"4 th International Conference on Earth Science & Climate Change"
Alicante, Spain 16-18 June 2015

Valuable contribution of the advance monitoring in the fishery management of Peruvian anchovy



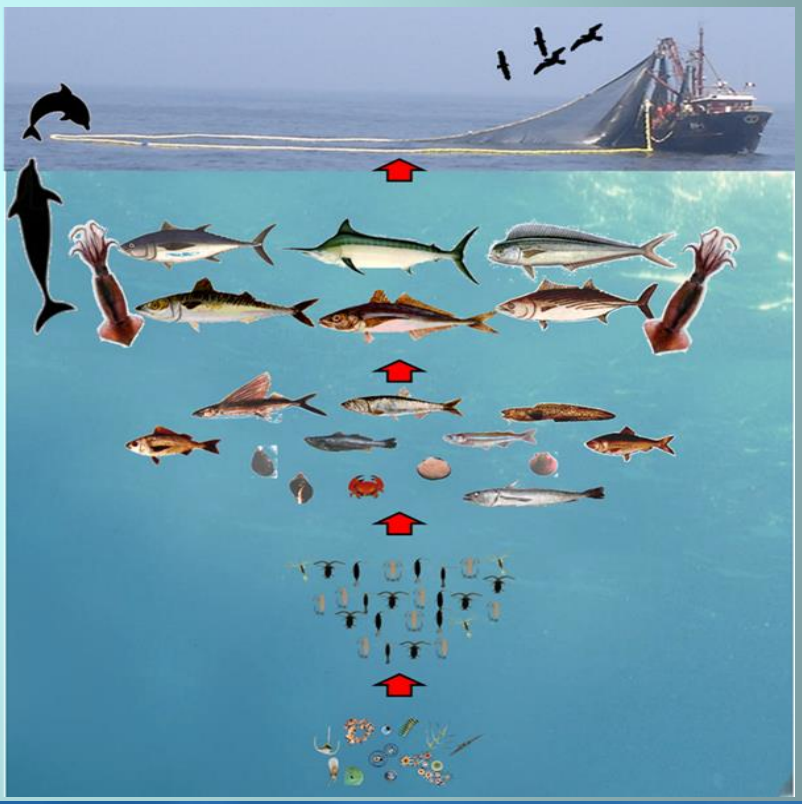
Monitoring in the fishery of Peruvian anchoveta

M. Sc. Marilú Bouchon Corrales
Directora Gr. Inv. Recursos Pelágicos
IMARPE



Tropical Location

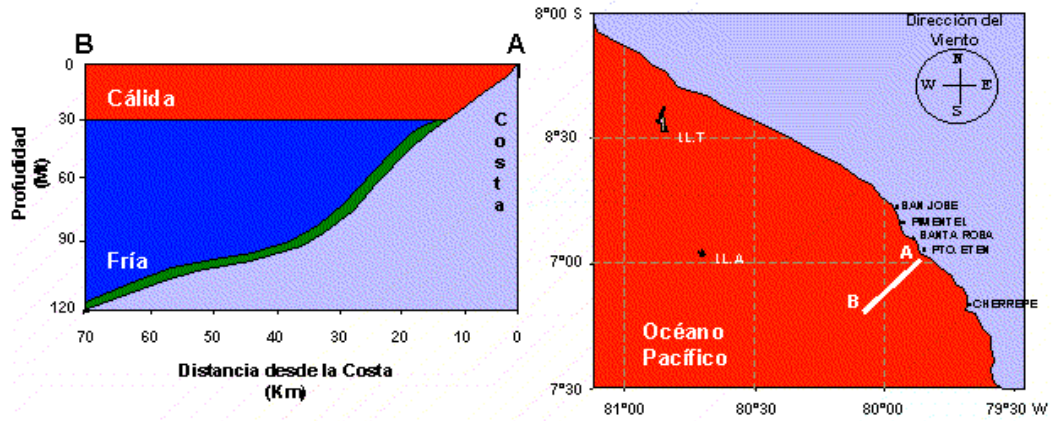
The Peru or Humboldt current and the upwelling system

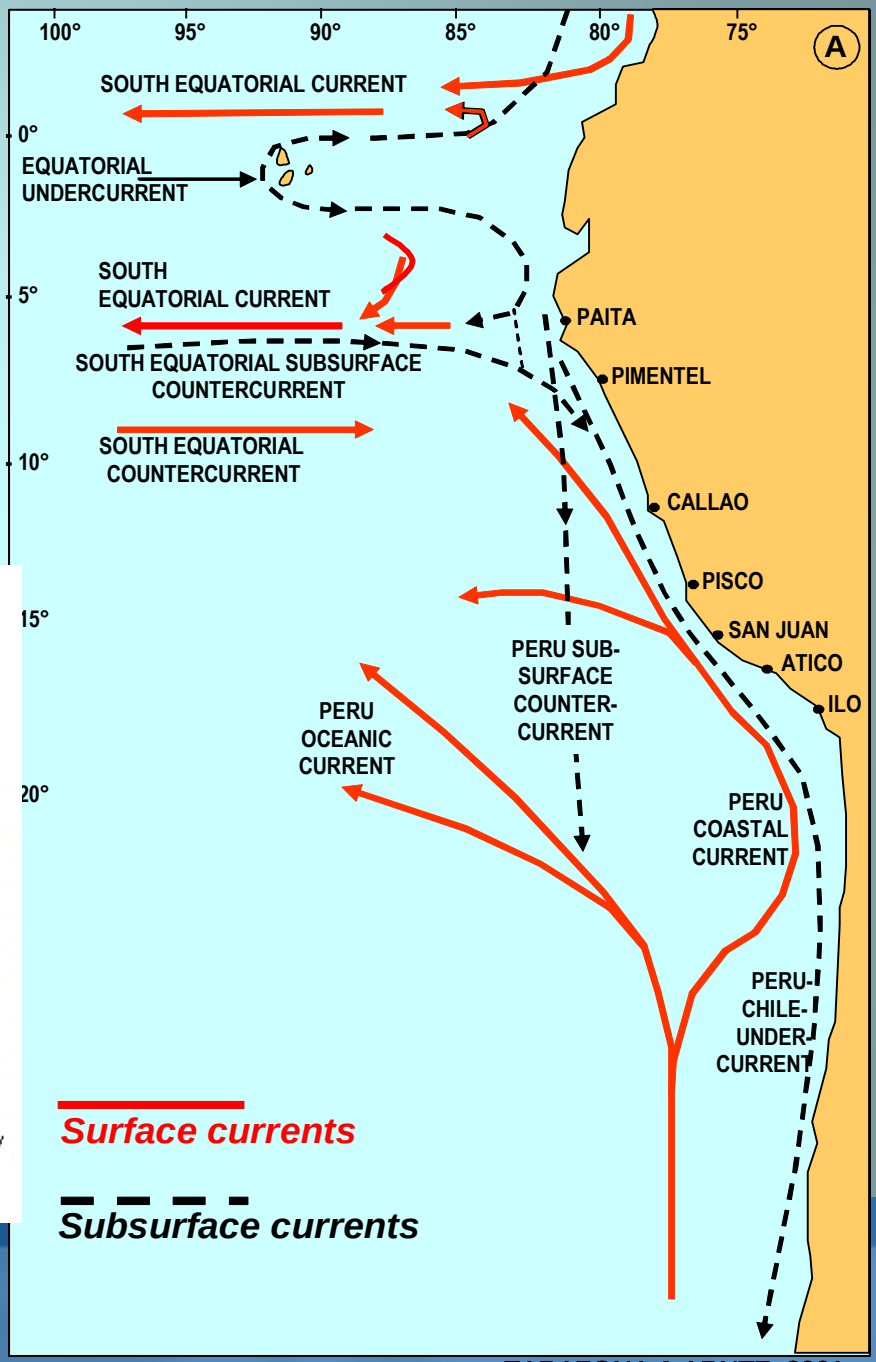


Peru has tropical location near of ecuator. Has the Humboldt curret, one on the most productive marine ecosystem

Complex System of Surface and Subsurface Currents

Upwelling means: sea surface fertilization and production of phytoplankton .

