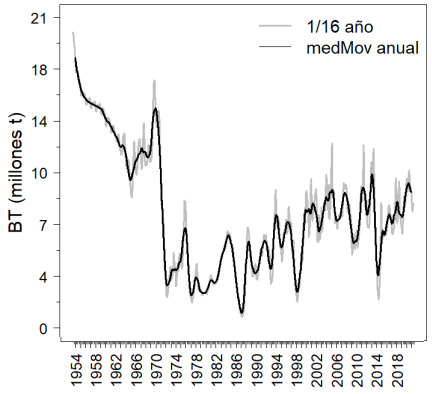
Peruvian fisheries

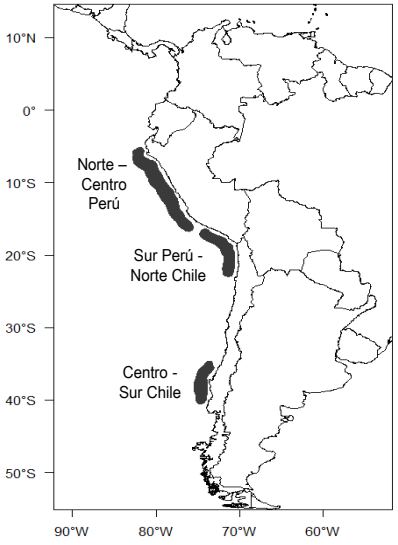
- PELAGIC FISHERY
  - Anchoveta (5,0 – 6,0) million t
  - Jack mackerel (100-200) thousand t
  - Mackerel (50-100) thousand t
  - Sardine (< 0.01) thousand t
- DEMERSAL FISHERY
  - Hake (20 – 40) thousand t
  - Non target species (Sea bass, Weakfish, Smoothhound, etc.) (10 – 20) thousand t
- OTHER DEEP SEA SPECIES
  - Eel (1 – 6) thousand t
  - Tootfish and King crabs (<0,5) thousand t
- ARTISANAL FISHERY
  - Fish (Striped mullet, Silverside, Drum, etc) (20 – 40) thousand t
  - Invertebrates (False abalone, mussles shell, scallops, etc) (30 – 50) thousand t
  - Other invertebrates (1 - 10) thousand t
- JIGGING FISHERY
  - Jumbo squid (300 - 500) thousand t

Peruvian anchovy as a study case

Engraulis ringens

Biomass
High and variable

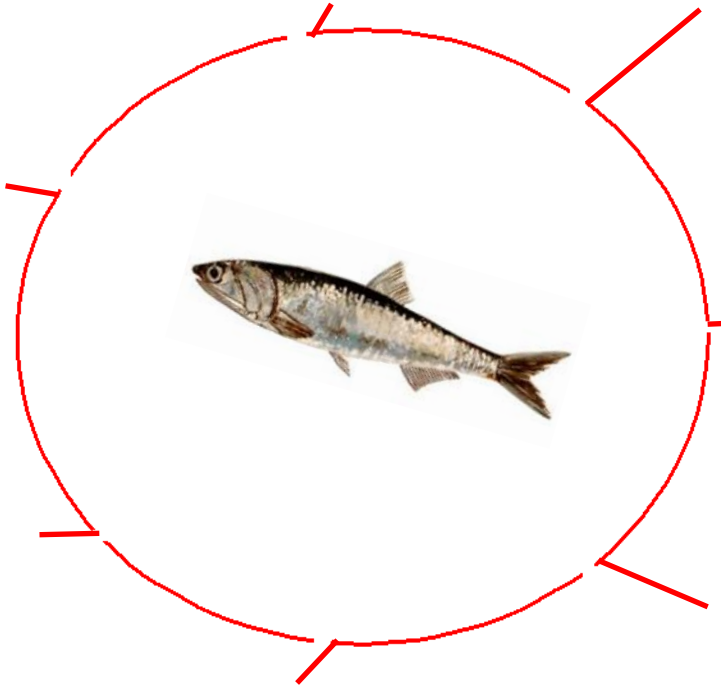




Stocks
(3) coastal-pelagic

Size
small

0 — 12 — 20 cm LT



Lifecycle
brief

0 — 1 — 2 — ~4 años

Fast growth
(12 cm en 1 año)

