

Marine Environment Monitoring Systems in Korea

Clean Ocean for the Future
Cleaner Ocean For Happier Earth

**KOEM, NIFS, KIOST
Hanyang Univ.**



National Marine Environment Monitoring Systems

I. Marine Environment Monitoring (using research vessels)

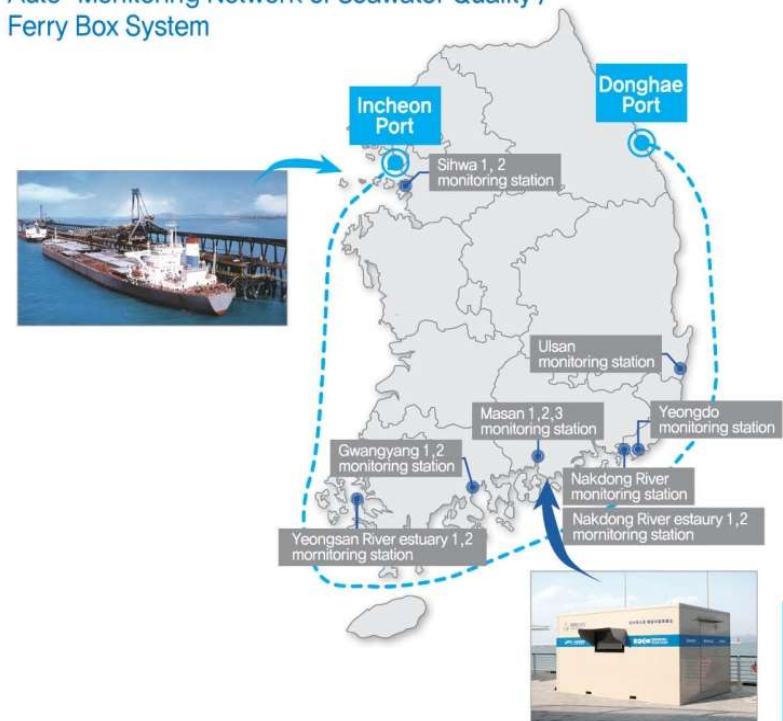
II. Continuous Monitoring

I.



II.

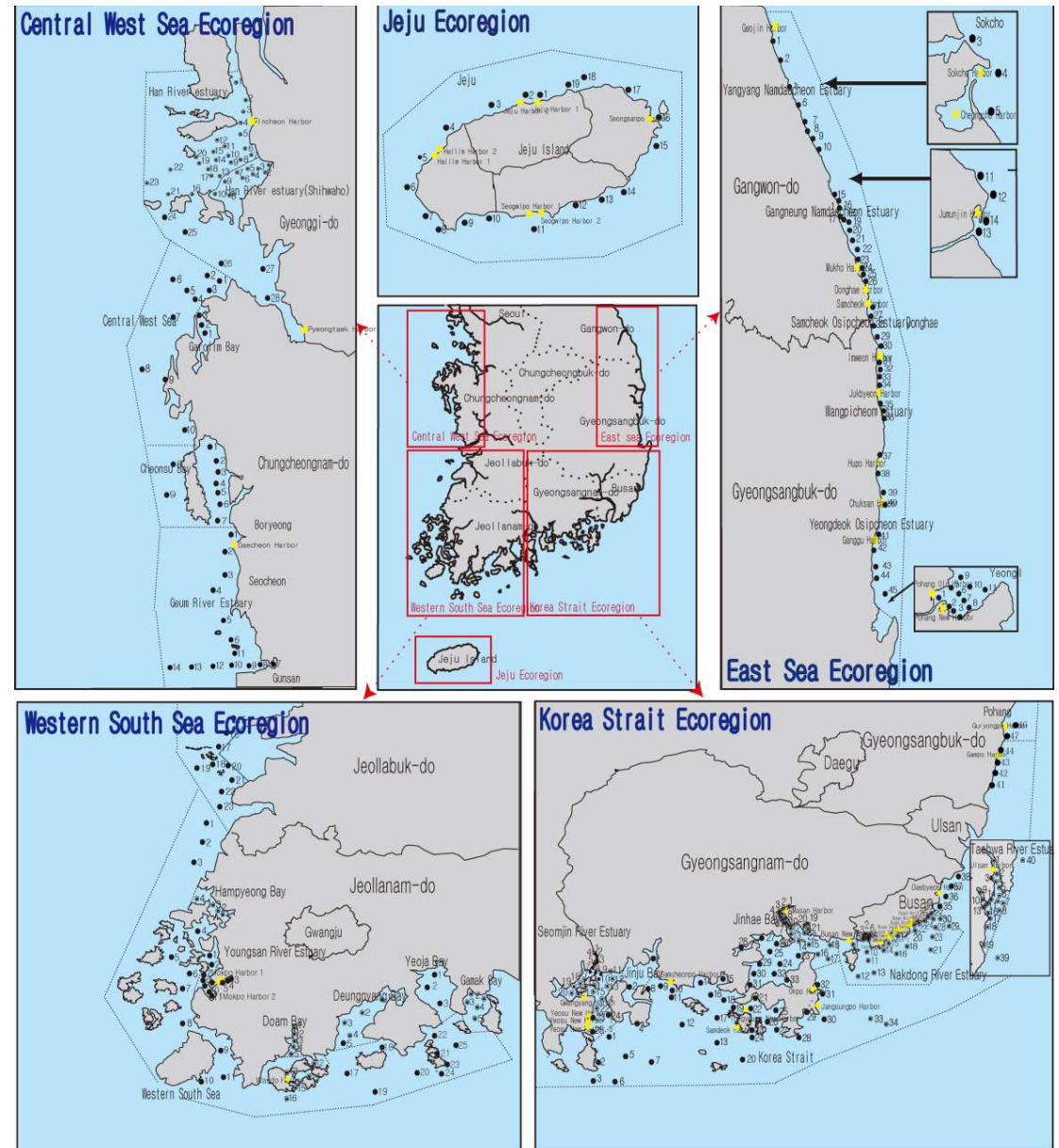
Auto-Monitoring Network of Seawater Quality / Ferry Box System



Marine Environment Monitoring

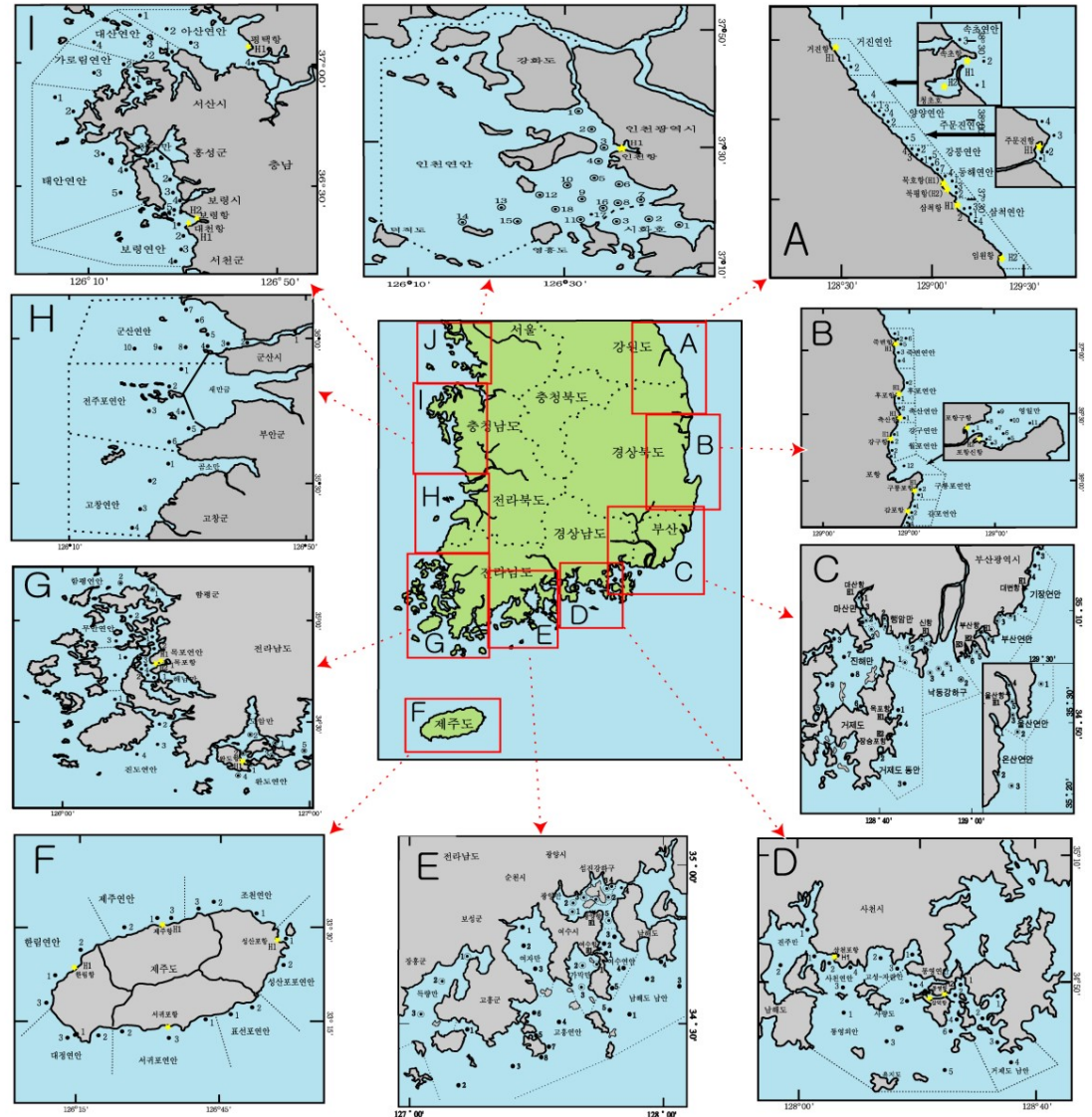
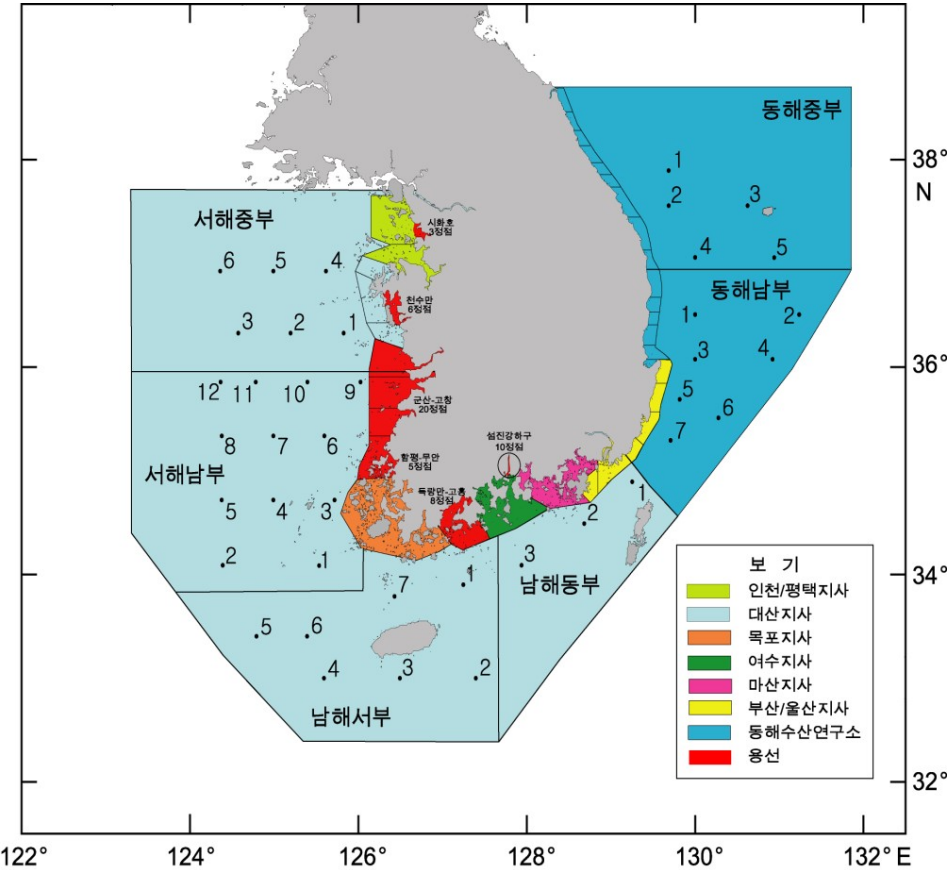
- Sampling stations
 - 425 sts.
- Sampling frequency
 - 4 times/yr
 - (Feb., May, Aug., Nov.)
- Sample matrix
 - Seawater, sediment, biota
- Survey parameters
 - ~50 items

