Implementation of National Strategic Action Plan (NSAP) In Korea

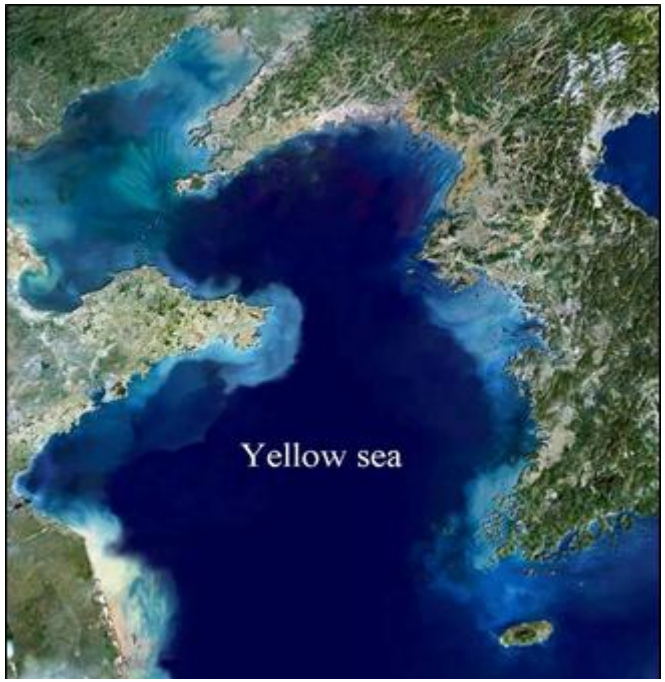
HyunHee Ju, Ph.D.

2019. 03. 12.

Korea Institute of Ocean Science & technology

KIOST
한국해양과학기술원

Contents



KIOST
한국해양과학기술원

PART.1:
Significance of evaluation for NSAP

1. Significance of evaluation for NSAP implementation

KIOST 한국해양과학기술원

➢ Background & significance

- NSAP is a base to evaluation of implementation during 1st phase to both nations, the ROK and the ROC.

✓ giving a direction to improve environment/ecosystem/resources in the Yellow Sea

- Evaluation of the NSAP implementation can be to navigate the future after 2nd phase (i.g. YS Commission).

✓ internalizing the results of evaluation as poor/complementation/rolling plan

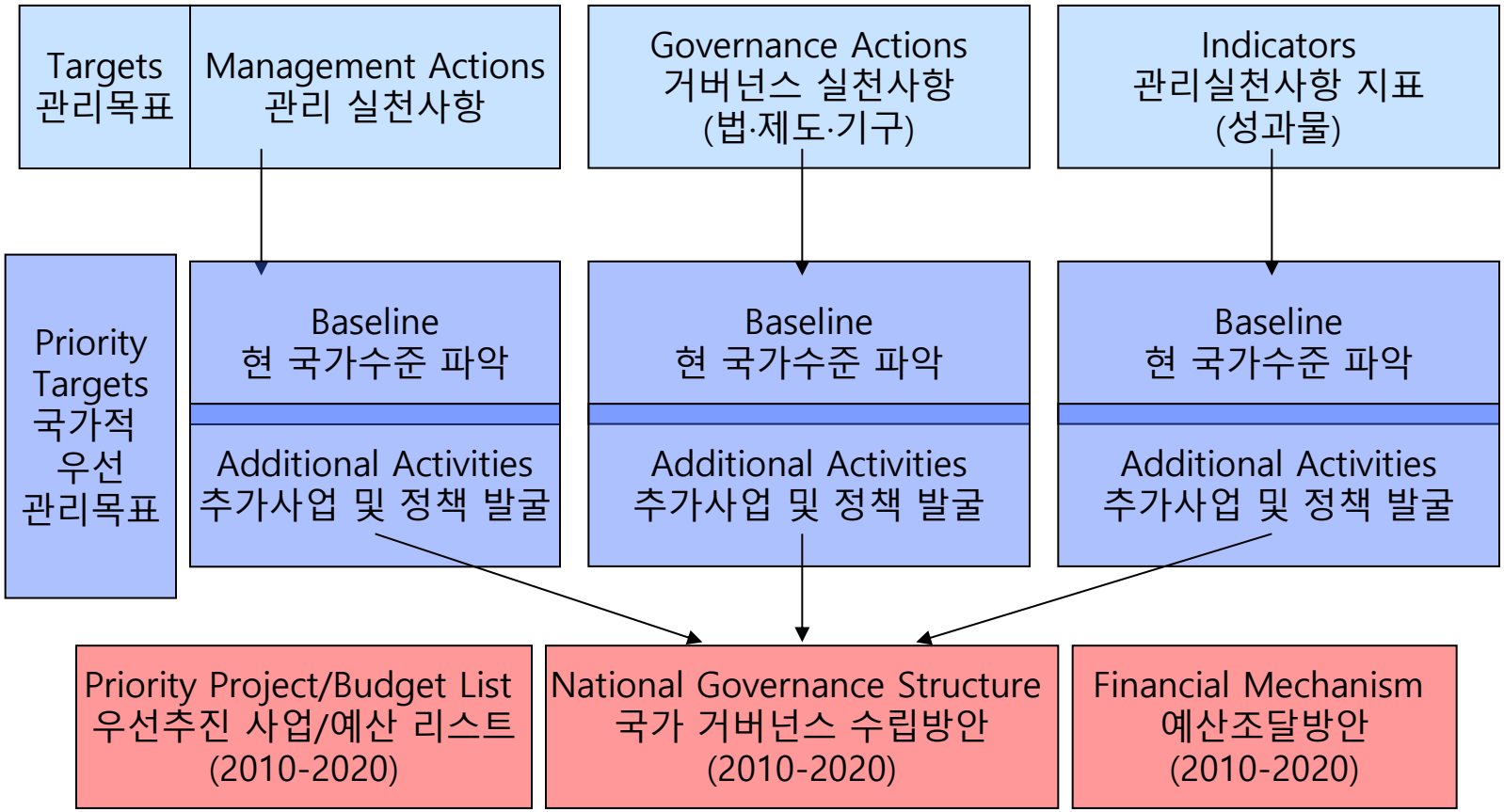
- Checkup for management of marine environment/ecosystem/resources

✓ Giving a guideline relating to a nation's policy

1. Significance of NSAP implementation analysis

KIOST 한국해양과학기술원

➢ NSAP Establishment Principle _SAP Review, Identification of current level



1. Significance of NSAP implementation analysis

KIOST 한국해양과학기술원

➢ NSAP Composition_11Targets/ 33 Management Actions

KIOST
한국해양과학기술원

PART. 2: Implementation of NSAP

2. Implementation of NSAP

KIOST 한국해양과학기술원

➢ Method & Flow_analyzing, Indicators, Feedback, Deriving results/evalution/suggestion

1st — Review NSAP's goals and management actions

2nd — Interpreting Goals & Management Actions establishment performance indicators (Based on 33 management actions)

3rd — **Evaluation of implementation by Management action**
Whether indicators are implemented, activities reviews, law & institution, policy environmental changes, etc.)

