

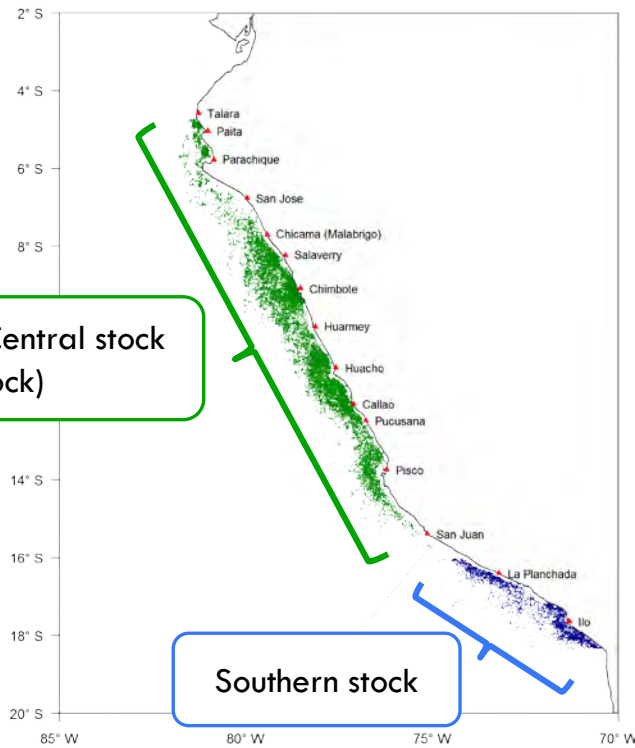


**Displacements of the Peruvian anchoveta stocks
in relation to environmental conditions: An
analysis using length structure analysis from
vessel monitoring system information**

Wencheng Lau-Medrano & Josymar
Torrejon-Magallanes

Displacements of the Peruvian anchoveta stocks in relation to environmental conditions: An analysis using length structure analysis from Vessel Monitoring System information

Displacements of the Peruvian anchoveta stocks in relation to environmental conditions: An analysis using length structure analysis from Vessel Monitoring System information



Northern and Central stock
(NC stock)

Southern stock

Differentiation of stocks
of Peruvian anchoveta

R. Jordán (1963)

Vertebrae
criterion

x

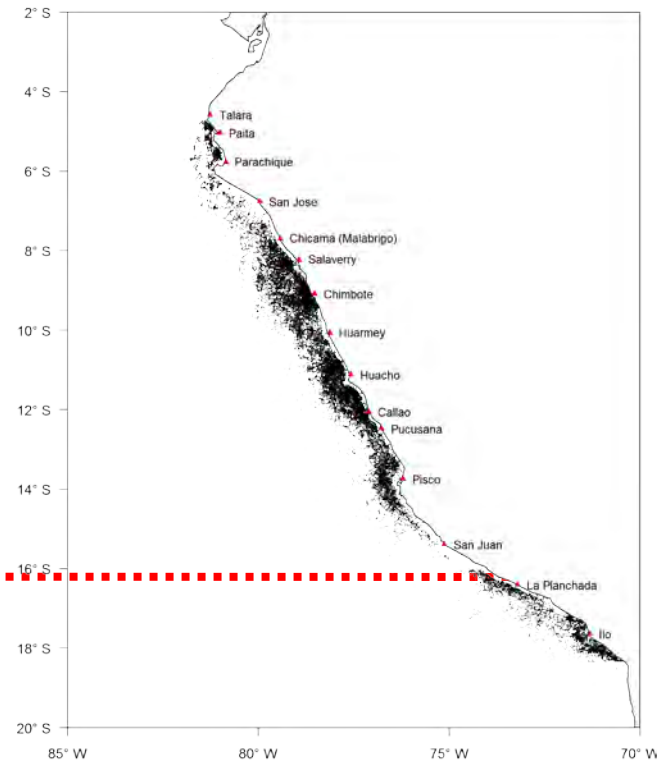
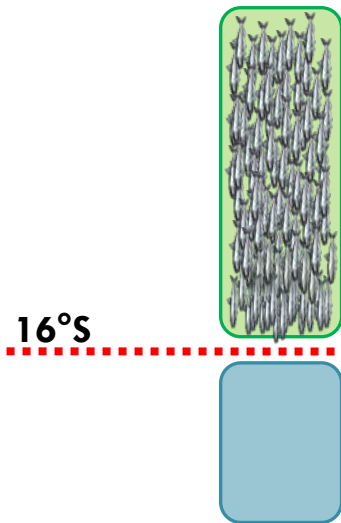
I. Tsukayama
(1966)

Gill number
criterion

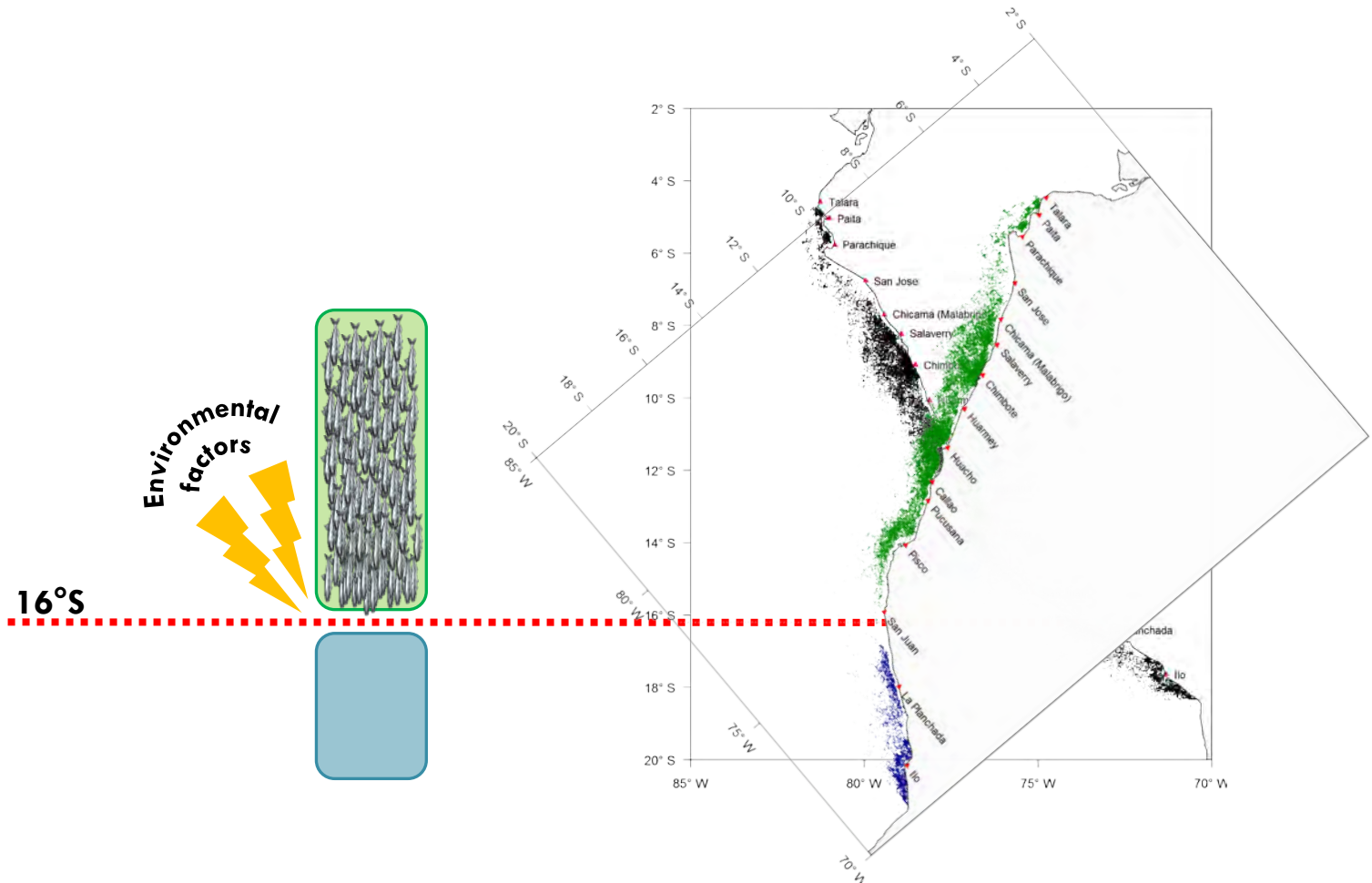
✓

Management strategies

Displacements of the Peruvian anchoveta stocks in relation to environmental conditions: An analysis using length structure analysis from Vessel Monitoring System information



Displacements of the Peruvian anchoveta stocks in relation to environmental conditions: An analysis using length structure analysis from Vessel Monitoring System information

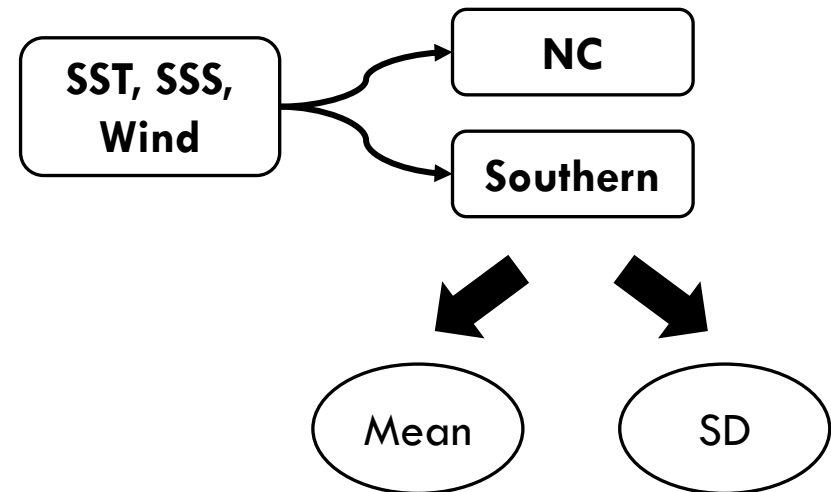
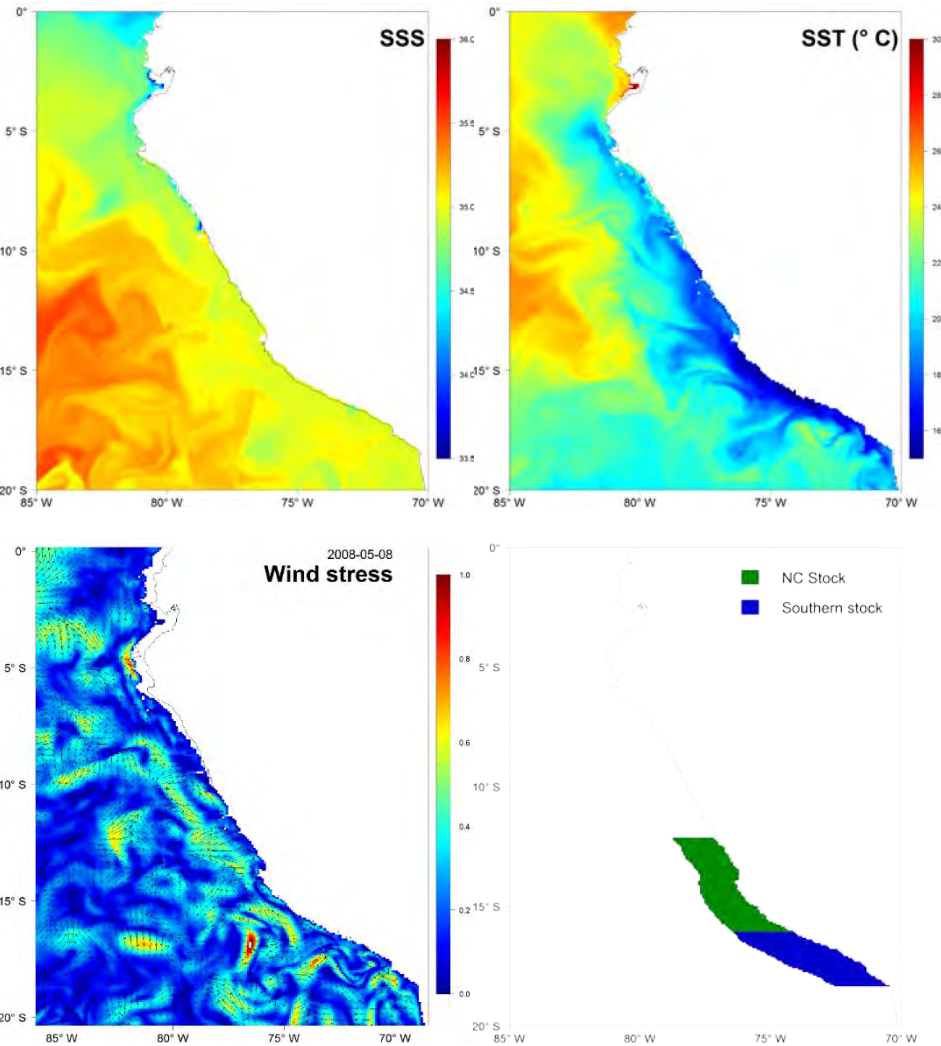