<Station map>



Marine Environment Monitoring (1980-)

해양환경측정망 조사정점 총괄

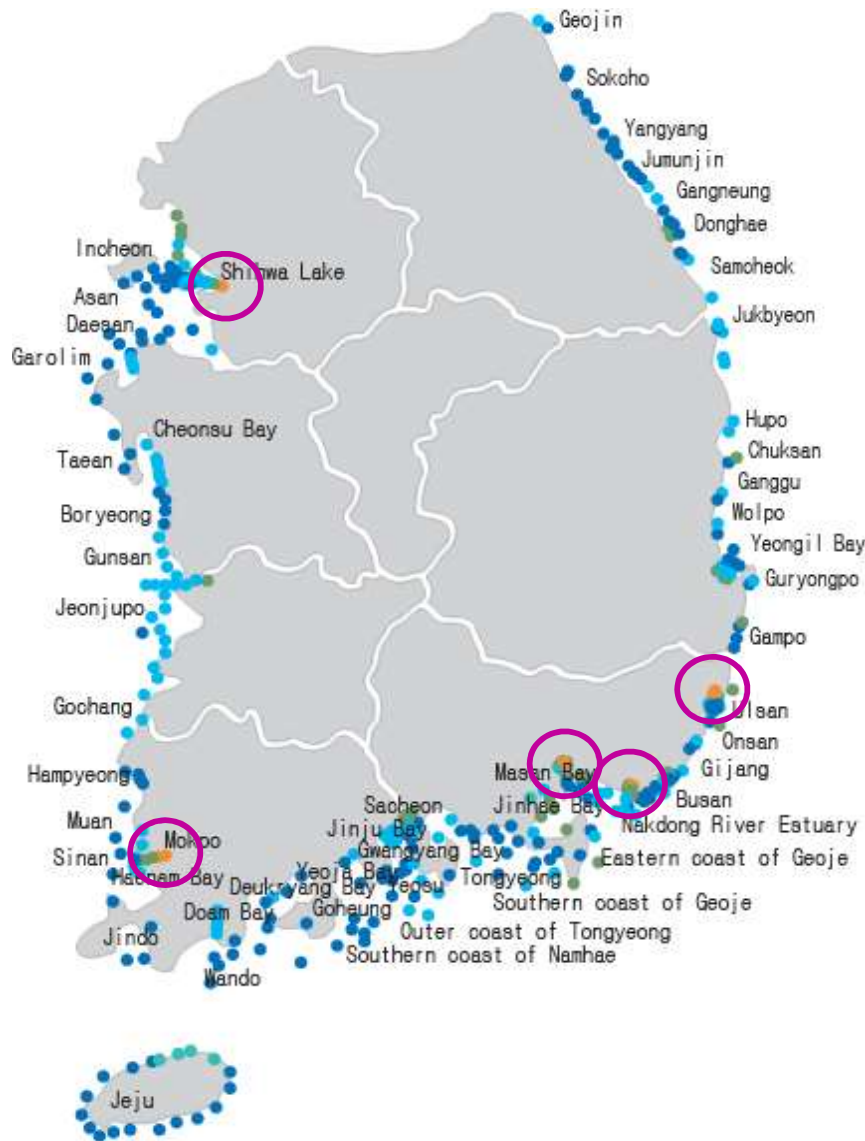


Marine Environment Monitoring

Matrix	Parameters		Month	Stations
Seawater	General Water P.	WT, Sal, pH, DO, COD, TN, DIN (NO ₂ -N, NH ₄ -N, NO ₃ -N), TP, DIP (PO ₄ -P), SiO ₂ -Si, O&G, SS, Transparency	2, 5, 8, 11	374 STN
	Trace Metals	Cu, Pb, Zn, Cd, Cr ⁶⁺ , Tot Hg, As, CN	2, 8	81 STN
Biota	General Water P.	Chlorophyll- <i>a</i> , Ecoli	2, 5, 8, 11	374 STN
			2, 5, 8, 11	81 STN
	Trace Metals	Cu, Pb, Zn, Cd, Cr, Tot Hg, As	2	25 STN
	POPs	PCBs, TBT, OCPs, PAHs, Dioxins/Furans	2	25 STN
Sediment	General Water P. (4)	Grain size, IL, Sulfate, COD	2	81 STN
	Trace Metals (7)	Cu, Pb, Zn, Cd, Cr, Tot Hg As	2	81 STN
	POPs	PCBs, TBT, OCPs, PAHs, Dioxins/Furans	2	25 STN

Water quality monitoring results

Water quality (2016)



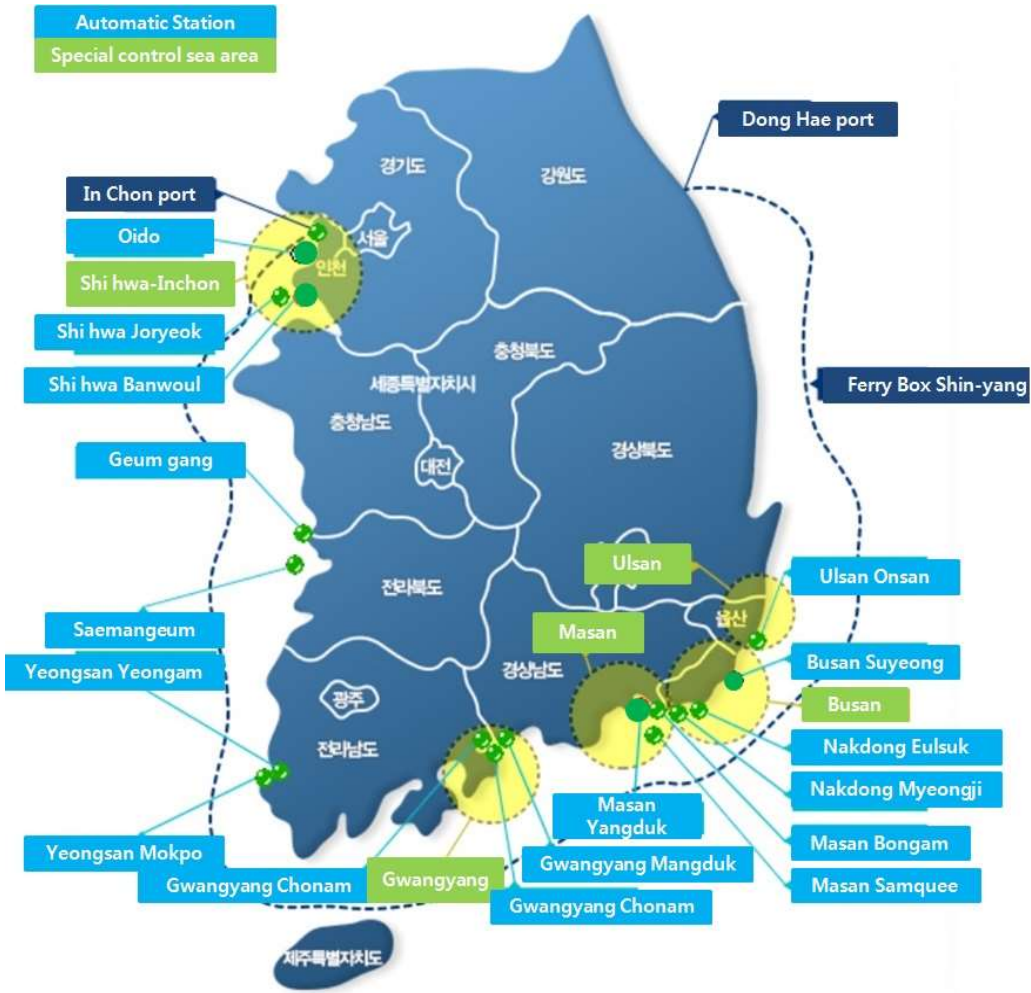
WQI (Water Quality Index)

