Biological and fishery aspects of the jumbo flying squid (*Dosidicus gigas*) in the main fishing areas of the Peruvian sea between July 2015 to June 2017

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Jumbo flying squid research
Data analysis

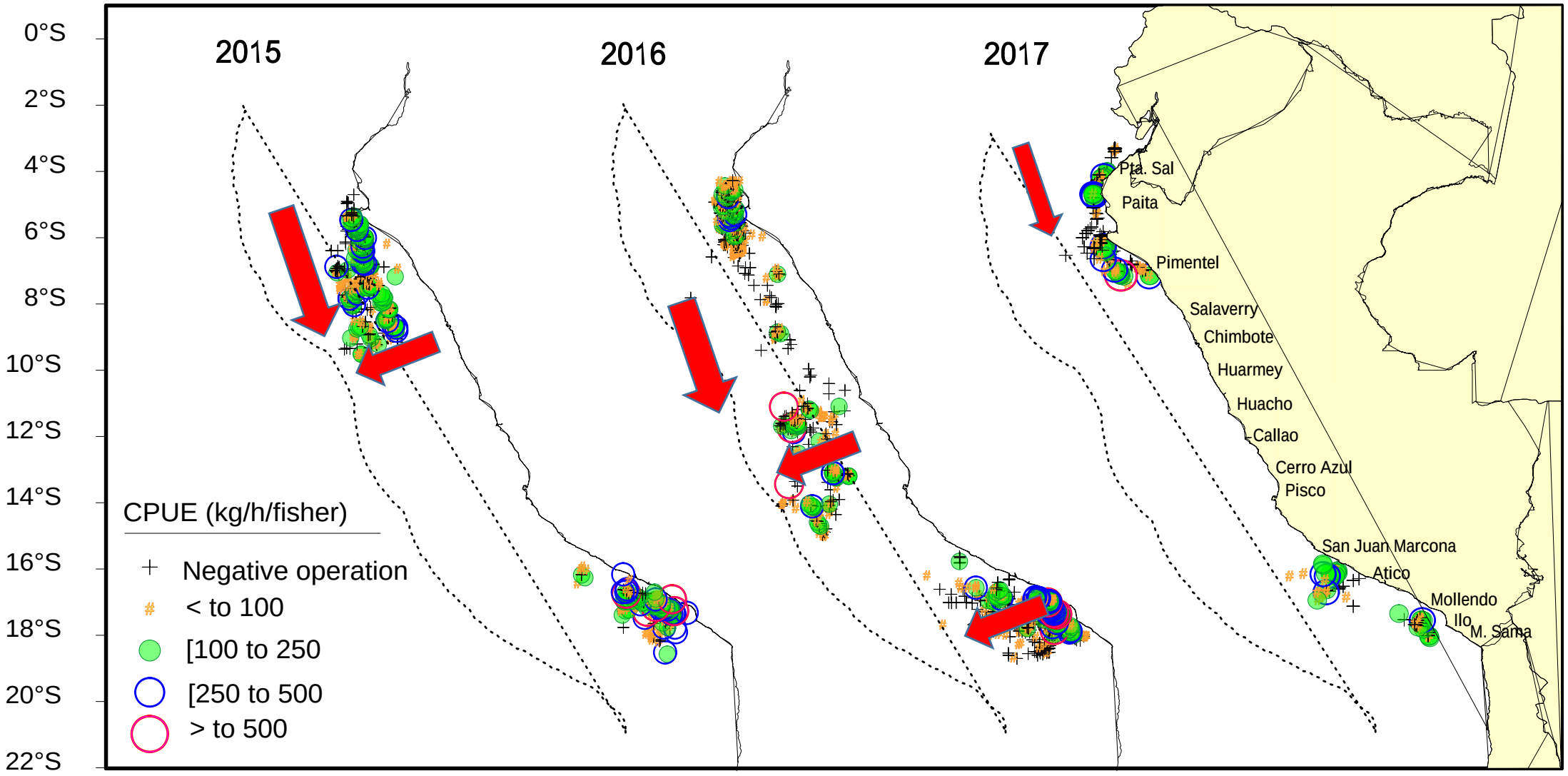
Artisanal fishery monitoring

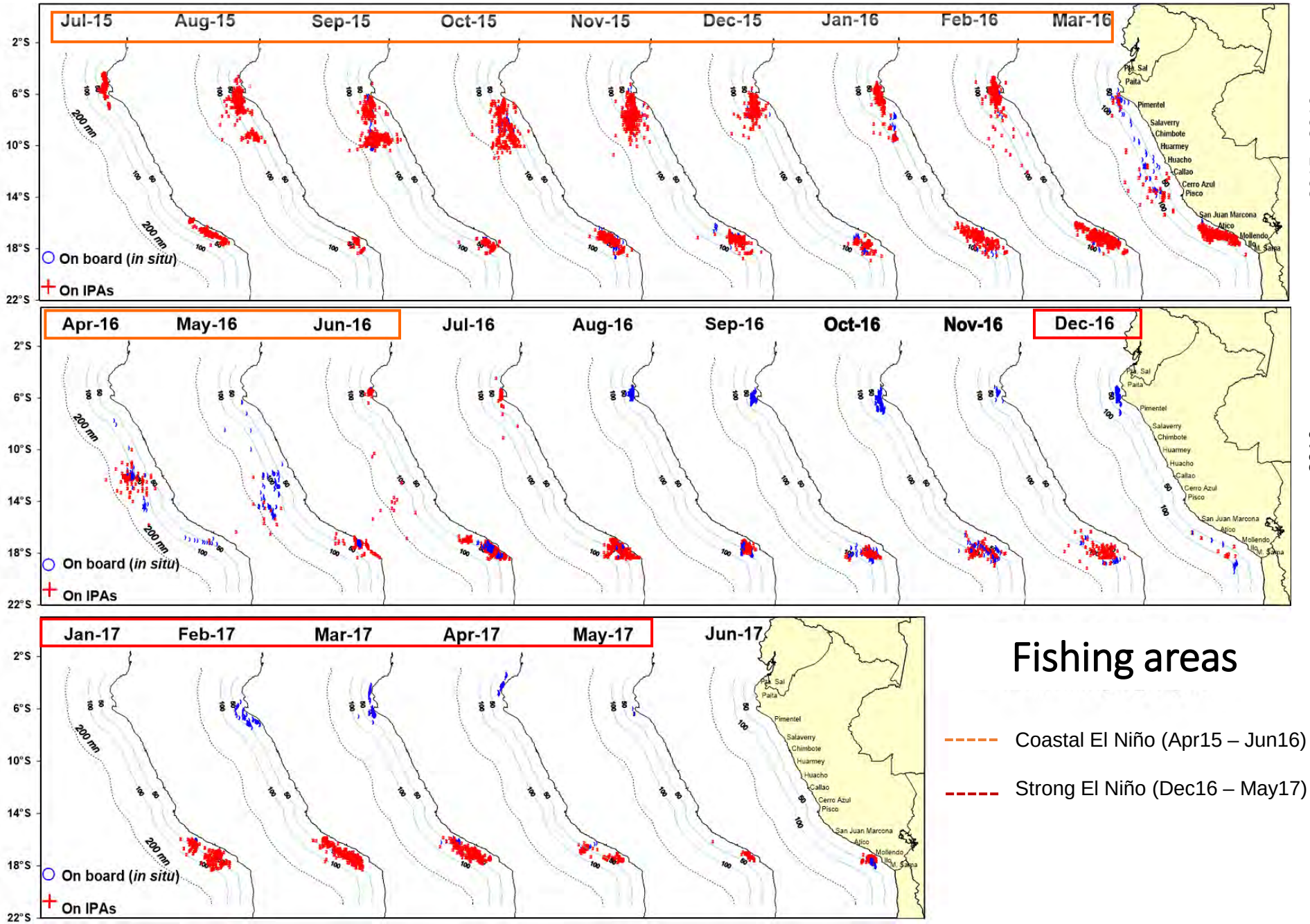
Landing ports | **On board**

- Biological data
  - Size composition
- Catch and fishing effort
  - CPUE
- Fishing areas