Comprehensive analysis

① Whether or not	Y/N	Analysis of implementation status (by management goal& actions)
② Evaluation/ Suggestion	Description E&S	

2. Implementation of NSAP

KIOST 한국해양과학기술원

➢ Summary: 33 indicators for each Management Action, Two Y/N

	Actions in NSAP	Indicator	Result
1	1.1 : Reduce the number of fishing boats and maintain a proper mid-long term level of fishing efforts, in consideration of the fish stock	Reducing boats number	Y
2	1.2 : Designate the closed areas and seasons for spawning and fishery resources	Set up Closed season/area	Y
3	1.3 : Improve monitoring and assessing the stock fluctuation in the region	Expansion of fishery resource target species & survey area	Y
4	2.1 : Set appropriate mesh size and develop fishing gears in resources management type	Set appropriate mesh size develop fishing gears in resources management type	Y
5	2.2 : Restore fishery resources	Result of fishery resources restoration	Y
6	2.3 : Establish reasonable fishery resources management system	TAC and target fish species trend	Y
7	3.1 : Reduce pollutant and improve promote the health of aquaculture organisms by Integrated Multi-Trophic Aquaculture(IMTA)	Reduce Aquatic life disease incidence	Y or N
8	3.2 : Supply industrialized seawater recirculating filter system and develop substitute feed source using fishery byproducts	Development of seawater recirculating filter system/ substitute feed source	Y
9	3.3 : Implement early warning, diagnosis system, effective management for mariculture diseases	Legal infectious disease monitoring, disease diagnosis, vaccine	Y
10	4.1 : Intensive pollution monitoring and evaluation	Regular survey of marine environment/ monitoring	Y
11	4.2 : Comply with the international standards for regulating the toxic pollutants	Stockholm Convention Acceptance Foundation Management	Y
12	4.3 : Implement the international agreements regarding the regulations on oil and HNS	Acceptance of oil / HNS regulation international convention	Y
13	5.1 : Manage land-based point pollution source loads	Expansion of basic environmental facilities	Y
14	5.2 : Manage land-based non-point pollution source and atmospheric pollutants	Manage land-based non-point pollution source and atmospheric pollutants	Y
15	5.3 : Introduce new technology to reduce nutrient (nitrogen and phosphorus)	Wastewater treatment facility High throughput rate	Y
16	6.1 : Minimize generation of marine litters through the management of original sources of marine litters and solid wastes materials	Measures to prevent the generation of solid waste	Y

2. Progress of implementation of NSAP(T. 1-2)

KIOST 한국해양과학기술원

➢ Summary: 33 indicators for each Management Action, Two Y/N

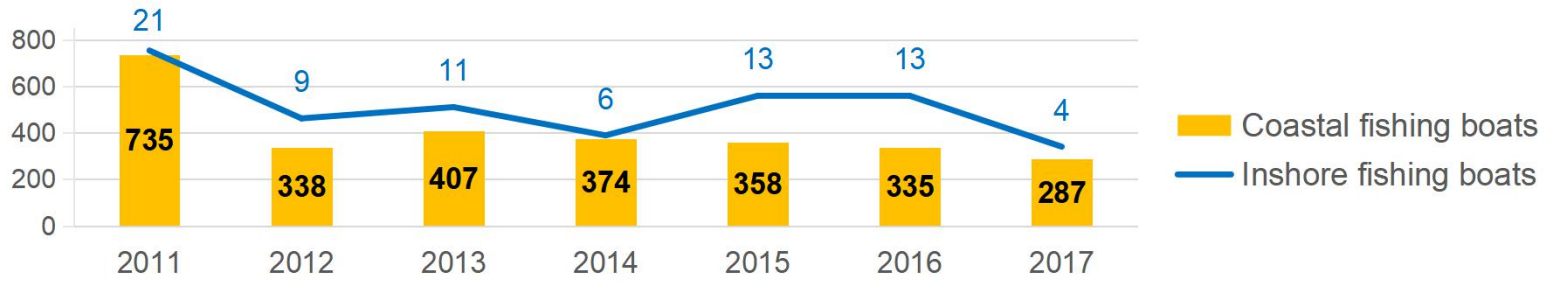
17	6.2 : Strengthen a capability of marine litter treatment	Marine waste management equipment and equipment introduction Collection volume	Y
18	6.3 : Establish management system of marine litters	marine litters Management System	Y
19	6.4 : Promote public participation and international cooperation	Publice participation, education, international cooperation activities	Y
20	7.1 : : Conduct regular monitoring, assessment and information dissemination particularly in bathing beaches and other recreational waters	Regular survey/ Information dissemination	Y
21	7.2 : Control pollution in bathing beaches and other marine recreational waters	Management of pollutant emission facilities	Y
22	8.1 : Assess and monitor the impacts of N/P/Si ratio change	Assess N/P/Si ratio change	Y or N
23	8.2 : Assess and monitor impacts of lower nutrition level by climate change	Monitoring / evaluation progress	Y
24	8.3 : Forecast ecosystem changes by climate change in the long-term scale	Perform related research	Y
25	8.4 : Monitor and assess the transboundary impact of jellyfish blooms	Monitor and assess Action	Y
26	8.5 : Monitor HAB occurrences	Monitoring/ evaluation actions	Y
27	9-1 : Maintenance population and genetic diversity of marine living organisms including endangered and endemic species and development of management guideline	Development of domestic guidelines and law	Y
28	10.1 : Supplement costal management plan and develop regional guideline for effective habitats conservation and implementation	Supplement costal management plan	Y
29	10.2 : Expand marine protected areas (MPA), implement effective management and establish a network	Expand MPAs/ effetive management	Y
30	10.3 : Control new coastal reclamation demand and implement a proper management	Control coastal reclamation	Y
31	10.4 : Promote public awareness of the benefits of biodiversity conservation	Related public awareness actions	Y
32	11.1 : : Control and monitoring inflow of non-native species by discharge of ship ballast water	Device and technology development Monitoring / Control Actions	Y
33	11.2 : Efficient control of non-native species by precautionary approach	non-native species/harmful marine biological management system(actions)	Y

2. Implementation of NSAP(Target.1:1.1-1.3) : 25-30% reduction in fishing effort

KIOST 한국해양과학기술원

1.1_ Reduce the number of fishing boats and maintain a proper mid-long term level of fishing efforts, in consideration of the fish stock

- Number of reduced fishing boats: Compared to 2009, 2017 downward earnings are at 25% level.



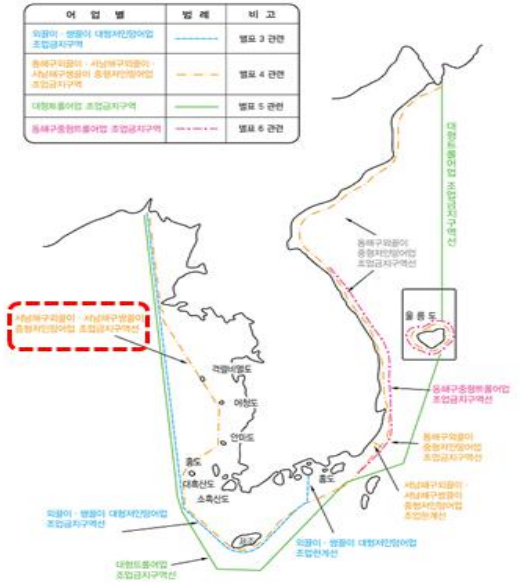
1.2_ Designate the closed areas and seasons for spawning and fishery resources

- Set up Closed Season/area: Article 7 (1) of the Enforcement Ordinance of the Fisheries Resources Management Act specifies and prohibits prohibited fishing zones (fishing zones) by type of fishery
- Designation of fisheries resource protection zone

(km²)

Year	Number	Designated area(Total)	Sea level			Inland water surface
			Sub Total	Water surface	shore	
2011	30	3,230	2,894	2,526	368	336
2015	30	3,161	2,864	2,495	369	297
2017	30	3,172	2,863	2,495	368	309

(source: MOF)