$$= 10 * [\text{DO}\%(\text{bottom})] + 6 * [(\text{Chl } a + \text{Secchi Disk}) / 2] + 4 * [(\text{DIN} + \text{DIP}) / 2]$$

Water Quality Index Range	Water Quality Rating
≤ 23	Excellent
24-33	Good
34-46	Medium
47-59	Bad
≥ 60	Very Bad

Continuous Marine Environment Monitoring

● Map of stations



- Stations : 17 stations in pollution hotspots and estuaries
- Monitoring matrix : surface seawater (~1 m depth)



Continuous Marine Environment Monitoring

Platform



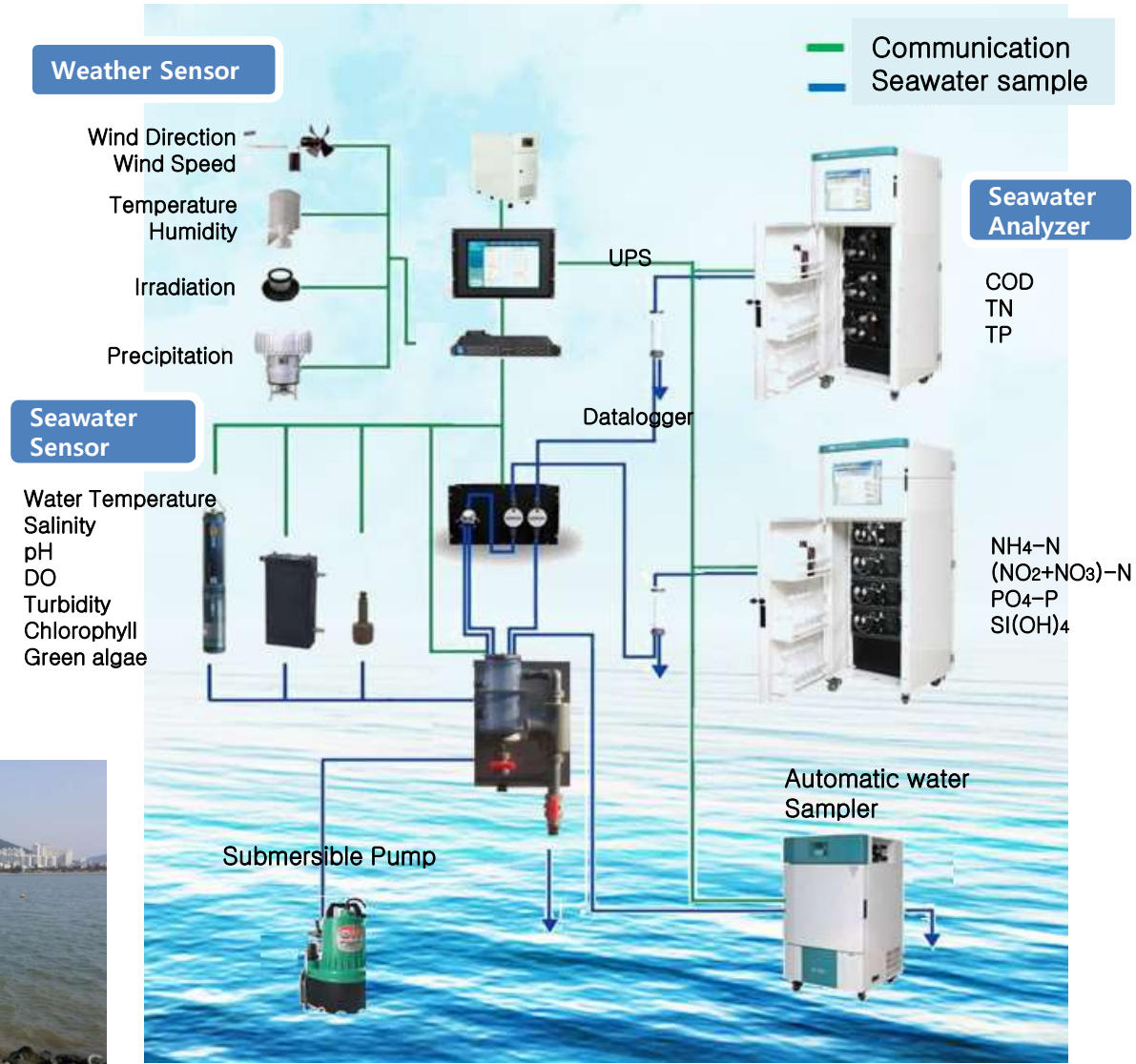
Seawater sampling system



Cantilever



Float

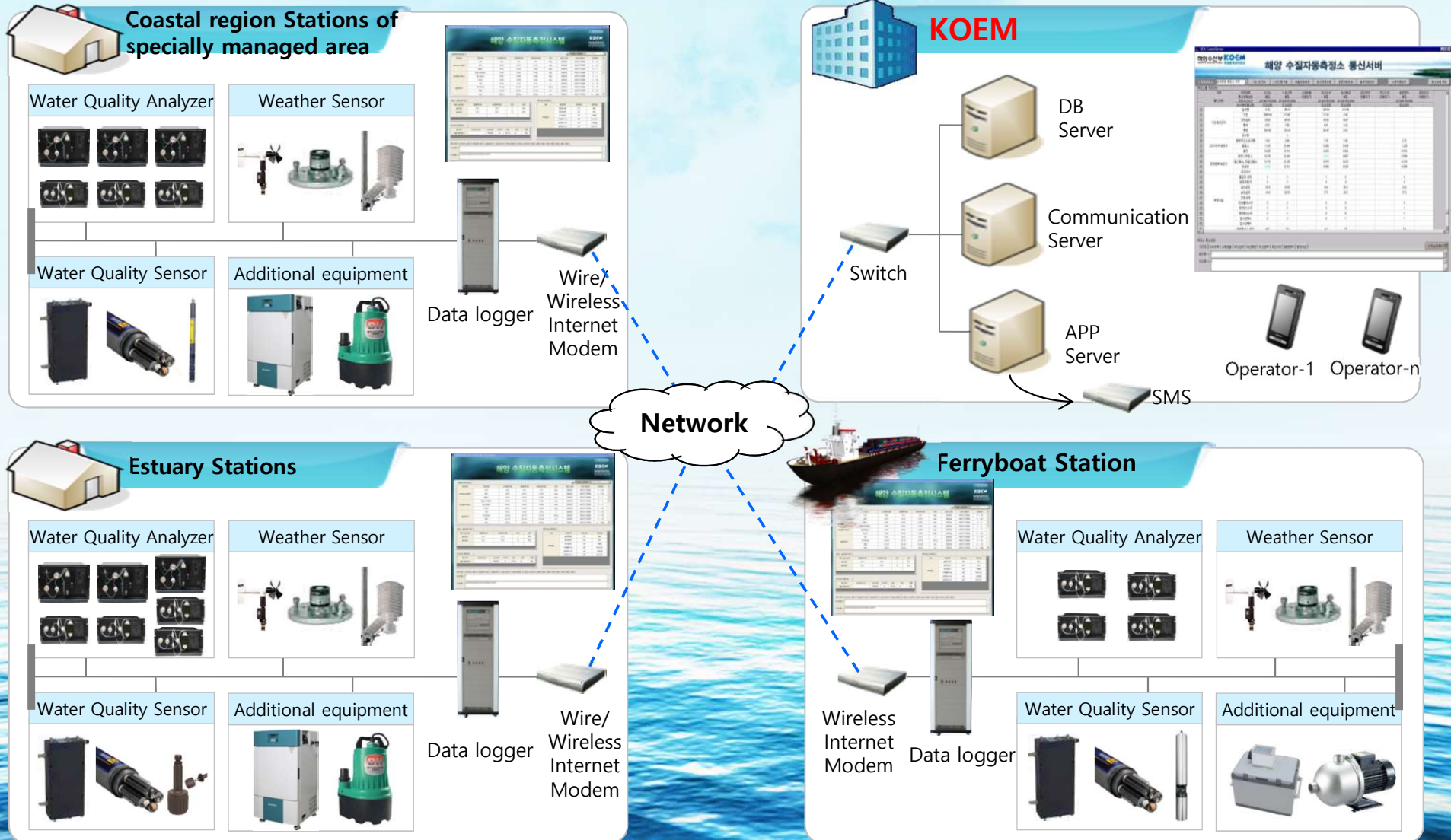


Measurement cycle

Weather Sensor	5 min
Water Quality Sensor	5 min
Water Quality Analyzer	1 hour

National Monitoring Scheme

> Operating System



Monitoring results

Data service :