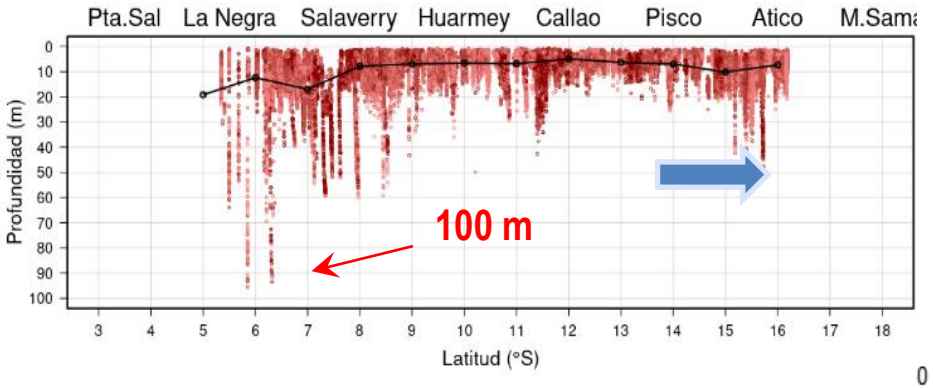
Partial spawner

(15.0 cm) = => 13 584 ovo/mes

Ecology
Phytoplankton and Zooplankton
Birds and marine mammals

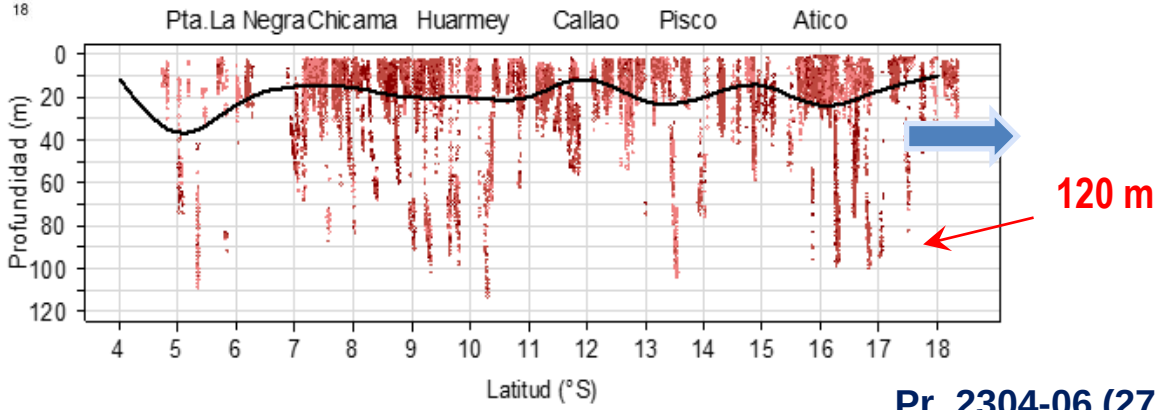
Peruvian anchovy as a study case

Cr. 2302-04 (19 Feb - 24 Mar)

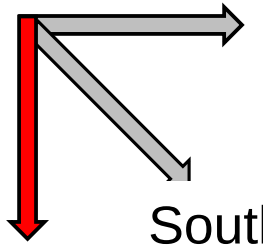


Change in pattern distribution (warm conditions)

EUREKA LXXIV (17 - 21 Apr 2023)



