CHANGE IN EUPHAUSIID SPECIES COMPOSITION IN THE TRANSITION ZONE OF THE CALIFORNIA CURRENT DURING THE PERIOD 1998-2016

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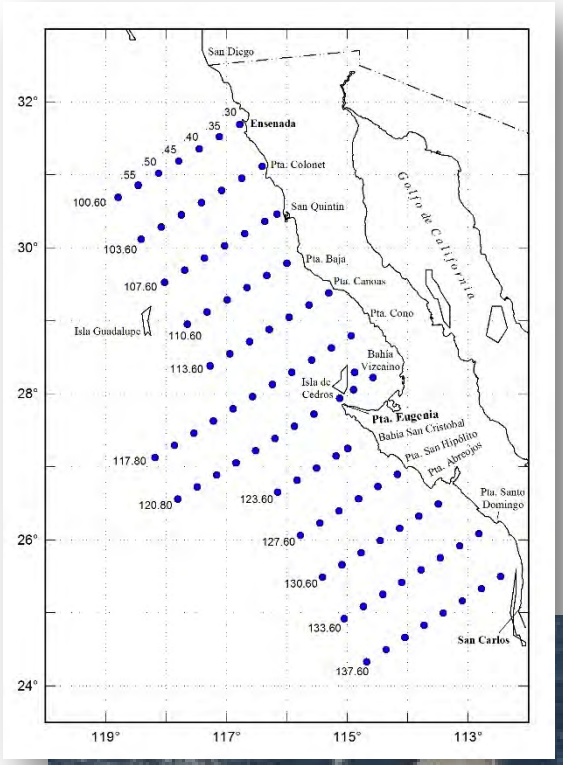
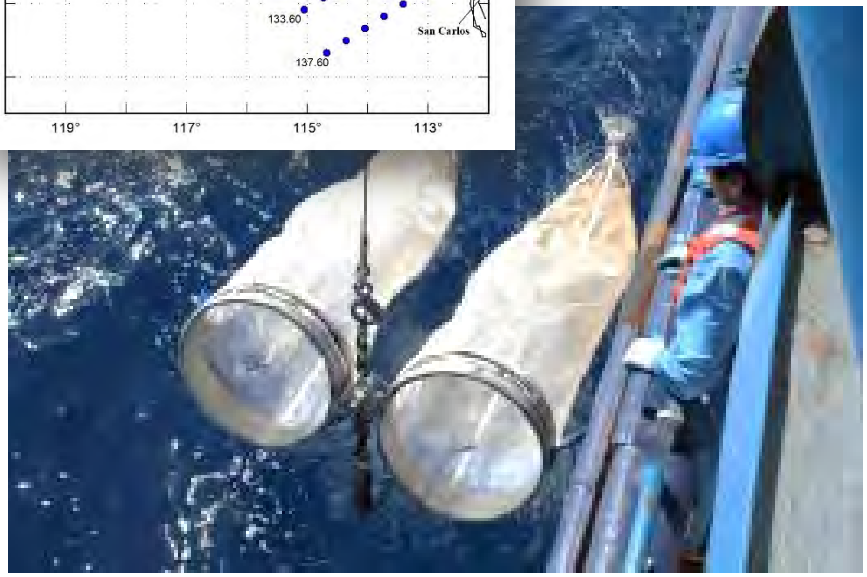
- Understanding Changes in Transitional Areas of the Pacific, Symposium 2018-

Zooplankton Sampling IMECOCAL Cruises

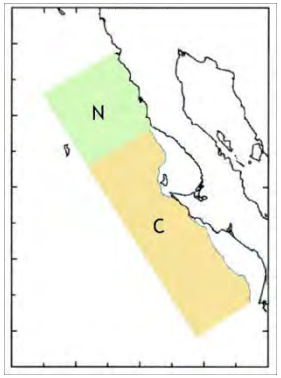




500 µm mesh Bongo Net
Oblique tows in the upper 200 m

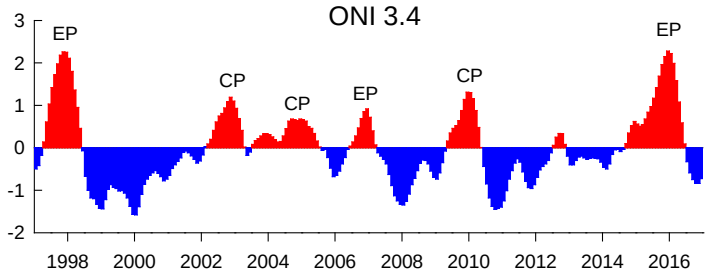
SST and Upwelling Index

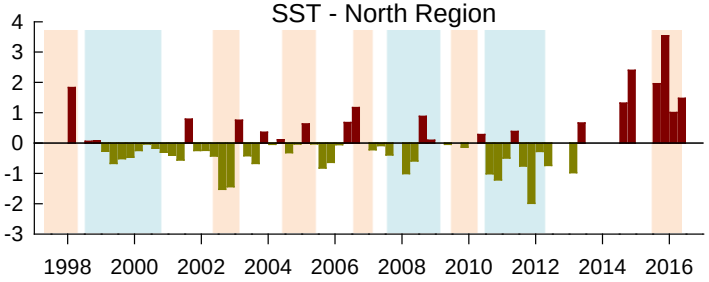
OCEANIC DOMAIN

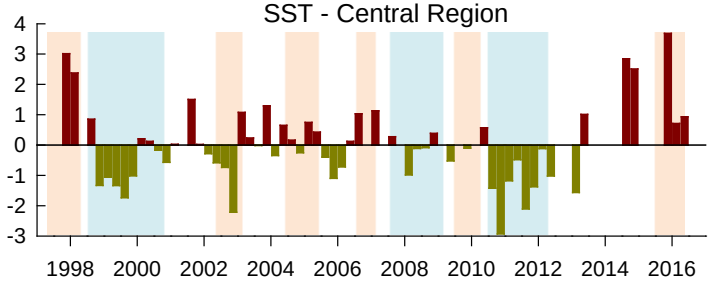


Correlation (R)

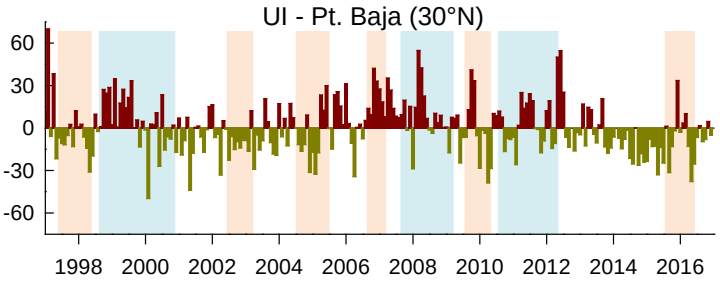
ONI	North	Central
SST	0.450	0.558
UI	-0.308	-0.358

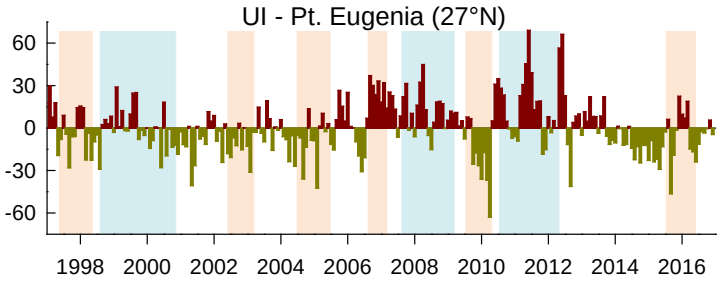






R = –0.327 *

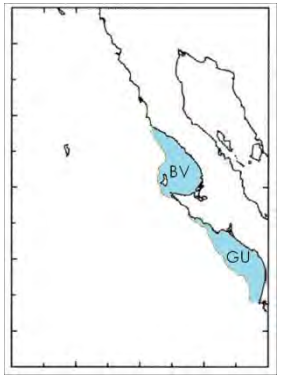




Significant correlation of ONI with SST and UI.
However, some events departure from this pattern (mainly El Niño 2002-2003 and 2006-2007).
The magnitud of SST anomalies is higher in the central region, suggesting a weakening of ENSO effects toward the north.