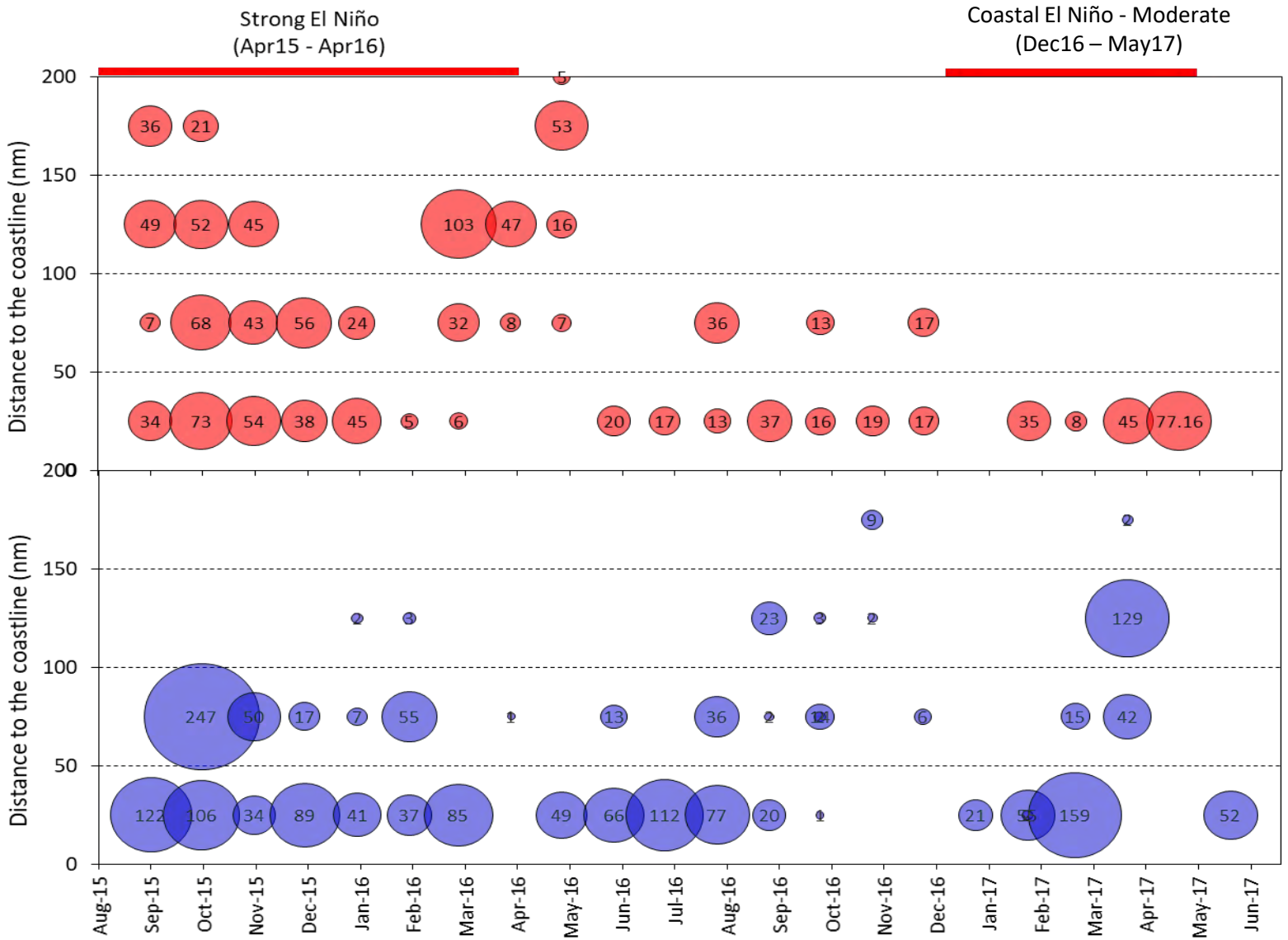
NOAA → MUR (SST) → Thermal gradients

Distribution and concentration of Jumbo flying squid

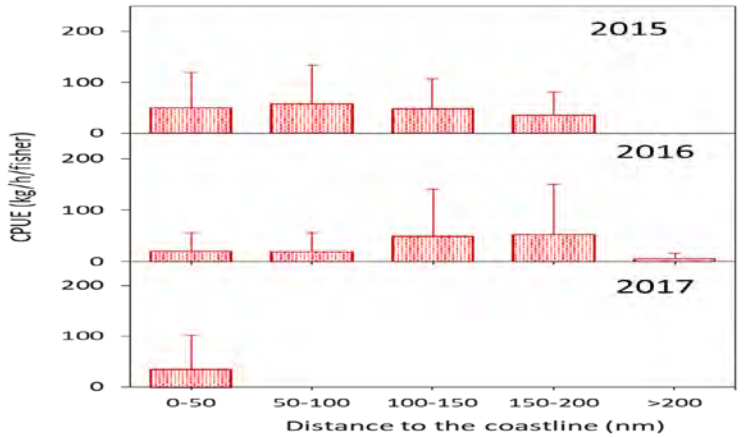



Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
2°S
6°S
10°S
14°S
18°S
22°S
200 nm
100
80
50
On board (in situ)
On IPAs
Pta. Sal