North → **South**

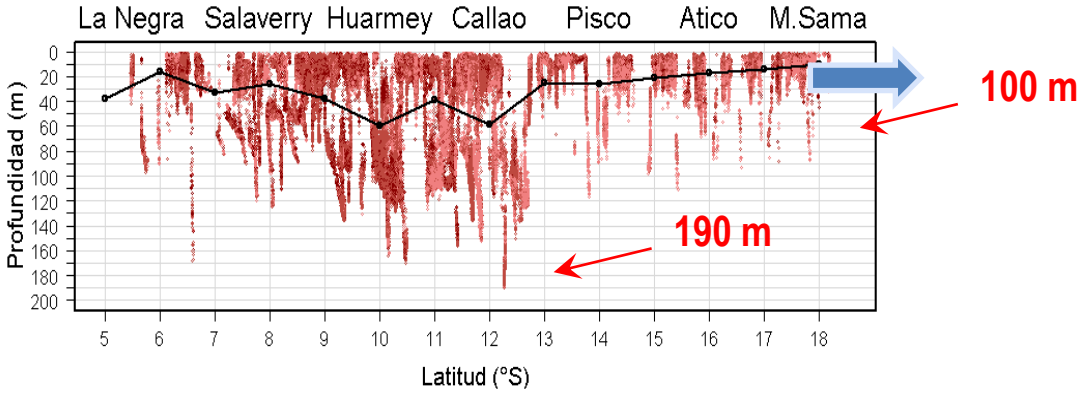


Coast and high density

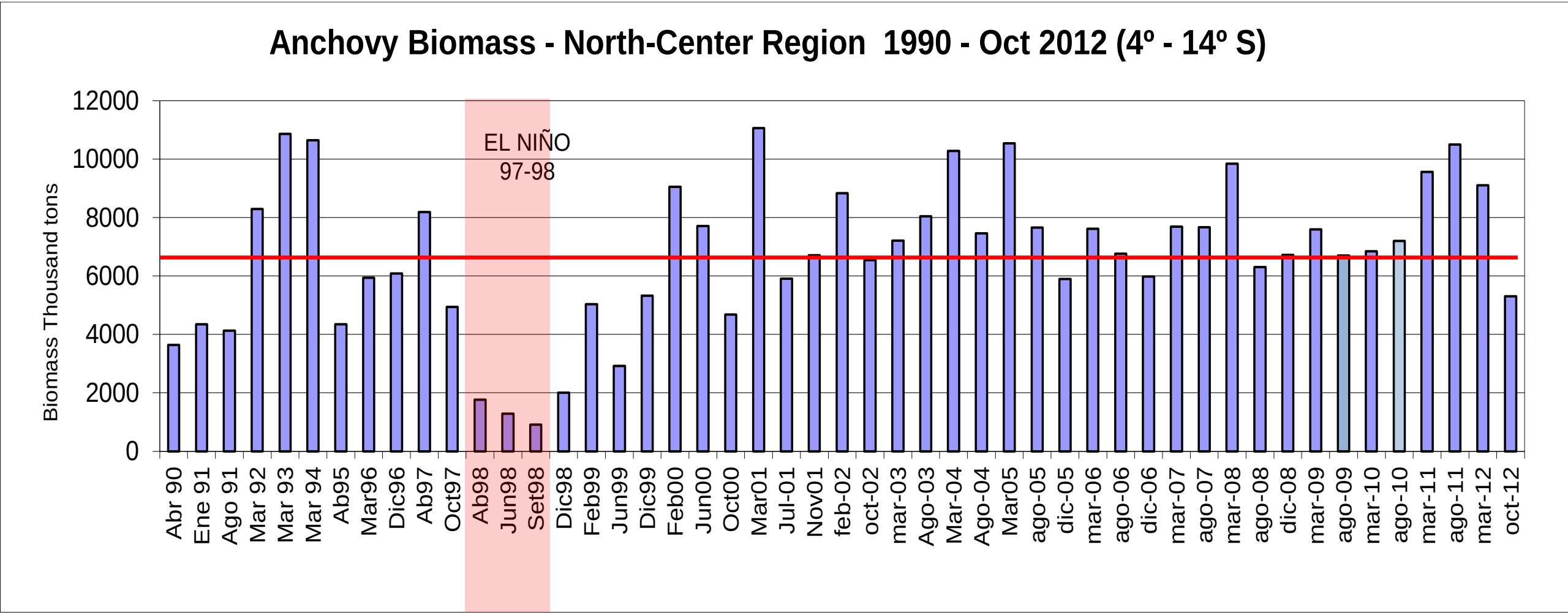
South

Deeper

Pr. 2304-06 (27 Apr - 05 Jun)



