

## **Vessel Oil Spills in US Waters: Descriptive Statistics**

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I'd like to present some data and analysis on vessel oil spills and recoveries of spilled oil in US waters. The data are from the US Coast Guard (USCG) for the period 1991-1995, although data for the first and last years are incomplete. The dataset includes a total of 18,575 reported spills, representing a total volume of 3,268,319 gallons of spilled oil.

For the three years for which data are complete (1992-1994), US- and foreign-flagged vessels spilled an average of 960,000 gallons of oil per year while situated in US waters. Most of this amount was spilled directly into a water body (referred to here as "in-water spills"), while about 6 percent, or an average of 60,000 gallons per year, was spilled aboard the vessel or on a dock ("out-of-water spills").

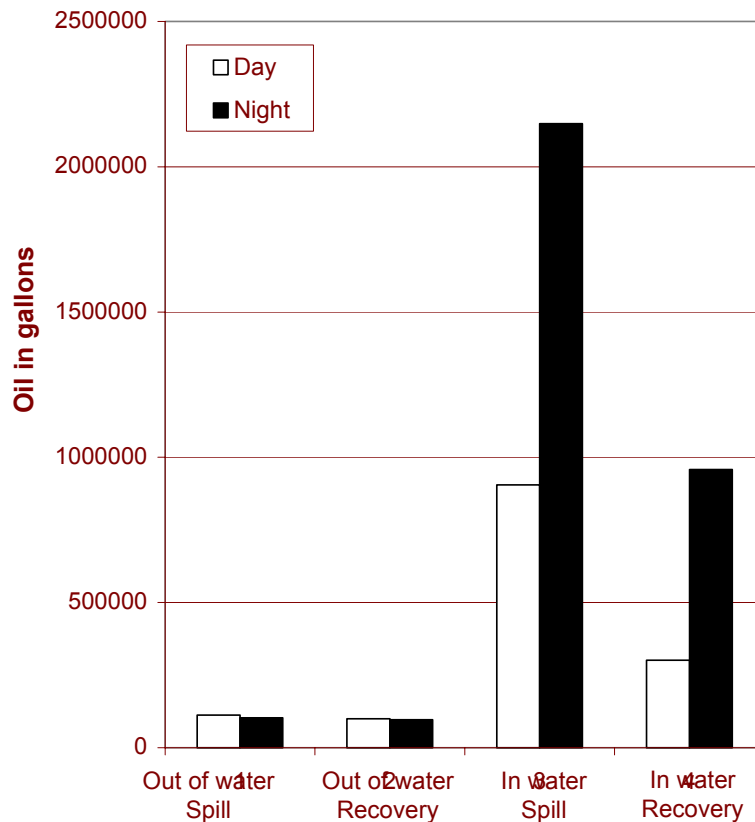
The proportion of spilled oil that was recovered averaged 91 percent for out-of-water spills, compared to an average recovery rate of just 41 percent for oil spilled directly into the water. Taking all types of incidents together, the annual average recovery rate was 44 percent of the total volume of oil spilled.

Analysis of the USCG data reveals some distinct patterns in the temporal, locational, and size distribution of oil spills in the United States. It also reveals that just a few types of vessels and a few types of incident causes account for most of the oil spilled in US waters.

The most striking temporal patterns are those associated with time of day.

Although 81 percent of all detected spills occur during daylight hours, roughly twice as much oil is spilled at night as during the day (Fig. 1). A somewhat weaker seasonal pattern is discernible as well. For in-water spills and for all spills combined over the five-year period (1991-1995), the greatest volume of oil was spilled in winter (40 percent) and the smallest volume in summer (15 percent).