Data & Methods

Environmental data

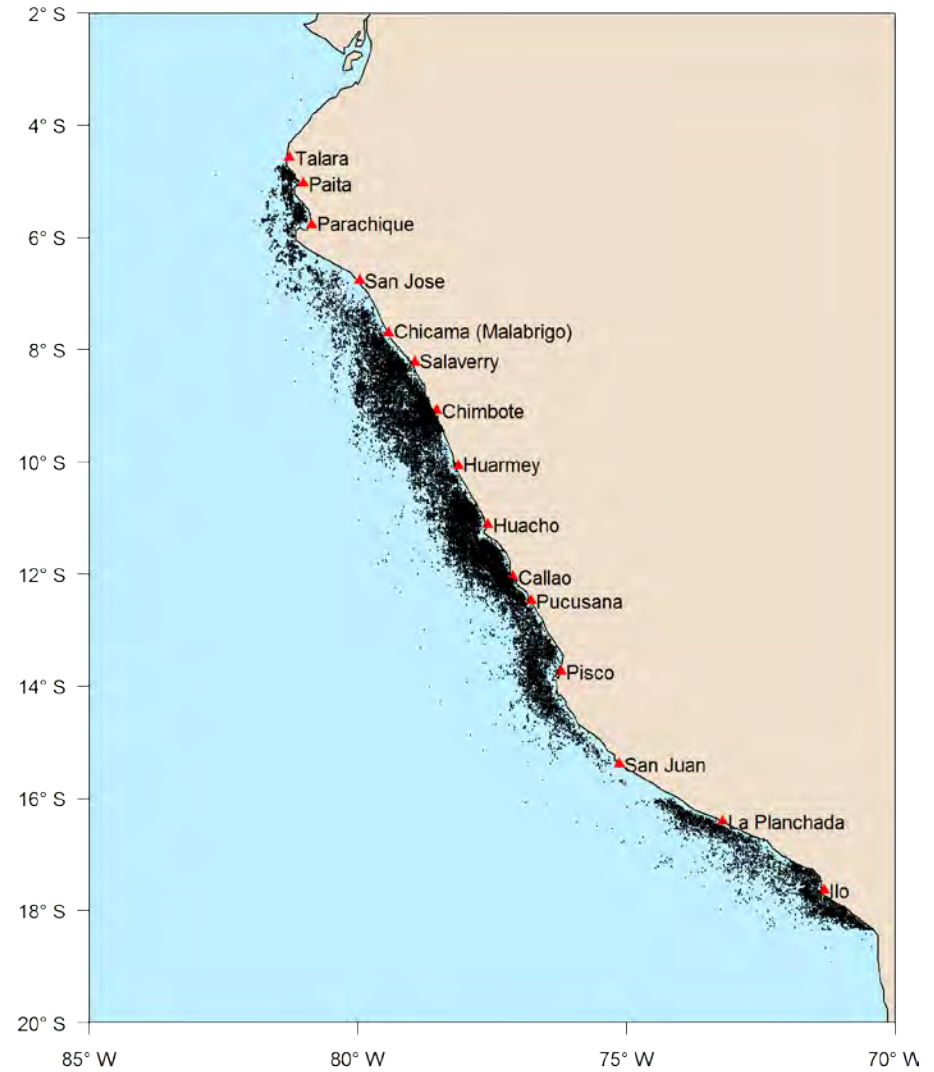
- Source: HYCOM
- Reanalysis
- High spatial and temporal resolution
- Spatial indexation by stocks



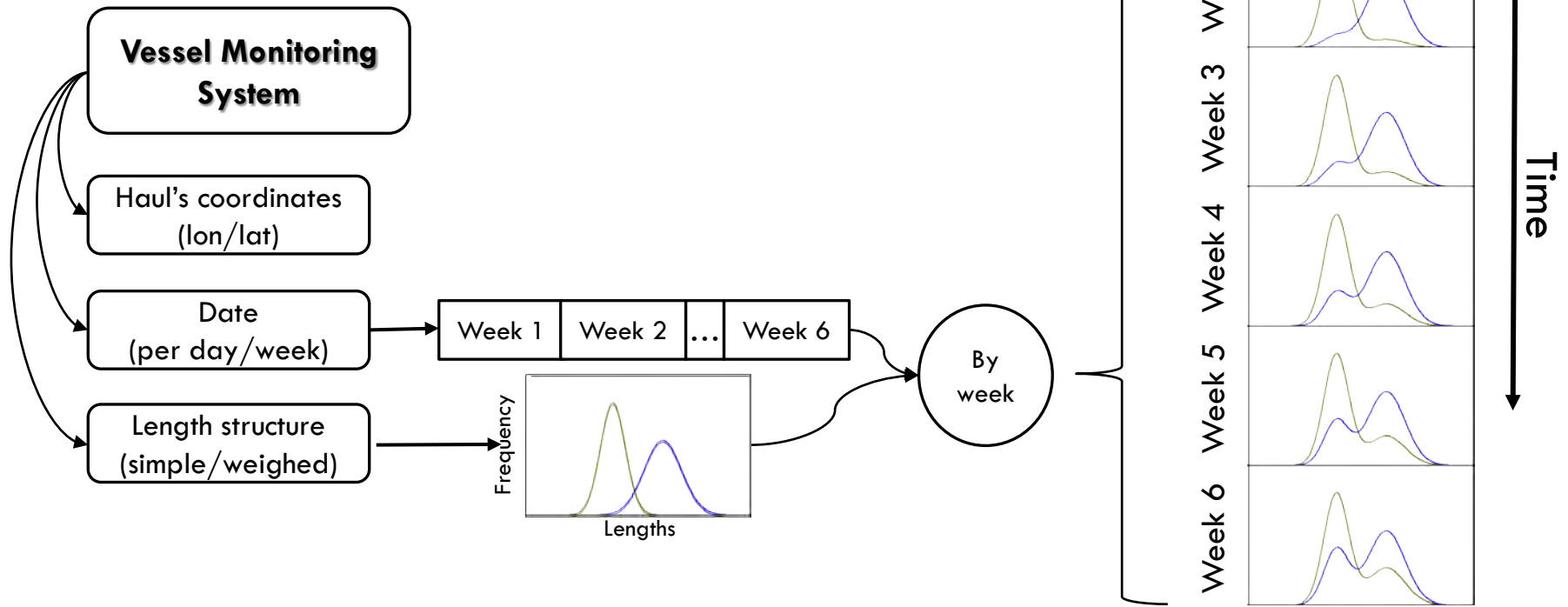
Fishing data

Vessel Monitoring System

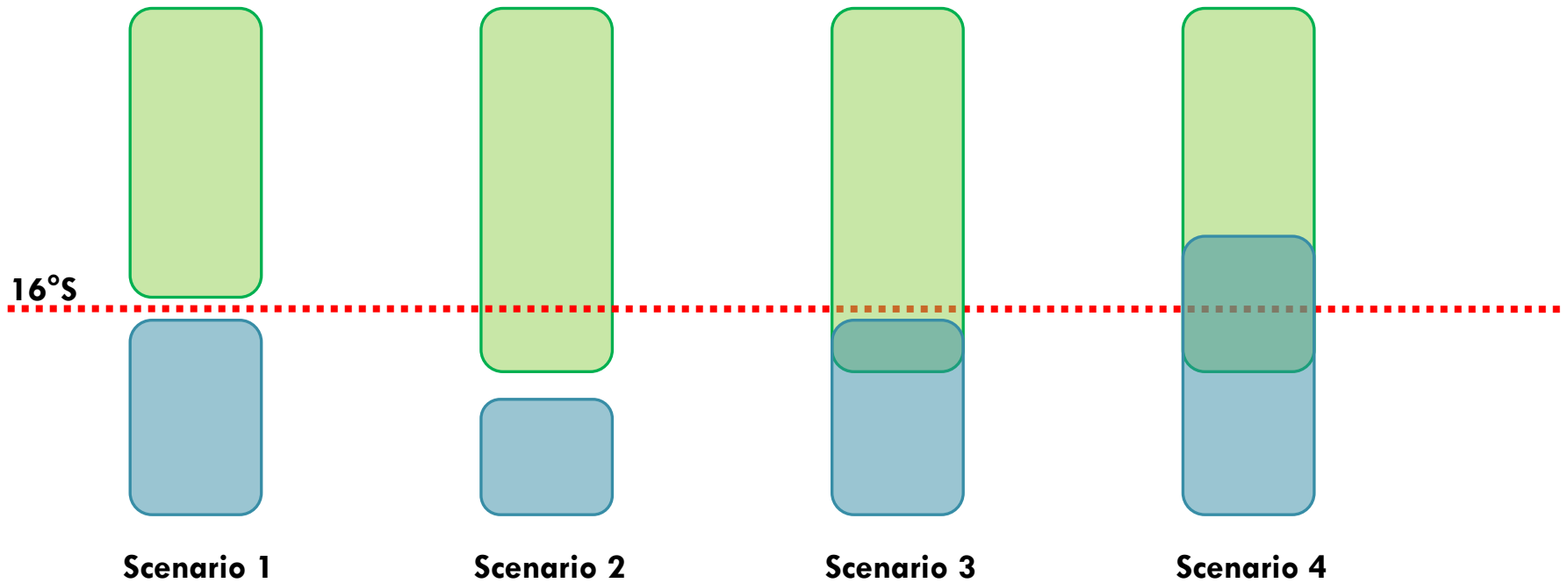
Haul's coordinates
(lon/lat)

