



‘Typical’ Responses and Use of Environmental Science

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Outline

Oil – Uses & Sources to the Environment

Response Scale

Key Environmental Roles: SSC, EUL, EU

Response Time Line

How Science is Used in Response

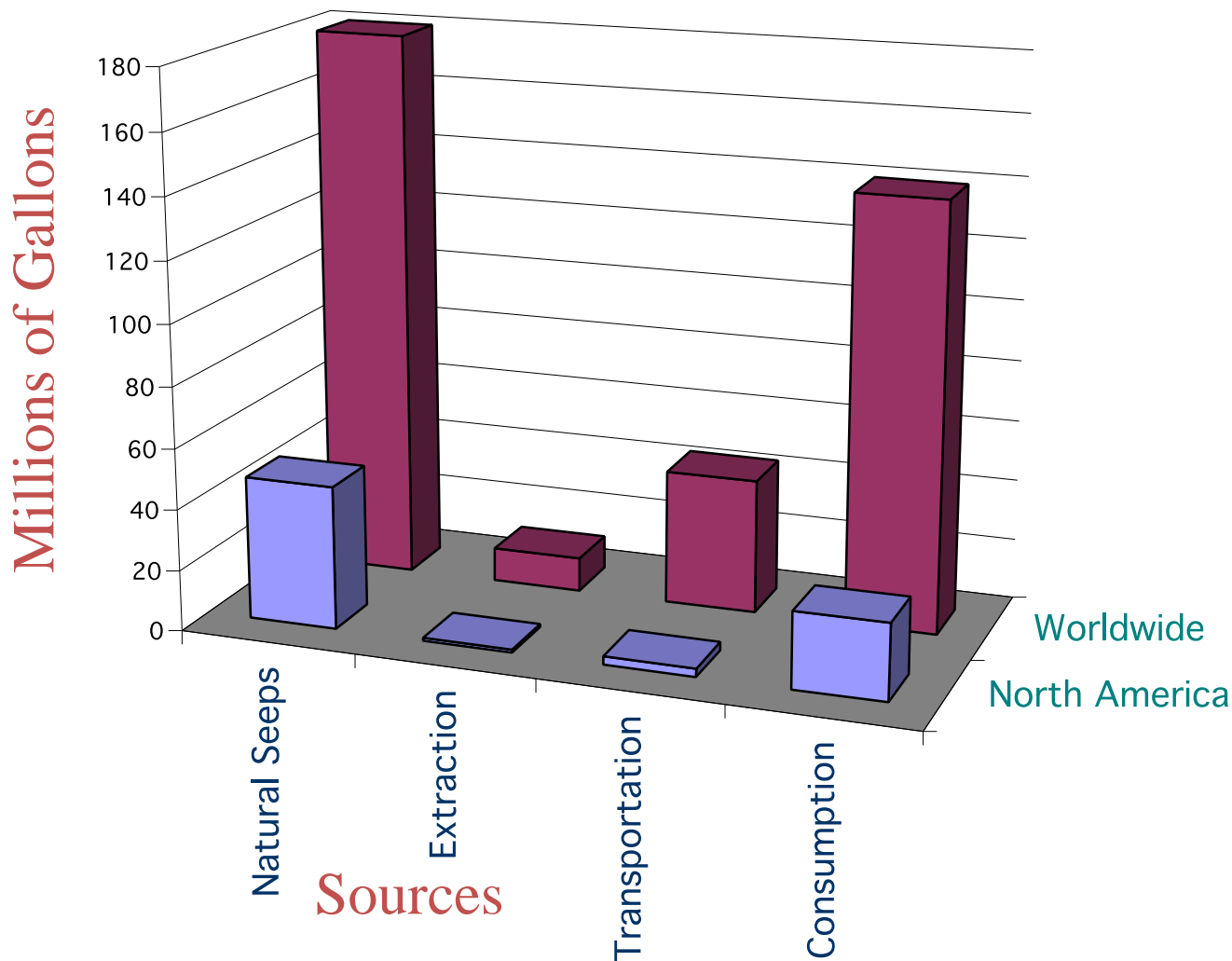
– Techniques & Tradeoffs

What Is All That Oil Used For?