- Marine Environment Information System (MEIS) website (www.meis.go.kr)
- Reports (Annual and semiannual reports)

MEIS Marine Environment Information System
국가해양환경정보통합시스템
해양환경 연구기관간 서버연계 및 정보통합 기반 조성

MEIS 국가해양환경정보통합시스템

News ▶ 해양쓰레기 수거, 정부지원 '질실'(뉴스웨이, 2014.11.25)

맞춤형서비스

- 해양환경교실
- 국가에서 집중관리하는 해역은 어떤것이 있을까?
- 기후변화로 지구가 힘들어요
- 민화로 배우는 해양환경
- 전문자료실
- 정책지원

POPUP ZONE

환경보전해역백지 다운로드

해양수질평가지수 해양수질자동측정망 국내해양환경조사현황

정점명 : 영산영암
주소 : 전남 영암군 삼호읍 나불리 544
측정일시 : 2015-01-27 07시
수온(°C) : 6.3208
염분 :
수소이온농도 : 8.1242
용존산소(mg/L) : 10.6992
화학적산소요구(mg/L) : 2.665
총질소(mg/L) : 1.218
총인(mg/L) : 0.0359

시계열(수온)

시계열(수온)	1/27 03	1/27 04	1/27 05	1/27 06	1/27 07
수온(°C)	6.3208	6.3208	6.3208	6.3208	6.3208

관련사이트

해양수산부, 국립해양조사원 KHDA, 국민안전처, 국립수질연구원, KIOST, KOEM 해양환경관리공단

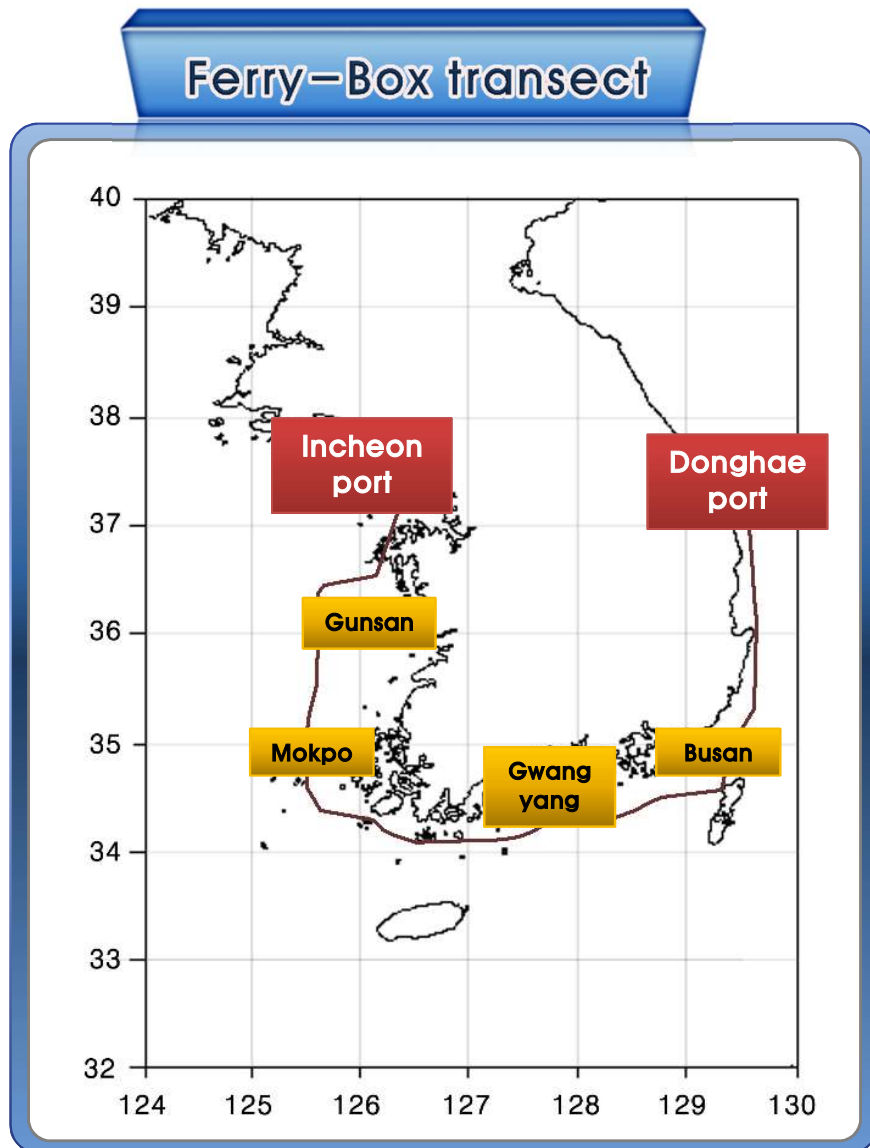
부산권역
해양수질자동측정소
측정자료 소식지
2014년 상반기(1월-6월)

해양수산부 KOEM 해양환경관리공단

2015
한국해양환경관리공단
2015년
한국해양환경
조사연보 제20권
Annual Report on Marine Environment
Monitoring in Korea 2015