2. Implementation of NSAP(Target.1:1.1–1.3)

KIOST 한국해양과학기술원

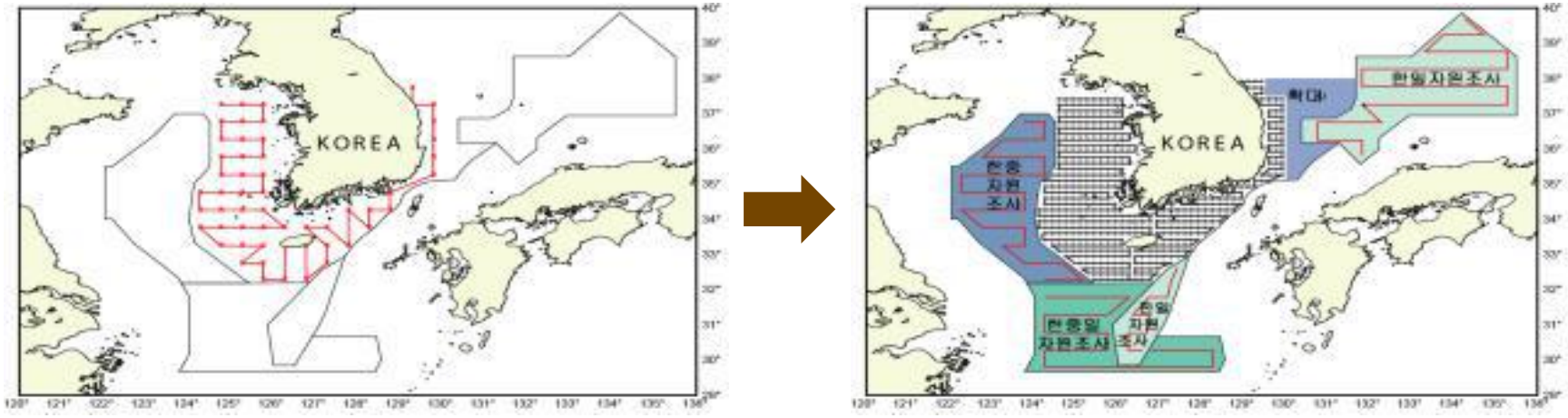
1.3_ Improve monitoring and assessing the stock fluctuation in the region

- Expansion of fishery resource target species & survey area
  : #1. Regular fishery resource surveys are conducted(based on fisheries data)

Year	'06	'07	'08	'09-'11	'12	'14
Target species	4	7	10	12	15	16
Added species	Sailfin sandfish Blue crab Small octopus Blue abalon	Mottled skate Yellow corvina Cod	Arrow toothed File fish Purple washington clam	Hairtail Pike eel	Mackerel Octopus dofleini Tile fish	Pollack

: #2. Time / Spatial Survey Reinforcement Strengthening→ Improving credibility and policy effectiveness

Fishery resource Investigation area



Before('06)

Improved('16)

2. Implementation of NSAP(Target.2: 2.1–2.3)

KIOST 한국해양과학기술원

➢ 2.1_Set appropriate mesh size and develop fishing gears in resources management type

- Set appropriate mesh size develop fishing gears in resources management type

: #1. set the standards for the prohibition of use of fishery species(@ Enforcement Decree of the Fisheries Act)

(The Minister of Maritime Affairs and Fisheries, if deemed necessary for the protection of fishery resources in Article 45-3 paragraph 3)

Type of fishery		Mainly captive species	Mesh size
1. 근해어업(Offshore fishing)	가. 외끌이대형저인망어업 (Large excavation)		33mm or less
	나. 쌍끌이대형저인망어업 (Large-scale trawl fishing)		54mm or less
	다. 동해구외끌이중형저인망어업, 서남해구외끌이중형저인망어업, 서남해구쌍끌이중형저인망어 (East Sea Offshore fishing tackle, Midwest fishing tackle, West sea tackle fishing tackle, Middle west tackle fishing tackle)		33mm or less
	라. 대형트롤어업		54mm or less
	아. 동해구중형트롤어업		43mm or less
	바. 대형선망어업		30mm or less
	사. 소형선망어업		30mm or less
	아. 근해자망어업	삼치	100mm or less
		조기류 (a yellow corbina)	50mm or less
		대게	240mm or less
	자. 근해안강망어업		35밀리미터 이하
	차. 근해장어통발어업		35밀리미터 이하
	카. 근해통발어업	대게	150밀리미터 이하
		붉은 대게	125밀리미터 이하
		그 밖의 어종	35밀리미터 이하
2. 연안어업	가. 연안개량안강망어업		25밀리미터 이하
	나. 연안선망어업		15밀리미터 이하
	다. 연안통발어업	붉장어, 낙지, 새우류, 민꽃게류	22밀리미터 이하
		대게	150밀리미터 이하
		붉은 대게	125밀리미터 이하
		그 밖의 어종	35밀리미터 이하
	라. 연안조망어업		25밀리미터 이하
	아. 연안선인망어업		15밀리미터 이하
	바. 연안자망어업	삼치	100밀리미터 이하
		조기류	50밀리미터 이하
		대게	240밀리미터 이하
3. 구획어업	가. 장망류어업(영광군에서 주목망을 사용하는 어업)		25밀리미터 이하
	나. 장망류어업(영광군에서 주목망을 사용하는 어업), 패류형망어업 외의 구획어업		15밀리미터 이하

2. Implementation of NSAP(Target.2: 2.1–2.3)

KIOST 한국해양과학기술원

➢ 2.2_ Restore fishery resources

- Result of fishery resources restoration: The fisheries resource recovery business(-1980s) , related budgets are being increased(artificial reefs, sea-seed release, sea forests, and ocean ranching projects)

Table. Artificial reefs(2011-2016)

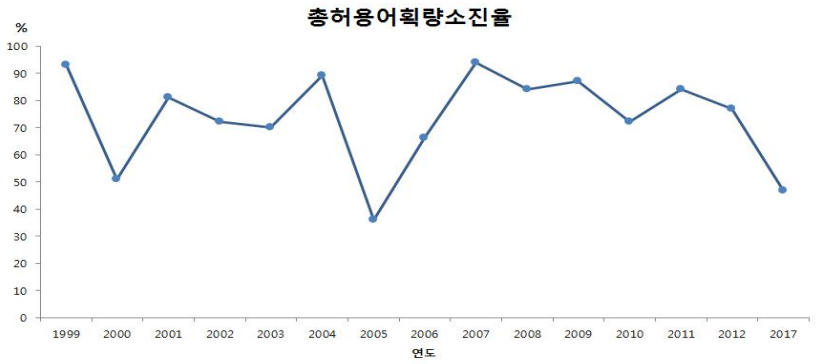
Year	Installation area(ha)	Installed amount	budget(Billion won)
2011	3,133	10,015	393.84
2012	3,274	8,315	448.64
2013	2,778	9,741	379.33
2014	2,938	11,661	408.92
2015	2,790	10,743	540.11
2016	1,194	10,836	363.95

Table. sea forests(2011-2018)

Item	2011	2012	2013	2014	2015	2016	2017	2018
Budget (billion Won)	129	159	198	327	357	348	352	352
number	11	10	9	19	21	24	18	20
area(ha)	715	860	1,388	2,574	3,236	3,064	3,043	3,107

➢ 2.3_ Establish reasonable fishery resources management system

- TAC and target fish species trend: Korea's TAC system has been in operation since 1998, TAC consumption rate is steadily decreasing from 2011→Protection effect of fishery resources



	Taget species	2011	2012	2013	2014	2015	2016	2017	2018
Establish recommendation for species recovery	도루묵								
	꽃게								
	낙지								
	오분자기								
	참홍어								
	참조기								
	대구								
	기름가자미								
	개조개								
	말쥐치								
	갈치								
	갯장어								
	고등어								
	대문어								
	옥돔								
	살오징어								
	주꾸미								
	명태(자원)								
	명태(양식)								

2. Implementation of NSAP(Target.3: 3.1–3.3)

KIOST 한국해양과학기술원

➢ 3.1_ Reduce pollutant and improve promote the health of aquaculture organisms by Integrated Multi–Trophic Aquaculture(IMTA)