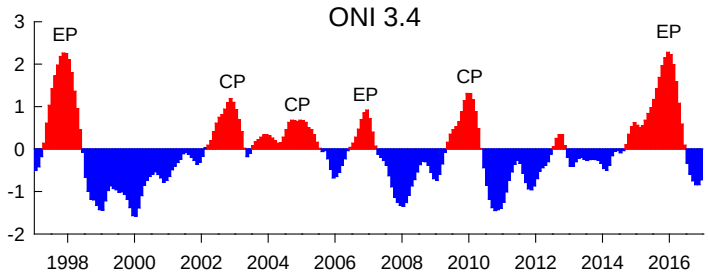
SSTand Upwelling Index

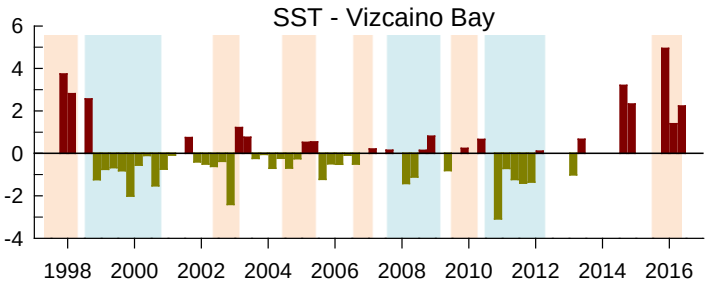
NERITIC DOMAIN

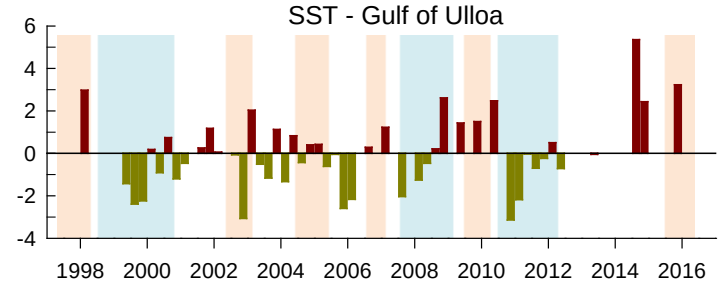


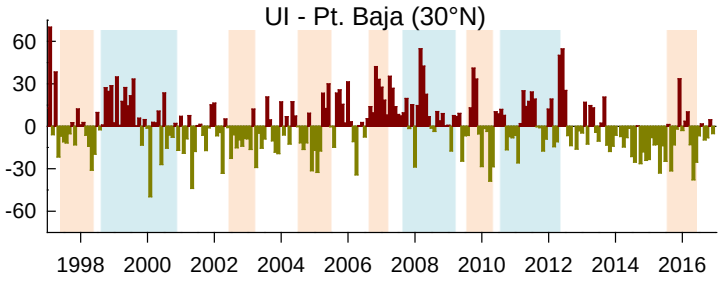
Correlation (R)

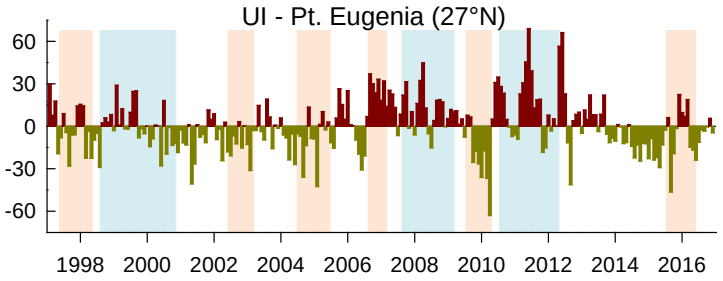
ONI	VB	GU
SST	0.560	0.521
UI	-0.308	-0.358

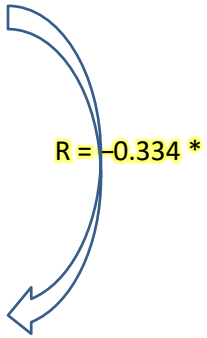








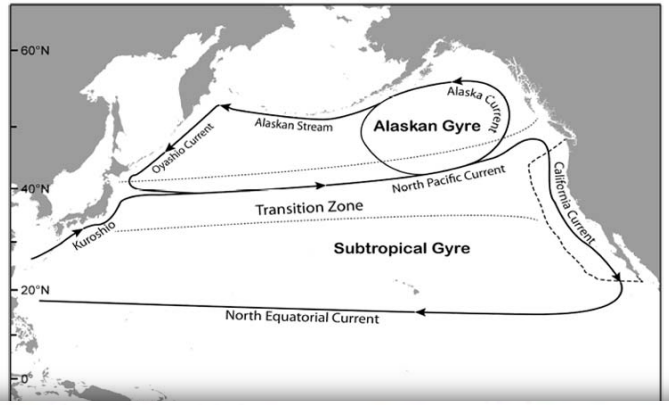


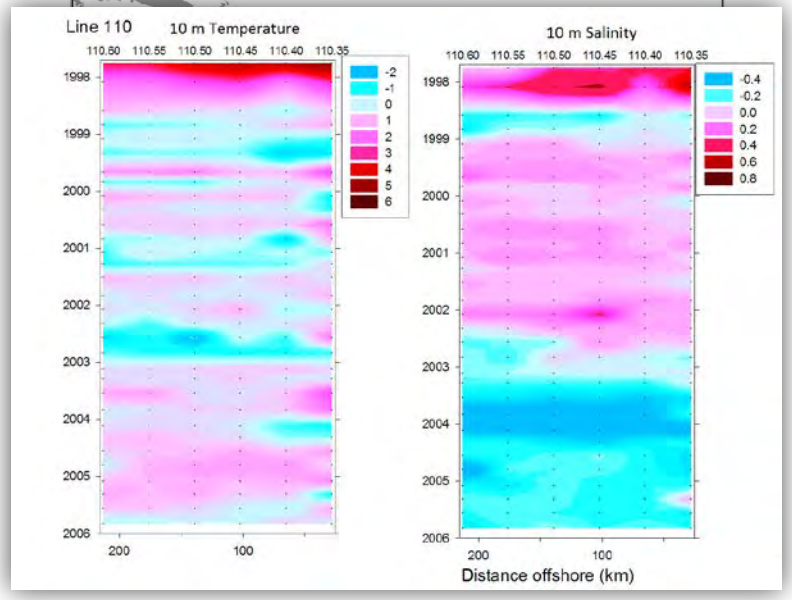


Coherence with observations between neritic and oceanic regions.
The magnitud of SST anomalies is higher in the Gulf of Ulloa, indicating that Vizcaino Bay is more protected from ENSO (particularly during El Niño 2009-2010).

OTHER INTERANNUAL INFLUENCES IN THE NORTHEAST PACIFIC

In 2002-2003 a decrease in salinity and temperature revealed the influence of subarctic water intrusion in the CCS, related with North Pacific Current position and bifurcation

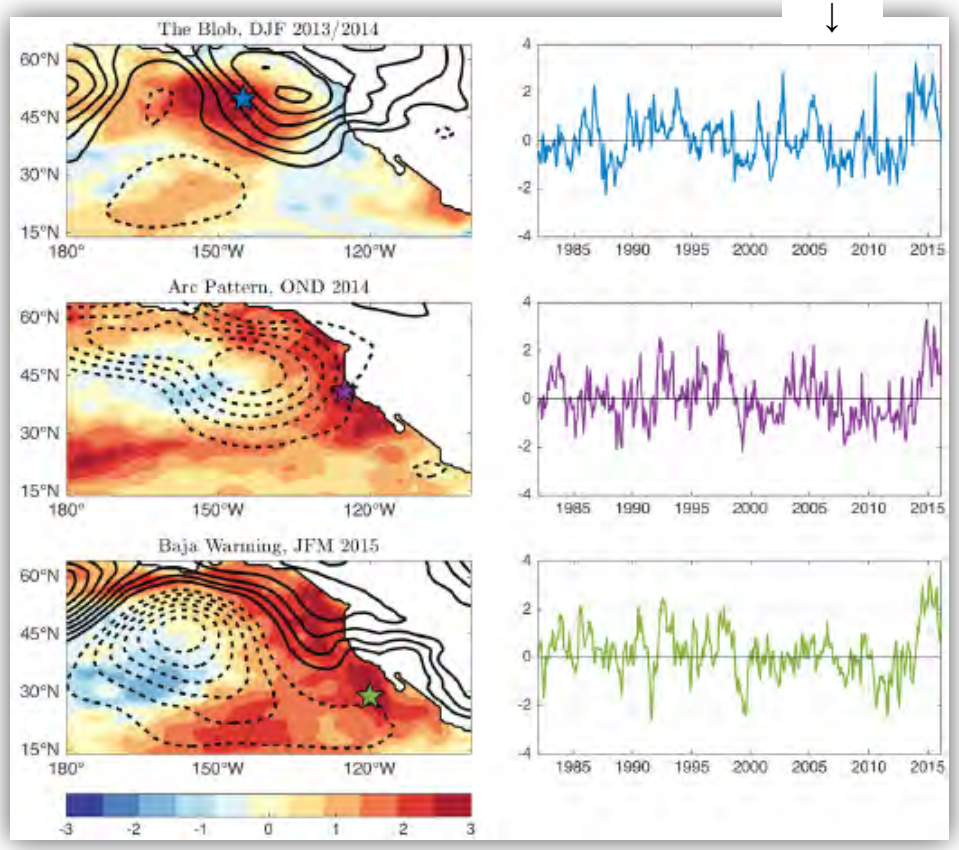




Off Baja California

In 2014-2015 there were record warm temperature anomalies in the CCS, related to low atmospheric pressure over the north Pacific and winds failure
(lack of wintertime cooling in 2013/2014)