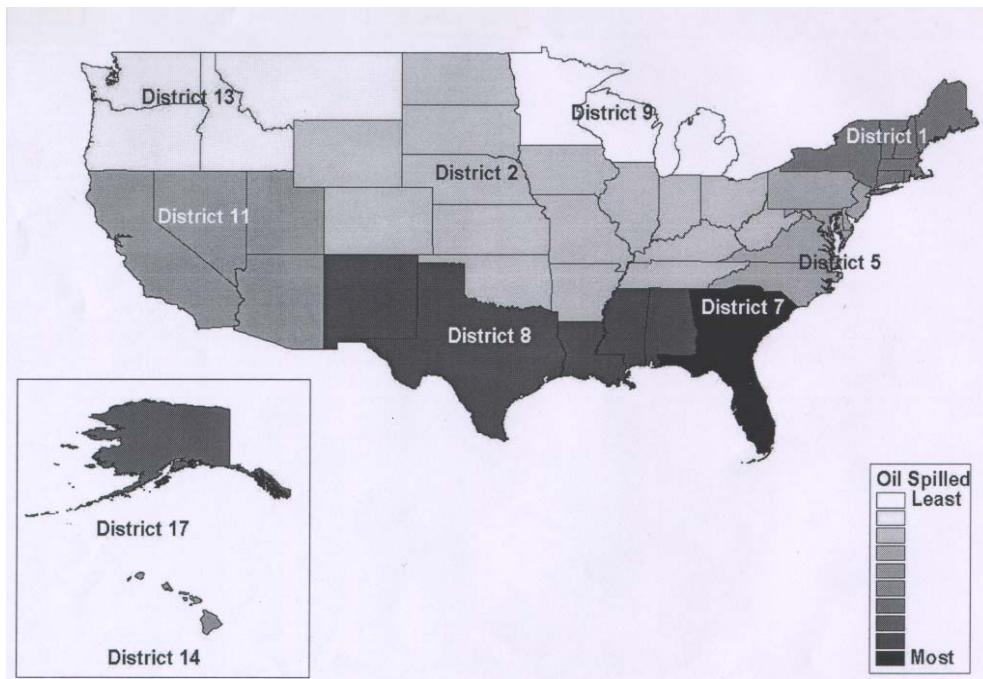
Figure 1. US Oil Spills: Time of Occurrence



Some geographic regions and some types of waterbodies tend to experience larger volumes of spilled oil than others. Of ten USCG districts that existed in 1991-1995 (see

Fig. 2),<sup>1</sup> District 7, which corresponds to the state of Florida, received the greatest volume of oil spilled directly into the water. USCG District 8, which includes the five southernmost states from New Mexico to Alabama, received the greatest volume of out-of-water spills.

