



Distribution of Pacific Sardine Spawning between U.S. and Mexico from 2000 to 2013

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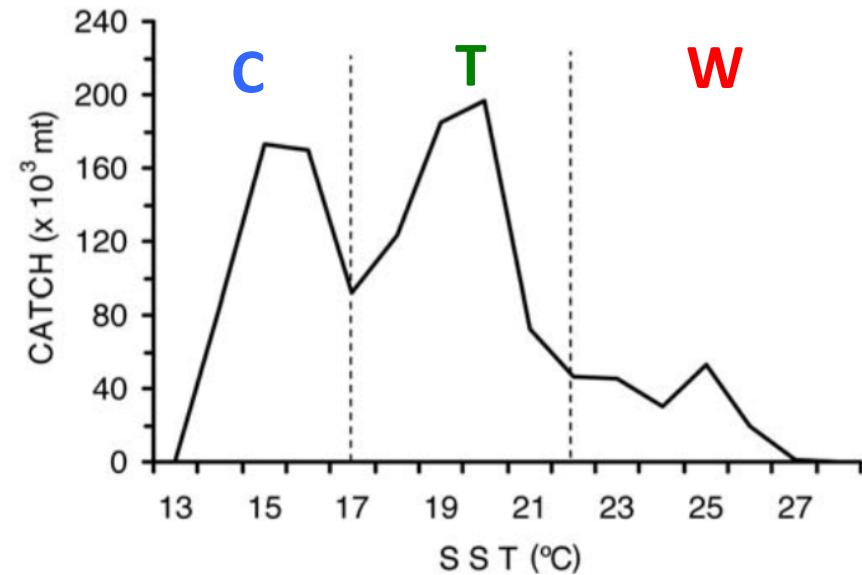
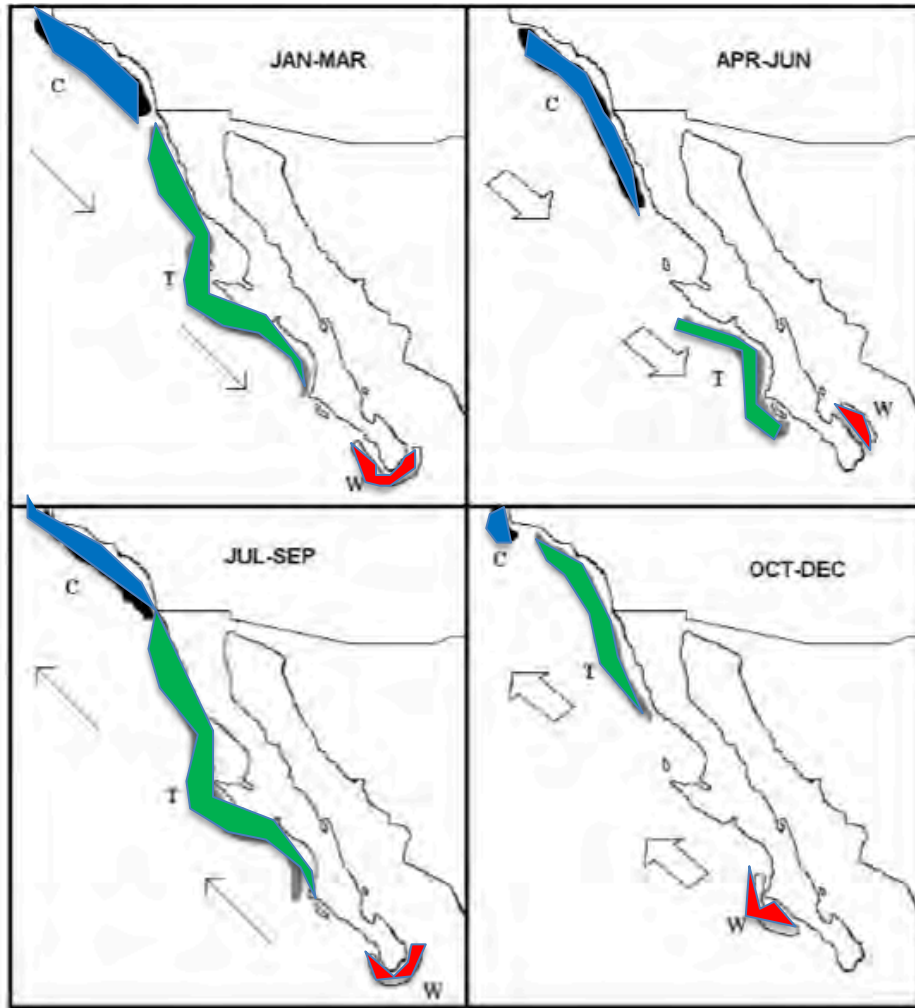
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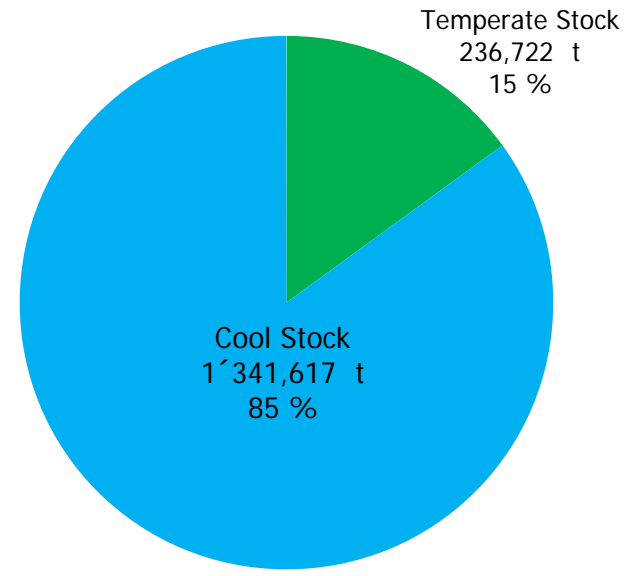
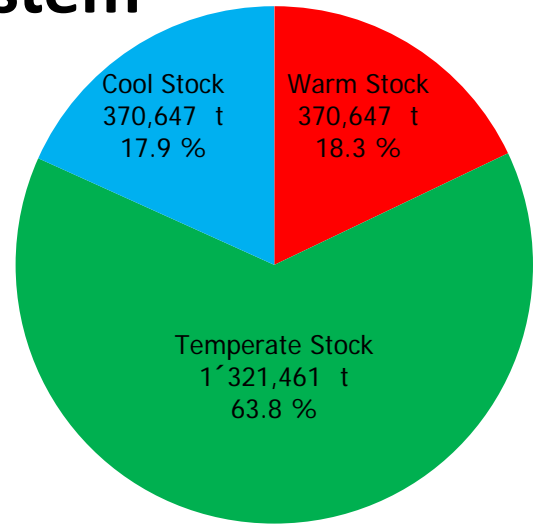
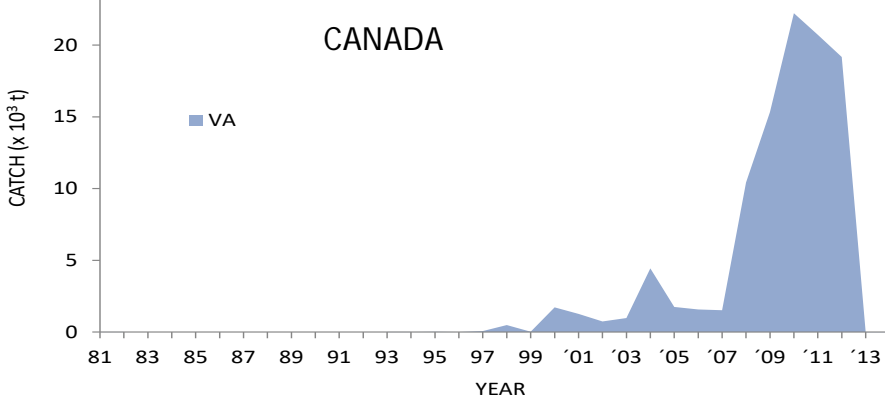
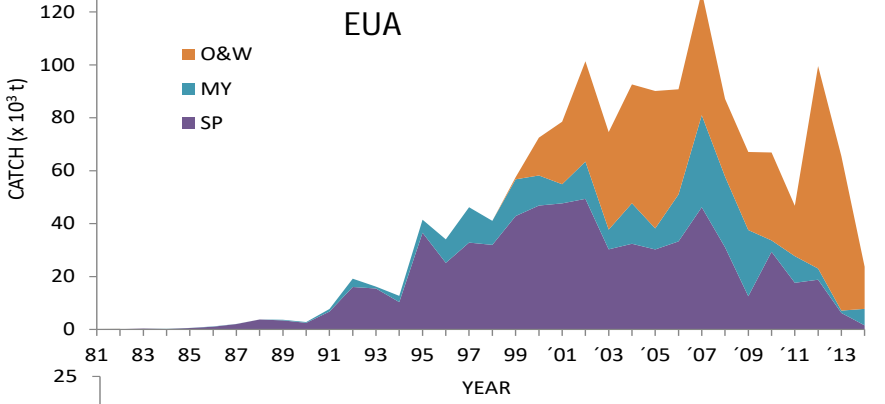
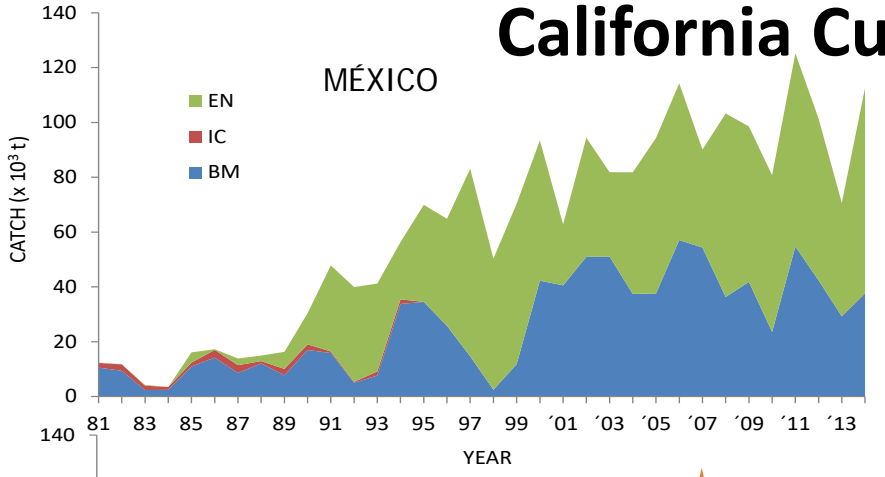
PICES symposium: Understanding Changes in Transitional Areas of Pacific
La Paz, Baja California Sur – April 24, 2018