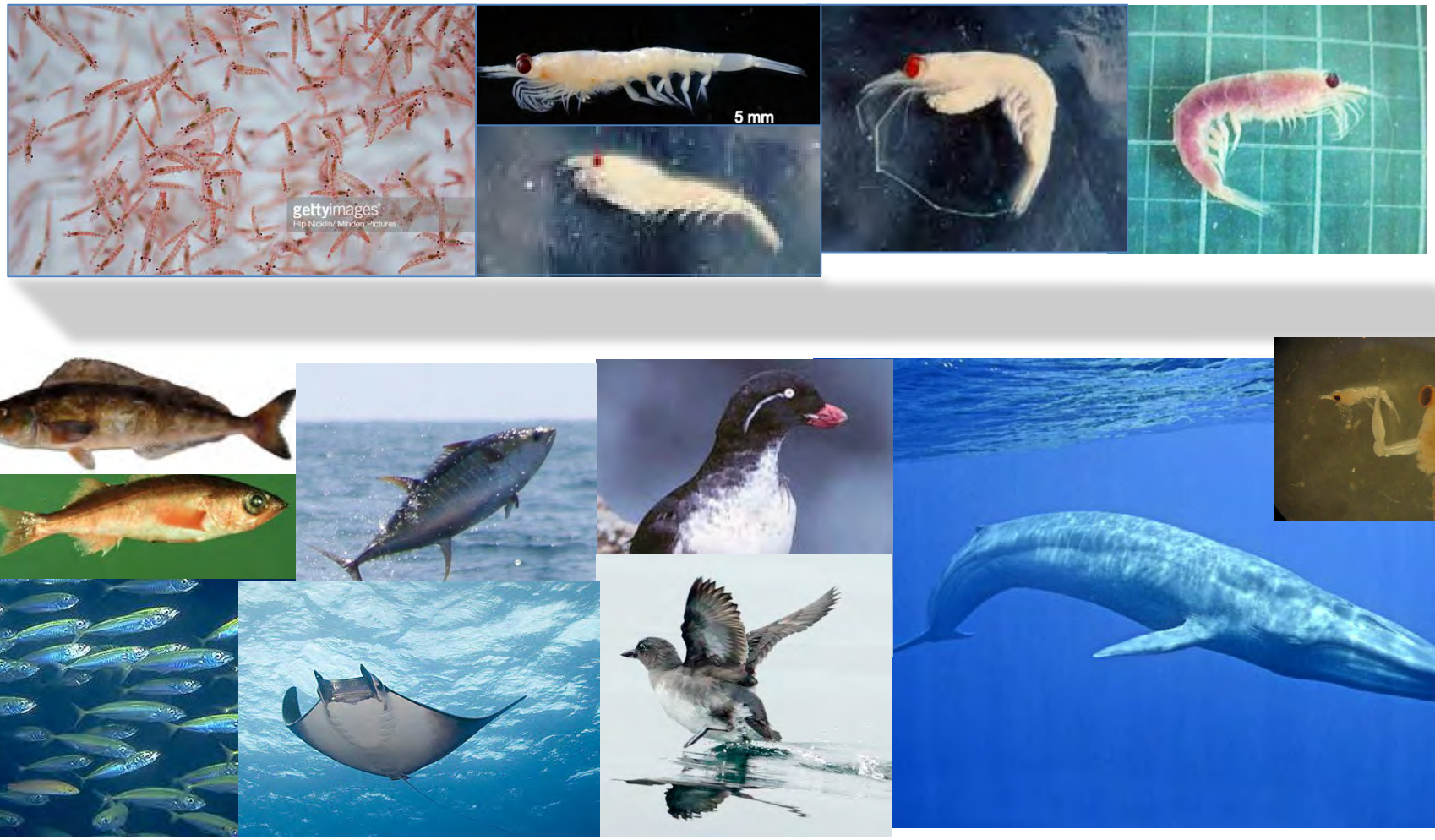
SST ↓



Amaya et al. (2006)

Euphausiids are good indicators of climate

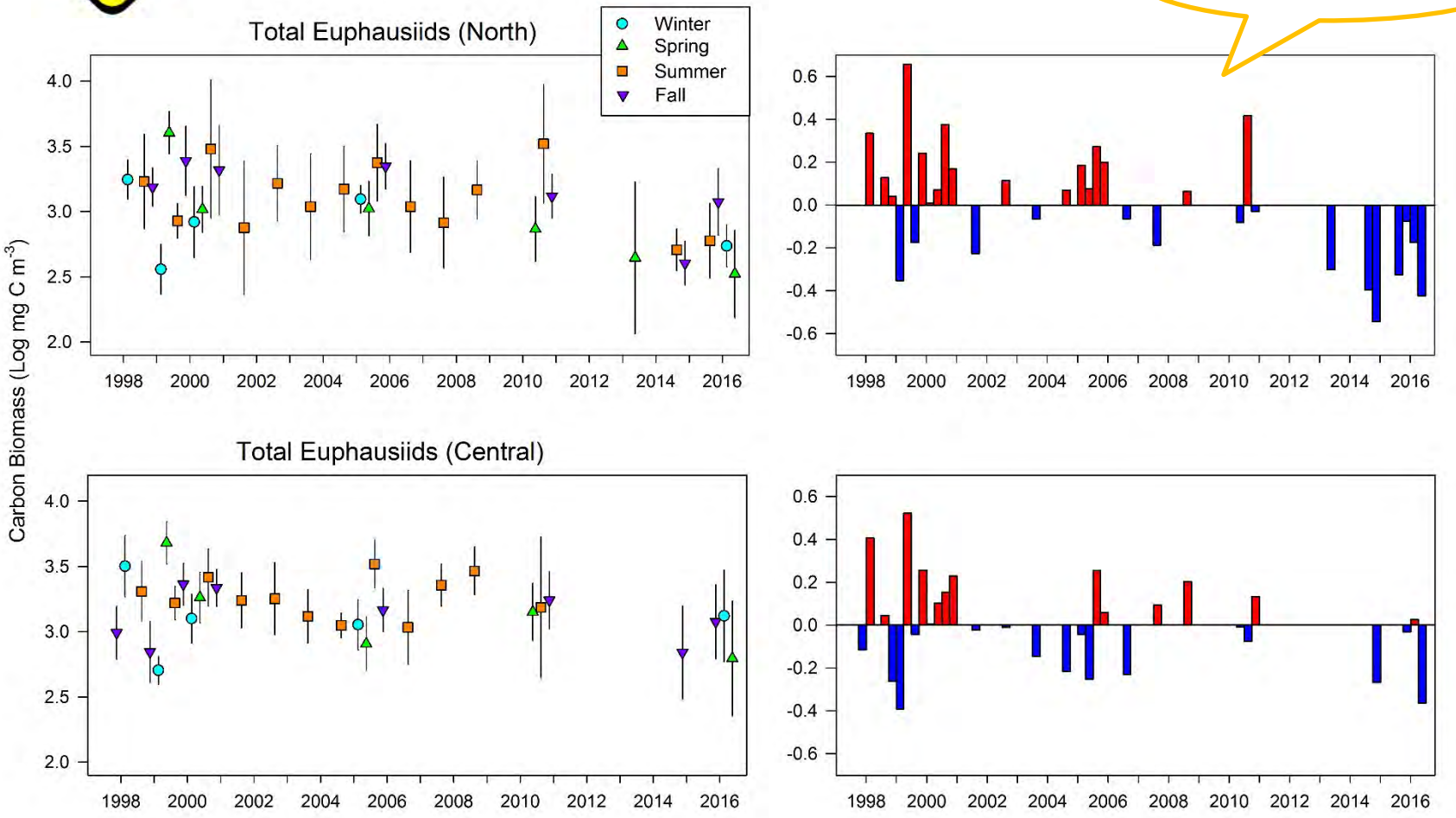
- ✓ Sensitive to changes in temperature
- ✓ Important link between primary productors and large predators
- ✓ Euphasiid biogeography is well known



Euphausiid time series are under construction

(oceanic nighttime samples)

Biomass anomalies (seasonal means removed)