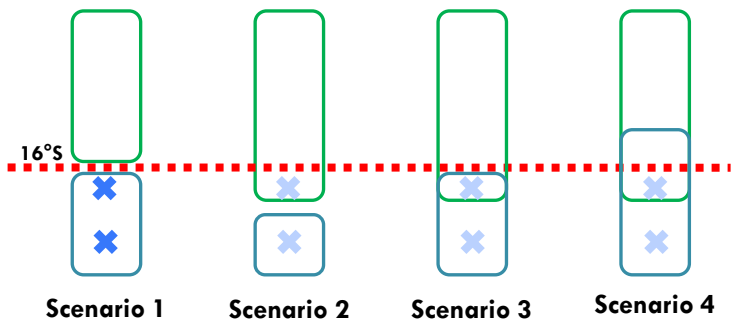


Fishing data



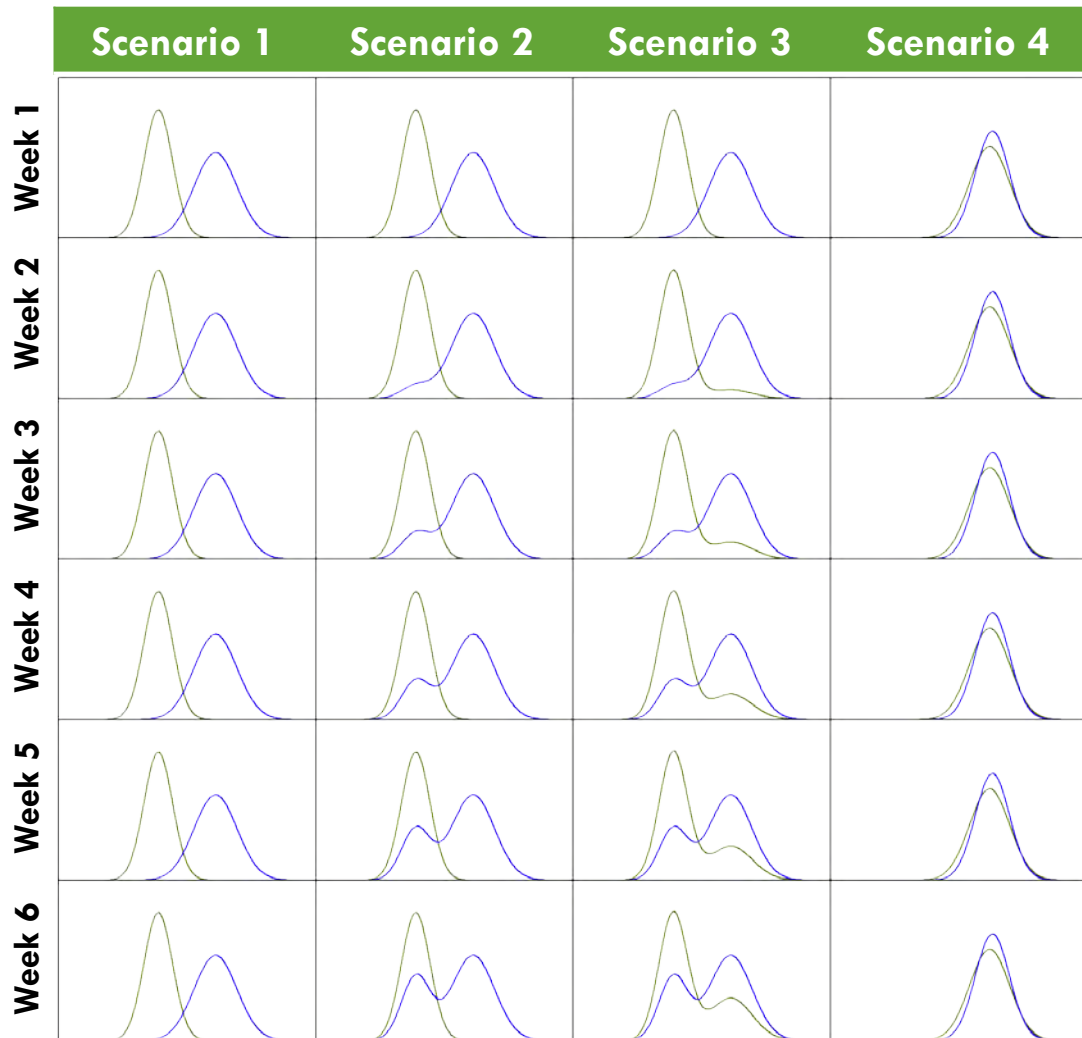
HYPOTHETICAL MOVEMENTS SCENARIOS

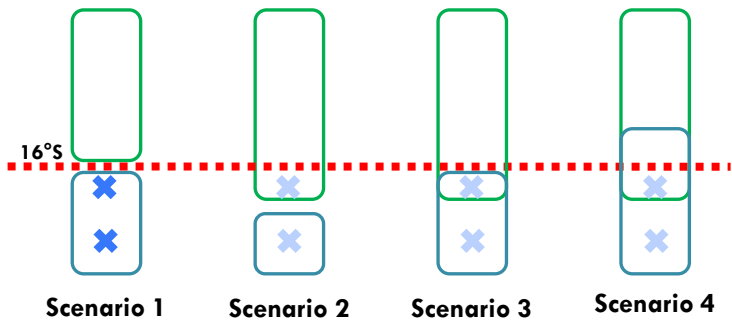




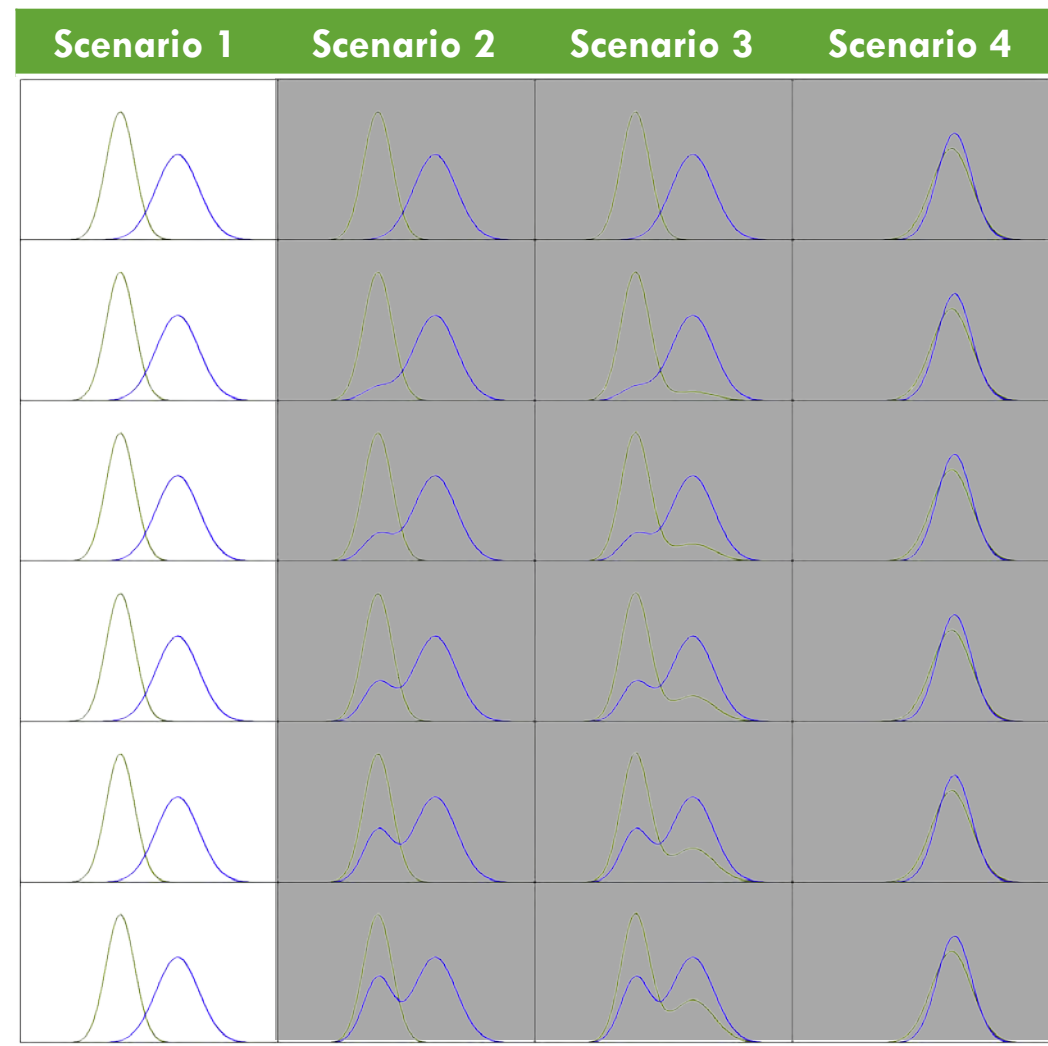
Sample of NC stock

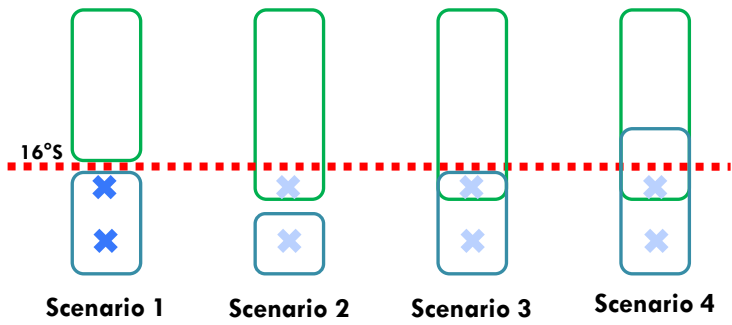
✕ Sample of Southern stock



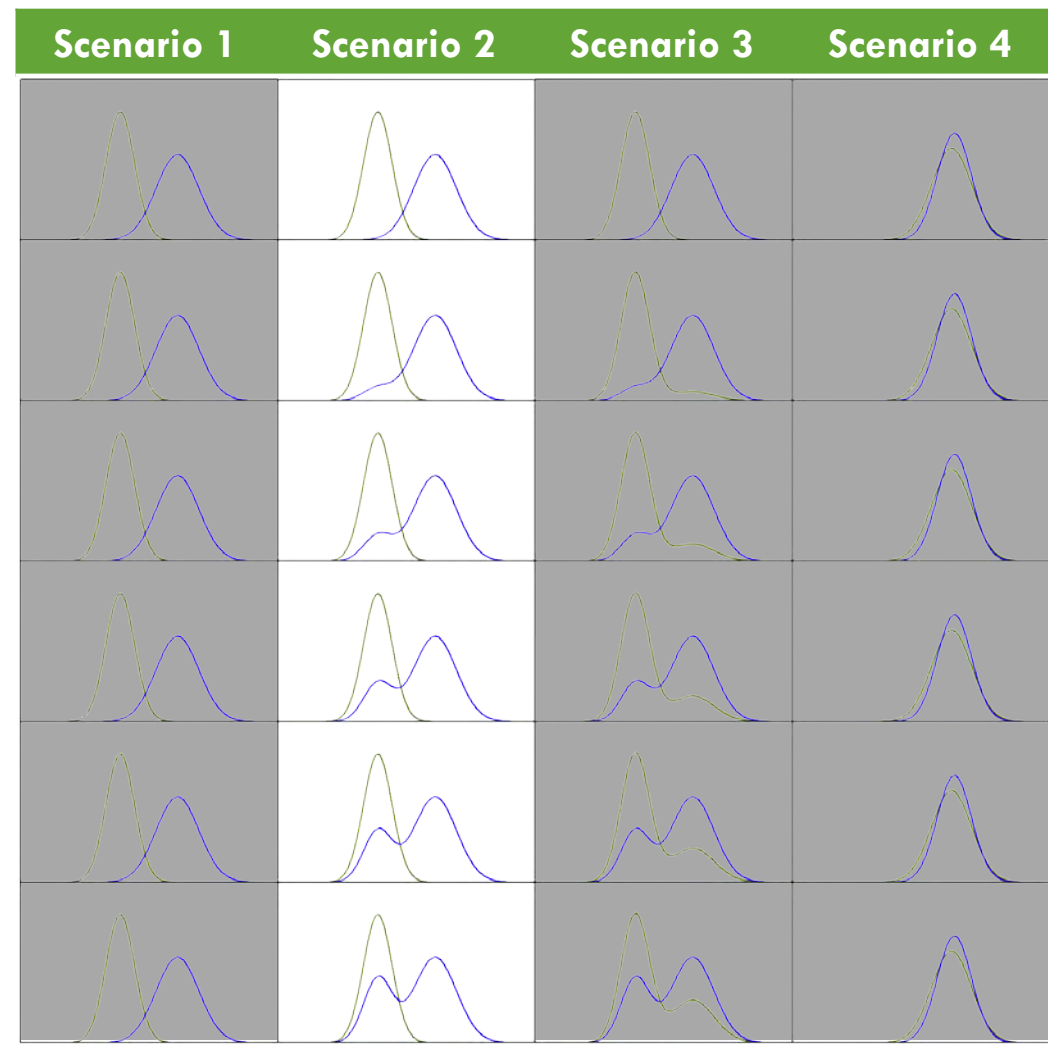


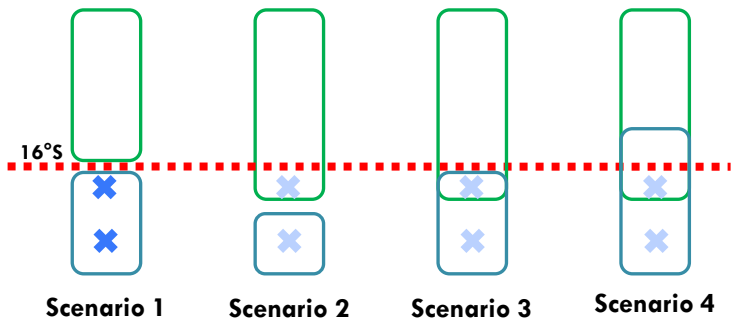
- Two initial modes.
- No displacements
- Selected latitudinal limit is real
- No mixing between cohorts