Pacific sardine stocks and their seasonal movements based on commercial landings (Felix-Uraga et al. 2004)



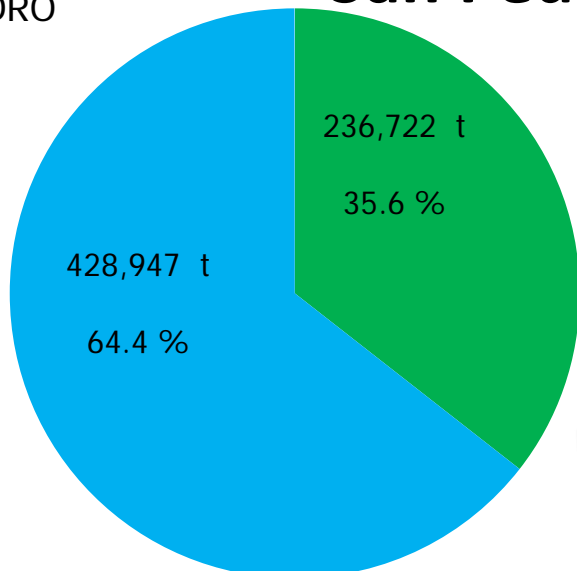
Conceptual model of stock movements and their relationship to temperatures

Cumulative landings of the Pacific Sardine in the California Current System



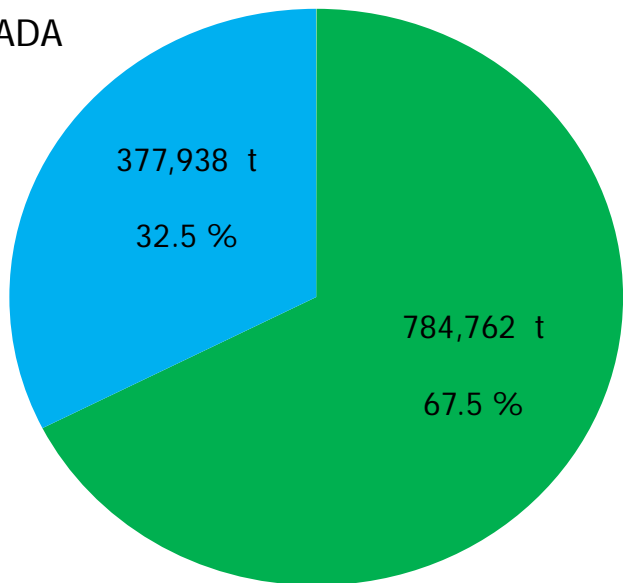
Landings of **Temperate** and **Cool** stocks in Ensenada and San Pedro fishery, 1981-2012

