Strategies of marine biodiversity conservation based on ICZM —a case study in Quanzhou bay, China

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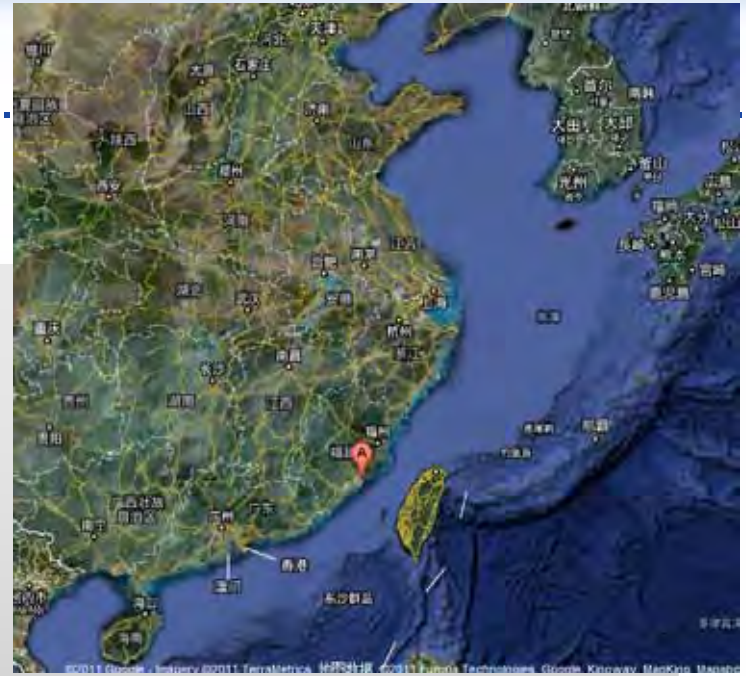
Outline

- Study area introduction
- Threats Analysis of marine biodiversity
- Study boundary determination
- Marine biodiversity integrated assessment
- Biodiversity conservation monitoring network
- Integrated decision support system



Study area introduction

Quanzhou Bay locates in the southeast coastal zone of Fujian province, the total sea area of this bay is 128 km^2. Jin river and other rivers flow into this bay. There are estuary wetlands, mangrove, shallow sea and other eco-systems. There is rich biodiversity in Quanzhou Bay, with more than 1000 species recorded.




Saunders'Gull


Razor clam


wetland


Chinese Egret

mangrove


Seascape

Why ICZM?

