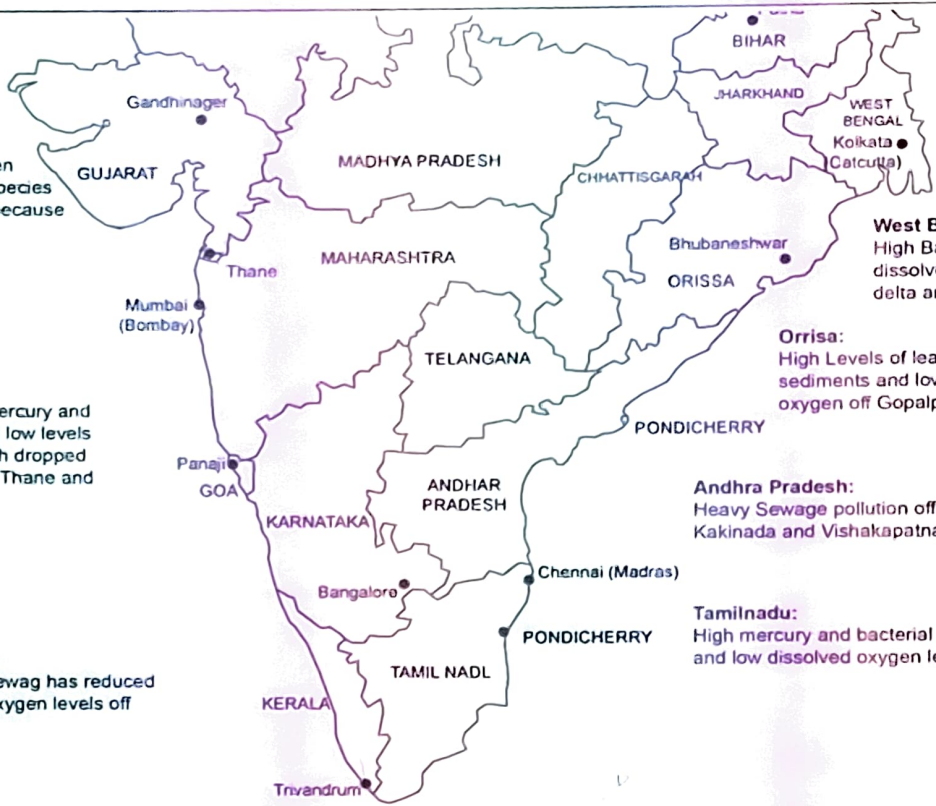
Ocean Pollution

- ✓ How much pollution can the oceans tolerate?
- ✓ Coastal zones: How does pollution affect coastal zones?
- ✓ What are major sources of ocean pollution and what is being done?
- ✓ Oil spills

Oceans can disperse and break down large quantities of degradable pollution if they are not overloaded.

- ✓ Pollution will be worst near heavily populated coastal zones
- ✓ Wetlands, estuaries, coral reefs, mangrove swamps
- ✓ 40% of world's pop. Live within 62 miles of coast

Ocean Pollution



Gujrat:
High Levels of Biological Oxygen Demand and nitrites. Several species have been wiped out possibly because of caustic soda industries

Maharashtra:
High concentrations of mercury and cadmium off Mumbai and low levels of dissolved oxygen which dropped to almost zero in 1991 in Thane and Mahim creek

Karnataka:
Domestic sewag has reduced dissolved oxygen levels off Mangalore

West Bengal:
High Bacteria levels and low dissolved oxygen in the Ganga delta and Kolkata.

Orrisa:
High Levels of lead and mercury in sediments and low level of dissolved oxygen off Gopalpur