SAN PEDRO



(Félix-Uraga 2015, *IN PRESS*)

ENSENADA



Outline of presentation

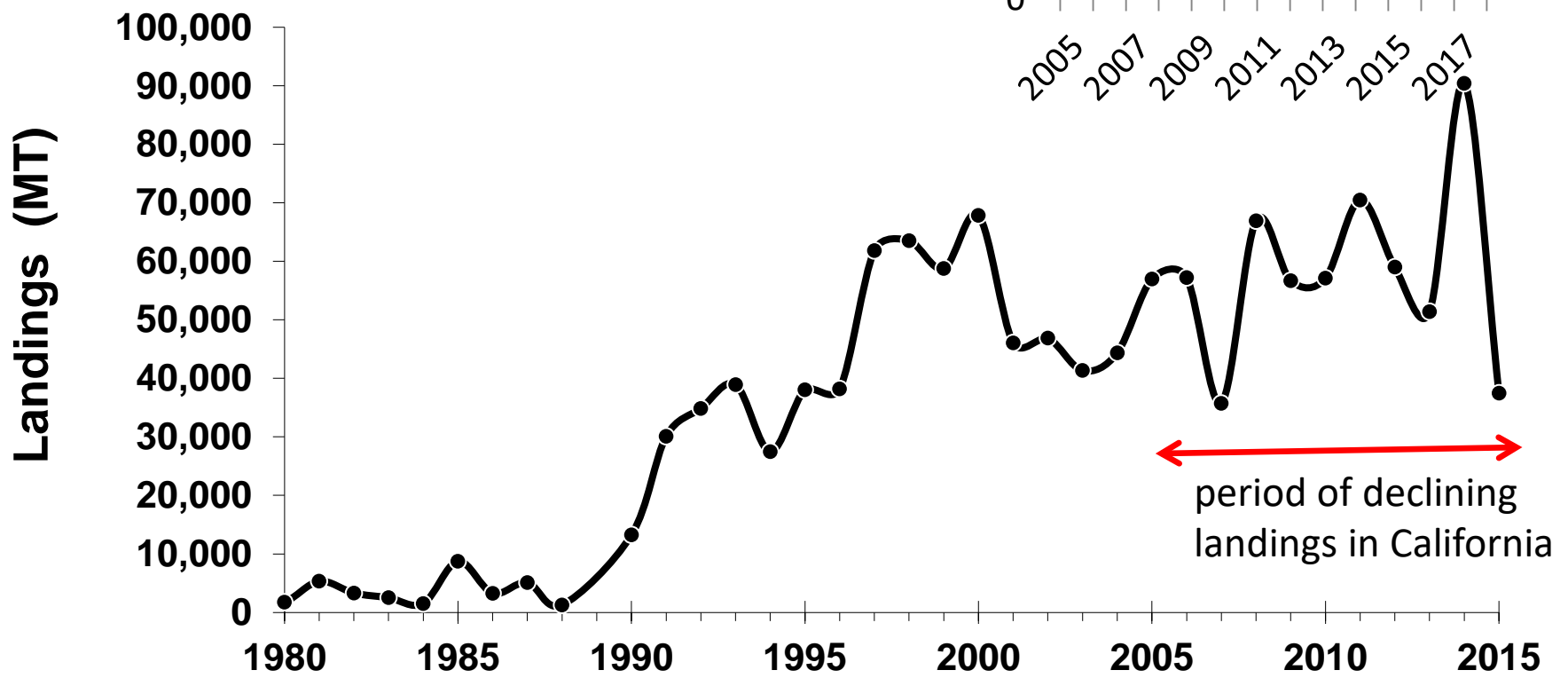
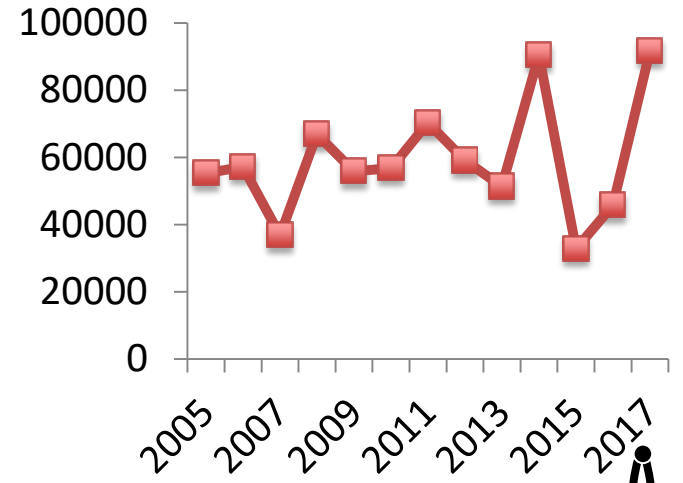
❖ The Pacific sardine

- a. Commercial landings and stocks
- b. Seasonal spawning off Baja California
- c. Interannual variability of spawning off California and Baja California

❖ Question?

