Aggregation habitat variation of pacific saury and its influence factors based on HSI model

Chuanxiang Hua

2019-10-16

CONTENT

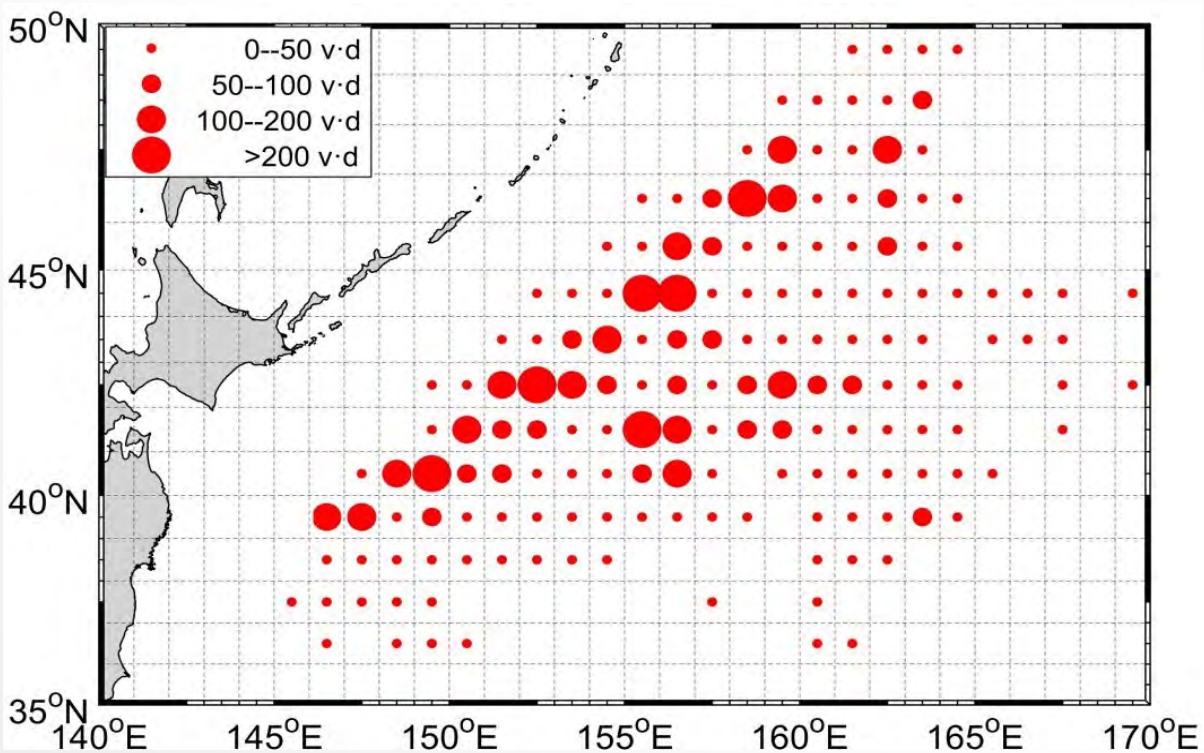
1. Introduction
2. Material and methods
3. Results
4. Discussion
5. Summary

1. INTRODUCTION

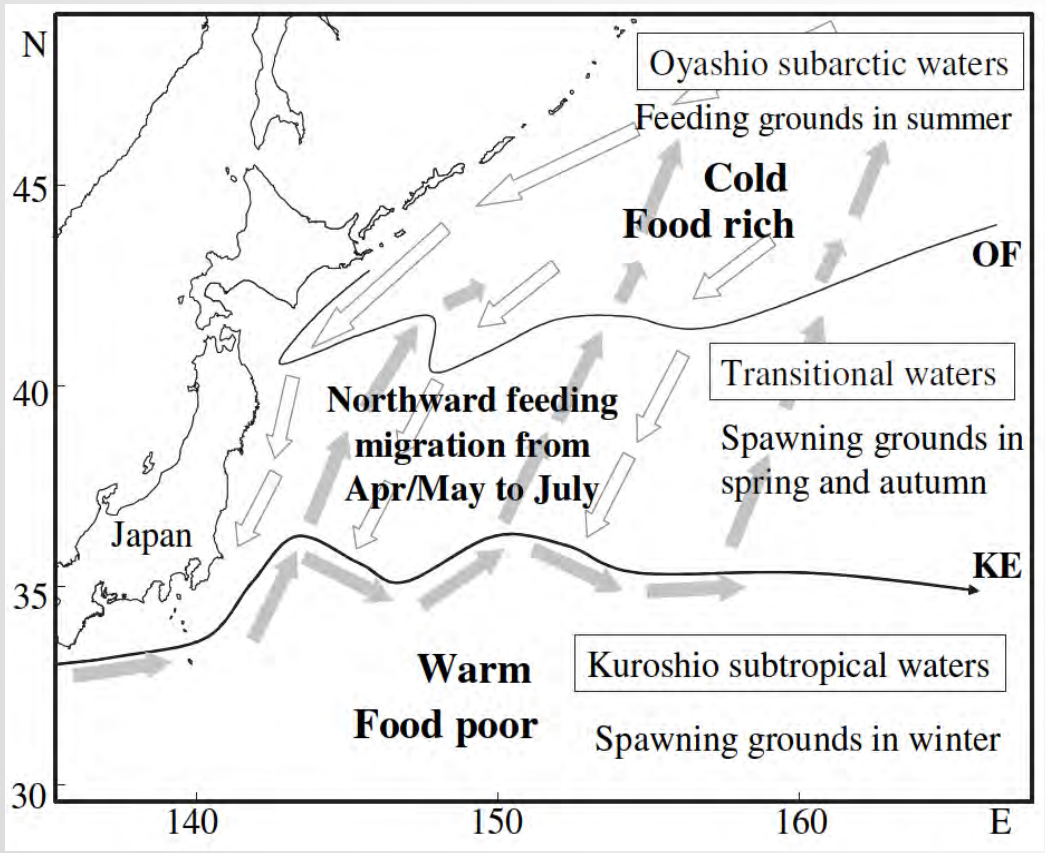
There are about 60 China’s PS fishing vessels operated in the NWP.

The fishing area mainly distributed outside of Japan/Russia’s EEZ .

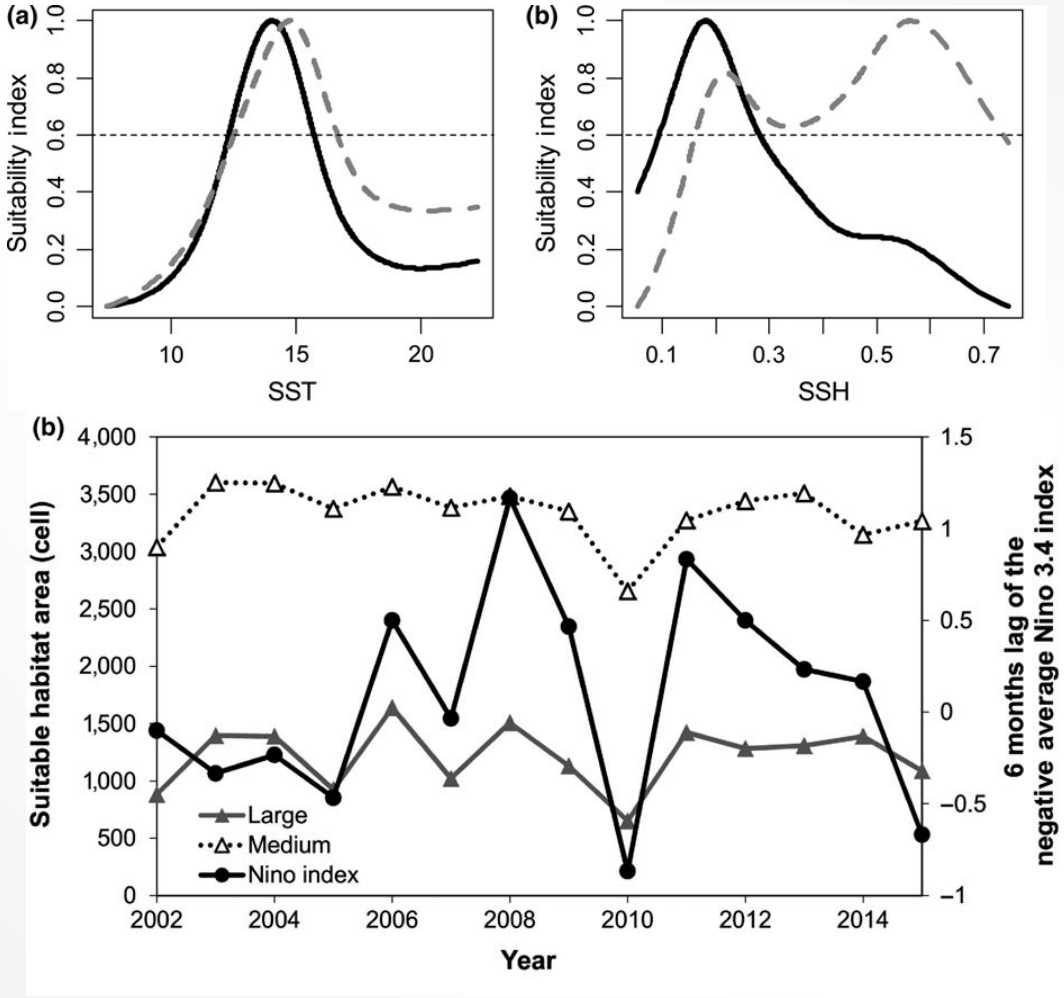
Main fishing season: June to November



1. INTRODUCTION

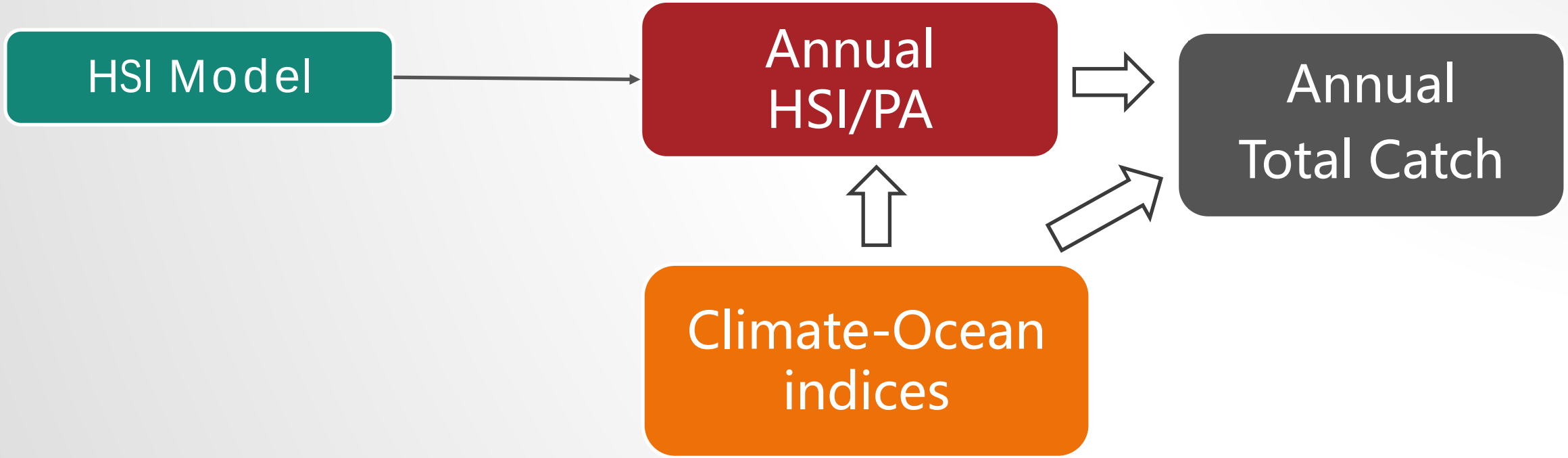


(*Kurita, et al, 2004 ； Tian, et al, 2003*)



