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Increasing Economic Impacts of the Yellow Sea Fisheries through Marine Biodiversity Conservation

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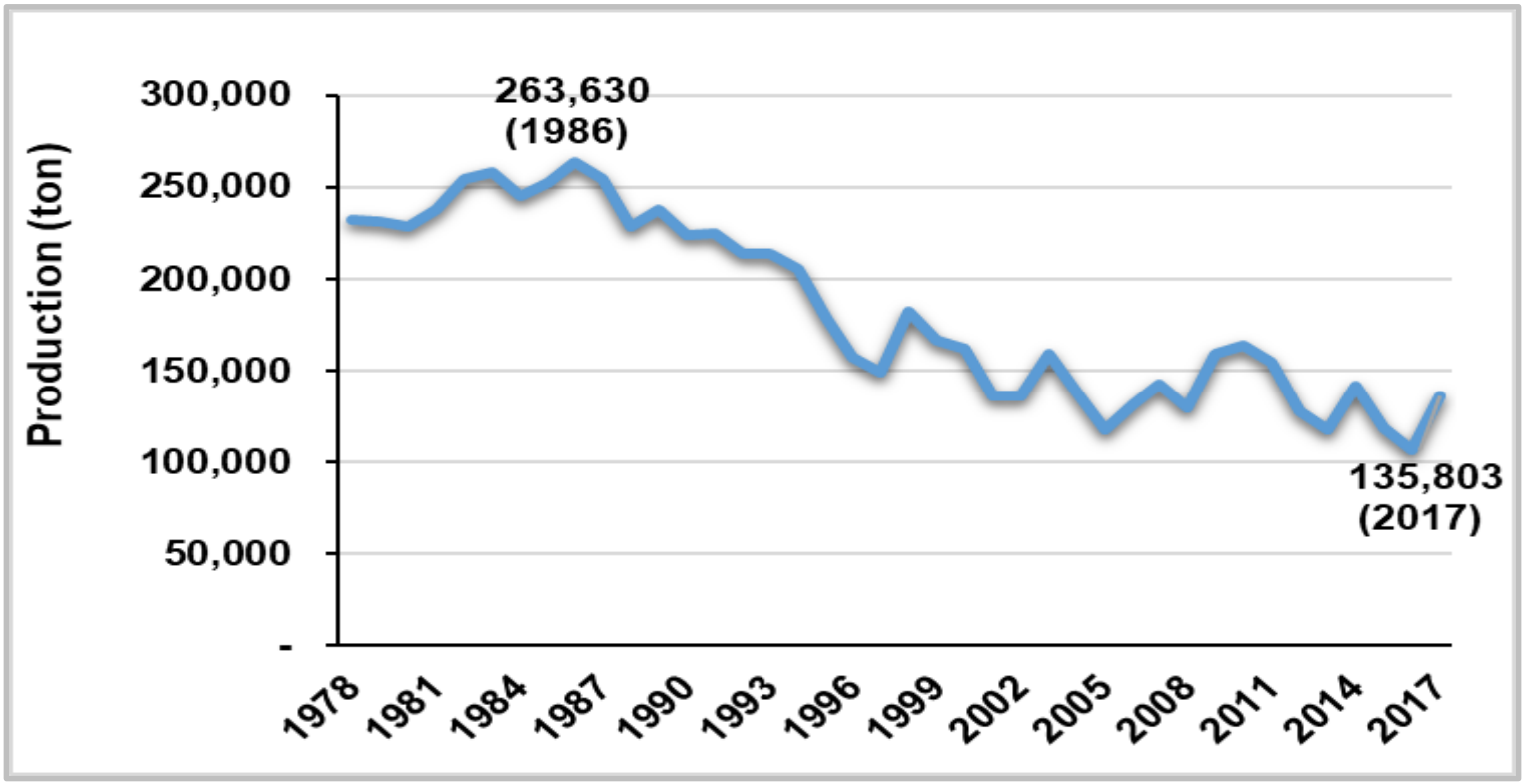


[Source: Statistics Korea, Fisheries Production (kostat.go.kr)]

