

THE OIL POLLUTION ACT OF 1990 AND NATURAL RESOURCE DAMAGE ASSESSMENT

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INTRODUCTION

Before the March 1989 *Exxon Valdez* oil spill in Alaska, little attention was paid to the loss of seabirds from oil spills, and damage claims for injury to natural resources such as seabirds were rare. Since the *Exxon Valdez* spill and the subsequent passage of the *Oil Pollution Act of 1990* (OPA 90), the pursuit of damages for injury to natural resources has become an expected element of the overall cost of an oil spill. In the present paper, we discuss

- how the enactment of OPA 90 appears to have affected the oil and marine transportation industries in the United States, especially along the west coast.
- how, following the *Exxon Valdez* spill, natural resource damage (NRD) claims for injury to seabirds have become commonplace, but distinctly different when US west coast oil spills are compared with those on the US east and Gulf of Mexico (Gulf) coasts.
- how beached birds have become central to estimating total seabird mortality caused by a spill.
- our predictions concerning the future source of west coast vessel spills and the changing nature of NRD claims resolution nationwide.

OPA 90 AND CHANGES IN THE OIL AND MARINE TRANSPORTATION INDUSTRIES

The chaos and environmental damage caused by the massive 1967 *Torrey Canyon* crude oil spill (>35 million gallons) off southern England resulted in the US Environmental Protection Agency promulgating the 1968 National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Before the NCP was promulgated, few regulations governed the transportation of oil in US waters, and federal agencies had little authority or responsibility to respond to or to clean up oil spills (www.epa.gov/oilspill/ncpover.htm).

In 1972, following the well-publicized 1969 Santa Barbara, California, offshore oil platform blowout and the collision and spill from two oil tankers off San Francisco, California, in 1971, Congress amended the 1948 Federal Water Pollution Control Act [now known as the Clean Water Act or CWA (Carter 2003)] to further define liability for the discharge of oil and hazardous substances, and the federal role in responding to spills. The amendments also stated that “the objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters” (33 USC 1251 *et seq.*). Following the 1989 *Exxon Valdez* oil spill, in which 11 million gallons of crude oil were released into Prince

William Sound, Alaska, federal regulators discovered that the legal provisions in the CWA were inadequate to “restore and maintain the physical, chemical, and biological integrity” of the environment affected by a large oil spill.

At about the same time as the *Exxon Valdez* spill, several other large oil spills also occurred in the United States (Table 1). Together, these events culminated in Congress enacting the *Oil Pollution Act of 1990* [OPA 90 (Hodgson 1990, Browning & Shetler 1992)]. The passage of OPA 90 led to further modifications in the response portion of the NCP that substantially increased the liability exposure of oil carriers, increased oil spill reporting requirements, mandated more frequent and involved vessel inspections and spill drills, required oil spill contingency planning and held spillers explicitly responsible for injury to natural resources (Public Law 101-380).

The *Exxon Valdez* spill, which still is not completely settled, has already resulted in a multi-billion dollar cost to ExxonMobil Corporation for response, penalty, third-party and natural resource damages (OSIR 1994, www.evostc.state.ak.us). In the aftermath of the *Valdez* incident and the passage of OPA 90, many oil companies instituted a variety of changes in their business practices to protect them from similarly large financial claims (Jardin 1991, Kennedy 1992, Hobbie & Garger 2001, Wilkinson 2002). It may be that the most important public benefit provided by OPA 90 is a reduction in

TABLE 1
Large US oil spills that occurred within 1.5 years
of the 1989 *Exxon Valdez* oil spill^a