(*Chang, et al, 2018*)

1. INTRODUCTION



（PA: potential suitable habitat area）

CONTENT

1. Introduction
2. Material and methods
3. Results
4. Discussion
5. Summary

2. MATERIAL AND METHODS

HSI Model

- Fishing Data
- Oceanographic Data
  (2003-2017)

$$SI_{v,i} = \frac{Effort_i}{Effort_{max}}$$

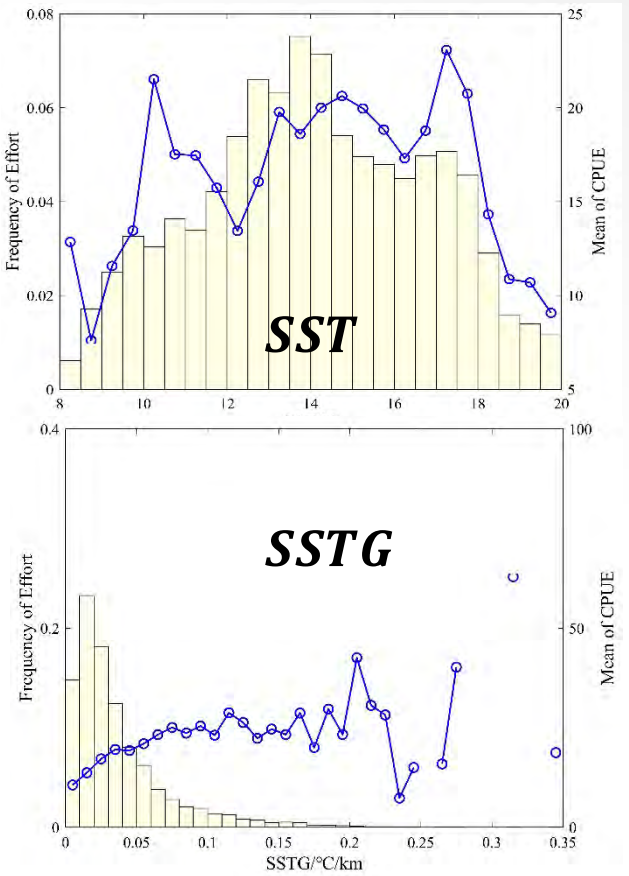
- Yield-Density Model (SI)
  (Reciprocal of binomial)

$$y = \frac{1}{(a + bx + cx^2)}$$

- Weighted arithmetic mean model (WAMM)

$$HSI = SI_{sst} \bullet W_{sst} + SI_{sstg} \bullet W_{sstg}$$

BRT



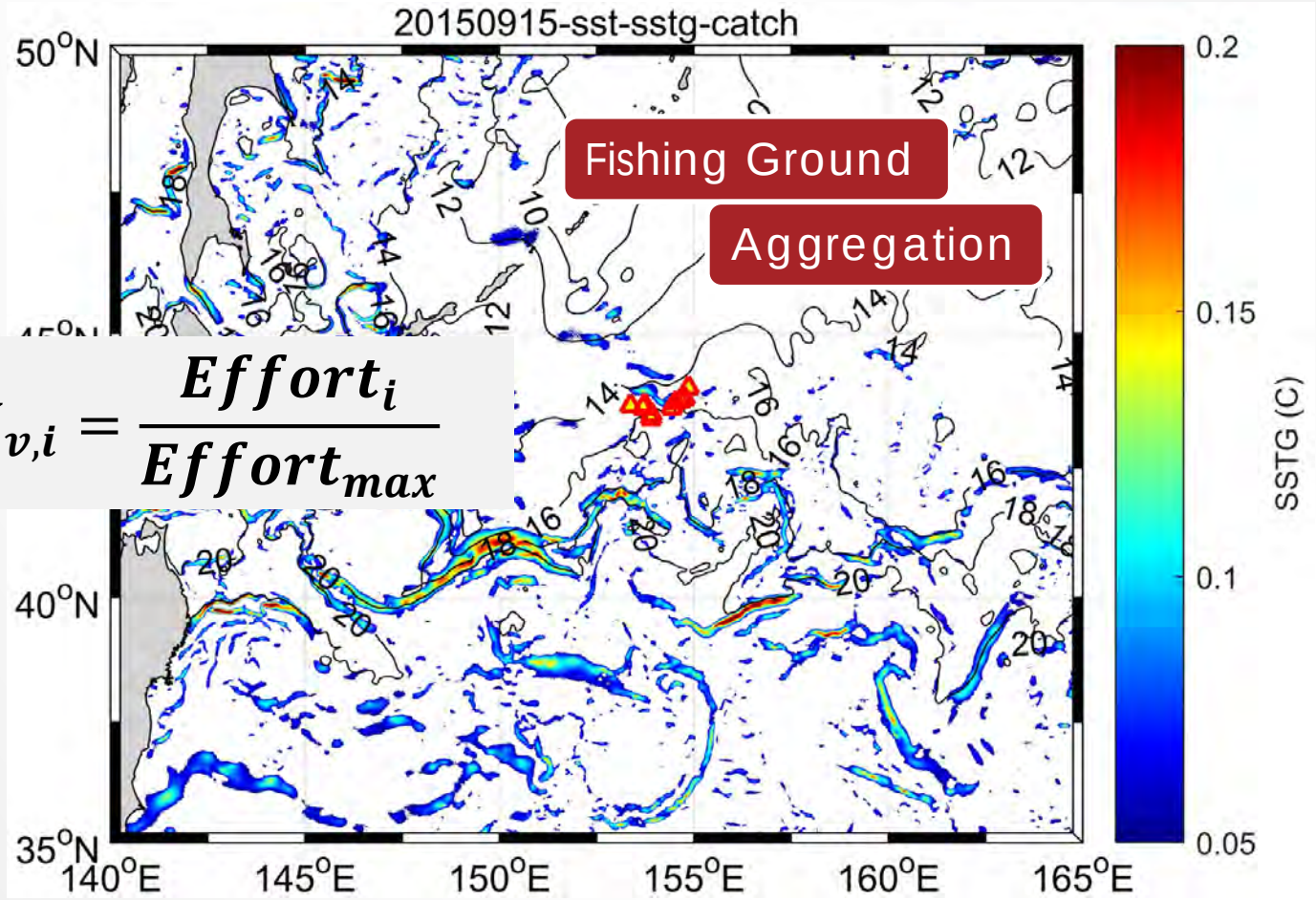
(Hua, et al, online)

2. MATERIAL AND METHODS

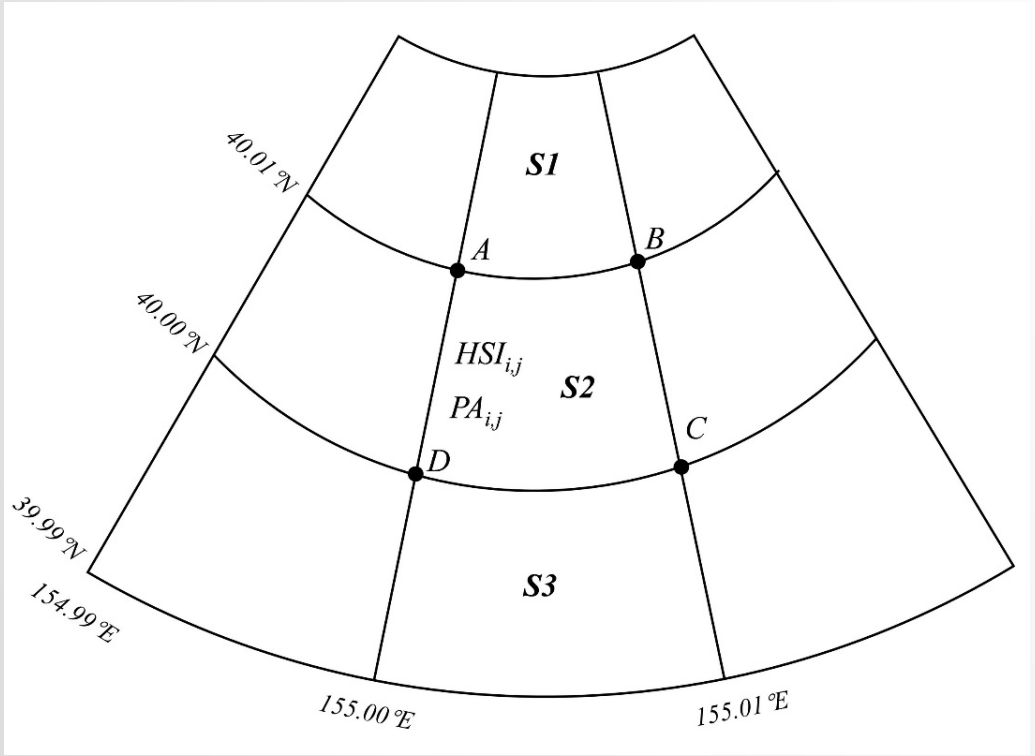
HSI Model

- Fishing Data
- Oceanographic Data
  (2003-2017)