Situations of Fisheries in Yellow Sea, ROK

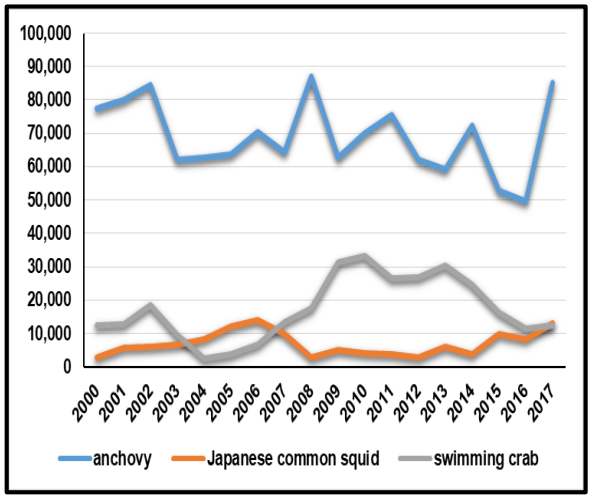
[Major species caught in Yellow Sea in 2017]

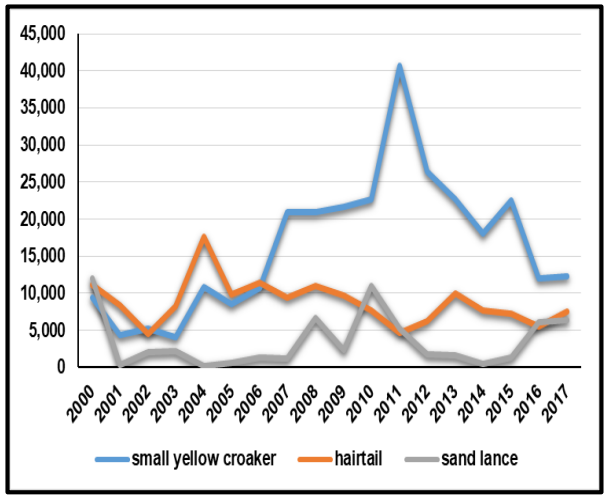
NO.	Species	Production (ton)	NO.	Species	Production ton)
1	Anchovy	85,011	15	Nibe croaker	2,322
2	Common squid	12,957	16	Collichthys niveatus	2,057
3	Swimming crab	12,496	17	Konosirus punctatus	1,729
4	Small yellow croaker	12,241	18	Flatfish	1,621
5	Hairtail	7,588	19	Chub mackerel	1,522
6	Sand lance	6,329	20	Common conger	1,388
7	Spanish mackerel	6,054	21	Korean rockfish	1,182
8	Long arm octopus	4,929	22	Mugil cephalus	1,117
9	Blackmouth angler	4,160	23	Red seabream	842
10	Cod	3,803	24	Sea bass	841
11	Butter fish	3,525	25	Muraenesox cinereus	776
12	Webfoot octopus	3,145	26	Ray	485
13	Octopus	2,628	27	Black porgy	477
14	Flounder	2,603	28	Japanese icefish	0

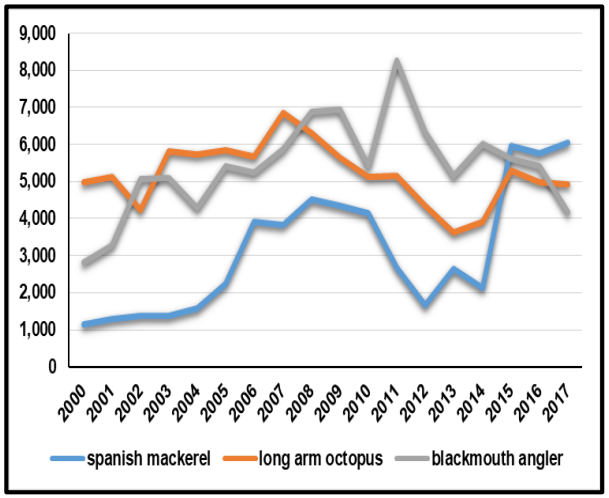
[Source: Statistics Korea, Fisheries Production (kostat.go.kr)]

