



Heavy metal pollution in the Yancheng Biosphere Reserve, Jiangsu, China

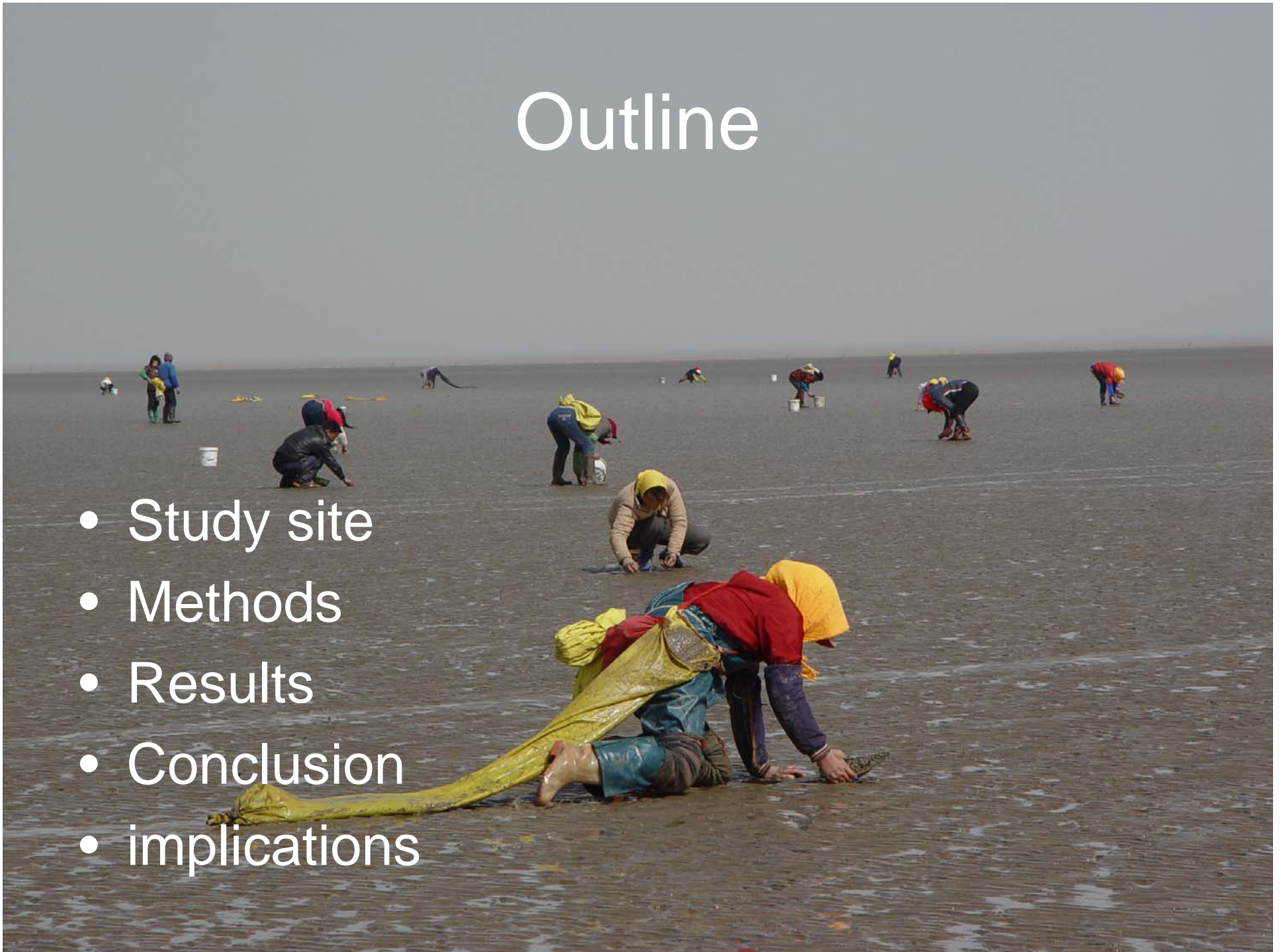