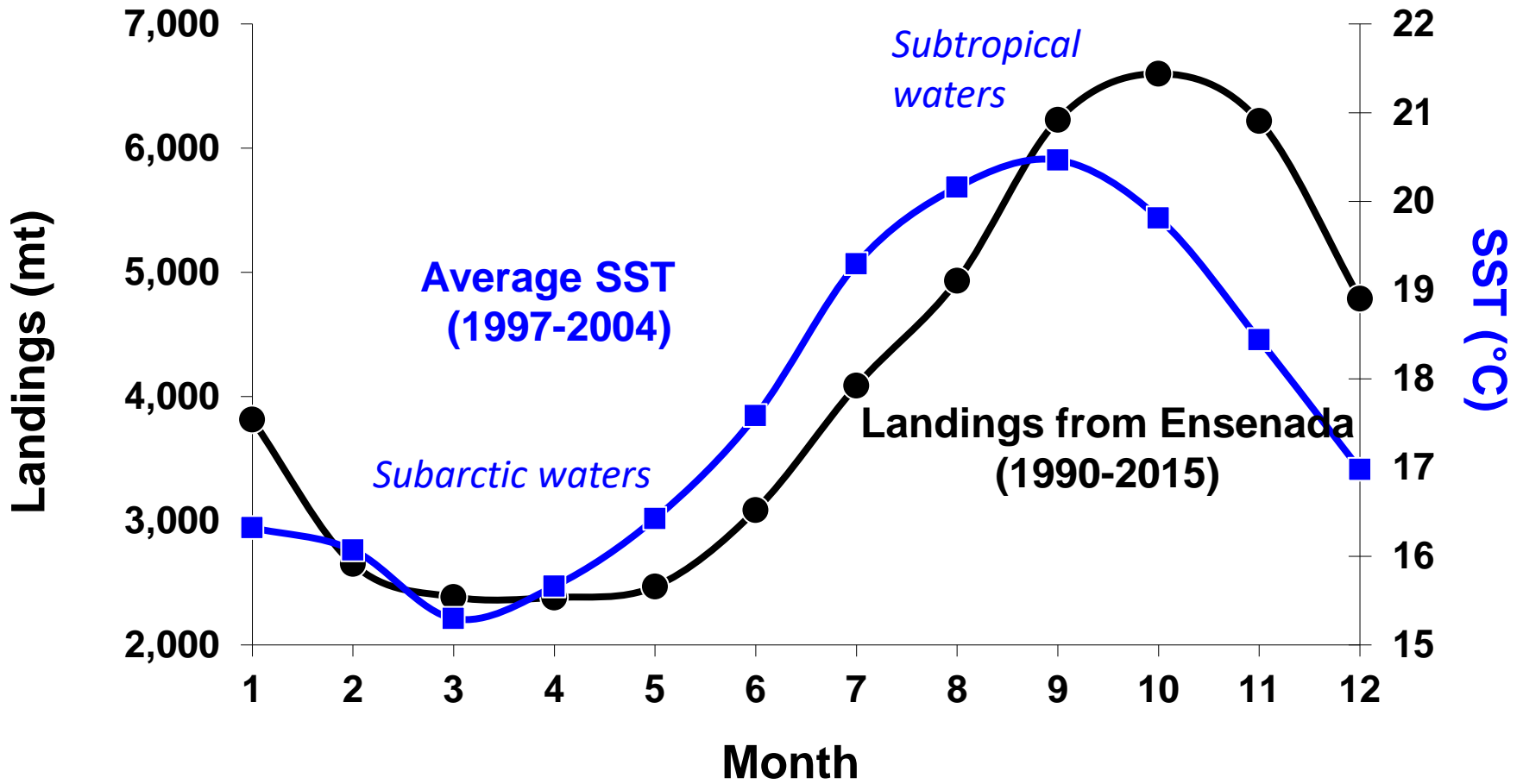
What is the proportions of spawning that occurred within waters of Mexican and U.S. Exclusive Economic Zones (EEZ)?

Sardina *Sardinops sagax*



Landings report by Ensenada fleet:
Stocks: Cool + Temperate

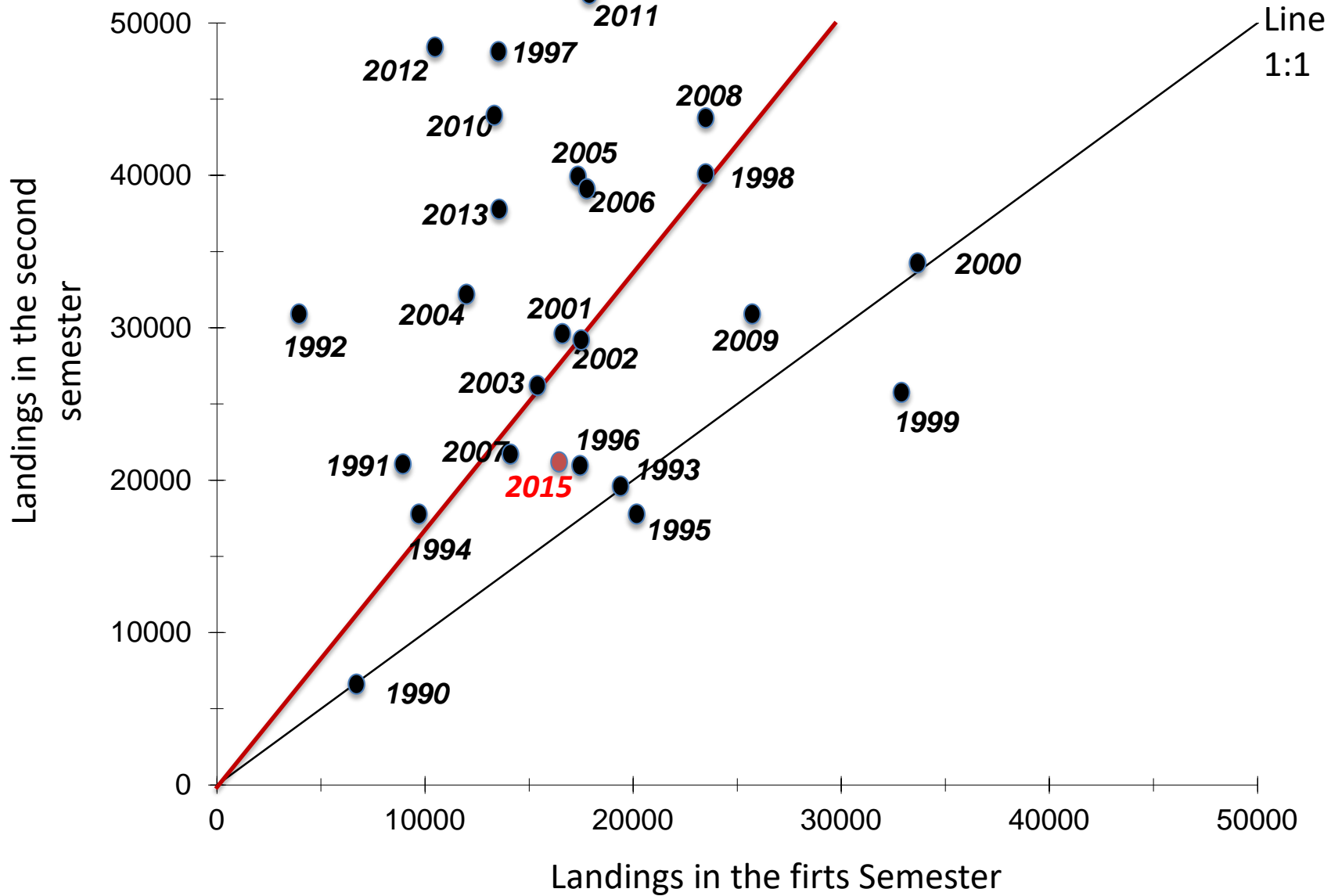
Seasonal pattern of sardine landings and sea surface temperature (SST)