Sampling gaps; taxonomic analysis more intensive in summer

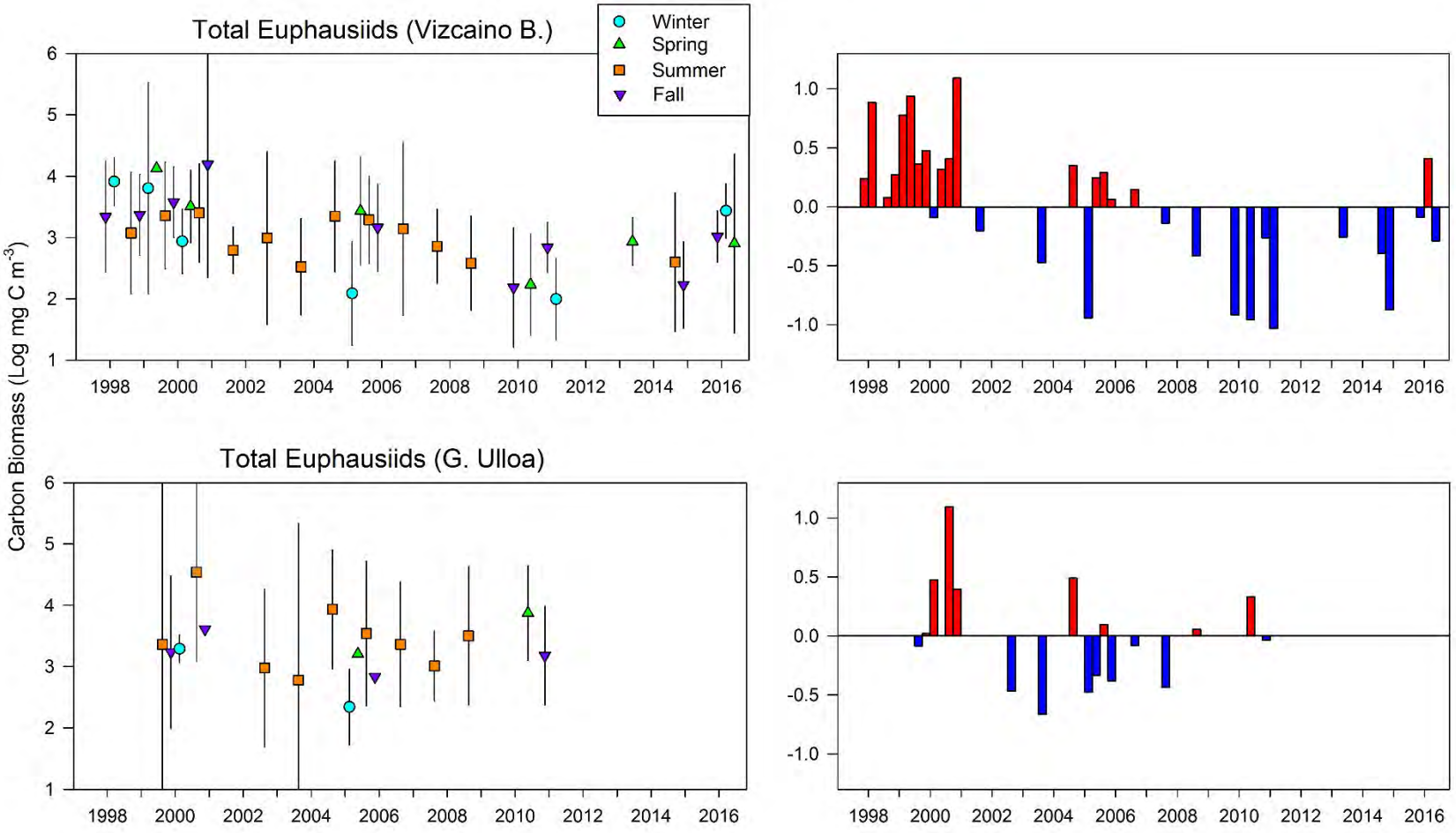
However, biomass anomalies showed low values in recent years (2013-2016)

Positive anomalies in both phases of the ENSO 1997-2000 excepting the transition from El Niño to La Niña.

Contrast between El Niño 1997-1998 and El Niño 2015-2016.

Coastal shelf euphausiids

(day and nighttime samples combined, in some cases)



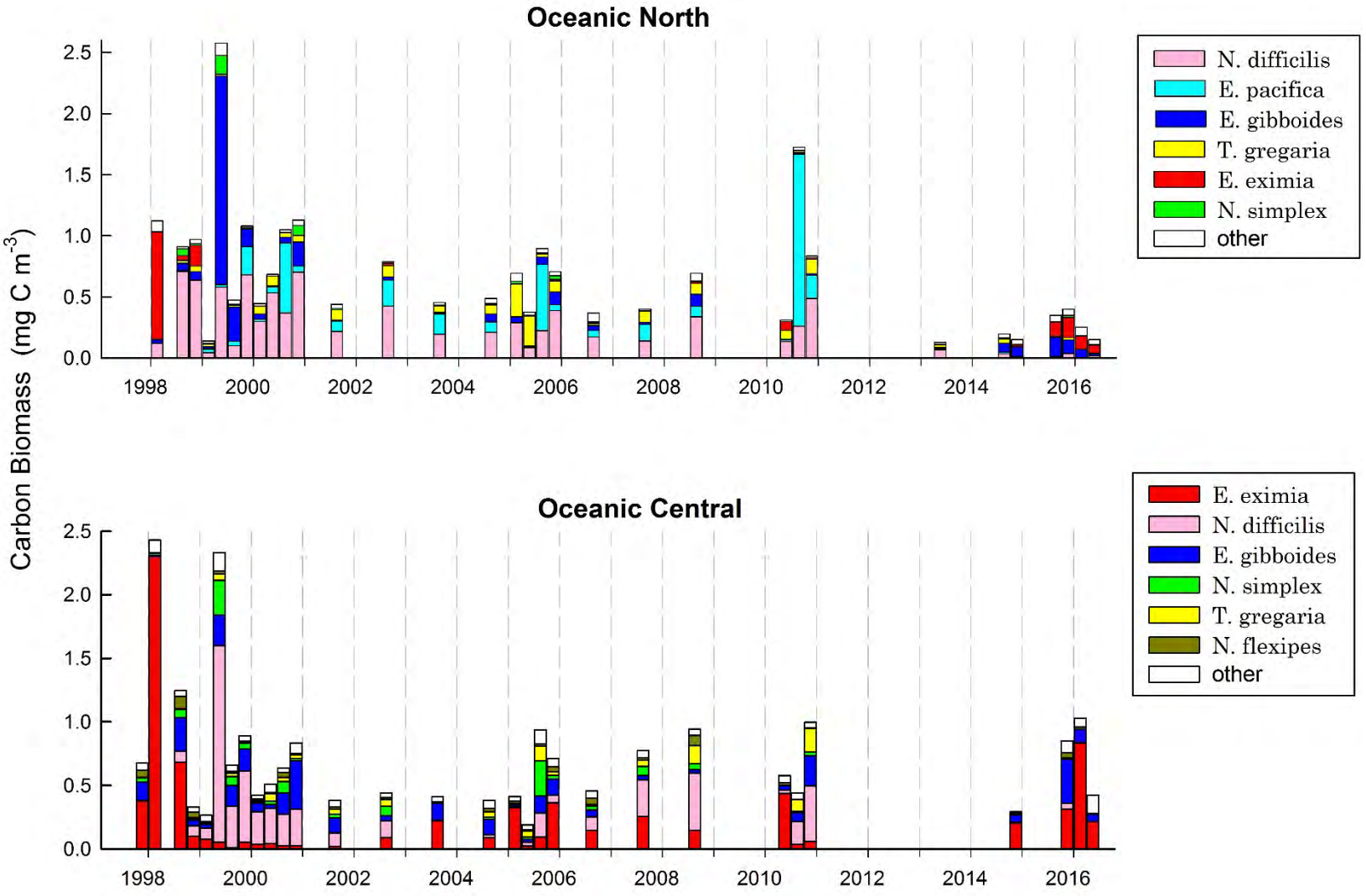
Poor sampling coverage in the Gulf of Ulloa; taxonomic analysis more intensive in summer.

In Vizacaino Bay → strong negative anomalies associated to CP El Niño (2004-2005 and 2009-2010), and La Niña 2010-2011.

Positive anomaly associated to EP-El Niño Winter (January 1998 and January 2016).