해양수산부 KOEM 해양환경관리공단

Ferry-Box (Ship of Opportunity) system



Commercial ship



Seawater sensors



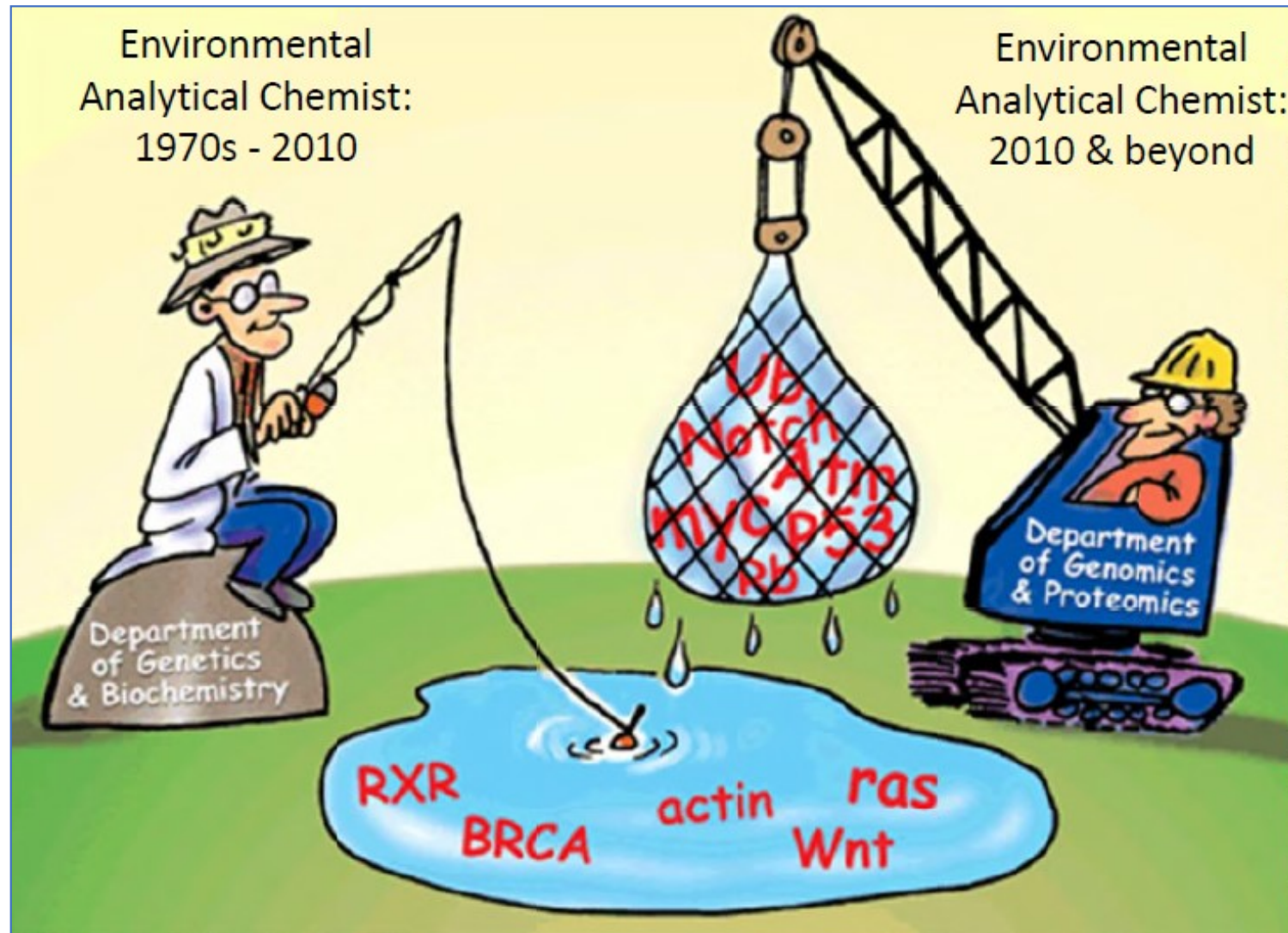
Atmosphere sensors



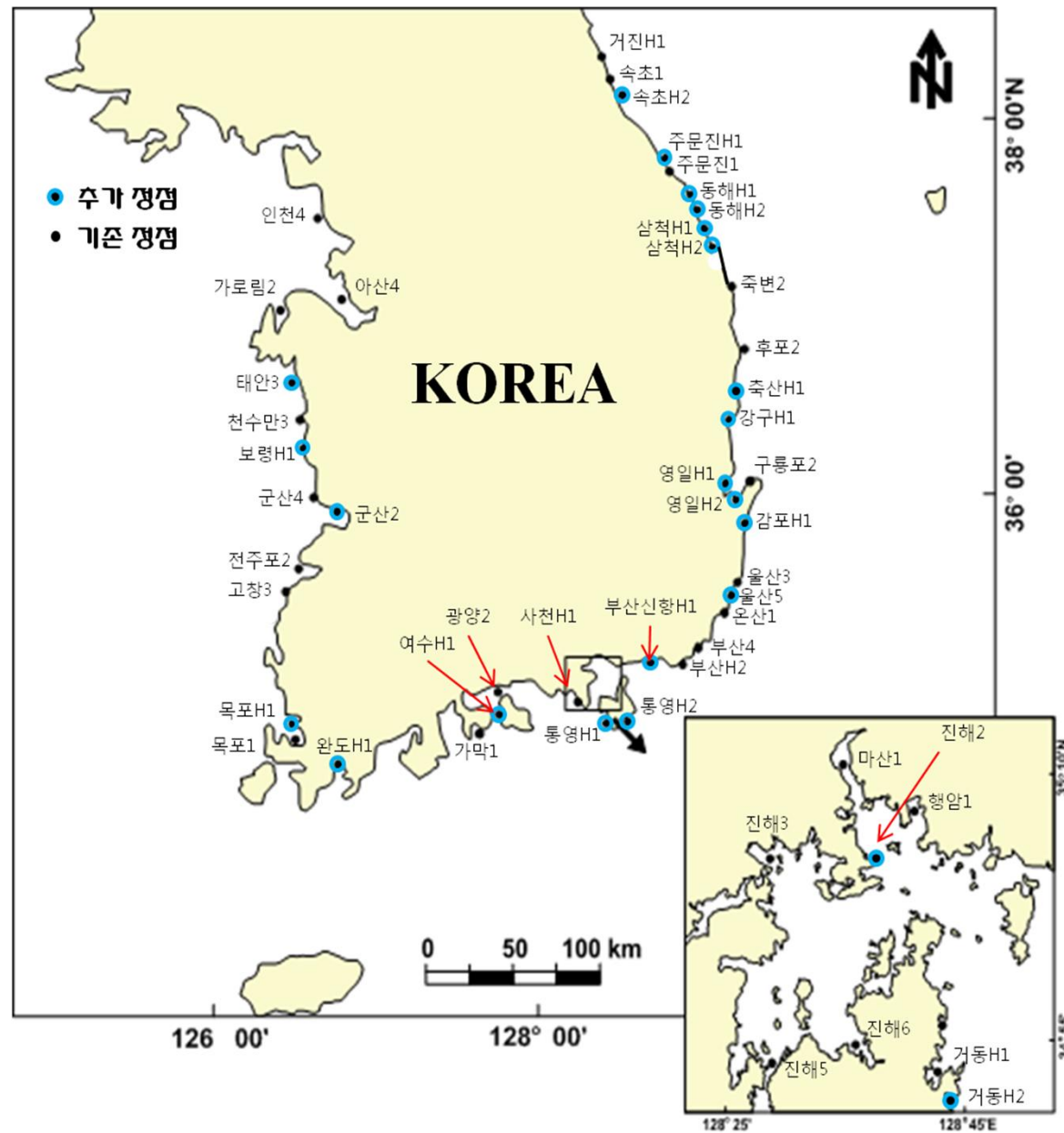
Monitoring instrument

- ❖ Line : Incheon-Donghae port
- ❖ Distance : ~1200 km
- ❖ Frequency : ~8 times/month
- ❖ Seawater : Temp., etc.(10 para.)
- ❖ Atmosphere : 3 para.

POPs in the Marine Ecosystems (2015)



Sampling Stations (25+25)



Target Pollutants: Dioxins & Furans (17)

PCDDs (7)	I-TEF	PCDFs (10)	I-TEF
2,3,7,8-T ₄ CDD	1	2,3,7,8-T ₄ CDF	0.1
1,2,3,7,8-P ₅ CDD	0.5	1,2,3,7,8-P ₅ CDF	0.05
		2,3,4,7,8-P ₅ CDF	0.5
1,2,3,4,7,8-H ₆ CDD	0.1	1,2,3,4,7,8-H ₆ CDF	0.1
1,2,3,6,7,8-H ₆ CDD	0.1	1,2,3,6,7,8-H ₆ CDF	0.1
1,2,3,7,8,9-H ₆ CDD	0.1	1,2,3,7,8,9-H ₆ CDF	0.1
		2,3,4,6,7,8-H ₆ CDF	0.1
1,2,3,4,6,7,8-H ₇ CDD	0.01	1,2,3,4,6,7,8-H ₇ CDF	0.01
		1,2,3,4,7,8,9-H ₇ CDF	0.01
1,2,3,4,6,7,8,9-O ₈ CDD	0.001	1,2,3,4,6,7,8,9-O ₈ CDF	0.001

Target Pollutants: PCBs (22)

PCBs (22)	IUPAC No.	PCBs	IUPAC No.
2,4'-Dichlorobiphenyl	8	2,2',3,3',4,4'-Hexachlorobiphenyl	128
2,2',5-Trichlorobiphenyl	18	2,2',3,4,4',5'-Hexachlorobiphenyl	138
2,4,4'-Trichlorobiphenyl	28	2,2',4,4',5,5'-Hexachlorobiphenyl	153
2,4,5-Trichlorobiphenyl	29	2,2',3,3',4,4',5-Heptachlorobiphenyl	170
2,2',3,5'-Tetrachlorobiphenyl	44	2,2',3,4,4',5,5'-Heptachlorobiphenyl	180
2,2',5,5'-Tetrachlorobiphenyl	52	2,2',3,4',5,5',6-Heptachlorobiphenyl	187
2,2',3,4,5'-Pentachlorobiphenyl	87	2,2',3,3',4,4',5,5'-Octachlorobiphenyl	194
2,2',4,5,5'-Pentachlorobiphenyl	101	2,2',3,3',4,4',5,6-Octachlorobiphenyl	195
2,3,3',4,4'-Pentachlorobiphenyl	105	2,2',3,3',4,5',6,6'-Octachlorobiphenyl	200
2,3,3',4',6-Pentachlorobiphenyl	110	2,3,3',4,4',5,5',6-Octachlorobiphenyl	205
2,3',4,4',5-Pentachlorobiphenyl	118	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	206

Target Pollutants: OCPs (14) & CLBz (8)

OCPs (14)

DDT	<i>o,p'</i> -DDE	HCH	α -HCH	CHL	Oxychlordane
	<i>p,p'</i> -DDE				cis-chlordane
	<i>o,p'</i> -DDD		β -HCH		trans-chlordane
	<i>p,p'</i> -DDD				trans-nonachlor
	<i>o,p'</i> -DDT		γ -HCH		cis-nonachlor
	<i>p,p'</i> -DDT				

CLBz (8)

1,2,3-Trichlorobenzene	1,2,3-TriCB
1,2,4-Trichlorobenzene	TriCB
1,3,5-Trichlorobenzene	TriCB
1,2,3,4-Techlorobenzene	TeCB
1,2,3,5-Techlorobenzene	TeCB
1,2,4,5-Techlorobenzene	TeCB
1,2,3,4,5-Pentachlorobenze	PeCB
1,2,3,4,5,6-Hexachlorobenze	HCB

Target Pollutants: PAHs (16)

PAHs (16)

Naphthalene	NaP
Acenaphthylene	AcPy
Acenaphthene	AcP
Fluorene	Flu
Phenanthrene	PhA
Anthracene	AnT
Fluoranthene	FluA
Pyrene	Pyr
Benzo(a)anthracene	BaA
Chrysene	Chr
Benzo(b)fluoranthene	BbF
Benzo(k)fluoranthene	BkF
Benzo(a)pyrene	BaP
Indeno(1,2,3-c,d)pyrene	InP
Dibenz(a,h)anthracene	DbA
Benzo(g,h,i)perylene	BghiP

Target Pollutants: PBDEs (22)