Incident name	Vessel type	Spill date	Location	Volume (US gal.)
<i>Shell Martinez</i>	Facility	Apr 1988	California	440 000
<i>Nestucca</i>	Barge	Dec 1988	Washington	253 000
<i>World Prodigy</i>	Tanker	Jun 1989	Rhode Island	289 000
<i>Presidente Rivera</i>	Tanker	Jun 1989	New Jersey	307 000
<i>Exxon Baywav</i>	Pipeline	Jan 1990	New York	567 000
<i>American Trader</i>	Tanker	Feb 1990	California	400 000
<i>BT Nautilus</i>	Tanker	Jun 1990	New York	253 000
<i>Mega Borg</i>	Tanker	Jun 1990	Gulf of Mexico	5 095 000
<i>Apex Barges</i>	Barge	Jul 1990	Texas	694 000

^aSource: Helton and Penn, 1999.

the amount of oil accidentally released into the environment thanks to company-instituted changes in business practices. Based on experience, it seems apparent that the environment and the public are better served through reduction or prevention of oil releases, rather than through subsequent cleanup and restoration actions.

The US Coast Guard compiled data on reported US oil spills over the 29-year period from 1973 to 2001, and we grouped those data into four- to five-year intervals (www.uscg.mil/hq/g-m/nmc/response/stats/Summary.htm, Fig. 1).

Fig. 1 makes it clear that all categories of relatively large-volume oil spills (more than 10 000 US gallons) were declining in the United States before OPA 90 was enacted. Following the passage of OPA 90, spills in the 10 000- and 50 000-US-gallon categories continued to drop by about one third, and spills greater than 100 000 gallons

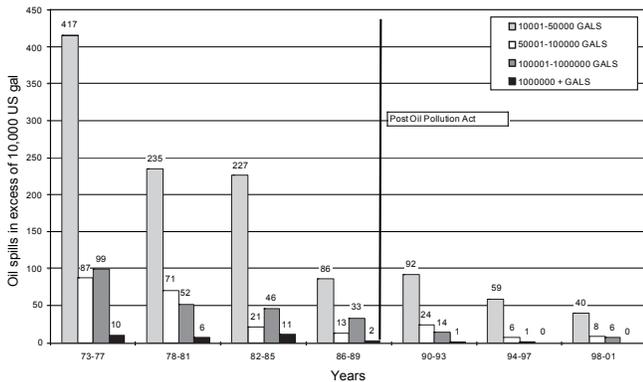


Fig. 1. Oil spills in excess of 10 000 US gallons as reported by the US Coast Guard 1973–2001 (www.uscg.mil/hq/g-m/nmc/response/stats/aa.htm). Data grouped into four- to five-year intervals for this paper.

TABLE 2
Very large (>3 000 000 US gal.) marine oil spills from vessels that occurred throughout the world after the enactment of Oil Pollution Act of 1990^a

Incident name	Vessel type	Spill date	Location	Volume (US gal.)
<i>ABT Sumner</i>	Tanker	May 1991	Atlantic Ocean	15 000 000
<i>Haven</i>	Tanker	Nov 1991	Italy	42 000 000
<i>Katina P</i>	Tanker	Apr 1992	Indian Ocean	21 600 000
<i>Nagasaki Spirit</i>	Tanker	Sep 1992	Indonesia	3 600 000
<i>Aegean Sea</i>	Tanker	Dec 1992	Spain	22 200 000
<i>Braer</i>	Tanker	Jan 1993	Scotland	25 000 000
<i>Seki</i>	Tanker	Mar 1994	United Arab Emirates	4 770 000
<i>Thanassis A</i>	Tanker	Oct 1994	South China Sea	10 900 000
<i>Sea Empress</i>	Tanker	Feb 1996	United Kingdom	21 600 000
Unknown	Tanker	Jul 1996	Mexico	10 600 000
<i>Nakhodka</i>	Tanker	Jan 1997	Japan	5 250 000
<i>Erika</i>	Tanker	Dec 1999	France	6 000 000

^aSource: oils.gpa.unep.org/facts/oilspills.htm.

became even less frequent, dropping by 85%. In the largest spill category, the drop in frequency was even greater, with only one US spill of more than 1 000 000 gallons in the 11 years after the passage of OPA 90, as compared with 29 spills of that magnitude in the preceding 17 years. The single very large US oil spill between 1990 and 2001 contrasts with the worldwide total of 12 vessel oil spills in excess of 3 000 000 gallons during that same period (Table 2).