Euphausiid species composition based in geometric means

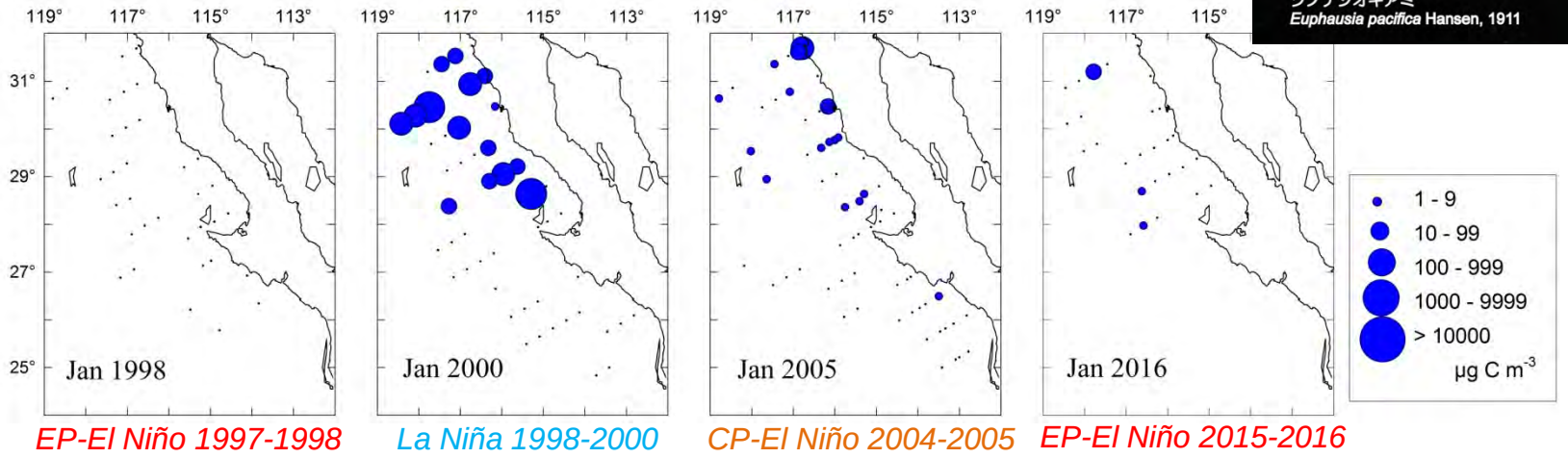
(oceanic nighttime samples)



Vertical migrant species crossing the thermocline are more responsive to changes in SST

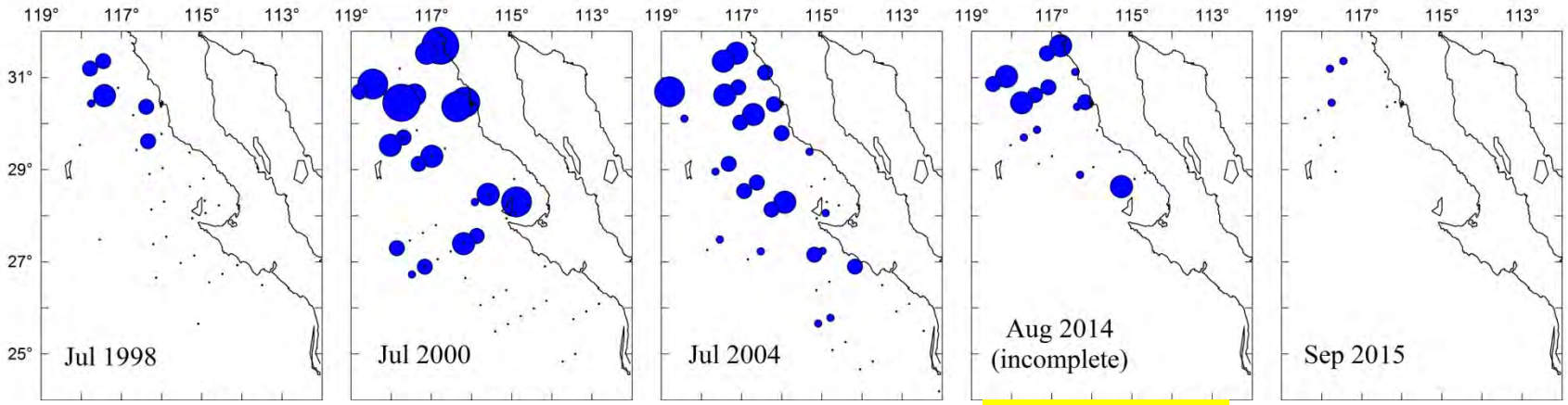
Euphausia pacifica → COOL WATER INDICATOR (better in winter)

WINTER



EP-El Niño 1997-1998 | La Niña 1998-2000 | CP-El Niño 2004-2005 | EP-El Niño 2015-2016

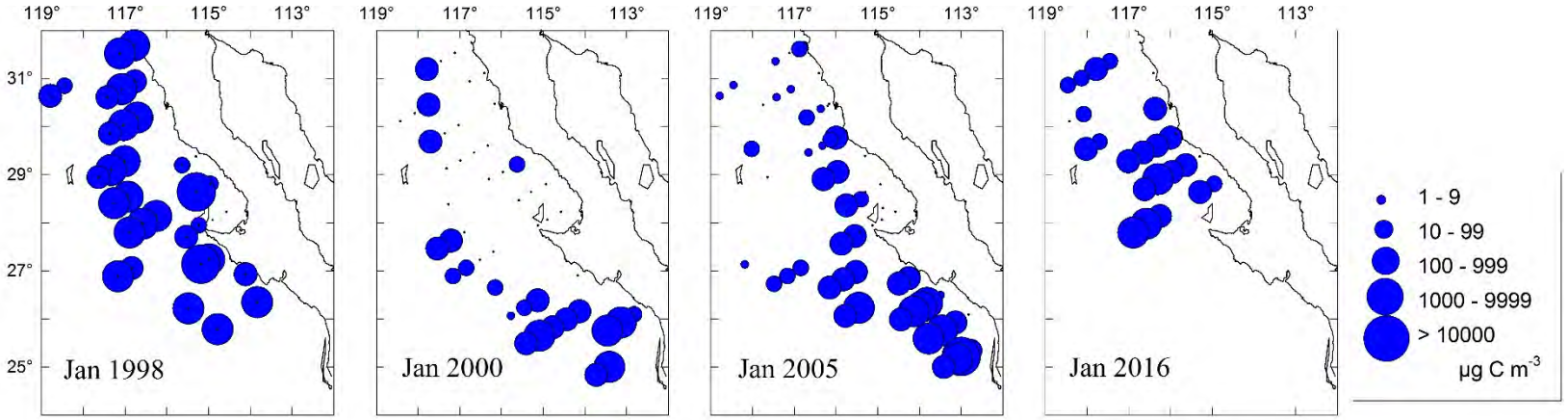
SUMMER



EP-El Niño 1997-1998 | La Niña 1998-2000 | CP-El Niño 2004-2005 | Blob 2014-2015 | EP-El Niño 2015-2016

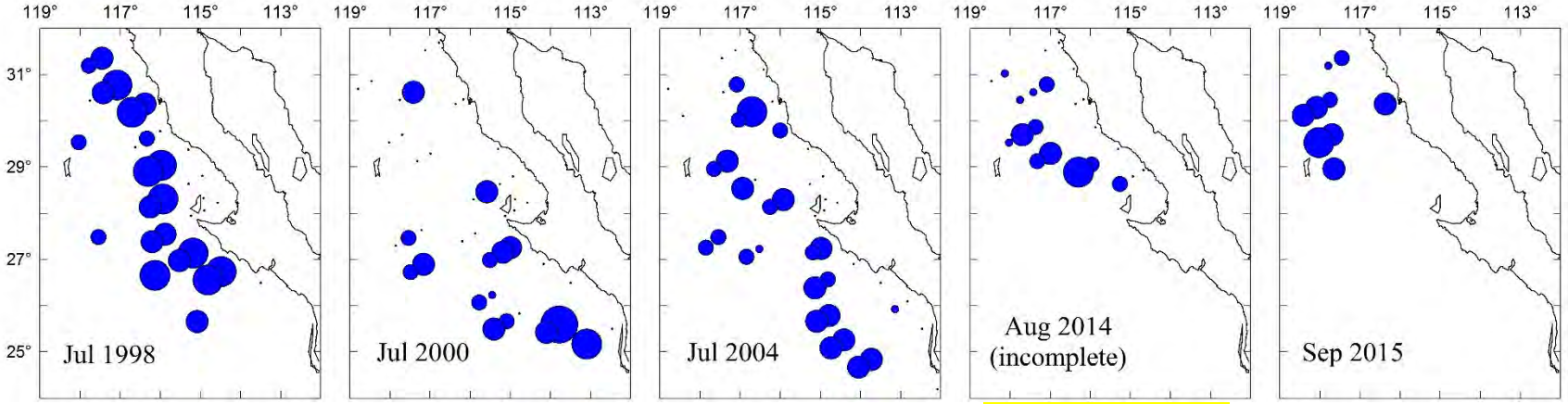
Euphausia eximia → WARM WATER INDICATOR (better in summer)