Paita
Pimentel
Salaverry
Chimbote
Huarmey
Huacho
Callao
Cerro Azul
Pisco
San Juan Marcona
Atico
Mollendo
Ilo
M. Sama
2015 - 2016
2016
Fishing areas
Coastal El Niño (Apr15 – Jun16)
Strong El Niño (Dec16 – May17)

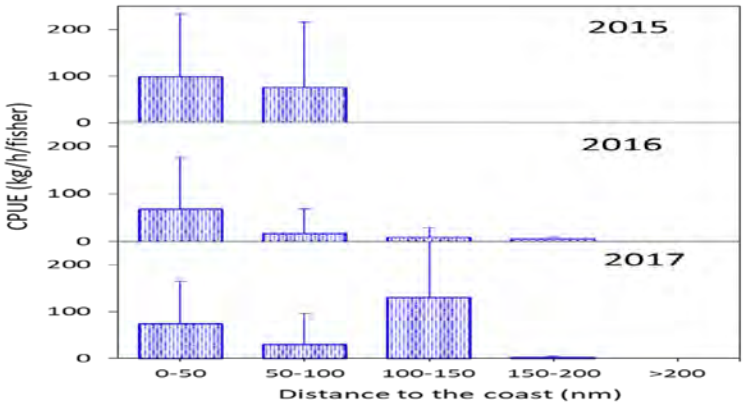
Monthly variation of the CPUE by distance to the coast



