

Coastal Sustainable Development



New Words:

- Watershed 流域 marshe湿地 estuary河口
shelf edge陆架外缘
- **tsunami** 海啸
- Exclusive Economic Zones经济专属区
Hydrological processes水文过程
- ballast water压仓水 integrated coastal
management海岸带综合管理



Outline

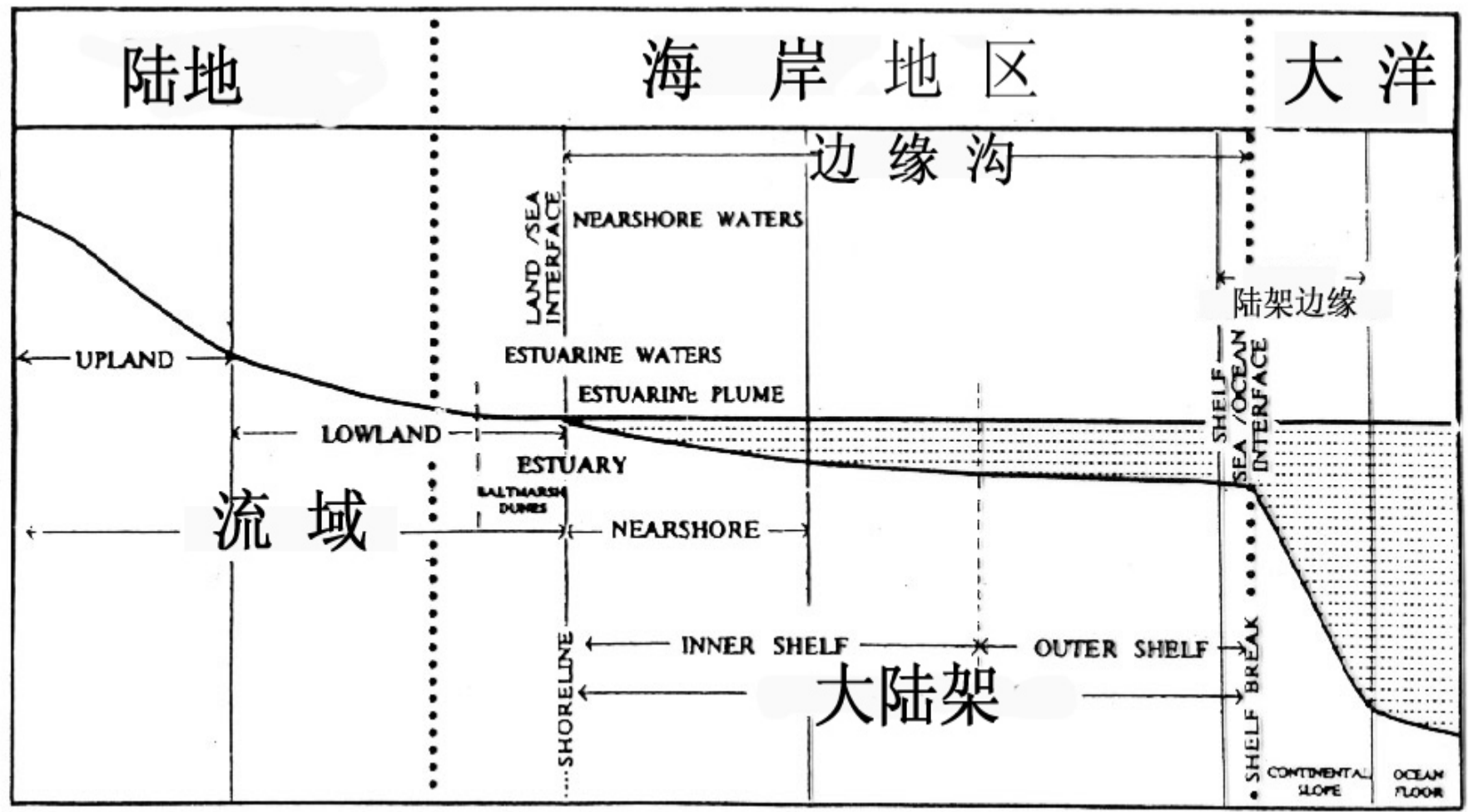
- **1、 Characteristics of Coastal Zone**
- **1.1 Definition of Coastal Zone**
- **1.2. Natural Characteristics of the Coastal Zone**
- **1.3. Socio-Economic significance of the Coastal Zone**
- **2、 The Threats and Challenges to the Coastal Zone**
- **3、 Coastal Sustainable Development**



1.1 Definition of Coastal Zone

The interface between the land and the sea, but concern and interest are concentrated on the area in which human activities are interlined with both the land and the marine environments.





“Coastal zone system” including

- ☞ **Inland areas** -----Watershed which affect the coast mainly via rivers and non-point sources of pollution
- ☞ **Coastal Lands** ----Wetlands, marshes where human activity is concentrated and directly affects adjacent waters
- ☞ **Coastal water**----estuaries, lagoons and shallow waters, where the effects of land-based activities are dominant
- ☞ **Offshore waters** ---shelf edge , Exclusive Economic Zones (200 nautical miles offshore)

Agenda 21 challenges us to think about the entire spectrum of area compassing both the land and water sides through its call for “integrated management and sustainable development of coastal and marine areas, including Exclusive Economic Zones.”

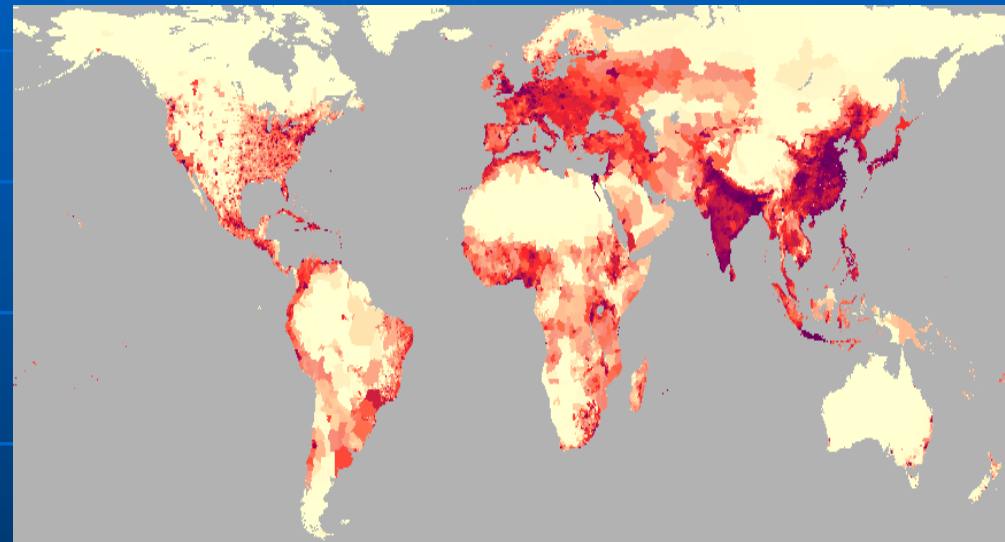
--- *Agenda 21,*

Chapter 17

保护海洋资源

44% of the world's population live
within 150 km of a coastline

- River basins and human dimensions
- Coastal development and change: implications of land use and sea use changes
- Fate and transformation of materials in coastal and shelf waters
- Sustainability and resource management issues
- Risk and safety



GLOBAL
I G B P
CHANGE

coastal zone of China



- EEZ 3,000,000 km²
- Coast line 18000 km²
- island 6500 ↑
- population >1/3
- GDP >60%

1.2 Natural Characteristics of the Coastal Zone

- Interface between the land and marine environments and is influenced by both

- Coastal environments are very complex and dynamic systems

Hydrological processes --- tide, currents, water mixing

Biological processes --- productivity, spawning ground

Chemical processes--- transport of pollutants, sedimentation, redox reaction

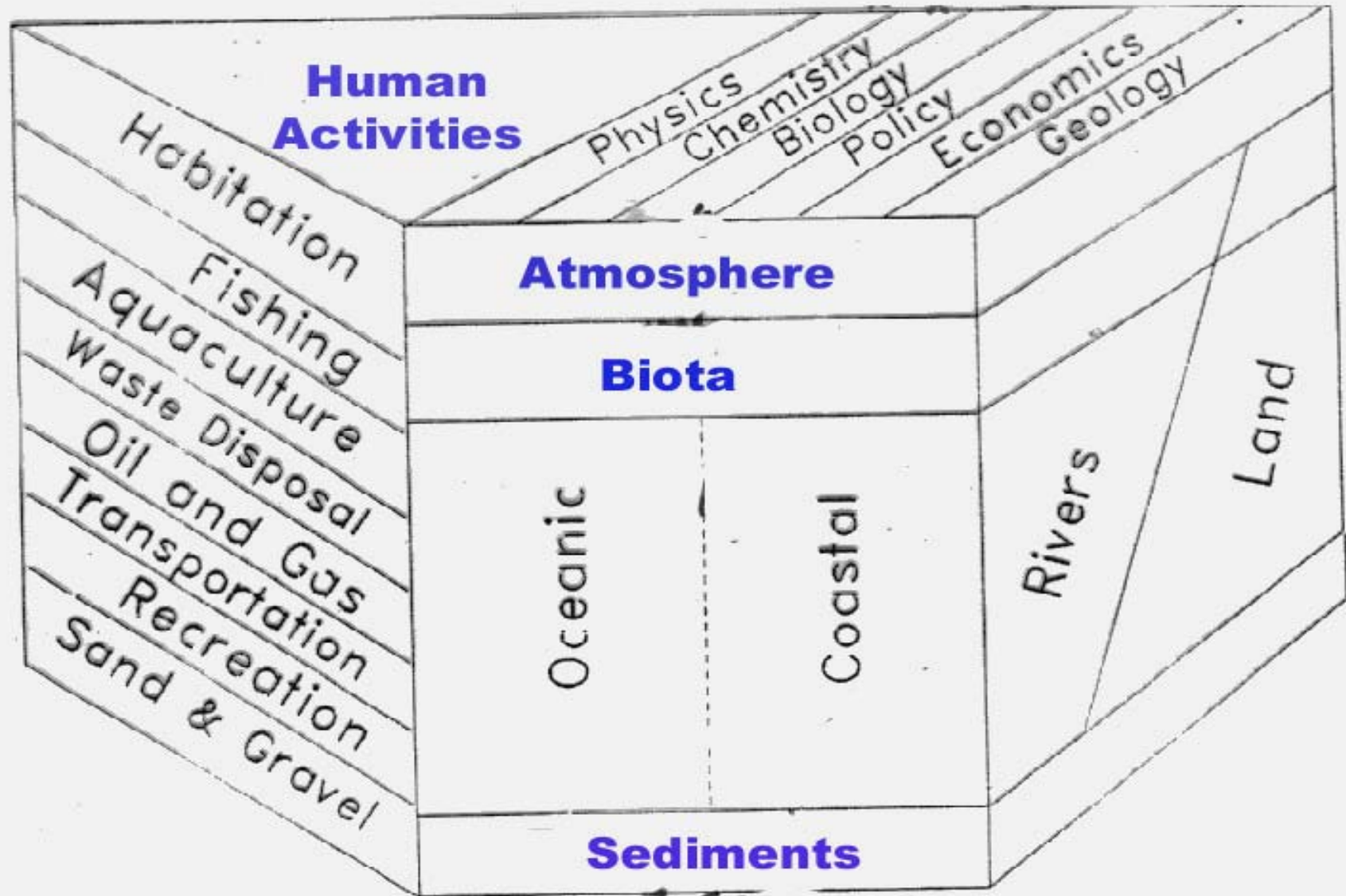
Geological processes --- resuspension, diffusion, erosion, siltation, natural subsidence

- Influenced by weather and climatic change, including:
 - sea level rise from global warming, storm surges, typhoons and hurricanes.
- Influenced by human being activities
 - coastal fisheries, aquaculture, forestry and agriculture