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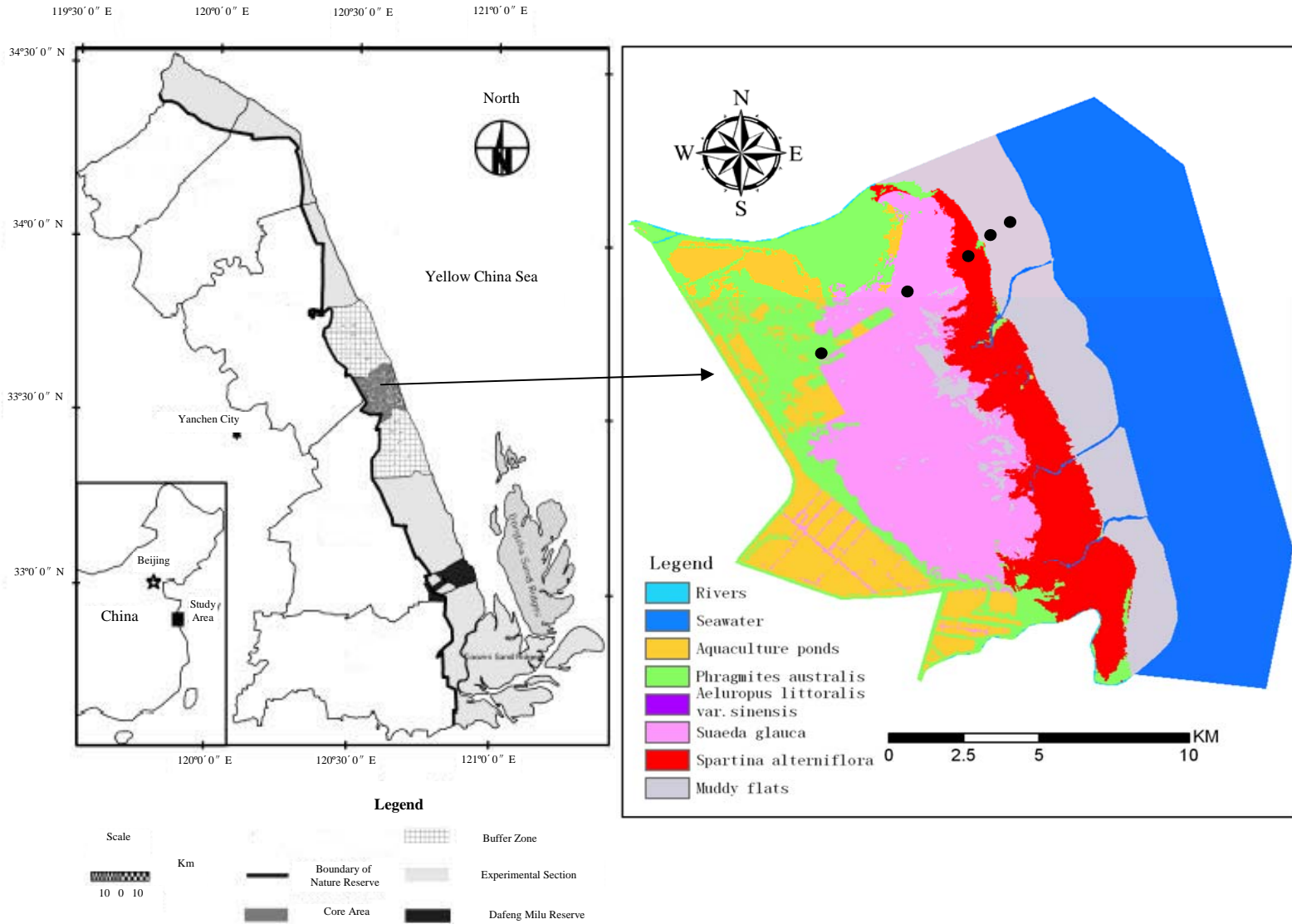
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Outline