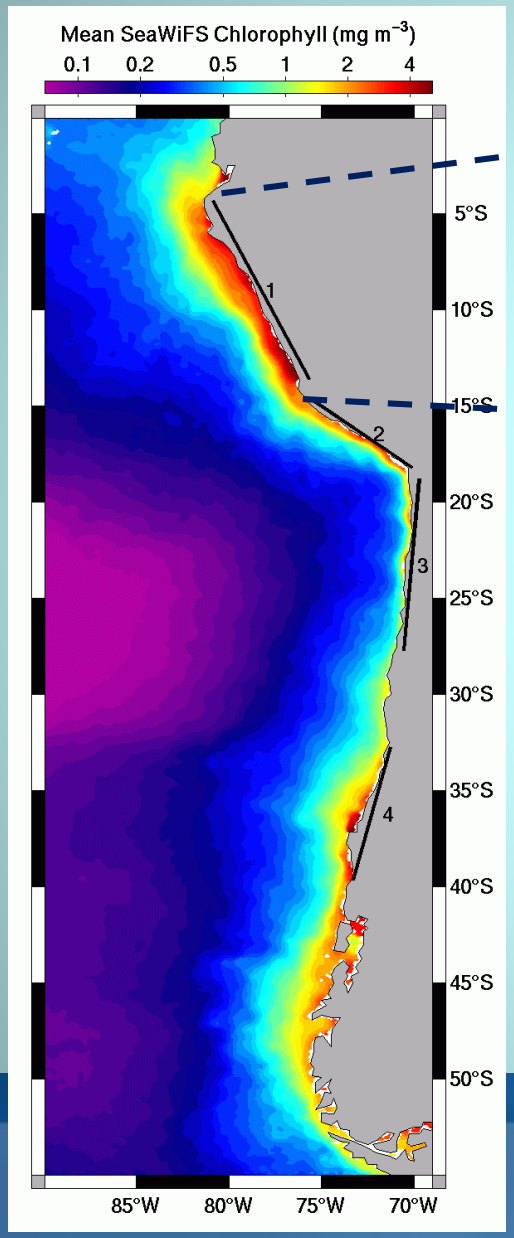


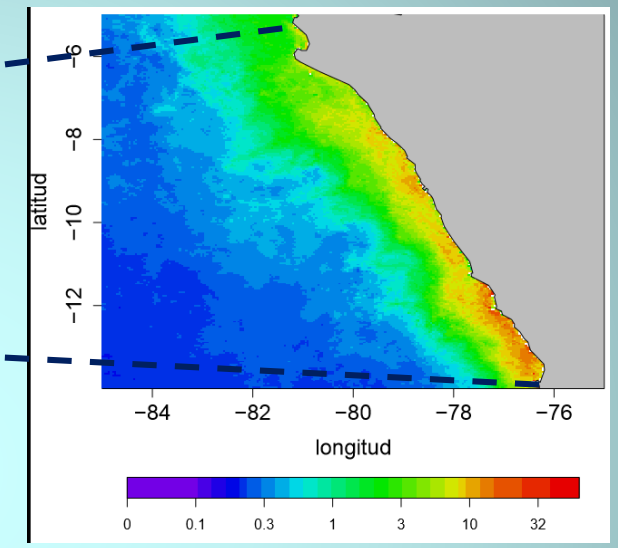


This ecosystem have complex system currents.
Also has the larges and intense upwelling system

TARAZONA & ARNTZ, 2001

Humboldt current: high variability and productivity





The higher variability next of Peruvian coast

This area has high variability and productivity, also sometimes the upwelling is disrupted by El Nino event.

This event has had the greatest impact of fisheries in Peru.

Main marine pelagic resources



Engraulis ringens



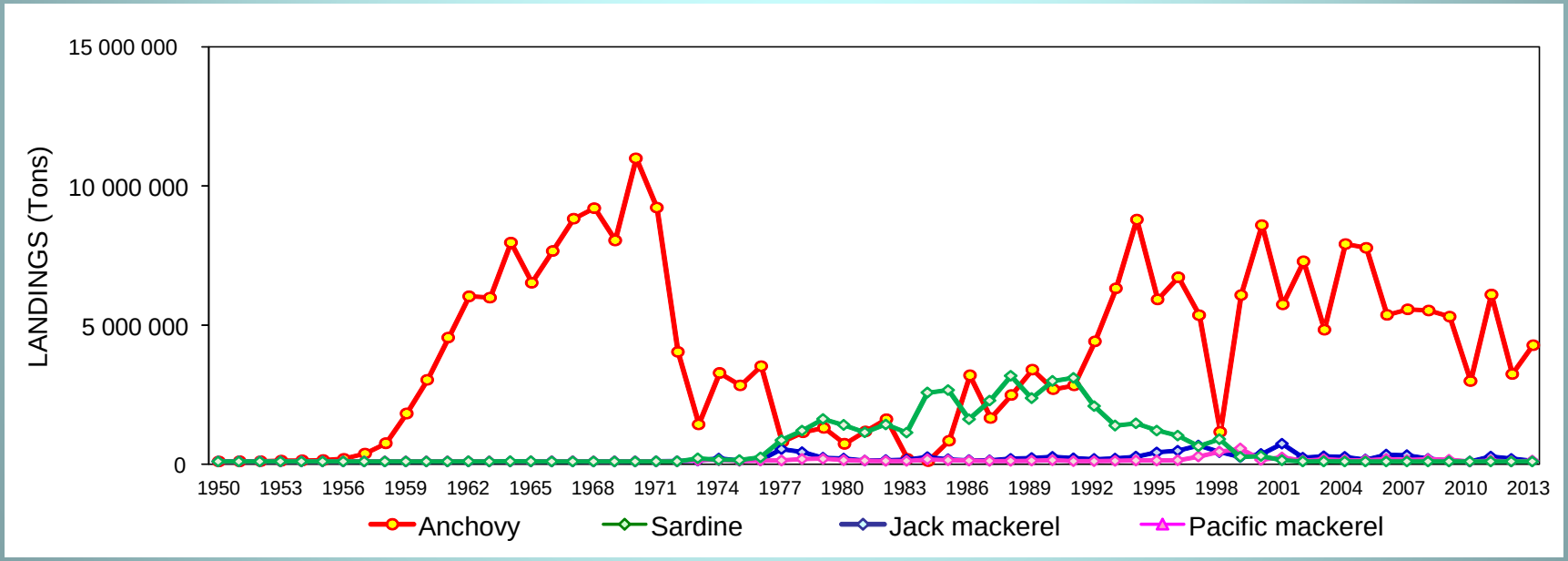
Sardinops sagax sagax



Trachurus murphyi



Scomber japonicus



The Peruvian anchovy is located in the Humboldt Current Ecosystem. This supports the biggest fishery around the world; it is probably the best monitored large ecosystem