Andhra Pradesh:
Heavy Sewage pollution off Kakinada and Vishakapatnam

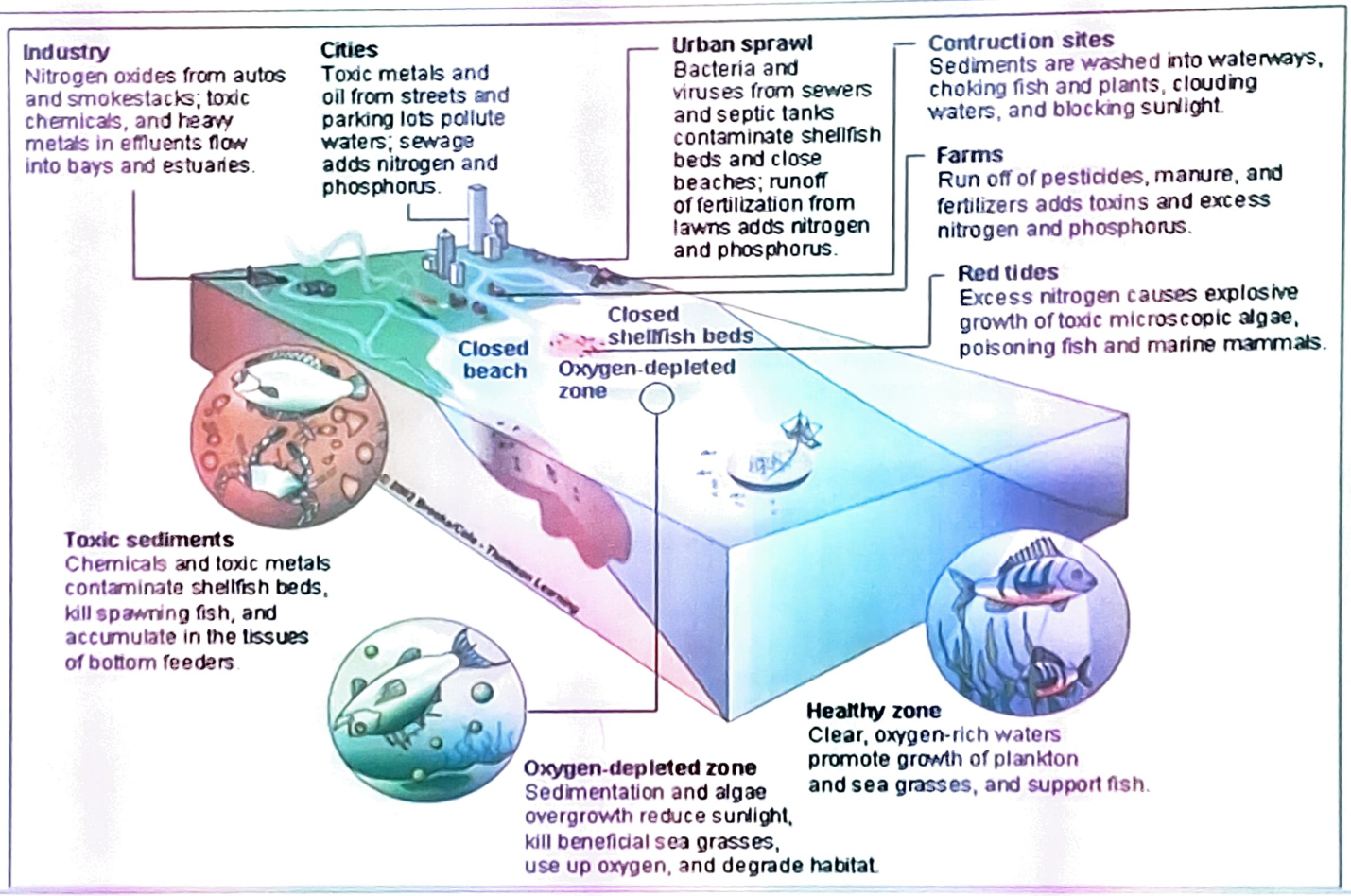
Tamilnadu:
High mercury and bacterial levels off Tuticonn and low dissolved oxygen levels off Chennai

Kerala:
Petroleum hydrocarbons from fishing vessels off Kannur. Timber and rayon industrial wastes, mercury and copper off Kozhikode,copper off Kochi and Kollam and titanium factory effluents off Trivandrum. Sea sediments off Vizhinjam and Kozhikode are contaminated by sewage.