- Study site
- Methods
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- implications



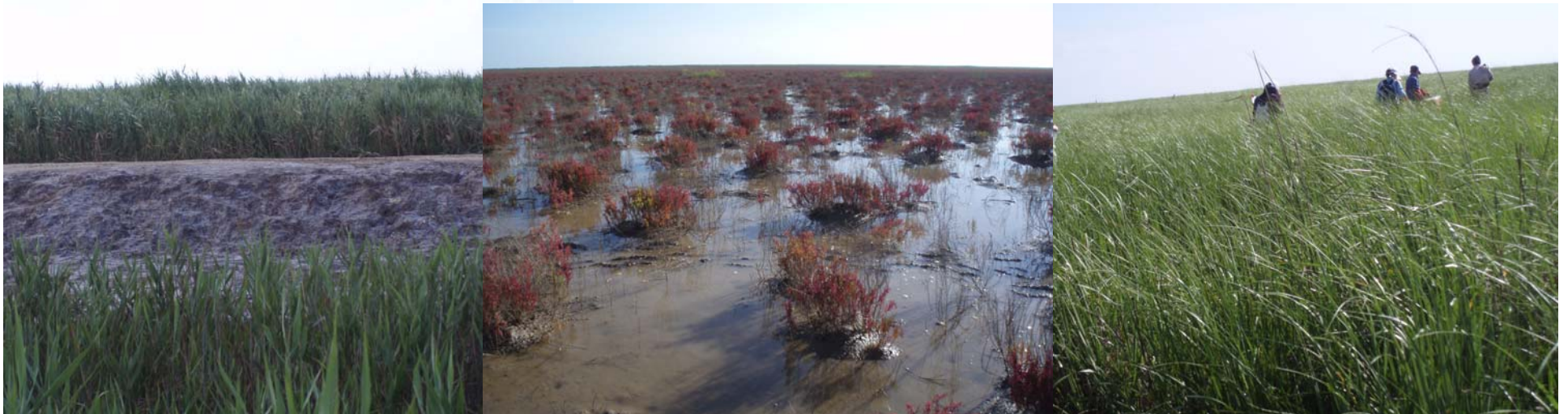
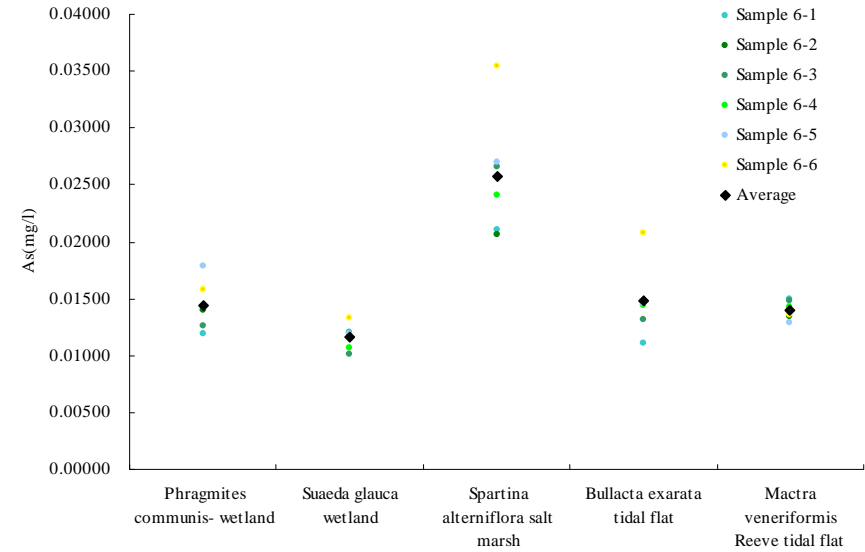
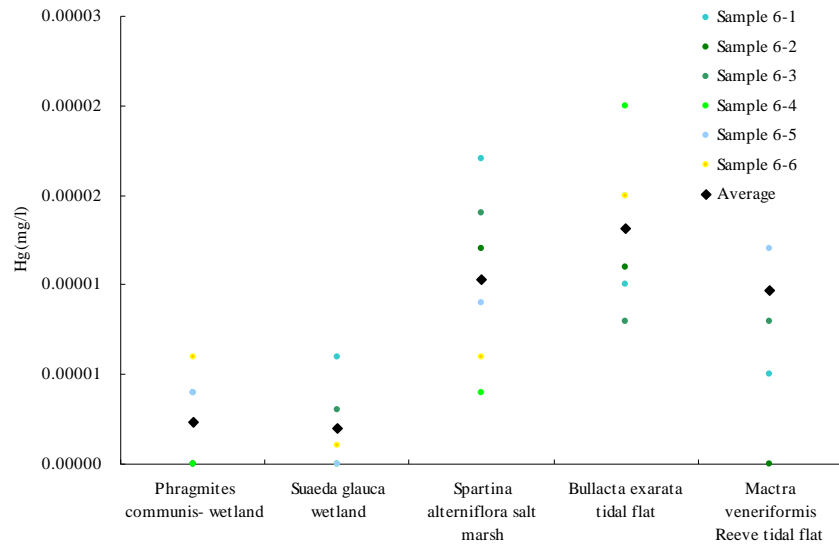
Study site