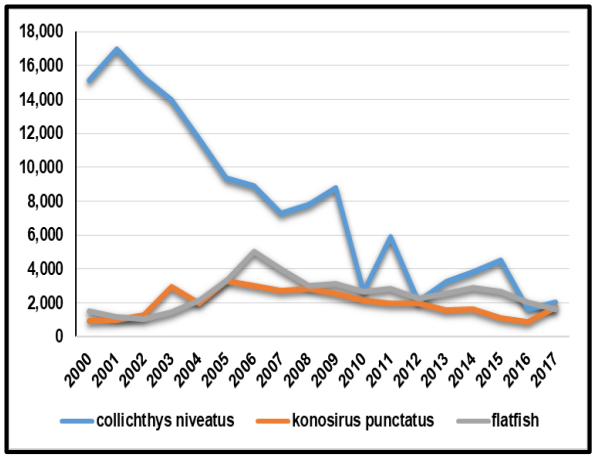
Situations of Fisheries in Yellow Sea, ROK

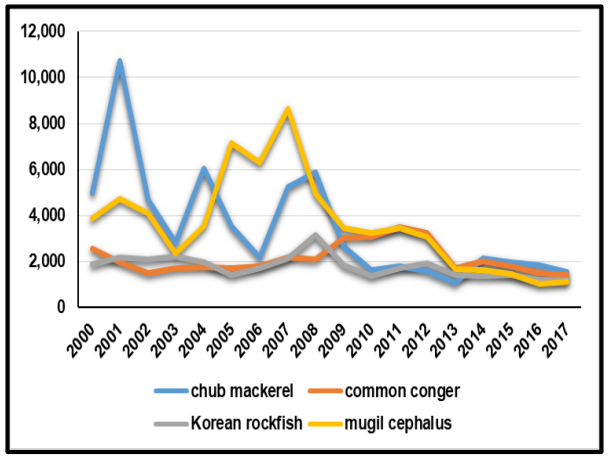
[Figure. Changes of major species production in Yellow Sea (2000-2017)]