$$SI_{v,i} = \frac{Effort_i}{Effort_{max}}$$



2. MATERIAL AND METHODS



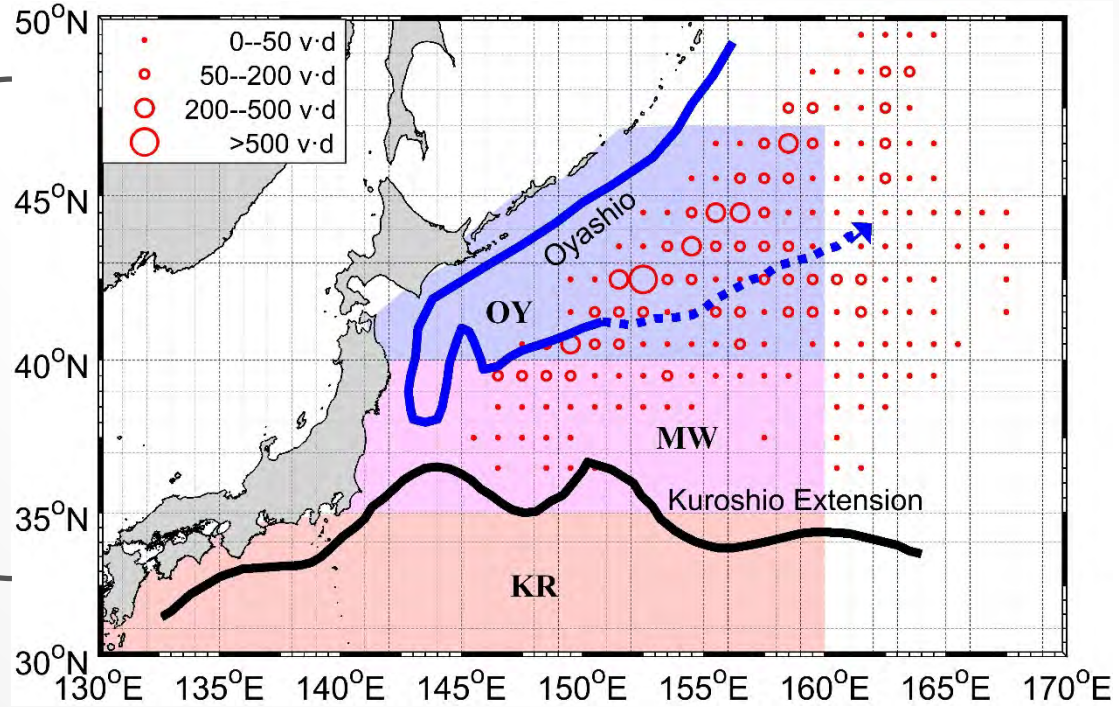
Potential suitable habitat area (km²) (*PA*)

- HSI ≥ 0.6
- WGS84

Annual HSI/PA

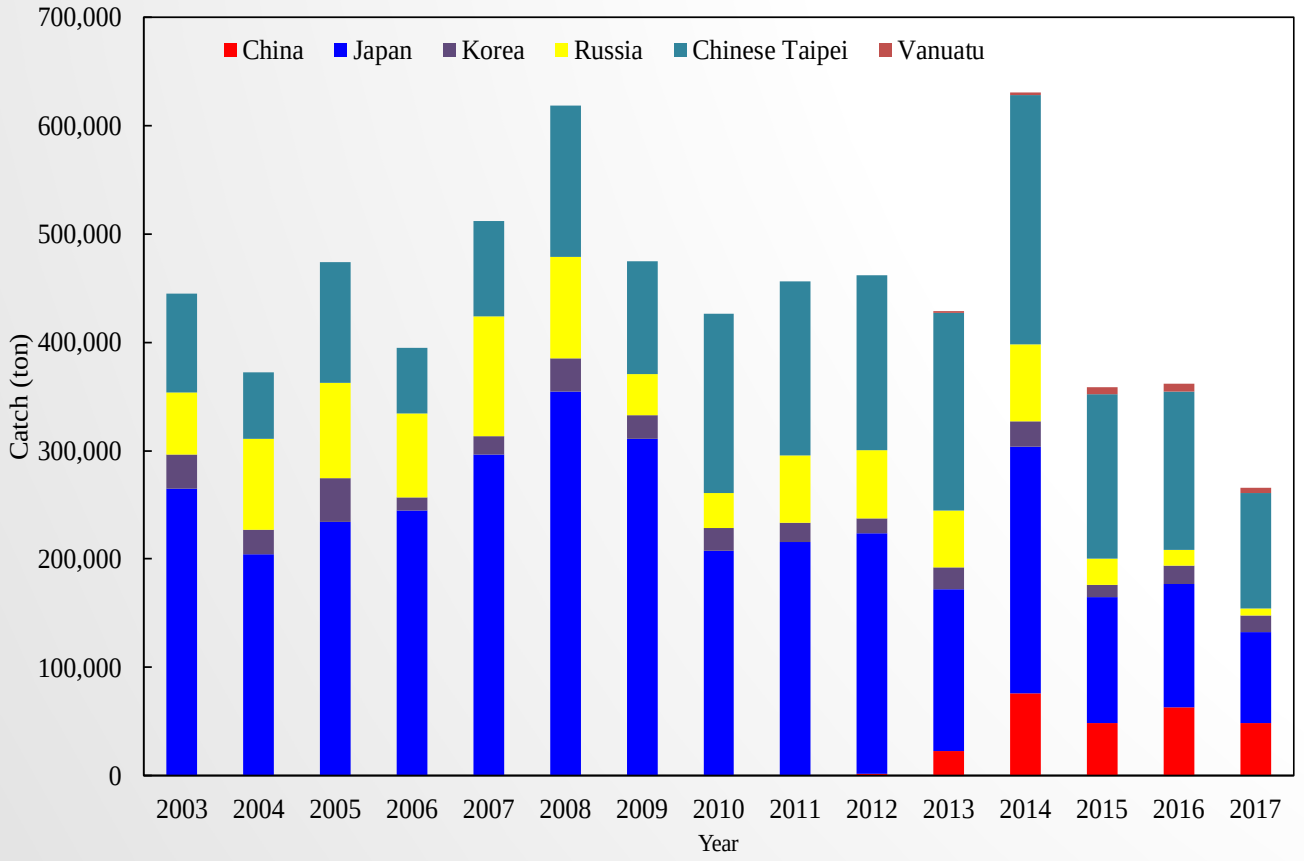
- HSI FA
- HSI OY
- HSI MW
- HSI KR

- PA FA
- PA MW
- PA OY
- PA KR



(*Ito, et al, 2007*)

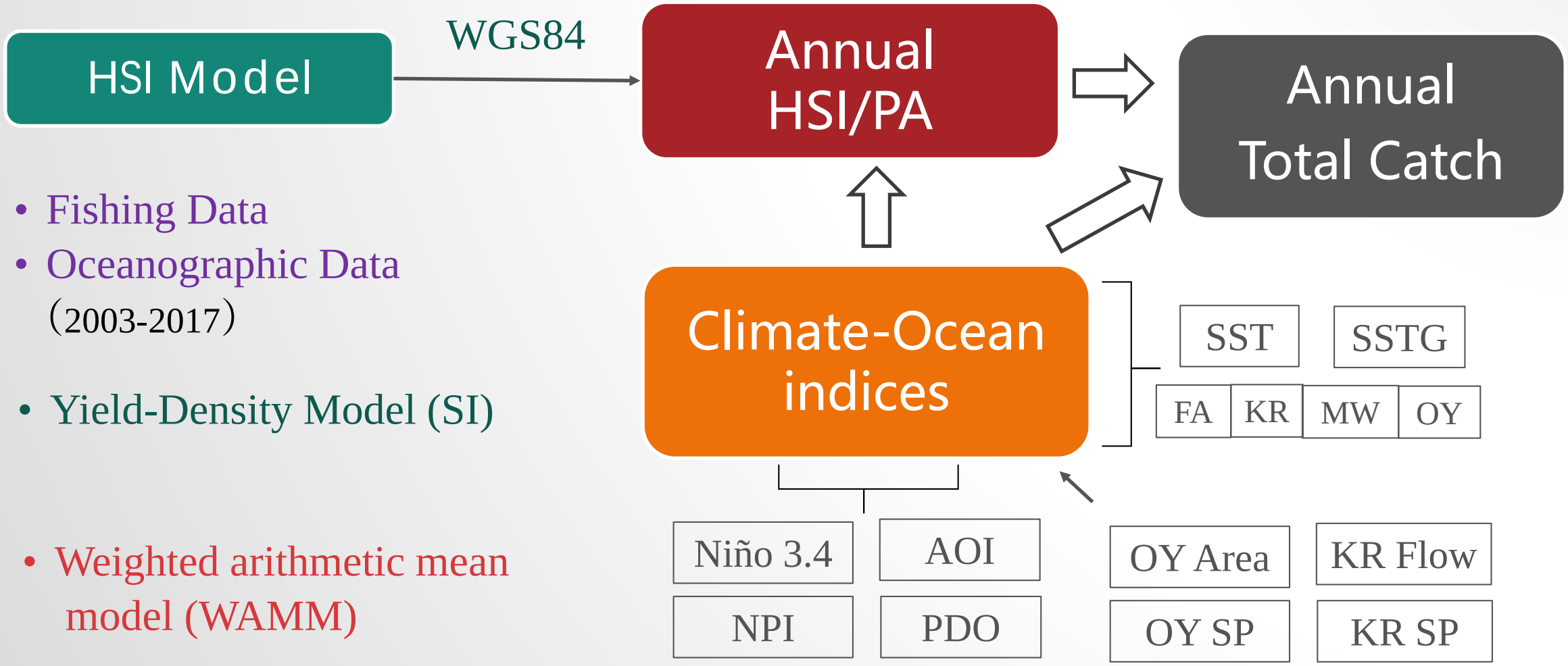
2. MATERIAL AND METHODS



Annual Total Catch

Annual Total Catch (*NPFC website,2018*)