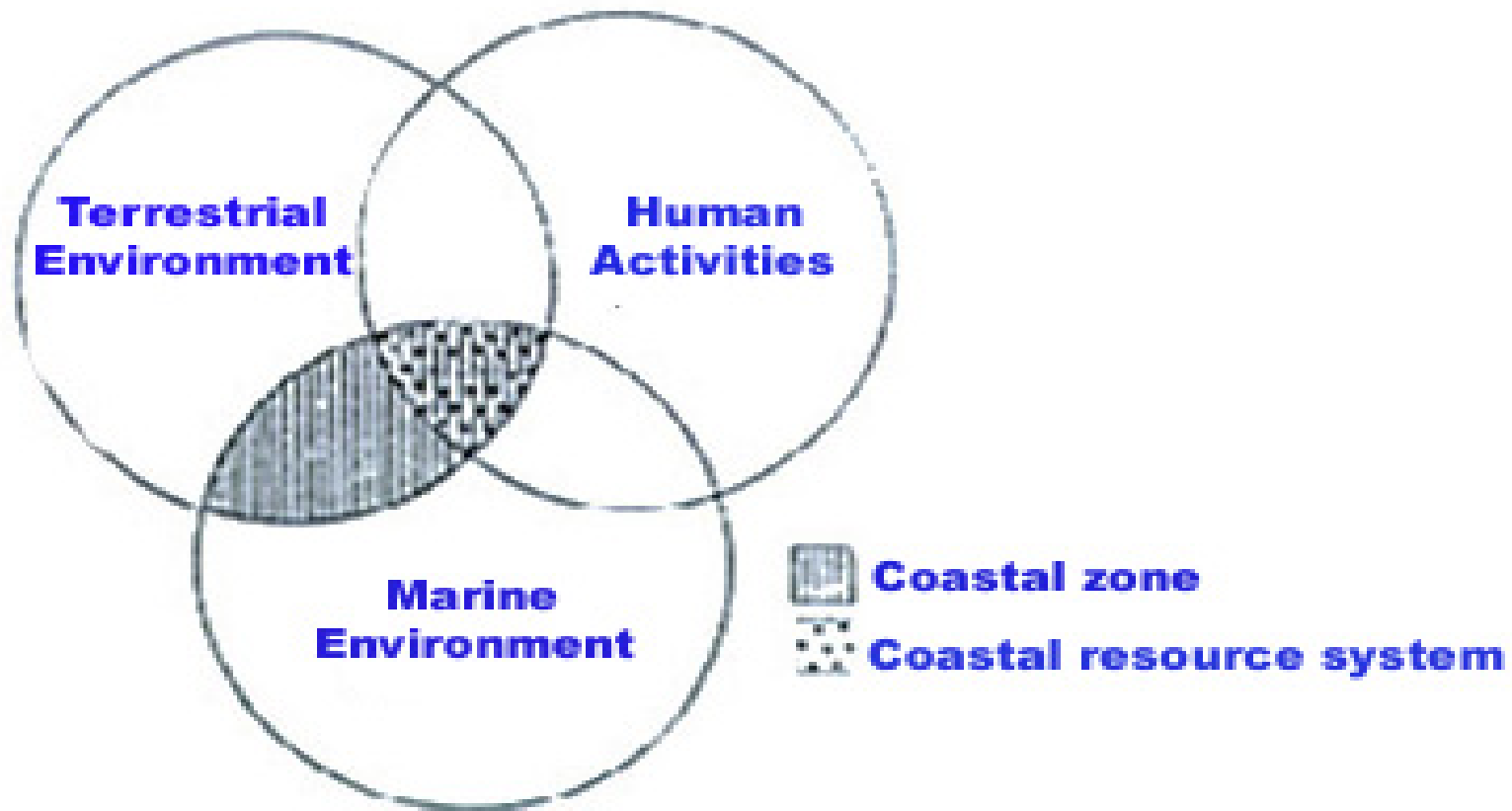
1.3 Socio-Economic significance of the Coastal Zone

- The coastal zone occupies only 8% of the world's surface, but accounts for 26% of the world's production.
- Many of the world's major cities are located in coastal areas and a large portion of economic activities are concentrated in these cities.
- The zone occupies less than 15% of the Earth's land surface, yet it accommodates more than 60% of the world's population.
- Ocean soil of sovereignty

The Coastal Ecosystem



Relationship between Coastal Zone and Coastal Resource System



Source: Scura, et al. 1992, 17

2. The Threats and Challenges to the Coastal Zone

2.1 Marine Pollution

2.2 Degradation of coastal ecosystem and coastal habitats

(Mangrove, salt marshes and coastal wetlands and coral reefs)

2.3 Conflict Uses

(use or non-use of particular coastal and ocean areas; government agencies that administer programs related to the coast and ocean)

2.4 In large Scale & Generally Catastrophic

(Sealevel rise, Tsunamis, Hurricanes, Sea Storms and Swells)

2.1 marine pollution

- “**Pollution** is the introduction by man, directly or indirectly, of substances or energy to the marine environment (including estuaries), resulting in such **deleterious effects** as harm to living resources, hazards to human health, hindrance of marine activities including fishing; impairment of the quality for use of seawater and reduction of amenities”
(GESAMP)



1. 2000年舟山群岛赤潮
(夜光藻)

2. “德航298”油轮被挪威籍“BOW
CECIL”轮撞沉，230 M3燃料油
全部泄漏入珠江口海域



3. 石油平台溢油





4. 港湾、码头和养殖场污染严重

5. 中华白海豚频频毙命厦门海域 新华网福建频道 2004-06-28



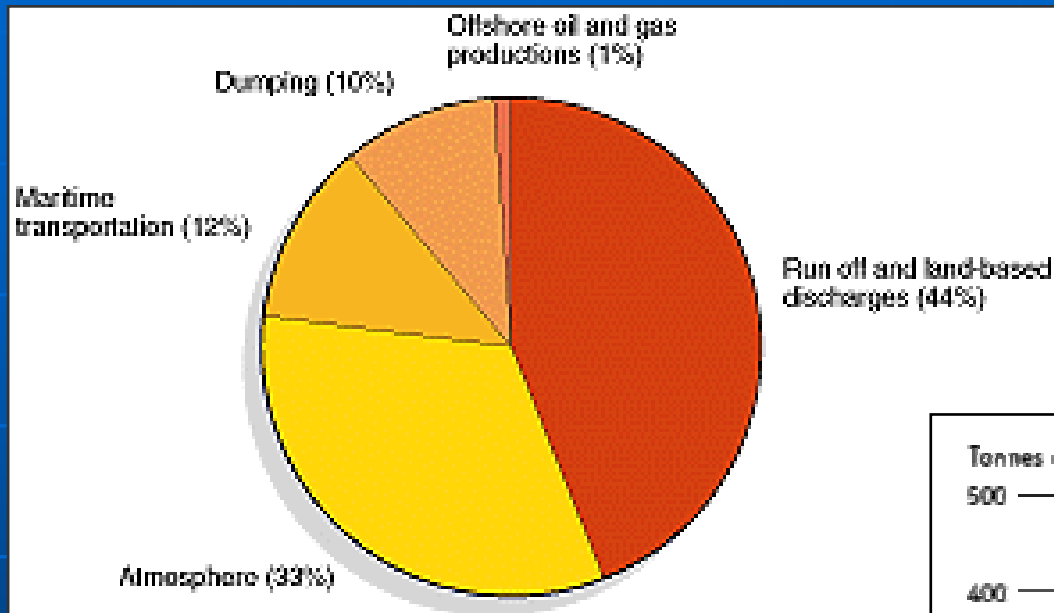


6. Of the 13 beaked whales that stranded in the Bahamas in March 2000 after exposure to active **sonar**, seven died, including this one.