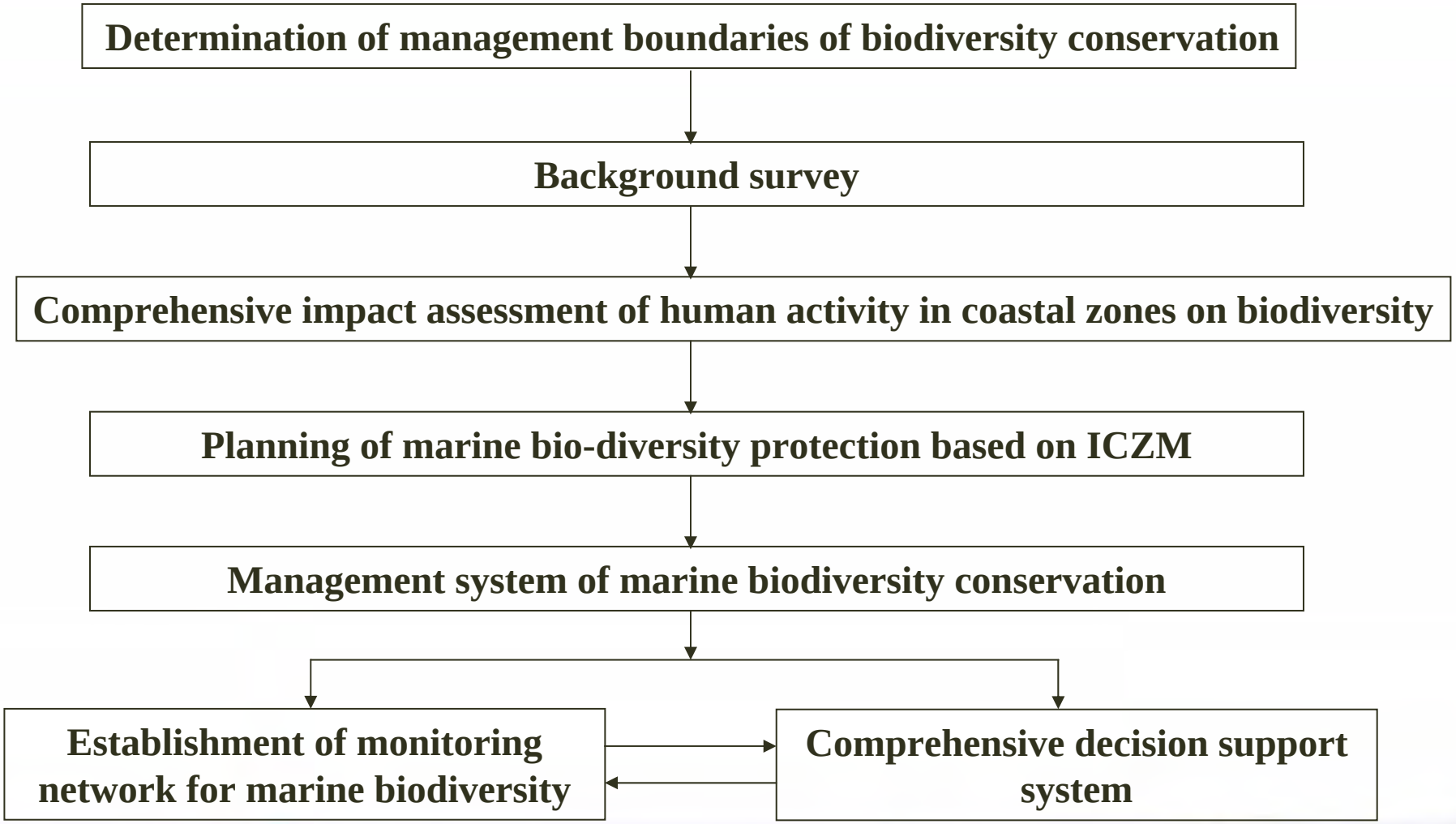
- Due to the complexity of biodiversity conservation, the partial and non-systematic methods, which are in simple consideration of sea excluding basin-wide area, were proved ineffective.
- Both ICZM and establishment of marine natural reserve are widely acknowledged as most effective measure for marine biodiversity conservation.

Why ICZM?

- **Integrated coastal zone management (ICZM) is a continuous and dynamic process which is utilized to determine policy and management strategy that solve the contradiction in the utilization of coastal zone resources and limit the impact of human activity on coastal zone environment.**

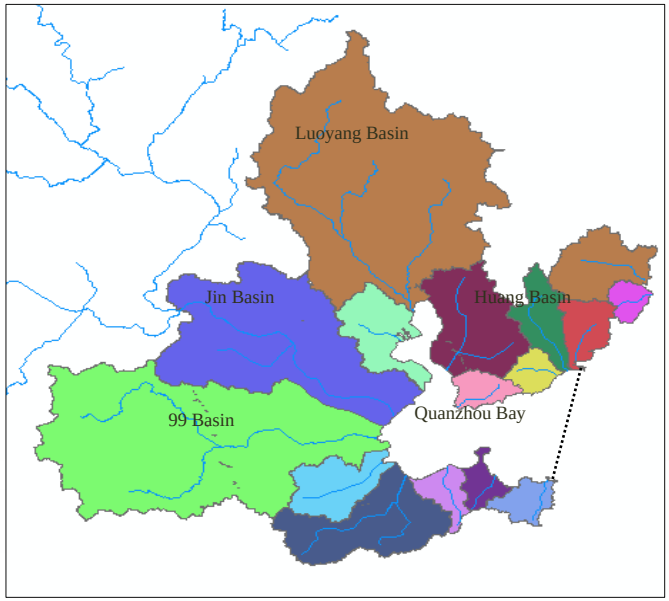
- **One of the primary aims of ICZM is to sustainably maintain a high level of biodiversity and protect vital habitats.**