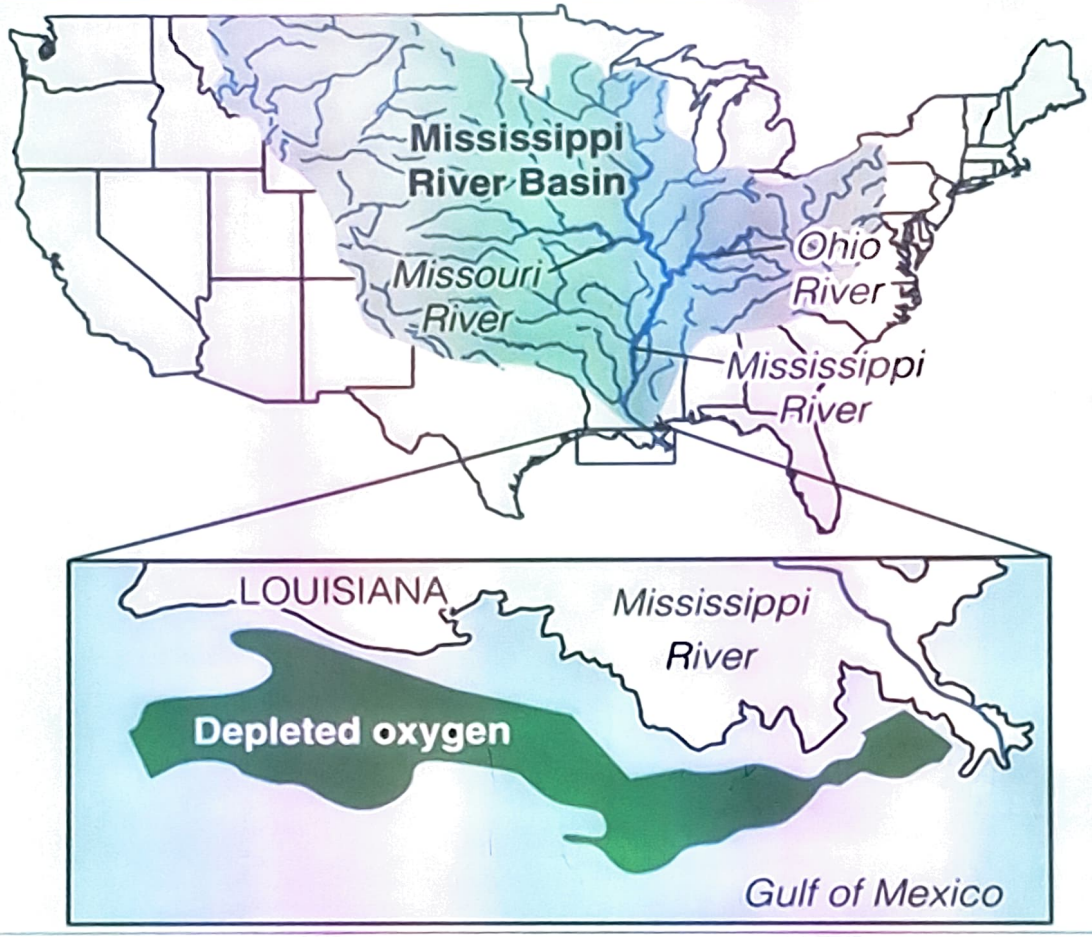
Ocean Pollution

- ✓ Large amounts of untreated raw sewage (viruses)
- ✓ Leaking septic tanks
- ✓ Runoff
- ✓ Algae blooms from nutrients
- ✓ Dead zones NO Do
- ✓ Airborne toxins
- ✓ Oil spills

Ocean Pollution



Ocean Pollution



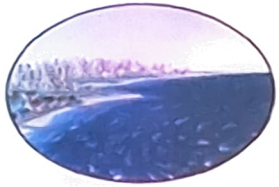
Ocean Pollution

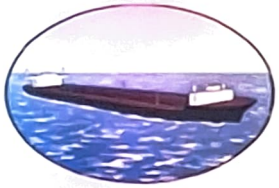
- ✓ Preventing and reducing the flow of pollution from land and from streams emptying into the ocean is key to PROTECT OCEANS.

Solutions

Coastal Water Pollution

Prevention	Cleanup
Reduce input of toxic pollutants	Improve oil-spill cleanup capabilities
Separate sewage and storm lines	
Ban dumping of wastes and sewage by maritime and cruise ships in coastal waters	Sprinkle nanoparticles over an oil or sewage spill to dissolve the oil or sewage without creating harmful byproducts (still under development)
Ban ocean dumping of sludge and hazardous dredged material	
Protect sensitive areas from development, oil drilling, and oil shipping	Require at least secondary treatment of coastal sewage
Regulate coastal development	
Recycle used oil	Use wetlands, solar-aquatic, or other methods to treat sewage
Require double hulls for oil tankers	