Figure 2. US Oil Spills in Water by Coast Guard District

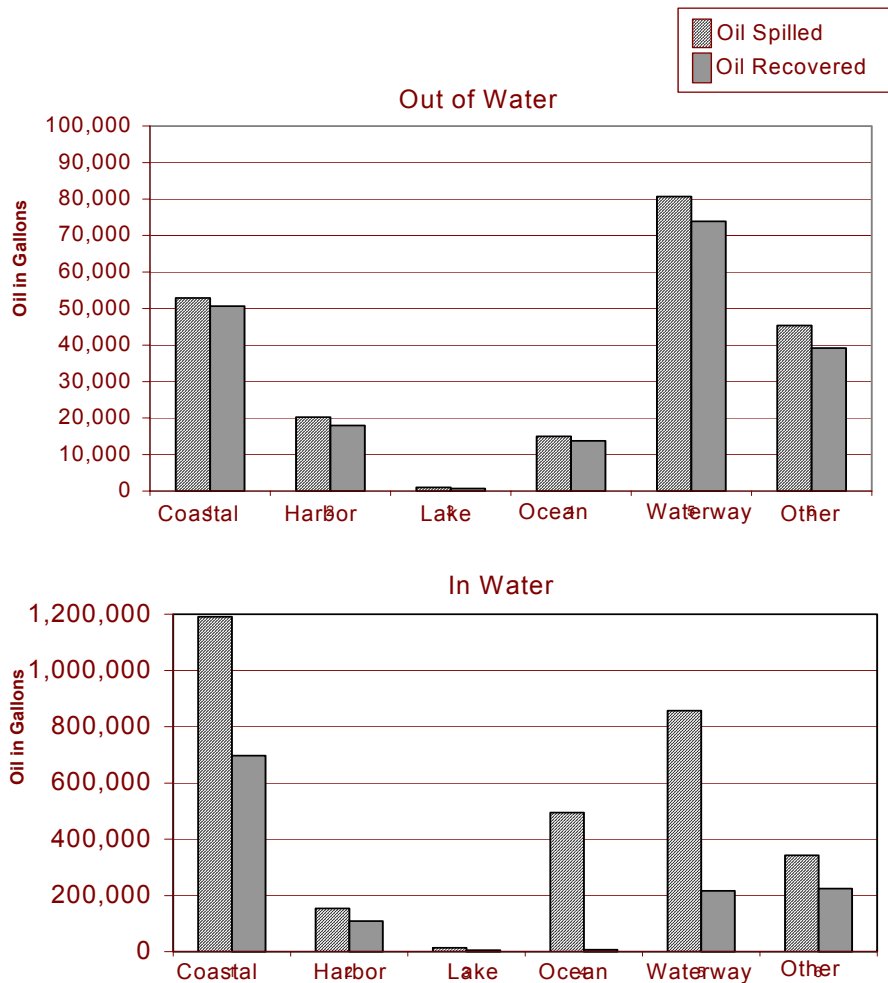


The rates of recovery of spilled oil were highest in Florida and lowest in Alaska for both types of spills. Given the very different environmental conditions in the two locations, it is not surprising that recovery rates for in-water spills diverged much more widely. In-water spill recovery rates were about 13 percent in Alaska vs. 62 percent in Florida, compared to out-of-water spill recovery rates of about 78 percent vs. 98 percent.

<sup>1</sup> The US Coast Guard district system of organization began with 6 districts in 1838. The number of USCG districts reached a peak of 17 in 1944, and it has since been reduced on several occasions by consolidating districts. The most recent consolidation occurred in May 1996 (i.e., after the period for which data are reported here), when Districts 2 and 8 were combined and designated as the new District 8, bringing the total number of districts down to just nine.

More oil is spilled directly into coastal waters<sup>2</sup> than into any other type of waterbody, but the greatest volume of out-of-water oil spills occurs in waterways (i.e., rivers and canals). Waterways also receive the second-largest volume of in-water spills, followed by ocean waters.<sup>3</sup> Oil recovery rates are extremely low for ocean waters and are only about 25 percent for waterways, but for coastal waters they exceed 50 percent (Fig. 3).

Figure 3. US Oil Spills by Waterbody



<sup>2</sup> Bays and sounds are included in the category designated "coastal waters."

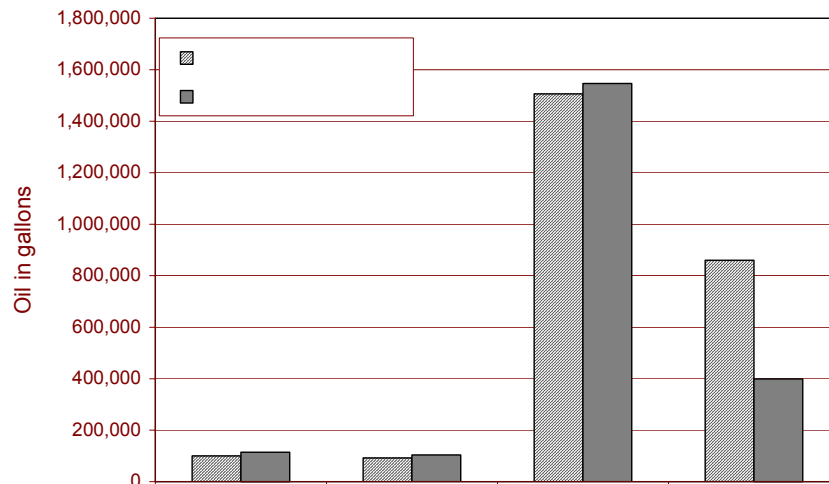
Of 21 vessel types represented in the USCG database, four types of vessels—tank barges, fishing boats, tankers, and freight ships—account for nearly 80 percent of all the oil spilled by vessels that are situated in US waters. Nearly half of all the oil spilled directly into the water is spilled by tank barges (Table 1).