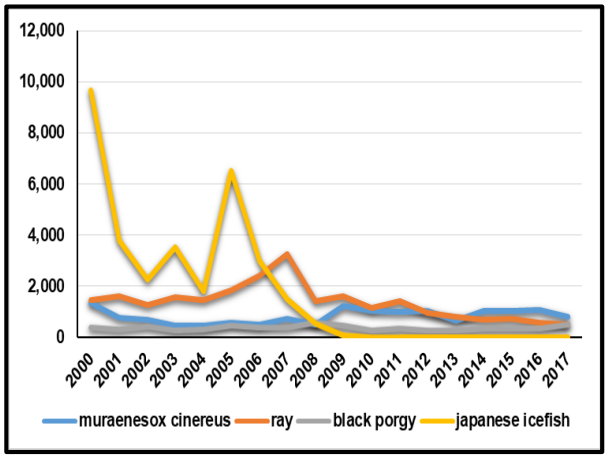








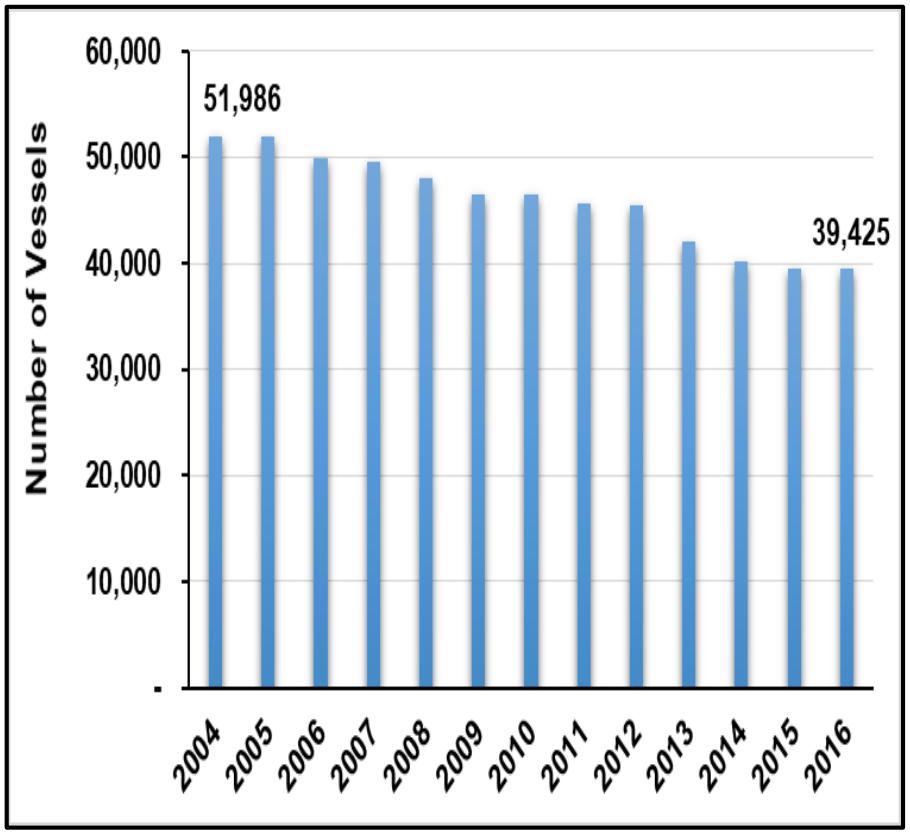


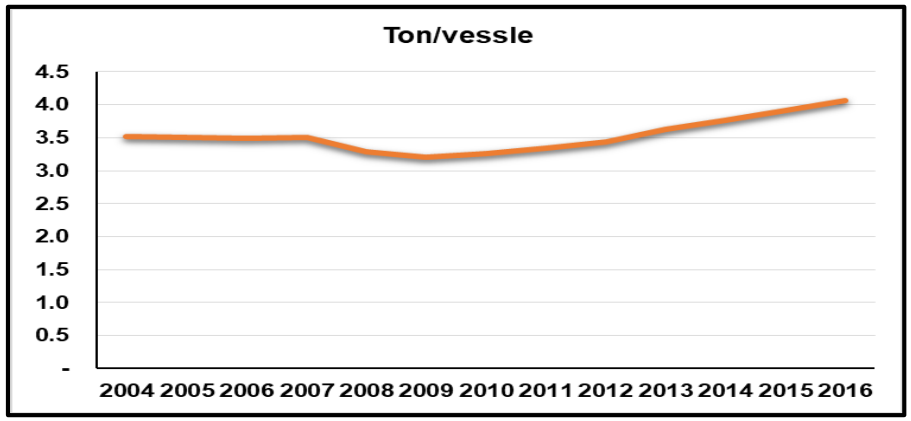


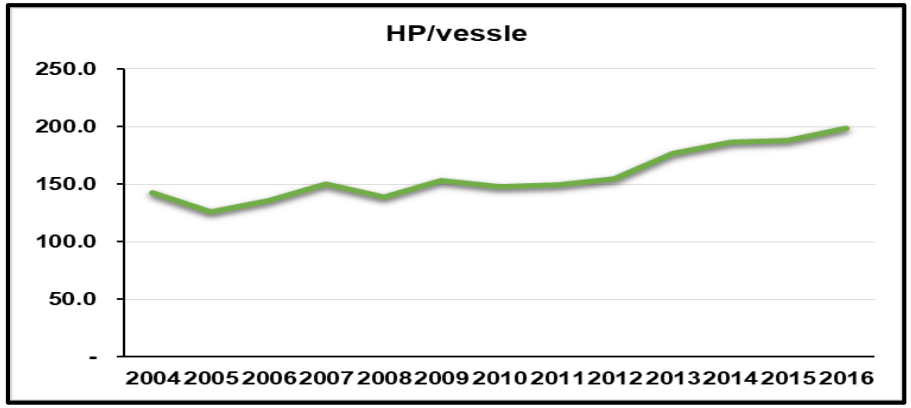
[Source: Statistics Korea, Fisheries Production (kostat.go.kr)]

Situations of Fisheries in Yellow Sea, ROK

[Changes of number of vessels, ton/vessel, and HP/vessel in Yellow Sea (2004-2016)]







[Source: Statistics Korea, Fisheries Production (kostat.go.kr)]