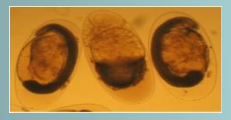
Peruvian anchovy



Engraulis ringens







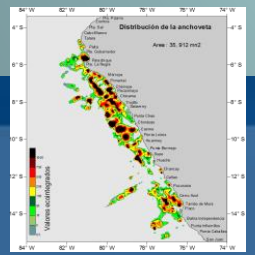
High fecundity



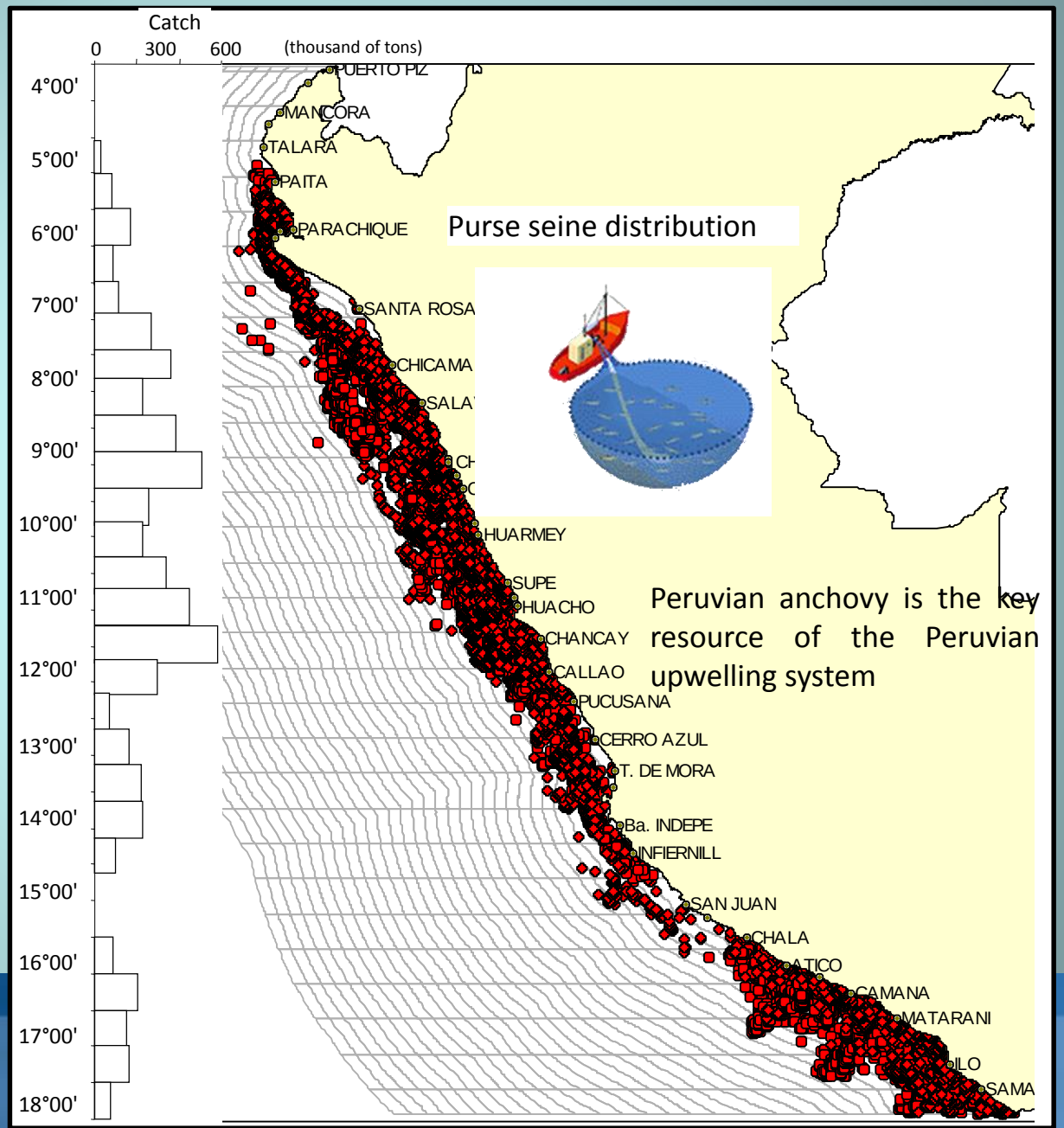
Planktivorous fish



Behavior in schools



High biomass





Scientific observer programs of IMARPE

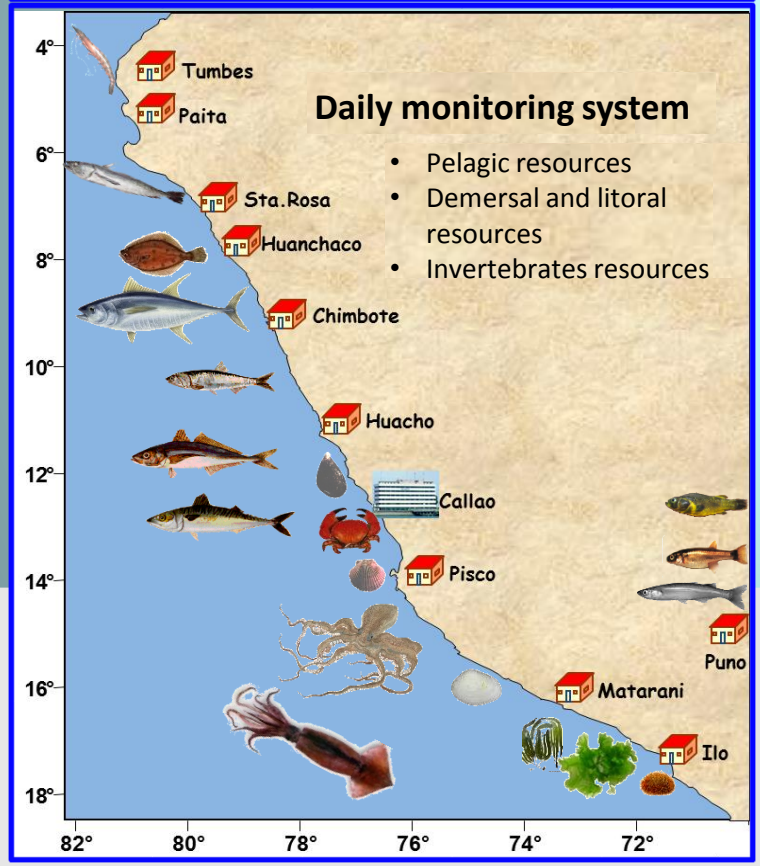
Observation and monitoring

IMARPE have for the anchovy a " Adaptative management". Their population dynamic is highly variable and responds quickly to many forcing factors

Scientific observer programs of IMARPE

Observer program

In land



Daily monitoring system

- Pelagic resources
- Demersal and litoral resources
- Invertebrates resources

On board

Research surveys



Scientific technician of IMARPE (TCI)



Logbook On board Observer Program (LOOP)



In Land: Daily monitoring system

To get data on catch, effort, size, species Composition,etc.









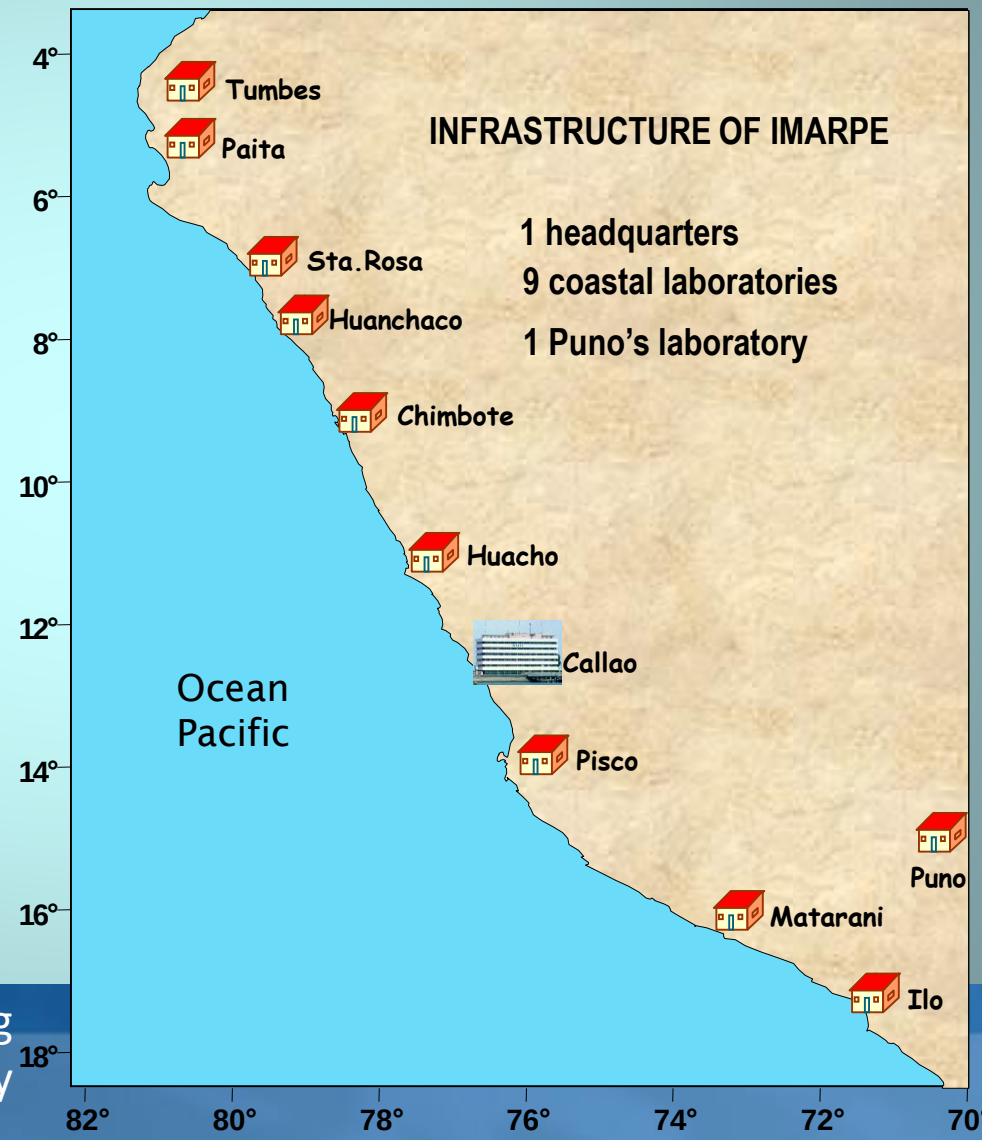
INSTITUTO DEL MAR DEL PERU — F04-D/IMP

REGISTRO DE DESEMBARQUES DIARIOS DE LA PESQUERÍA PELÁGICA

PUERTO/CALETA:			
DESTINO :	[ ] CHD [ ] CHI	FECHA	/ /

ESTABLECIMIENTO PESQUERO :

EMBARCACIÓN			ESPECIE		ÁREA
MATRÍCULA	NOMBRE	TIPO DE FLOTA	NOMBRE	DESEMBARQUE (t)	ISOPARALITORAL



The Peruvian pelagic fishery monitoring system is characterized by daily frecuency and quick advice.

Daily monitoring system



Biometric and biological sample



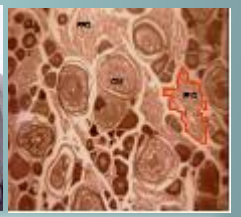
Trophic ecology

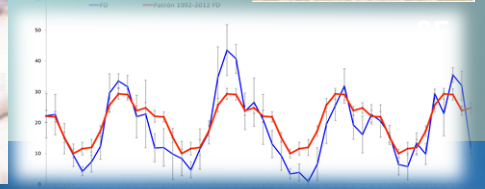


Age and growth



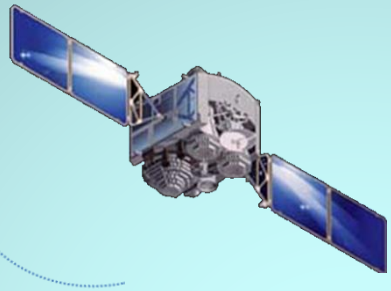






Reproductive biology

Vessel Monitoring System Program (SISESAT)