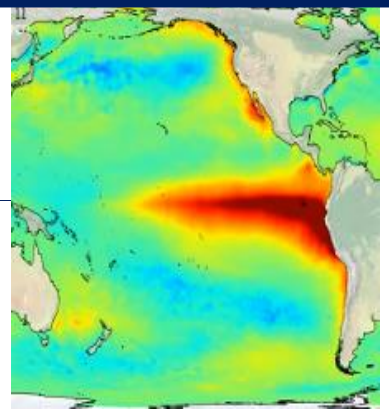
Peruvian anchovy as a study case

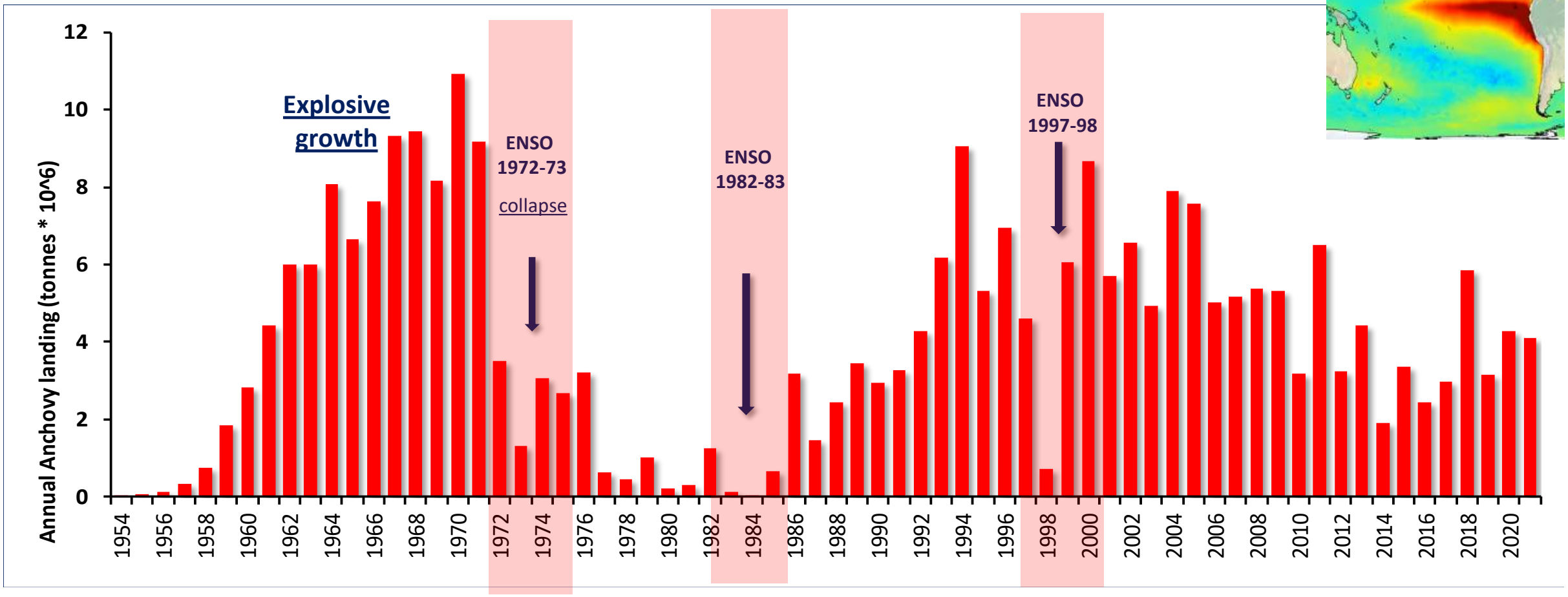


The Niño Event has a strong effect in the Peruvian anchovy availability during the stock assessment survey

Peruvian anchovy as a study case

Landing of northern-central stock of anchovy



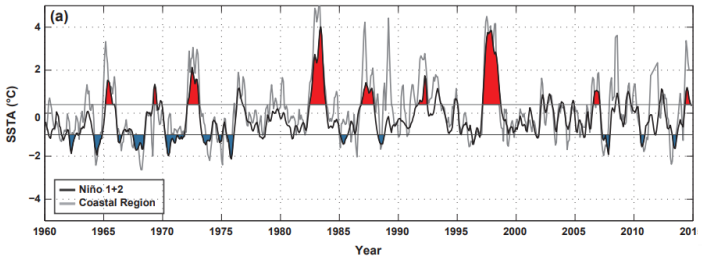


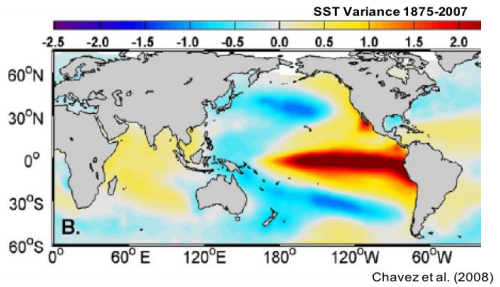
The variability is the result of combined action of environmental anomalies and the magnitude of the fishing effort

Challenges for adaptation: lessons from the past and present for the future

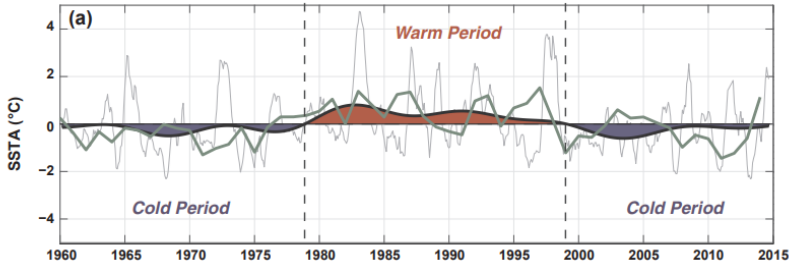
Observation systems and management actions