Table 1. Volume of Oil Spills by Vessel Type (1991-1995)

Vessel Type	Out-of-water spills		In-water spills		All spills	
	Gallons	% of total	Gallons	% of total	Gallons	% of total
Tank barge	37,098	17.2	1,394,862	45.7	1,431,960	43.8
Fishing boat	35,423	16.5	349,859	11.5	385,282	11.8
Tanker	56,926	26.5	335,353	11.0	392,279	12.0
Freight ship	47,742	22.2	293,867	9.6	341,609	10.5
<b>Top 4 vessel types</b>	<b>177,189</b>	<b>82.3</b>	<b>2,373,941</b>	<b>77.8</b>	<b>2,551,130</b>	<b>78.1</b>
17 other vessel types	38,025	17.7	679,164	22.2	717,189	21.9
All vessel types	215,214	100	3,053,105	100	3,268,319	100

Although US-flagged ships account for the great majority of ships in US waters, foreign-flagged ships spill nearly as much oil here as do US-flagged ships (Fig. 4).

Figure 4. Spills by US and non-US Vessels in US Waters



<sup>3</sup> In the USCG database, "ocean waters" includes locations from 12 nm to 200 nm from shore.

Non-accidental discharges are classified as "pollution" in the USCG database, and they are responsible for about half the total volume of oil spilled by vessels in US waters (Table 2). Among 13 accidental causes for which data are recorded, groundings are responsible for the greatest volume of oil spilled (29 percent of all spills), followed by allisions (10.7 percent). Among the remaining 11 types of accidents, only sinkings and collisions contribute more than one percent of the total volume of oil spilled.

Table 2. Volume of Oil Spills by Nature of Incident (1991-1995)

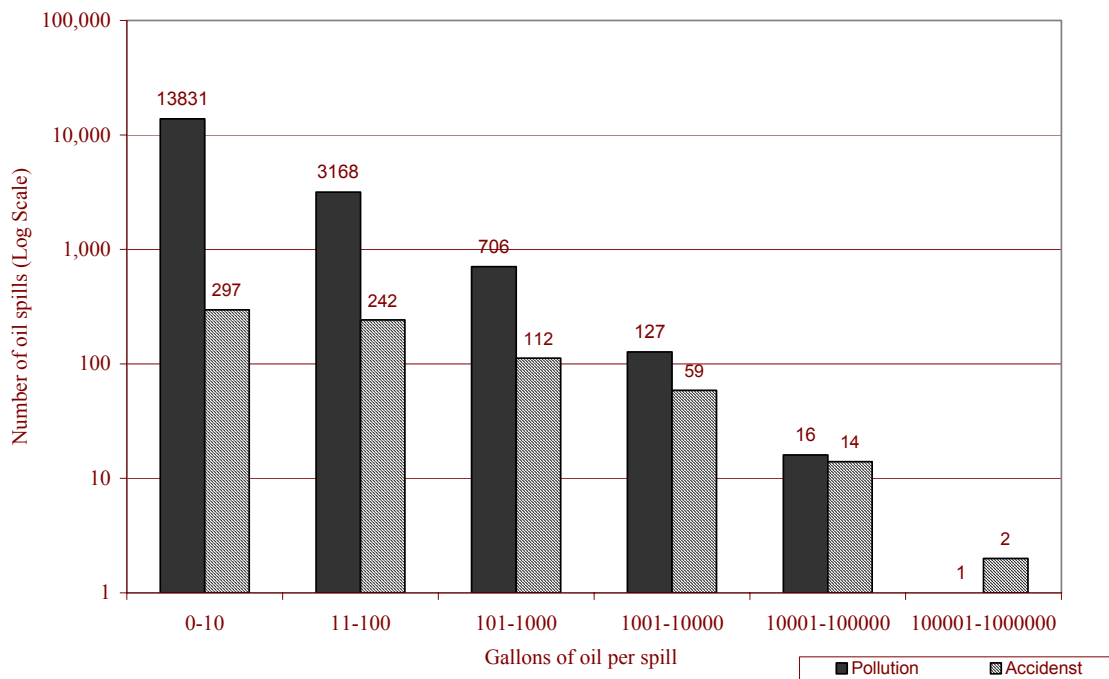
Nature/ Cause of incident	Out-of-water spills		In-water spills		All spills	
	Gallons	% of total	Gallons	% of total	Gallons	% of total
Pollution	202,538	94.1	1,449,357	47.5	1,651,895	50.5
Grounding	4,335	2.0	947,434	31.0	951,769	29.1
Allision	109	0.1	327,948	10.7	328,057	10.0
Sinking	1,273	0.6	170,484	5.6	171,757	5.3
Collision	675	0.3	91,217	3.0	91,892	2.8
Flooding	450	0.2	18,256	0.6	18,706	0.6
Capsize	1	0.0	12,597	0.4	12,598	0.4
Unknown	752	0.3	8,816	0.3	9,568	0.3
Structural	6	0.0	8,410	0.3	8,416	0.3
Fire	2,501	1.2	6,146	0.2	8,647	0.3
Personal cas	20	0.0	5,508	0.2	5,528	0.2
Equipfail	2,554	1.2	5,481	0.2	8,035	0.2
Explode	0	0.0	1,451	0.0	1,451	0.0
Breakaway	0	0.0	0	0	0	0.0
Total	215,214	100	3,053,105	100	3,268,319	100.0