PBDEs (22)	IUPAC No.	PBDEs	IUPAC No.
2,2',4-Tribromodiphenylether	17	2,2',3,4,4',5'-Hexabromodiphenylether	138
2,4,4'-Tribromodiphenylether	28	2,2',4,4',5,5'-Hexabromodiphenylether	153
2,2',4,4'-Tetrabromodiphenylether	47	2,2',4,4',5,6'-Hexabromodiphenylether	154
2,2',4,5'-Tetrabromodiphenylether	49	2,3,3',4,4',5-Hexabromodiphenylether	156
2,3',4,4'-Tetrabromodiphenylether	66	2,2',3,4,4',5',6-Heptabromodiphenylether	183
2,3',4',6-Tetrabromodiphenylether	71	2,2',3,4,4',6,6'-Heptabromodiphenylether	184
3,3',4,4'-Tetrabromodiphenylether	77	2,2,3',4,4',5',6-Heptabromodiphenylether	191
2,2',3,4,4'-Pentabromodiphenylether	85	2,2',3,3',4,4',5,6'-Octabromodiphenylether	196
2,2',4,4',5-Pentabromodiphenylether	99	2,2',3,3',4,4',6,6'-Octabromodiphenylether	197
2,2',4,4',6-Pentabromodiphenylether	100	2,2',3,3',4,4',5,5',6-Nonabromodiphenylether	206
2,3',4,4',6-Pentabromodiphenylether	119	2,2',3,3',4,4',5,6,6'-Nonabromodiphenylether	207
3,3',4,4',5-Pentabromodiphenylether	126	2,2',3,3',4,4',5,5',6,6'-Decabromodiphenylether	209

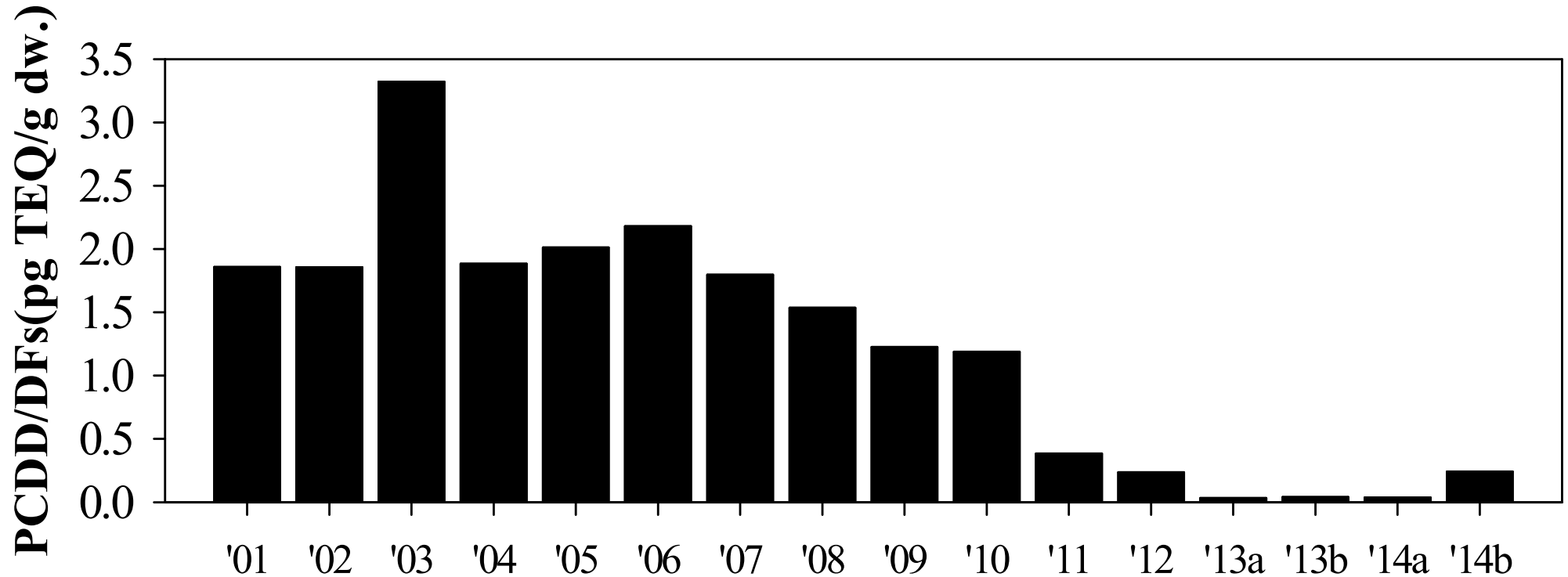
Target Pollutants: PFCs (16)

PFCs (16)		MW
Perfluorobutane sulfonate	PFBS	300
Perfluorohexane sulfonate	PFHS	399
Perfluorooctane sulfonate	PFOS	500
Perfluorodecane sulfonate	PFDS	599
Perfluoropentanoic acid	PFPeA	264
Perfluorohexanoic acid	PFHxA	314
Perfluoroheptanoic acid	PFHpA	364
Perfluorooctanoic acid	PFOA	414
Perfluorononanoic acid	PFNA	464
Perfluorodecanoic acid	PFDA	514
Perfluoroundecanoic acid	PFUnDA	564
Perfluorododecanoic acid	PFDoDA	614
Perfluorotridecanoic acid	PFTTrDA	664
Perfluorotetradecanoic acid	PFTTeDA	714
Perfluorohexadecanoic acid	PFHxDA	764
Perfluorooctadecanoic acid	PFODDA	814

Target Pollutants: HBCDs (3)

HBCDs	IUPAC No.
alpha-hexabromocyclododecane	α -HBCD
beta-hexabromocyclododecane	β -HBCD
gamma-hexabromocyclododecane	γ -HBCD

Trend of PCDD/Fs in Bottom Sediments



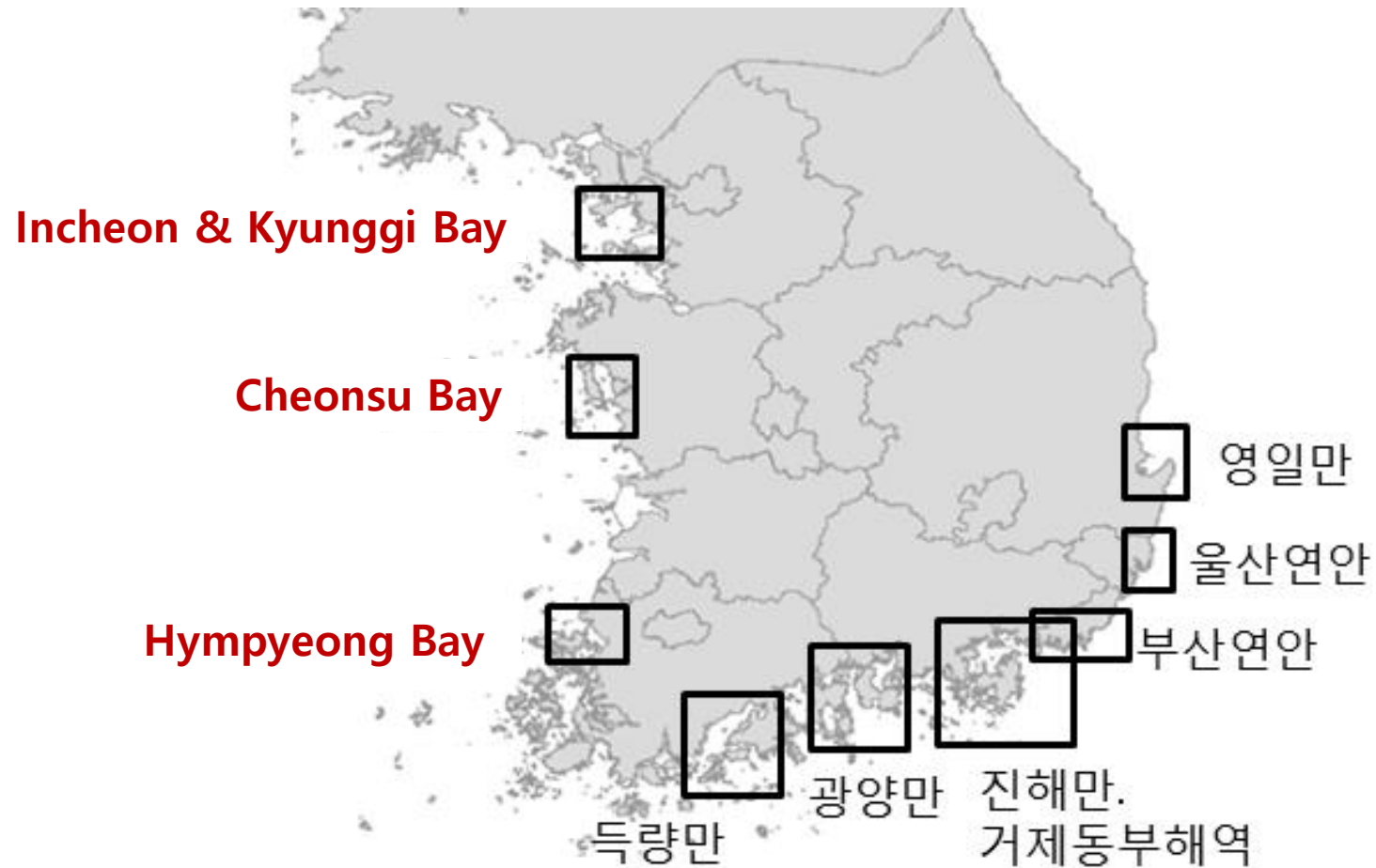
- Trend of PCDD/Fs in bottom sediment (a: 25 sampling stations, b: 25 old and 25 new sampling stations)

Microplastics on Beach (KIOST)

(1mm < s < 5 mm)