Approaches of marine biodiversity conservation based on ICZM

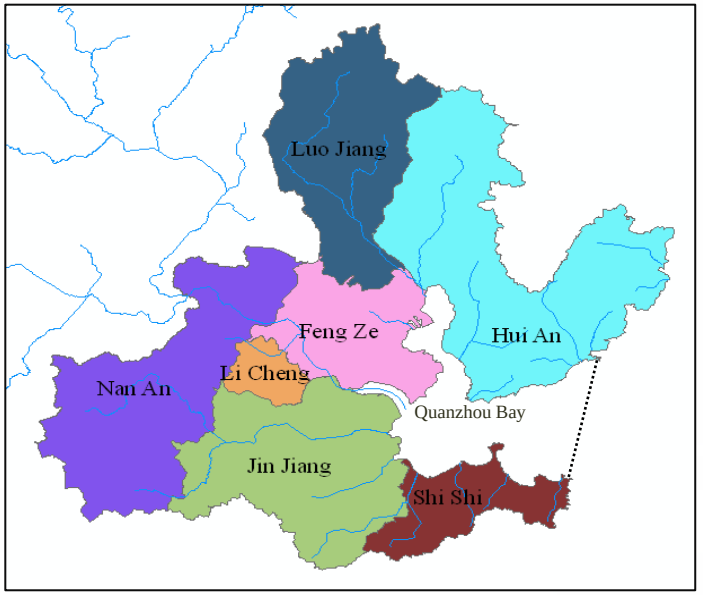


Determination of study boundary

- **Boundary was determined by the watersheds around the bay.**
- **For big river basin (Jinjiang River), the watershed area is too large to be managed in the whole area, so the boundary was considered from the dam that is close to the estuary (Jinji dam).**



Management boundary for biodiversity conservation in Quanzhou



Administrative regions included in the study area

Threats analysis of marine biodiversity in Quanzhou Bay

Sewage outlet

Wastewater dischage

Habitat destruction analysis

Year	Natural landscape		Artificial landscape	
	Area (hm^2)	Percentage (%)	Area (hm^2)	Percentage (%)
1975	18868.66	100	-	-
1989	17777.58	94.22	647.63	3.43
2001	17294.62	91.66	1104.83	5.86
2008	16679.60	88.40	1857.96	9.85

The composition of landscape in QuanZhou bay

Overfishing

Fish diversity of Quanzhou Bay in 1985 and 2008

Year	Shannon-Wiener index H′	Pielou index J′	Margalef index D	Trophic index TI
1985	3.05	0.76	-	2.79
2008	2.32	0.58	7.62	2.54

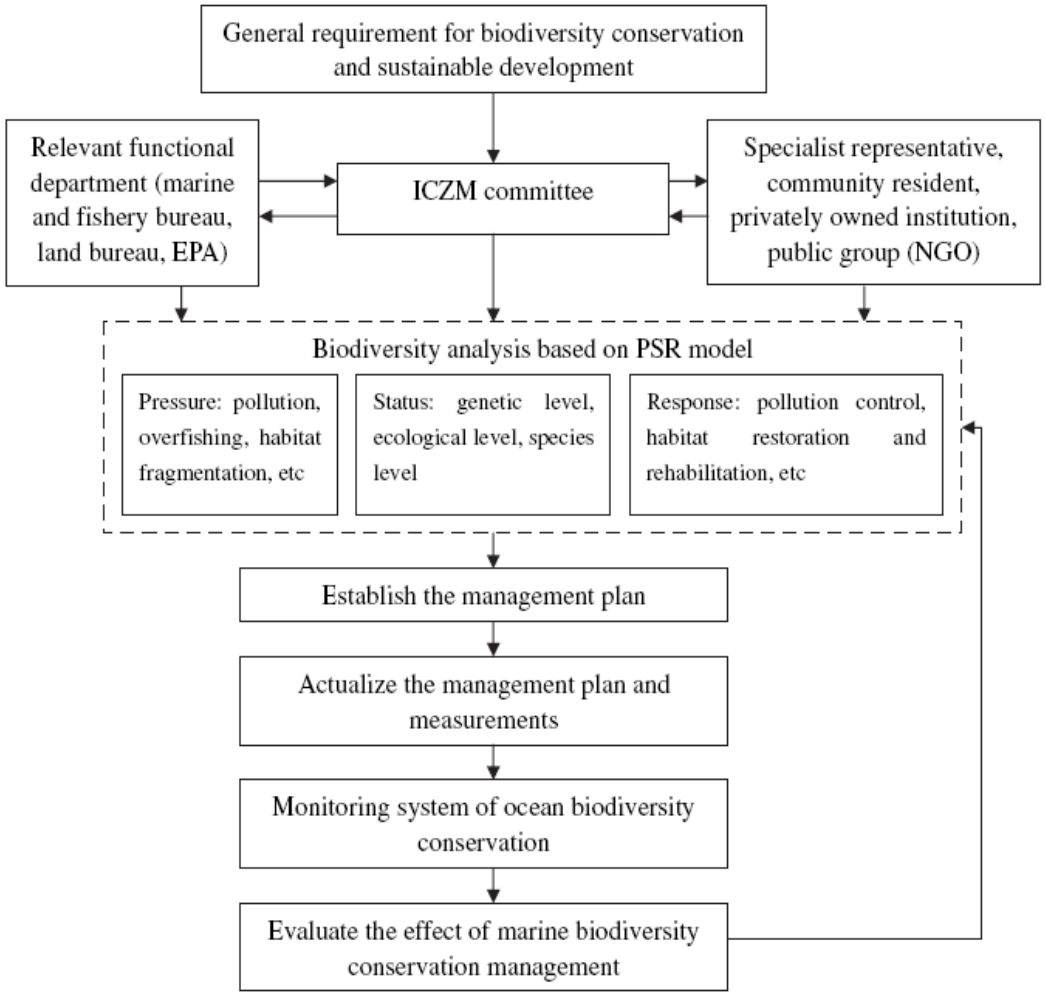
Compared to the 1985, we found that the composition and the dominant of fish species in Quanzhou Bay changed obviously, the diversity index and Trophic index of fish species deceased distinctly.