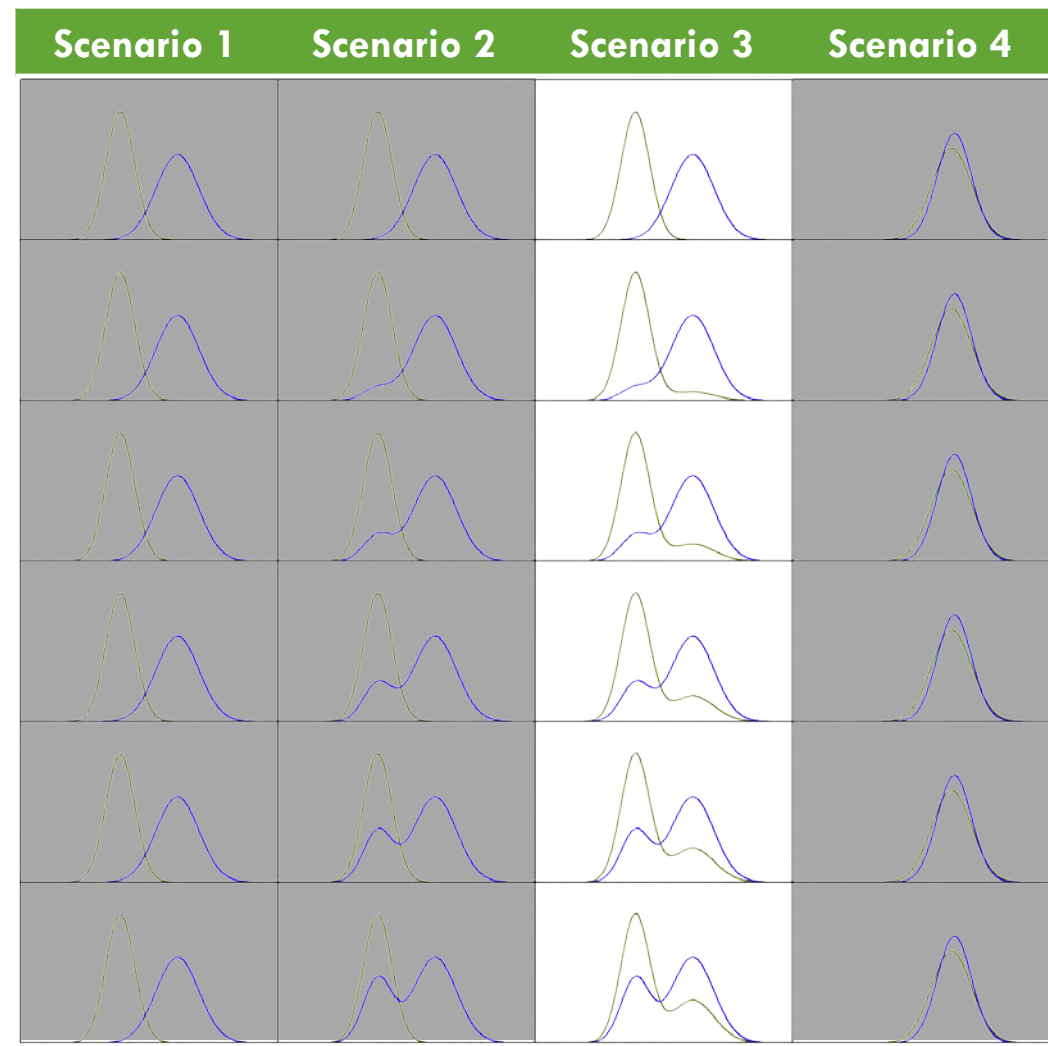


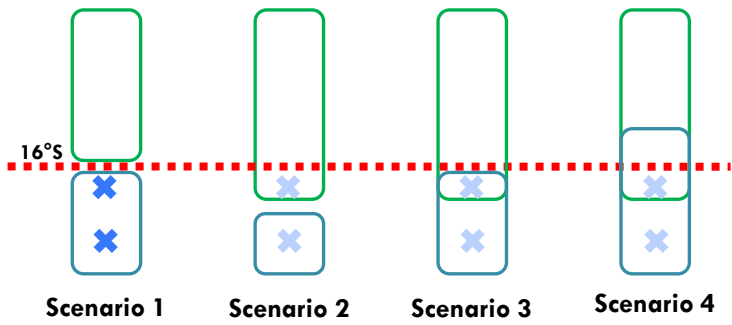
- Two initial modes.
- Displacement of two stocks at time.
- There is a separation between stocks.
- Observed mixing: For one stock



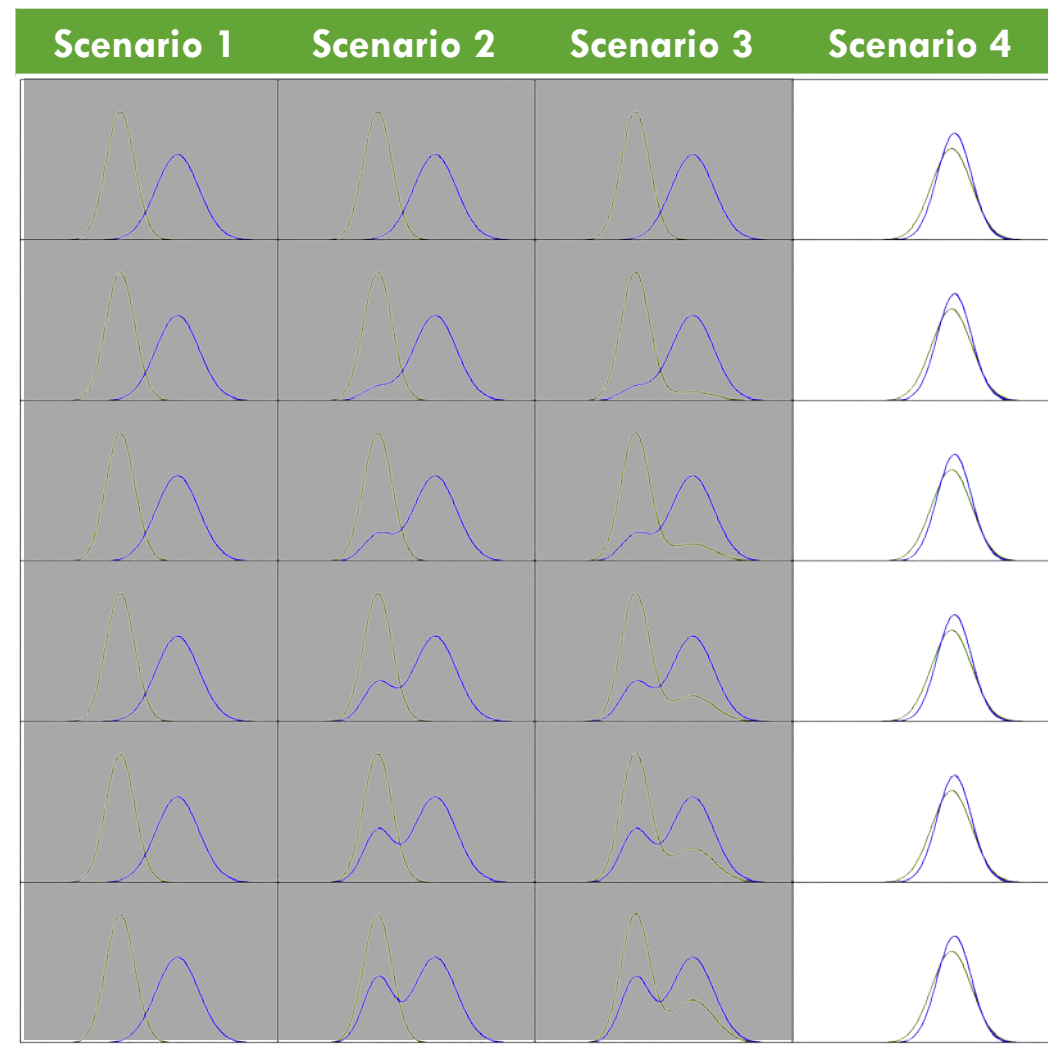


- Two initial modes.
- Displacement of two stocks, overlay
- Observed mixing: For both stock





- One initial mode for both.
- There is not latitudinal limit
- Complete mixing between cohorts
- Possible continuation of Scenario 3