2. MATERIAL AND METHODS



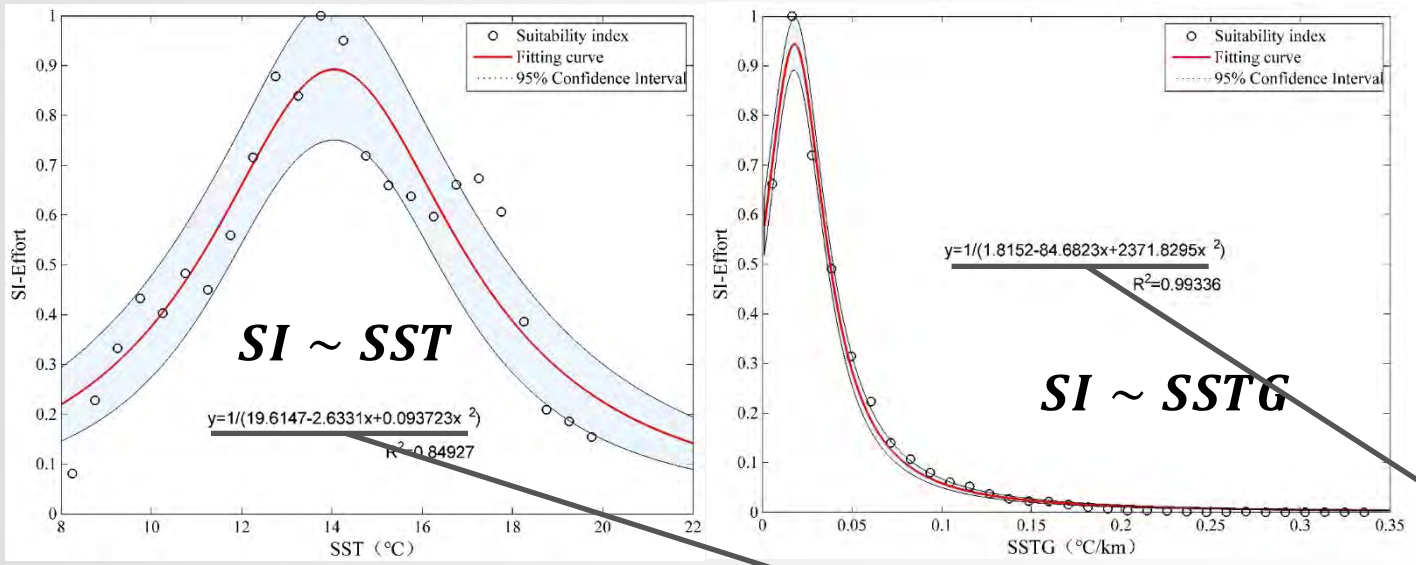
- Fishing Data
- Oceanographic Data (2003-2017)
- Yield-Density Model (SI)
- Weighted arithmetic mean model (WAMM)

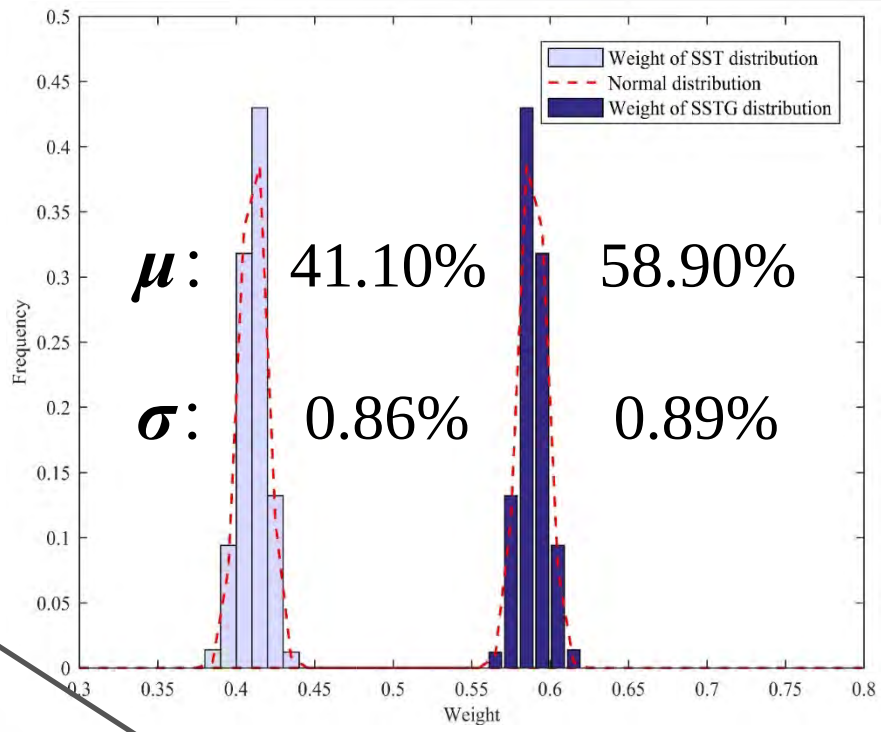
CONTENT

1. Introduction of Pacific saury fishery in Chinese mainland
2. Material and methods
3. Results
4. Discussion
5. Summary

3. RESULTS

HSI Model



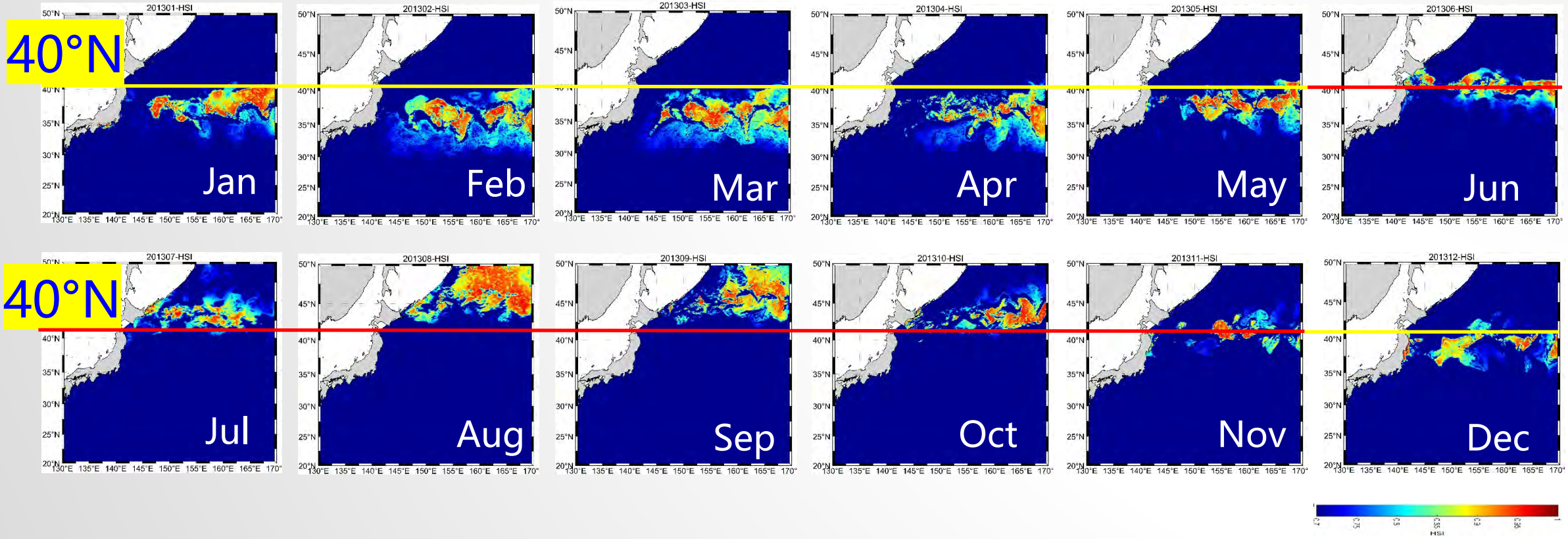


Variable	Unit	Opt	95% CI	
SST	℃	**14.05**	14.02	14.07
SSTG	℃/km	**0.0179**	0.0178	0.0181

$$HSI = \widehat{SI}_{sst} \bullet 41.10\% + \widehat{SI}_{sstg} \bullet 58.90\%$$