WINTER



EP-El Niño 1997-1998 | La Niña 1998-2000 | CP-El Niño 2004-2005 | EP-El Niño 2015-2016

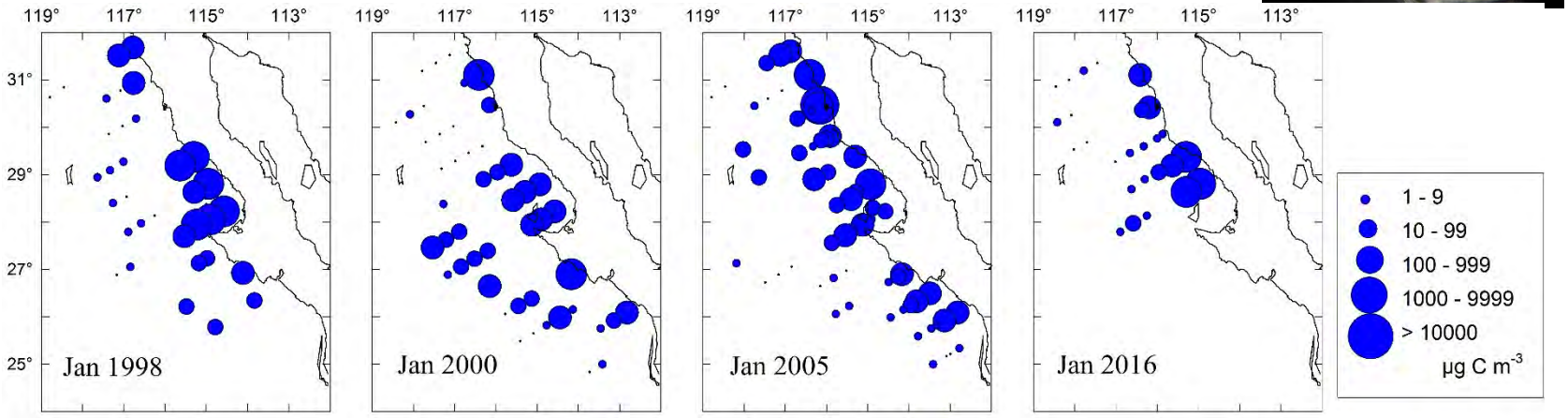
SUMMER



EP-El Niño 1997-1998 | La Niña 1998-2000 | CP-El Niño 2004-2005 | Blob 2014-2015 | EP-El Niño 2015-2016

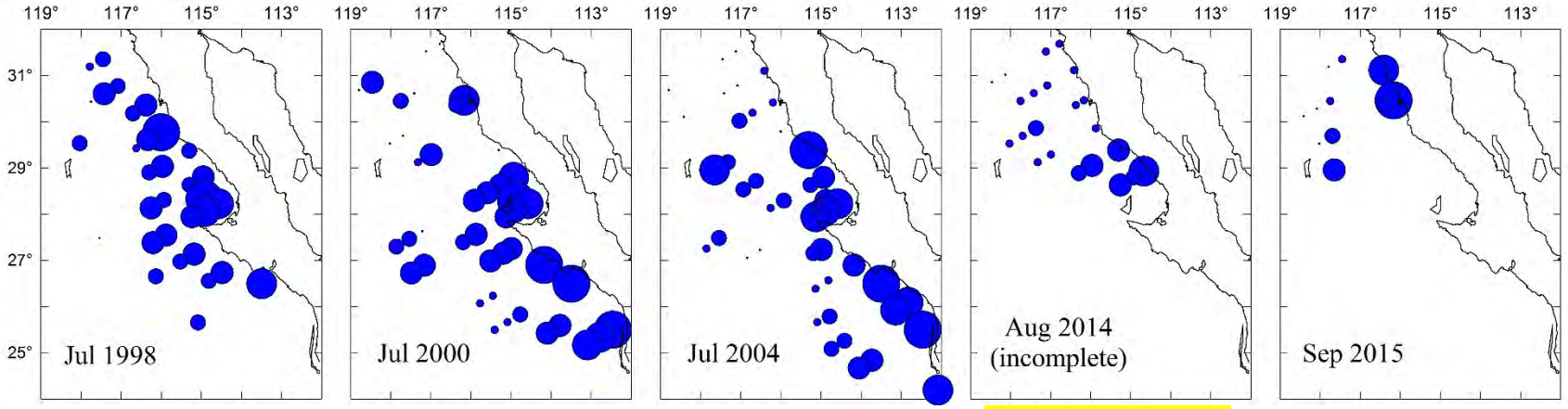
Nyctiphanes simplex → WARM WATER INDICATOR? (better in winter)

WINTER



EP-El Niño 1997-1998 | La Niña 1998-2000 | CP-El Niño 2004-2005 | EP-El Niño 2015-2016

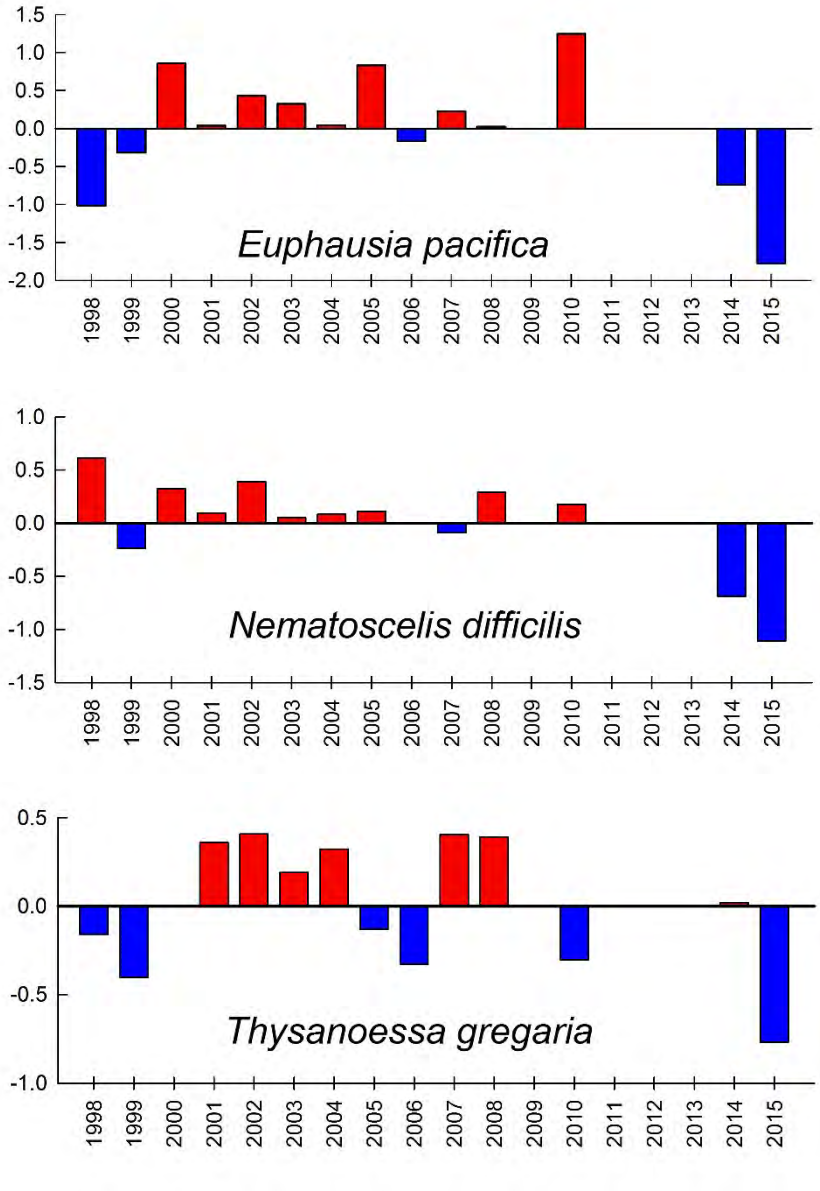
SUMMER

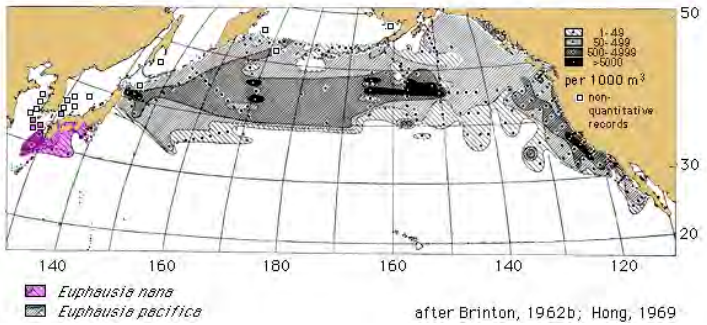


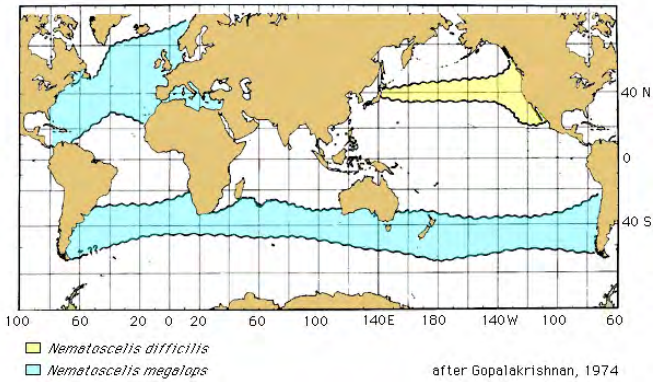
EP-El Niño 1997-1998 | La Niña 1998-2000 | CP-El Niño 2004-2005 | Blob 2014-2015 | EP-El Niño 2015-2016