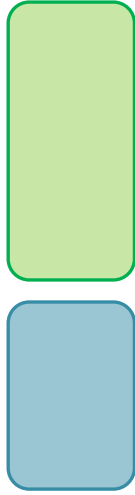


Results |

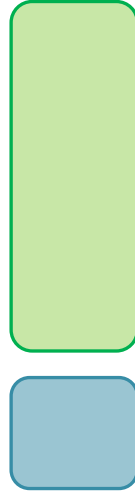
**STUDY
CASES**

SCENARIOS

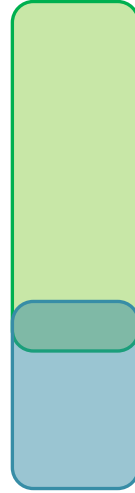
Scenario 1



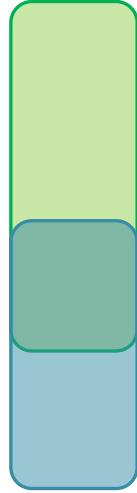
Scenario 2



Scenario 3



Scenario 4



■

2010_19-24

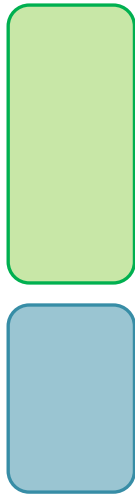
2011_22-30

2012_15-22

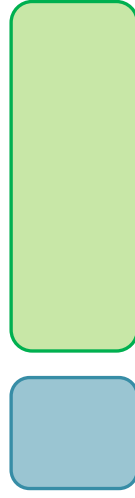
2012_24-30

2014_15-21

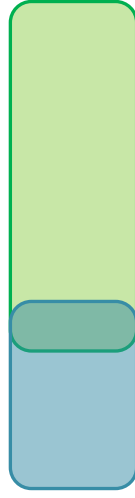
SCENARIOS



Scenario 1



Scenario 2



Scenario 3



Scenario 4

STUDY CASES

■

2010_19-24

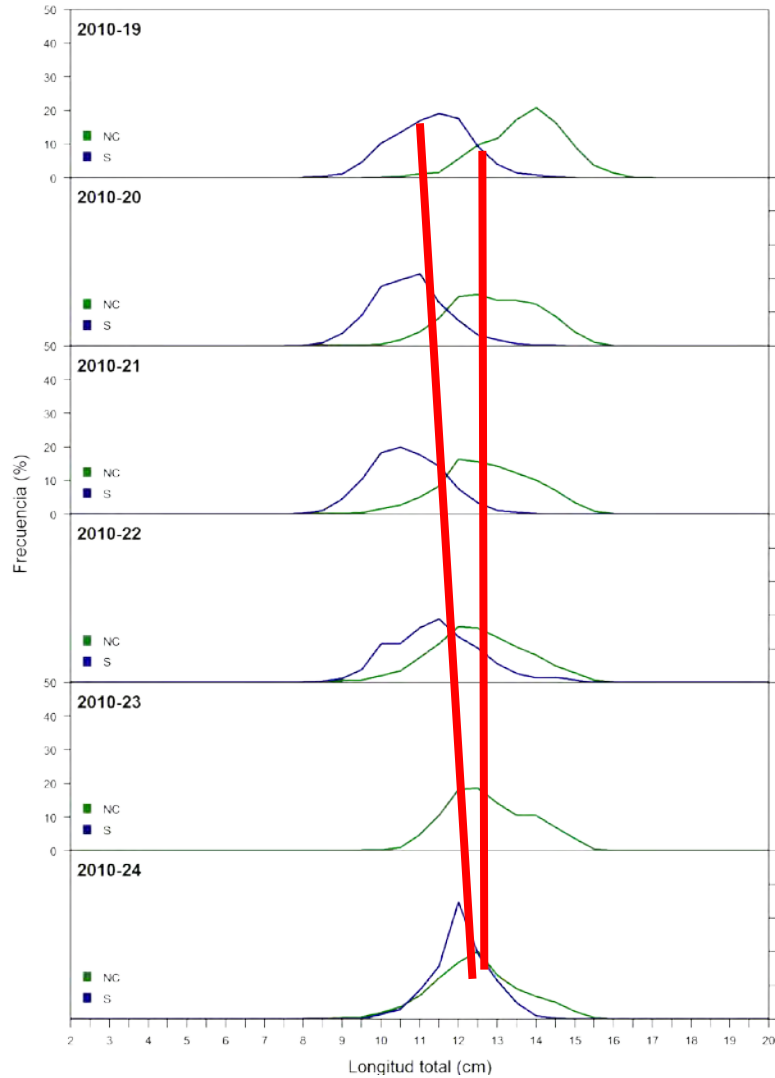
2011_22-30

2012_15-22

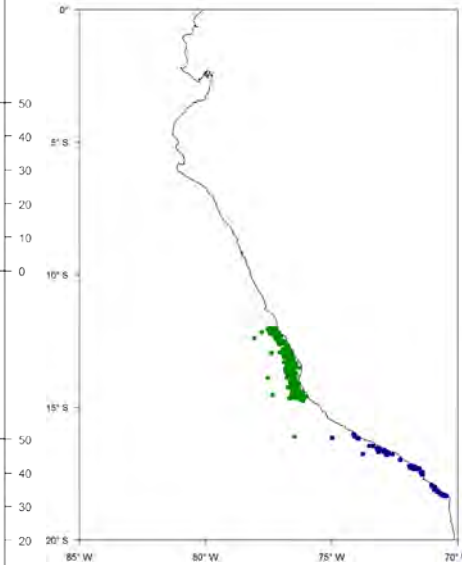
2012_24-30

2014_15-21

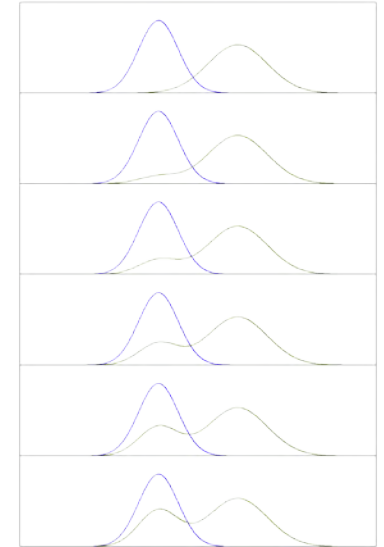
SCENARIO 2



Spatial distribution



Pattern



2010_19-24

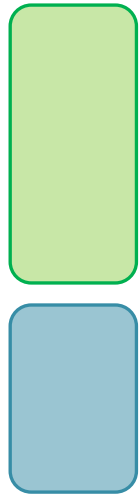
Two different modes (cohorts?)

At the end: Same mode

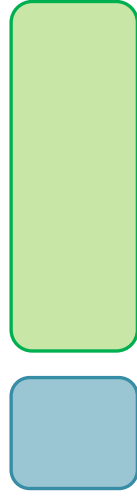
No growth effect

Classification: moderated La Niña

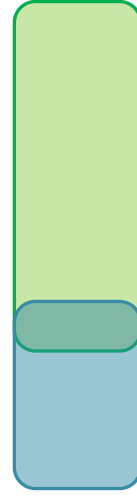
SCENARIOS



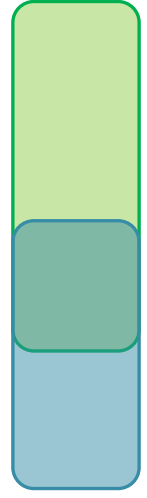
Scenario 1



Scenario 2



Scenario 3



Scenario 4

STUDY CASES

■

2010_19-24

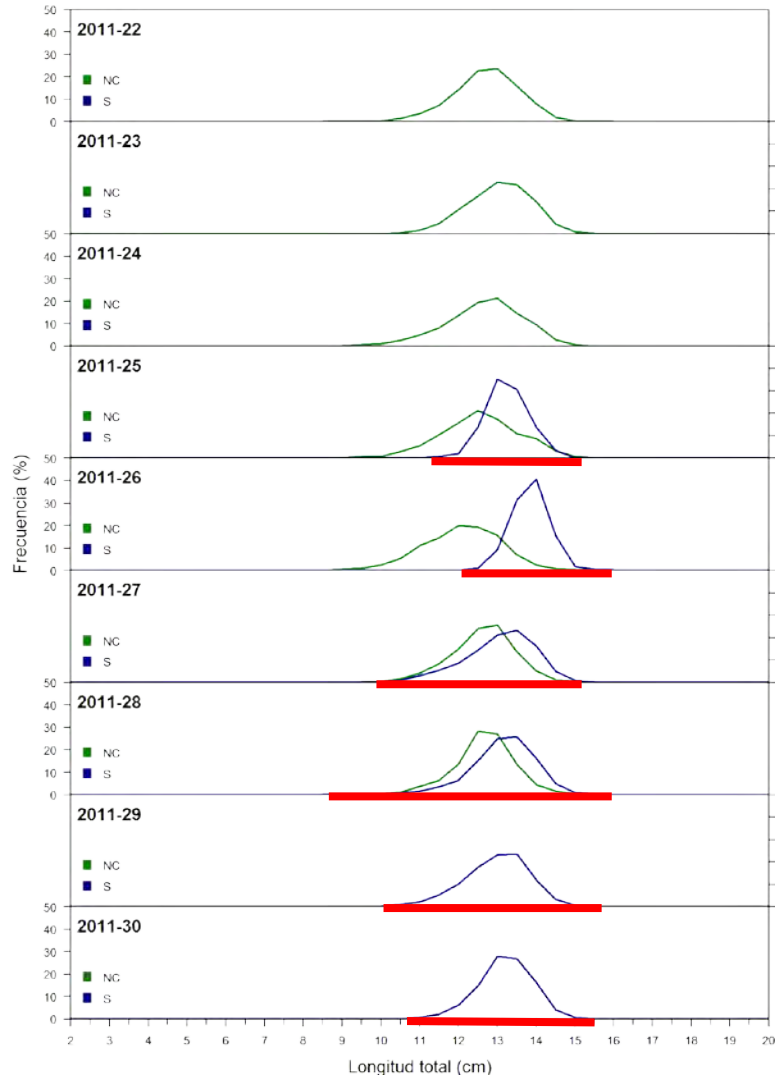
2011_22-30

2012_15-22

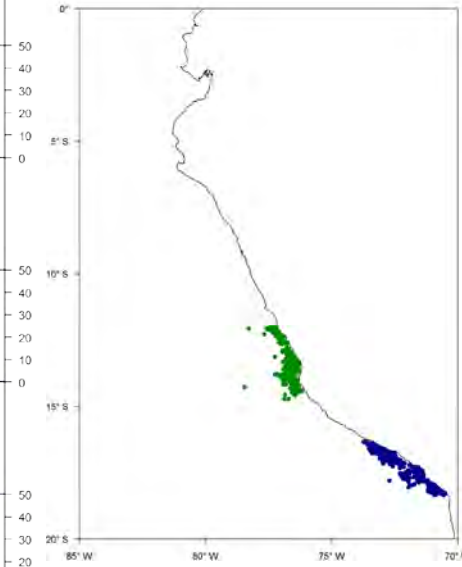
2012_24-30

2014_15-21

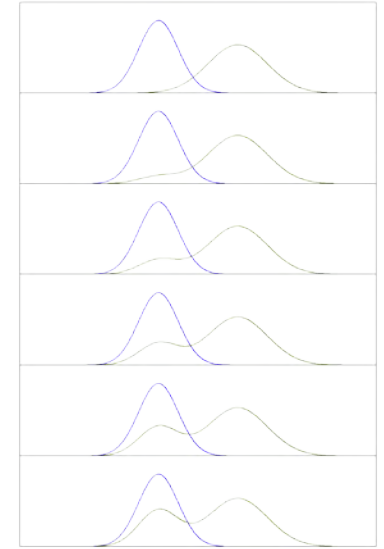
SCENARIO 2



Spatial distribution



Pattern

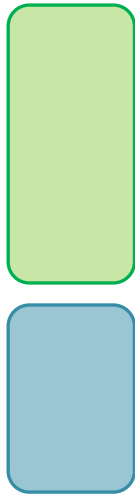


2011_22-30

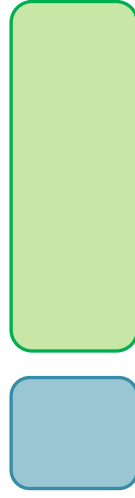
Length range of Southern stock got wider
Length range and mode of NC stock kept constant