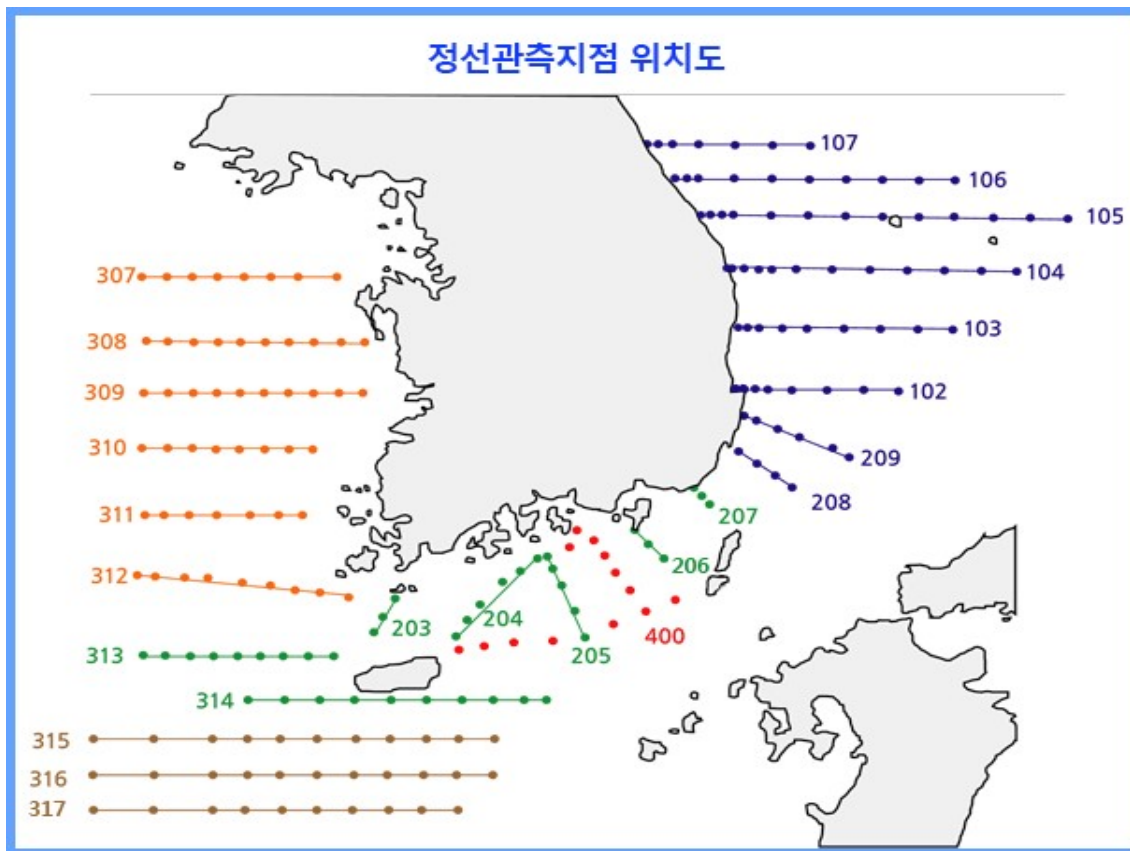


Microplastics in sea surface (KIOST)



Serial Oceanographic Observations by NIFS (1921-)

The serial oceanographic observations have been carried out from 1921 in Korea. The present-day **207 stations from 25 observation lines** have been set up. The survey cruise is implemented bimonthly for the waters around the Korean Peninsula.

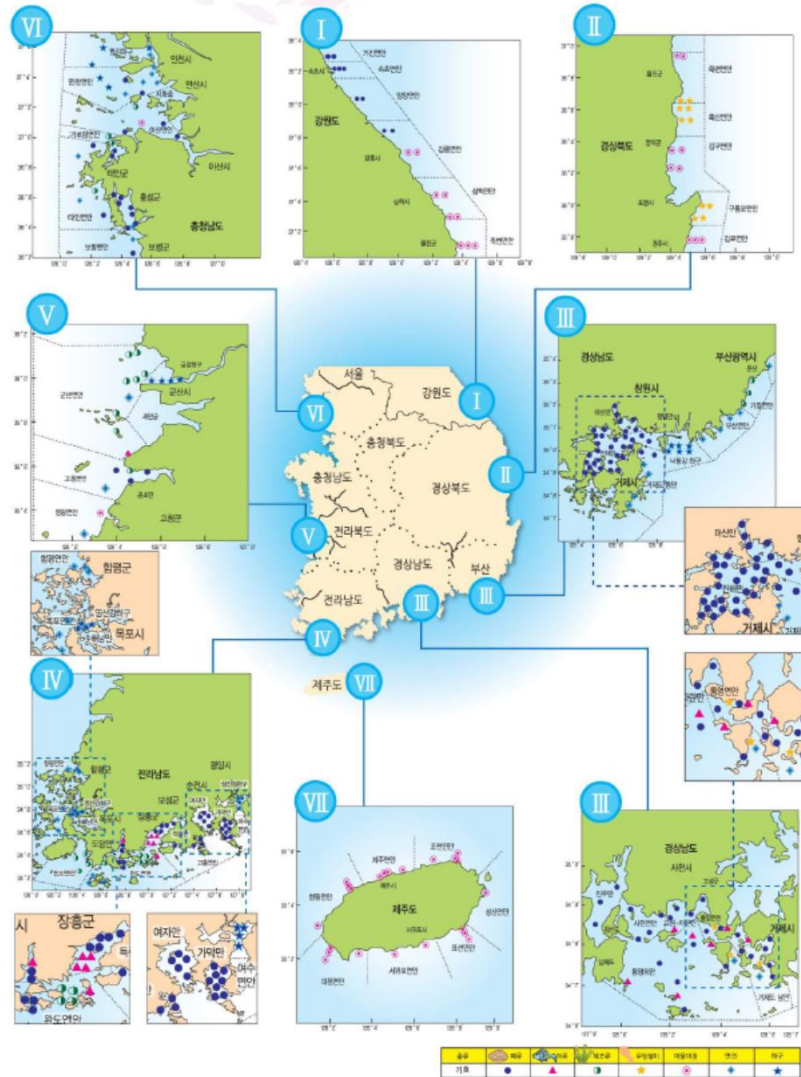


Observation Parameters

- ✓ Seawater temp. and salinity
- ✓ DO
- ✓ Nutrients
nitrate, nitrite, silicate, phosphate
- ✓ Zooplankton biomass
- ✓ Chlorophyll-*a*
- ✓ Meteorological parameters
air temp, air pressure, wind direction and speed, cloudage and cloud form, wave direction and height

Integrated Monitoring of Aquaculture Farms (NIFS)

어장환경모니터링 조사정점 총괄



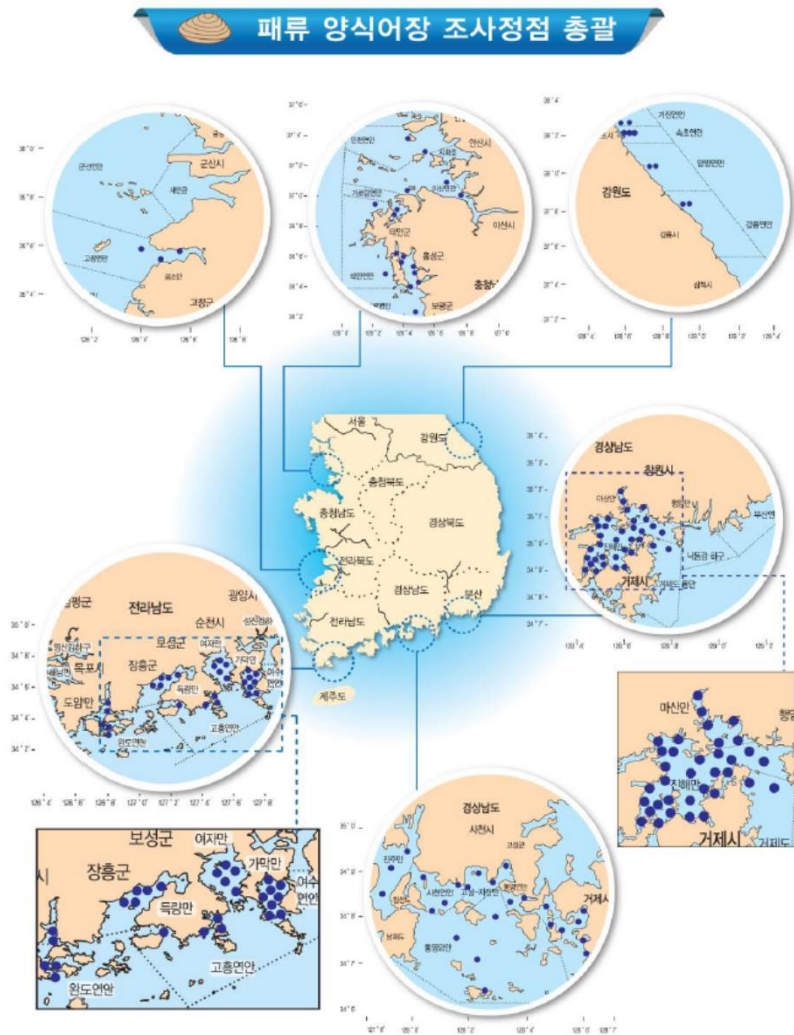
This monitoring program started in Feb. 2009.

Monitoring STN (208)		Frequency
West coast	3 zones (38 STN)	Feb., Apr., June, Aug., Oct., Dec.
South coast	18 zones (128 STN)	
East coast	5 zones (42 STN)	

Matrix	Monitoring Parameters
Seawater	W.T., pH, Sal, DO, COD, SS, Tr, NO ₂ , NO ₃ , NH ₃ , PO ₄
	Cu, Zn, Pb, Cd, Cr, As, THg
	PCBs, OrgP,
Biota	Chl-a
	Cu, Pb, Zn, Cd, Cr, As, THg
	PCBs, TBT, OrgP, PAHs
Sediment	Particle size, IL, Sulfides, COD
	Cu, Pb, Zn, Cd, Cr, As, THg
	PCBs, TBT, OrgP, PAHs

Bivalve Aquaculture Farms (NIFS)

This monitoring program started in Mar. 2012.