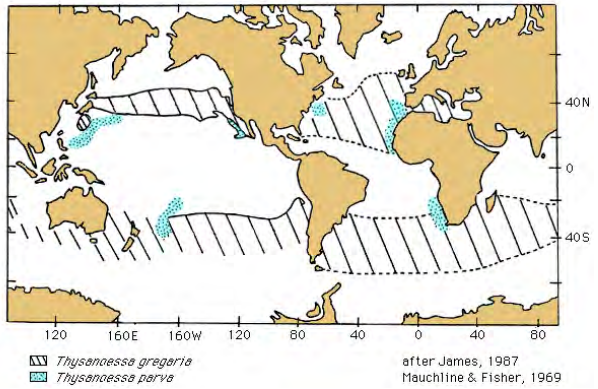
Typical California Current Species (Transition Zone)

Biomass Anomaly (Log µg C m^{-3})



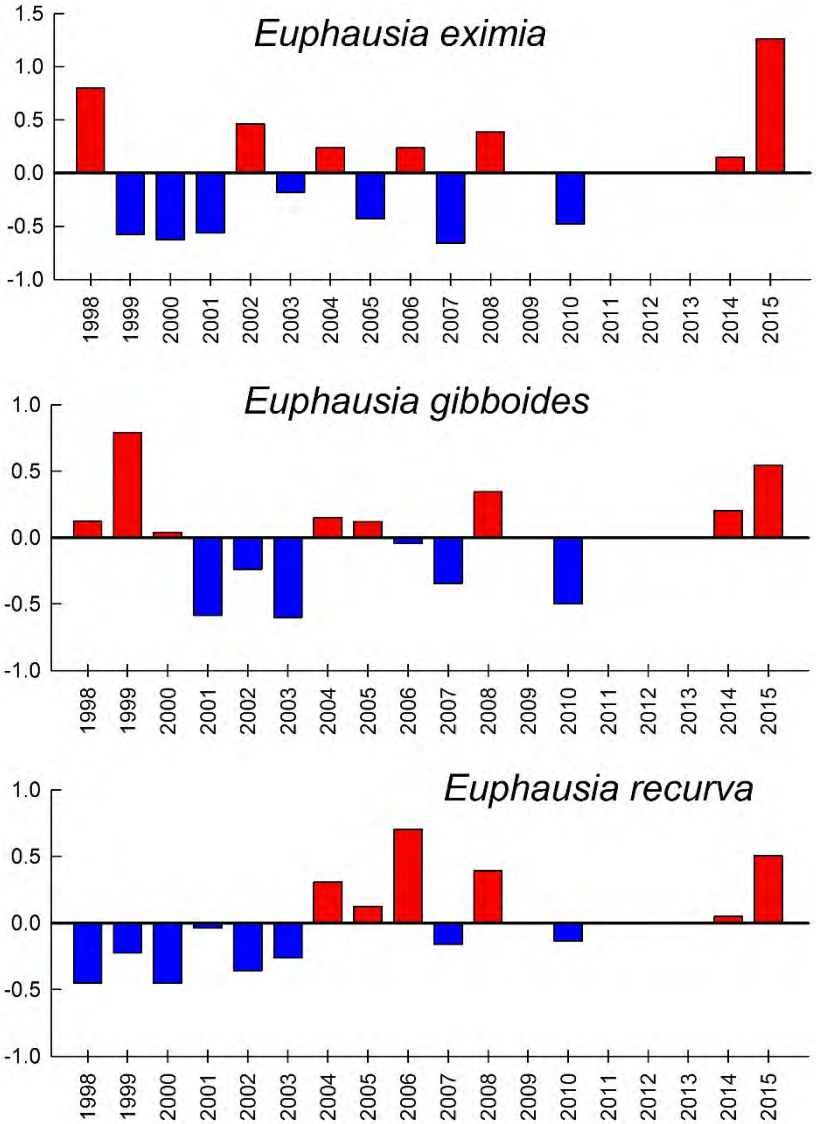


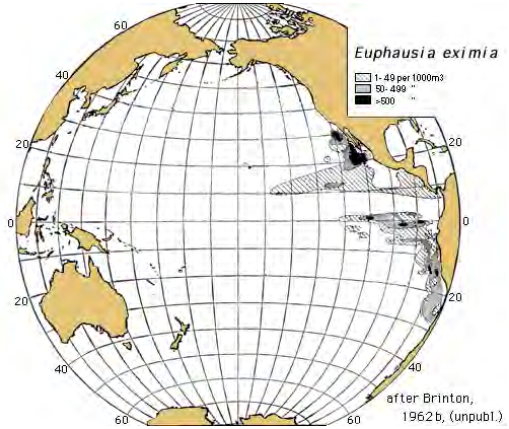


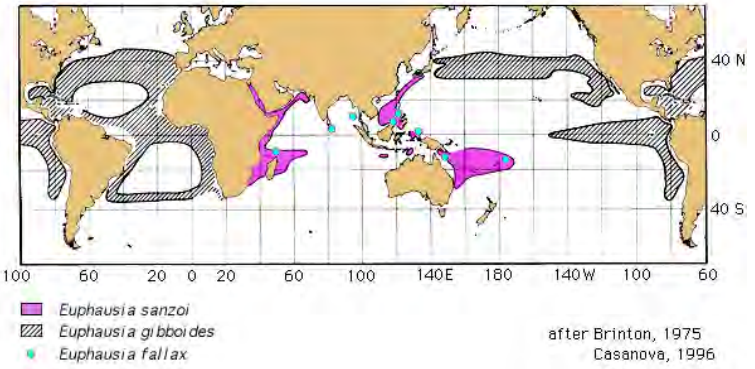


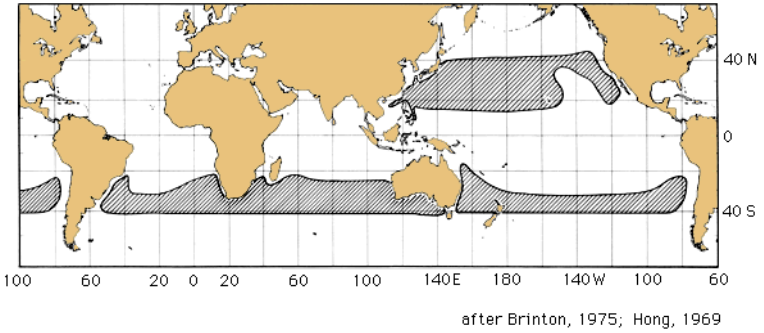
Oceanic Species present at the west side of the California Current

Biomass Anomaly (Log µg C m^{-3})