The reduction in relatively large US oil spills coincided with a steady decrease in the total number of spills reported in the United States by oil-carrying tankers and barges (Fig. 2). In the 17 years before OPA 90 was enacted, a constant decrease occurred in the number of spills reported by oil carriers from a high of more than 7200 in 1973–1977 to a low of 2695 in 1986–1989.

Reports of spills from oil-carrying vessels continued to decrease after OPA 90 was enacted, and by 1998–2001, reports had dropped to the lowest level (1325) of any period. In contrast, a large increase in the number of spills reported by cargo vessels had occurred following enactment of OPA 90, from a 15-year low of 4972 in 1986–1989 to an all-time high of 20 108 for 1998–2001. This large increase likely reflected in part the increase in fines imposed by OPA 90 for not reporting a spill (from \$10 000 to \$250 000). Nevertheless, the all-time high figure reported in 1998–2001 is surprising given that, in 1999–2003, US ports recorded a decrease in general cargo vessel traffic of 40% and a decrease in containerized cargo vessel traffic of 11% (US MARAD 2004).

Following enactment of OPA 90, the US west coast (defined here as the coastal portions of California, Oregon, Washington, Alaska, Hawaii and the US Trust Territories in the Pacific) saw a shift in the types of vessels spilling “consequential” amounts of oil and a significant reduction in the total volume of oil released. We define consequential oil spills as those events that involved either substantial quantities of spilled oil, usually in excess of 30 000 US gallons, or those that likely affected more than 1000 seabirds.

Before OPA 90, oil-carrying vessels were responsible for nearly all consequential oil spills on the west coast; since OPA 90, nearly all such spills have come from non-oil-carrying vessels (Tables 3 and 4). Even after excluding the huge *Exxon Valdez* spill, the volume of oil released per vessel before OPA 90 was more than four times greater than that spilled by vessels after OPA 90 (Mann–Whitney *U*-test: $U = 96.5$, $n_1=12$, $n_2=10$, $p < 0.01$). One additional change that

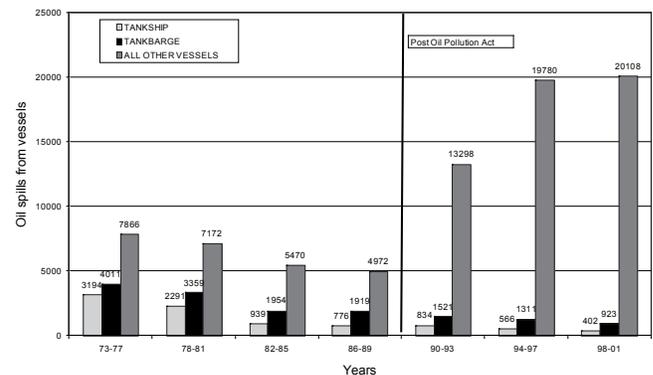


Fig. 2. Total number of oil spills from tankers, barges, and other types of vessels as reported by the US Coast Guard 1973–2001 (www.uscg.mil/hq/g-m/nmc/response/stats/aa.htm). Data grouped into four- to five-year intervals for this paper.

TABLE 3
Consequential oil spills from vessels occurring within 25 miles of the US west coast states of Alaska, California, Oregon, Hawaii and Washington before the enactment of the Oil Pollution Act of 1990^a