Changes in Ensenada landings from [1990-2015]

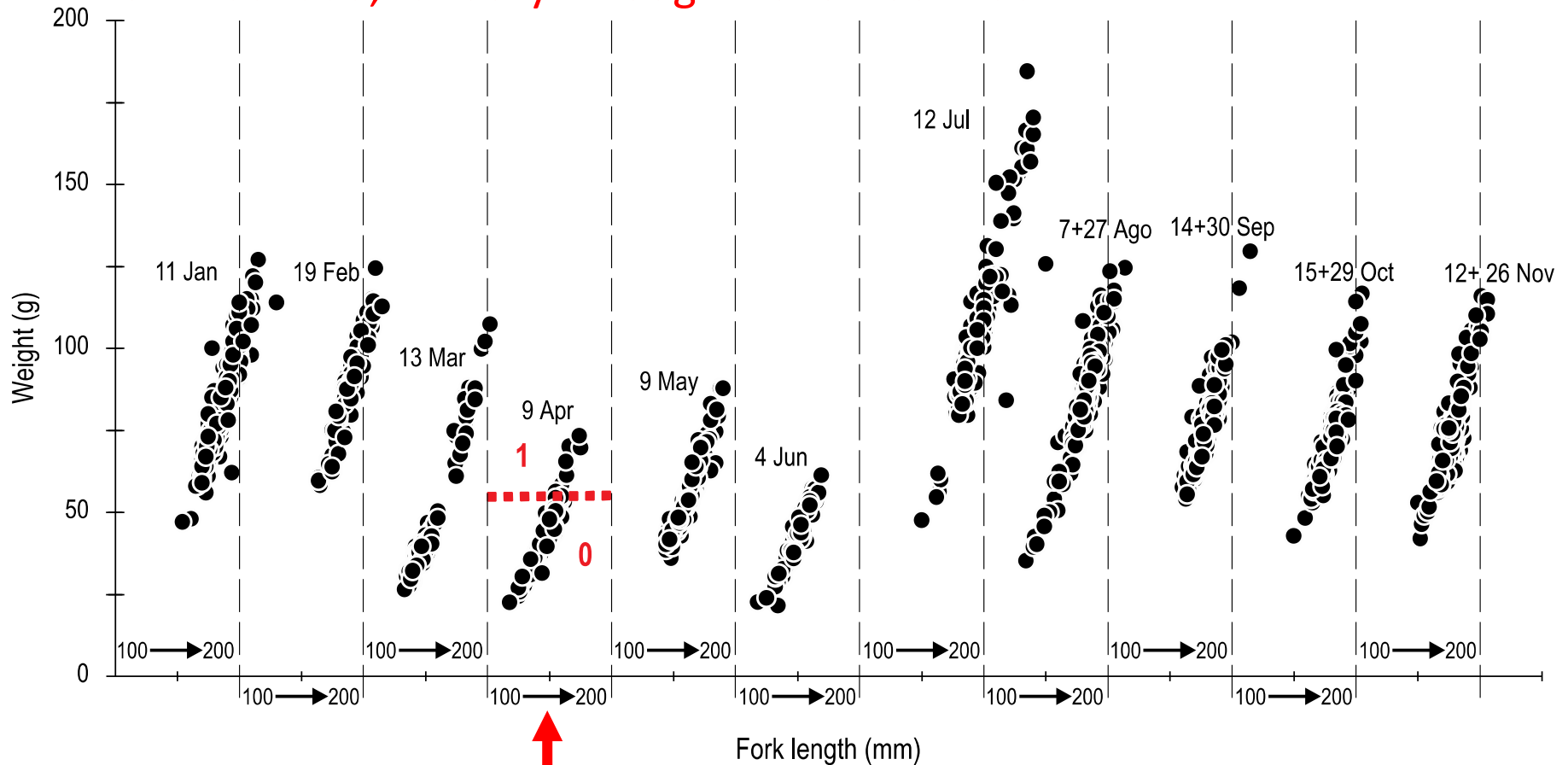
1er semester → Cool Stock

2do semester → Temperate Stock



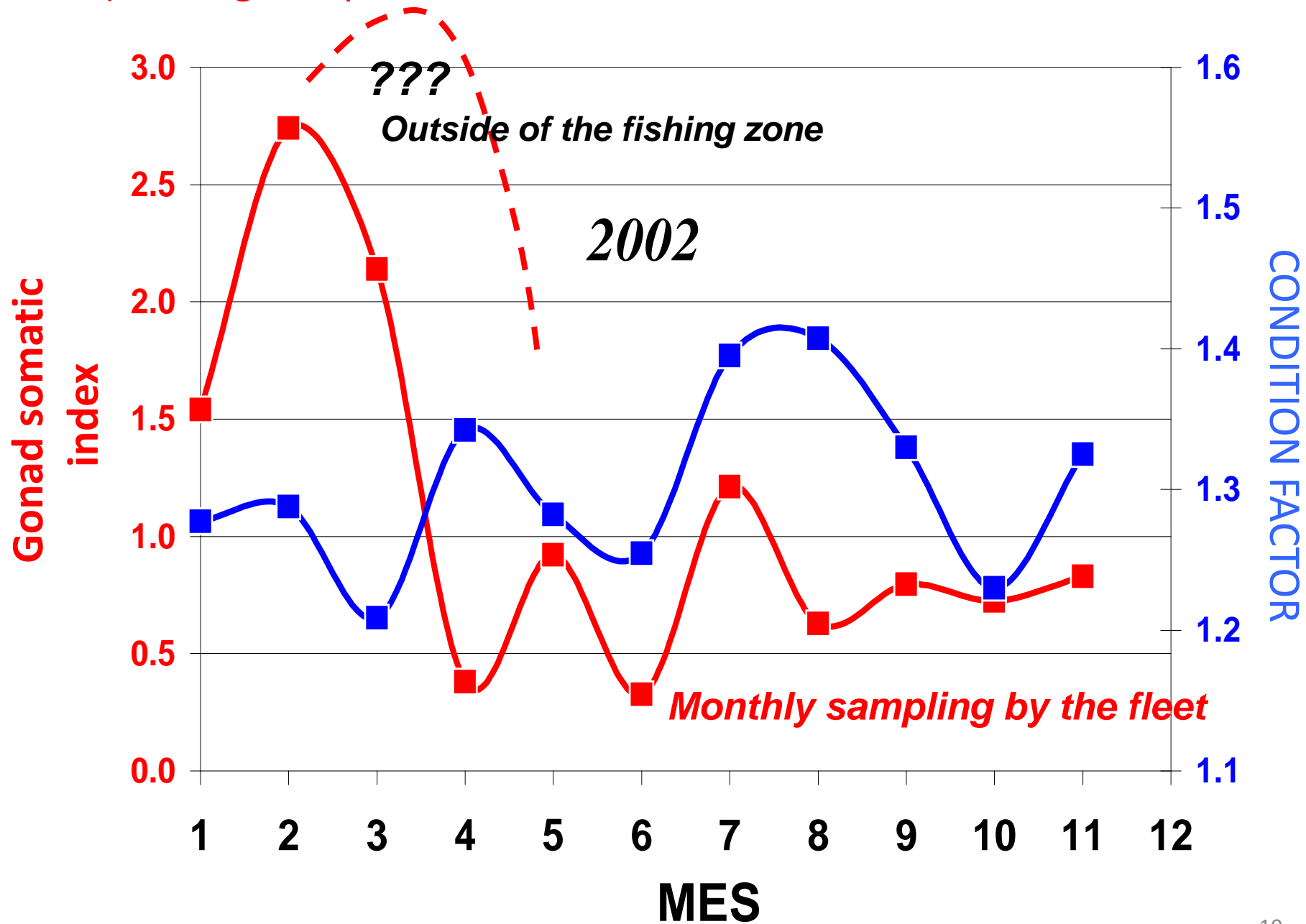
Biological evidence for shift in stocks from landings