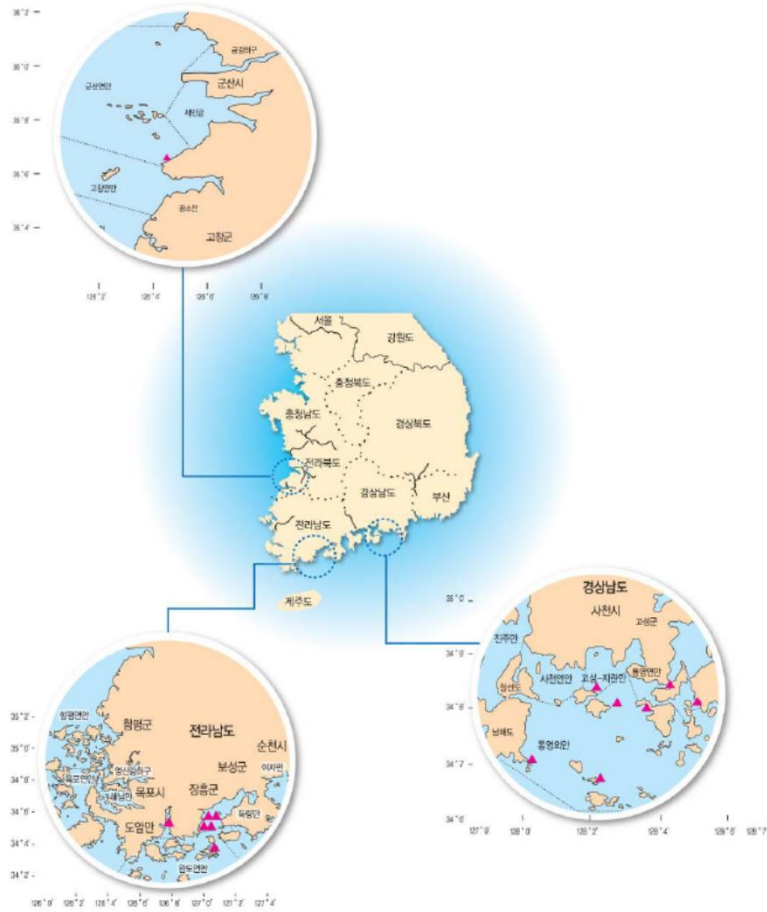
Monitoring STN (186)		Frequency
Bivalve	110 STN	Feb., Apr., June, Aug., Oct., Dec.
Fish	14 STN	
Seaweed	28 STN	
Squirt	21 STN	
Coastal zone	47 STN	

Matrix	Monitoring Parameters
Seawater	W.T., pH, Sal, DO, SS, Tr, NO ₂ , NO ₃ , NH ₃ , PO ₄
	PCBs, OrgP,
Biota	Chl-a
	Cu, Pb, Zn, Cd, Cr, As, THg
	PCBs, TBT, OrgP, PAHs
Sediment	Particle size, IL, Sulfides, COD
	Cu, Pb, Zn, Cd, Cr, As, THg
	PCBs, TBT, OrgP, PAHs

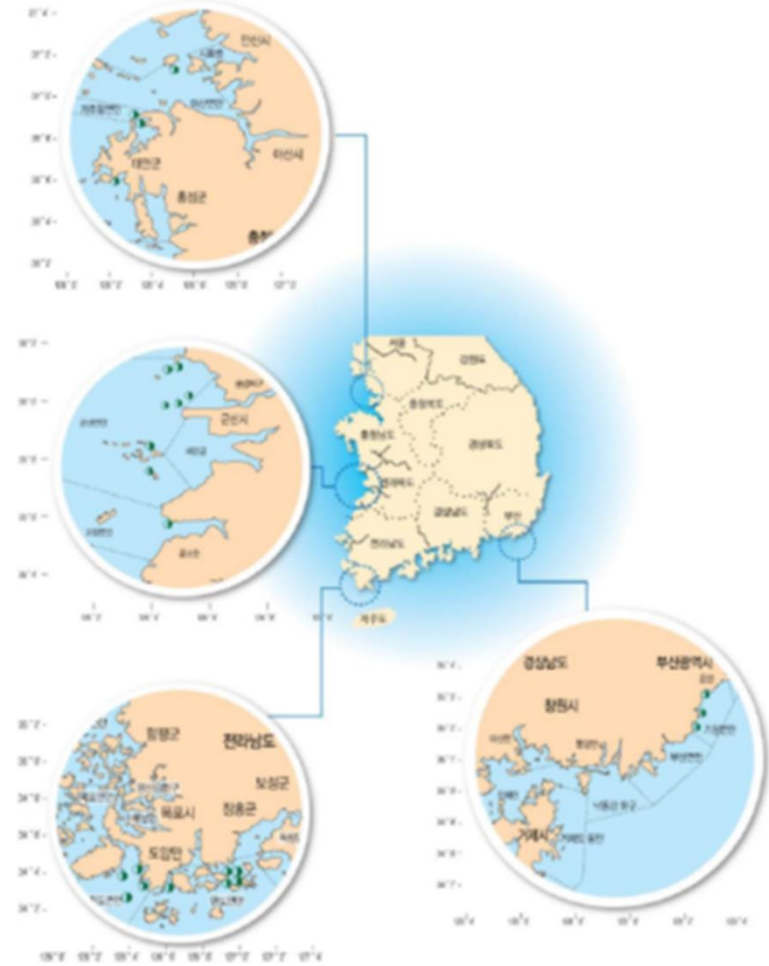
Fish Aquaculture Farms

Seaweed Aquaculture Farms

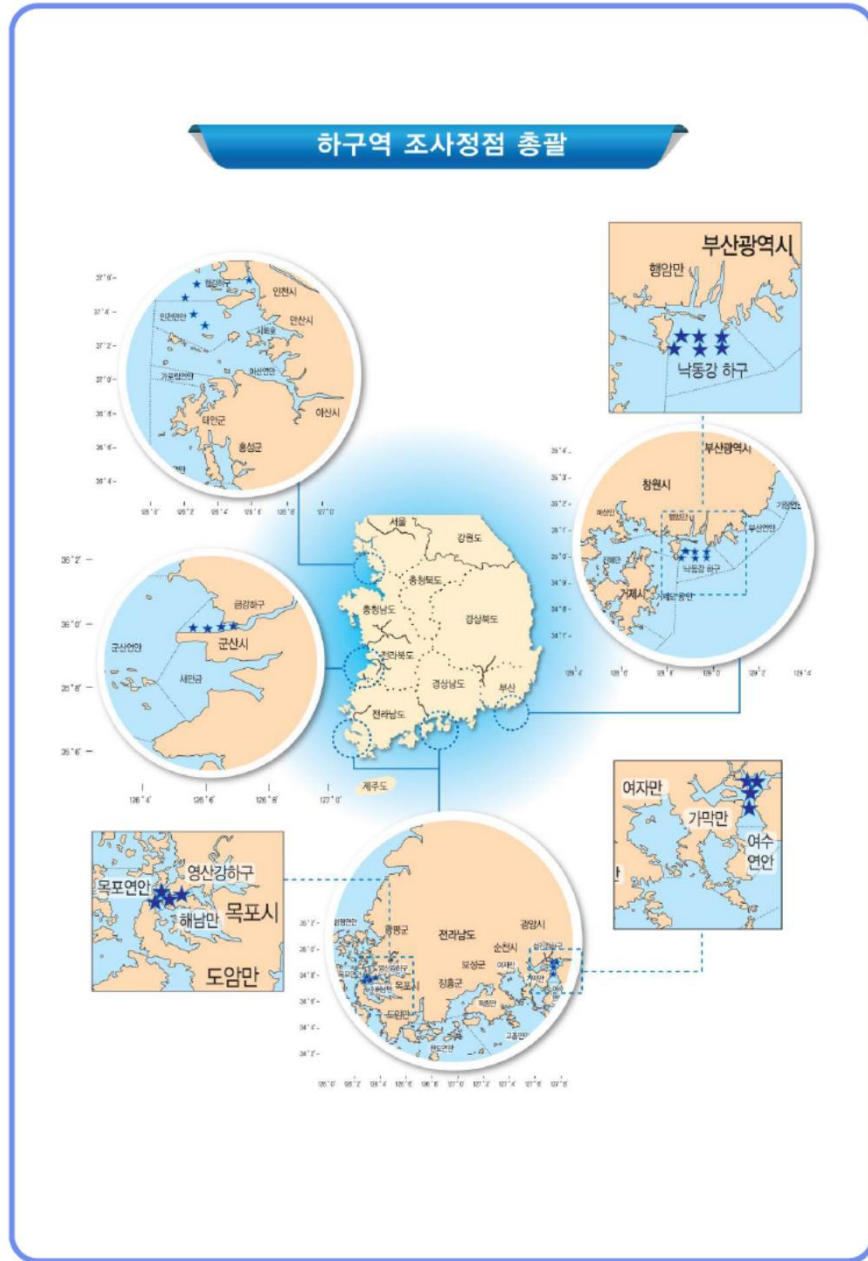
어류 양식어장 조사정점 총괄



해조류 양식어장 조사정점 총괄



Estuaries



TMs & POPs Monitoring

