PICES-2021

Oct 18-22, 25-29, 2021 | Hosted online by China

The annual variations of grey mullet (*Mugil cephalus*) population in related to changed sea surface temperature and multiscale climate indices in the Northwest Pacific Ocean

Che-Chen Chuang, Ming-An Lee, Po-Yuan Hsiao, Yan-Lun Wu

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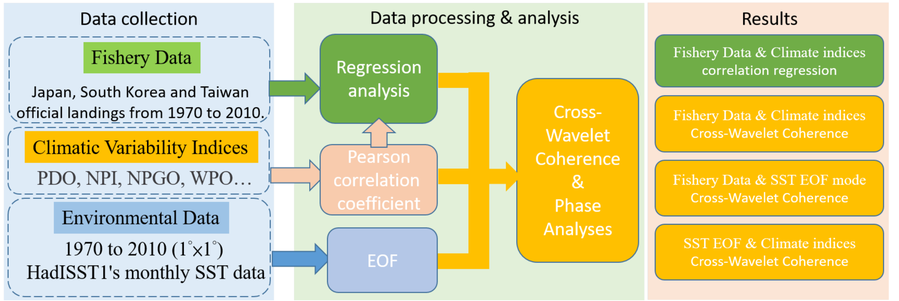
Introduction

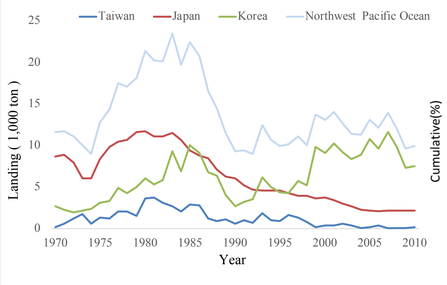
- Mullet (*Mugil cephalus L.*) is a cosmopolitan species distributed in tropical and temperate regions in the Northwest Pacific Ocean(NWP). Due to the NWP mullet characteristics of spawning migration, the annual winter migration follow China Coastal Current to Taiwan Straits in period of late November to next January.
- Shen et al. (2011) identified three cryptic species of *M. cephalus* in the NWP. It has been confirmed that the stock migrating to the Taiwan Strait in winter belong to the NWP1 cryptic species, and its distribution range covers four countries including Japan, South Korea, Taiwan and China.
- Lan et al. (2014) through wavelet analysis revealed that variations in climatic indices, include of Pacific Decadal Oscillation (PDO), the Oceanic Niño Index (ONI), and sea surface temperatures (SSTs) might have affected the abundance and migration behavior of grey mullet in the Taiwan Straits in winter.

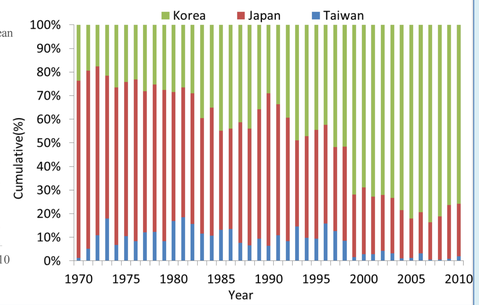
Methods



1. The study analyzed long-term (1970-2010) records of grey mullet (*Mugil cephalus*) fishing data to analysis different regions characteristic of landing fluctuations of grey mullet in Northwest Pacific Ocean including waters around Taiwan, Japan, and Korea.
2. The time series trends and correlations between landing of grey mullet and sea surface temperature influences by multiscale climate indices were analysis using Empirical orthogonal function and wavelet coherence analyze.