- Develop of IMTA & Reduce Aquatic life disease incidence: National Institute of Fisheries Science(NIFS) conducted(No actual application and dissemination)

- "Development of fishery tourism type multi-nutrition solid form (IMTA) technology using fish tank"('11-'13, East Sea type)
- "Development of sea-specific ecological integration (IMTA) technology"('14-'18, South Sea type)

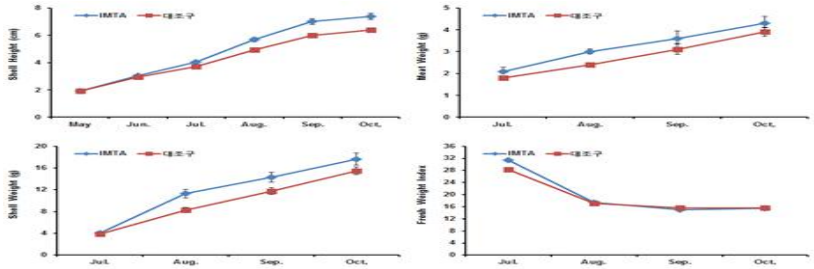


Fig. Growth rate of IMTA to single culture(South Sea type)

➢ 3.3_ Supply industrialized seawater recirculating filter system and develop substitute feed source using fishery byproducts

- Development of seawater recirculating filter system/ substitute feed source: NIFS developed

- Basic model for the seawater recirculation filter system('12-'17)
- Alternative feed sources using fishery byproducts

Year	Development feed
2011	Alternative raw materials for flounder fermented fishery by-products(넙치 발효)
2012	Flounder substitute feed raw material(넙치 어분)
2013	Alternative feedstuffs of red sea bream(참돔 식물성 혼합 대체)
2014	Alternative feed ingredients for flounder hydrolysates(넙치 가수 분해물)
2015	Korean rocky duck vegetable mixed feed raw materials(조피볼락 동식물성 혼합)
2016	Korean rockfish cheese tuna by-product substitute raw material(조피볼락 치어 참치)

2. Implementation of NSAP(Target.3,4: 3.3 & 4.1)

KIOST 한국해양과학기술원

➢ 3.3_ Implement early warning, diagnosis system, effective management for mariculture diseases

- Legal infectious disease monitoring, disease diagnosis, vaccine: Implemented through " Development and operation of aquaculture prevention program" (NIFS)

- Result: disease prevalence rate (active prevalence number of diseases / number of legal infectious diseases): ('15) 76% → ('17) 90%) 18 species → ('17) Improved to 19 species

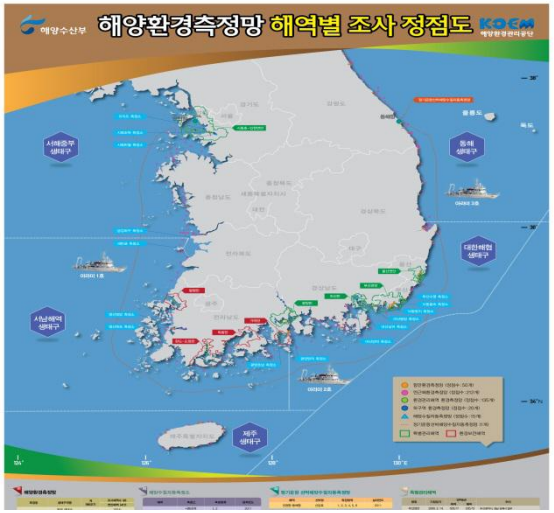
Table. Vaccine sales for fisheries

S/Y	2011	2012	2013	2014	2015	2016
Sales (Billion Won)	13	18	23	19	25	32

➢ 4.1_ Intensive pollution monitoring and evaluation

- Regular survey of marine environment/ monitoring: Operating a stable and stable marine environment survey system(-1980s)

- In particular, it adjusts survey items, survey areas and intensive survey subjects according to changes in environment and demand, and operates them practically.



Division		Survey item	Time(month)	Site(unit)
Sea water	General items	Water temperature, salinity, pH, DO, COD, TN, DIN (NO_2-N, NH_4-N, NO_3-N), TP, DIP(PO_4-P), SiO_2-Si, oil, SS, Transparency	2, 5, 8, 11	374
	Trace metal	Cu, Pb, Zn, Cd, Cr^{6+}, Total Mercury(총수은), As, CN	2, 8	81
Marine life	General items	Chlorophyll-*a*	2, 5, 8, 11	374
		Total colon bacillus(총대장균군)	2, 5, 8, 11	81
	Trace metal	Cu, Pb, Zn, Cd, Cr, 총수은, As	2	25
	persistent organic pollutants (POPs)	PCBs, TBT, Organochlorine Pesticide (유기염소계농약), PAHs, dioxin/furan(다이옥신/퓨란)	2	25
Sediment	General items	입도, 강열감량, 황화물, COD	2	81
	Trace metal	Cu, Pb, Zn, Cd, Cr, 총수은, As	2	81
	persistent organic pollutants (POPs)	PCBs, TBT, Organochlorine Pesticide (유기염소계농약), PAHs, dioxin/furan(다이옥신/퓨란)	2	25

2. Implementation of NSAP(Target.4: 4.2-4.3)

KIOST 한국해양과학기술원

➢ 4.2_ Comply with the international standards for regulating the toxic pollutants

- Stockholm Convention Acceptance Foundation Management: Joining the Stockholm Convention(2007)

- Management standards for organic pollutants are set the same as those of the Stockholm Convention
- Changed the domestic standard by reflecting the standard or discussion

→ #1.「 Submitted to the Residual Pollutant Management Act」 , 「 Marine Environment Management Act 」

→ #2. POPs monitoring network has been installed, operated to monitor and analyze the pollution status

Table. Status of Residual Pollutants (POPs) in Korea(Enforcement Decree of the Residual Pollutant Control Act)

Year	POPs	Remarks
2008	(12종) 알드린, 엔드린, 디엘드린, 톡사펜, 클로르데인, 헵타클로르, 미렉스, 헥사클로벤젠, 폴리클로리네이티드비페닐, 디디티, 다이옥신, 푸란	When ratifying the Stockholm Convention ('07. 1), reflect the POPs included in the Convention
2011	(21종) 기존 12종, 클로르데칸, 린단, 알파헥사클로로사이클로헥산, 베타헥사클로로사이클로헥산, 테트라브로모디페닐에테르와 펜타브로모디페닐에테르, 헥사브로모디페닐에테르와 헵타브로모디페닐에테르, 헥사브로모비페닐, 펜타클로로벤젠, 과불화옥탄술폰산	Reflected 9 newly registered POPs at the 4th Conference of the Parties to the Stockholm Convention ('09. 5)
2015	(23종) 기존 21종, 엔도설판, 헥사브로모사이클로도데칸	Two new POPs registered at the 5th ('11 .4) and the 6th ('13 .5) Stockholm Convention Convention
2017	(27종) 기존 23종, 펜타클로로페놀, 헥사클로로부타디엔, 염화나프탈렌, 수은	Reflecting the newly listed POPs in the 7th Conference of the Parties to the Stockholm Convention ('15. 5), reflecting the mercury in accordance with the adoption of the Minamata Convention on mercury ('13 .10)

➢ 4.3_ Implement the international agreements regarding the regulations on oil and HNS

- Acceptance of oil / HNS regulation international convention :「 Marine Environment Management Act」

- Conducting international conferences and international cooperation activities for the implementation of the Convention
  - Preparation of "Hazardous and Hazardous Substances (HNS)" response manual
  - Operation of persistent organic pollutant monitoring network (Ministry of Environment, 2008 ~)
  - Establishment of information system for coastal control
  - Set up Korea-Japan HNS response system