Incident name	Vessel type	Date	Location	Flag	Gallons (US)	Beached birds	Estimated dead birds	Date of settlement	Bird-focused restoration ^b	Total nat. res. restoration ^c	Sources ^d
San Francisco	Tankers	Jan 1971	California	US	810 000	>7 000	7 000–20 000	None	None	None	1
<i>Sansinena</i>	Tanker	Dec 1976	California	US	1 260 000	None	None	None	None	None	2
<i>Toyota Maru</i>	Tanker	? 1978	Oregon	Non-US	30 000–58 000	None	None	None	None	None	3
<i>Blue Magpie</i>	Cargo	Nov 1983	Oregon	US	70 000	365	No estimate	None	None	None	4
<i>Mobil Oil</i>	Tanker	Mar 1984	Oregon	US	198 000	458	No estimate	None	None	None	2,5
<i>Puerto Rican</i>	Tanker	Oct 1984	California	US	1 250 000	1 368	4 815	1987	None	\$494 733	1,6
<i>ARCO Anchorage</i>	Tanker	Dec 1985	Washington	US	239 000	1 917	~4 000	1987 ^e	None	\$32 930	7
<i>Apex Houston</i>	Oil barge	Jan 1986	California	US	25 900	4 198	9 856	1994	\$5 400 000	\$5 400 000	1,8
<i>Hana</i>	Oil barge	Jan 1987	Hawaii	US	42 200	19	No estimate	None	None	None	9
<i>MCN Barge #5</i>	Oil barge	Jan 1988	Washington	US	91 500	None	None	None	None	None	2
<i>Nestucca</i>	Oil barge	Dec 1988	Wash/BC	Non-US	230 000	>13 000	52 000–78 000	1991	~\$2 000 000	\$7 480 000 ^f	8
<i>Exxon Valdez</i>	Tanker	Mar 1989	Alaska	US	10 800 000	>30 000	350 000+	1991	~\$200 000 000 ^g	~\$900 000 000 ^h	10,11
<i>American Trader</i>	Tanker	Feb 1990	California	US	416 598	914	3 400	1994	\$2 485 000	\$3 180 000 ⁱ	8

^aBecause of the underreporting of spills prior to OPA 90 this table only represents the better-documented incidents

^bBird-focused restoration includes on-the-ground restoration actions such as predator control, habitat improvements, monitoring and purchase of property or conservation easements to protect nesting or roosting habitat.

^cTotal natural resource restoration does not include funds obtained for lost human use.

^dSources: (1) Carter 2003a; (2) Scholz *et al.* 1994; (3) Carter & Kuletz 1995; (4) Bayer 1988; (5) Carter *et al.* 1998; (6) K. Pease, NOAA, pers. comm.; (7) Kittle 1987; (8) Final Restoration Plan and Environmental Assessment for named spill; (9) Demarest & Elliott 1997; (10) US General Accounting Office 1991; (11) www.evostc.state.ak.us and M. Baffrey, Executive Director, Valdez Trustee Council, pers. comm.

^eState only settlement.

^f~\$4 500 000 natural resource damage settlement with Canada.

^gIn excess of \$26 000 000 was spent directly on restoration of several species of seabirds and more than \$350 000 000 on all habitat acquisition projects, many of which benefited seabirds.

^hThis figure includes civil, criminal and earned-interest funds spent on restoration activities.

ⁱLost human use judgment of \$18 100 000 against Attransco.

TABLE 4
Consequential oil spills from vessels occurring within 25 miles of the US west coast states of Alaska, California, Oregon, Hawaii, Washington and the US Pacific Trust Territories following the enactment of the Oil Pollution Act of 1990