Variability NHCS

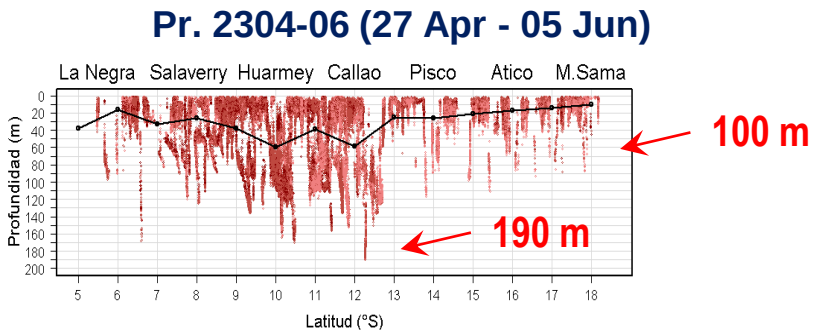


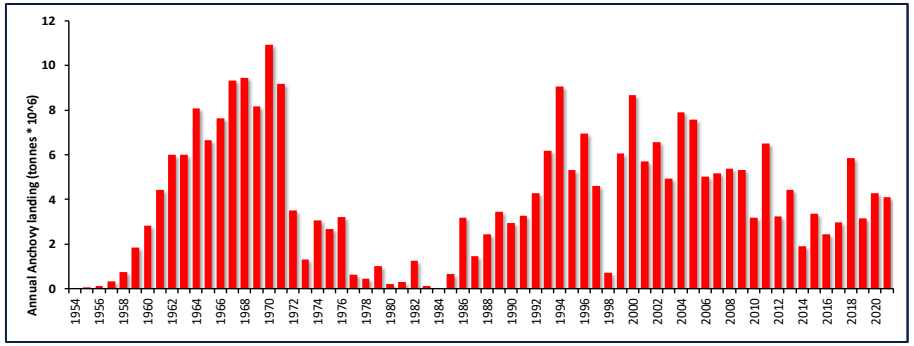


Chavez et al. (2008)



Effects in species (e.g. anchovy)





Main actions

Sea and living resources observation systems

Decision-making system for very short-term management (24 - 48 hours)

Management Measures (fishing season or year)

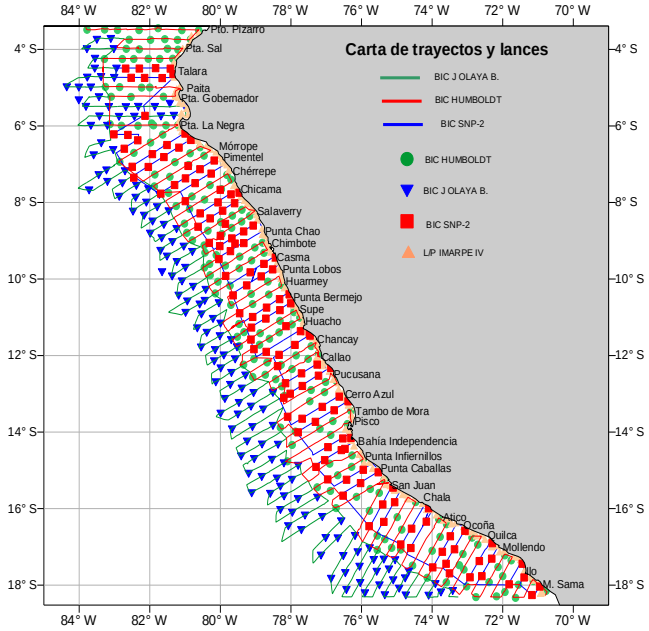
Sea and living resources observation systems

- **Fisheries monitoring program in the main landing points of the peruvian coast: biological and fisheries aspects.**
- **Research surveys (~4-5 each year): anchovy, hake, jumbo squid, jack and chub mackerels. Also a spawning biomass survey for anchovy.**
- **Scientific observers on board programs in the commercial fleet.**
- **Activities with the fleet participation:**

i. **Eureka (since 1960): distribution, relative abundance and condition of the species (similar to a survey).**

ii. **Exploratory fishing.**

- **Use of vessel monitoring system (VMS) for industrial fleet.**



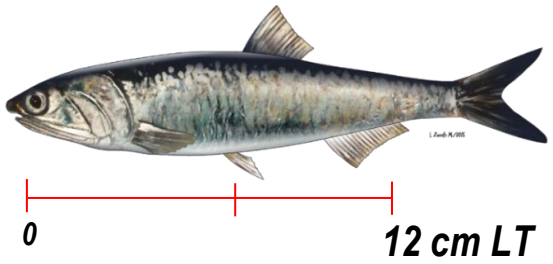
Decision-making system for very short-term management