Classification: Normal

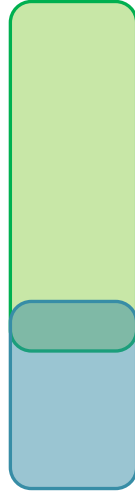
SCENARIOS



Scenario 1



Scenario 2



Scenario 3



Scenario 4

**STUDY
CASES**

■

2010_19-24

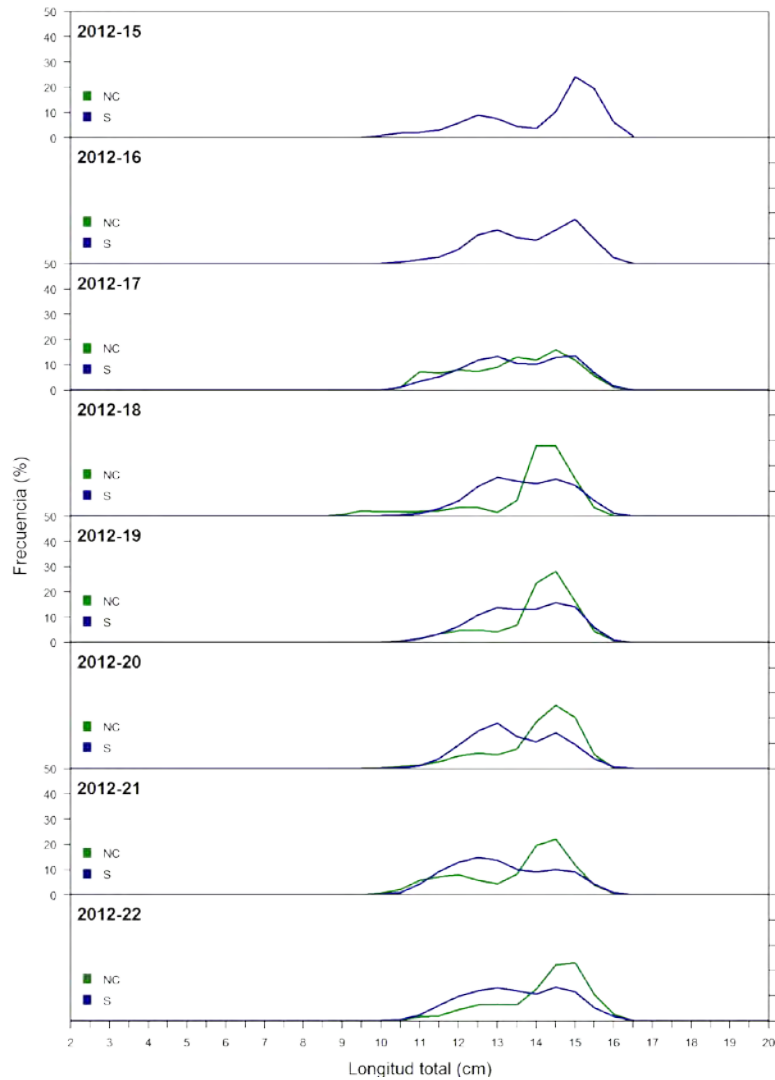
2011_22-30

2012_15-22

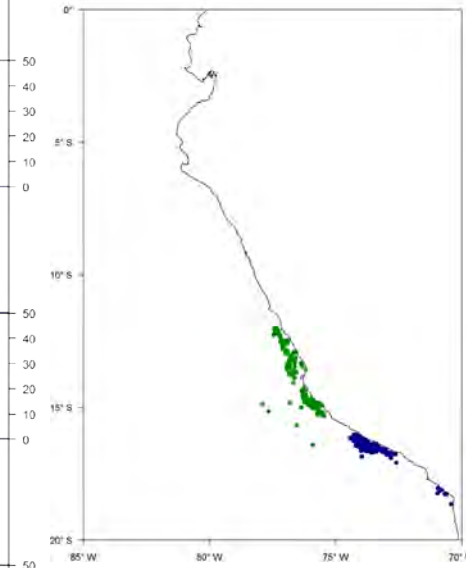
2012_24-30

2014_15-21

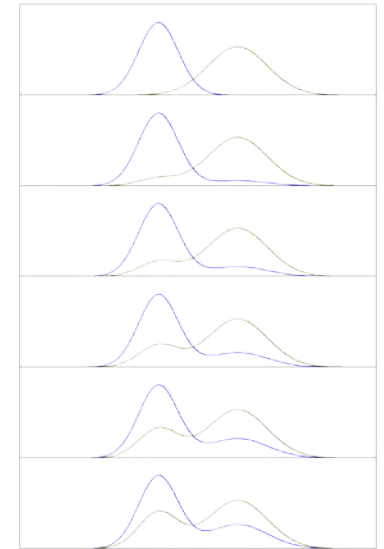
SCENARIO 3



Spatial distribution



Pattern



2012_15-22

Two different modes (cohorts?)

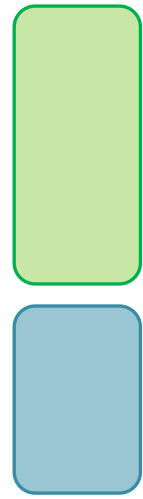
At the end: Same modes

No growth effect

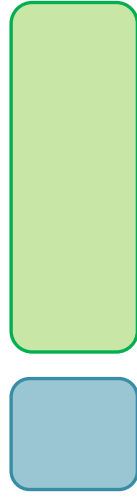
Classification: weak El Niño

**STUDY
CASES**

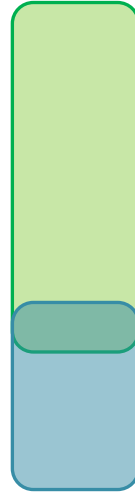
SCENARIOS



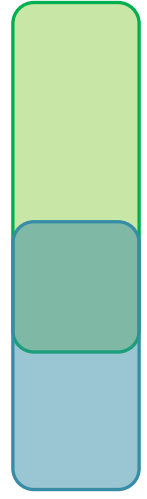
Scenario 1



Scenario 2



Scenario 3



Scenario 4

■

2010_19-24

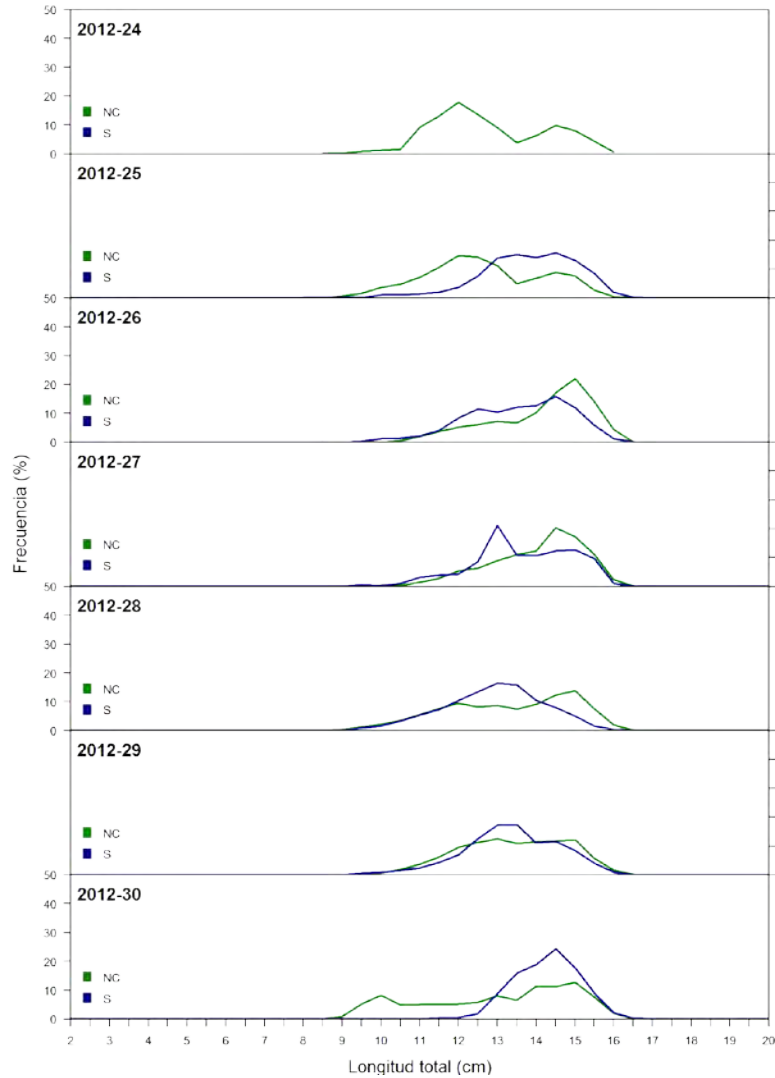
2011_22-30

2012_15-22

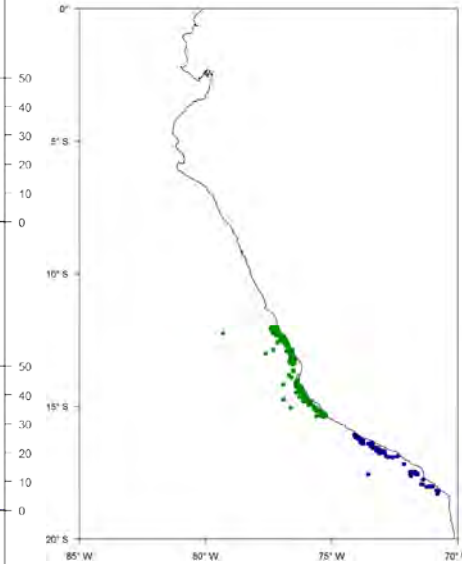
2012_24-30

2014_15-21

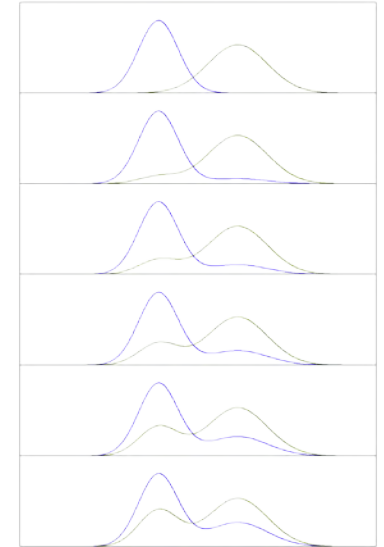
SCENARIO 3



Spatial distribution



Pattern



2012_24-30

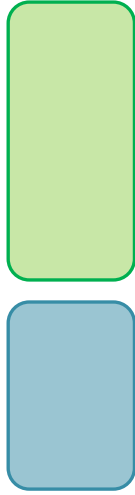
Length range of Southern stock increased
Length range and mode of NC stock kept constant