Alien species invasion

Invasion of *spartina*

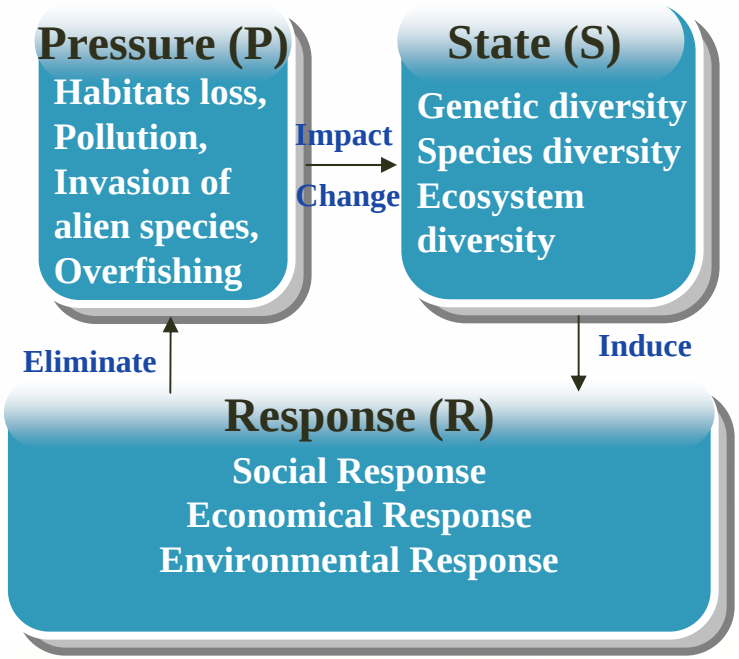
The mangrove surrounded by *spartina*

Management framework of biodiversity conservation



Marine biodiversity integrated assessment

- **Objective: Explains why and how the human activities impact on marine biodiversity, so as to provide scientific evidence for later planning and management.**



Marine biodiversity integrated assessment

First class indicator	Second class indicators	Third class indicators
Pressure indicators	Pollution	Sewage in collection area and total quantity of contaminants
		Over standard rate of heavy metal in sea water
		Integrated index of sediment quality
	Habitat destruction	Percentage of natural landscape to artificial landscape
		Fragmentation index of landscape
	Fishery	Annual change of fishery outputs
	Alien species	Percentage of area dominated by main alien species in habitat
		Ratio of alien species to native species

Marine biodiversity integrated assessment

First class indicator	Second class indicators	Third class indicators
State indicators	Species	Change rate of bird species in wetlands
		Change rate of floral species in tidal flat
		Change rate plankton species
		Change rate of benthos species in tidal flat
	Rare and endangered species	Quantity and distribution change rate of sensitive species
	Ecosystem intactness	Trophic level
	Habitats	Change rate of habitats diversity
Response indicators	Social response	Activity budget for environmental protection education
	Economical response	Ratio of marine environmental investments to GDP
		Ratio of scientific research funds to GDP
	Environmental response	Ratio of qualified sewage discharge in coastal industries
		Coastal zone reserve coverage