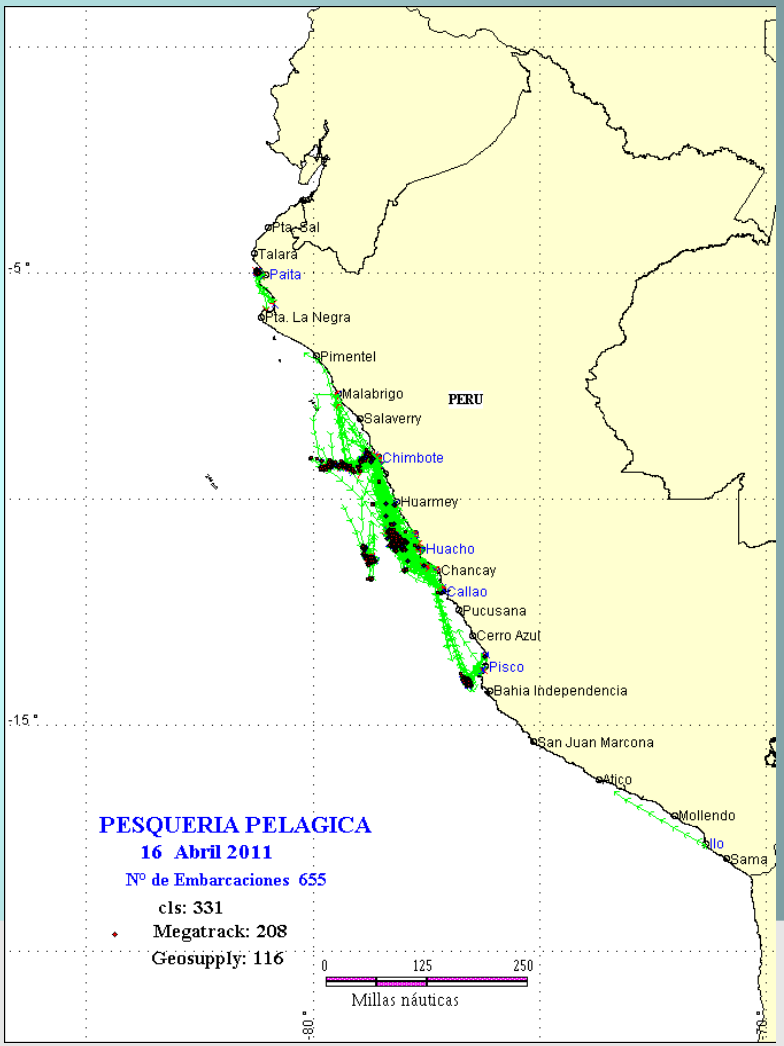


CLS PERU
COLECTA LOCALIZACION SATELITES

MEGATRACK

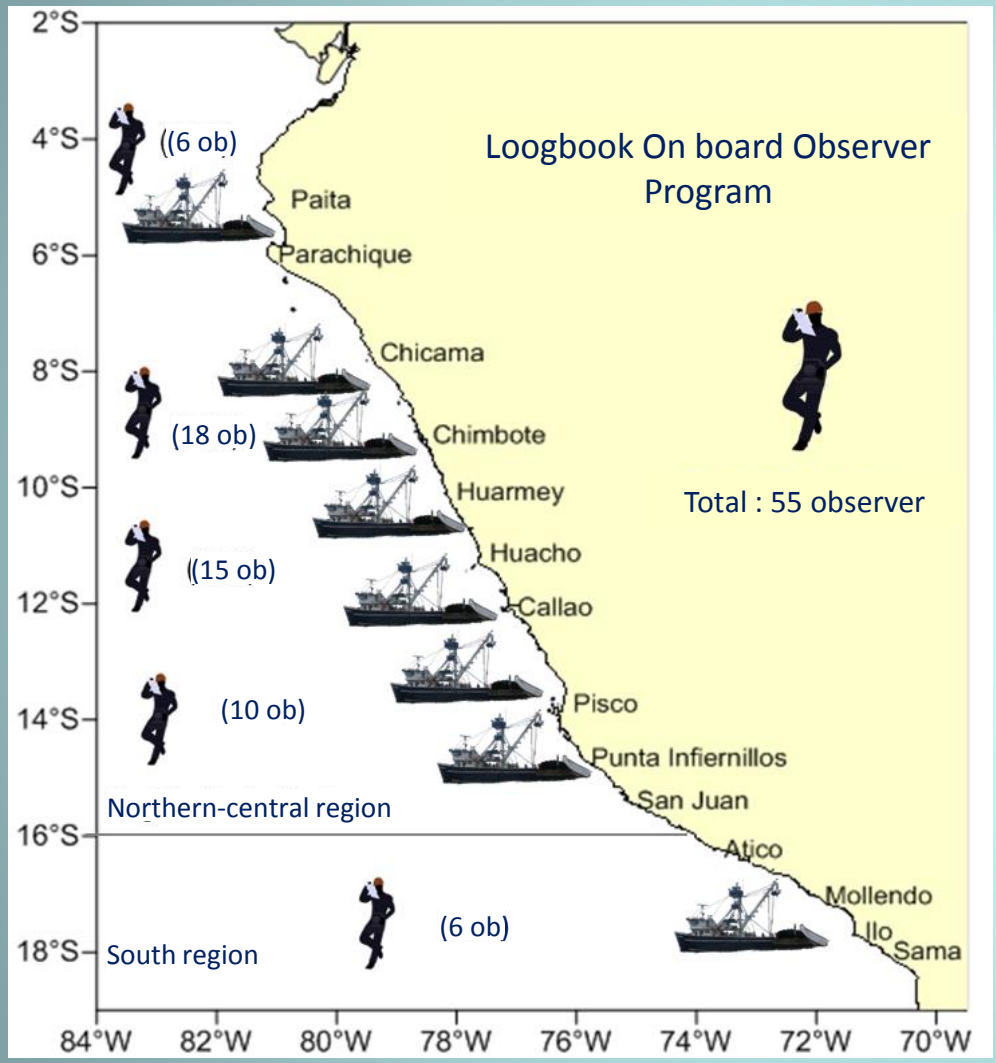
GeoSupply





Monitoring is complemented with a vessel monitoring system to register interaction of vessels in a fishing area

Peruvian Logbook On board Observer Program (LOOP)





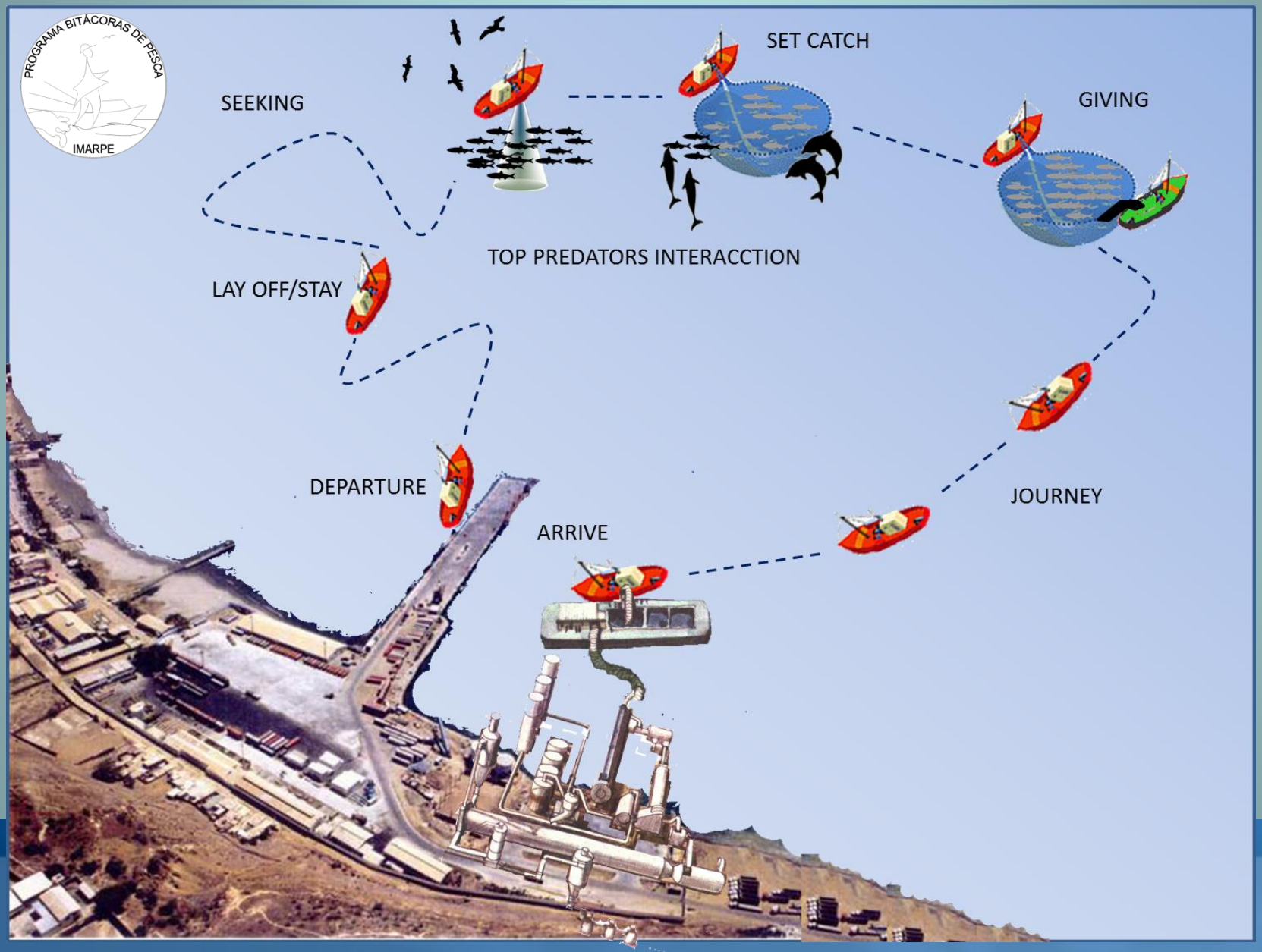




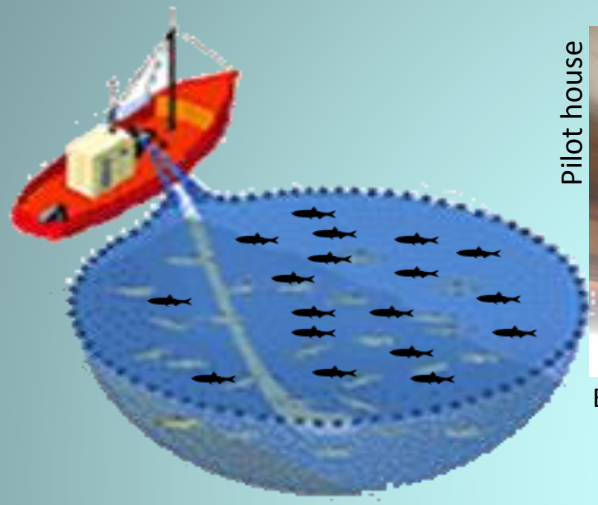


IMARPE has LOOP on board that monitoring the main anchovy density areas

Peruvian Logbook On board Observer Program (LOOP)