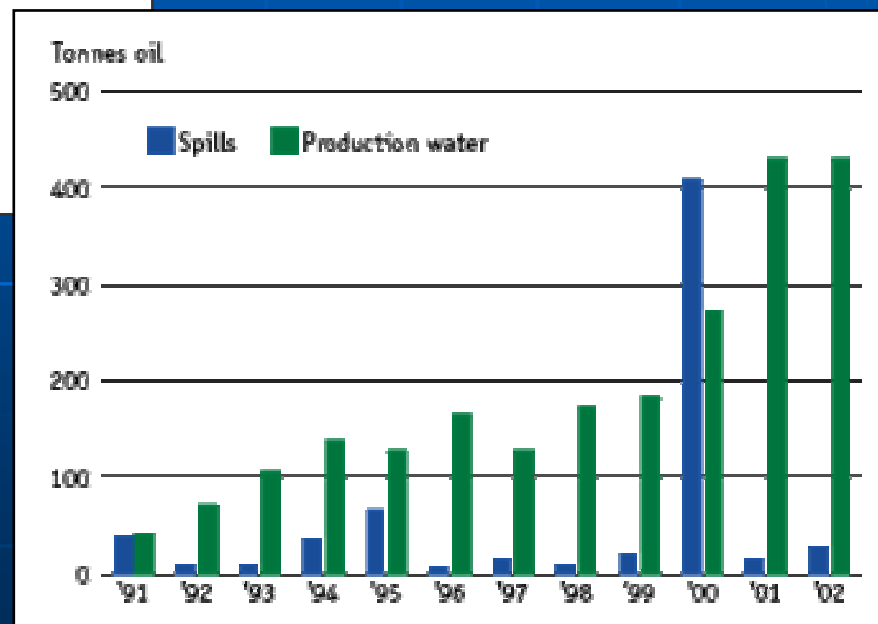


7. Marine debris plastic, glass, rubber, metal, paper, wood, cloth and discarded nets

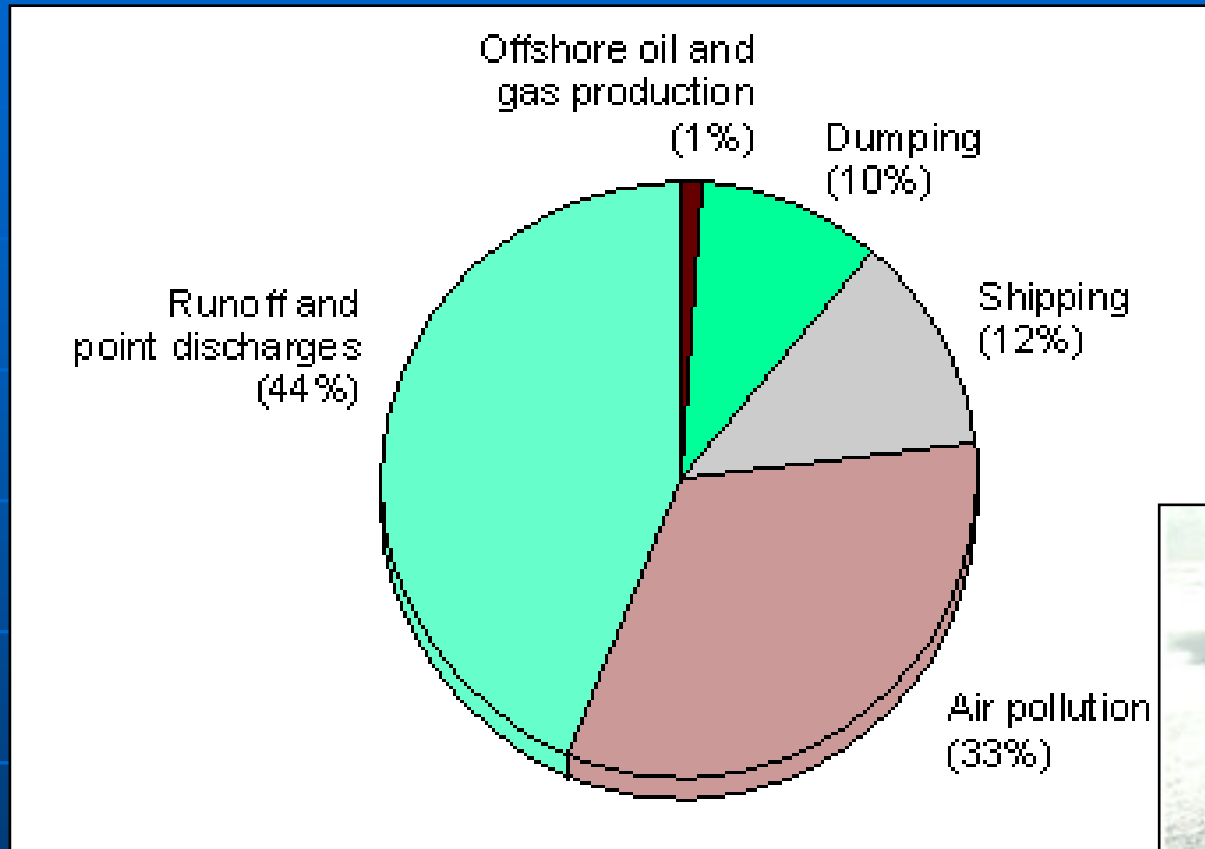
Major sources of marine pollution



Source: GESAMP, 1990



Pollution threat to the marine

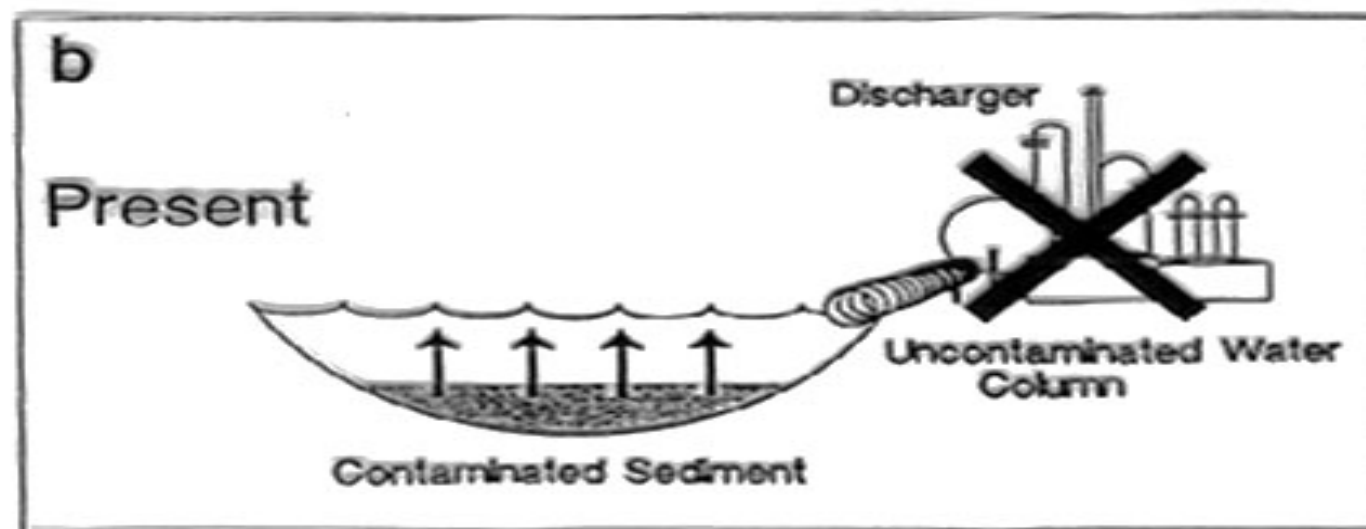
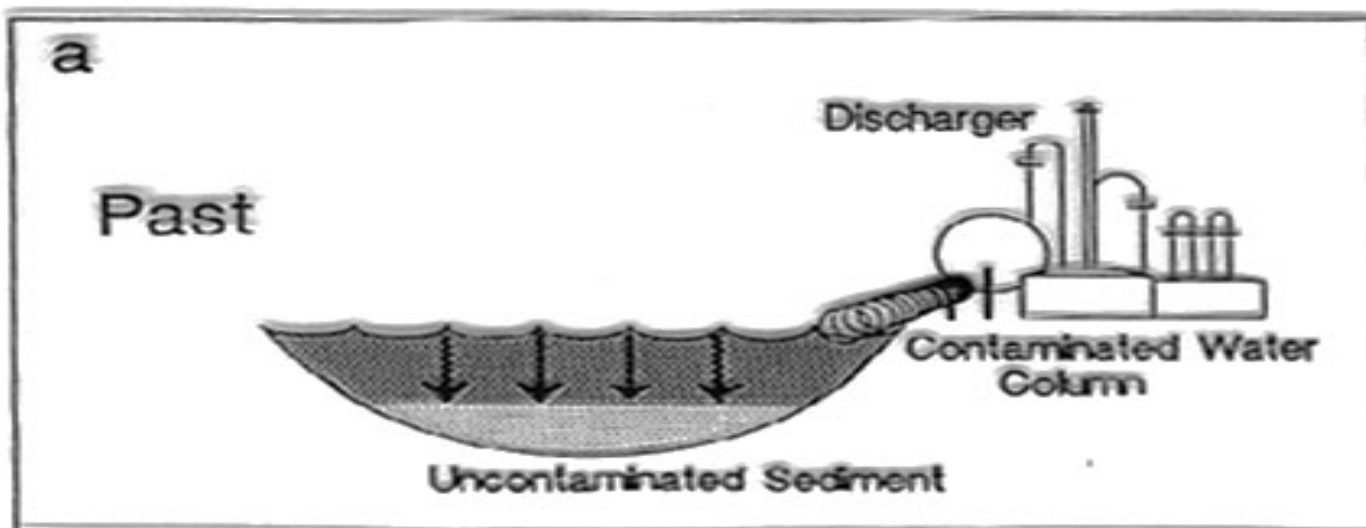


Oil Pollution Statistics for 2003-2004

Table 6.1-5 Point and Nonpoint Sources of Pollution in Marine Waters

Sources	Common Pollutant Categories
Point Sources	
Municipal sewage treatment plants	BOD, bacteria, nutrients, ammonia, toxic chemicals
Industrial facilities	Toxic chemicals, BOD
Combined sewer overflows	BOD, bacteria, nutrients, turbidity, total dissolved solids, ammonia, toxic chemicals
Nonpoint Sources	
Agricultural runoff	Nutrients, turbidity, total dissolved solids, toxic chemicals
Urban runoff	Turbidity, bacteria, nutrients, total dissolved solids, toxic chemicals
Construction runoff	Turbidity, nutrients, toxic chemicals
Mining runoff	Turbidity, acids, toxic chemicals, total dissolved solids
Septic systems	Bacteria, nutrients
Landfills/spills	Toxic chemicals, miscellaneous substances
Silvicultural runoff	Nutrients, turbidity, toxic chemicals

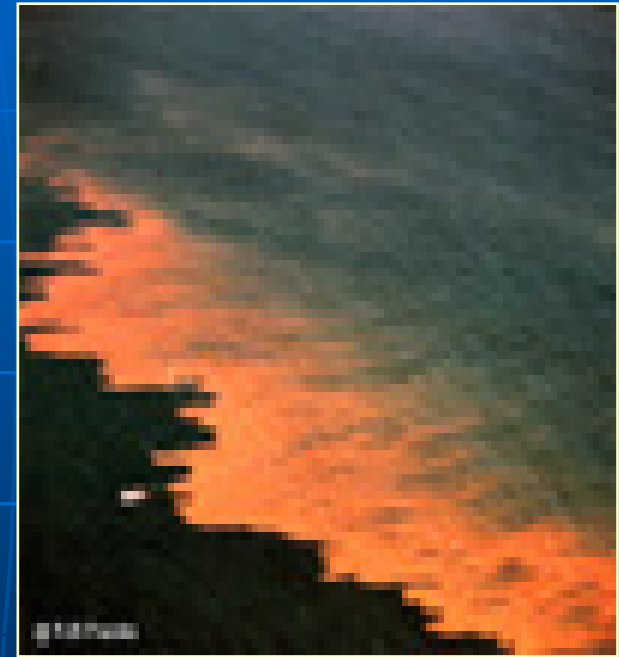
Source: U.S. Environmental Protection Agency, National Water Quality Inventory, Washington, D.C., 1986.



(a) Historical contamination of sediments from anthropogenic sources; (b) contemporary release of contaminants into the water column from contaminated sediments.

What is red tide?

- A proliferation of a marine plankton toxic and often fatal to fish, perhaps stimulated by the addition of nutrients.
- A tide can be red, green, or brown, depending on the coloration of the plankton.
- Discoloration of surface waters, most frequently in coastal areas



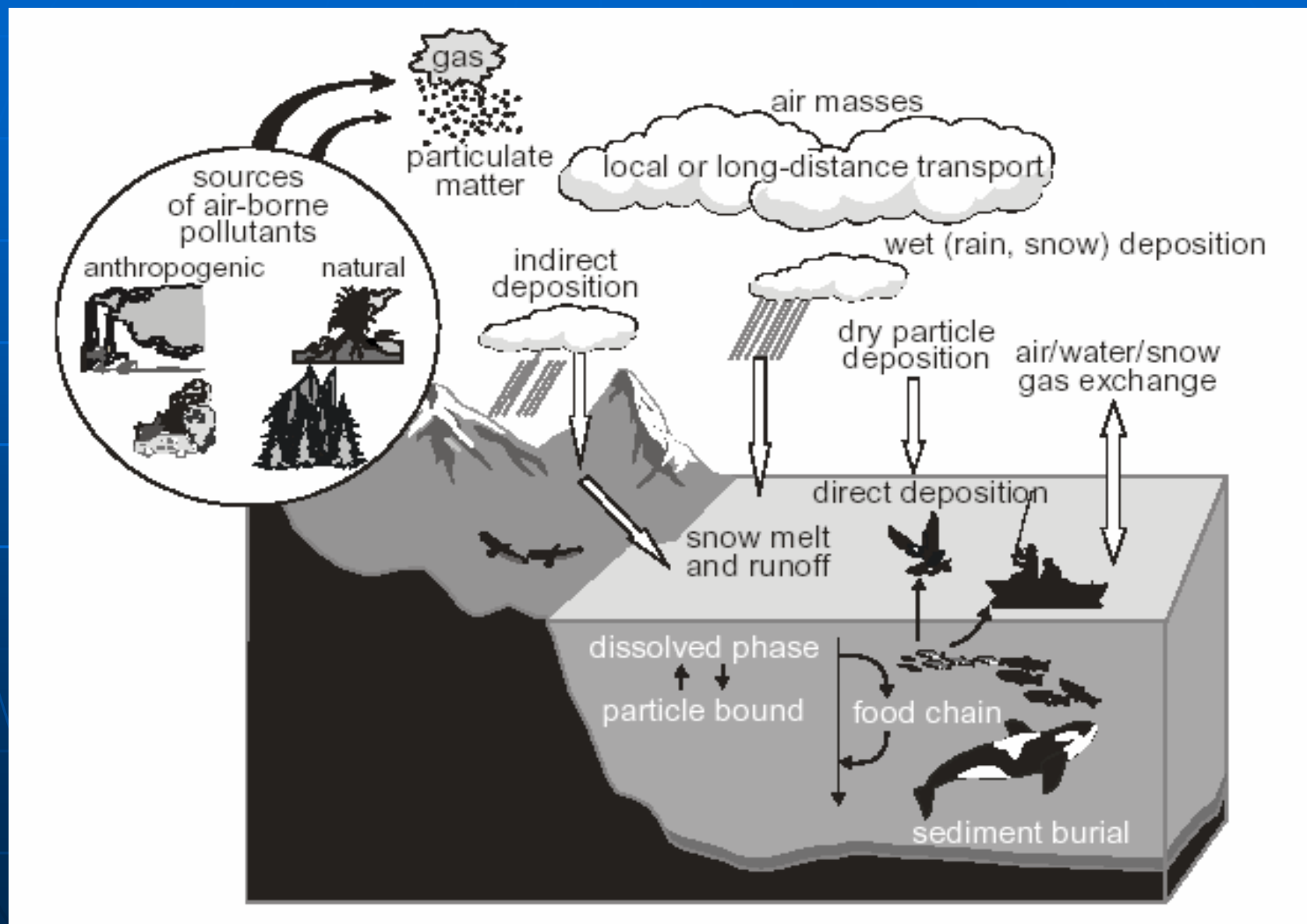
California Noctiluca Bloom

What is POPS?