Methods

- Data collection: Content of Cu, Pb, Zn, Cr, Ni, Cd, Hg, As analyzed in economic macrobenthos, sedimentary, wetlands plants. In water samples, only Hg and As were measured
- Sampling done using stakeholders
- Ecological pre-warning assessment. Levels compared with national standard and historical data (1978-1979) acting as background data, to assess environmental impacts caused by recent economic development and the possible food safety implications
- Information exchange and awareness to public media. Information exchange with governments, local stakeholders, and information transfer to public media

Results: surface water

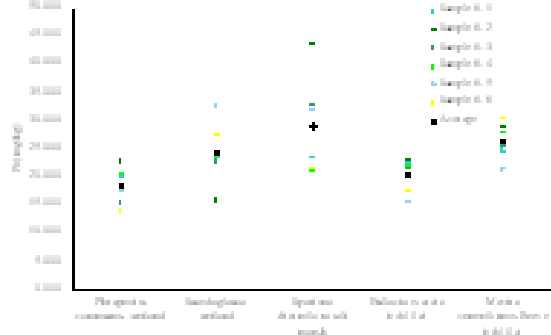
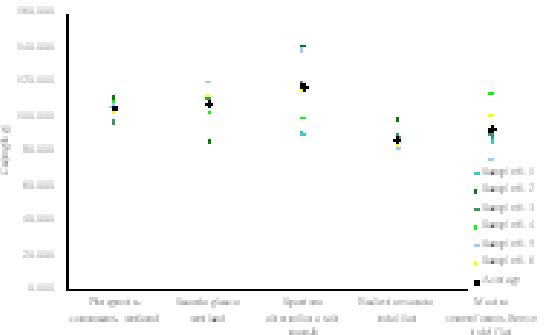
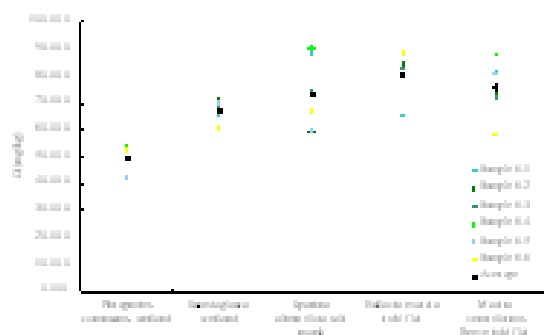
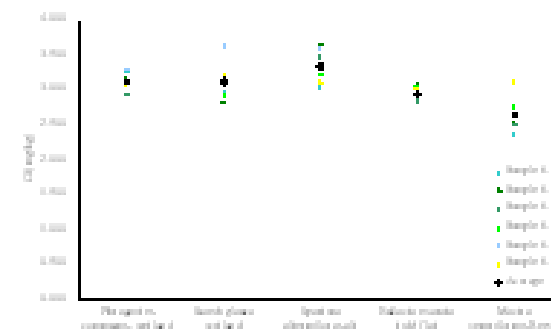
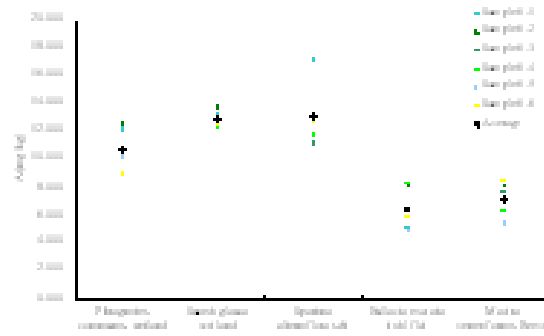
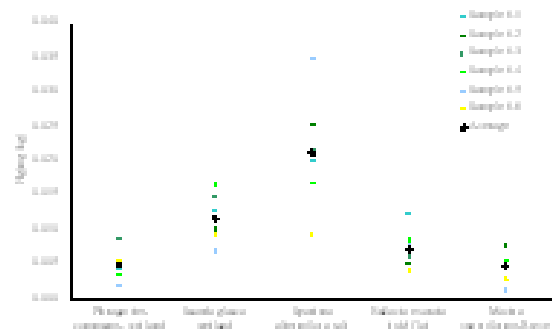