Incident name	Vessel type	Date	Location	Flag	Gallons (US)	Beached birds	Estimated dead birds	Date of settlement	Bird-focused restoration	Total nat. res. restoration	Sources ^a
<i>Tenyo Maru</i>	Cargo	Jul 1991	Washington/ British Columbia	Non-US	173 000	5 040	No estimate	1994	\$4 760 000	\$5 160 000	2
<i>Jin Shiang Fa</i>	Fishing	Oct 1993	American Samoa	Non-US	100 000	None	No estimate	2003 ^b	None	\$1 264 000	2
<i>Citrus</i>	Cargo	Feb 1996	Alaska	Non-US	Unknown	876	1 609±70	Pending ^b	Pending	Pending	3
<i>Cape Mohican</i>	Other	Oct 1996	California	US	40 000	288	593	1998	\$800 000	\$2 595 000	4
<i>Kuroshima</i>	Cargo	Nov 1997	Alaska	Non-US	39 000	167	>2 000	2002 ^b	\$162 200	\$653 000	2
<i>Kure</i>	Cargo	Nov 1997	California	Non-US	4 537	951	5 206	Pending	Pending	Pending	4
Tesoro	Tanker	Aug 1998	Hawaii	US	5 000	54	No estimate	1999	\$500 000	~\$1 000 000	2
<i>Command</i>	Cargo	Sep 1998	California	Non-US	3 000	171	1 900	1999	\$3 200 000	\$3 970 000	1,4
<i>New Carissa</i>	Cargo	Feb 1999	Oregon	Non-US	70 000	1 285	3 137	Pending ^b	Pending	Pending	2,5
<i>Stuyvesant</i>	Dredge	Sep 1999	California	US	~2 000	1 272	2 405	2006	\$6 098 900	\$6 815 000	1,4
<i>Selendang Ayu</i>	Cargo	Dec 2004	Alaska	Non-US	335 732	1 603	Pending	Pending ^b	Pending	Pending	6

^aSources: (1) Carter 2003a; (2) Final Restoration Plan and Environmental Assessment for named spill; (3) Flint *et al.* 1999; (4) www.dfg.ca.gov/ospr/organizational/scientific/nrda/NRDA.htm and D. Welsh, US Fish and Wildlife Service, pers. comm.; (5) Ford *et al.* 2001a; (6) www.dec.state.ak.us/spar/perp/response/sum_fy05/index.htm.
^bThe Natural Resource Trustee Agencies or the responsible party involved with this spill have or anticipate submitting a claim for damage assessment or restoration costs to the US Coast Guard-administered Oil Spill Liability Trust Fund (US Coast Guard 2005).

occurred on the west coast was a significant shift in the ownership of vessels spilling oil: Before OPA 90, spills were attributable mostly to US-flagged vessels; since OPA 90, spills have been attributable mostly to non-US-flagged vessels (Tables 3 and 4; Fisher exact test: $p < 0.01$).

Comparing consequential vessel oil spills after OPA 90 on the US west coast with those on the US east and Gulf coasts shows some noteworthy differences. Whereas most west-coast spills have come from cargo vessels, all east- and Gulf-coast spills have come from oil carriers (Table 5). The volume of oil released per spill on the east and gulf coasts averages more than three times the west-coast volume (Mann–Whitney U -test: $U = 123.0$, $n_1=16$, $n_2=10$, $p < 0.02$). Additionally, most west-coast vessel spills come from non-US-flagged vessels, but east- and Gulf-coast spills are evenly distributed between US-flagged and non-US flagged vessels.

SEABIRDS AND NRD CLAIMS

Federal and state governments filed their first US west-coast oil-spill-related damage claims for injury to natural resources in the late 1980s for the 1984 *Puerto Rican* and 1985 *ARCO Anchorage* tanker spills. The settlements obtained in both cases were modest given the magnitude of the documented injury to natural resources, and neither settlement contained a bird restoration component despite estimated injury to 4000 or more seabirds.

The first settlement for injury to seabirds occurred in 1991, after the passage of OPA 90, for the massive bird kill (52 000–78 000) caused by the 1988 *Nestucca* oil spill (Table 3). Again, this settlement was fairly modest given the magnitude of the injury.

The next two settlements for natural resource injury were obtained in 1994 at about the same time that the National Oceanic and Atmospheric Administration (NOAA) was finalizing the rules that would guide implementation of the natural resource damage assessment (NRDA) regulations of OPA 90. After five years of litigation, the *Apex Houston* case was settled and most settlement funds were dedicated to restoration projects to benefit Common Murres *Uria aalge* and Marbled Murrelets *Brachyramphus marmoratus*, the two species most affected by the spill. A settlement with one responsible party in the 1990 *American Trader* tanker spill was obtained in 1994, but not until a jury reached a verdict in favor of the State of California in 1997 were funds released for seabird restoration efforts.