LOOP: Catch set



Pilot house



Echo sounder: Furuno FCV 882L













3. DE LA CALA

COD. VIAJE: _____

3.1. FECHA, HORA Y UBICACIÓN

N° CALA: _____

	FECHA	HORA	longG	longM	latG	latM
INICIO	/ /	:				
FIN	/ /	:				

LUGAR DE REFERENCIA: _____

3.2. CARACTERÍSTICAS DEL MAR

TEMP. SUPERFICIAL (°C): _____

ESTADO DEL MAR	
1. CALMO, 2. REGADO	
3. MARejadilla, 4. MARejada, 5. FUERTE	

INSTRUMENTO	
1. TERM. MANUAL	
2. SENSOR LANCHA	

3.3. CARACTERÍSTICAS DEL CARDUMEN (sobre el que se toma la decisión de pesca)

DETECCIÓN	
1. ECOSONDA	
2. SONAR	
3. RADIO	
4. VISUAL	

SI ES VISUAL	
1. PAJARADA	
2. LOBOS/DELFINES	
3. SALTADERO/CARRIQUERA	
4. MORADO/BLANCOR	

TOPE SUP (Bz): _____

TOPE INF (Bz): _____

COD. FOTO: _____

TIPOLOGÍA	
1. CARDUMEN	
2. ESTRATO	
3. MIXTO	
4. DISPERSO	

COLOR	
1. AZUL	
2. VERDE	
3. AMARILLO	
4. ROJO	

3.4. CAPTURA

CAPT. LANCE (t) = ENVASADO + OFRECIDO + DESCARTE

(1+2+3)	(1)	(2)	(3)

ANCH. ENMALLADA | 1) SI | 2) NO

CAPT. CERO	
1. JUVENILES	
2. MANIOBRA	
3. FALLA TÉCNICA	
4. OTRA ESPECIE	

DESCARTE	
1. EXCESO	
2. JUVENILES	
3. OTRA ESPECIE	
4. OTRO	

3.5. INTERACCIÓN

PESCA OFRECIDA

	EMBARCACIÓN	CÓDIGO	(t)
1			
2			
3			
	TOTAL LANCE		

3.6. INCIDENCIAS

MOTIVO TDC	
1. ROMPIÓ RED	
2. ROMPIÓ GARETA	
3. FALLA SIST. HIDRAUL.	
4. ACCIDENTE	

* OTROS

COLECTA	CANT.	CÓD.
EJEMPLARES		
GÓNADAS		
ESTÓMAGOS		
OTOLITOS		
ESCAMAS		
AGUA		
*		

3.7. COMPOSICIÓN POR ESPECIES

CAPTURA:

CÓD.	ESPECIE	PESO (kg)	CAPT. (t)	%
	TOTAL			100

PRESENCIA:

CÓD.	ESPECIE

3.8. INTERACCION CON DEPREDADORES SUPERIORES

ESPECIE	PRESENCIA		CAPT ACCIDENTAL		COMP*	ESTADO
	NUM	MOMENTO	NUM	MOMENTO		

MOMENTO: (1) Antes, (2) Durante, (3) Después
* COMPORTAMIENTO: (1) Buscando, (2) Alimentándose, (3) Socializando, (4) Reposando
ESTADO: (1) Liberado vivo, (2) Liberado muerto, (3) Cautivero, (4) Muerto, (5) Otro: _____

LOOP: Biological information

❖ Resources

Target species



Engraulis ringens "anchoveta"



Trachurus murphyi "Jack mackarel"



Scomber japonicus "Pacific mackarel"

Indicator species

EN











LN

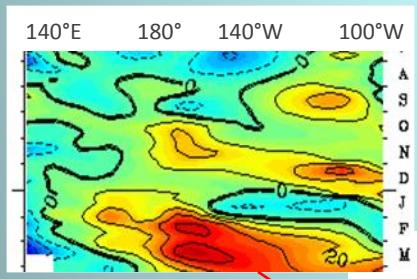


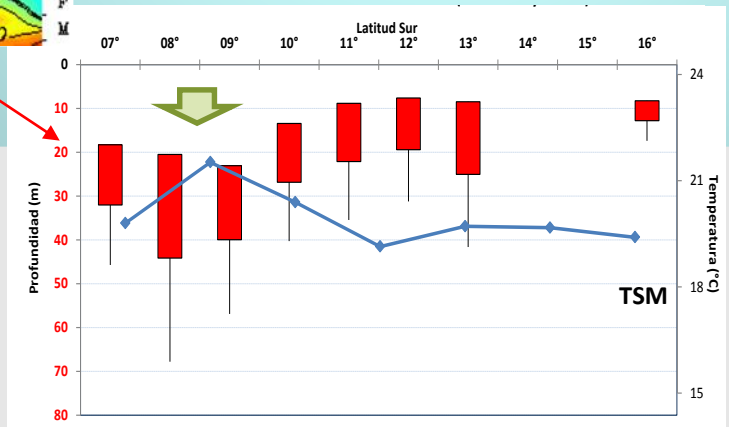


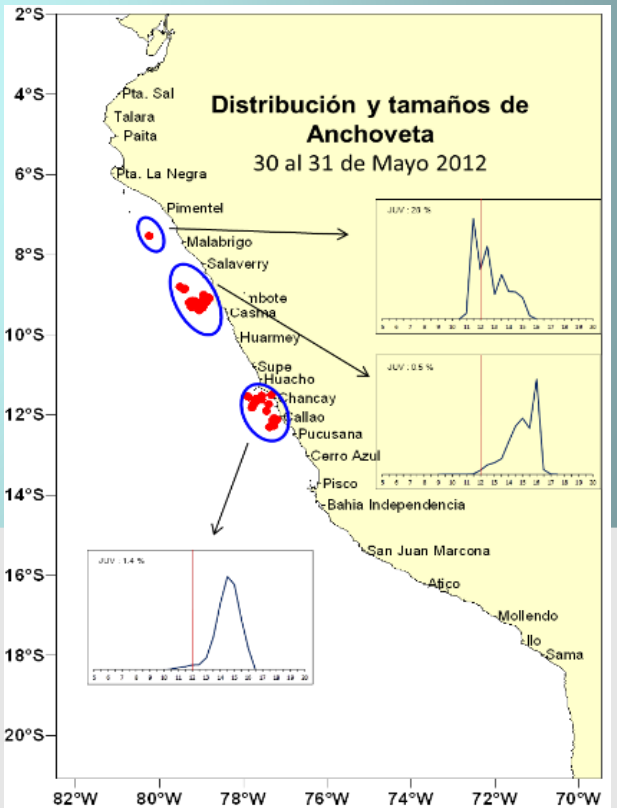
❖ Distribution

Kelvin wave

20°C Isotherm deep (m)