Biodiversity conservation monitoring network

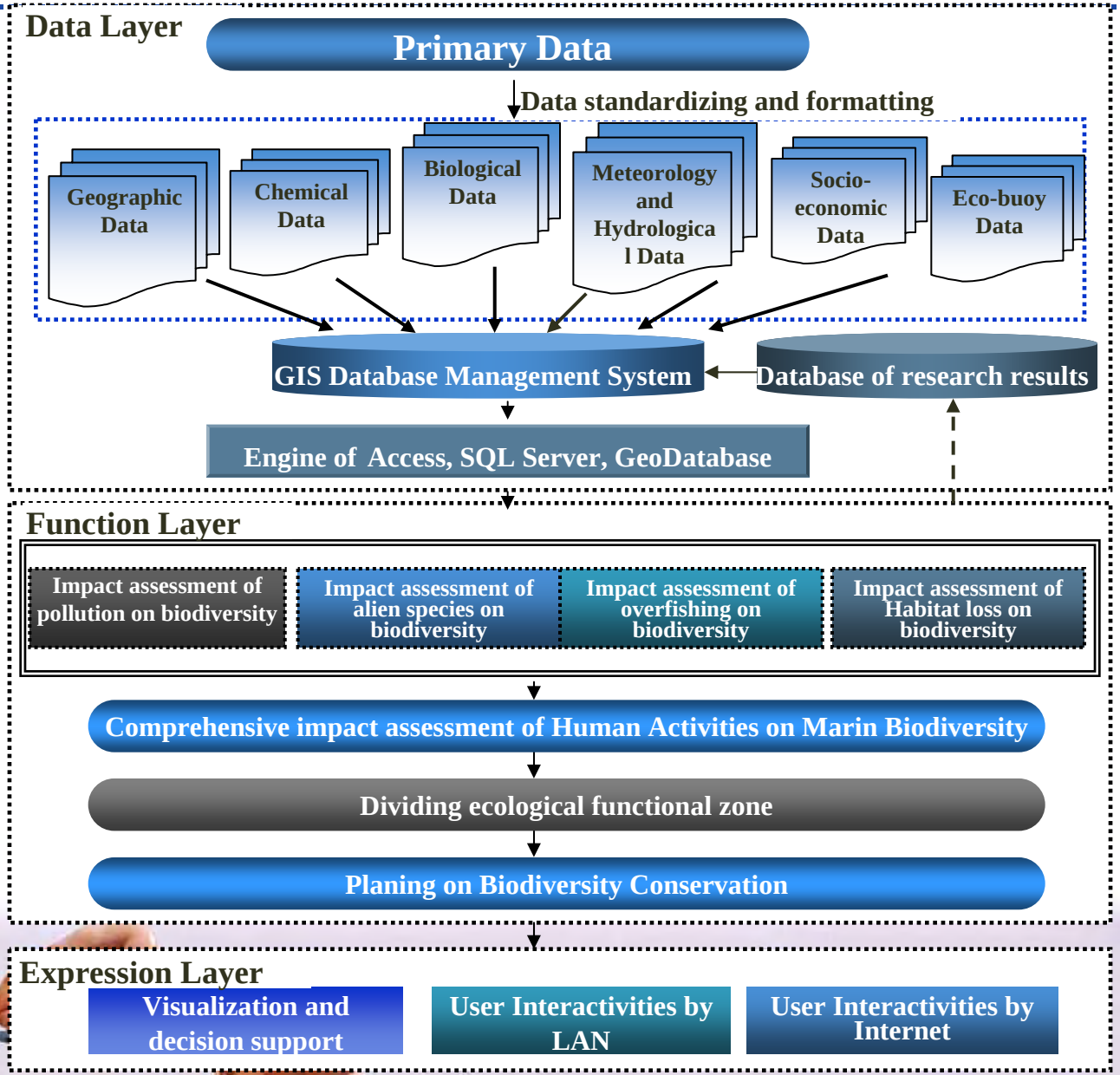
Catalog	Items	Contents	Methods	Frequency
Pressure monitoring	Habitat destruction	Land use and plant coverage change and landscape change	RS (remote sensing) and GIS	1 time /year
	Alien species invasion	Category and distribution of alien species	Field investigation and RS	1 time /year
	Pollution	Category, concentration, and amount of pollutants	Field investigation and model simulation	3 times/year (separately in high flow, normal and dry flow period)
	Aquaculture and fishery	Category, area and distribution of aquaculture; output and sorts of fishery	Field investigation and statistical data	1 time /year