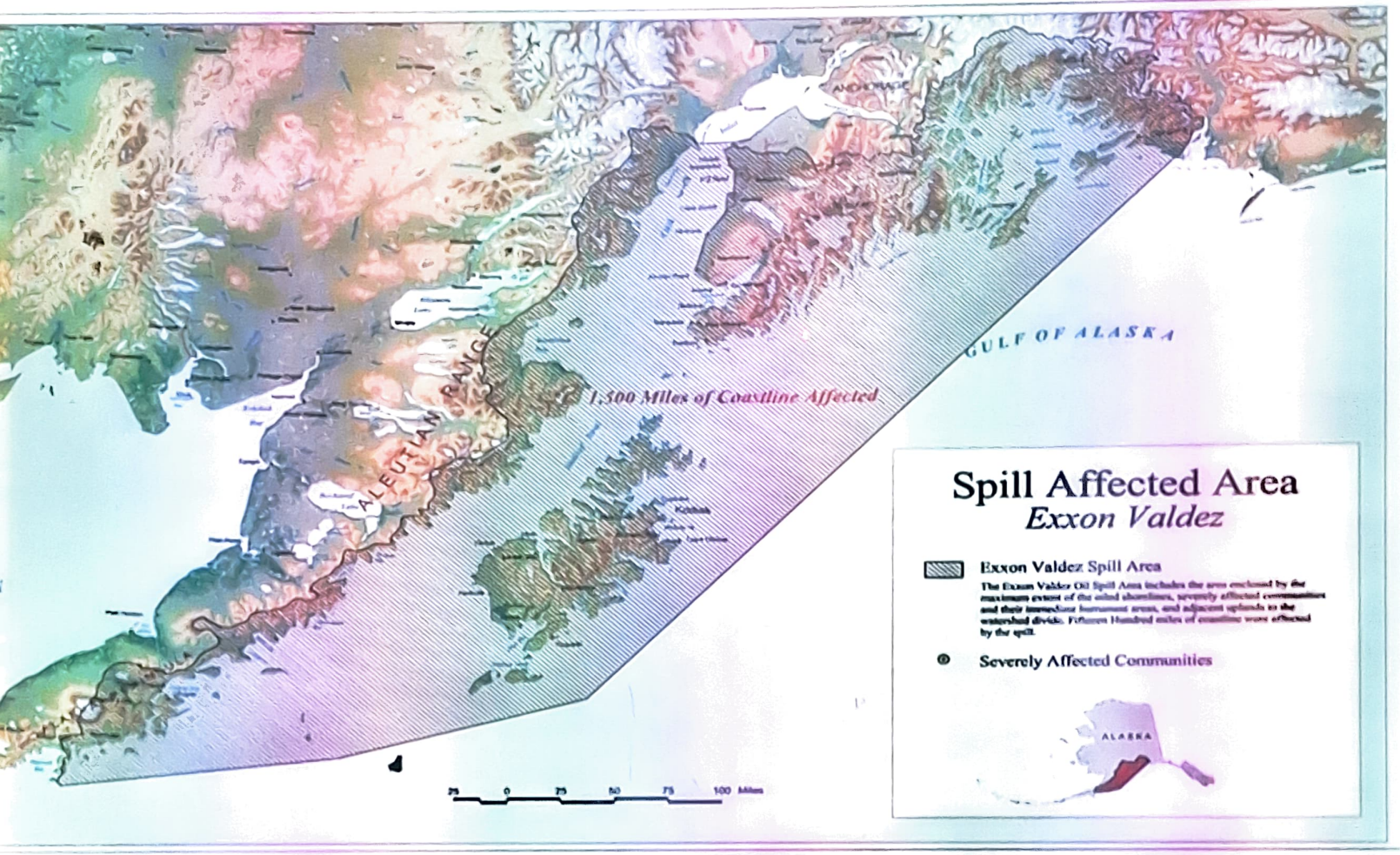




Oil Spills

- ✓ **Sources:** offshore wells, tankers, pipelines and storage tanks
- ✓ **Effects:** death of organisms, loss of animal insulation and buoyancy, smothering
- ✓ Significant economic impacts
- ✓ **Mechanical cleanup methods:** skimmers and blotters
- ✓ **Chemical cleanup methods:** coagulants and dispersing agents