Stock Assessment of YS Fishery Resources

	Results of Stock Assessments (Kim et al., 2018)				Results of Stock Assessments (Our Lab)		
Parameter	FOX model	CYP model	ASPIC model	Maximum Entropy model	Observation-error model (Pella-Tomlinson)	Observation-error model (FOX)	Bayesian State-Space model
MSY (mt)	219,146	174,232	232,700	238,088	179,437	179,291	231,949
B_{MSY} (mt)	-	796,311	808,500	459,762	995,254	996,354	1,272,000
E_{MSY} (GT)		142,232	138,800	161,438	137,474	137,515	126,111
K (mt)	123,110	2,164,598	1,617,000	1,140,541	2,702,957	2,708,372	2,544,000
q (/GT)	-	1.54E-06	2.07E-06	3.21E-06	1.31E-06	1.31E-06	1.45E-06
r (/year)	-	0.219	0.476	0.835	0.181	0.180	0.365
R^2	0.896	0.899	0.933	0.953	0.947	0.947	0.999
RMSE	0.451	0.728	0.290	0.252	0.238	0.238	0.039

- Catch (2017): 135,803 ton => Potential Yield of YS (MSY): 231,949 ton

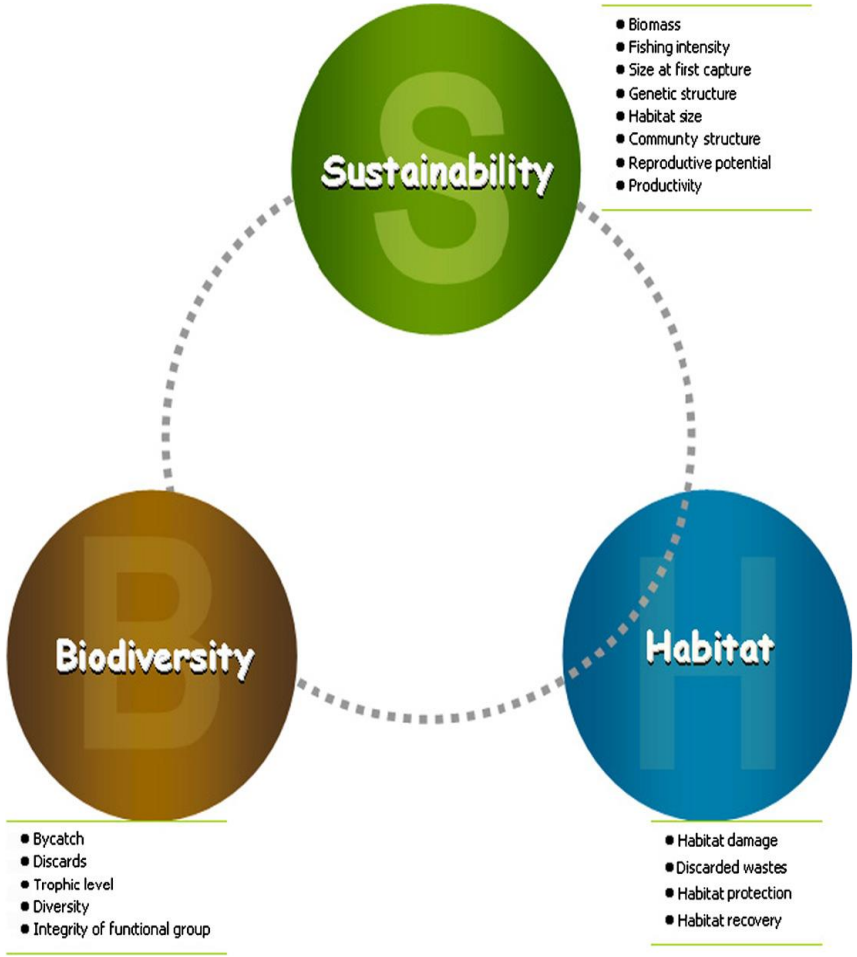
Ecosystem-Based Approach including Marine Biodiversity

- Zhang et al.(2008) developed a comprehensive pragmatic ecosystem-based approach using Indicators in order to consider sustainable fisheries and to holistically assess and manage fisheries resource and associated ecosystems

  - It mainly considered three different objectives (sustainability, biodiversity, habitat) and developed various attributes and indicators