2. Implementation of NSAP(Target.5: 5.1–5.2)

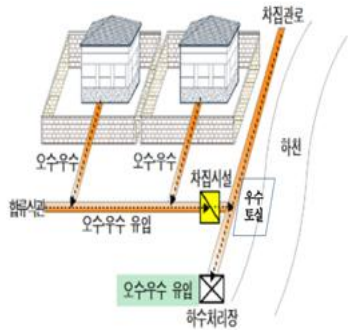
➢ 5.1_ Manage land–based point pollution source loads

- Expansion of basic environmental facilities: Promoting a project to expand environmental facilities to reduce the pollutant load(Ministry of Environment)

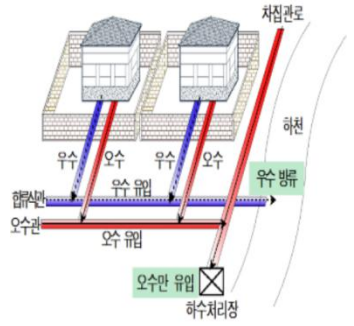
- Related basic facilities are increasing every year, maintenance of sewer pipes continuously

Table. Status of Environmental Facilities in Korea by Year

Facilities	2012	2013	2014	2015	2016
Public sewage	360	394	408	405	415
Industrial wastewater	51	56	59	65	71
Farm wastewater	48	47	47	46	47
Livestock wastewater	22	17	19	17	16
Manure handling	31	28	27	26	27
Simple sewage	12	12	12	12	12
Village sewage	1,638	1,669	1,726	1,761	1,747
Total	2,162	2,223	2,298	2,332	2,335



Combined sewage treatment(합류식)



Classification sewage treatment(분류식)

➢ 5.2_ Manage land–based non–point pollution source and atmospheric pollutants

- Manage land-based non-point pollution source and atmospheric pollutants: Various systems are being implemented to manage nonpoint pollution sources(Ministry of Environment& Ministry of Ocean & Fisheries

- Carried out for the four major river basins and special management waters

- Establishment of a measurement network for pollution control(463('11)→533('17)

- Implementation of water pollution total amount management system (Ministry of Environment) ('11 ~)
- Conduct non-point source management area designation system
- Total amount of pollution management(Ministry of Ocean & Fisheries)

2. Implementation of NSAP(Target.5, 6: 5.3&6.1)

KIOST 한국해양과학기술원

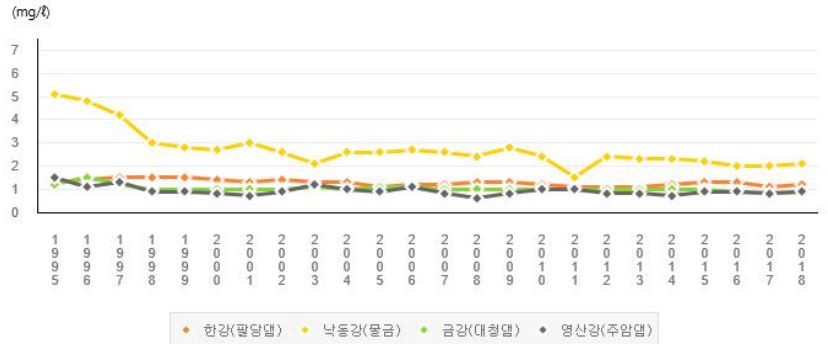
➢ 5.3_ Introduce new technology to reduce nutrient (nitrogen and phosphorus)

- Wastewater treatment facility High throughput rate : Developing related technology facilities for removing nutrients from point sources(Ministry of Environment)

- Level of high-throughput of domestic environmental facilities has gradually increased(‘12-)
- BOD of the four major rivers(main inflow routes of point pollution sources) has gradually decreased

Table. High-level throughput of environmental facilities (%)

Facilities	2012	2013	2014	2015	2016
Public sewage	80.6	83.8	84.6	90.1	91.3
Industrial wastewater	47.1	57.1	66.1	58.5	60.6
Farm wastewater	14.6	29.8	34.0	43.5	46.8
Livestock wastewater	36.4	41.2	42.1	58.8	56.3
Manure handling	45.2	46.4	40.7	46.2	51.9
Simple sewage	58.3	58.3	58.3	66.7	66.7
Village sewage	52.6	54.8	55.9	64.2	71.7
Total	56.0	59.3	60.5	67.9	74.0



➢ 6.1_ Minimize generation of marine litters through the management of original sources of marine litters and solid wastes materials

- Measures to prevent the generation of solid waste: 「 Marine Environment Management Act」 establishes

- "Waste Maritime Collection and Treatment Plan”, “Marine Litter Basic Plan(every five years, 2008-)
- Replaced styrofoam buoy with eco-friendly buoy and recovered waste styrofoam




Table. Distribution of biodegradable fishes

Year	2014	2015	2016	2017	Total
Fishing boat	370	380	480	374	1,604

2. Implementation of NSAP(Target.6: 6.2–6.3)

KIOST 한국해양과학기술원

➢ 6.2_ Strengthen a capability of marine litter treatment

- Marine waste management equipment and equipment introduction Collection volume : Management activities have been actively carried out through various marine litter collection and treatment facilities

- Promoting various projects for the management of marine litter(Sea, fishing port, fishing spot etc.,)
- The amount of marine litter collected is increasing

Table. Status of installation of marine garbage on the ship by region

Region	2010	2011	2012	2013	2014	2015	2016	2017
Busan	-	2	-	-	-	-	-	-
Incheon	-	1	-	-	-	-	-	-
Chungnam	5	1	2	2	3	3	3	3
Jeonbuk	-	2	2	2	2	2	2	2
Jeonnam	24	29	35	39	43	41	34	35
Gyeongnam	11	7	7	9	14	11	8	13
Total	40	42	46	52	62	57	47	53

Table. Amount of collection of marine litter by fishing port management ship

Year	days of operation	Volume (ton)			
		Floating garbage	Immersed garbage	obstacle	Total
2014	1,230	174	1,231	3,827	5,232
2015	1,253	39	1,590	4,649	6,278
2016	1,244	4	1,710	6,374	8,088
2017	1,279	1	341	12,428	12,770

➢ 6.3_ Establish management system of marine litters

- Marine litters Management System : Establishing and operating an integrated information system of marine litter

- Marine litters generation, collection volume, survey information, education, related data are managed
- Marine Waste Integrated Information System& Marine Litters Response Center (www.malic.or.kr), 2011-

Table. Marine Litter Response Center's budget('14-'18, one million won)

Year	2014	2015	2016	2017	2018	합계
Budget	307	269	271	381	407	1,634

2. Implementation of NSAP(Target.6,7: 6.3&7.1)

KIOST 한국해양과학기술원

➢ 6.3 Promote public participation and international cooperation

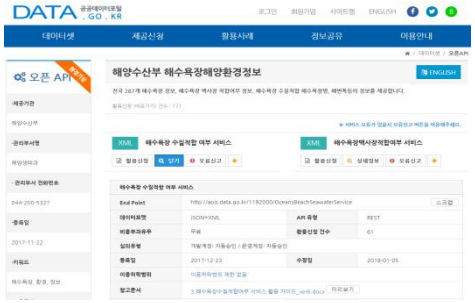
- Publice participation, education, international cooperation activities : Educating & promoting public awareness of marine litter, promoting international cooperation activities at the local level to solve marine litter problem
  - Various public service ads and TV campaigns are in progress, marine litter photography contest
  - Activation of coastal cleanup citizen participation, NOWPAP RAP / MALI and ICC Campaign Workshop

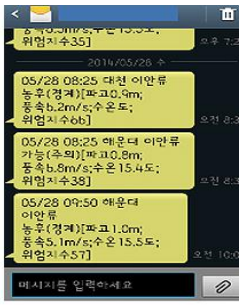
Table. Related Budget('14-'18, one million won)

Item	2014	2015	2016	2017	2018	Total
Joint campaigns and public service ads	3,500	3,500	3,500	3,500	3,500	17,500
Promotion Contest (photo)	70	44	40	44	136	334

➢ 7.1_ Conduct regular monitoring, assessment and information dissemination particularly in bathing beaches and other recreational waters

- Regular survey/ Information dissemination: Based on the standards and management guidelines for the "management of beaches"
  - Regular monitoring system for pollution and pollution of beaches has been established
  - Monitoring & information sharing system for pollution and harmful elements
- disclosure of relevant data, occurrence of toxic jellyfish, information of emergence of toxic jellyfish, etc.