* Fuel (for transportation and factories)			
* Electricity generation	hair spray	hair gel	balloons
* Machinery	cosmetics	toiletries	pet toys
* Asphalt	sandals/flip flops	ballpoint pens	vertical blinds
* Heating	plastic hangers	phones	picture frames
* Wax (crayons, candles)	polyester clothing	trash bags	photo albums
* Medicines	children's balls	toys	document binders
* Ink	freezer bags	shopping bags	Teflon products
* Plastics	storage containers	band-aids	candles
* Fertilizers	egg cartons	disposable plates	garden hose
* Pesticides	marking pens	office equipment	kitchen utensils
* Paints/varnishes	faux fur	pantyhose	spray paint
* Etc., etc., etc.			

petroleum jelly and many more products!

Estimates of Annual Petroleum Inputs to the Sea



11 Year Distribution from Hotline



10 Year Distribution from Hotline



Spill-Specific Roles:

- ### ***Important Supporting Roles:***

- **Weather Forecasting**
- **Fisheries Management**
- **Protected/Endangered Species**
- **Satellite Interpretation**
- **Emergency Navigation Hazard Detection**





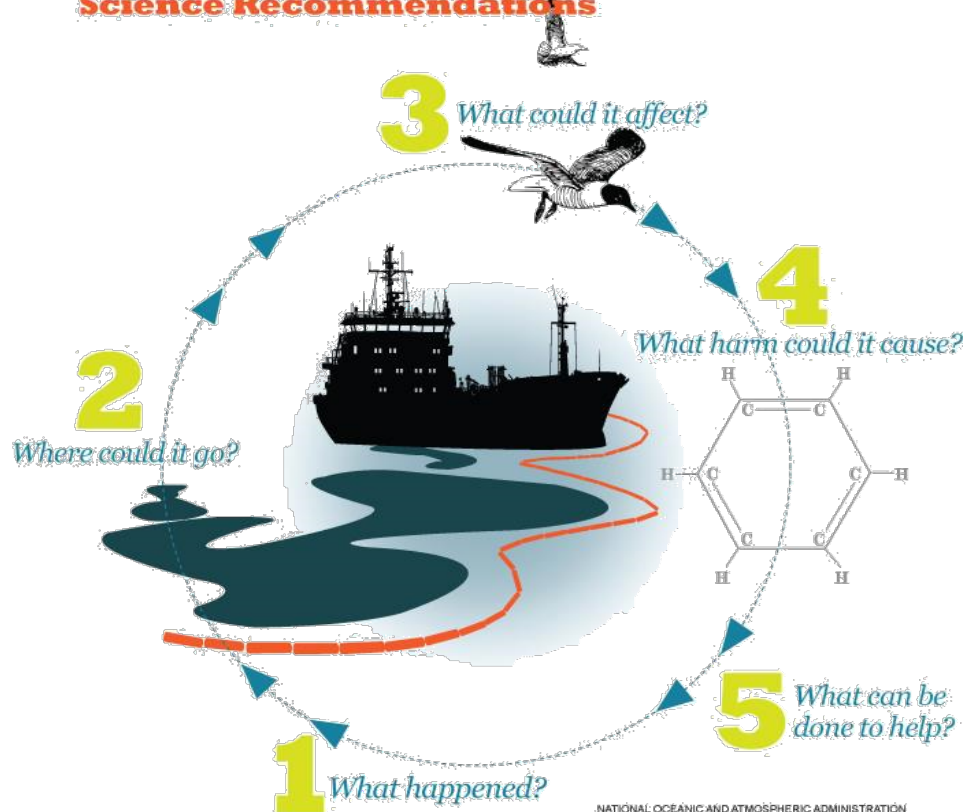
NOAA SSC arrives

Incident occurs.....

Happy Captain!

Scientific Support Role

Questions Guiding NOAA's Oil Spill Science Recommendations



Scientific Support Coordinator

Activities

- Trajectory Modeling
- Identify resources at risk
- Evaluate cleanup strategies
- Perform shoreline assessments and aerial observations
- Coordinate NOAA resources (i.e. forecasts, fisheries)
- Analyze pollutant chemistry & environmental effects
- Data management
- Train emergency responders
- Coordinate scientific activities with academia and industry



Environmental Unit

EU works in the Planning Section under the Incident Command System

Key responsibilities to ensure that any response to an incident addresses environmental, cultural, and socioeconomic priorities.

Identifies sites for protection and recommends procedures to minimize impacts from a spill and from response operations.

Provides critical input to the planning process and formulation of Incident Action Plans for Operations through field assessments, recommendations for treatment strategies, response monitoring, sampling and data management, and preparation of plans for activities requiring permits.