Oil Spills


ANCHORAGE
GULF OF ALASKA
ALEUTIAN RANGE
1,500 Miles of Coastline Affected
75 0 75 50 75 100 Miles
Spill Affected Area
Exxon Valdez
Exxon Valdez Spill Area
The Exxon Valdez Oil Spill Area includes the area enclosed by the maximum extent of the oiled shorelines, severely affected communities and their immediate harvesting areas, and adjacent uplands to the watershed divide. Fifteen Hundred miles of coastline were affected by the spill.
Severely Affected Communities
ALASKA

Heavy Metals

- ✓ The term **heavy metal** refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations.
- ✓ Heavy metals are toxic to human health
- ✓ Most common heavy metals are lead(Pb), mercury(Hg), cadmium(Cd) chromium (Cr) and arsenic(As)
- ✓ Indoor concentration of heavy metals is generally less than their outdoor concentration
- ✓ They are mainly produced by industrial activities, and deposit slowly in the surrounding water and soil

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- ✓ Note: Arsenic is not actually a metal but is a semimetal i.e. its properties are intermediate between those of metals and nonmetals.

Properties of heavy metals

- ✓ They occur near the bottom of the periodic table
- ✓ Have high densities
- ✓ Toxic in nature
- ✓ Nondegradable

Transport phenomenon

- ✓ Water
- ✓ Food
- ✓ Air
- ✓ Adsorption or absorption onto various materials

- ✓ Example: Over half of the heavy metal input into Great Lakes is due to deposition from air.

Heavy Metals

- ✓ are natural components of the Earth's crust
- ✓ they cannot be degraded or destroyed
- ✓ to a small extent they enter our bodies via food, drinking water and air
- ✓ as trace elements, some heavy metals (e.g. copper, selenium, zinc) are essential to maintain the metabolism of the human body, however, at higher concentrations they can lead to poisoning
- ✓ heavy metal poisoning could result, for instance, from drinking-water contamination (e.g. lead pipes), high ambient air concentrations near emission sources, or intake via the food chain

Densities of Some Important Heavy Metals and Important Substances

Element	Density (g/cm^3)
Hg	13.5
Pb	11.3
Cd	8.7
As	5.8
H_2O	1.0
Mg	1.7
Al	2.7

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Drinking Water Standards for Heavy Metals

Metal	U.S. Environmental Protection Agency (EPA)	Canada	World Health Organization (WHO)
As	50 ppb (2 ppb)**	50 ppb (25 ppb)**	50 ppb (10 ppb)**
Cd	5 ppb	5 ppb	5 ppb
Pb	20 ppb	10 ppb	50 ppb (10 ppb)**
Hg	2 ppb	1 ppb	1 ppb

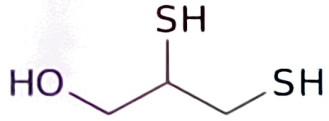
*Values in μg/L are numerically identical to those listed for ppb.
**Revised standards reducing concentrations to these lower levels were under consideration during the writing of this book, and may now be in place.

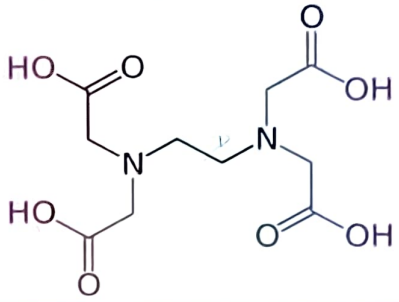
Tables 9-1,2. Baird, *Environmental Chemistry*, 1995

Toxicity of heavy metals

- ✓ Mercury is highly toxic in vapor form but lead, cadmium and arsenic are more toxic in their cationic form
- ✓ Toxicity arises from strong affinity of the heavy metal cations for sulfur
- ✓ Medicinal treatment for heavy metal poisoning is done by chelation therapy by administering compounds known as chelates

Example: British Anti-Lewisite(BAL), ethylene diamine tetra acetic acid(EDTA).





Toxicity of trace heavy metals

Metal	Route of Entry	Toxicity Effect	TWA by ACGIH (mg / m^3)	Carcinogen (suspected by NIOSH)
Arsenic	Inhalation and ingestion	Irritation of respiratory system, Liver and Kidney damage, Loss of appetite, nausea and vomiting etc	0.20	Yes
Cadmium	Inhalation and ingestion	Lung, liver and kidney damage; Irritation of respiratory system	0.05	Yes
Chromium	Inhalation, ingestion, and absorption through skin	Lung damage and Irritation or respiratory system	0.5	Yes