1. Bans and temporary closures (carried out in a short time ~ 24 –48vh)

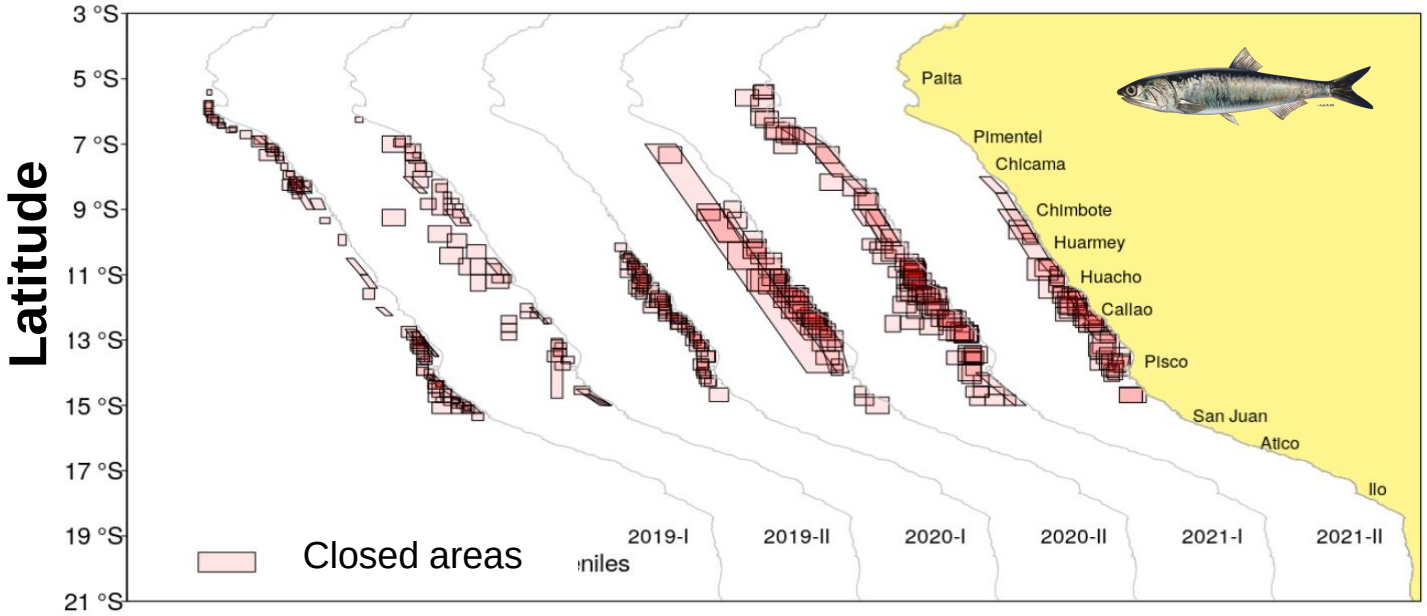
- **Juveniles**
- **Reproductive activity**
- **Incidental catch**

2. Size and fishing gear limits

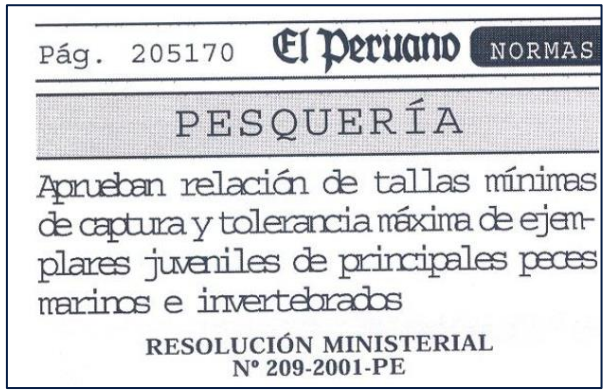
- **Minimum catch size (MCS)**
- **Minimum mesh size**
- **Catch tolerance percentage below the MCS**



Mesh size = 13 mm
% Tolerance = 10%



2001: The Ministry enacted a normativity that provides a list of minimum catch sizes and maximum tolerance for juvenile of the main marine fishes and invertebrates



Pág. 205170 El Peruano NORMAS

PESQUERÍA

Aprueban relación de tallas mínimas de captura y tolerancia máxima de ejemplares juveniles de principales peces marinos e invertebrados