Another striking pattern is the distribution of spills by spill size. Roughly three-quarters (76 percent) of all oil-spill incidents result in spills of ten gallons or less, and another 18 percent of incidents involve spills that range in size from 11 to 100 gallons. In other words, although tank barges spill a larger volume of oil than any other single type

of vessel, fishing boats and other non-oil-cargo vessels account for a large share of oil-spill incidents.

Less than one percent of the recorded 18,575 oil-spill incidents that occurred during the 1991-1995 period resulted in spills of 10,000 gallons or more. The few spills in this size range were about as likely to be non-vessel-accident-related<sup>4</sup> as vessel-accident-related (Fig. 5).

Figure 5. US Oil Spills: Frequency of Spill by Volume



To recap, the main results of the analysis are the following:

- *Spill volumes:* In-water spills of oil averaged 900,000 gallons/year and out-of-water spills averaged 60,000 gallons/year.
- *Recovery rates* were 41 percent for spills into the water and 91 percent for out-of-water spills.

<sup>4</sup> Such as spills that occur during loading/unloading oil cargoes.

- *Temporal patterns:* Detected spills occurred mostly during the day, but spill volumes were larger at night. The greatest number of spills occurred in winter, and the fewest occurred in summer.
- *Locational patterns:* Of ten USCG districts, District 7 (Florida) received the greatest volume of in-water spills and District 8 (southern midwest) received the greatest volume of out-of-water spills. In terms of types of waterbodies, coastal waters and waterways received the greatest volume of in-water spills, while waterways received the greatest volume of out-of-water spills.
- *Vessel characteristics:* Tank barges, tankers, and fishing boats account for two-thirds of the oil spilled directly into the water; together with freight ships, they account for more than three-quarters of the total volume of oil spilled by vessels situated in US waters. Non-US-flag vessels, although comparatively few in number, spill nearly as much oil in US waters as do US-flag vessels.
- *Incident characteristics:* Non-accidental discharges ("pollution" incidents) account for about half of all the oil spilled by vessels in US waters, while groundings are the leading accidental cause of in-water spills. More than three-quarters of the total volume of oil spilled by vessels in US waters involves spills of ten gallons or less.