3. RESULTS

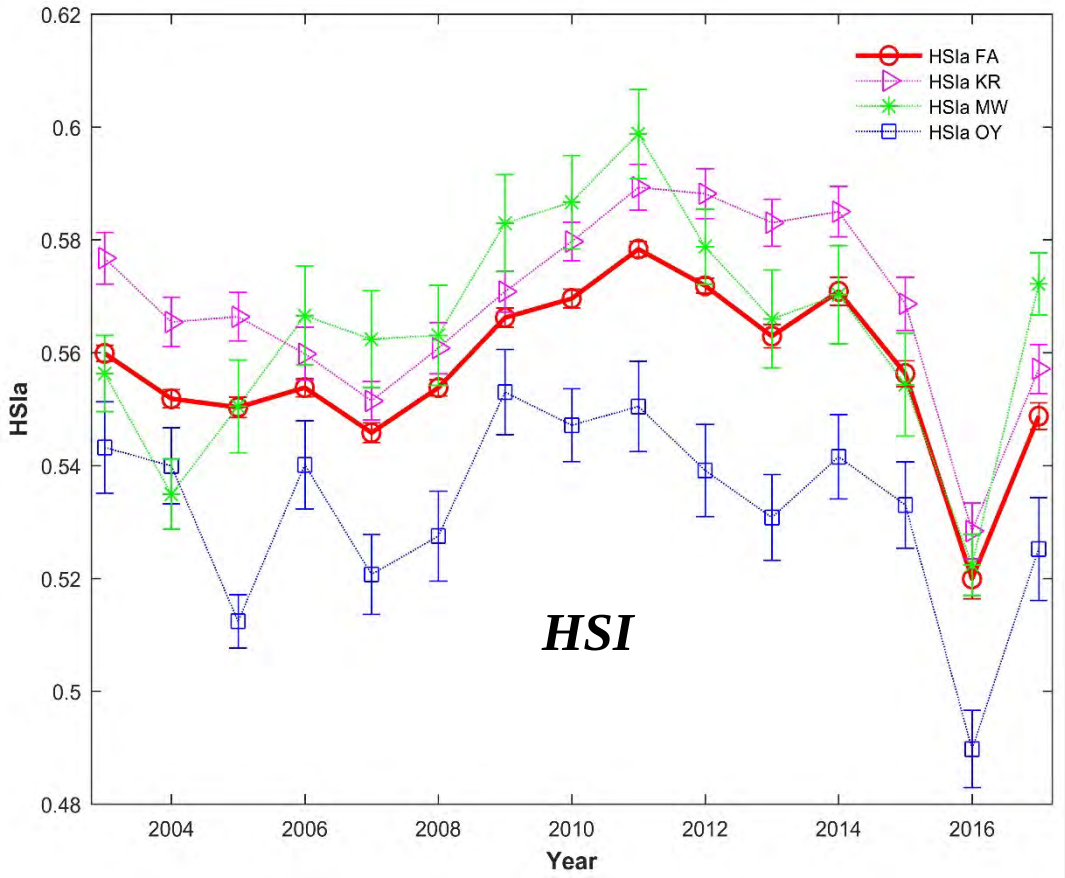
Monthly distribution of HSI

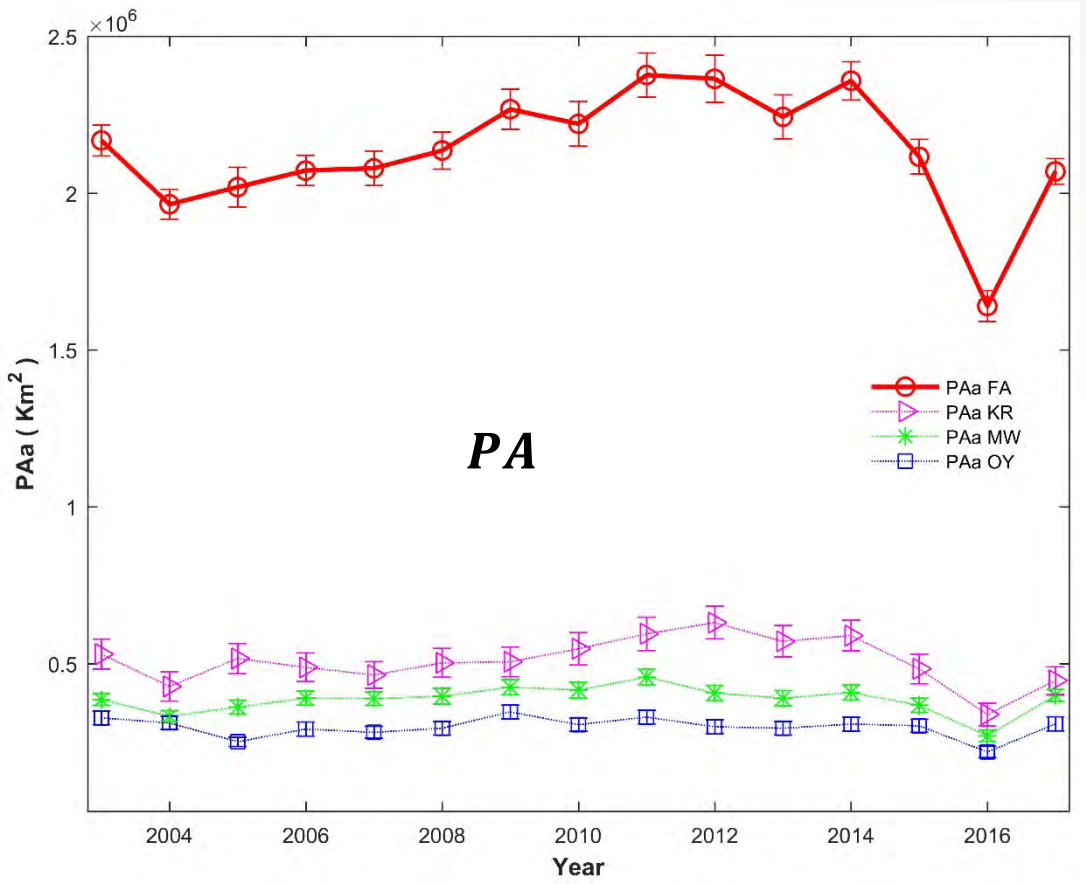


- In Winter and Spring, High HSI（HSI≥0.6）area, distributed in MW, southern 40°N
- In main fishing season: northern ward in Jun-Aug Southern ward Sep-Nov northern 40 °N

3. RESULTS

Annual variation of HSI / PA



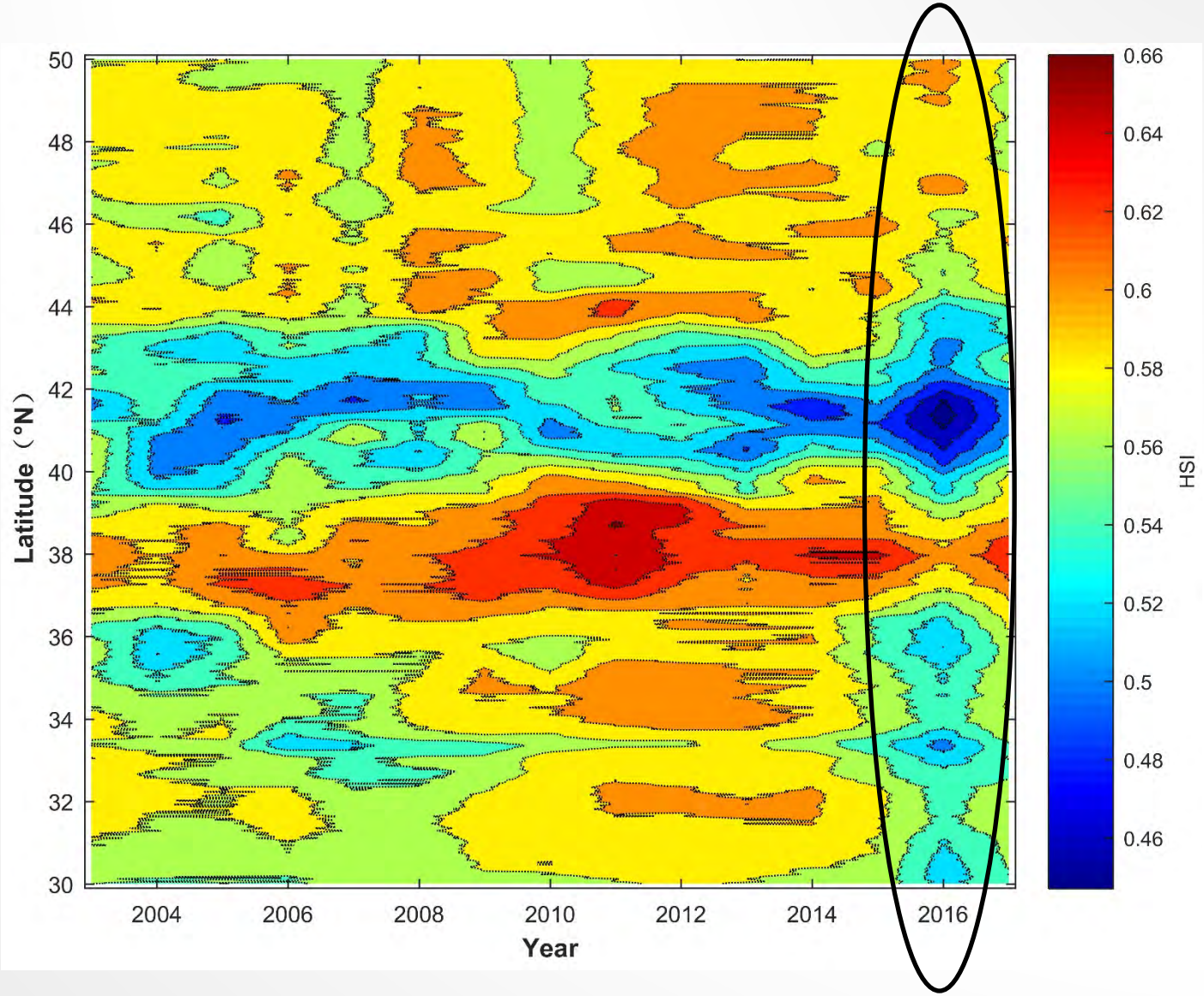


- In 2016, the value of annual FA/PA was significantly lower than other years.

3. RESULTS

Annual variation of HSI

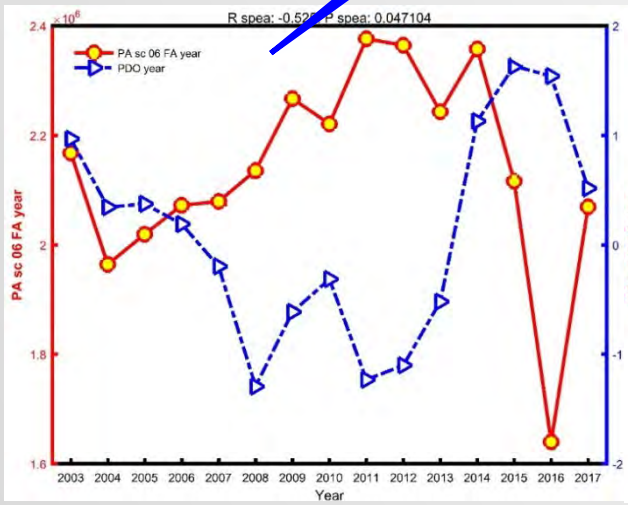
- In latitude direction, the value of annual HSI value in 2016 is significantly lower than other years.

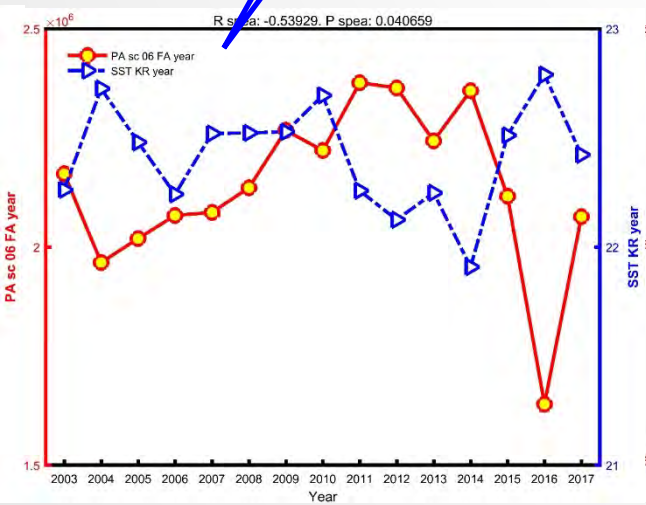


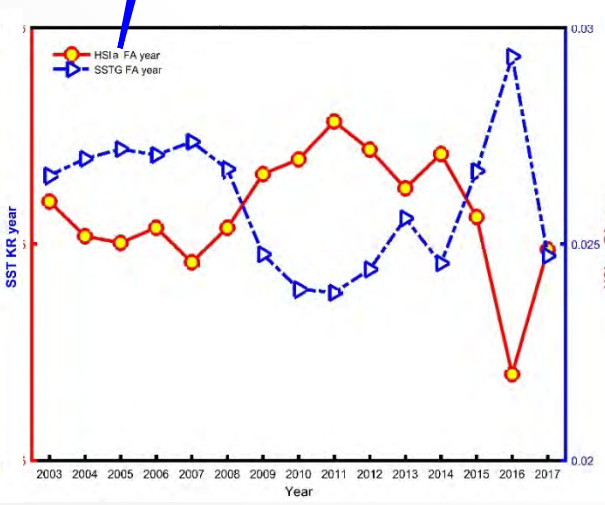
3. RESULTS

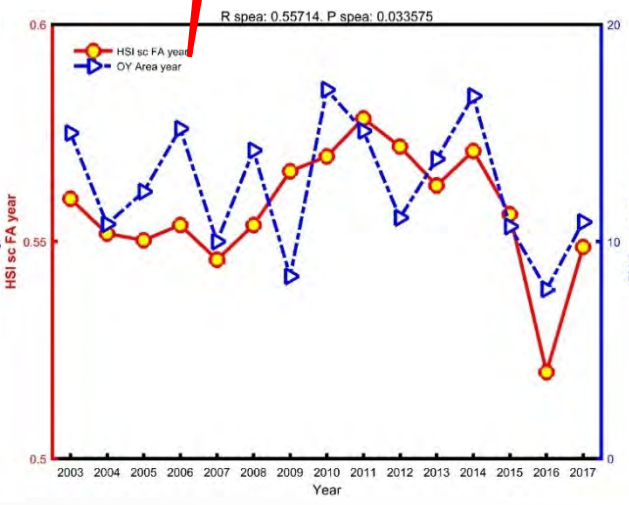
The relationship between yearly HSI/PA and climate-ocean indices