RESOLUCIÓN MINISTERIAL
Nº 209-2001-PE

Management measures

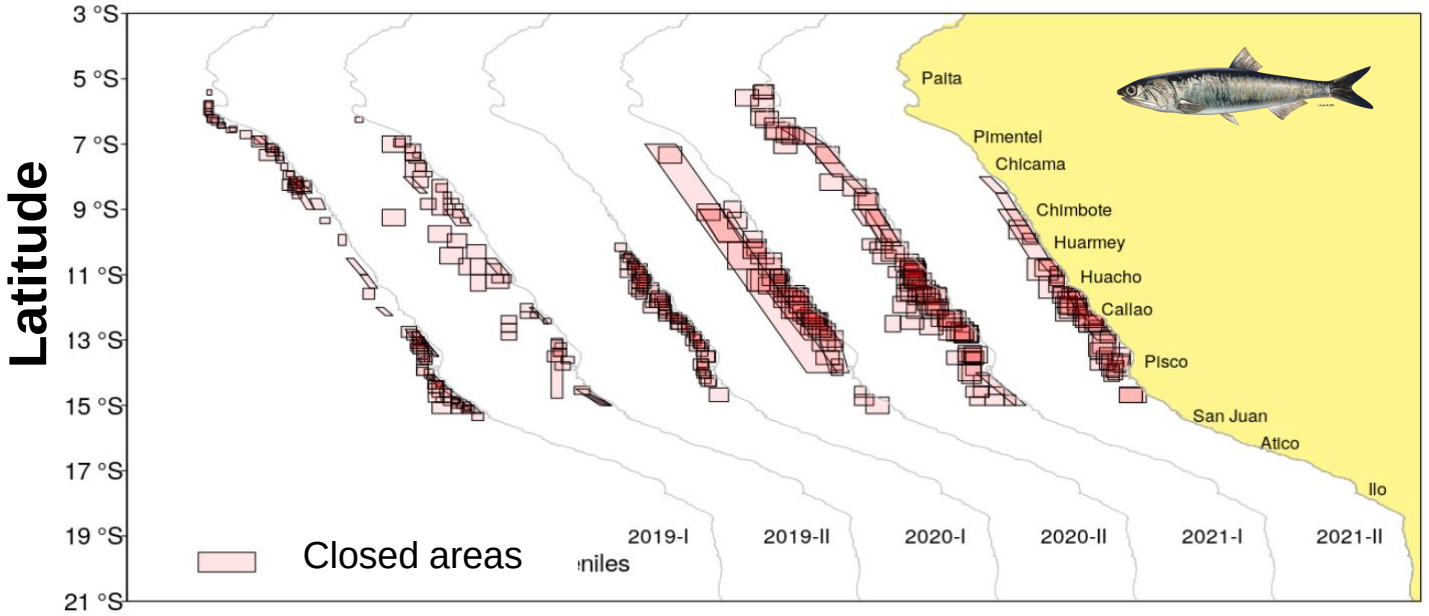
1. Bans and temporary closures (carried out in a short time ~ 24 h)
- Juveniles
- Reproductive activity
- Incidental catch

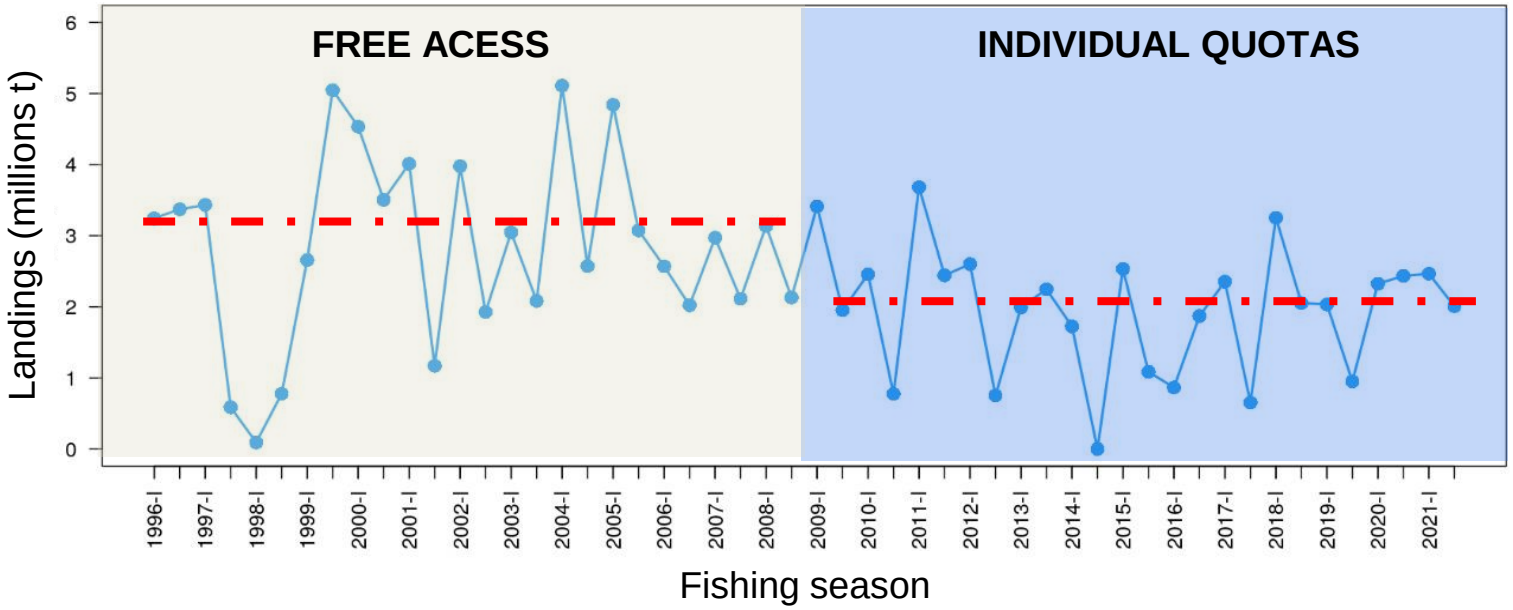
2. Size and gear limits
- Minimum catch size (MCS)
- Minimum mesh size
- Catch tolerance percentage below the MCS