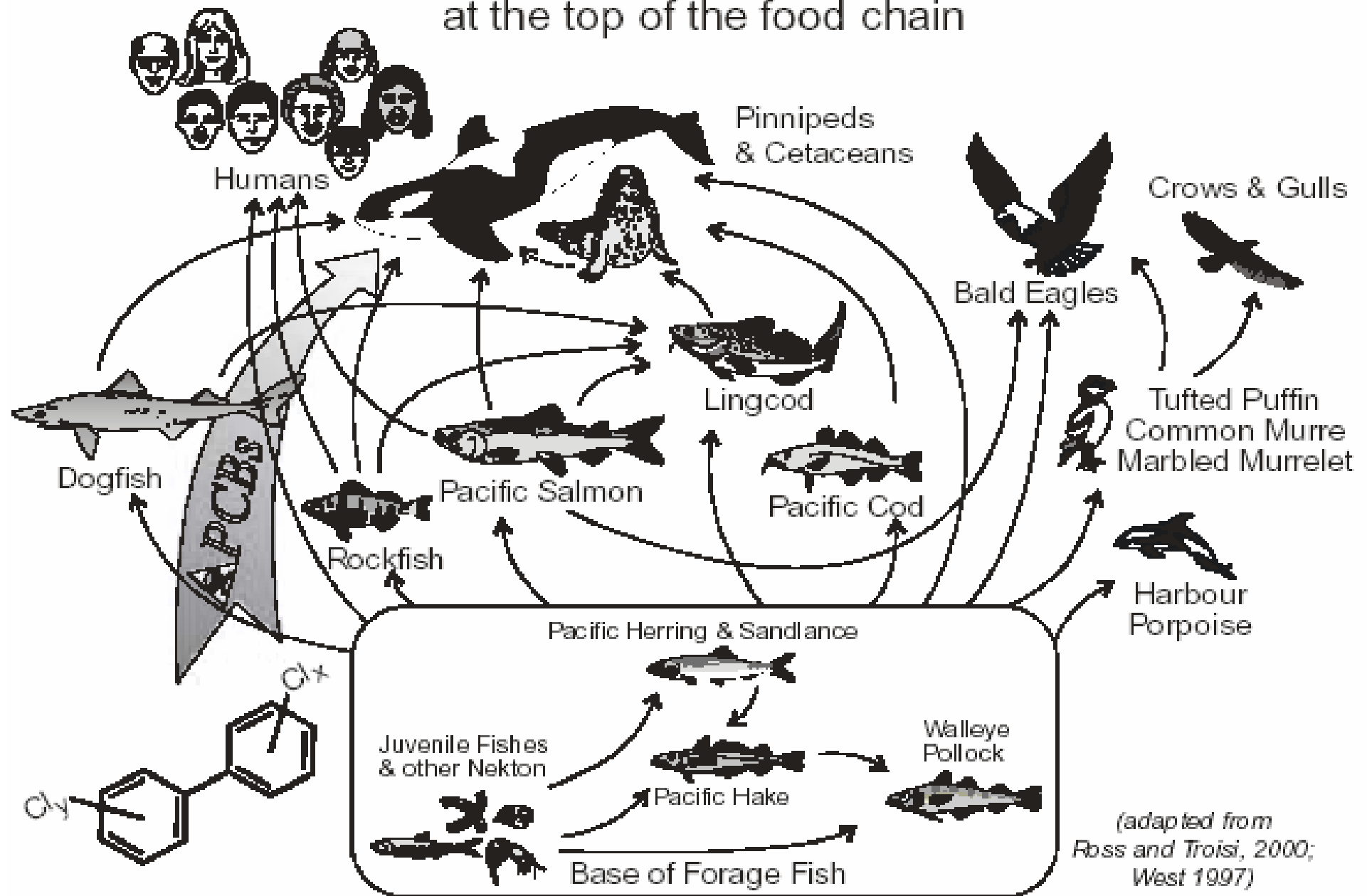
- Persistent organic pollutants, a group of PTBs which are capable of long-range transport and deposition.
- They are believed to be transported primarily in the atmosphere.
- These have global effects. Most are already banned in Western Europe but some are still in use in developing countries.

- The POPs include the following 12:
PCBs, dioxins and furans, aldrin, dieldrin,
DDT, endrin, chlordane,
hexachlorobenzene, Mirex, toxaphene and
heptachlor.
- They fall into three groups:
 - ✓ chlorinated pesticides
 - ✓ industrial chemicals
 - ✓ emissions and by-products.

POPs在近海环境中的生物地球化学循环



Toxic chemicals accumulate at the top of the food chain



Eutrophication hazard

WFPHA, World Federation of Public Health Association, 2000

- 对人

- 对动物

Stockholm Convention on POPs

- To deal with the global problem, a convention on POPs was passed at a meeting in Stockholm, Sweden, in May 2001, that has been signed by 151 countries.
- The convention was ratified by China in June 2004 and became effective in the country in November that year.

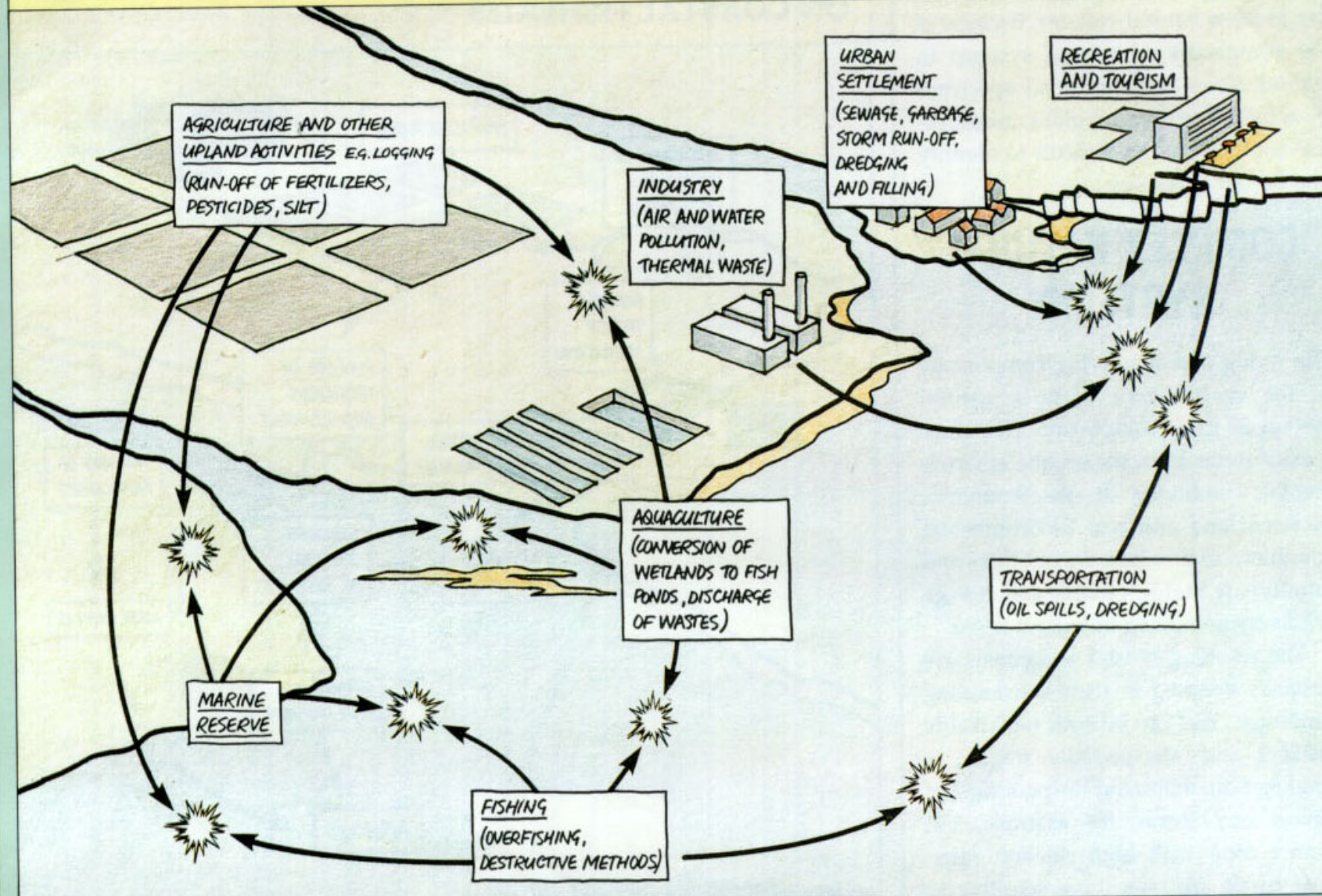
- The treaty requires all parties to take necessary steps to ban the production and use of some of the most toxic chemicals.
- In china ,the management and control of POPs should span their whole life cycle - from production, circulation, utilization, import and export and waste disposal and require coordinated effortfrom different government departments



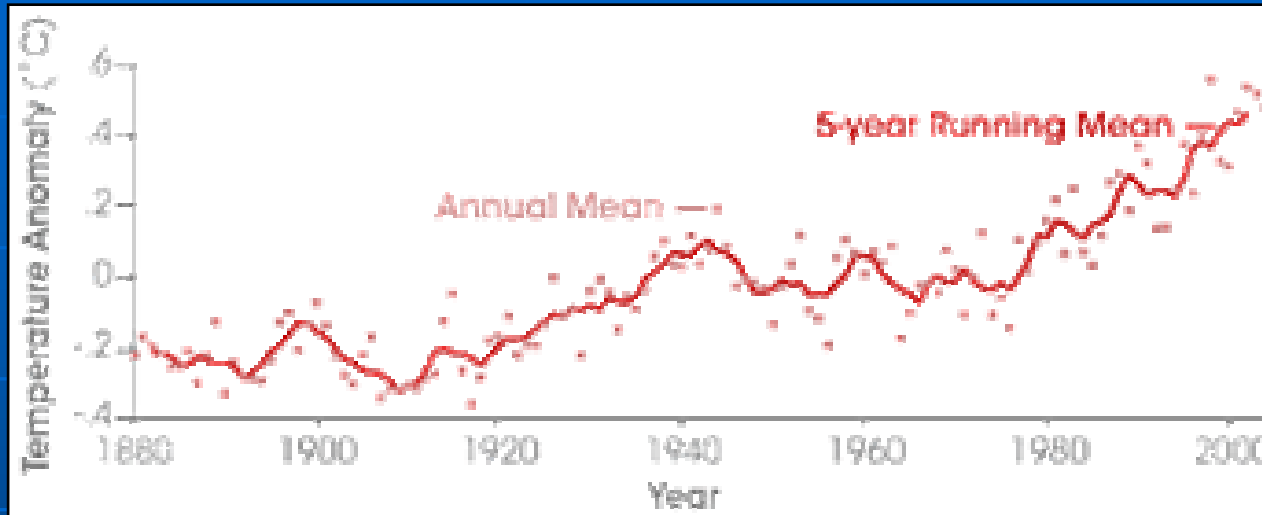
China-POPs.org

2.2

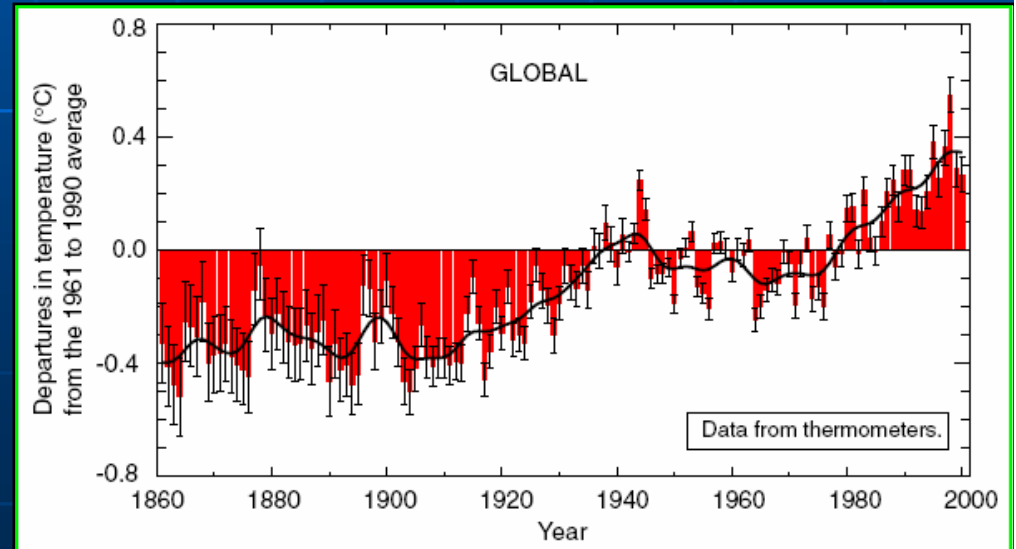
SOME POTENTIALLY CONFLICTING USES OF COASTAL RESOURCES



2.2 Global warming



- Global mean temperatures have risen over the past 100 years by about 0.6°C .
- Over half of the increase has occurred in the last 25 years.