Environmental Unit Leader

EUL is Responsible For:

Environmental matters associated with the response:

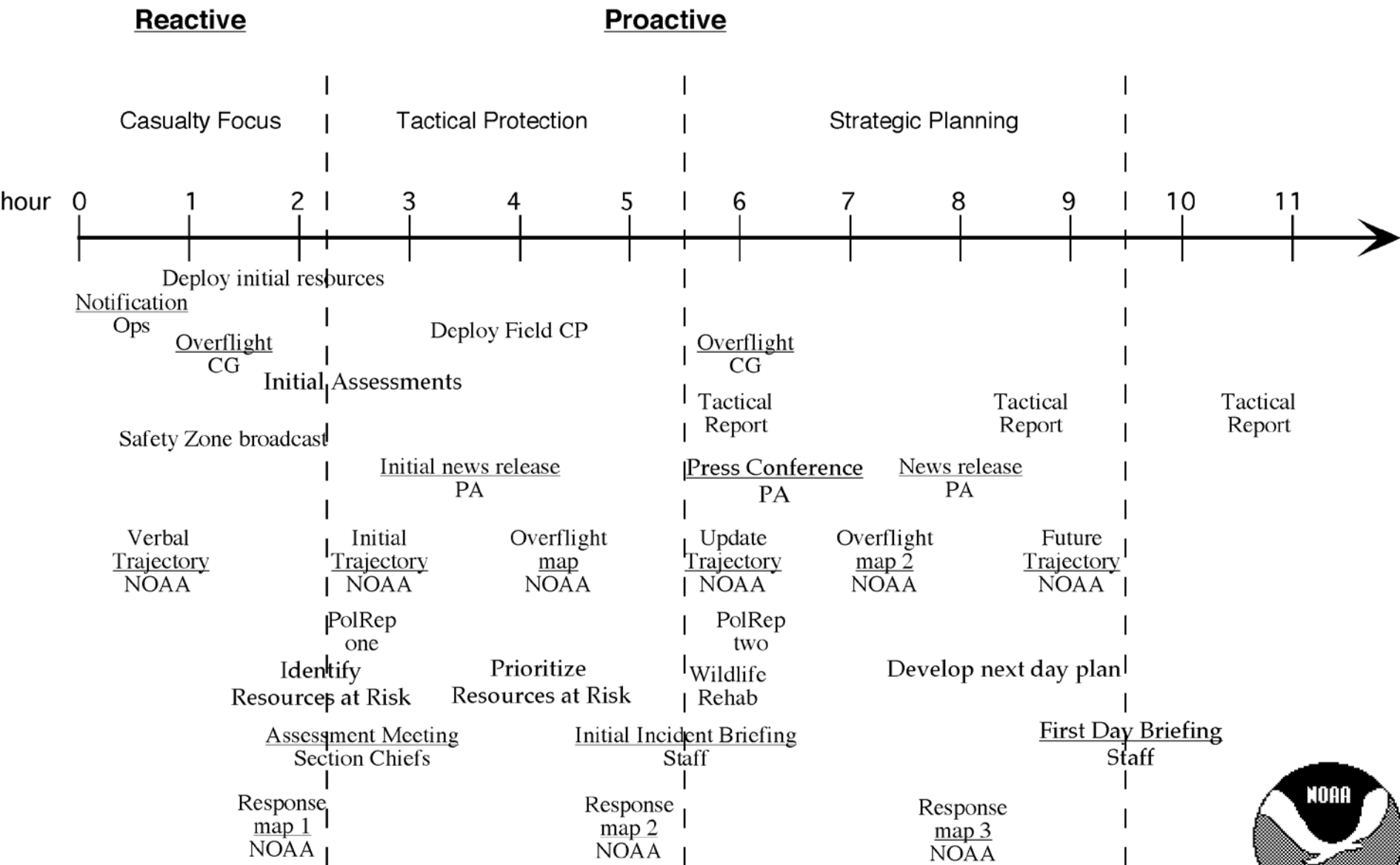
Strategic assessment, modeling, surveillance, and environmental monitoring and permitting.

Prepares environmental data for the situation unit.