1). Length–weight relationship from monthly samples of landings at Ensenada, January through November 2002



April, 2002

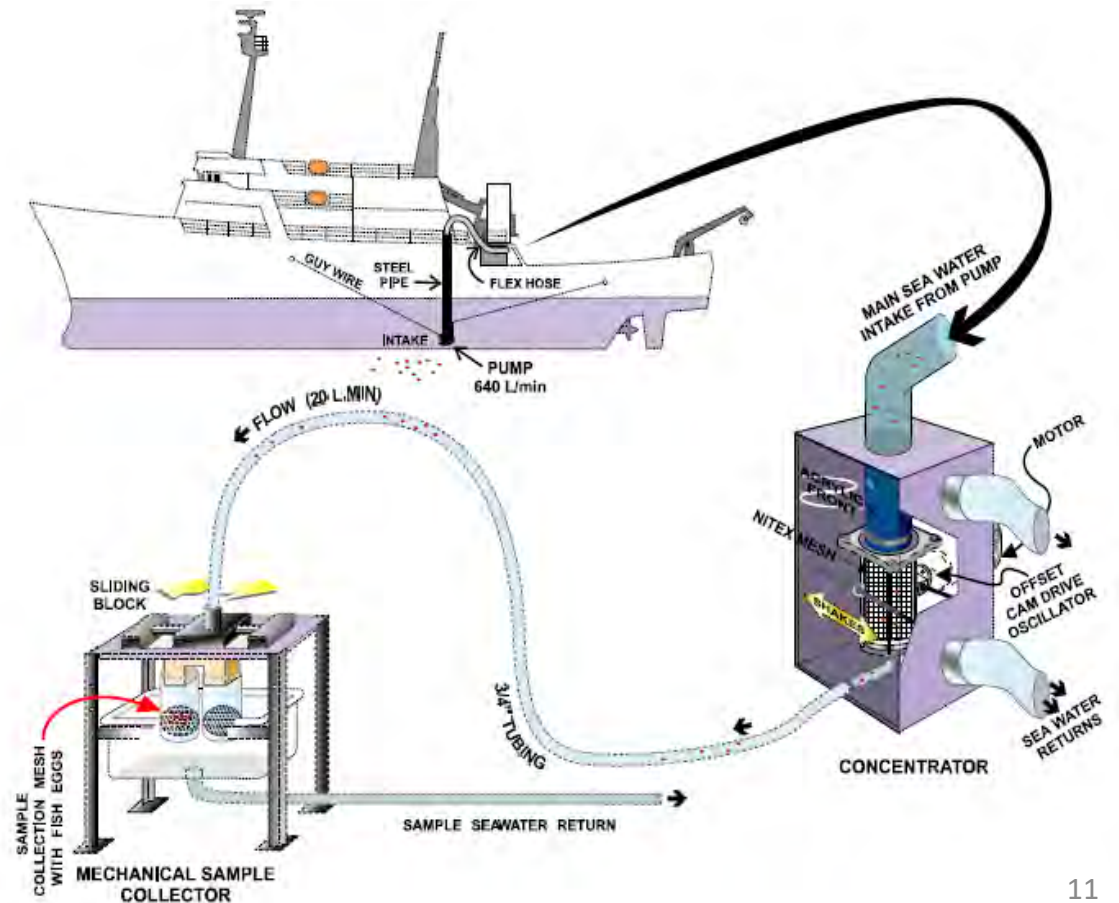
2). Timing of reproduction of the different stocks