Outcome of the weather change

- *Melting of continental ice sheets* will cause global sea-levels to rise.
- Global warming will heat the upper several hundred meters of ocean water, causing a thermal expansion of the water and a global sea-level rise.



Venice - The Rialto Bridge

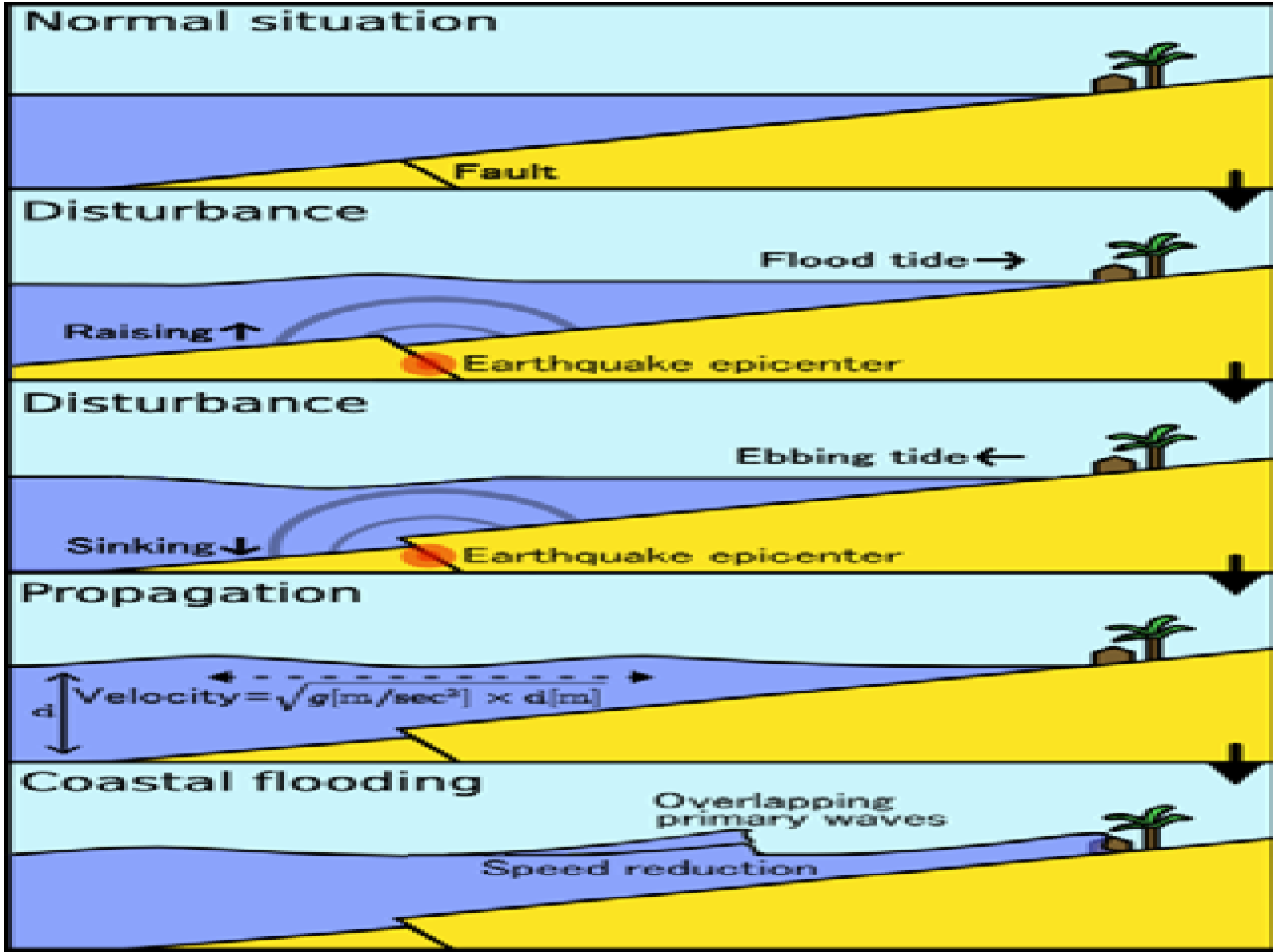
over 240 years



Tsunami : natural diasaster

- A **tsunami** is a natural phenomenon consisting of a series of waves generated when water in a lake or the sea is rapidly displaced on a massive scale.
- Earthquakes, landslides, volcanic eruptions and large meteorite impacts all have the potential to generate a tsunami.





The Indian Ocean tsunami

—the deadliest diasaster in the modern history



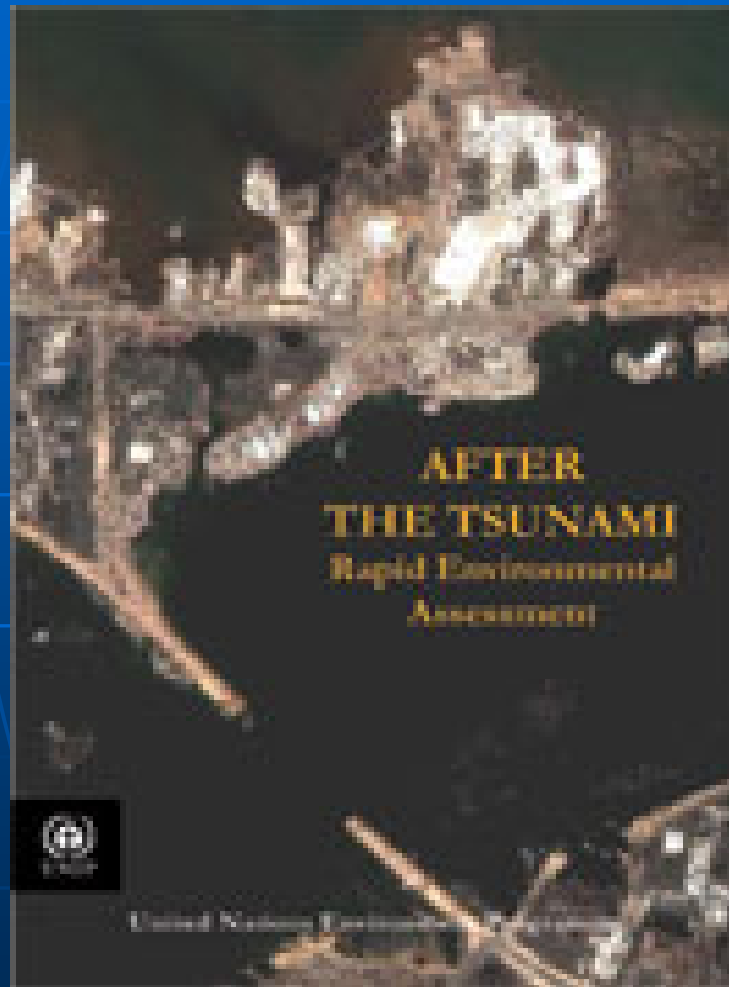
- Time: 26 December 2004
- Aftermath: Approximately 250,000 lives have been lost.
- Overall damage : exceed \$10 billion.
- Appear approximately 290,000 cubic meters of waste on the country .
- 69 inhabited islands were severely damaged.

Human component in magnitude of damage

- Human destruction of coral reefs that had formerly protected some coastal areas was a significant factor in the loss of life and damage in the area.
- Similarly, the removal of coastal mangrove trees is believed to have intensified the effect of the tsunami in some locations.
- Another factor is the removal of coastal dunes.



After the Tsunami: Rapid Environmental Assessment



The UN has started working on an Indian Ocean Tsunami Warning System and aims to have initial steps in place by end 2005.

3. Coastal Sustainable Development

- *Agenda 21, sets forth rights and obligations of States and provides the international basis upon which to pursue the protection and sustainable development of the marine and coastal environment and its resources.*

--- Agenda 21 **Chapter 17**

2001 Global Conference on Oceans and Coasts at Rio+10

- **Purpose:**

Intended to provide an overall assessment of progress achieved on oceans and coasts since the Earth Summit and to provide input to the discussions by governments at the World Summit.



Global Conference on Oceans, Coasts and Islands

- The **Global Conference on Oceans, Coasts, and Islands *Mobilizing for Implementation of the Commitments Made at the 2002 World Summit on Sustainable Development***, to be held at UNESCO in Paris on November 12-14, 2003, aims to catalyze useful strategies for achieving implementation of the global oceans agenda.

Coastal management conferences

- **Inaugural National (USA) Conference on Coastal and Estuarine Habitat Restoration, April 13-16, 2003, Baltimore, Maryland**
 - mobilize the coastal and estuarine habitat restoration community
- **Coastal Zone 03 conference, July 13 to 17, 2003, Baltimore, Maryland**
 - Port and harbor management, Regional land management, Management responses to coastal hazards, management of aquatic resources
- **International Coastal Symposium March 14 to 19, 2004 in Itajaí city, Brazil**
 - discuss recent or new advances in scientific, technical, and socio-economic understanding of environmental issues related to coastal processes.