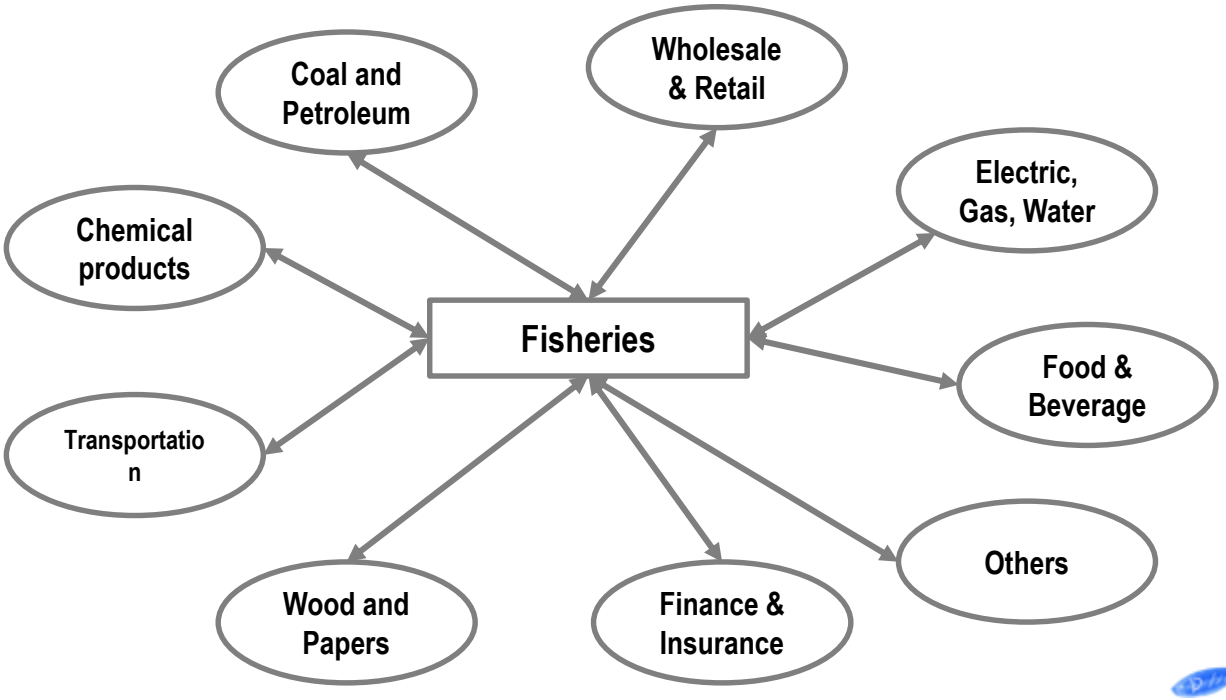
- Attributes for the Biodiversity Objectives

  - Total Bycatch
  - Total Discards
  - Trophic Level
  - Diversity (No. of species)
  - Integrity of functional groups (Invasive/Traditional species, etc.)
  - Gear restrictions and avoidance tactics



Economic Impacts of YS Fisheries

- **Input-out analysis** (IO analysis) is a form of macroeconomic analysis based on the interdependencies between economic sectors or industries
- It is commonly used for estimating the impacts of positive or negative economic shocks and analyzing the ripple effects through an economy
- Fishery Resources from Fisheries are used as raw and/or intermediate materials for other industries and other industries are used for fisheries (fishing industry) as inputs



Economic Impacts of YS Fisheries

- Increasing Economic Impacts of the YS Fisheries from Ecosystem-based management including marine biodiversity conservation

		Current Level (As of 2017) (A)	Achieving Objectives[1)] (B)	Differences (B-A)
Commercial Fisheries Yellow Sea	Production (ton)	135,803	231,949	96,146
	Direct Impact (Fishing Revenue) (billion won)	614.3	1,095.3	454.0
	Generating Production (billion won)	1,051.6	1,796.1	744.5
	Generating Employment (persons)	18,148	30,996	12,848

1) Assuming potential MSY of the YS fisheries as 231,949 tons from the stock assessment

Conclusion and Suggestions

- **Economic impacts of YS fisheries can be increased *significantly* from effective ecosystem-based management including marine biodiversity conservation**

- **In addition to management of sustainability (fishing intensity, biomass, etc.) and habitat (habitat damage, habitat recovery and protection, etc.), conservation of marine biodiversity is also important**
  - **Prevention of bycatch, discards and increasing trophic level and diversity, etc.**

- **More researches on benefits of other activities and environment**
  - **Recreational fisheries**
  - **Environment benefits of marine biodiversity**
  - **Utility of fishing communities in Yellow Sea regions**

THANK YOU