Results: Water

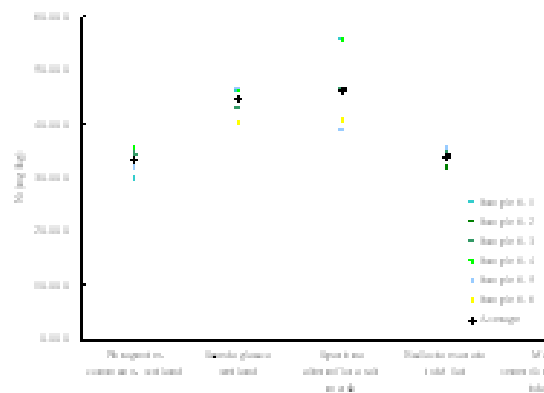
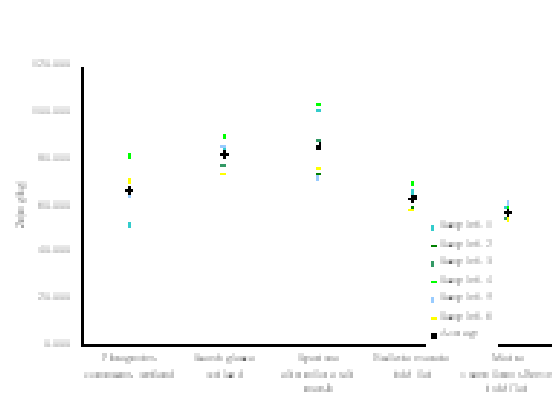
	<i>Phragmites Communis</i> wetland	<i>Suaeda Glauca</i> wetland	<i>Spartina Alterniflora</i> wetland	<i>Macra Veneriformis</i> Reeve tidal flat	<i>Bullacta Exarata</i> tidal flat	GB3097-1997			Background value
						1 st class	2 nd class	3 rd class	
Hg	0	0	0.00001	0.00001	0.00001	0.00005	0.0002	0.0005	0.0016
Standard deviation	0	0	0	0	0	--	--	--	--
As	0.014	0.012	0.026	0.015	0.014	0.02	0.03	0.05	0.003
Standard deviation	0.002	0.001	0.005	0.003	0.001	--	--	--	--

- Water quality was better than 1st class water according to GB 3097-1997 Sea Water Quality Standard, with the exception of As concentrations in the surface water in *Spartina alterniflora* wetland that was 2nd class.
- However, concentrations had increased since measurements in 1978-1979 (the background values), which indicates the influence of anthropogenic activities since 1980 with arsenic levels increasing in seawater.

Results: sedimentary



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Results: sedimentary

	Hg	As	Cd	Cr	Cu	Pb	Zn	Ni
<i>Phragmites communis</i> - wetland	0.005	11	3	50	106	18	67	33
<i>Suaeda glauca</i> wetland	0.012	13	3	67	108	24	83	45
<i>Spartina alterniflora</i> wetland	0.021	13	3	73	118	29	86	46
<i>Mactra veneriformis</i> Reeve tidal flat	0.007	6	3	80	87	20	64	34
<i>Bullacta exarata</i> tidal flat	0.005	7	3	76	93	27	57	33
1 st class	0	20	1	80	35	60	150	---
GB18668 -2002 2 nd class	1	65	2	150	100	130	350	---
3 rd class	1	93	5	270	200	250	600	---
Background value	0.019	8.59 ^[9]	0.72	28.50	15.99	17.63	78.10	---

Results: sedimentary

- The average concentrations of metals in the sediment samples all exceeded the background values for 1978-1979 in the coastal zone of Jiangsu Province except mercury.
- The concentrations of mercury, arsenic, chromium, lead, copper belonged to the first class of sediments, while the concentrations of cadmium belonged to the second class comparing to the Sediments of National Standards.
- The absorption capacity of heavy metals in vegetated wetlands with reed, *Suaeda glauca* and *Spartina alterniflora* was higher than that in non-vegetated wetlands with high density of macrobenthos, especially *Bullacta exarata* and *Macra veneriformis* Reeve.
- *Spartina alterniflora* wetland had a higher absorption capacity for heavy metals than other vegetated wetlands in the core area.