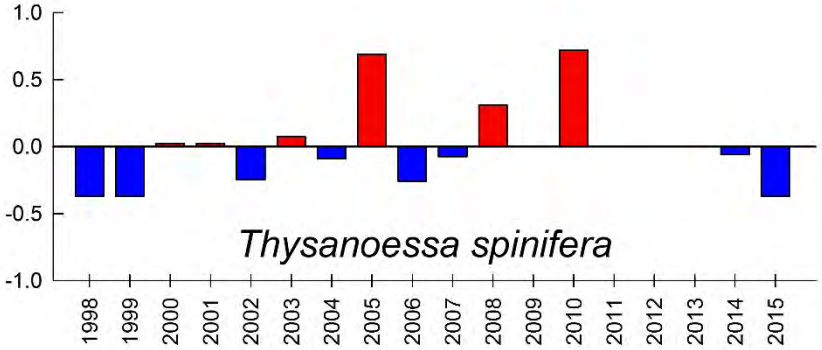


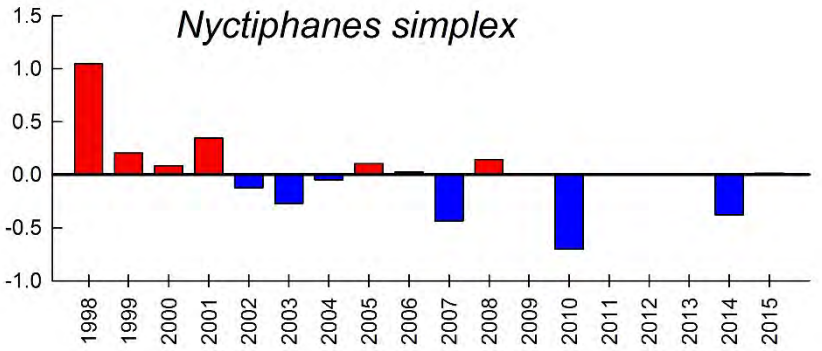


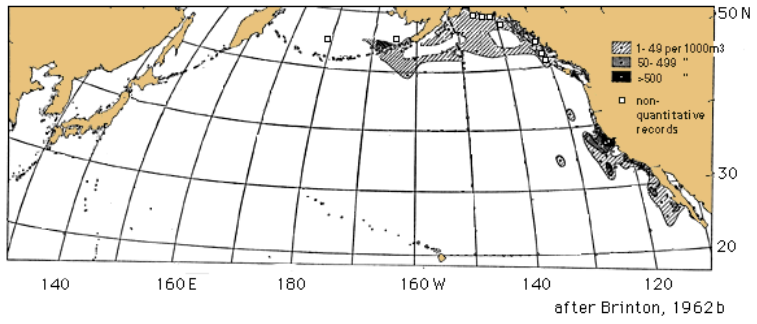


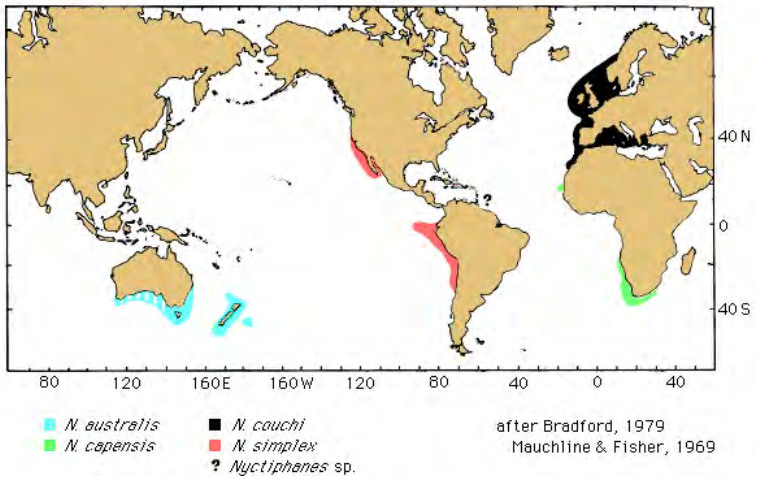
Coastal Species present at shelf and slope waters of the CCS

Biomass Anomaly (Log µg C m^{-3})

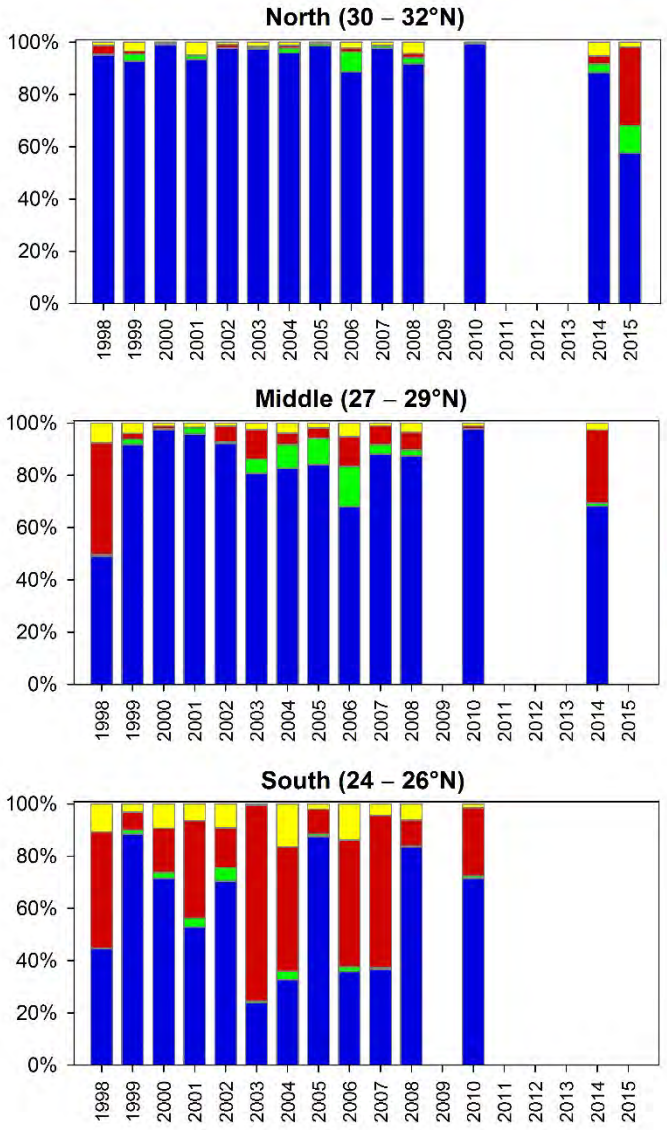






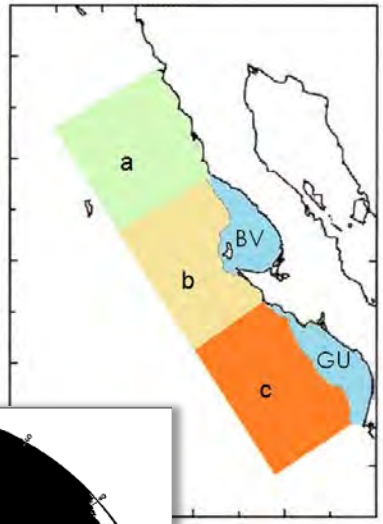


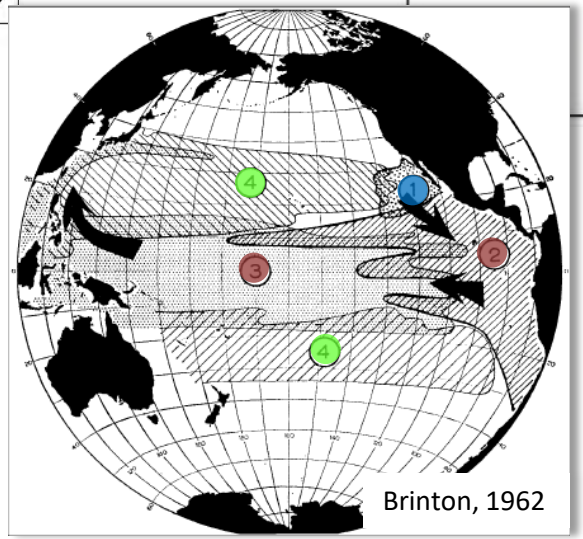
APPARENTLY ONLY THE STRONG EL NIÑO EVENTS HAVE EXTENDED INFLUENCE OVER THE KRILL COMMUNTIES LOCATED IN MIDDLE AND NORTH BAJA CALIFORNIA REGIONS



Pares-Escobar, Lavaniegos, & Ambriz-Arreola (2018, Prog. Oceanogr.)

34 euphausiid species from summer → identified, counted, converted to carbon mass, and grouped by biogeographic afinity





Brinton, 1962

CONCLUSIONS

- There is a significant correlation between ONI and SST anomalies; while upwelling index is inversely related to ONI. However there were exceptions in some events.
- Apparently, only strong El Niño events extend up to middle-north Baja California regions influencing krill communities
- Species presence and abundance may be good indicators of climate but must be interpreted in accordance with:
  a) The biogeography of the species
  b) A solid knowledge of the seasonal changes in the species composition of the study region
- The exclusive presence of tropical species not should be used as indicator of climate change, particularly in the central-south Baja California regions, because they are normal residents.
- Considerations of tropicalization effects due to climate change should be based in increasing abundance of tropical species or substantial geographical expansion.
- Therefore long-term series of euphausiid species are required. The longer the time-series, the better to define anomalies.

CICESE

Thanks !