3. **Catch quotas**
- **Total quotas**
- **Individual quotas**

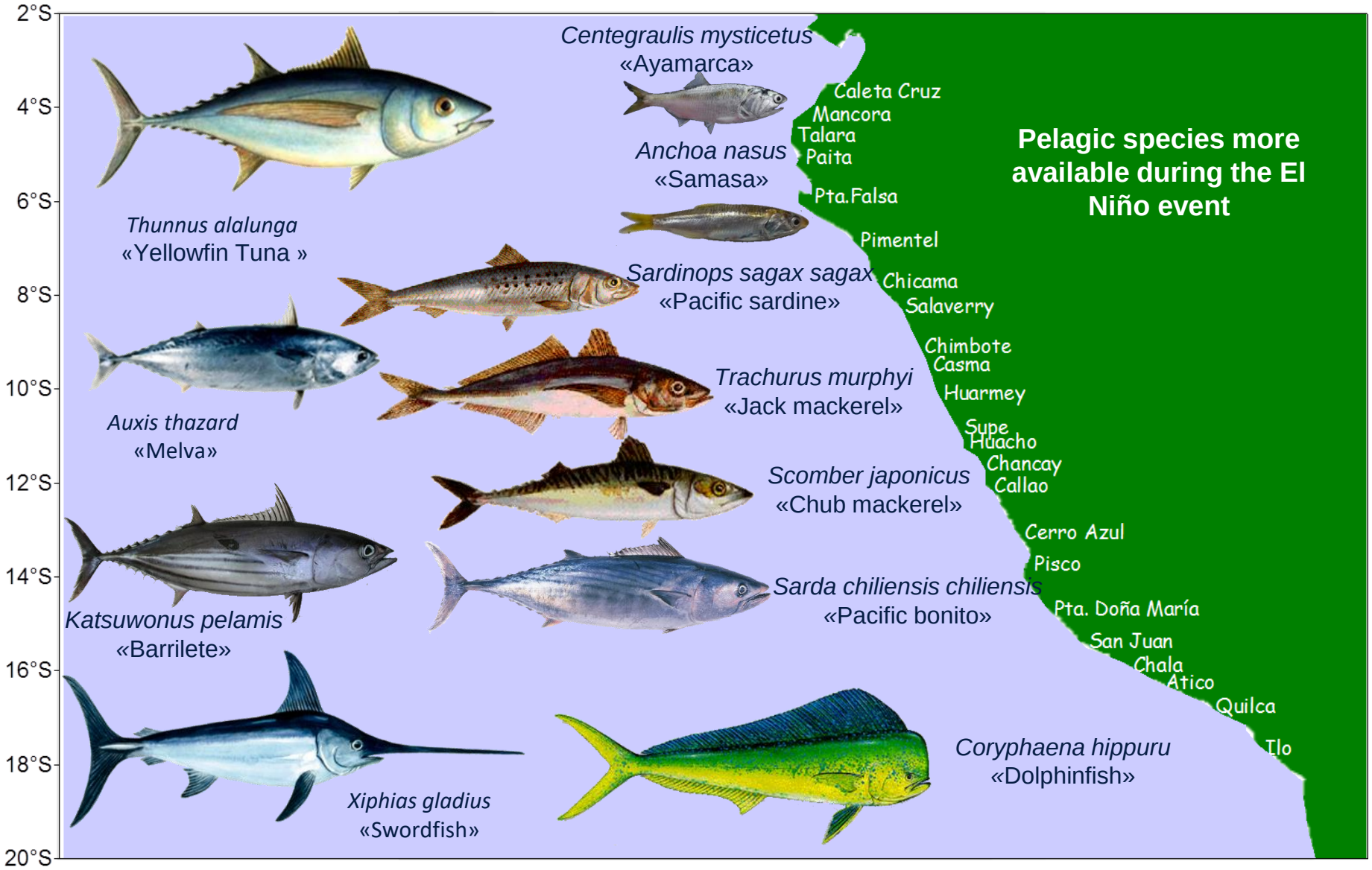
4. **Fishing seasons, fishing areas and others**

Adaptive approach for marine resources management and research





New challenges and opportunities for Peruvian fisheries in the future



Thanks you
Gracias

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