In all of the foregoing cases, the primary cause of action brought by the federal government was under the authority contained in the 1972 and 1977 amendments to the CWA—and, for the *Puerto Rican* and *Apex Houston* cases, also under the 1988 revisions to the 1972 Marine Protection, Research and Sanctuaries Act (Lee *et al.* 2002, Carter *et al.* 2003). Although the authority to file a damage claim for oil-spill-related injury to seabirds had been part of federal law since at least 1977, and several spills had caused documented injury to seabirds, no federal claims were brought until the late 1980s, and no settlements benefited seabirds until after the passage of OPA 90.

The lead author (RCH) represented the US Fish and Wildlife Service and the Department of the Interior in settlement negotiations for both the *Apex Houston* and *American Trader* spills. In both cases, the *Exxon Valdez* incident, the Congressional hearings leading up to the enactment of OPA 90, and public meetings held by NOAA in preparing the NRDA regulations to implement OPA 90 played

an important role in negotiations for NRDs. Attorneys representing the responsible parties for both spills were clearly aware of the public outrage precipitated by the *Exxon Valdez* oil spill and were wary of a jury trial. On the other hand, attorneys representing the US Department of Justice (Environmental Enforcement Division) and the California Attorney General's Office were emboldened by developments following the *Exxon Valdez* spill and now actively pursued the NRD claim for seabird restoration rather than accept the relatively small early settlement offers by the responsible parties (Lee *et al.* 2002, Carter *et al.* 2003).

Since OPA 90, all US west-coast vessel oil spills with consequential seabird losses resulted in a substantial portion of the damage claim being focused on restoration actions to benefit seabirds such as on-the-ground restoration actions and habitat protection (Table 4). From 1994 to 2005, west-coast bird-focused restoration funds obtained in vessel oil spill cases totaled more than US\$15 500 000 (six cases), and all oil spill cases currently being negotiated involving substantial seabird losses likely will contain a sizeable seabird restoration component. East- and Gulf-coast vessel oil spills during this same period have also resulted in substantial settlements for seabird restoration (more than US\$10 000 000 in seven settled cases) and several pending cases likely will have a seabird restoration component (Table 5). However, in contrast to the west coast, where substantial seabird restoration settlement funds were obtained in several cases, more than 80% of the funds collected in east- and Gulf-coast spills were for one incident, the *North Cape*. In most west-coast oil spill cases where a substantial claim for seabird injury has been made, more than 1000 beached seabirds were collected; in the east- and Gulf-coast incidents, usually no more than a few hundred beached seabirds were collected. Based on discussions with government and industry biologists and attorneys involved in NRD cases throughout the United States, and on analysis of data collated for the present overview, we make the following observations:

- In cases in which governments claim that numerous seabirds have been injured (and especially in those involving threatened or endangered species), total seabird mortality claims will be closely scrutinized by the responsible party.
- Compared with spills on the west coast, oil spills on the east and gulf coasts lead to relatively few beached birds being found afterwards.
- Total seabird mortality estimates on the west coast typically involve more detailed site-specific data and precise modeling efforts.
- The highest restoration claims for injury to seabirds are coming from east- and west-coast spills.
- If the damage claim for bird-focused restoration is considered solely from the perspective of recovered beached birds, then restoration payments are averaging about \$1050 per bird (Tables 4 and 5). (*Exxon Valdez* and *Anitra* settlements were excluded because the *Valdez* case had too many unique political and legal variables that influenced the settlement, and the bird portion of the *Anitra* settlement was exclusively for visibly oiled, but not captured, shorebirds.)