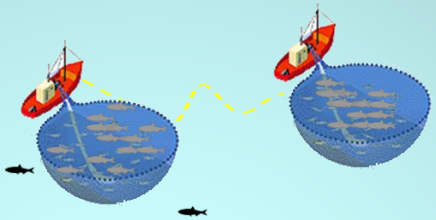


LOOP: Fishery information and top predators interaction

❖ Efective Effort



Search time



Number of catch set





Vessel trip with or without fish

❖ Discard





Juveniles





Overfishing



Other species

❖ Top predators interaccion

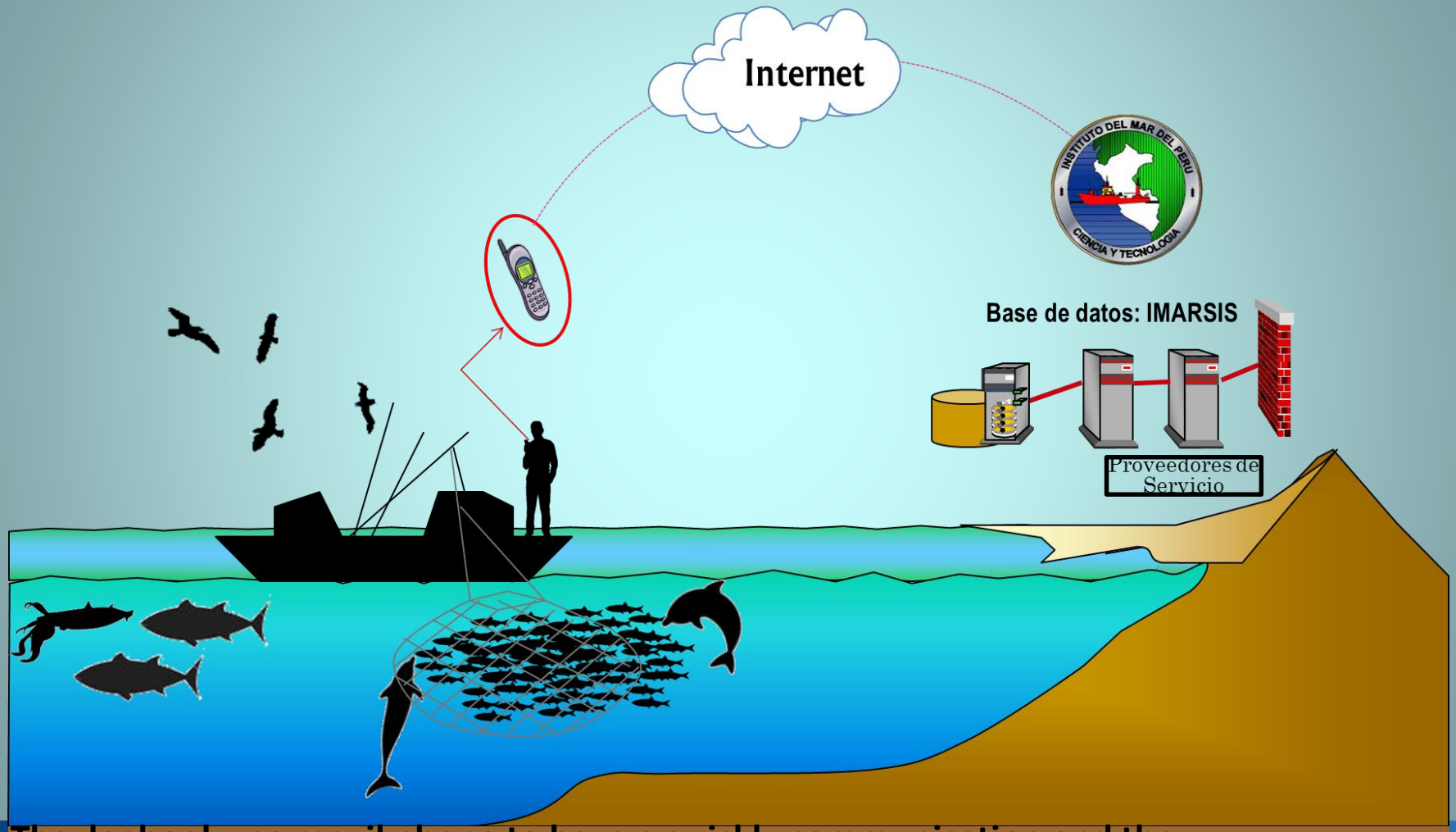








Peruvian Logbook On board Observer Program (LOOP)



The logbook use movil phone to have a quickly communication and the Information is registered in database IMARSIS.

Hydroacoustic survey in Peru



BIC Humboldt



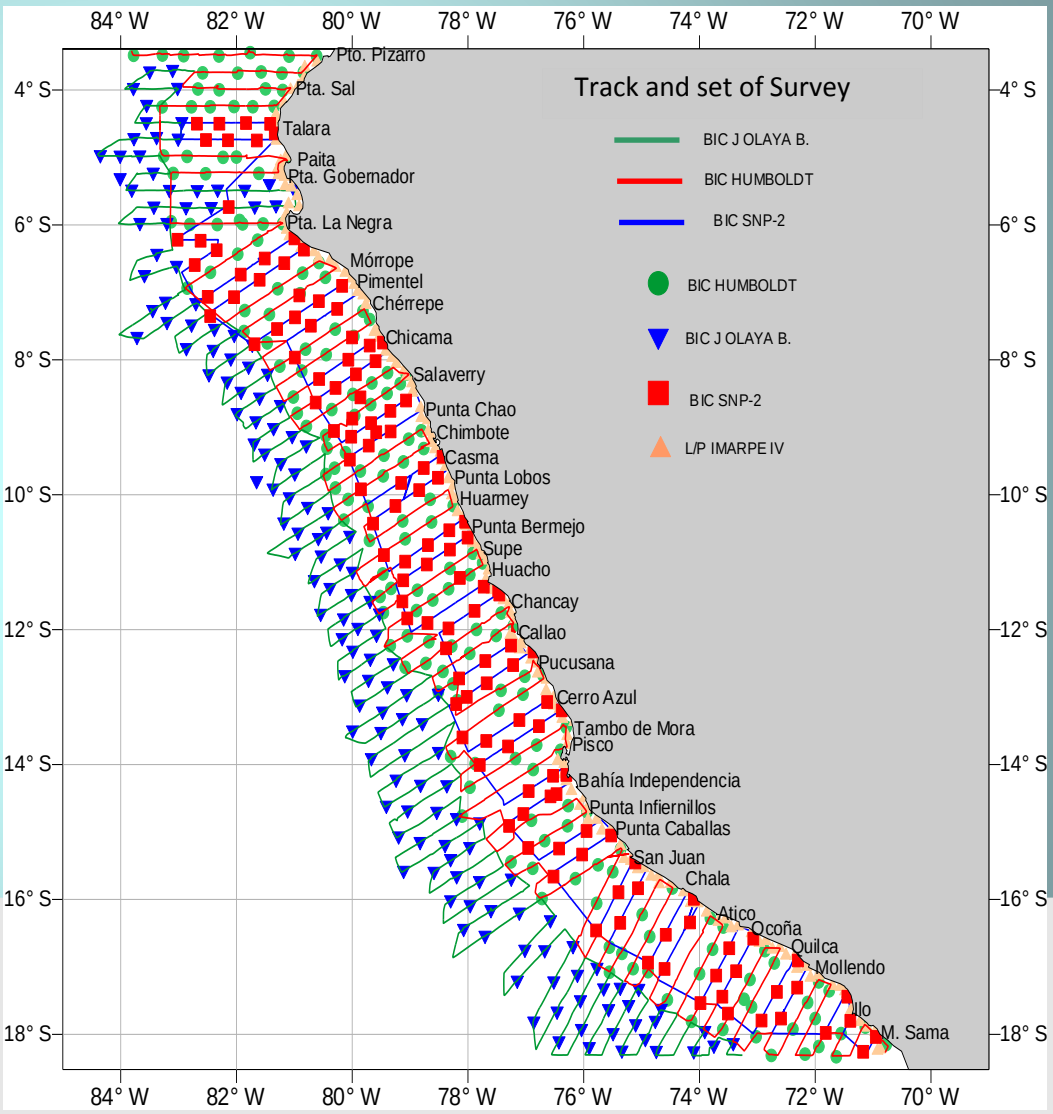
BIC José Olaya Balandra





BIC SNP-2 IMARPE IV – V – VI

Two acoustics survey per year. The first in the Austral summer and other in austral winter