Classification: weak El Niño

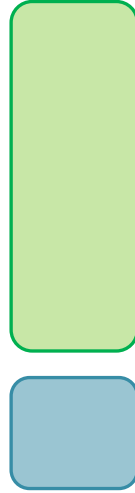
**STUDY
CASES**

SCENARIOS

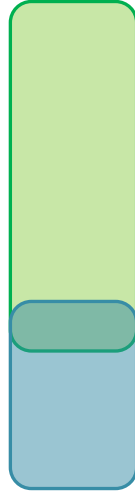
Scenario 1



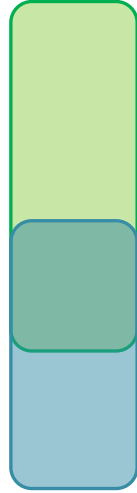
Scenario 2



Scenario 3



Scenario 4



■

2010_19-24

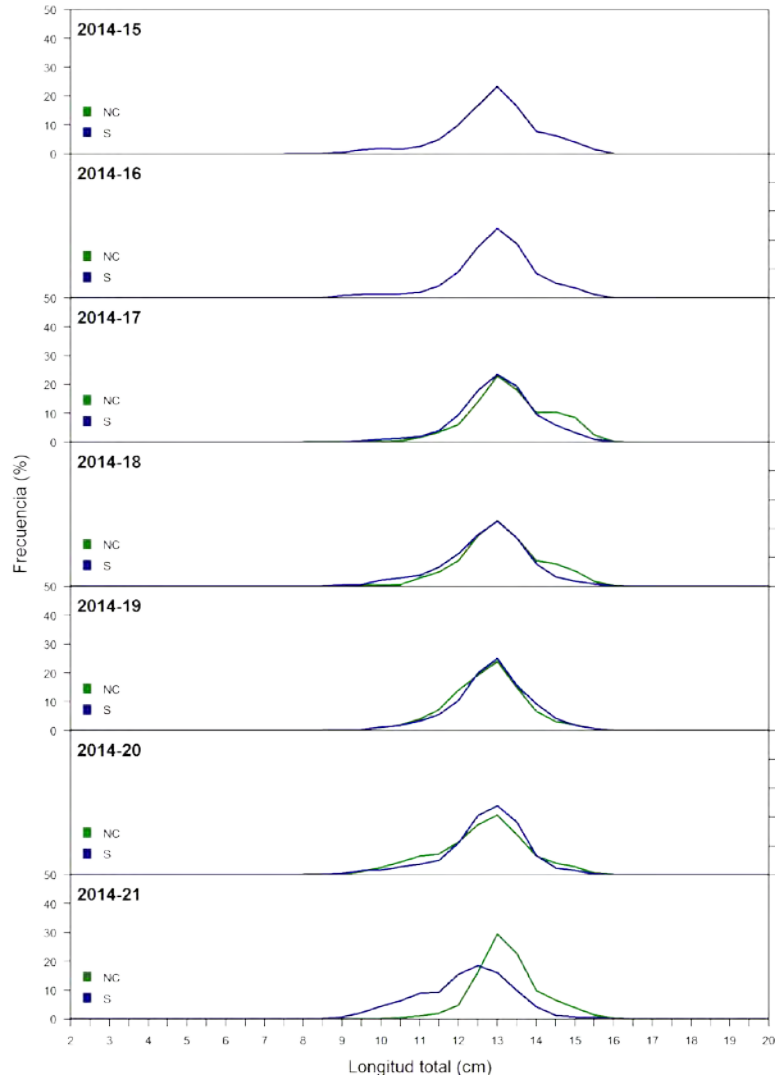
2011_22-30

2012_15-22

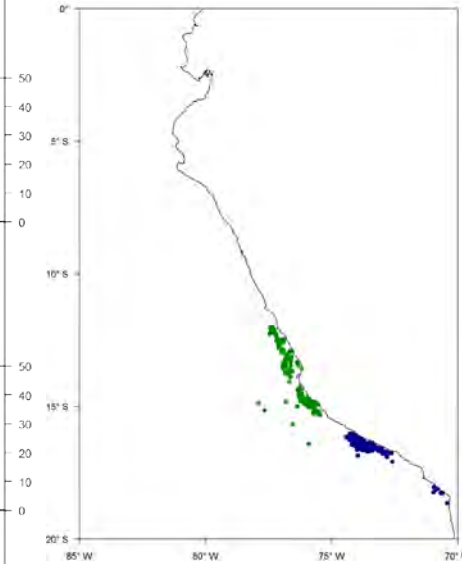
2012_24-30

2014_15-21

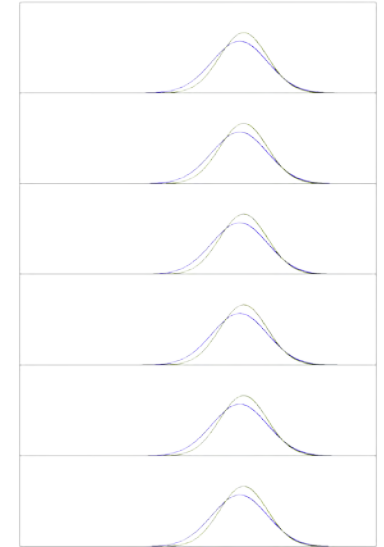
SCENARIO 4



Spatial distribution



Pattern



2014_15-21


Same distribution at the beginning and at the end

Slightly separation at the end

Classification: moderated El Niño

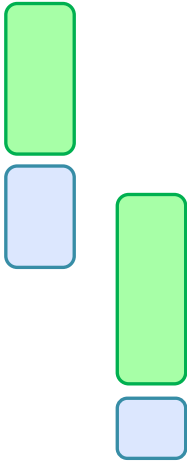
Results summary

Scenarios	Study Cases
1	-



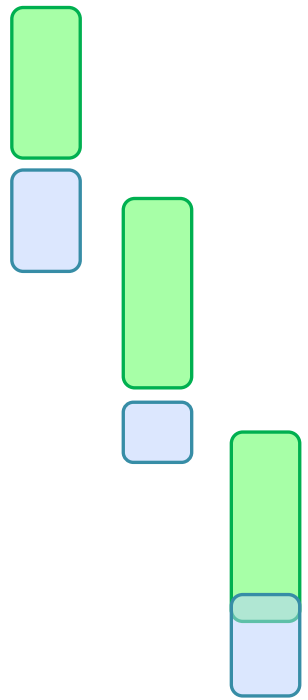
Results summary

Scenarios	Study Cases
1	-
2	2010_19-24
	2011_22-30



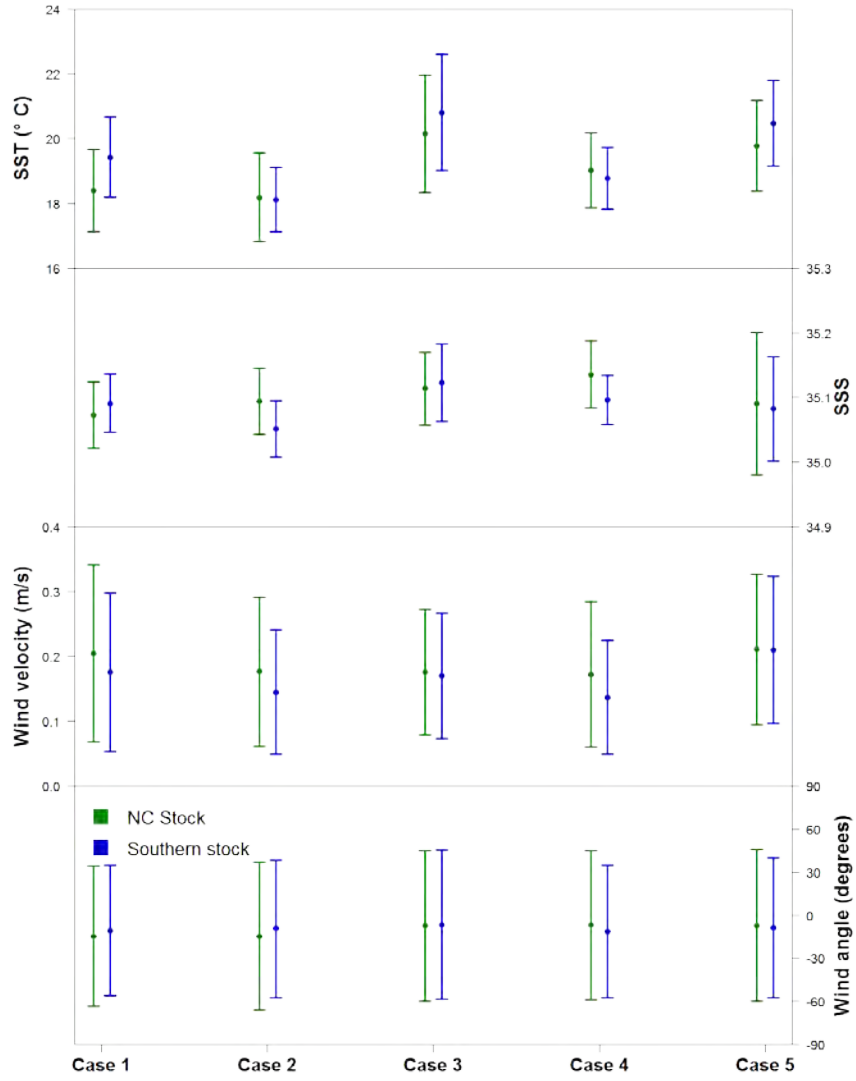
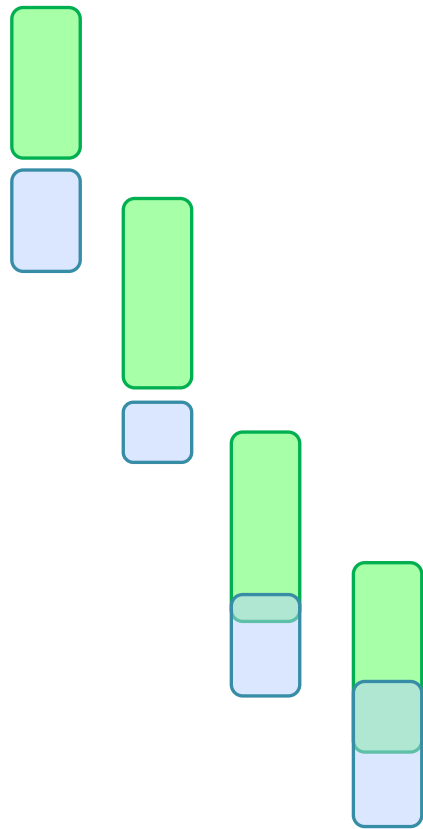
Results summary

Scenarios	Study Cases
1	-
2	2010_19-24
	2011_22-30
3	2012_15-22
	2012_24-30



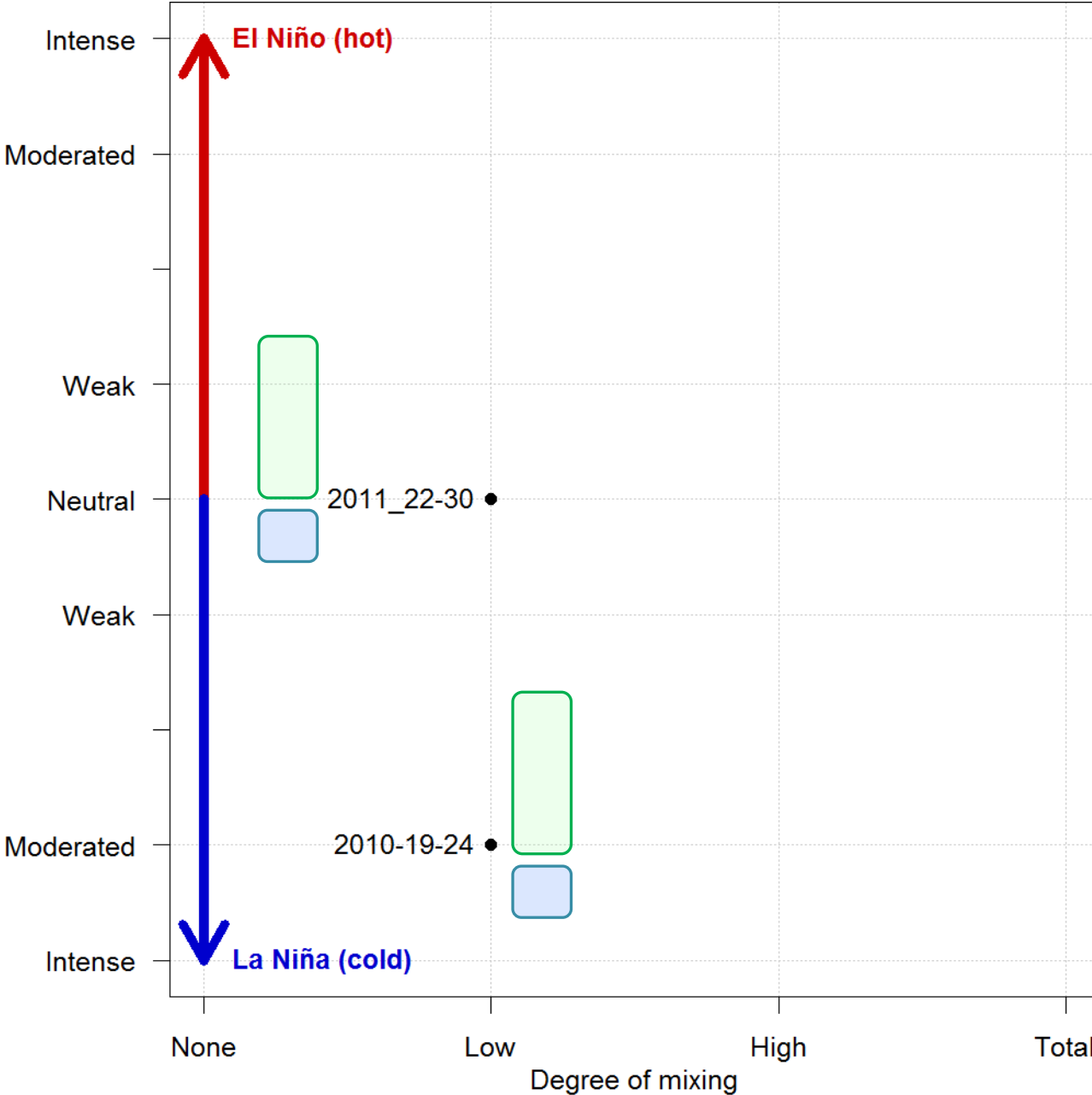
Results summary

Scenarios	Study Cases
1	-
2	2010_19-24
	2011_22-30
3	2012_15-22
	2012_24-30
4	2014_15-21