- **Wanted!**
Seas and Oceans--
Dead or Alive

---World Day for Environmental 2004

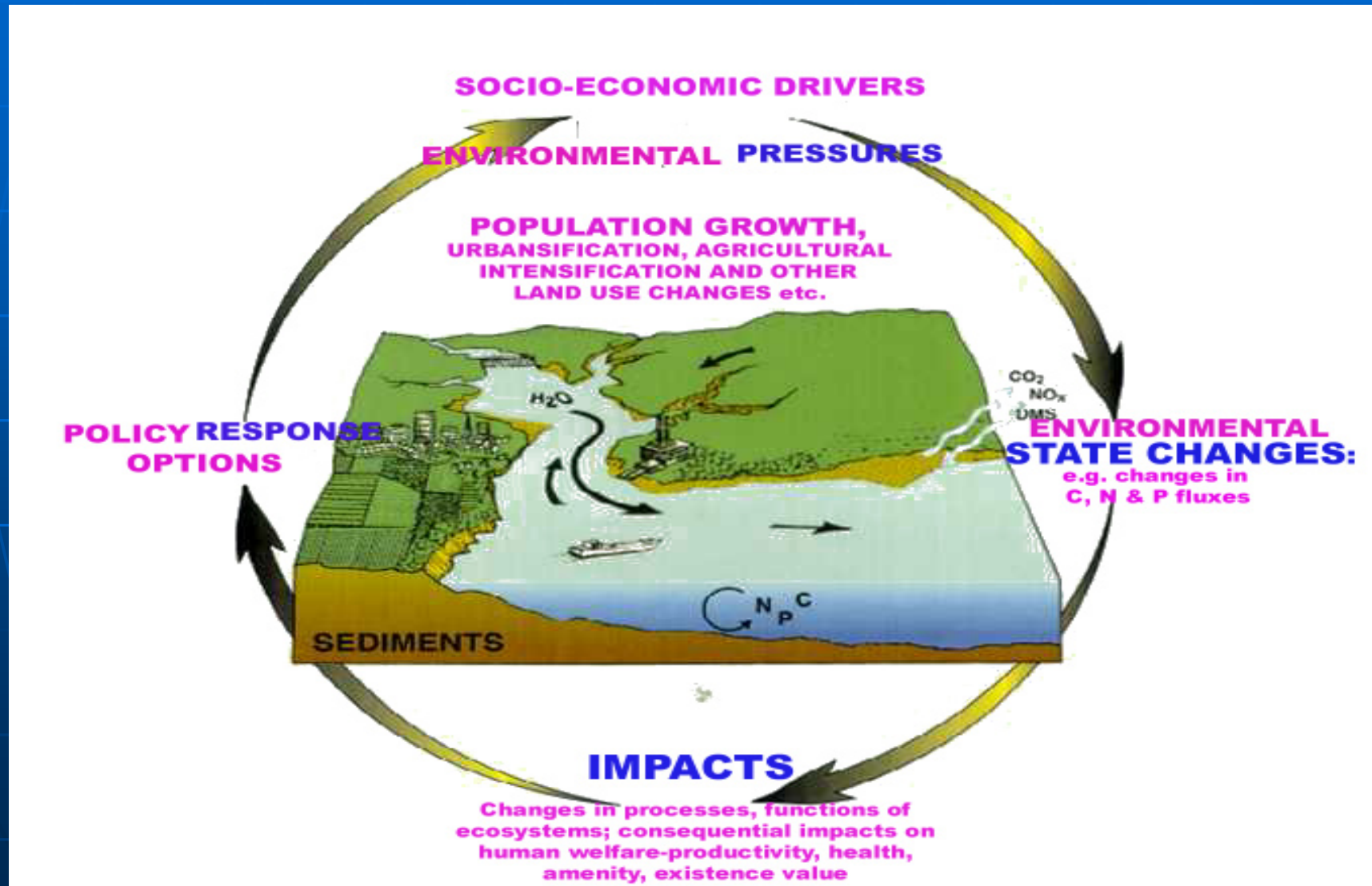


Three conditions required for sustainability:

--- According to Herman Dalys (1989)

- Rates of use of renewable resources do not exceed their rates of regeneration;
- Rates of use of nonrenewable resources do not exceed the rate at which sustainable renewable substitutes are developed;
- Rates of pollution emission do not exceed the assimilative capacity of the environment.

P-S-I-R Cycle and Continuous Feedback Process



3.1 Integrated evaluation of coastal zone sustainability

1. Justification of the indicator system

The selection of the indicators has been made according to the following criteria:

- Theoretically well founded;
- Relatively stable and independent;
- Clear in content;
- Measurable and comparable, easy to quantify;
- Regionally specific;
- Based on data that is acquirable.

Justification of the indicator system

Table 1
Sustainability indicator system for the coastal zone

Level one	Level two	Level three
Environment and resources sustainability index (ERSI)	Environmental quality	Fresh water quality index Air quality index Sea water quality index Area of public open space per head
	Resource levels	Sea water aquaculture products per head Land claim area per head Arable land per head
	Resource and environment management	Industrial waste water discharge per 10,000 RMB output Utilization ratio of industrial solid wastes Industrial waste gas discharge per head
Economic development sustainability index (EDSI)	General economic characteristics	Gross domestic product (GDP)
	Economic structure	Ratio of primary industry to GDP Ratio of secondary industry to GDP Ratio of tertiary industry to GDP

Society sustainability index (SSI)	Economic benefits	GDP per head Value of agricultural output per unit arable area
	Economic prosperity	Commodity turnover
	Economic intensity	GDP per power consumption GDP per water consumption
	Population index	Number of population Natural birth rate
	Infrastructure level	Power consumption per head Water consumption per head Telephone occupation per thousand people Passenger transportation per thousand people
	Educational level	Number of students per thousand people
	Health care	Number of hospital beds per thousand people
	Living standards	Income per head

2. Integrated evaluation

Macnail,
1989

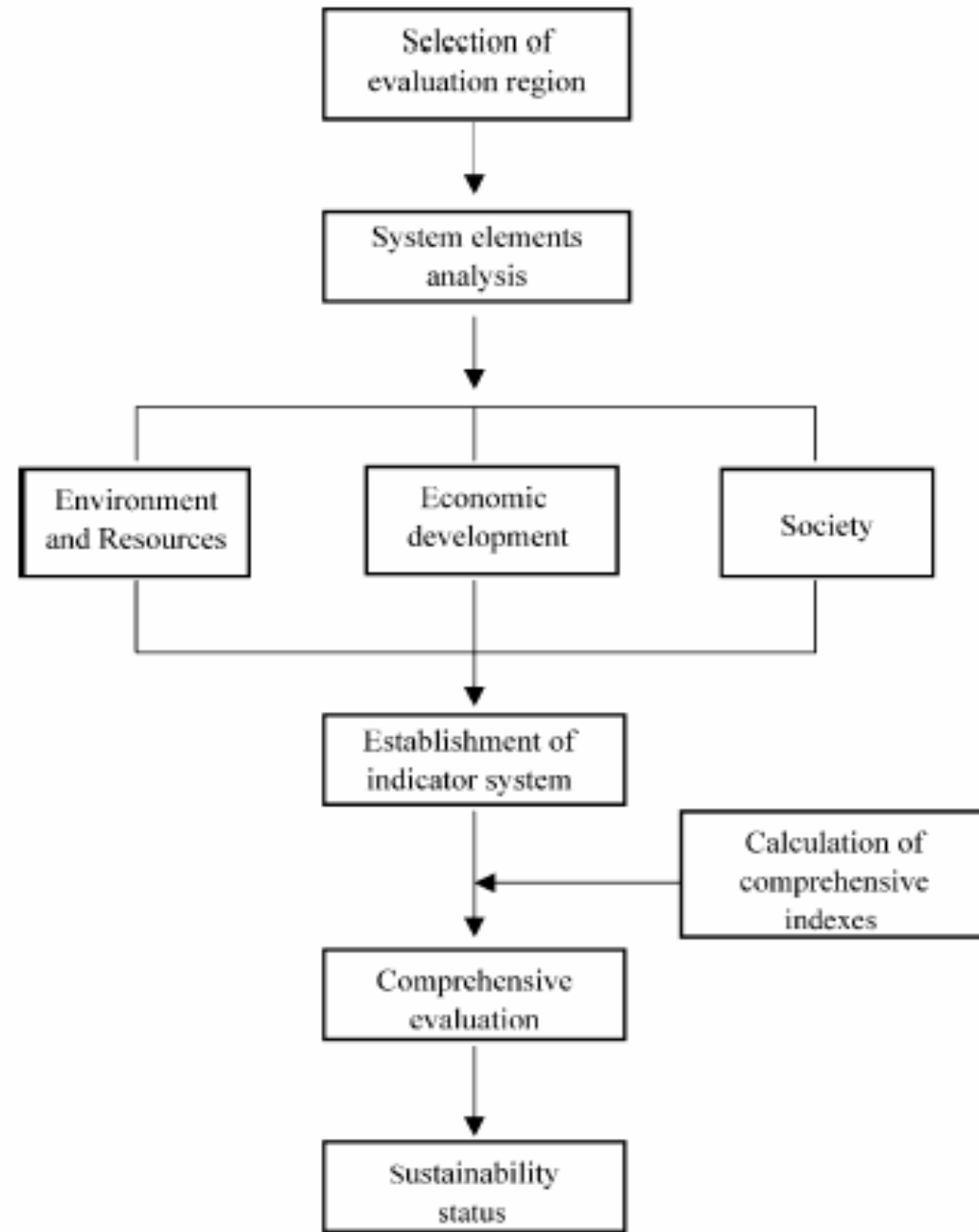
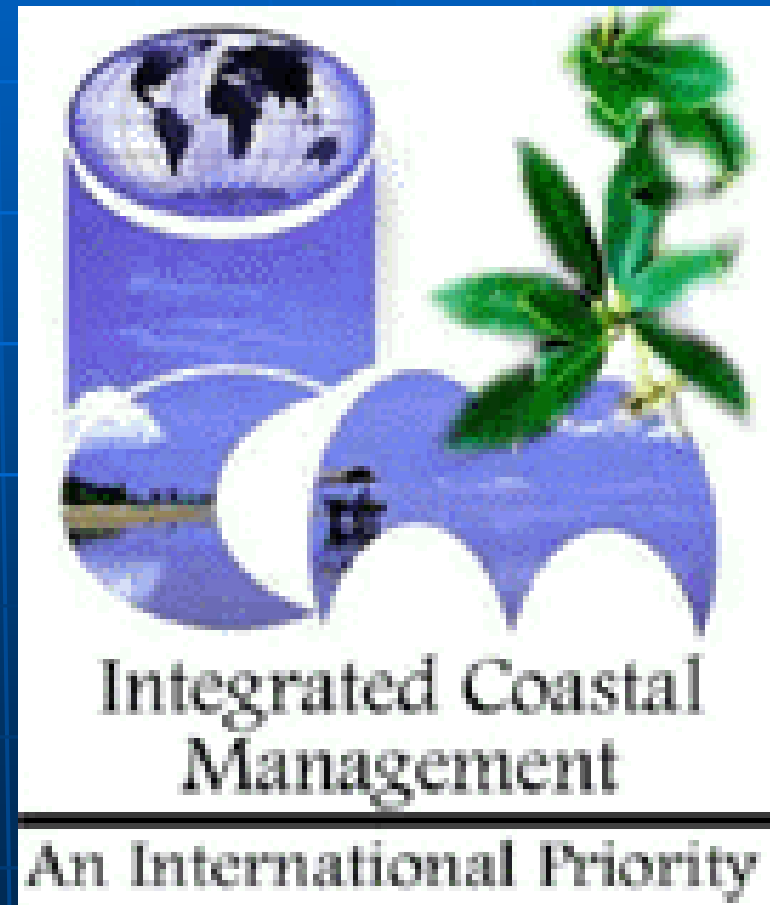