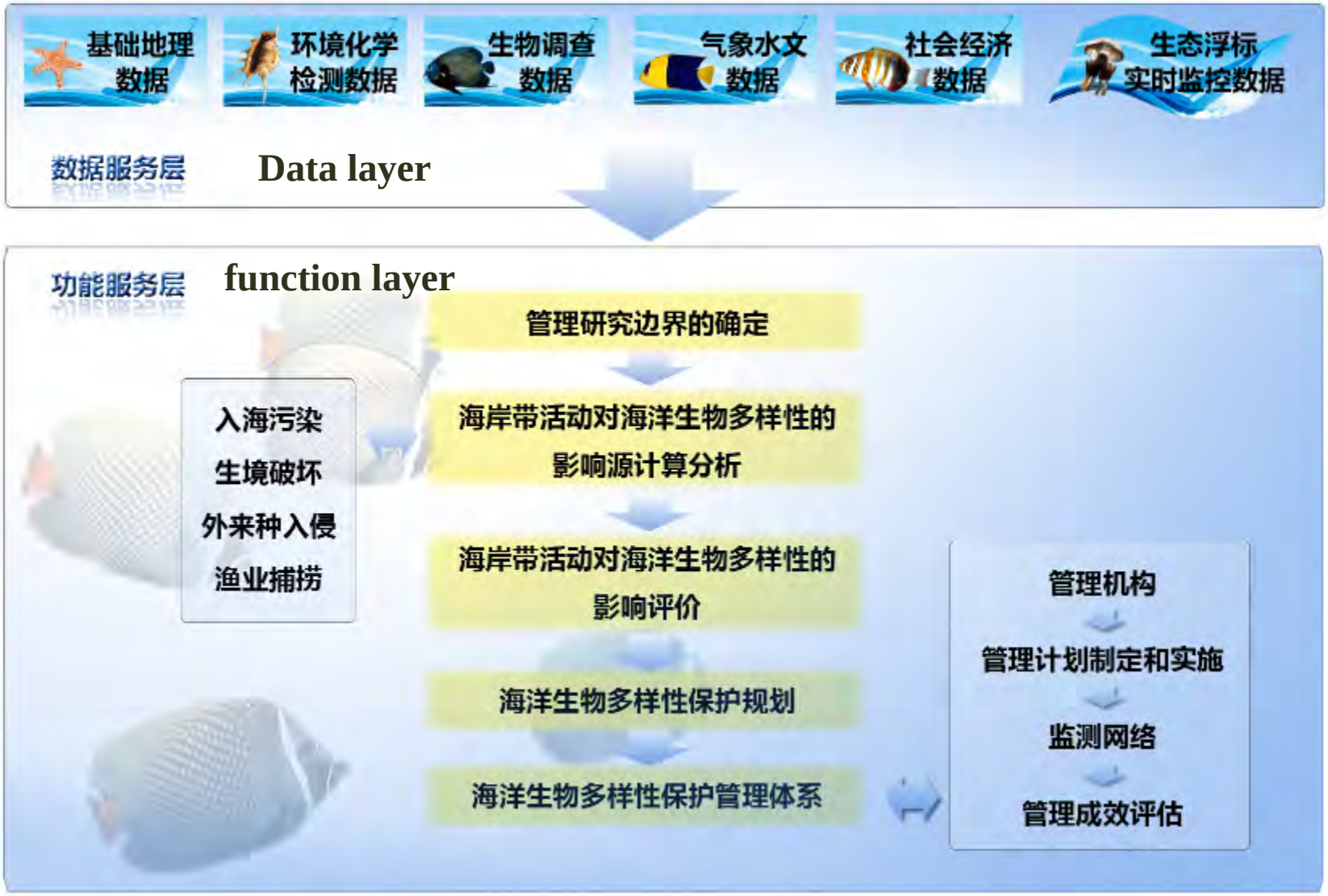
Biodiversity conservation monitoring network

Catalog	Items	Contents	Methods	Frequency
Status monitoring	Water quality status	Salinity, pH, DO, COD, DIN, DIP, oil, chlorophyll –a, heavy metals	Field investigation and consecutive observation of ecobuoy	field investigation, 3 times/year，ecobuoy consecutive observation in every half-hour or 4 hours
	sediment chemistry	oil, organic carbon, sulfide, heavy metal, PAHs、PCBs, and persistent organic pollutants, etc	Field investigation	1 time/year
	Seabirds	Sorts, quantity and distribution of birds	Field investigation	1 time/month
	Wetland vegetation	Main sorts and distribution	Field investigation remote sensing	1 time/year
	Planktons	Sorts, quantity and distribution of plankton animals and plants	Field investigation	4 times/year (one time in each season)
	Inter-tidal and neritic benthos	Sorts, quantity and distribution of large benthos	Field investigation	2 time/year (one in Spring and one in Autumn)
	Nektons	Sorts, quantity and distribution of nektons	Field investigation	2 time/year (one in Spring and one in Autumn)
Respond monitoring	Actual performance of policy and regulation	Policy and regulation related to biodiversity conservation	Survey	1 time/year
	ecological restoration	Fund in ecological restoration	Survey	1 time/year