Northern Zone

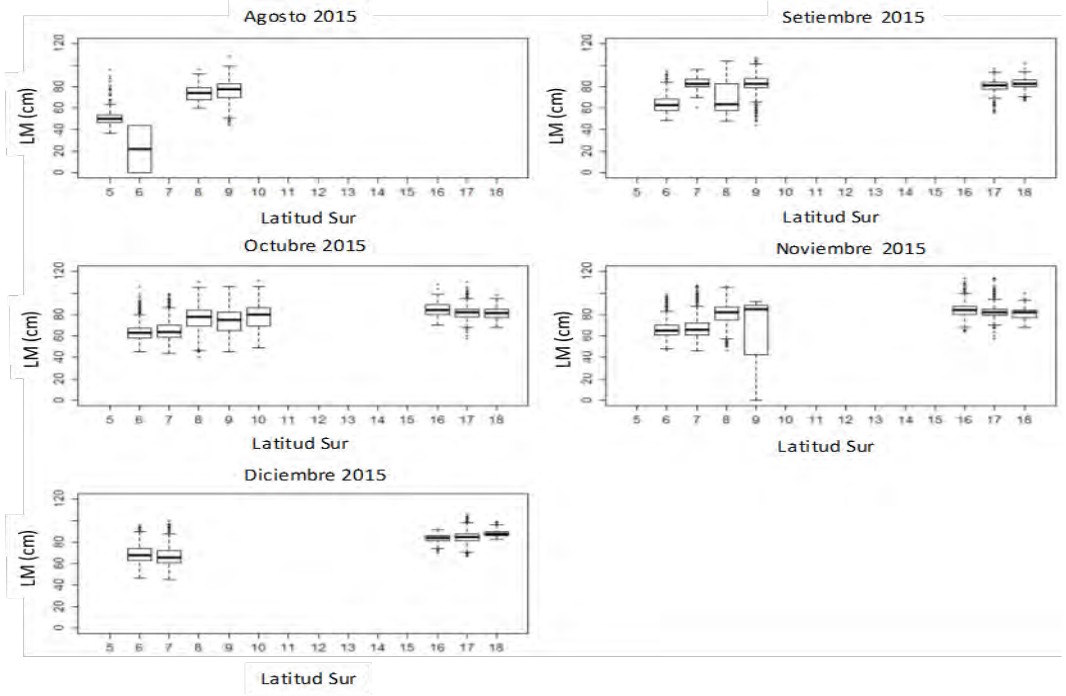


Southern Zone

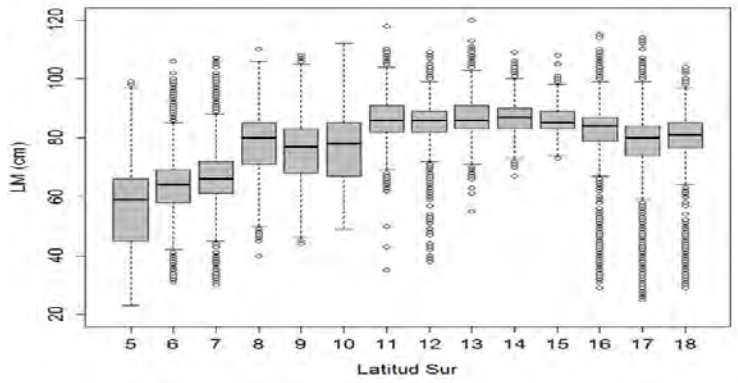


Monthly mantle length composition by latitud

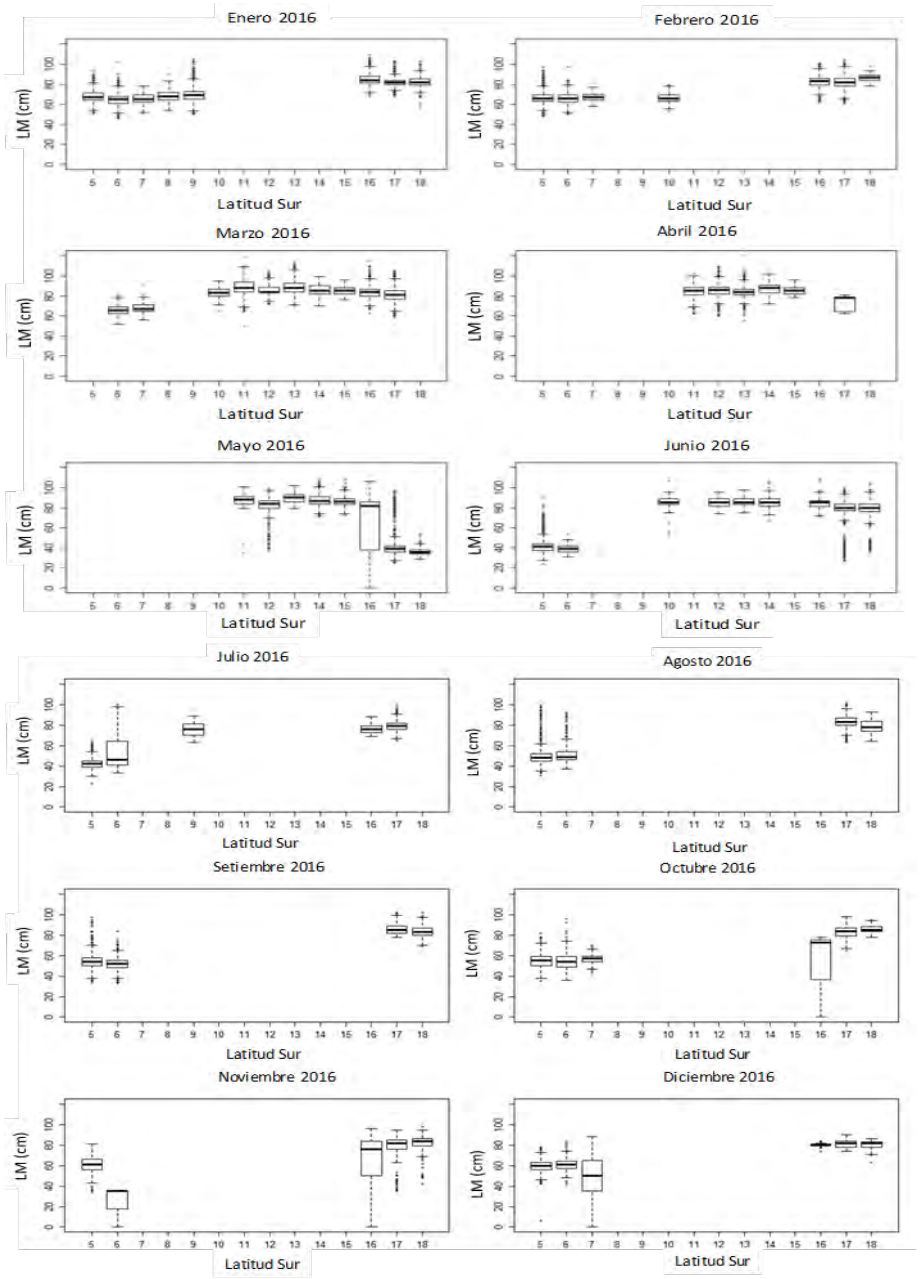
2015



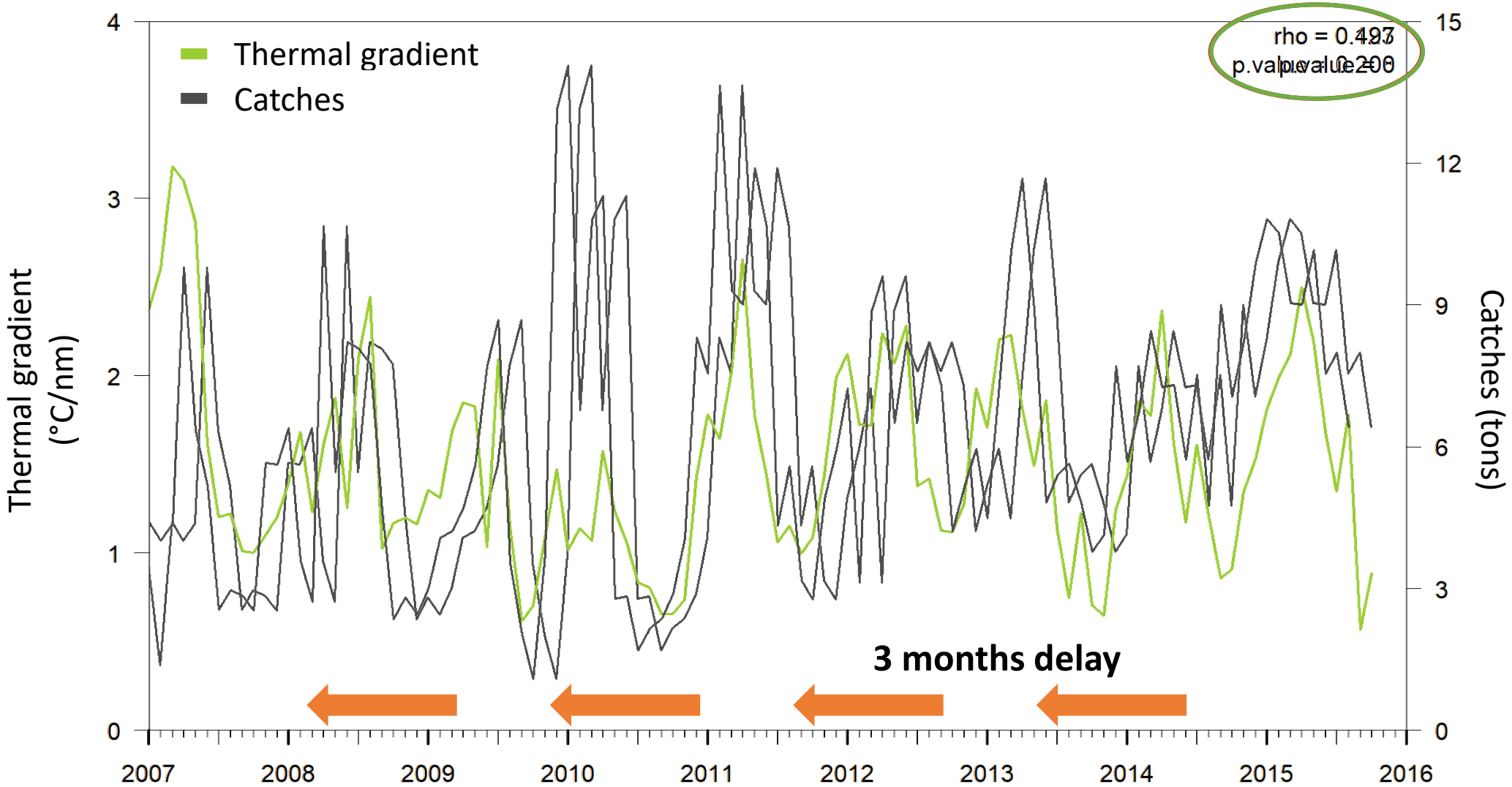
Mantle length composition, 2015-2017



2016



Time series of Jumbo flying squid monthly catches and thermal gradients



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ORIGINAL ARTICLE

WILEY FISHERIES OCEANOGRAPHY

Environmental modeling of occurrence of dolphinfish (*Coryphaena* spp.) in the Pacific Ocean off Mexico reveals seasonality in abundance, hot spots and migration patterns

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4.1 | Spatial distribution of dolphinfish

Off the BCP, the high abundance area was seasonal, occurring during summer and autumn months. On the western coast of the BCP, wind blows parallel to the coast, which creates zones of intense upwelling of subsurface, nutrient rich waters into the photic zone (Reilly, 1990) due to Ekman transport. These events can continue for 10 days (Cervantes-Duarte, Aguiñiga-Garcia, & Hernandez-Trujillo, 1993; Walsh, Whitledge, Kelly, Huntsman, & Pillsbury, 1977), are particularly intense from March to June (Zaytzev, Cervantes-Duarte, Montanate, & Gallegos-García, 2003), and are likely the cause of the high abundance of the pelagic red crab (*Pleuronocodes planipes*), a primary prey of dolphinfish in this area (Aguilar-Palomino et al., 1998; Tripp-Valdéz, 2005). Three to 4 months after these intense upwelling events, when the system entered into a "relaxation" state, dolphinfish catch began to increase. Ortega-García and Lluch-Cota (1996) found a 3 month lag between color fronts (peak chlorophyll concentration) and yellowfin tuna (*Thunnus albacares*) peak catch. The authors attributed the lag to the time required for the prey of tuna to appear higher up in the food web. Because dolphinfish and yellowfin tuna share habitat to some extent (as inferred by the incidental catch of dolphinfish in purse seiners that target tuna), the same explanation for the time lag could apply to our study fish: intense wind-driven upwelling occurred on the western coast of the

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Conclusions

- The main fishing areas were centered to the north (4°S - 9°S) and south (16°S - 19°S), to distances less than 100 nm from the coast.

- During the strong El Niño 2015-2016 (Apr 2015 - Jun 2016), the northern fleet showed a clear latitudinal migration from The North to South, especially between January and June 2016, reaching to 15°S and distances greater than 100 nm from the coast. After that, it returned to northern fishing areas, without showing spatial changes during El Niño 2016-2017 (December 2016 - May 2017).

- The highest CPUE were estimated in the South (17° - 18°S) and near the coast, reaches 250 kg/hour/fisherman; while in the North CPUE values were less than 100 kg/hour/fisherman.

- The mantle length composition showed an increasing trend from the North to the South.

- It was observed three months lag between the peak of the thermal gradient and the increment of the catches, that would be associated to the time of the concentration of jumbo squid prey.