2. Implementation of NSAP(Target.7,8: 7.2&8.1)

➢ 7.2 Control pollution in bathing beaches and other marine recreational waters

- Management of pollutant emission facilities : According to the「Sewerage Act」, the sewage treatment plant of major beaches is installed by local governments

- The regulations on the management and operation of the beach
- Actual operation and management are somewhat difficult

➢ 8.1_ Assess and monitor the impacts of N/P/Si ratio change

- Assess N/P/Si ratio change: Monitoring system for nutrients is maintained through the “marine environmental monitoring network”

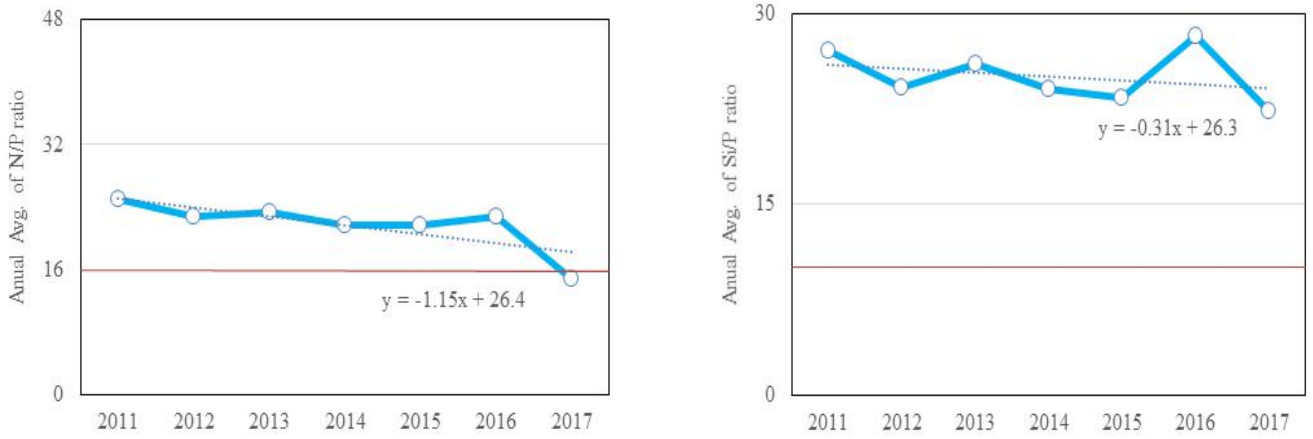


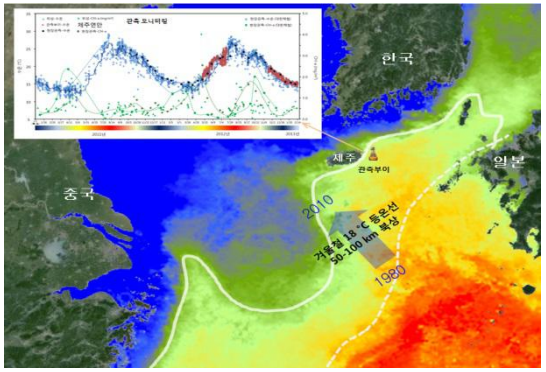
Fig. Annual N: P ratio change (left), Si: P ratio change (right), calculated by national marine environmental monitoring network data

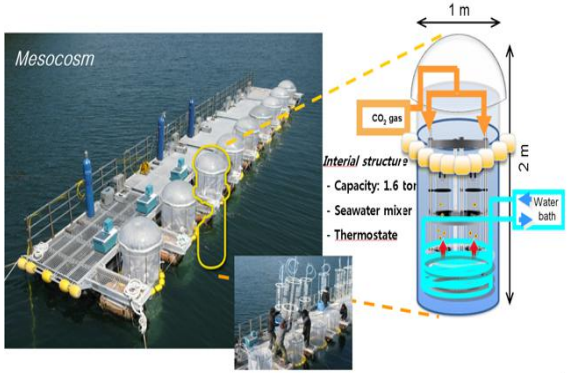
2. Implementation of NSAP(Target.8: 8.2–8.3)

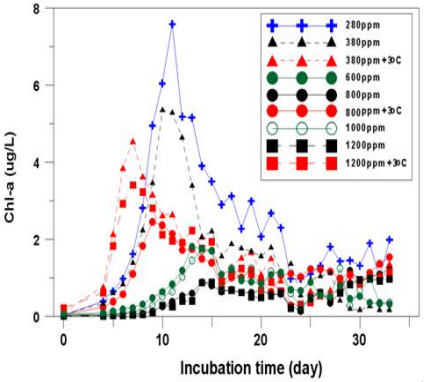
➢ 8.2 Assess and monitor impacts of lower nutrition level by climate change

- Monitoring / evaluation progress : Some of the activities carried out have been completed and terminated in a short period of time with a small national R & D task type(by KIOST, 2008-2010, 2013)

- In the last decade, decline in primary productivity and changes in the composition of microalgae (primary microalgae to microalgae) and the rapid increase of harmful zooplankton (jellyfish) since 2000

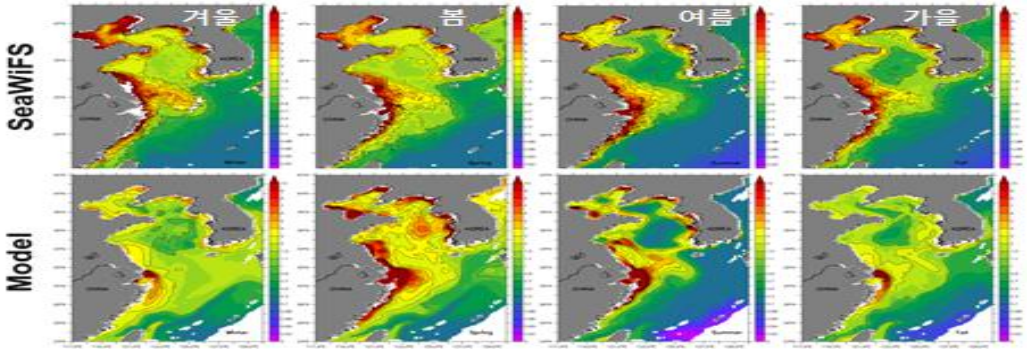






➢ 8.3_ Forecast ecosystem changes by climate change in the long-term scale

- Perform related research: Long-term projections for long-term fluctuation project were carried out by institutional research business unit(continuous programs execution required)



2. Implementation of NSAP(Target.8: 8.4–8.5)

KIOST 한국해양과학기술원

➢ 8.4 Monitor and assess the transboundary impact of jellyfish blooms

- Monitor and assess Action : Various activities have been developed
  - Research projects, national system construction, and international cooperation in the region
  - Provide information(Monitoring and appearance of jellyfish)