Integrated decision support system

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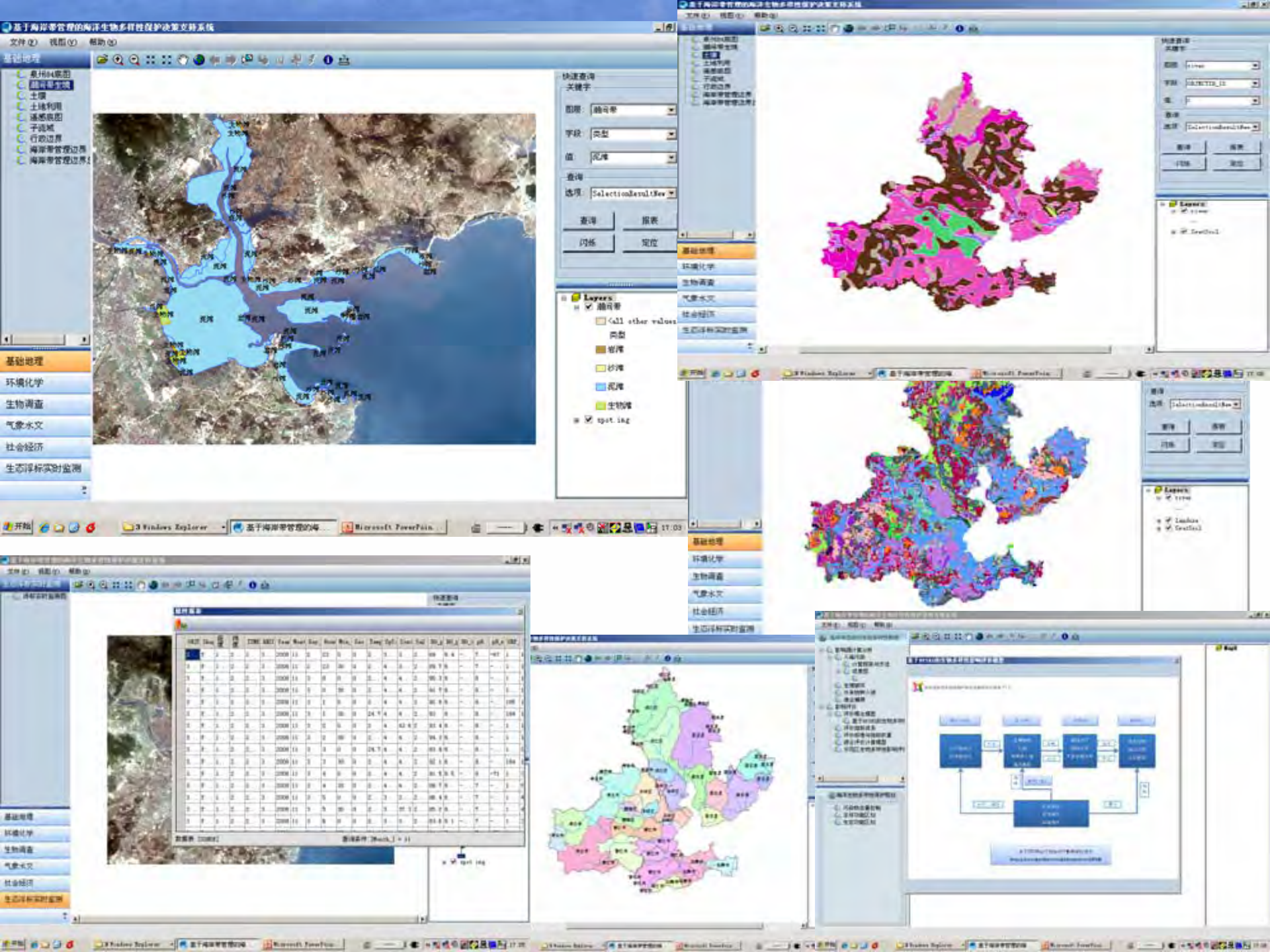
环境化学检测数据
生物调查数据
气象水文数据
社会经济数据
生态浮标实时监控数据
数据服务层
Data layer
功能服务层
function layer
管理研究边界的确定
海岸带活动对海洋生物多样性的影响源计算分析
海岸带活动对海洋生物多样性的影响评价
海洋生物多样性保护规划
海洋生物多样性保护管理体系
入海污染
生境破坏
外来种入侵
渔业捕捞
管理机构
管理计划制定和实施
监测网络
管理成效评估