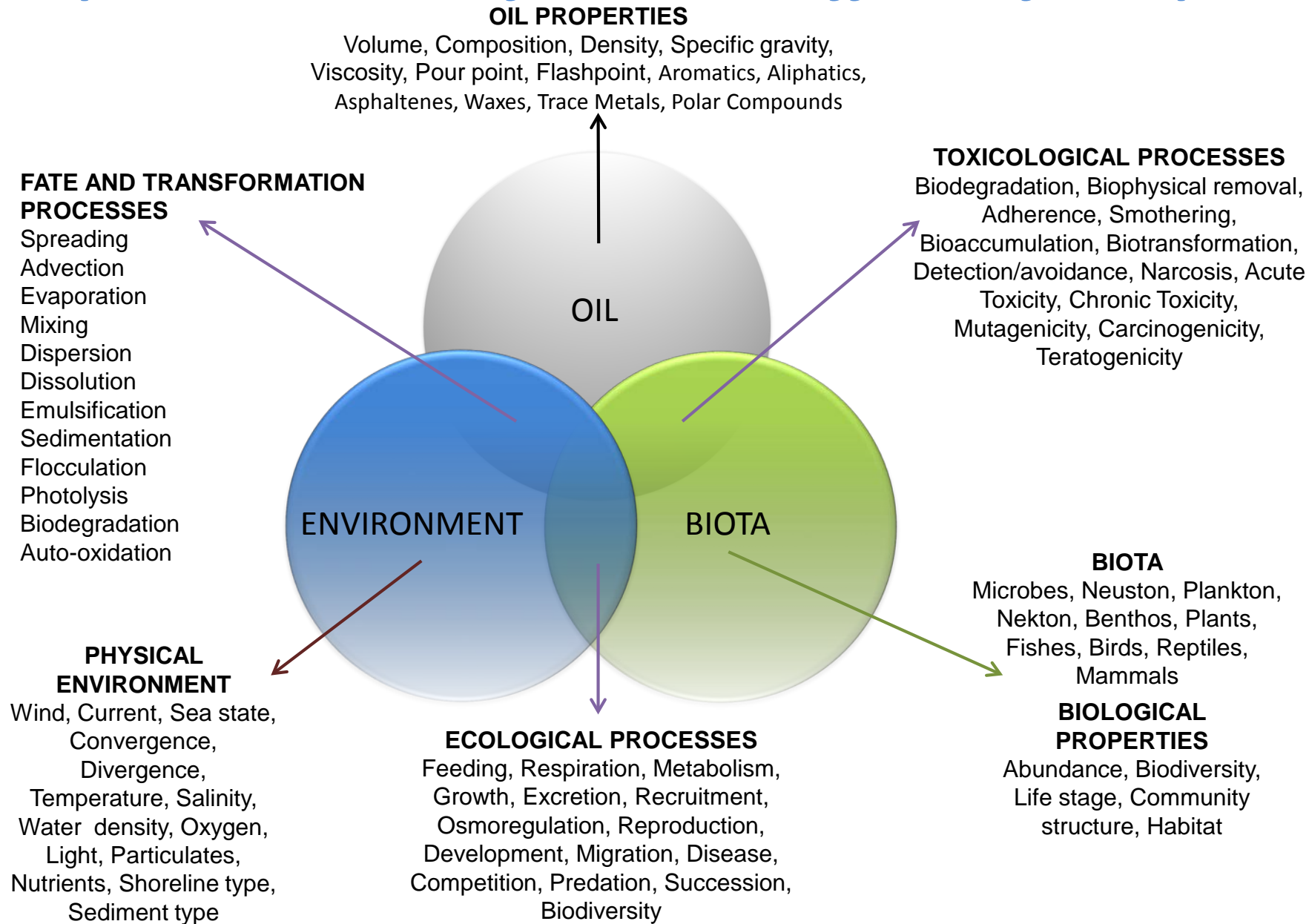
Technical Specialists may include:

Scientific Support Coordinator, Sampling, Response Technologies, Trajectory Analysis, Weather Forecast, Resources at Risk, Shoreline Cleanup Assessment, Historical/Cultural Resources, Disposal Etc.,