Table. Number of Nomura Catfish jellyfish(노무라깃해파리) monitoring

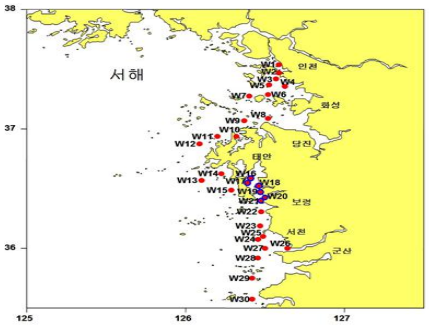
Sea/Year	2011	2012	2013	2014	2015	2016	2017
Inshore	3	5	5	5	5	5	5
Costal sea	24,420	22,275	23,680	37,760	37,760	18,290	17,515

Table. Estimated Number of Occurrences of Nomura Figueroa Jellyfish (100m-2, coastal: occurrence rate,%)

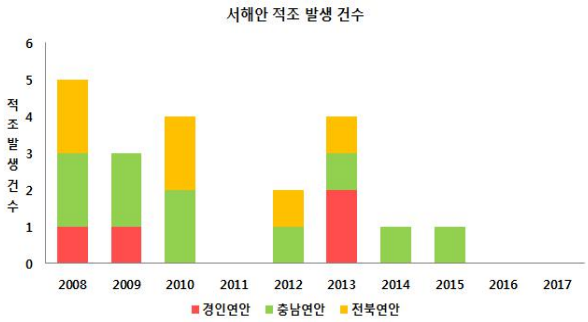
Sea/Year	2011	2012	2013	2014	2015	2016	2017
Offshore	0.2	3.1	0.2	-	-	-	-
Costal	4.81	25.12	25.21	15.61	19.31	24.15	16.59

➢ 8.5_ Monitor HAB occurrences

- Monitoring/ evaluation activities : NIFS has been continuously promoting monitoring and evaluation of harmful red tides
  - Since 2016, red tide has not occurred on the west coast
- Expansion of the red tide forecasting area & research scope using survey vessels/opportunity vessels
- Continuous physiological and ecological research on Yellow Sea red tide species
- Related activities for monitoring and evaluation of red tide effects(YSLME scale)



서해적조조사 정점도



2. Implementation of NSAP(Target.9, 10: 9.1&10.1)

KIOST 한국해양과학기술원

➢ 9.1_ Maintenance population and genetic diversity of marine living organisms including endangered and endemic species and development of management guideline

- Development of domestic guidelines and law : Establishment of Maritime Ecology Department(MOF)

- Has made the management of marine biodiversity conservation and protection guards
- Established various laws and long-term plans

- Based on the "Law Concerning the Conservation and Management of Marine Ecosystems (2006)"
- "Basic Plan for Marine Ecosystem Conservation and Management" every 10 years
- Have been pursuing various projects according to the plan

Table. Specification of protected marine life in Korea

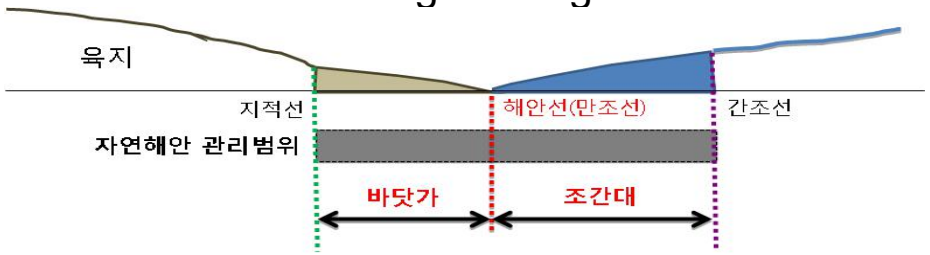
Year	2006	2012	2016
Designate Number	46	52	77
Remark	establishing marine ecology laws	Add 8 species Remove 1 species	Add 8 species

➢ 10.1_ Supplement costal management plan and develop regional guideline for effective habitats conservation and implementation

- Supplement costal management plan : Made efforts to manage land reclamation, reclamation, and destruction of natural coastline through revision of related laws including "Coastal Management Act".

- Reflects the environment & changes in the environment, complements regional plans,
- Establishes and implements various plans & regulations

- Implementation of natural coastal management goals and national natural coastal management goals



2. Implementation of NSAP(Target.10,11: 10.4&11.1)

KIOST 한국해양과학기술원

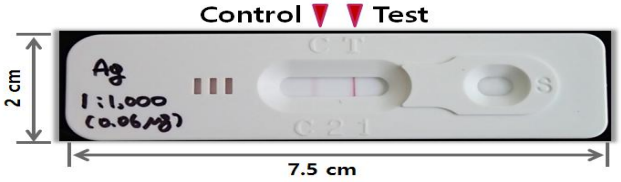
➢ 10.4_ Promote public awareness of the benefits of biodiversity conservation

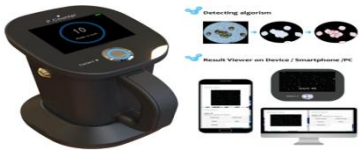
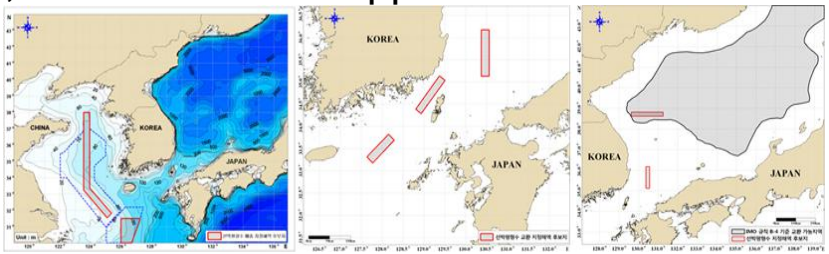
- Related public awareness actions : Carrying out public awareness-raising projects for developing contents(public's interest)
  - Opening of the National Marine Biological Resources Center(2015)
- Conducting a wide range of permanent and special exhibitions and events to promote public awareness



➢ 11.1_ Control and monitoring inflow of non-native species by discharge of ship ballast water

- Device and technology development(Monitoring / Control Actions) : Large-scale national R & D projects, systems, policies applicable to technology development, monitoring, control and management
  - Developed various devices and systems to monitor and control alien species caused by ship ballast water('development of countermeasures for ballast water emission regulation' project, KOST)
- Equipment and technology , Present the candidate site(Ballast water discharge designated area)
- Ship ballast water treatment and related system supplement, Establishment and operation of reporting system for vessel equilibrium entry and reporting system, National R & D support and infrastructure expansion



2. Implementation of NSAP(Target.11: 11.2)

KIOST 한국해양과학기술원

➢ 11.2 _ Efficient control of non-native species by precautionary approach

- Non-native species/harmful marine biological management system(actions) : Various regulations & systems have been supplemented
  - risk assessment, standards, management methods, related procedures
- Complementing regulation and management system for non-indigenous species inflow
- Non-indigenous species epidemiology, damage investigation and information system construction
- Promotion of harmful marine biological removal project
- Raising awareness and awareness about the introduction of alien species

Table. **Risk assessment criteria for designation and release of harmful marine organisms**

Standard	Details
Physiological and ecological characteristics of marine organisms to be evaluated	Ecological distribution characteristics: temporary or repetitive
	Post-event impact range: local or multiple emergence
	Diffusion rate: limited distribution, diffusion by current (algae), etc.
Characteristics of marine organisms to be evaluated on human or other organisms	Toxic substances of marine organisms
	Secondary damage caused by marine organisms
	Aesthetic adverse effects due to target marine life
Characteristics of damage to marine organisms to be evaluated	Whether the damage has occurred repeatedly
	The irresistible degree of difficulty such as individuals
	Necessity of Establishing National Response Plan