Results: plants

	Hg	As	Cd	Cr	Cu	Pb	Zn	Ni
Roots of <i>Phragmites communis</i> -	0.031	3.488	0.177	14.164	4.989	1.265	12.448	8.465
aboveground part of <i>Phragmites communis</i>	0.016	0.201	0.138	1.679	1.545	0.310	4.404	0.746
Roots of <i>Suaeda glauca</i>	0.035	1.190	0.059	2.533	9.776	0.736	5.242	3.362
aboveground part of <i>Suaeda glauca</i>	0.030	0.757	0.362	1.732	12.979	2.114	18.764	2.135
Roots of <i>Spartina alterniflora</i>	0.044	5.552	0.160	11.287	5.462	0.550	35.262	13.228
aboveground part of <i>Spartina alterniflora</i>	0.030	0.470	0.235	2.331	0.330	1.068	19.096	1.084

Results: plants

- All 8 heavy metals were present in the roots and leaves of *Phragmites communis*, *Suaeda glauca*, and *Spartina alterniflora*.
- Results indicate that heavy metal content tended to be higher in the roots of plants compared with the leaves.
- The levels of mercury, arsenic, chromium, zinc, nickel were highest in *Phragmites communis*, *Suaeda glauca*, and especially the aboveground part of *Spartina alterniflora* compared with other plants
- The levels of cadmium & lead were highest in the leaves of *Suaeda glauca* than that in other parts of the plants.
- The levels of chromium in the roots of *Phragmites communis* was the highest.

Results: Macrobenthos

	Hg	As	Cd	Cr	Cu	Pb	Zn	Ni
<i>Perinereis aibuhitensis</i> Living in <i>Suaeda glauca</i> wetland	0.001	4.286	0.901	3.727	37.126	0.326	84.383	19.193
<i>Perinereis aibuhitensis</i> Living in <i>Spartina</i> <i>alterniflora</i> wetland	0.002	6.163	0.691	3.071	47.371	0.177	91.895	19.897
<i>Bullacta exarata</i> Reeve living in tidal flat	0.003	6.511	1.011	6.045	163.353	4.196	55.334	30.227
<i>Mactra veneriformis</i> living in tidal flat	0.001	2.585	1.993	3.871	35.161	0.037	61.019	22.015
NY5073-2006 Pollution- free Food at Seafood Toxic Substances Harm Limited	0.5	1	1	2	50	1	--	--
Background value	0.04	0.57	0.365	2.33	15.99	0.356	--	--

Results: macrobenthos


- In macrobenthos, the contents of mercury, arsenic, chromium, copper, lead, nickel in the snail, *Bullacta exarata*, living in tidal flat were the highest, which indicated higher pollution by environments.
- The contents of cadmium in the clam, *Mactra veneriformis* Reeve, was the higher than that in other animals. The snail and clams are consumed locally and both of them are economically harvested by local stakeholders who pick them up during the low tide time.
- Analysis also showed that nearly all the concentrations of heavy metals in the three macrobenthos were far higher than the background value. And some of them exceeded the limit for pollution-free food according to 'NY5073-2006 Pollution-free Food at Seafood Toxic Substances Harm Limited'.

Thus, food safety is very important for those seafood consuming people, especially local stakeholders

Conclusion

- Results showed that concentrations of heavy metals have accumulated in the core area of YBR coinciding with economic development in recent years,
- Implies that anthropogenic activities are threatening the ecosystem health in the core area,
- Heavy metals are being transferred from water, sediments to plants, animals and microorganism along the food chain.
- Thus, there is an urgent need of sewerage treatment before discharge to the Yellow Sea in those areas surrounding the Reserve.

Implications: empowering stakeholders



- By working with stakeholders in collecting samples and through your public awareness work you build trust. This means that when you deliver the results they are ready to believe what you tell them, and providing them with information on the safety of their food and environment empowers the stakeholders to make decisions about how they want their environment to be.
- It gives stakeholders the option to approach local government and ask for changes to the effluent law for example, and provides them with evidence bring about changes. Without this study they may suspect that the environment is degrading but they have no evidence.
- Information is empowering.

Implications: a dim future due to rapid economic growth?

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Empowering stakeholders through involvement in monitoring and provision of information can be a major force in conservation.

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Thank you