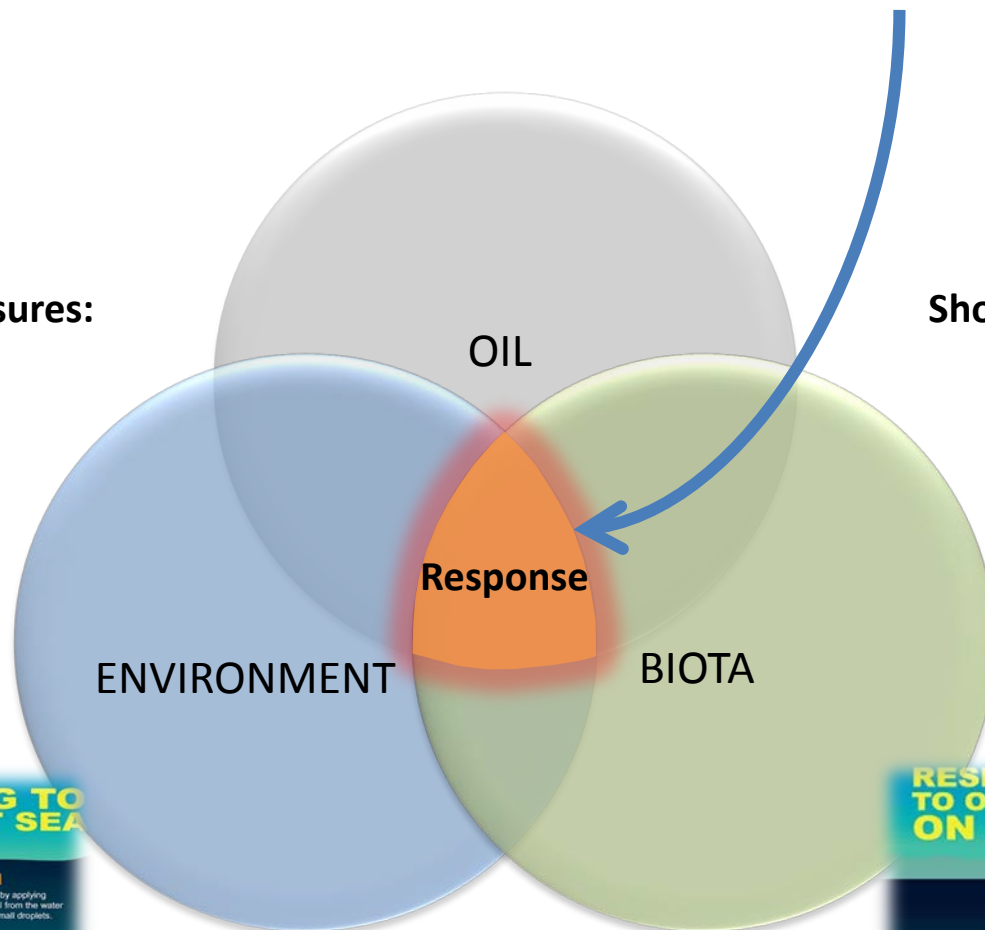
Response Activities



Transport, Fate, Transformation, Effects of Oil Spills



At the intersections: Spill Response



Open Water Countermeasures:

Open Water

Boom

Skim

Burn

Disperse

Shoreline Countermeasures:

Shoreline

Manual

Mechanical

Washing

Chemical

Bioremediation



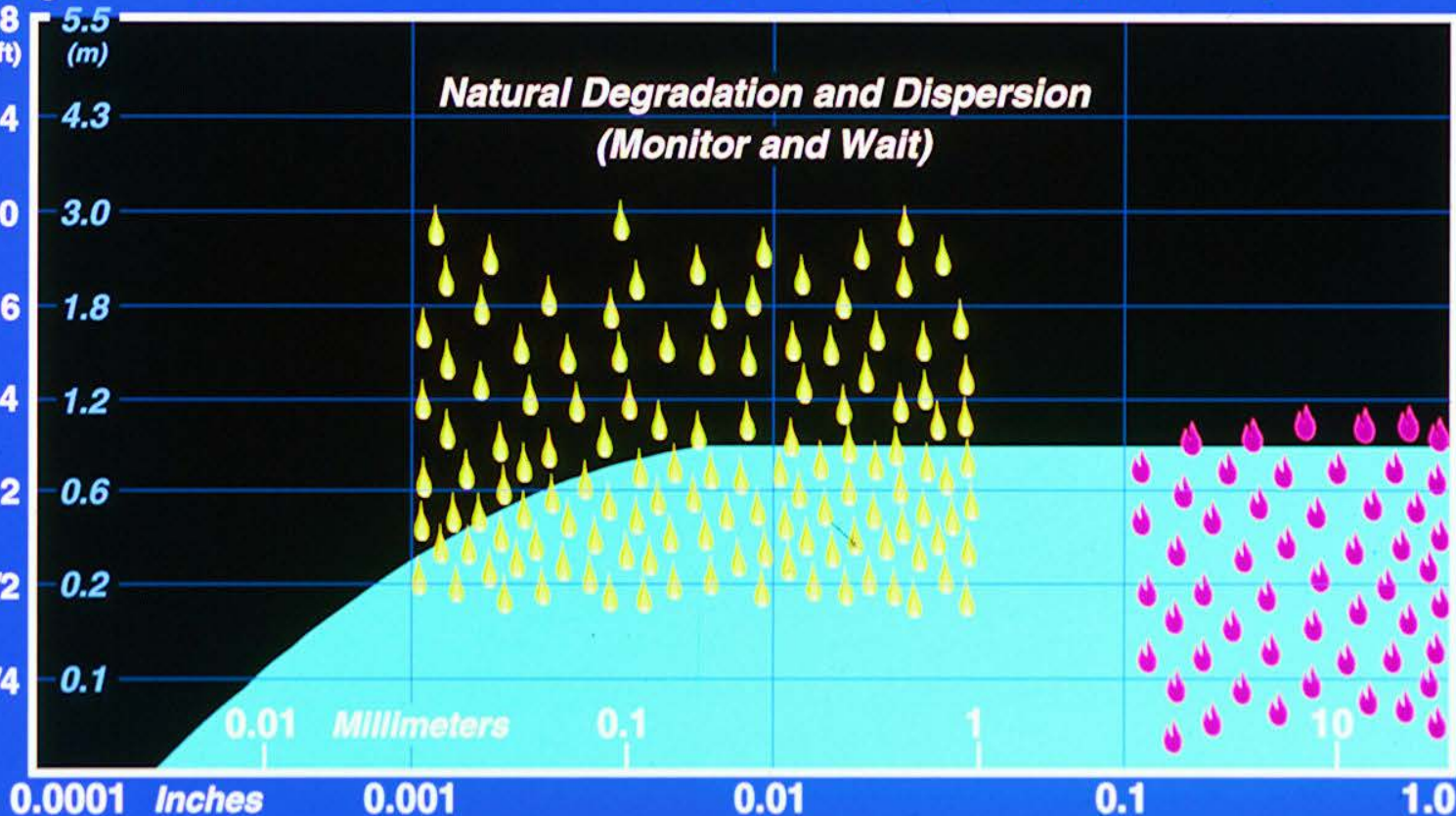
Wind Force
(Beaufort Scale)

Wind | Wind-Wave
(kts) | height
(ft) | (m)

34-40	8	18	5.5
28-33	7	14	4.3
22-27	6	10	3.0
17-21	5	6	1.8
11-16	4	4	1.2
7-10	3	2	0.6
4-6	2	1/2	0.2
1-3	1	1/4	0.1

PERFORMANCE EFFICIENCY

Typical Windows of Opportunity for Spill Responses



(after A.Allen)