Table. marine ecosystem disturbance and harmful marine life

Division	Category	국명(보통명)	Scientific name	Remark
Marine ecosystem disturbance creature(1species)	Chordate 척삭동물	유령멍게	Ciona robusta	'17 New
Harmful marine life(17species)	Phytoplankton	디노피시스	Dinophysis spp.	
		슈도니치아	Pseudo-nitzschia spp.	
		알렉산드리움	Alexandrium spp.	
		차토넬라	Chattonella spp.	
		코클로디니움	Cochlodinium polykrikoides	
	Zippo animal	노무라입깃해파리	Nemopilema nomurai	
		보름달물해파리	Aurelia aurita	'16 New
		작은부레관해파리	Physalia physalis	
		작은상자해파리	Carybdea brevipedalia	'17 New
		커튼원양해파리	Chrysaora pacifica	'17 New
	Echinoderm	별불가사리	Asterina pectinifera	
		아무르불가사리	Asterias amurensis	
	Taiga	관막이끼벌레	Membranipora tuberculata	
		세방가시이끼벌레	Tricellaria occidentalis	
		자주빛이끼벌레	Watersipora subovoidea	
	plant	갯줄풀	Spartina alterniflora	'16 New

KIOST
한국해양과학기술원

PART.3:

Comprehensive analysis & Suggestions

3. Comprehensive analysis & Suggestions

KIOST 한국해양과학기술원

Results:

	Actions in NSAP	Y/N
1	1.1 : Reduce the number of fishing boats and maintain a proper mid-long term level of fishing efforts, in consideration of the fish stock	Y
2	1.2 : Designate the closed areas and seasons for spawning and fishery resources	Y
3	1.3 : Improve monitoring and assessing the stock fluctuation in the region	Y
4	2.1 : Set appropriate mesh size and develop fishing gears in resources management type	Y
5	2.2 : Restore fishery resources	Y
6	2.3 : Establish reasonable fishery resources management system	Y
7	3.1 : Reduce pollutant and improve promote the health of aquaculture organisms by Integrated Multi-Trophic Aquaculture(IMTA)	Y ON
8	3.2 : Supply industrialized seawater recirculating filter system and develop substitute feed source using fishery byproducts	Y
9	3.3 : Implement early warning, diagnosis system, effective management for mariculture diseases	Y
10	4.1 : Intensive pollution monitoring and evaluation	Y
11	4.2 : Comply with the international standards for regulating the toxic pollutants	Y
12	4.3 : Implement the international agreements regarding the regulations on oil and HNS	Y
13	5.1 : Manage land-based point pollution source loads	Y
14	5.2 : Manage land-based non-point pollution source and atmospheric pollutants	Y
15	5.3 : Introduce new technology to reduce nutrient (nitrogen and phosphorus)	Y
16	6.1 : Minimize generation of marine litters through the management of original sources of marine litters and solid wastes materials	Y
17	6.2 : Strengthen a capability of marine litter treatment	Y
18	6.3 : Establish management system of marine litters	Y
19	6.4 : Promote public participation and international cooperation	Y
20	7.1 : Conduct regular monitoring, assessment and information dissemination particularly in bathing beaches and other recreational waters	Y
21	7.2 : Control pollution in bathing beaches and other marine recreational waters	Y
22	8.1 : Assess and monitor the impacts of N/P/Si ratio change	Y
23	8.2 : Assess and monitor impacts of lower nutrition level by climate change	Y ON
24	8.3 : Forecast ecosystem changes by climate change in the long-term scale	Y
25	8.4 : Monitor and assess the transboundary impact of jellyfish blooms	Y
26	8.5 : Monitor HAB occurrences	Y
27	9.1 : Maintenance population and genetic diversity of marine living organisms including endangered and endemic species and development of management guideline	Y
28	10.1 : Supplement costal management plan and develop regional guideline for effective habitats conservation and implementation	Y
29	10.2 : Expand marine protected areas (MPA), implement effective management and establish a network	Y
30	10.3 : Control new coastal reclamation demand and implement a proper management	Y
31	10.4 : Promote public awareness of the benefits of biodiversity conservation	Y
32	11.1 : Control and monitoring inflow of non-native species by discharge of ship ballast water	Y
33	11.2 : Efficient control of non-native species by precautionary approach	Y

3. Comprehensive analysis & Suggestions

➢ Factors: Legal System, Governance, Systems, Public, Cooperation

1 Legal system/policy

- Legal system
- Long-term planning
- Action plan guideline
- Participation in international agreements
- Amendment of legal system considering environment change

2 Exclusive Charge Department

- A dedicated department for policy I tation
- Established an organization with specialized functions
- MOF, KHOA, NIFS, MABIK, KIOST, KOEM, etc.
- Consistent policy enforcement

3 Various systems/ R&D/ Investment

- Regular Investigation Network
- Data generation and management / disclosure system
- Environmental monitoring system (Ocean, Soil, Atmosphere, etc.)
- Small / Medium-sized R & D and Performance

4 Broad public awareness/Cooperation

- Public awareness promotion based on various policies, plans, R & D projects
- Various activities carried out by NGOs, etc. (Marine litter, etc.)
- Other international cooperation

3. Comprehensive analysis & Suggestions

➢ Questions & Dilamas: Issue, Strengthen cooperation, North Korea

01

Significant issues are still in the YS

- Overfishing
- Marine litter Jellyfish breeding
- Contaminant inflow…

02

Effect of national implementation?

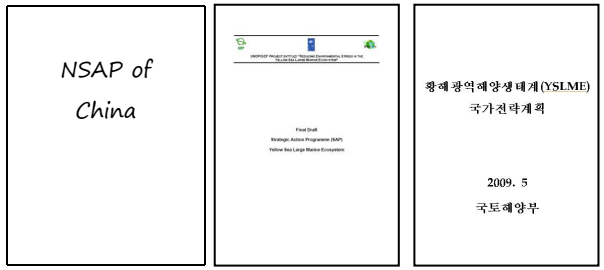
- Fishery resources & regulations in the YS
- Reigonal cooperation
- Regular communication system…

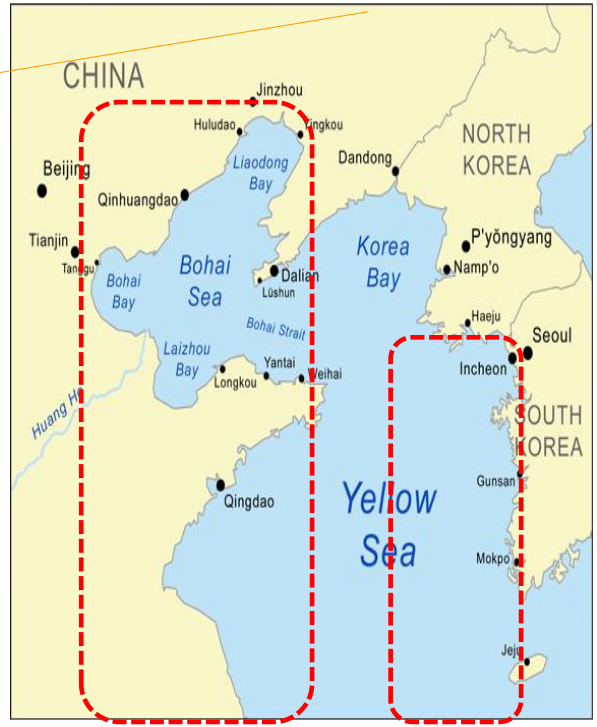
03

Reasonable/Complete way for conserving the YS

- Participation of North Korea
- Strengthen regional cooperation program(action)
- Analysis of environmental changes after NSAP implementation…

NSAP (China) | SAP | NSAP (KOREA)





Thanks for your attention

KIOST
한국해양과학기술원