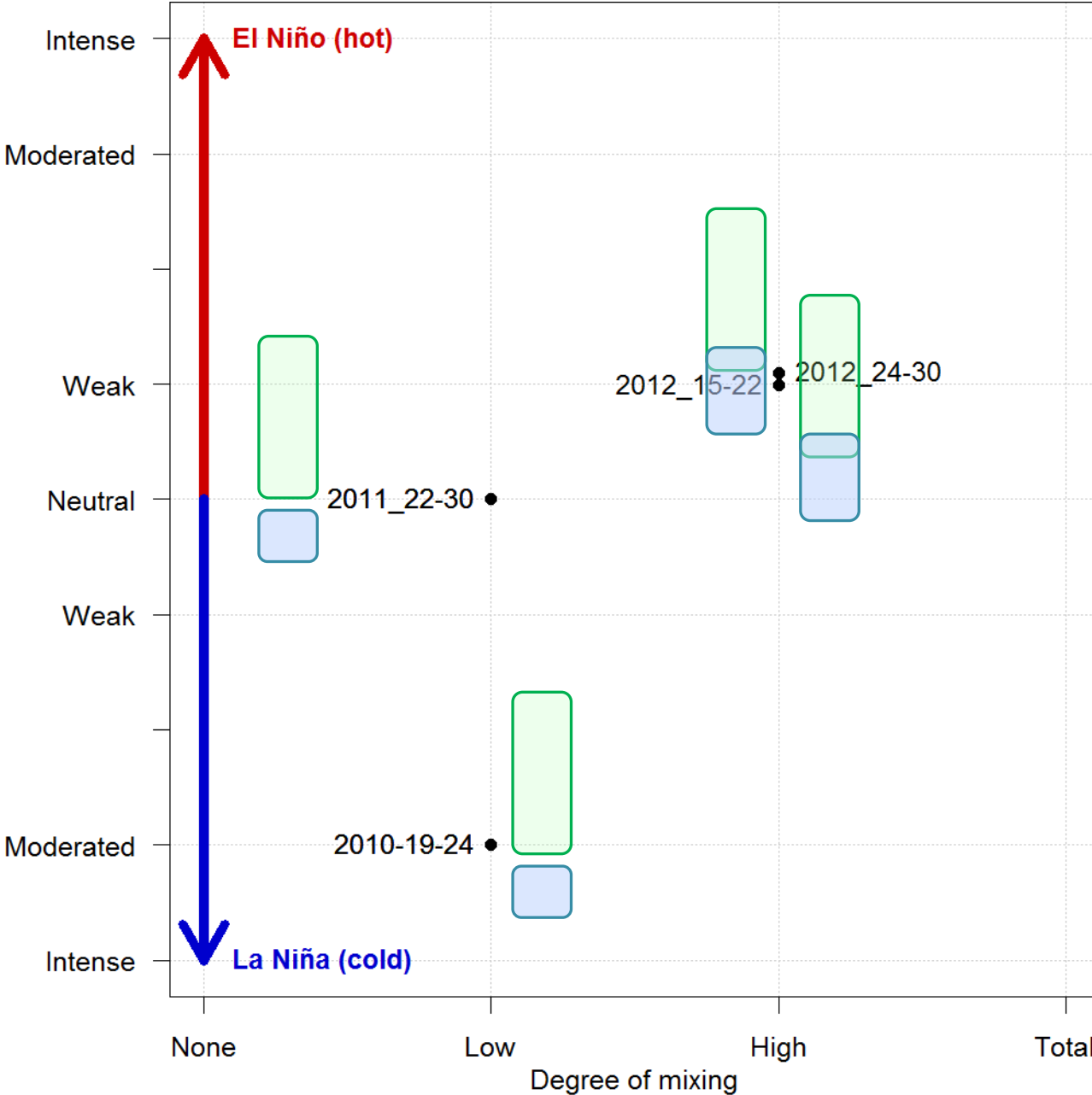
Results summary

Scenarios	Study Cases
1	-
2	2010_19-24
	2011_22-30
3	2012_15-22
	2012_24-30
4	2014_15-21



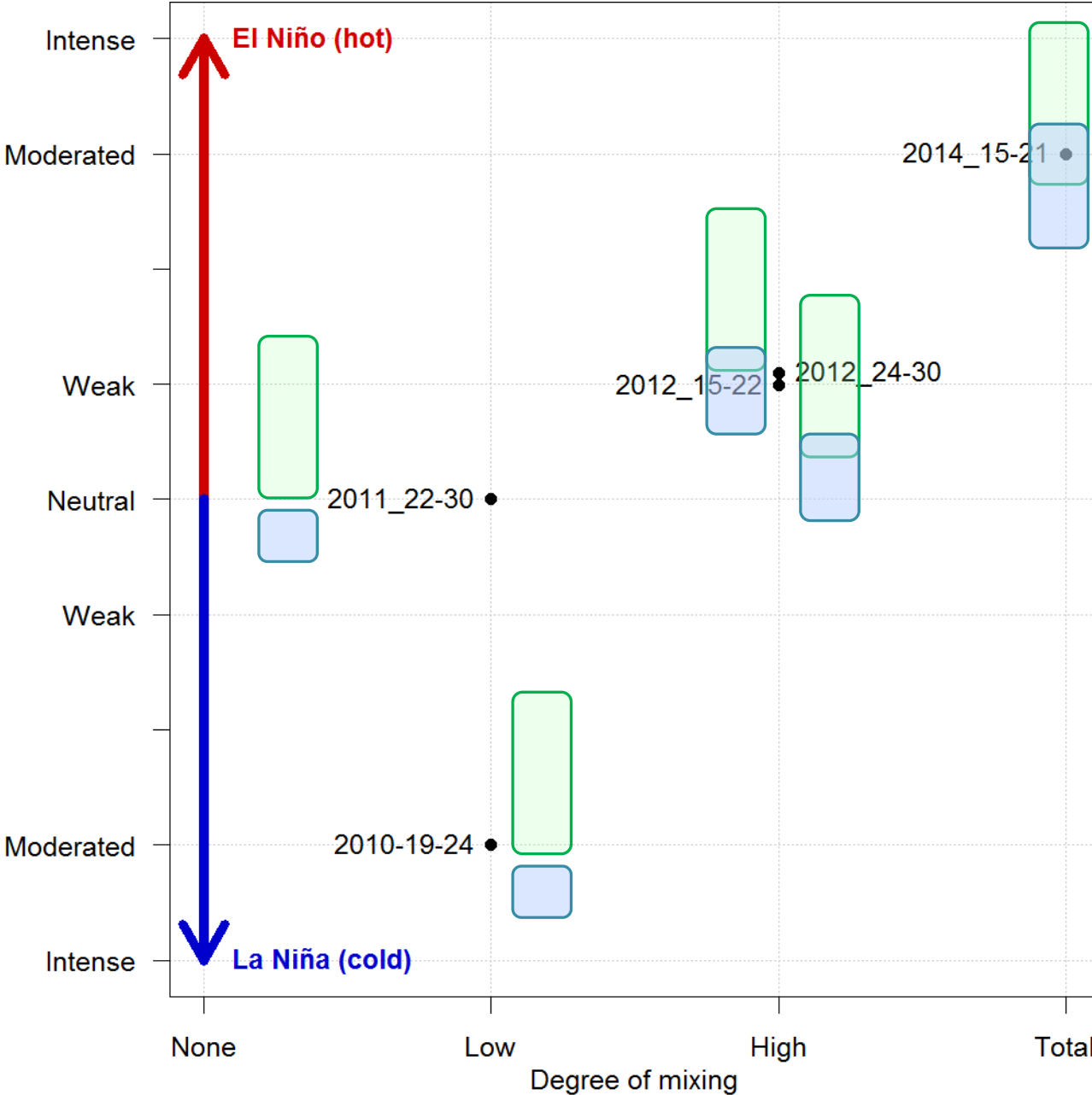
Results summary

Scenarios	Study Cases
1	-
2	2010_19-24
	2011_22-30
3	2012_15-22
	2012_24-30
4	2014_15-21



Results summary

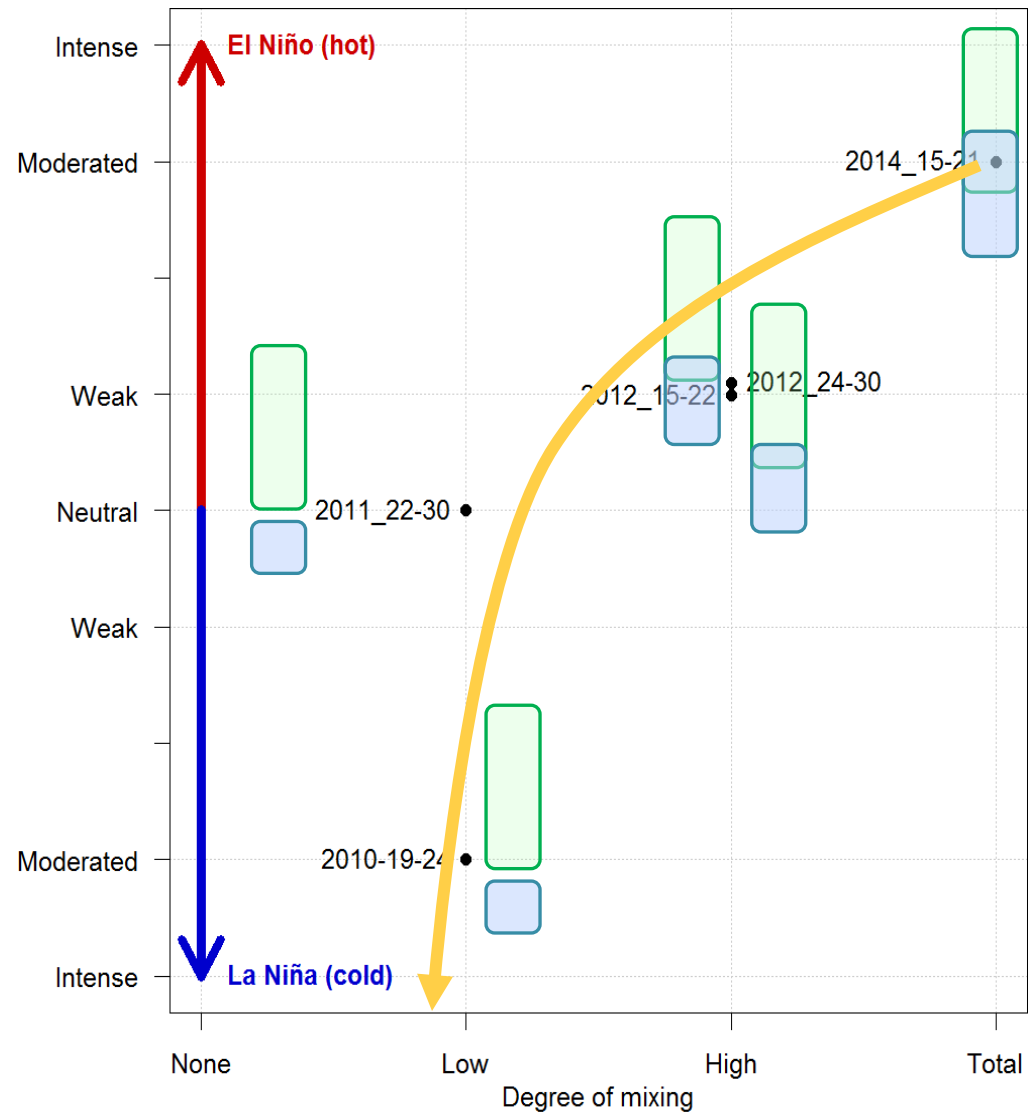
Scenarios	Study Cases
1	-
2	2010_19-24
	2011_22-30
3	2012_15-22
	2012_24-30
4	2014_15-21



PERSPECTIVES

Analysis

- Extend the study period. Cover the periods of intense La Niña.
- Explore new possible patterns of size distribution
- Explore other approaches of interaction with environmental variables (gradients)



PERSPECTIVES

Analysis

- Extend the study period. Cover the periods of intense La Niña.
- Explore new possible patterns of size distribution
- Explore other approaches of interaction with environmental variables (gradients)

Application

- Use this method for stock tracking, as an alternative to mark-recapture methods
- Monitoring and evaluation of stocks of different species, but with difficult identification (e.g. hake).
- Make the exercises with Southern Peruvian stock with Stock North of Chile



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FRANCE



Thank you

Listeners and collaborators