Mechanical Clean-Up



Dispersants



Burning

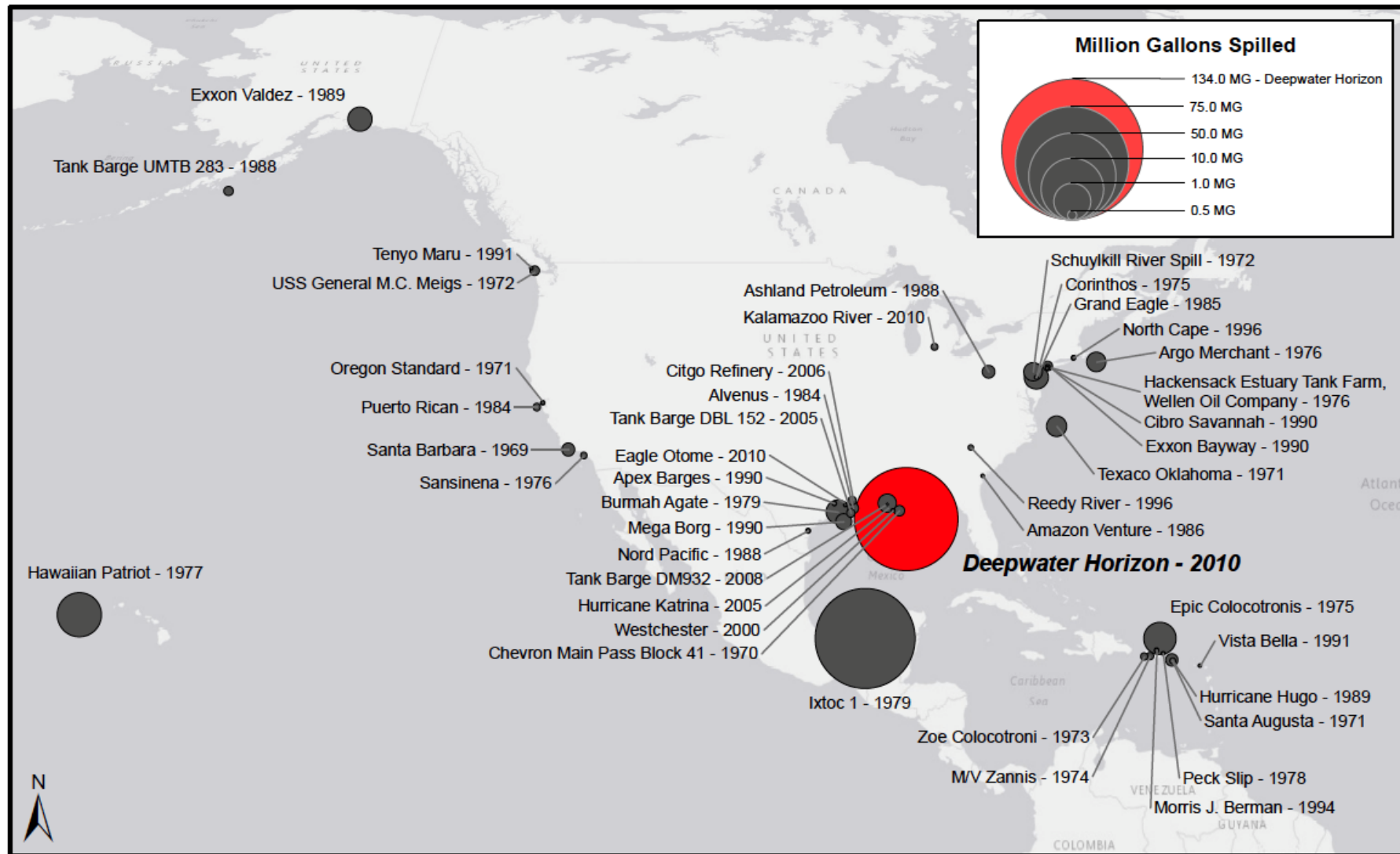
Who Else Might Be Affected By an Oil Spill? (Socio-Economic Effects)

- * Fishing industry
- * Resorts and recreation areas
- * Water supplies - drinking and industry
- * Etc., etc., etc.