		Nino 3.4	NPI	PDO	AOI	SST FA	SST KR	SST MW	SST OY	SSTG FA	SSTG KR	SSTG MW	SSTG OY	OY Area	OY SP	KR SP
HSI	FA									-0.850	-0.718	-0.746	-0.825	0.557		0.527†
	KR						-0.536			-0.807	-0.739	-0.668	-0.750	0.571		
	MW	-0.536†		-0.586						-0.850	-0.746	-0.954	-0.725			
	OY									-0.675	-0.550	-0.586	-0.825			0.649†
PA	FA			-0.525			-0.539			-0.811	-0.679	-0.821	-0.679			
	KR						-0.657			-0.725	-0.632	-0.721	-0.704	0.625		
	MW			-0.589						-0.832	-0.721	-0.939	-0.711			
	OY									-0.682	-0.696	-0.529	-0.575			





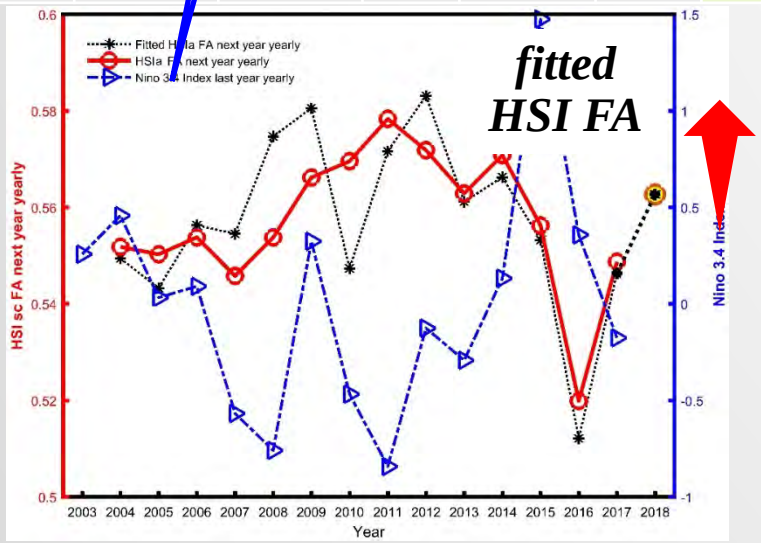


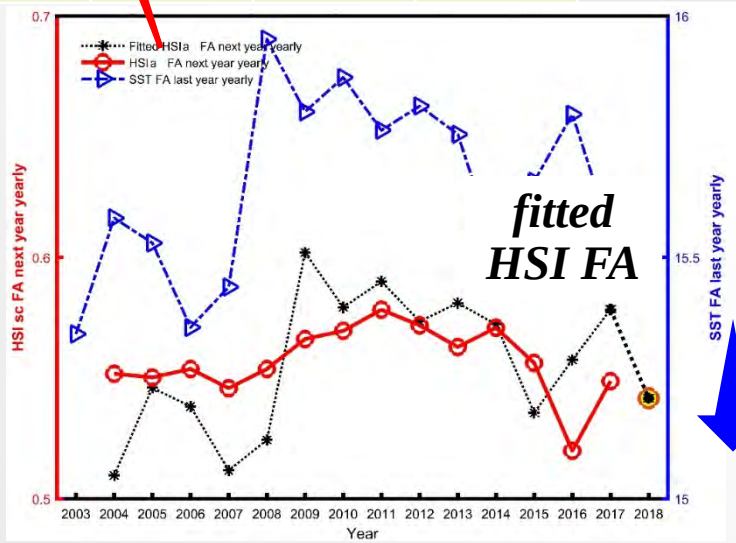


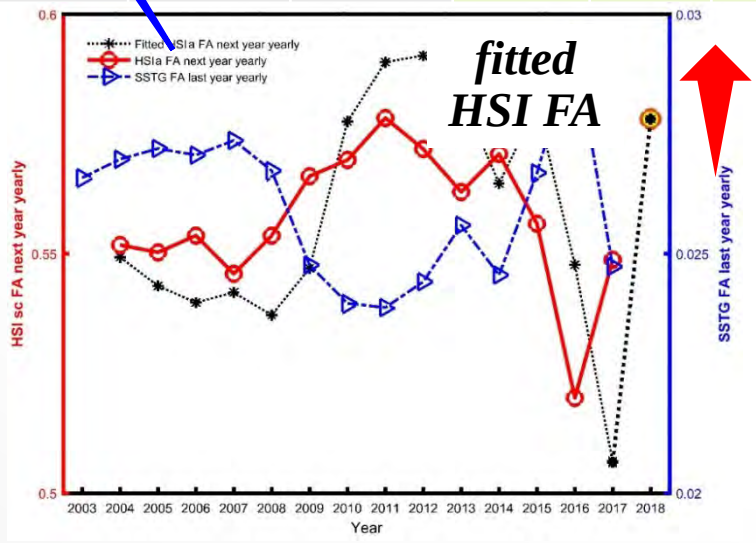
3. RESULTS

The relationship between yearly HSI/PA and last year's climate-ocean indices

		Nino 3.4	NPI	PDO	AOI	SST FA	SST KR	SST MW	SST OY	SSTG FA	SSTG KR	SSTG MW	SSTG OY	OY Area	OY SP	KR SP
HSI	FA	-0.688		-0.741		0.578			0.543	-0.710	-0.666	-0.864	-0.631			
	KR	-0.582		-0.732		0.577				-0.798	-0.745	-0.864	-0.741			
	MW	-0.543		-0.653		0.754		0.626†	0.688							
	OY	-0.556		-0.582								-0.604				
PA	FA	-0.820		-0.824		0.600			0.600	-0.591		-0.820	-0.556			
	KR	-0.626		-0.807		0.569				-0.613	-0.565	-0.727	-0.684			
	MW	-0.626		-0.684		0.705		0.666	0.640							
	OY							0.574								



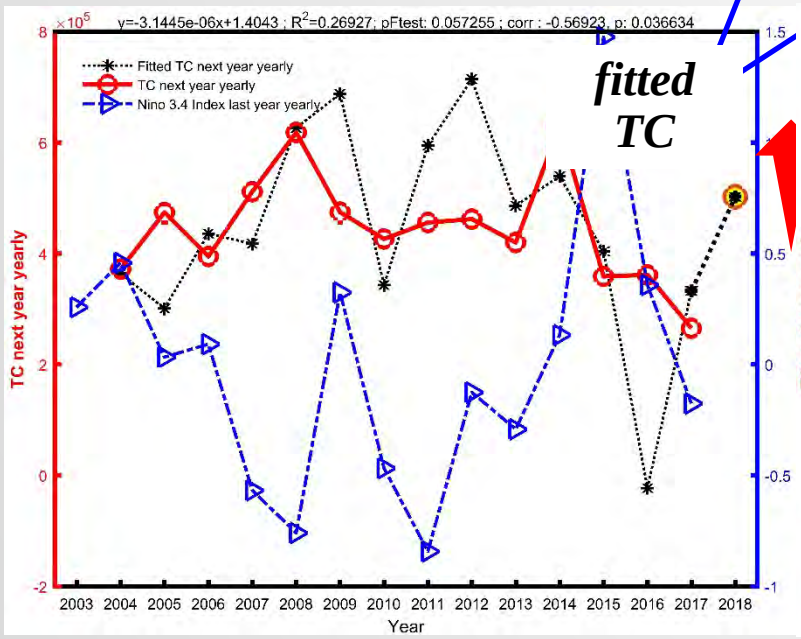


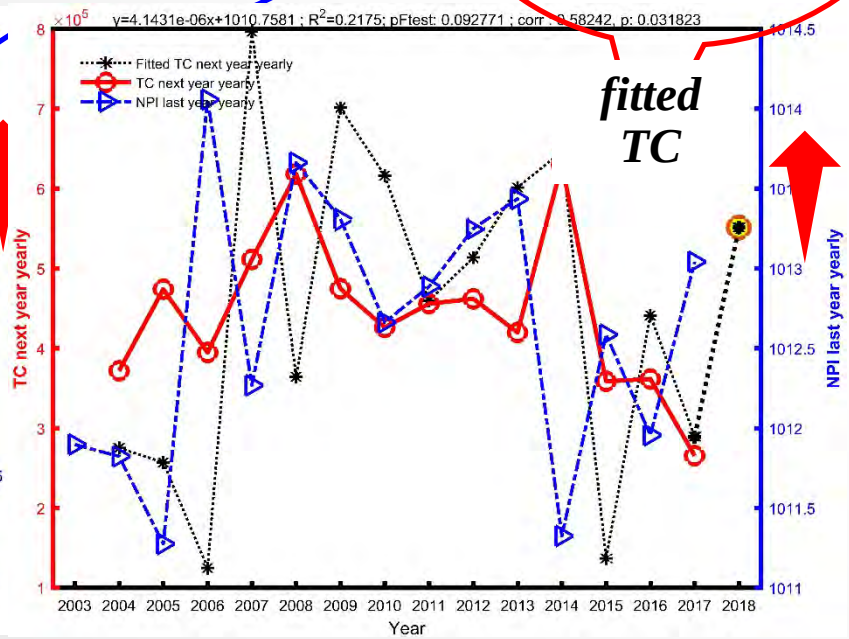


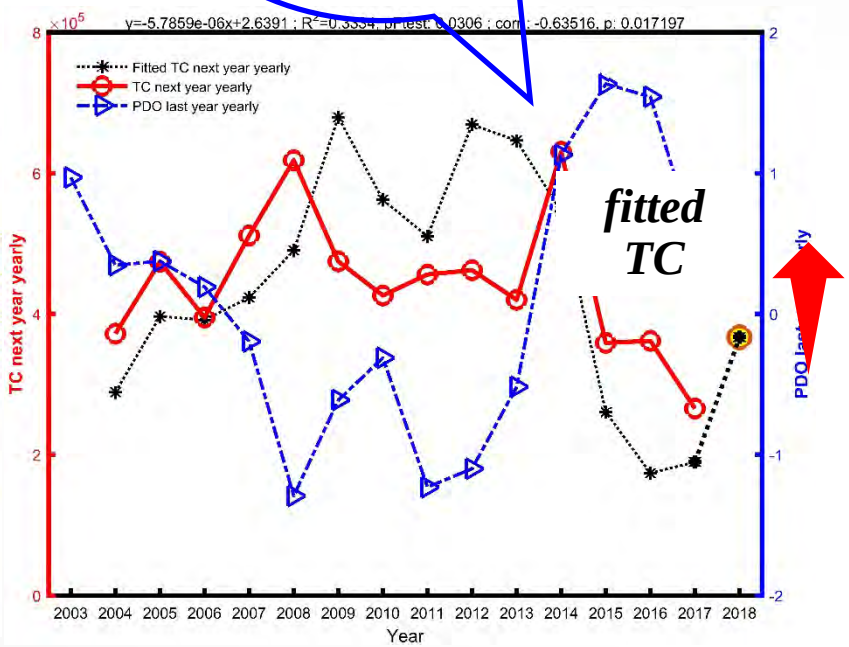
3. RESULTS

The relationship between TC and last year's HSI/PA/climate-ocean

	Niño 3.4 last year	NPI last year	PDO last year
corr	-0.569	0.582	-0.635
p	0.037	0.032	0.017
a	0.000	0.000	0.000
b	1.404	1010.758	2.639
R2	0.269	0.217	0.333