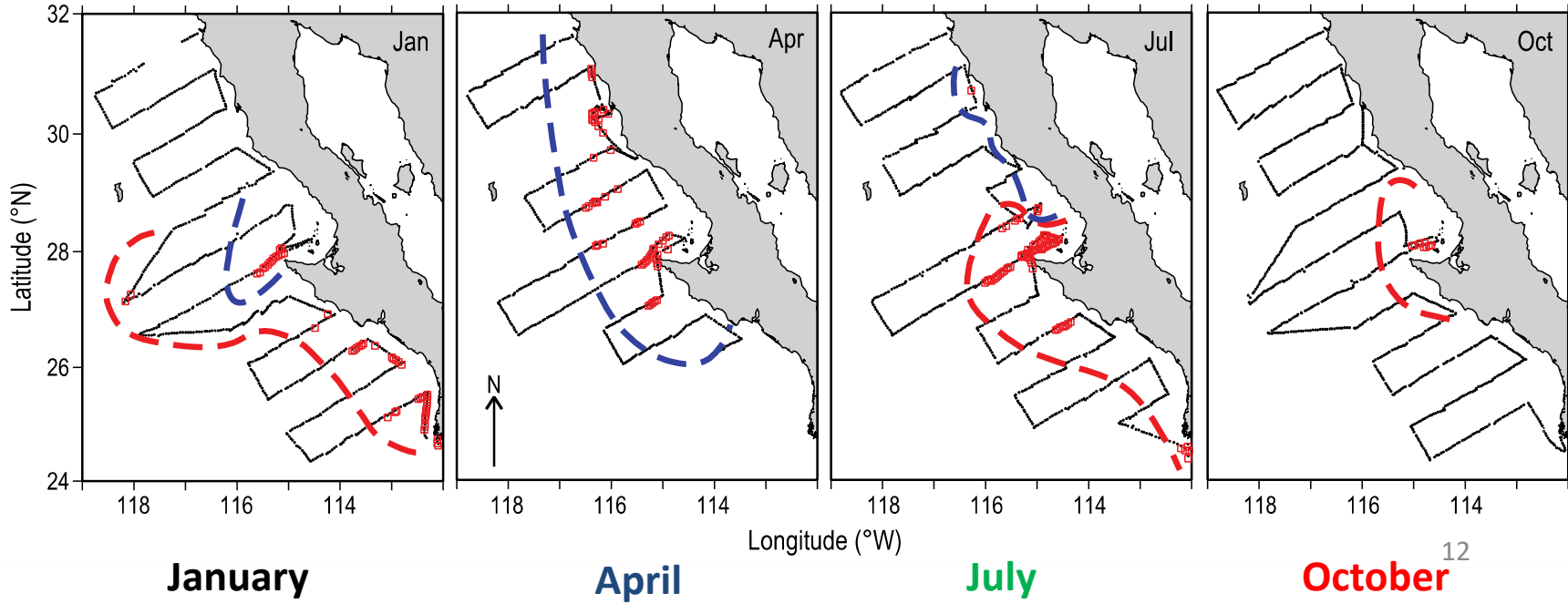
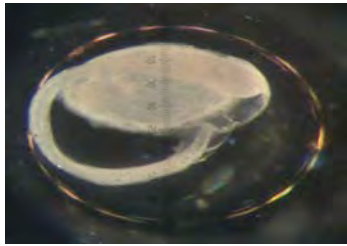
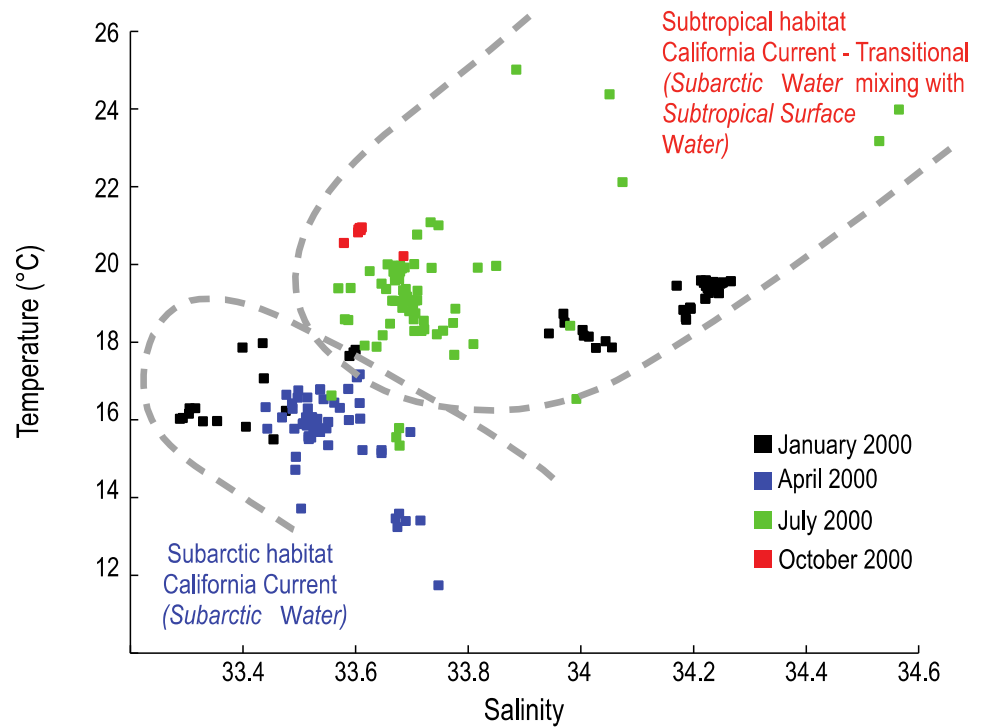
Cufes IMECOAL (México)+CalCOFI (US)

Larvae in 2.5-4 days = advection is limited (<150 km)