Results

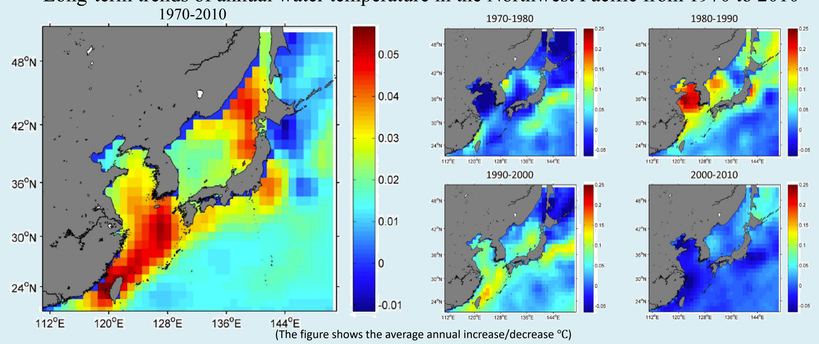




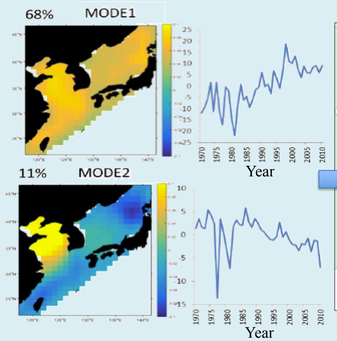
Landing climatic indices		Taiwan P value	Taiwan R	Japan P value	Japan R	Korea P value	Korea R	Northwest Pacific Ocean (total) P value	Northwest Pacific Ocean (total) R
								P<0.05	
								P<0.01	
PDO	Autumn	P<0.01	0.583	P<0.01	0.466	0.250	-0.184	0.080	0.276
PDO	Winter	P<0.01	0.399	0.060	0.296	0.169	0.218	P<0.01	0.452
PDO	Annual	P<0.01	0.563	P<0.05	0.371	0.514	0.105	P<0.01	0.413
WPO	Autumn	0.663	-0.070	0.689	0.064	0.682	-0.066	0.974	-0.005
WPO	Winter	P<0.01	-0.416	P<0.01	-0.417	P<0.05	0.378	0.449	-0.121
WPO	Annual	0.782	0.045	0.312	0.162	0.415	-0.131	0.786	0.044
NPGO	Autumn	P<0.01	-0.388	0.379	-0.141	0.229	0.192	0.839	0.033
NPGO	Winter	P<0.05	-0.331	0.268	-0.177	0.174	0.217	0.938	-0.012
NPGO	Annual	P<0.05	-0.367	0.307	-0.163	0.154	0.227	0.878	0.025
NPI		0.145	-0.231	0.259	-0.180	0.098	-0.262	P<0.01	-0.373

The significantly correlations were found between Western Pacific Oscillation (WPO), Pacific Decadal Oscillation (PDO) and North Pacific Gyre Oscillation (NPGO) with landing of grey mullet in the Japan, Korea, and Taiwan.

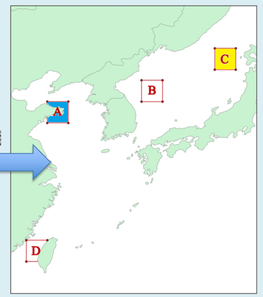
Long-term trends of annual water temperature in the Northwest Pacific from 1970 to 2010



EOF result

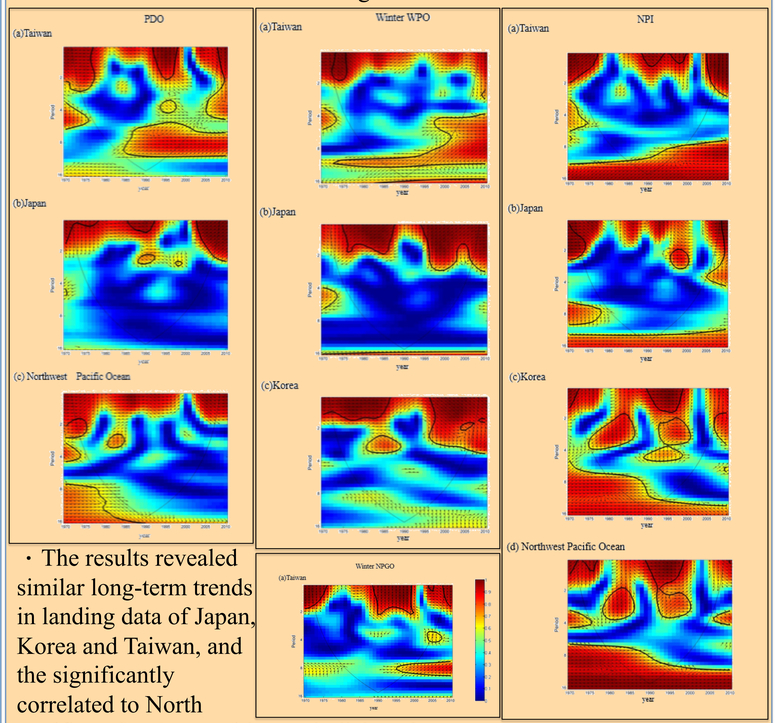


SST zone



- Through EOFs found that the similar spatial distribution and time series patterns between SST and grey mullet in autumn and winter, and could further divided into four sub-zones including (A)Yellow Sea, (B)Southwest Japan Sea, (C)Northeast Japan Sea, and (D) East China Sea.

Landing & Climate indices



- The results revealed similar long-term trends in landing data of Japan, Korea and Taiwan, and the significantly correlated to North Pacific Index (NPI) with a periodicity of 13-16 years across 1970 to 2010.