CONTENT

1. Introduction of Pacific saury fishery in Chinese mainland
2. Material and methods
3. Results
4. Discussion
5. Summary

4. DISCUSSION

Oceanographic of Fishing Ground

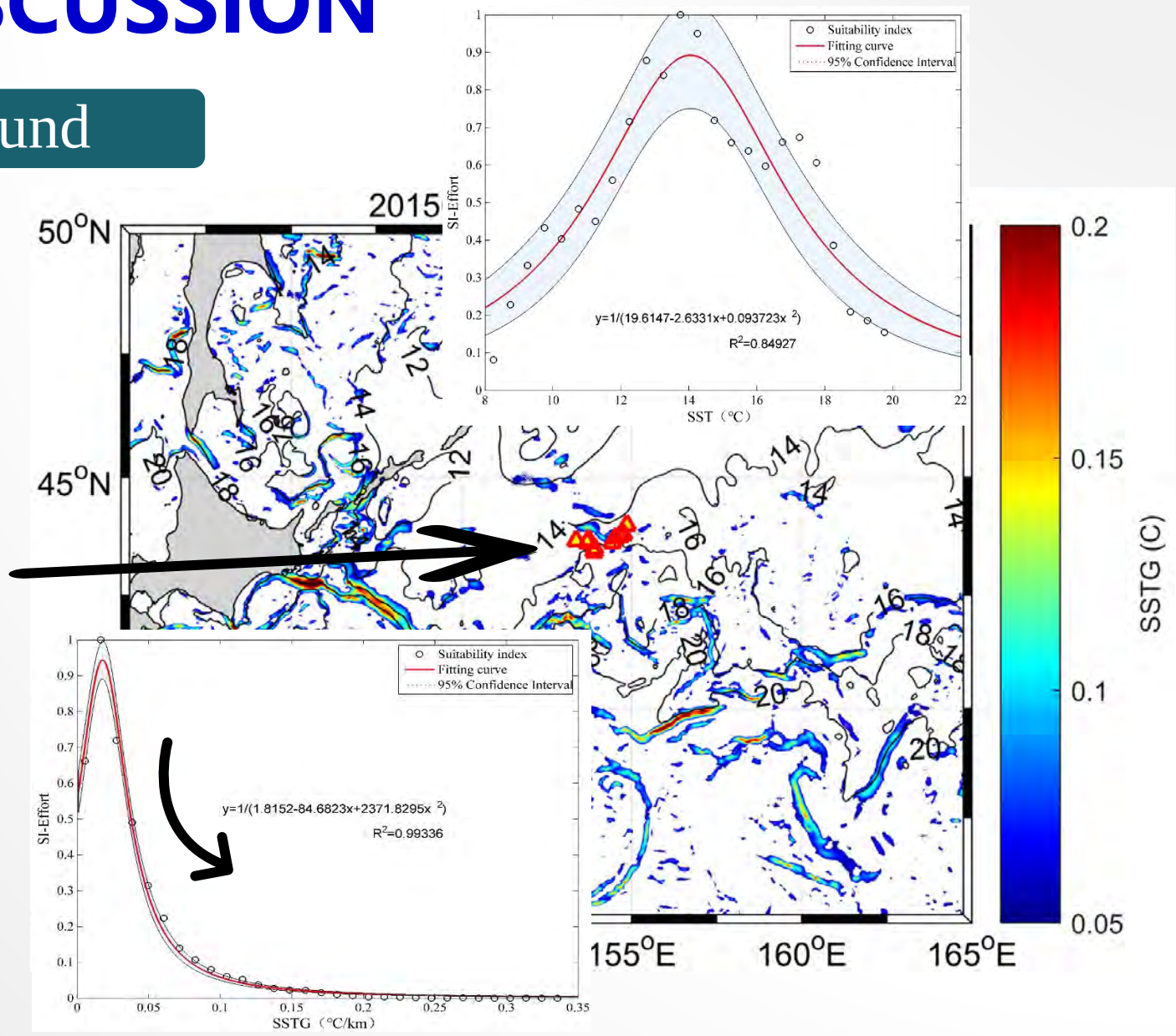
SST → Migration

(*Ito, et al, 2013*)

SST Front → Fishing Ground

(*Tseng, et al, 2014*)

SSTG → Aggregation

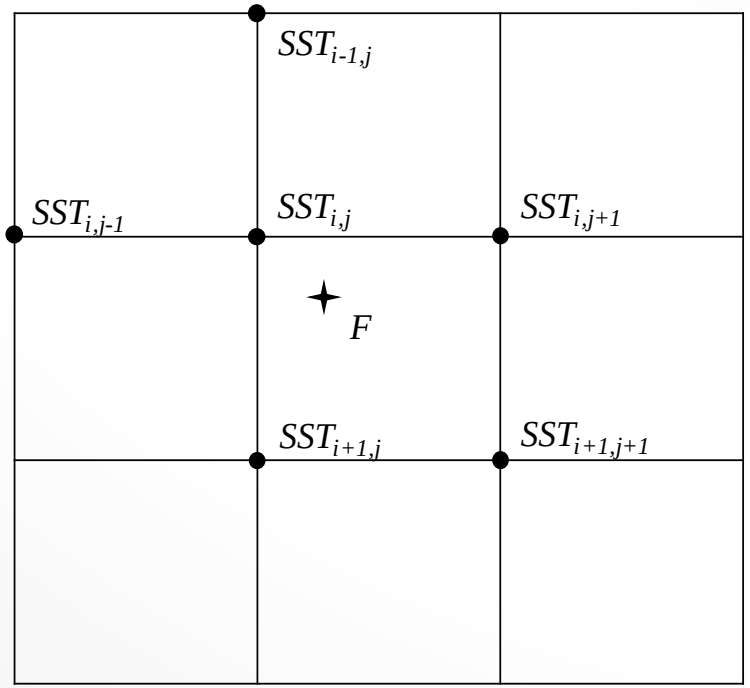


4. DISCUSSION

The SSTG

Medium and small scales	SSTG can changes the vertical movement of seawater and boundary layer thickness *(Chang, 2017)*
Large scale	SSTG intensity of the western Pacific Ocean (0°N–10°N, 130°E–150°E) can affects ENSO events *(Hoel, Funk, 2013)*

$$SSTG_{i,j} = \sqrt{\left(\frac{SST_{i+1,j} - SST_{i-1,j}}{\Delta x}\right)^2 + \left(\frac{SST_{i,j+1} - SST_{i,j-1}}{\Delta y}\right)^2}$$



SSTG could reflect the complexity of the ocean's system

Aggregation

Productivity

4. DISCUSSION

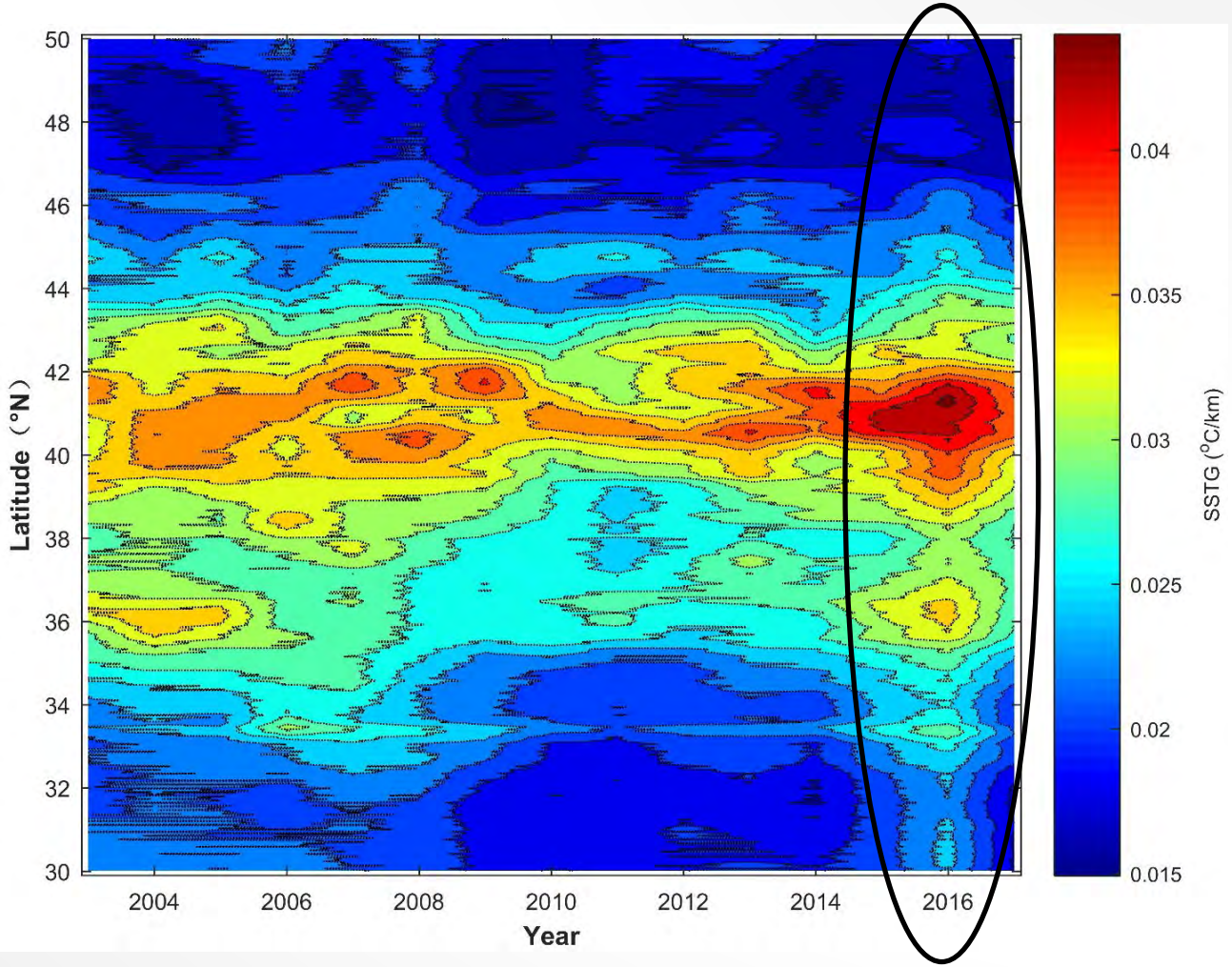
The SSTG

Medium and small scales	SSTG can changes the vertical movement of seawater and boundary layer thickness *(Chang, 2017)*
Large scale	SSTG intensity of the western Pacific Ocean (0°N–10°N, 130°E–150°E) can affects ENSO events *(Hoel, Funk, 2013)*