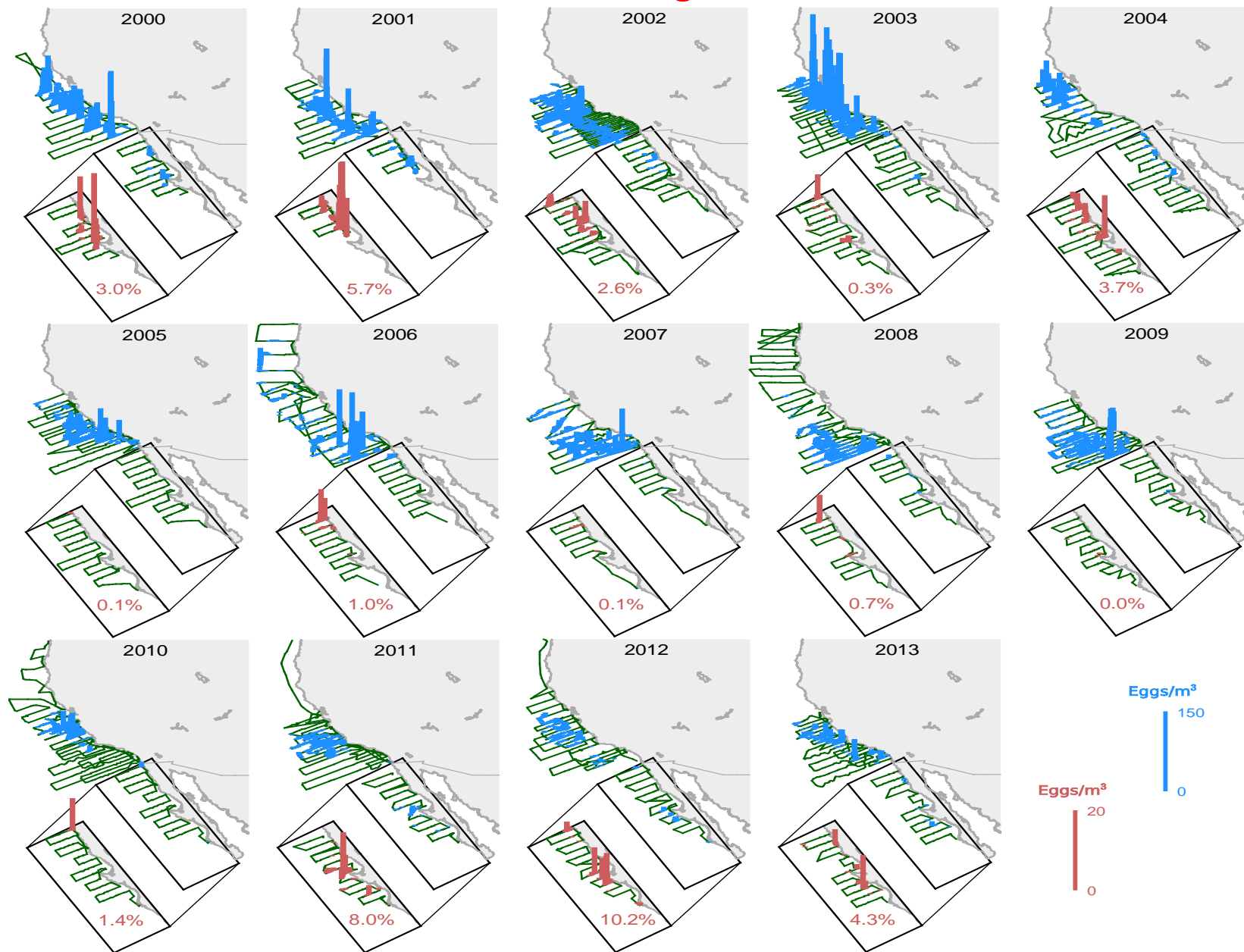
Diam: 1.3– 2.1 mm
Diam GA: 0.12-0.19 mm



3). The spawning habitats of the different stocks can be differentiated by salinity and temperature.



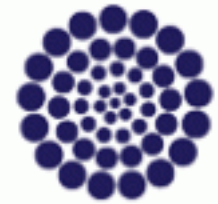
4). Distribution and abundance of spring spawning of sardine eggs in the CALCOFI and the IMECOAL from 2000 through 2013



Conclusions

- Commercial captures in Ensenada port are dominated by temperate stock.
- The cool stock spawns primarily in the U.S waters.
- A fraction ranging from 0% to 10% of all eggs captured occurred in the Mexican waters, usually from Punta Eugenia north to the border.
- It is unknown whether the relatively large proportion of eggs captured in Mexican coastal waters during 2011 and 2012 was due to movement of sardines into Mexican waters or increased production in the coastal area off Bahia Magdalena.
- It is also probably the temperate stock spawning out of their peak season.

IMECOCAL



CONACYT

Consejo Nacional de Ciencia y Tecnología



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CENTRO DE INVESTIGACIONES
BIOLÓGICAS DEL NOROESTE, S.C.



CalCOFI

NOAA - NMFS | CDF&W | IOB - SIO

CALIFORNIA
COOPERATIVE OCEANIC
FISHERIES INVESTIGATIONS



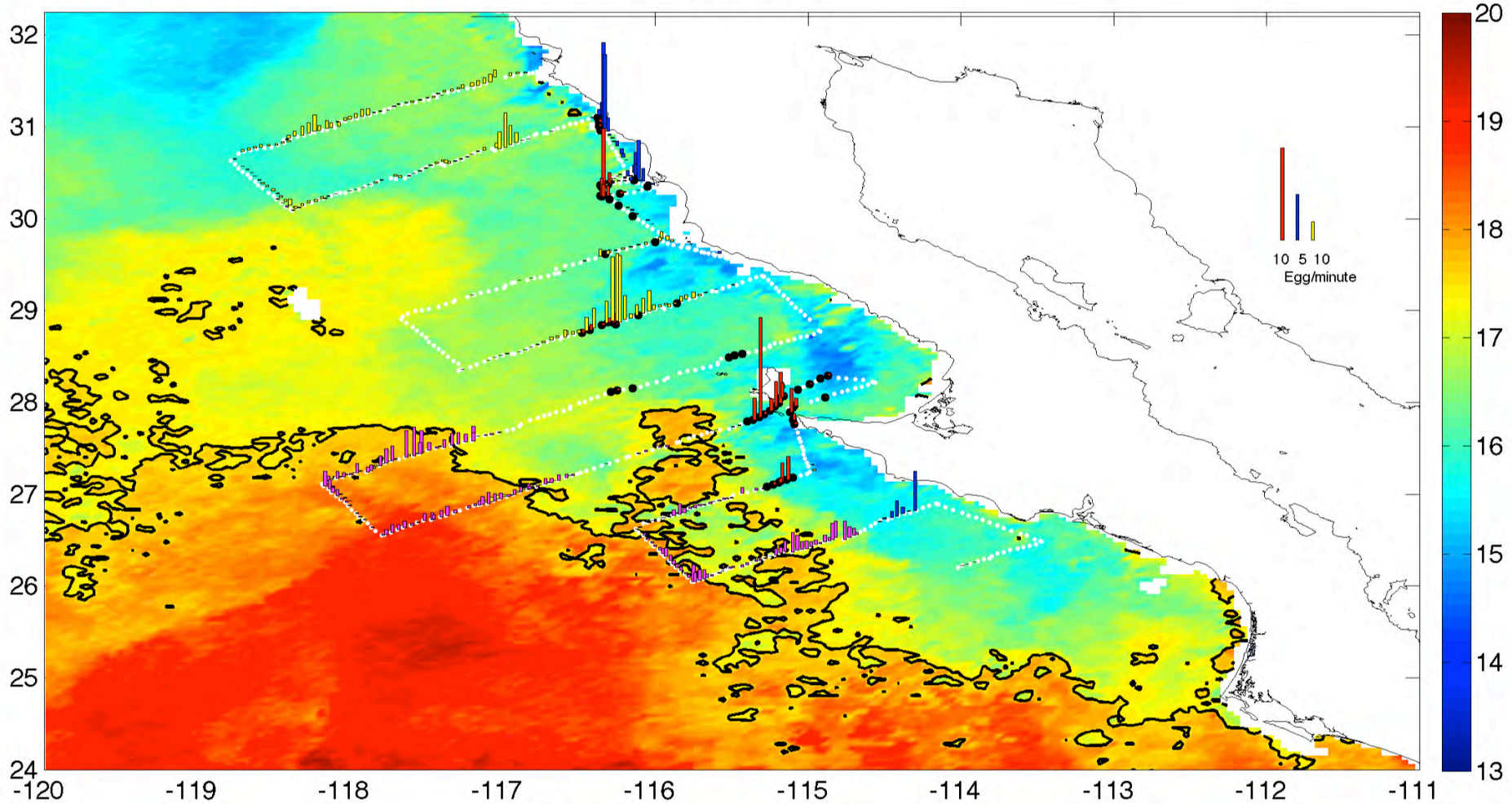
NOAA FISHERIES

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Southwest Fisheries Science Center



April-2000



Thanks!