Hydroacoustic survey in Peru













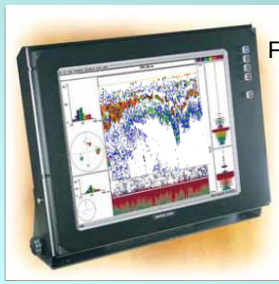






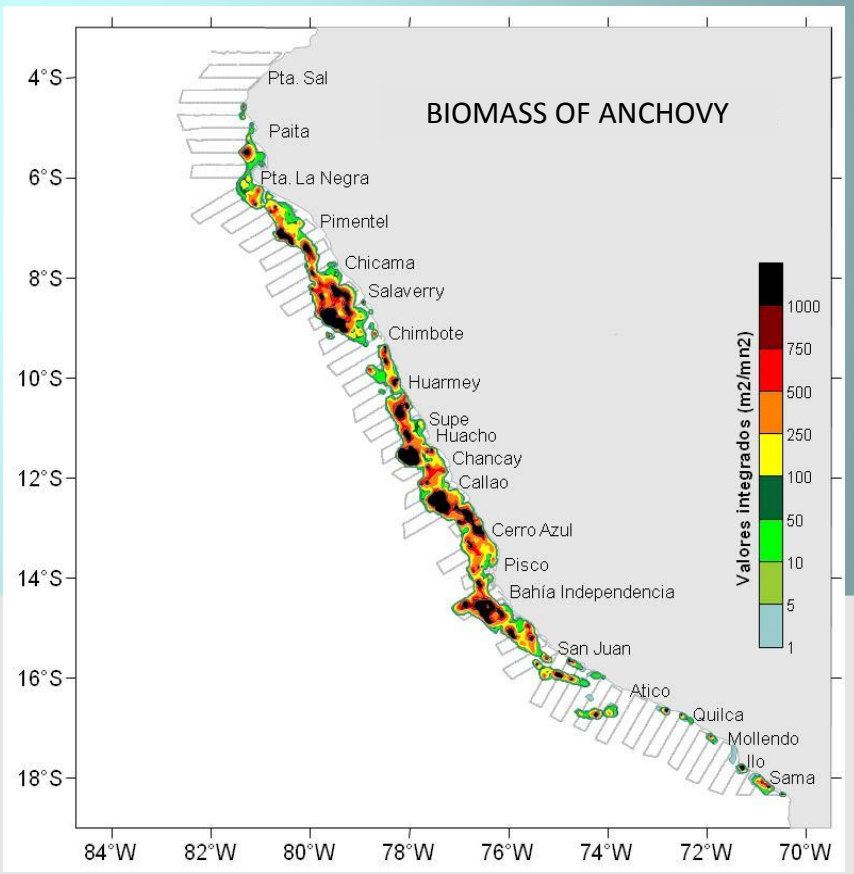






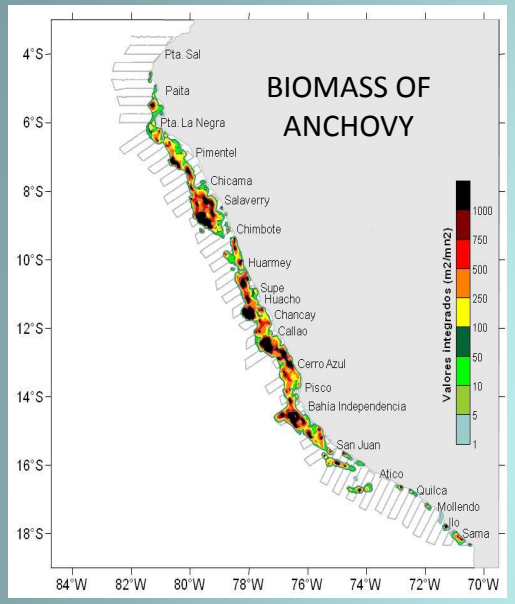
Frecuency (kHz):
38
48*
70*
120
200
*currently

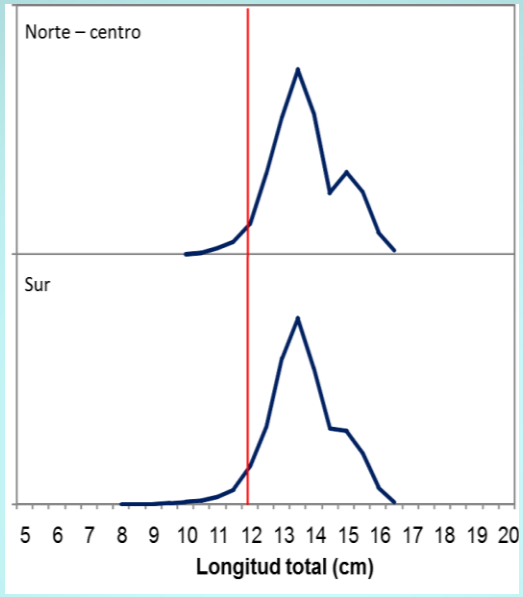


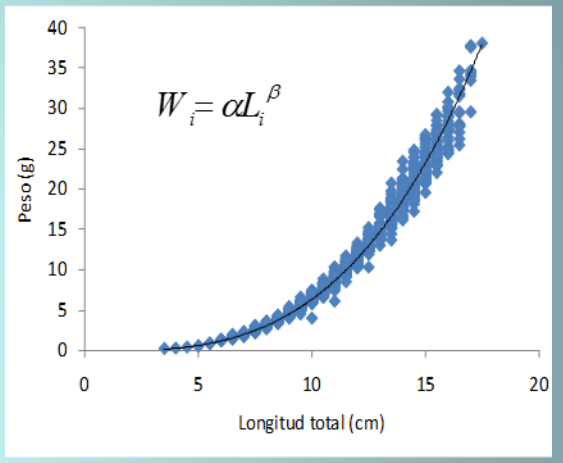


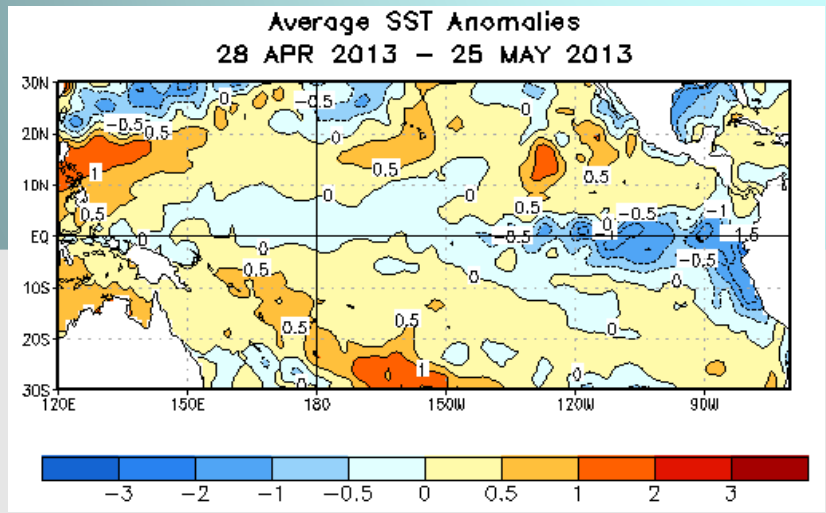
Catch quota

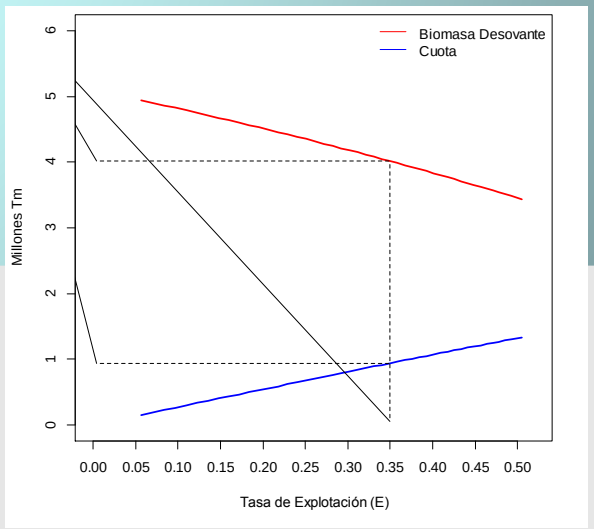
All information is sent to pelagic area which processes, analyzes and evaluates the status of anchovy and publishes a daily report and sent advice to the government to the quickly application