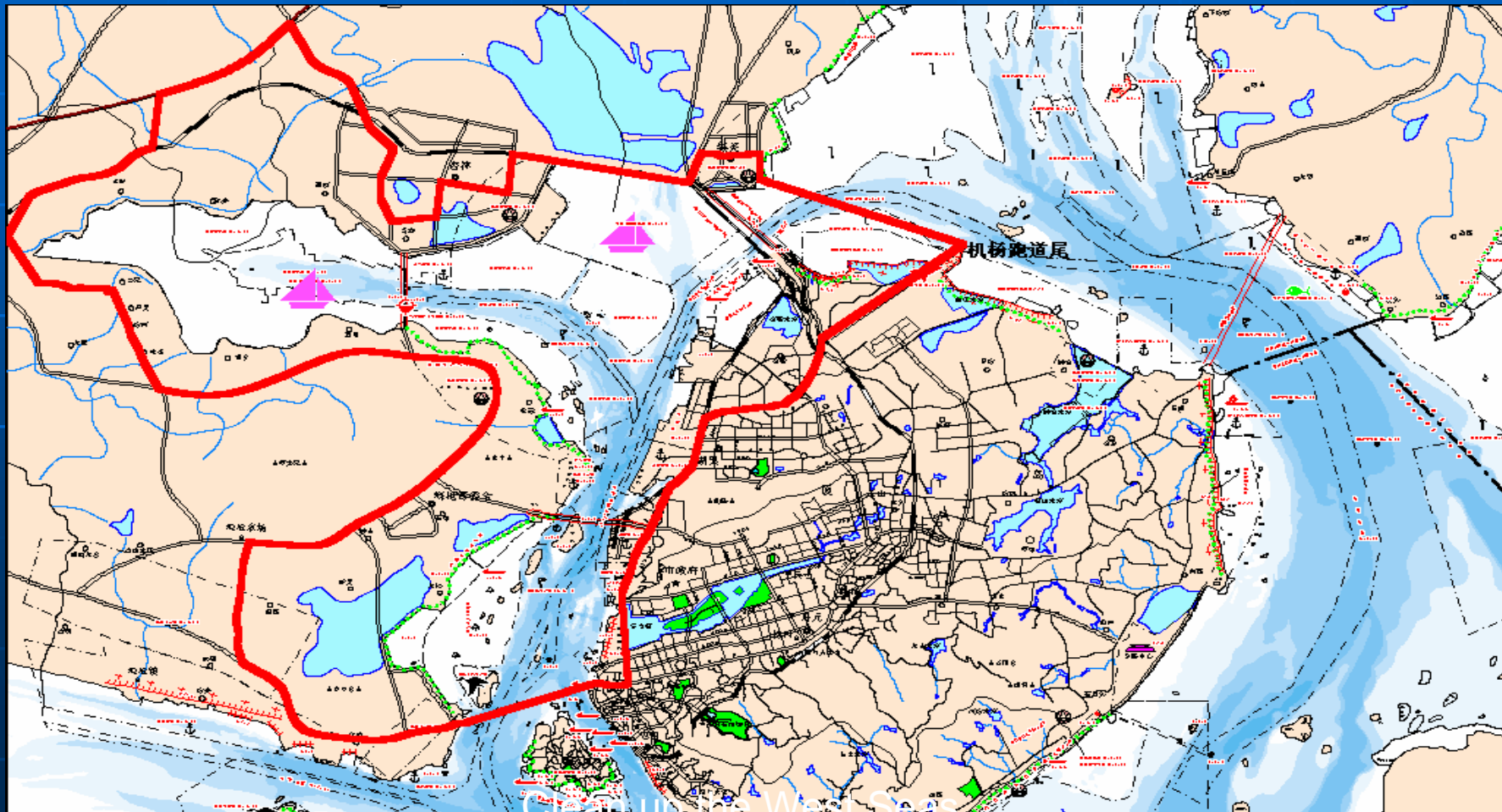
Fig. 1. The procedure of sustainability evaluation.

- While there are many definitions of sustainability, a systems approach can be applied to the sustainable development of the coastal zone identifying environment and resources, economic development and society subsystems to assess the development process.
- Using an integrated evaluation method based on a sustainable indicator system of the coastal region, a fuller view of the coastal zone development process towards sustainability can be clearly achieved.

- 3.2 One solution to achieve the sustainability of coastal zone is applying the approach ---- **ICM** (integrated coastal management).



In December 1997, Xiamen Municipal Government adopted the marine functional zoning scheme and issued an administrative order to 23 related agencies to implement the zoning scheme in the formulation and execution of their sectoral programs

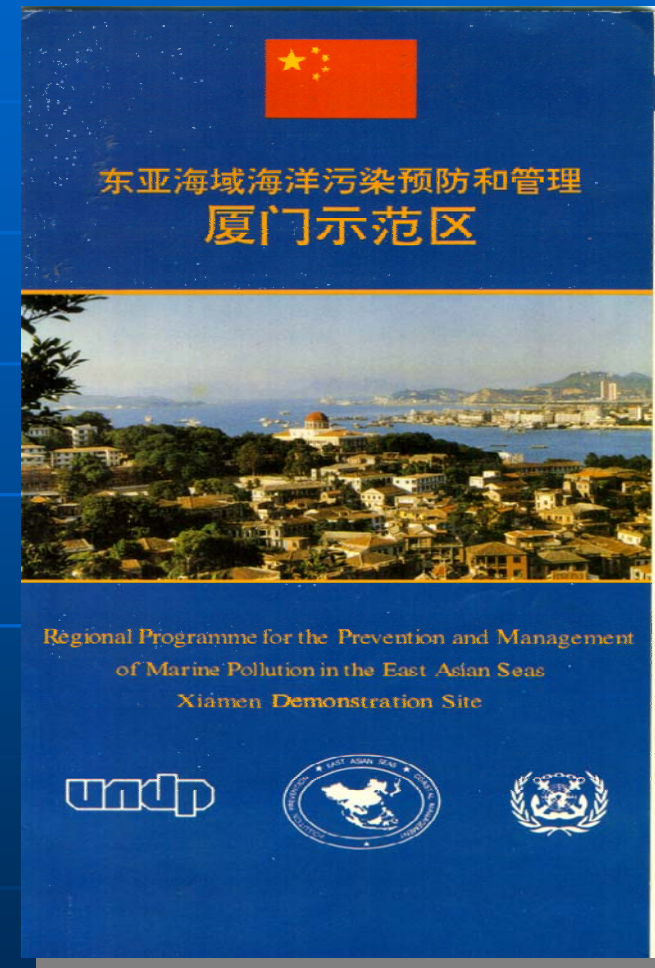


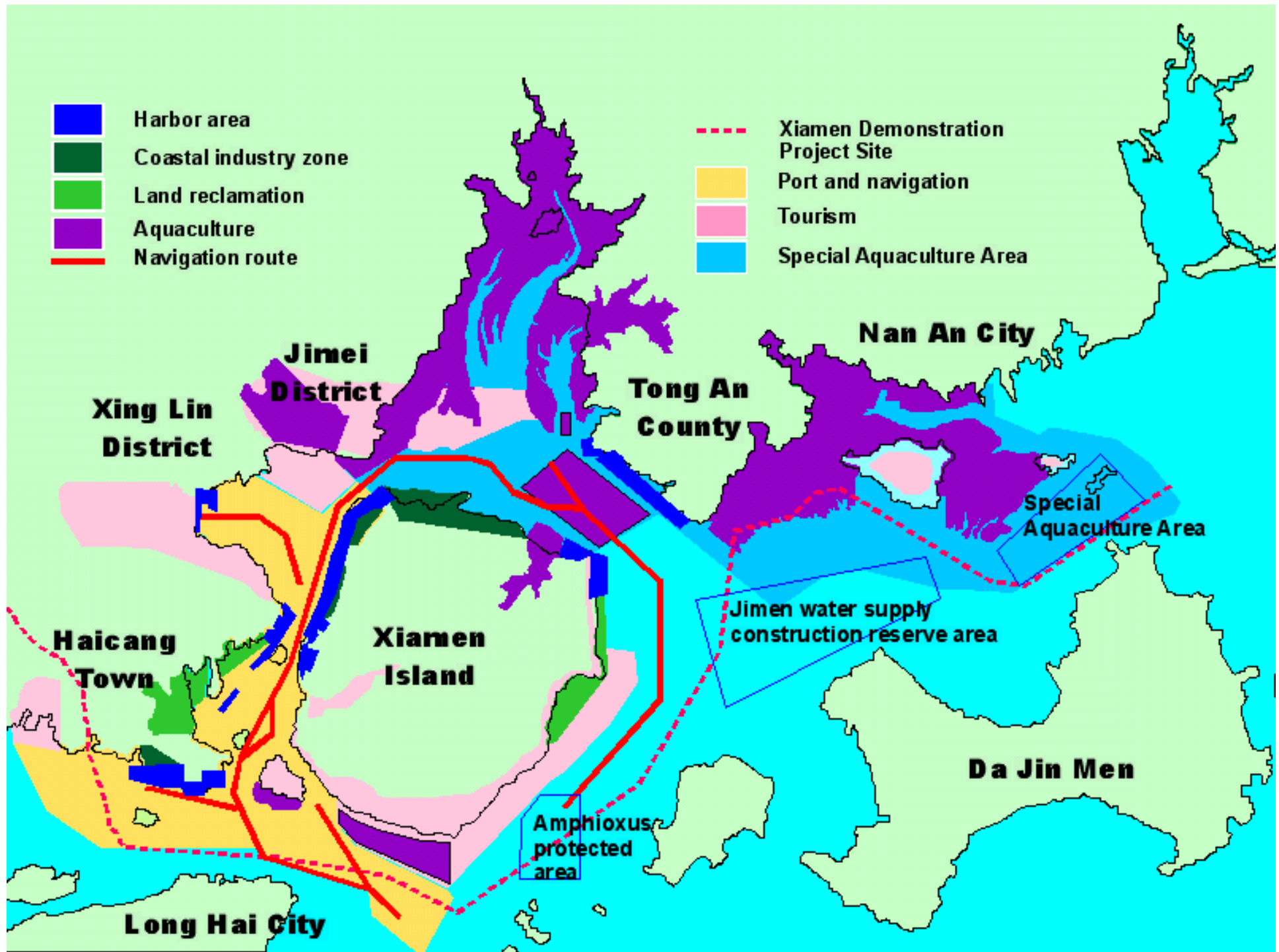
Clean up the West Seas

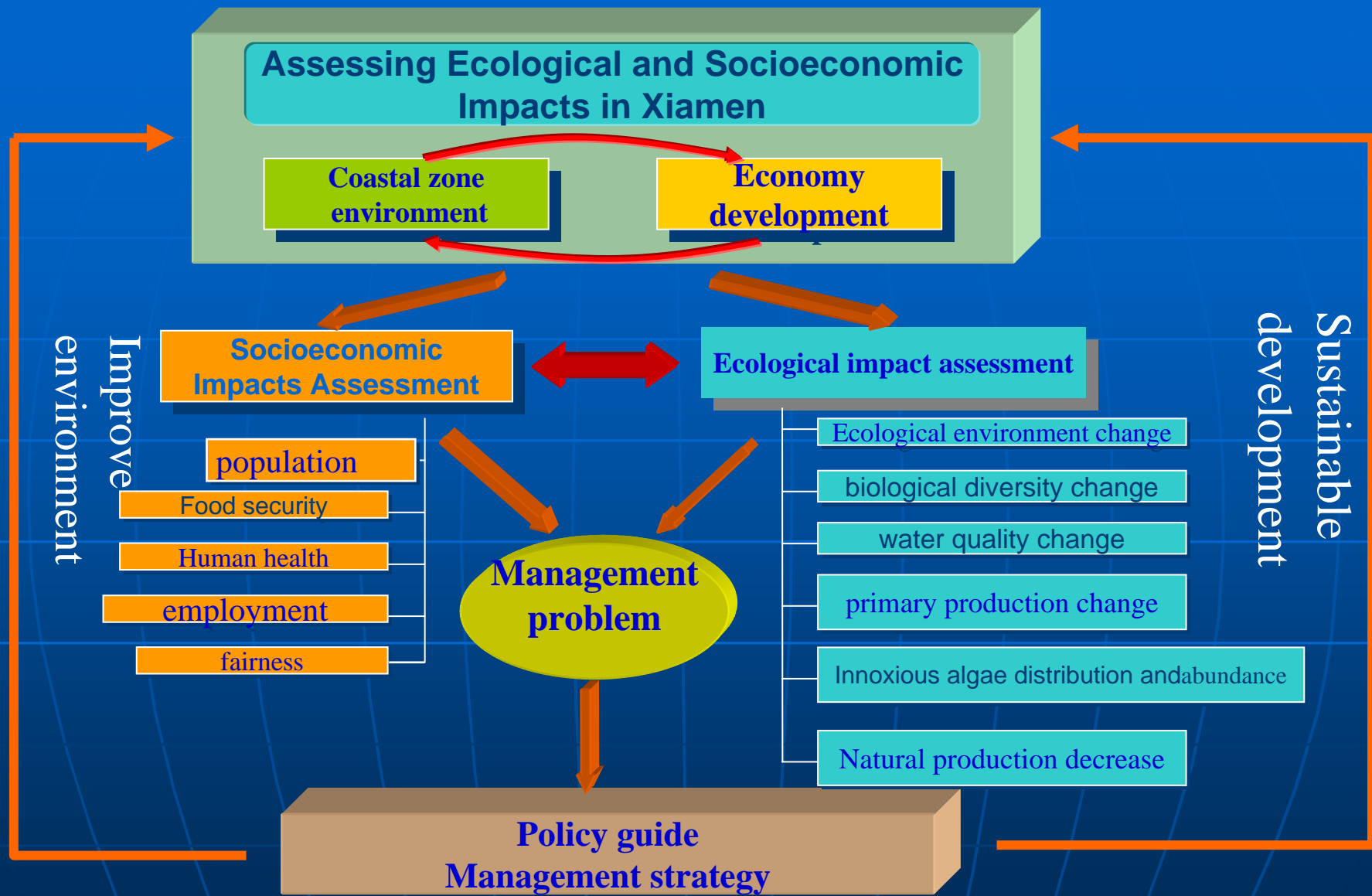


Improved environmental quality in the River Thames in England, Boston Harbor in the United States, and Xiamen Harbor in China show that determined, coordinated action can produce benefits even in large urban areas, where development and population pressures are concentrated.