SSTG could reflect the complexity of the ocean's system

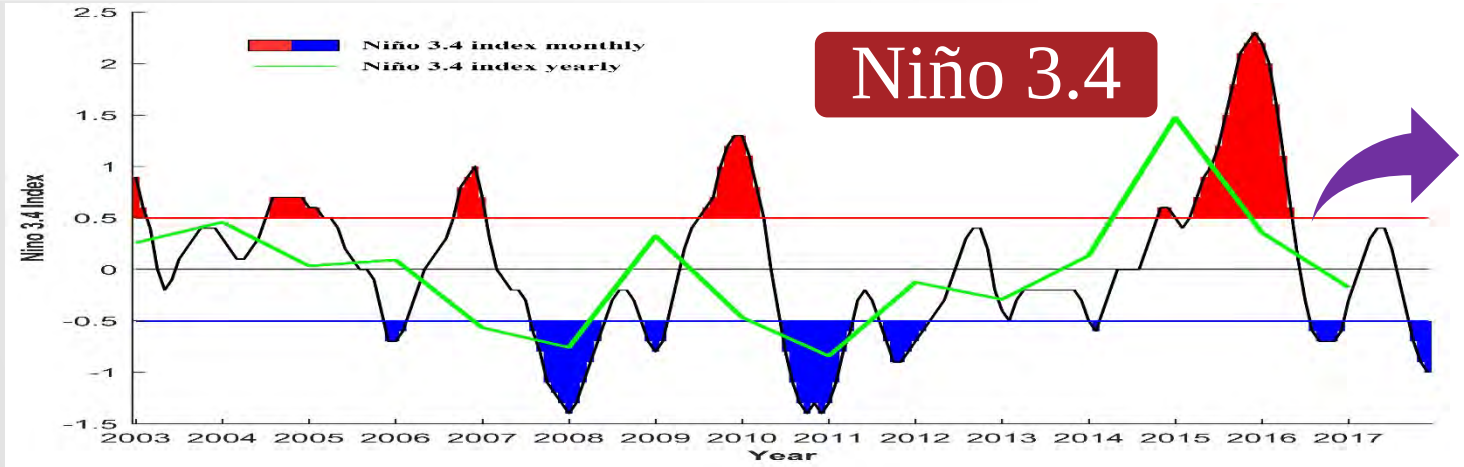
Aggregation

Productivity



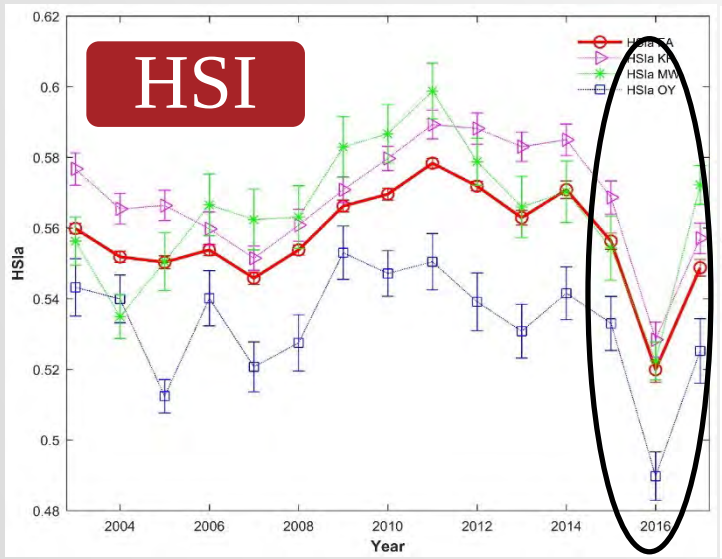
4. DISCUSSION

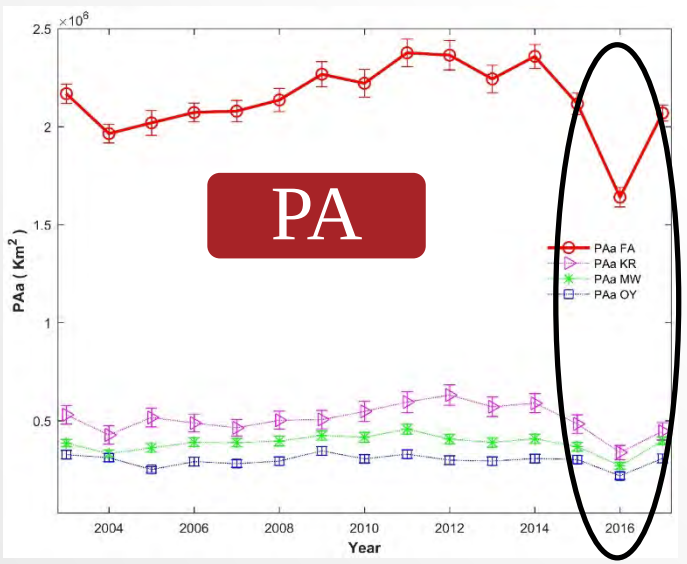
The Regime Shift

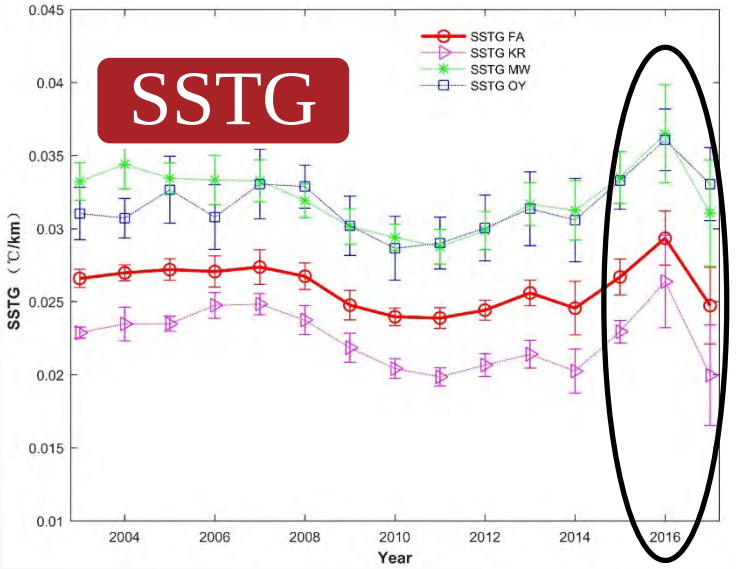


2016

- El Niño
- \+
- La Niña



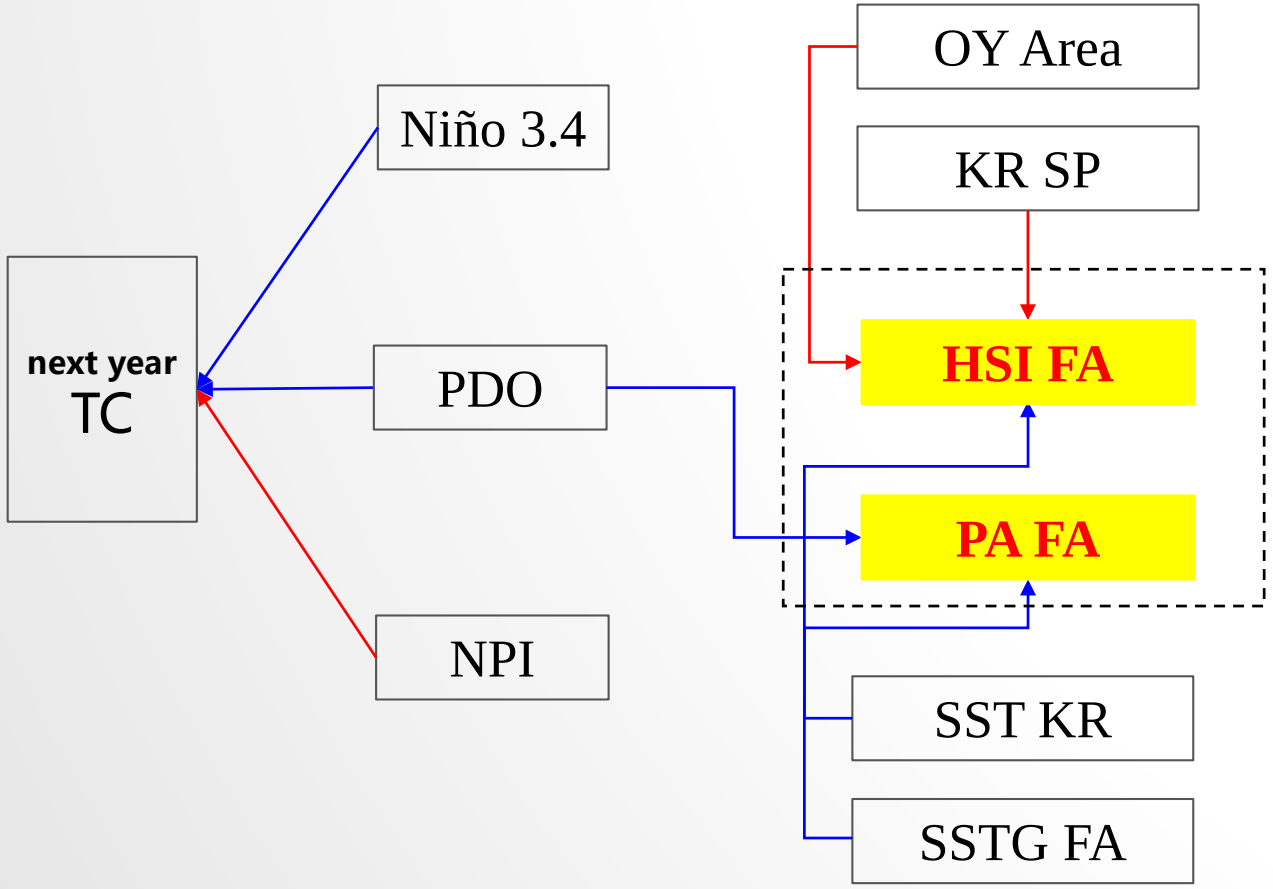




CONTENT

1. Introduction of Pacific saury fishery in Chinese mainland
2. Material and methods
3. Results
4. Discussion
5. Summary

5. SUMMARY



Hope these results could give basic data and information for the stock assessment and management of PS.