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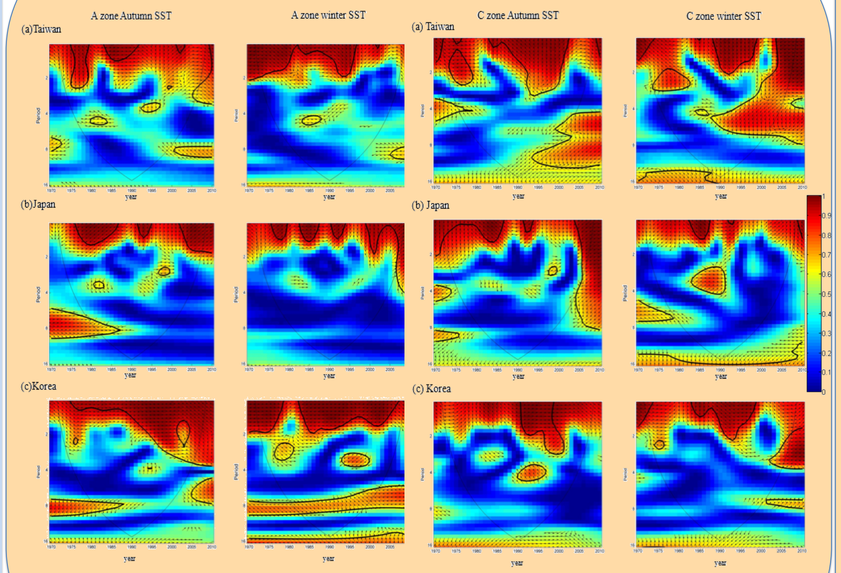
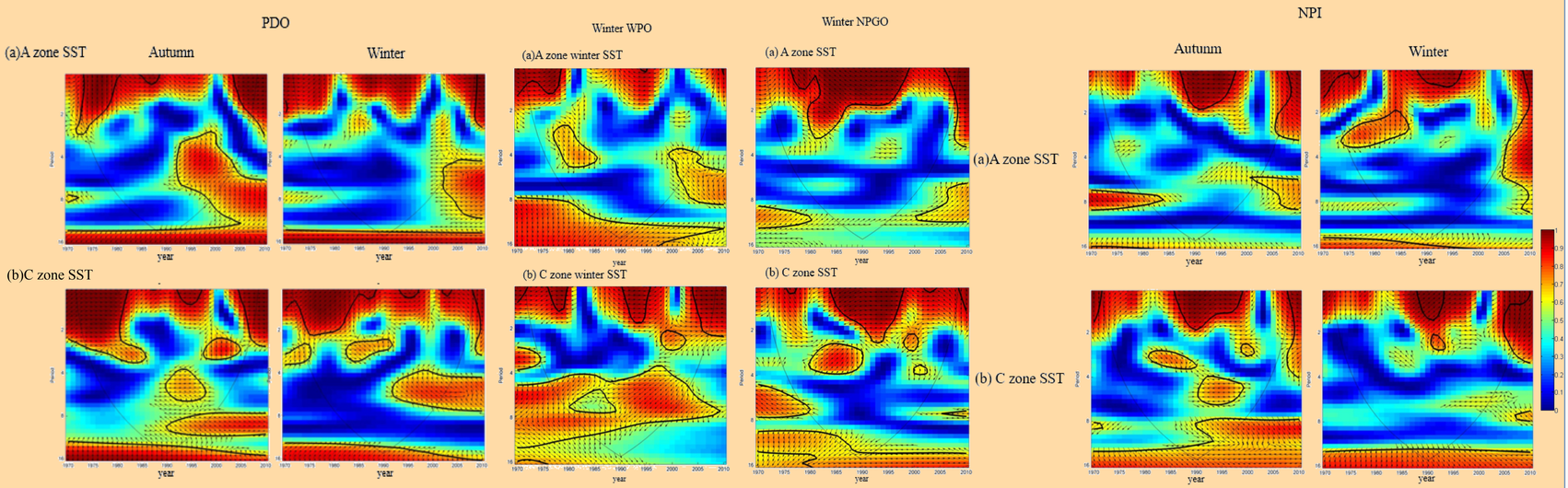
Results

Landing & SST zone



A significant coherence between the korea ‘s landing data and winter sea surface temperature with a periodicity of 8-10 years were occurred in A zone.

SST zone & Climate indices



The significantly correlations were found between Western Pacific Oscillation (WPO), Pacific Decadal Oscillation (PDO) and North Pacific Gyre Oscillation (NPGO) and North Pacific Index (NPI) had periodicity of 8-10/13-16 years with sea surface temperature in A&C zone.

Conclusion

1. The significantly correlations were found between Western Pacific Oscillation (WPO), Pacific Decadal Oscillation (PDO) and North Pacific Gyre Oscillation (NPGO) and had periodicity of 8-10 years with landing of grey mullet in the Japan, Korea, and Taiwan.
2. A significant coherence between landing and NPI with a periodicity of 13-16 years were occurred in the three areas.
3. Our results demonstrated the population and migration pattern of grey mullet were influenced by decadal (PDO and NPI) and interannual (WPO) climate indices via ocean-atmosphere interactions in the Northwest Pacific Ocean.

Acknowledgements

We give special thanks to Professor M.-A. Lee of National Taiwan Ocean University for support and guidance. We are also grateful to Mr. P.-Y. Hsiao and Ms. Y.-L. Wu for their help with this manuscript. I would like to express my thanks to Dr. Y.-C. Kuo for help with analysis. Thanks also to Dr. K.-W. Lan, whose advice was invaluable.