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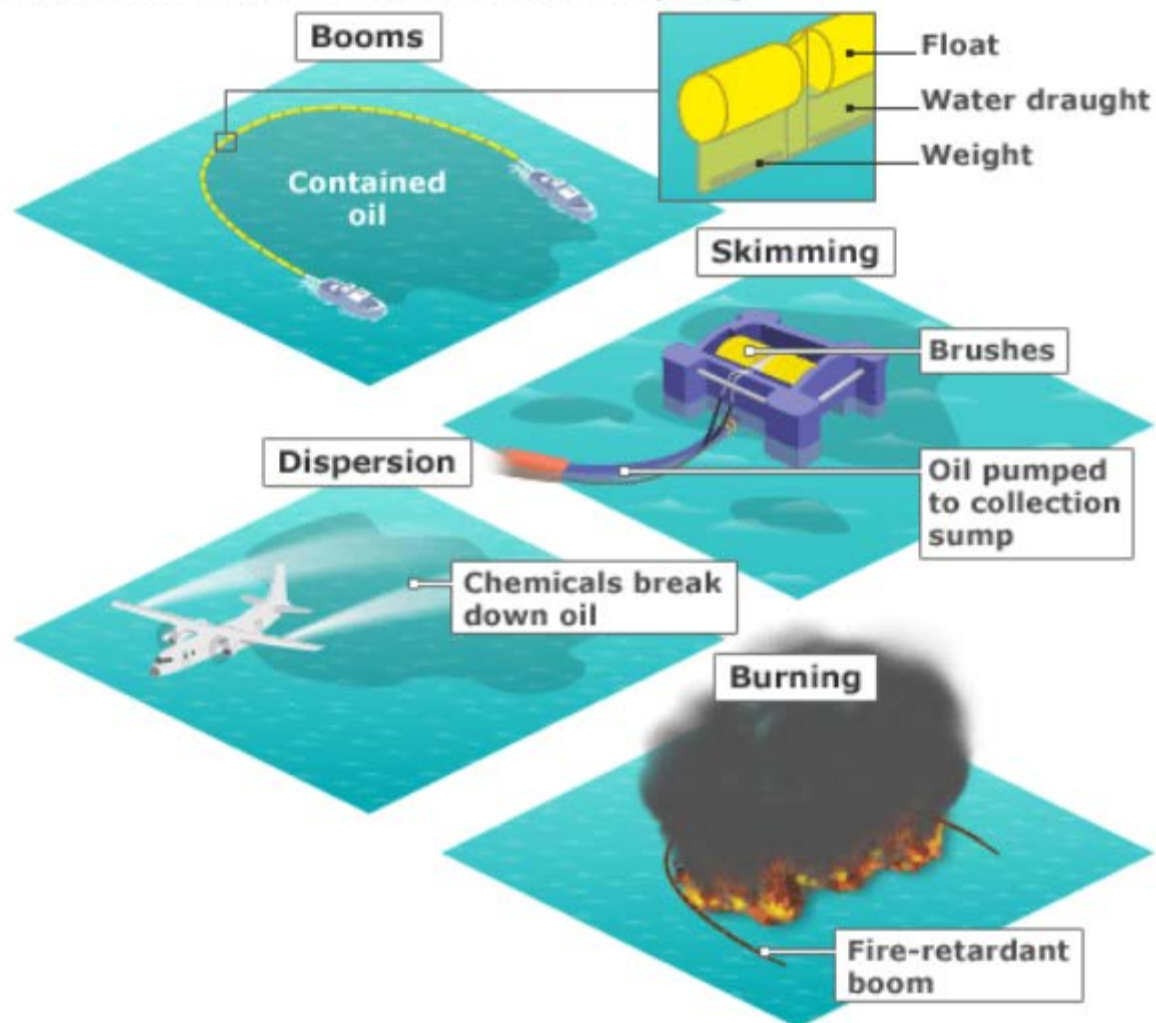
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Largest Oil Spills Affecting U.S. Waters | 1969 - 2010



Surface measures used to contain oil spillages



What Are the Environmental Impacts?

Impacts may be exaggerated in the media.

Nevertheless, oil can have a significant impact on the environment (shorelines, birds, mammals, fish).

Some components of oil are toxic – the fresher the oil the higher concentration of light end components (1 ppb can be toxic to invertebrate larvae).

Oil on feathers hinders the water-repellency of birds.

Oil on fur takes away its insulating capacities.

The Most Common Cleanup Techniques:

- ***Containment and Recovery***: Surround the oil with booms and recover the oil (for cleaning and reuse) with skimmers. Skimmers separate oil from the water by:
 - * centripetal force -- water is heavier than oil and spins out further so the oil can be pumped out
 - * lifting oil on a conveyor belt off the water surface; or
 - * wringing out oil that clings to oleophilic (oil-attracting) rope mops.

This technique is the most widely used as it is least destructive, but it may be 10-25% efficient.

- * ***Sorbents***: Remove oil with absorbent materials made from oleophilic substances. Some sorbents are made from natural materials -- straw, grasses, coconut husks, or wood chips.



- *Shoreline Cleanup:*

- Low-pressure or High-pressure water to rinse oil back onto water to be skimmed up.
- Manual pick-up
- Tilling soil

- *Natural Attenuation:* (Do Nothing)

Particularly in open ocean spills, cleanup is difficult and not efficient. Wave action and photo-oxidation (from sun) helps to break oil down.

High Pressure Washing a Rock Beach



Manual Recovery of Oil from a Salt Marsh



Skimming Oil Inside Boom



- *Dispersants:*

These are chemicals that **act like detergents** to break oil up into **tiny droplets** to dilute the oil's effect and to provide bite-sized bits for oil eating bacteria that occur naturally.

- *Burning:*

Burning is usually **95-98% efficient**, but does cause black smoke. The smoke is not more toxic than if the oil were burned as intended in fuels. It is more concentrated and needs to be monitored.

- *Bioremediation:*

Enhancing natural biodegradation by natural **oil-eating bacteria** or by providing them with **needed fertilizers or oxygen**.

Aircraft Spraying Dispersant on Oil



Igniting a Pool of Oil



Bioremediation Application