GESAMP(April,1998)







Framework: Assessing Ecological and Socioeconomic Impacts of Economic Development

Yuandang Lake Cleanup



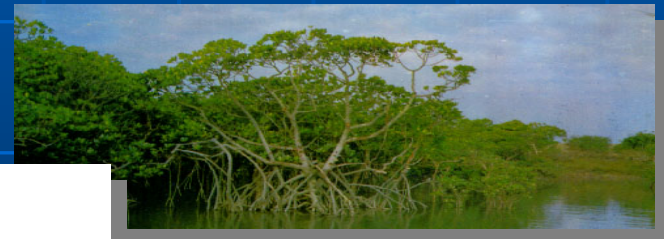
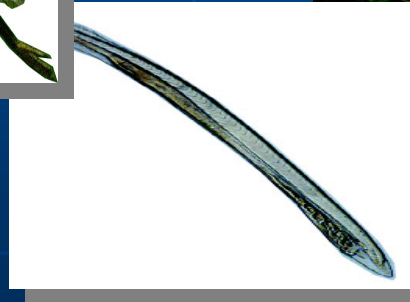
Benefit-cost Analysis of YDL Integrated Treatment Project (1989-2002)

Benefits (value of 2002) (million)	
Benefits to project	9850
Benefits to the environment	309.2
Costs	1084
Net Present Value	9075
Benefits and Costs Ratio	9.4

From the Yuandang Lake integrated treatment project, the municipal government learned lessons for not considering environmental consequences in pursuing economic growth, and also realized that a good quality environment could greatly advance city construction and socio-economic development

(Hao and Peng, 1998)

厦门珍稀物种国家级自然保护区

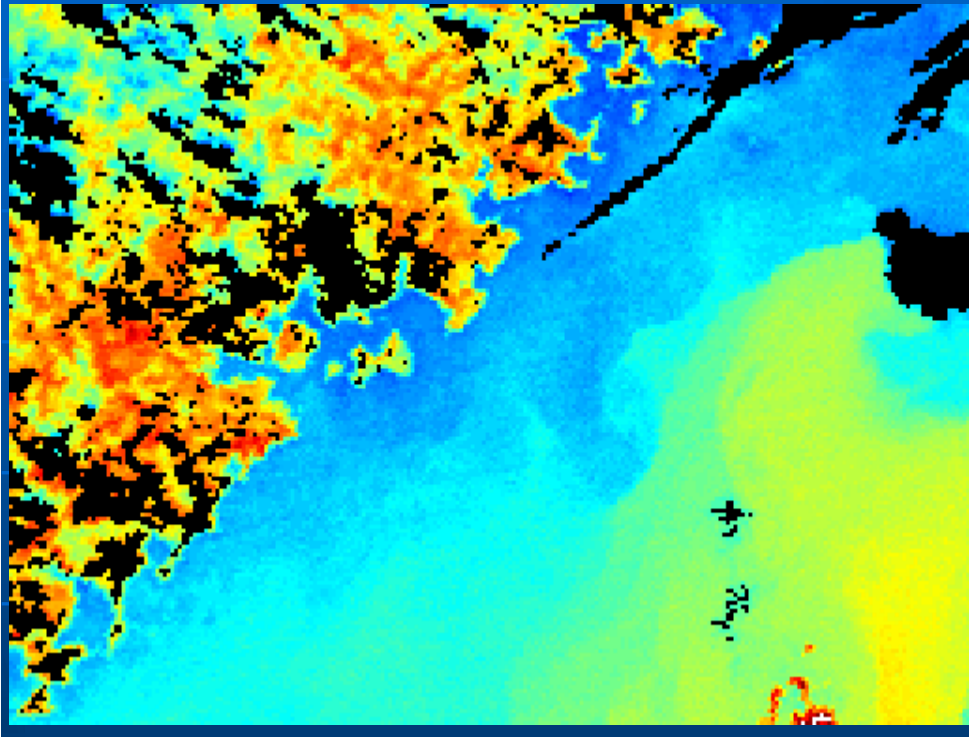


Benefits Analysis of the Preservation of Endangered Species and Scenic Spots (RMB)

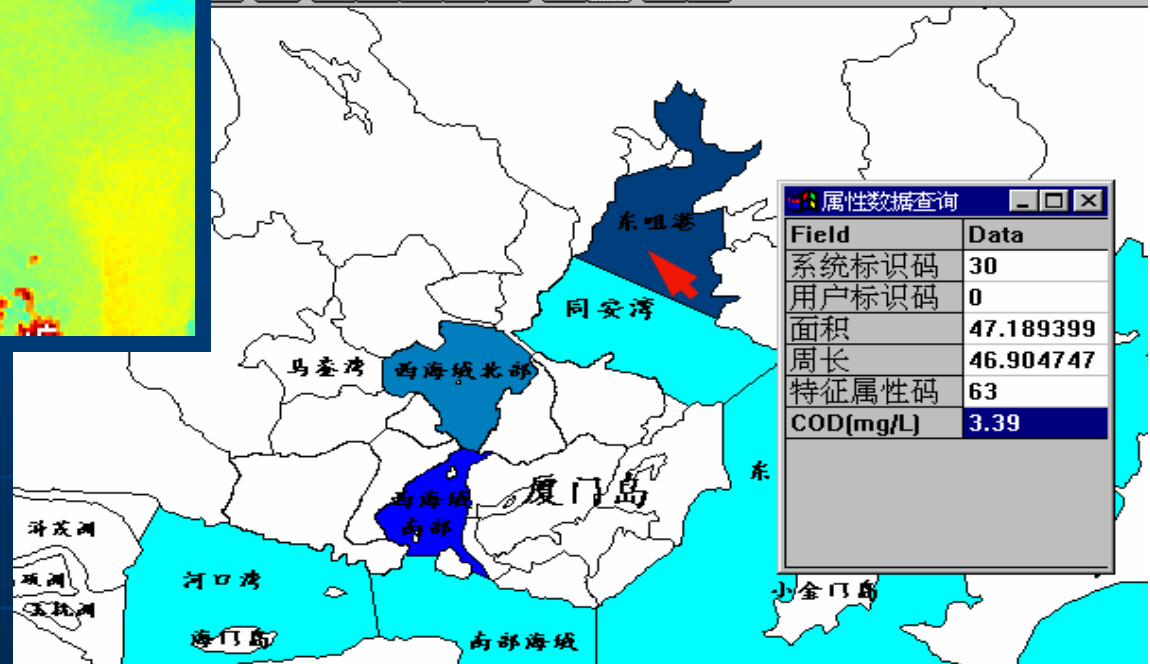
	Endangered Species	Scenic Spots
WTP average respondents/ year	85	77
Population (in 2000, million)	1.31	
Benefit/year (RMB. Million)	111.35	100.87
Discount rate	8% (average return rate)	
Present value of benefit (million)	1391.875	1260.875

Source: Peng Benrong, Qian Lanying, *Integrated Coastal Management (ICM) Contingent Valuation Survey in Xiamen*, Technical Report to GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asia Seas, 1998

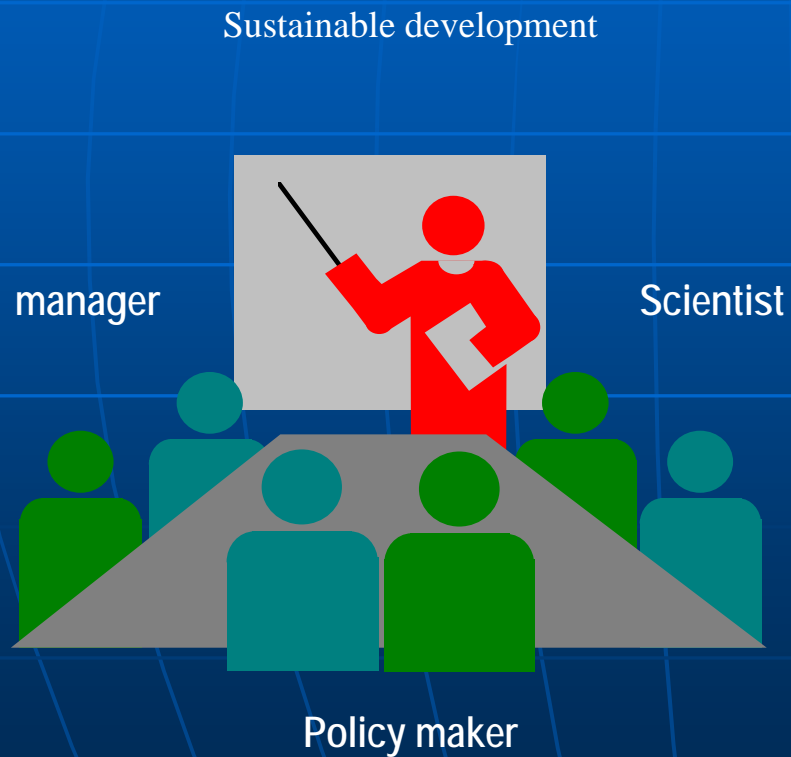
RS & GIS use in the coastal zone management



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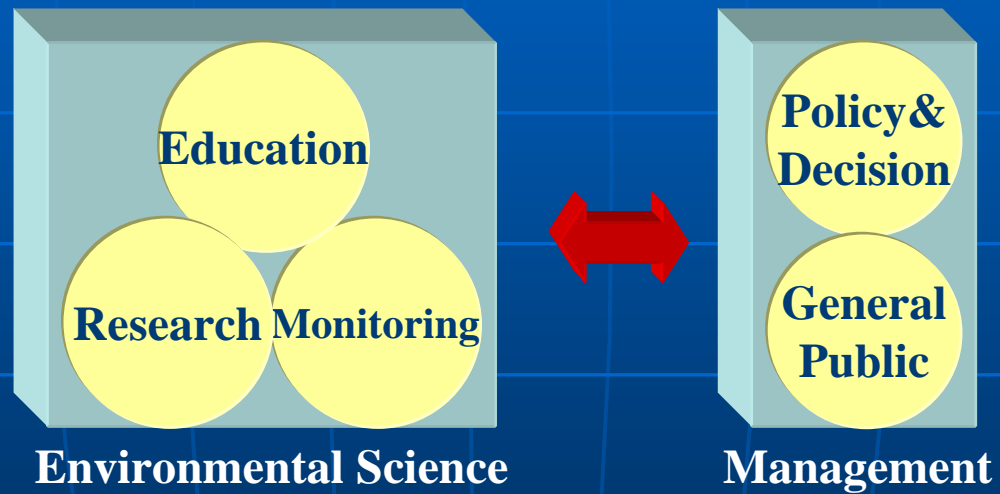


International (Xiamen) Coastal Sustainable Development Training Centre(2001)



- Xiamen University
- Municipal Government
- SOA
- PEMSEA

summarize



Thinking:

- **What is the definition of Coastal Area?**
- **What are the Natural Characteristics of the Coastal Zone?**
- **Take Xiamen as an example to explain the socio-economic significance in coastal zone.**

*Thank You
for Your
Attention!*