基于海岸带管理的海洋生物多样性保护决策支持系统
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基础地理
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生物调查
气象水文
社会经济
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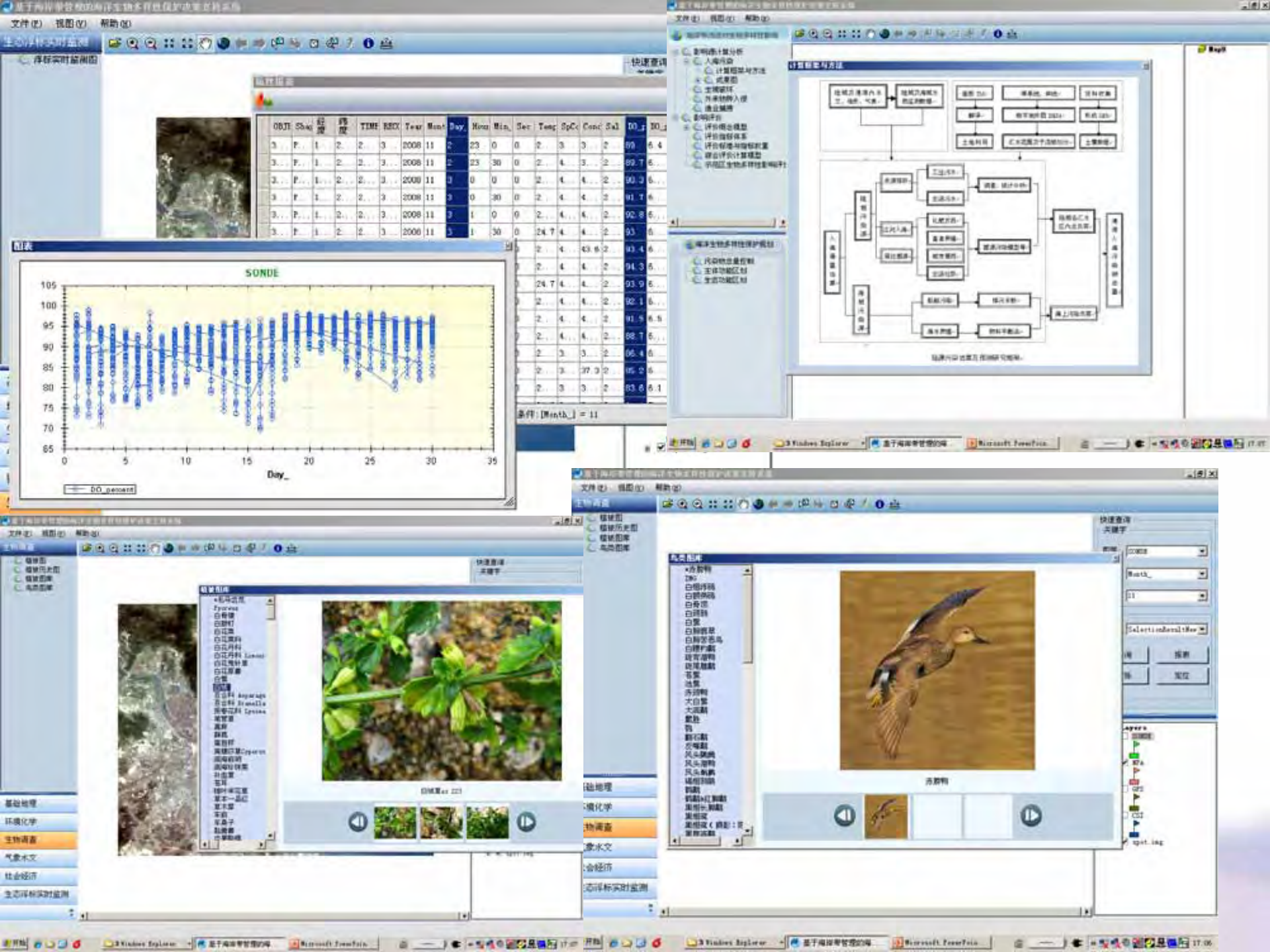
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