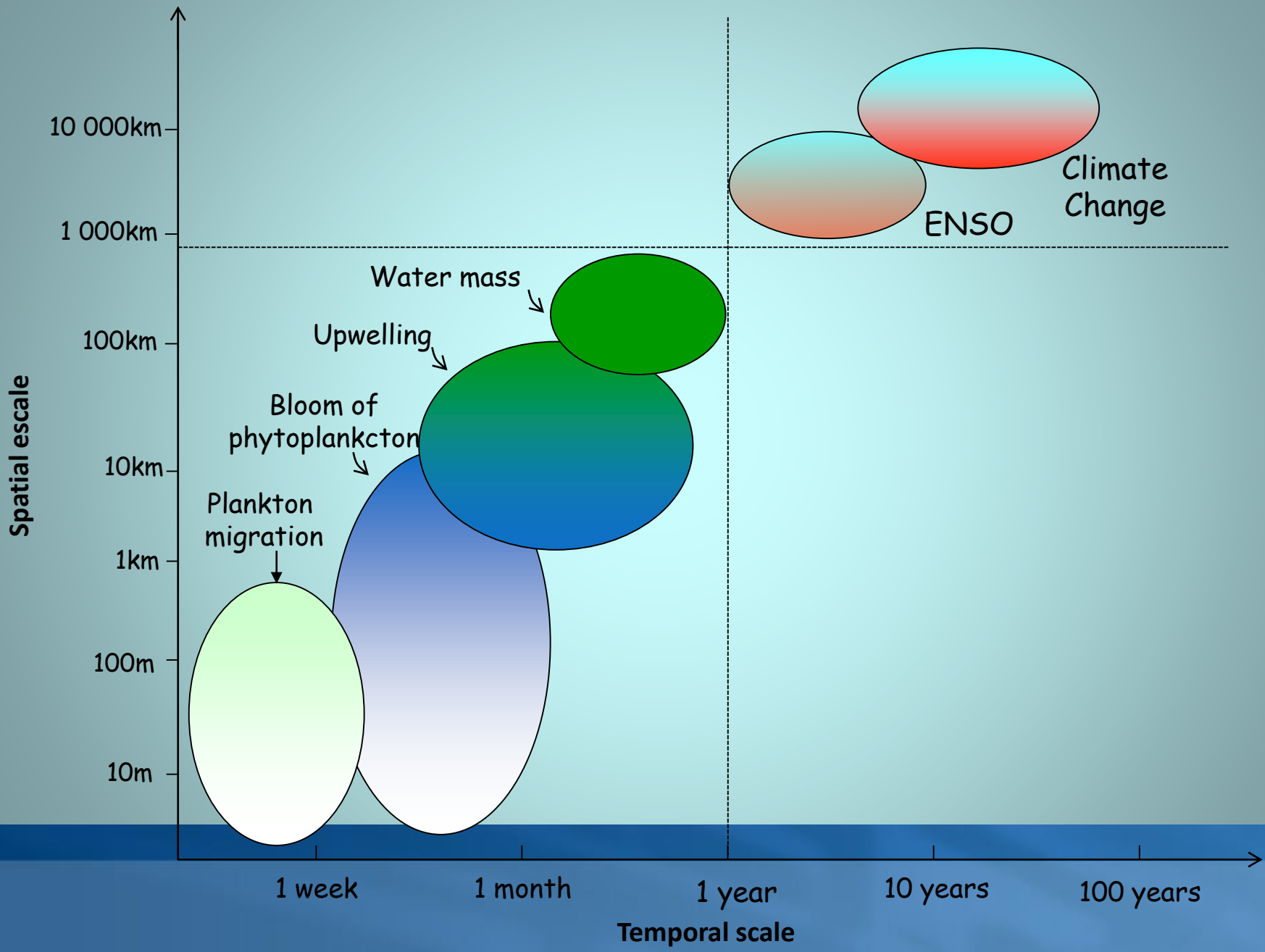






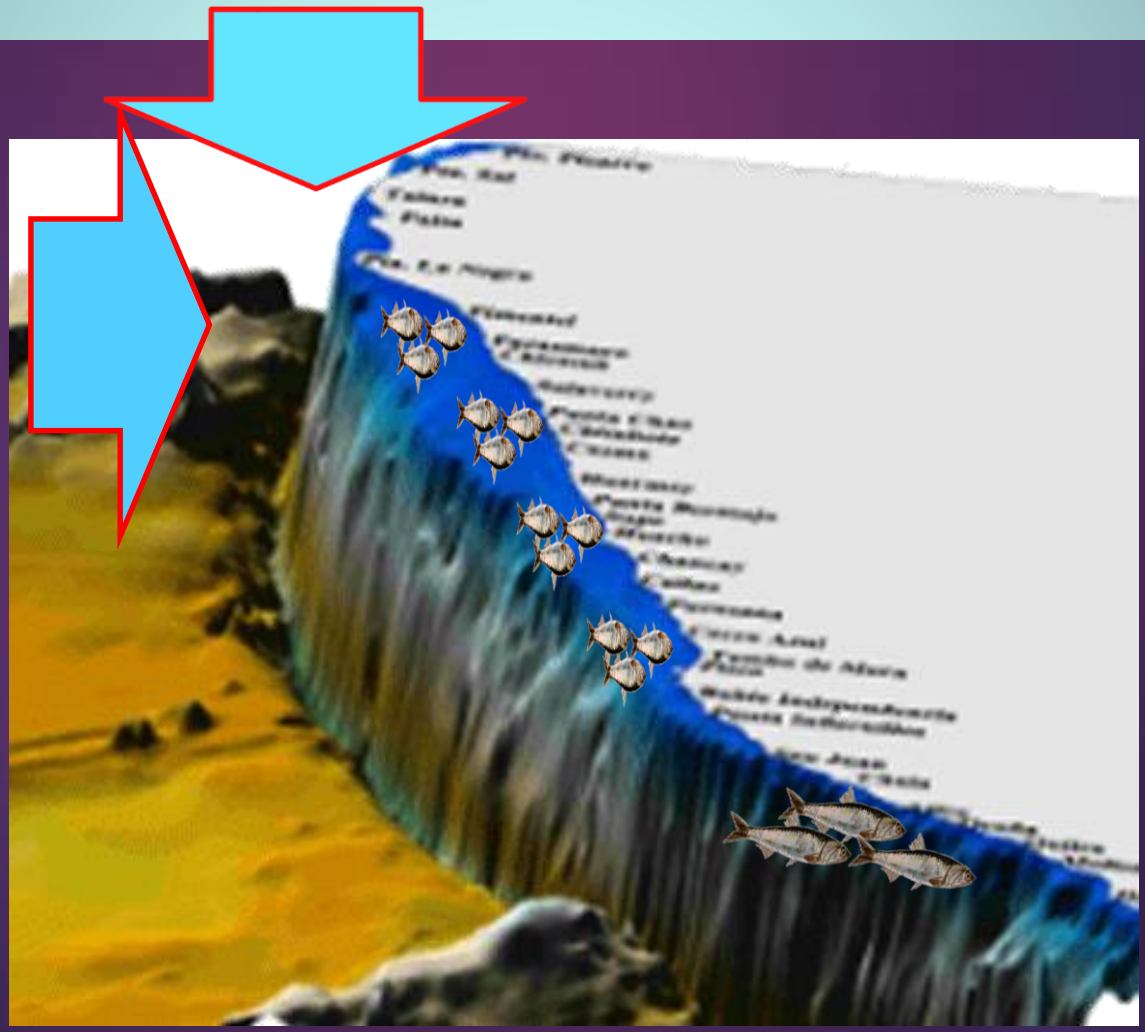

Adaptation to climate change

Spatial and temporal scales in marine process

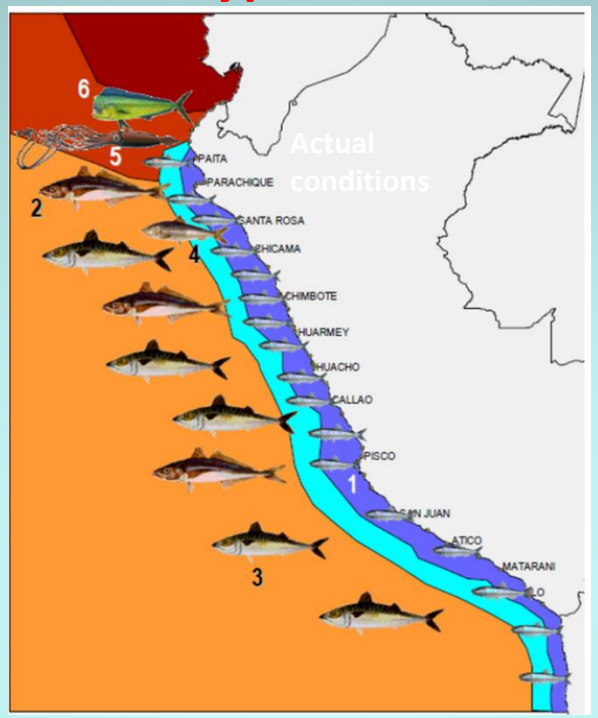


Climate change: Anchovy strategies

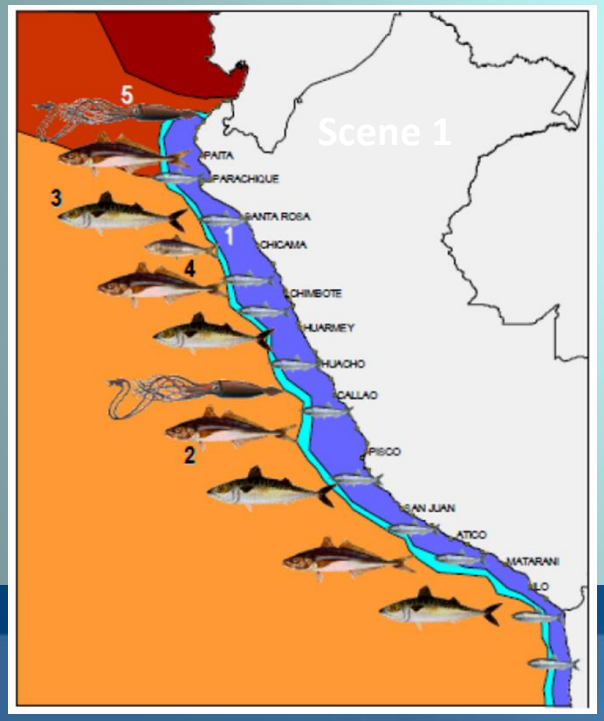
Sequence (3 steps) ⟶ **1.- Move to the coast** **2.- Deepening** **3.- Move to the south**



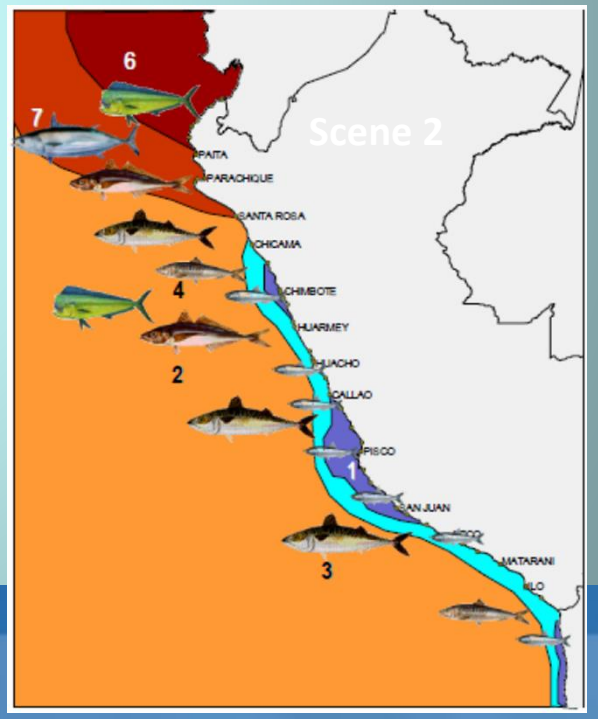
Change in species composition: hypothetical scenarios



Ocean warming and coastal cooling



Ocean and coastal warming



(D. Gutiérrez et al. 2011)

Concluding remarks:

To tackle environmental uncertainty:

An intense fishery monitoring and scientific cruisses are conducted.

Natural Long term changes:

We have adopted precautionary reference limits to annual yield, according to differente possible “states” or “regimes”.

To implement ecosystem approach:

Studies are conducted under agreement with other scientific institutions of developed countries to understand and model the Peruvian upwelling ecosystem;

Detailed information at:
http://www.imarpe.gob.pe


LA ANCHOVETA
ENGRAULIS RINGENS
1 SOL