Beached birds and estimates of seabird mortality for NRD claims

Little attention was paid to the impact that west coast oil spills had on seabirds until the 1984 *Puerto Rican* and 1986 *Apex Houston* oil spills off California (Burger & Fry 1993, Carter & Kuletz 1995, Carter *et al.* 1998). During both incidents, concerted efforts were made by personnel at the Point Reyes Bird Observatory (PRBO) to count dead oiled beached birds, and during the *Apex Houston* spill, the general

TABLE 5
Consequential oil spills from vessels traveling within or along the US east and Gulf of Mexico coasts following the enactment of the Oil Pollution Act of 1990

Incident name	Vessel type	Date	Location	Flag	Gallons (US)	Beached birds	Estimated dead birds	Date of settlement	Bird-focused restoration	Total nat. res. restoration	Sources ^a
<i>Bouchard No. 155</i>	Oil barge	Aug 1993	Florida	US	362 000	366	No estimate	1999	\$15 000	>\$600 000	1,3
<i>Morris J. Berman</i>	Oil barge	Jan 1994	Puerto Rico	Non-US	750 000	22	No estimate	2001	\$8 000	\$5 715 313	1,4,5
<i>Skaubay</i>	Oil barge	Feb 1995	Texas	Non-US	35 500	105	8 549 ^b	1999 ^c	\$122 000	\$277 000	6
<i>Jahre Spray</i>	Tanker	Jul 1995	New Jersey	Non-US	56 000	Unknown	Unknown	2003 ^c	\$51 000	\$117 000	7
<i>North Cape</i>	Oil barge	Jan 1996	Rhode Island	US	828 000	405	2 292	2000	\$8 349 126	\$27 597 198	2,5
<i>Buffalo 292</i>	Oil barge	Mar 1996	Texas	US	176 400	105	9 516 ^b	Pending ^d	Pending	Pending	5,6
<i>Anitra</i>	Tanker	May 1996	New Jersey	Non-US	42 000	0 ^e	No estimate	2004	\$1 250 000	\$1 250 000	2,5
<i>Julie N</i>	Tanker	Sep 1996	Maine	US	165 900	40 ^f	No estimate	2000	\$475 000	\$1 000 000	2,5
<i>American Heritage</i>	Tanker	Jul 1998	Louisiana	US	154 000	0	0	None	None	None	5
<i>WTC2014</i>	Oil barge	Jan 1999	Louisiana	Unknown	64 000	0	0	None	None	None	5
<i>Posavina</i>	Tanker	Jun 2000	Massachusetts	Unknown	59 000	0	0	2003	\$0	\$100 000	2,5
<i>Westchester</i>	Tanker	Nov 2000	Louisiana	Non-US	550 000	15	582	2003	Marsh creation	\$520 000	2,5
<i>New Amity</i>	Tanker	Sep 2001	Texas	Non-US	50 000	0	0	None	None	None	5,6
<i>Bouchard No. 120</i>	Oil barge	Apr 2003	Massachusetts	US	98 000	479	Pending	Pending	Pending	Pending	5,8
<i>M407</i>	Oil barge	Mar 2004	Texas	US	151 000	0	0	None	None	None	5,6
<i>Athos I</i>	Tanker	Nov 2004	New Jersey	Non-US	260 000	0	Pending	Pending ^d	Pending	Pending	5,9

^aSources: (1) Scholz *et al.* 1994; (2) Final Restoration Plan and Environmental Assessment for named spill; (3) www.publicaffairs.noaa.gov/releases/99/jan99/99jan99noaa99-901.html; (4) Trustee MOA and T. Penn, NOAA, pers. comm.; (5) US Department of Homeland Security—US Coast Guard 2005; (6) R. Seiler, Texas Commission on Environmental Quality, pers. comm.; (7) www.nj.gov/dep/nrr/reports/; (8) www.buzzardsbay.org/looncormorant.htm; (9) www.fws.gov/northeast/hjfieldoffice/News_Stories/Athos/athos.htm.

^bEstimate of bird mortality based on National Oceanic and Atmospheric Administration type A model.

^cState-only settlement.

^dThe Natural Resource Trustee Agencies or the responsible party involved with this spill have or anticipate submitting a claim for damage assessment or restoration costs to the US Coast Guard—administered Oil Spill Liability Trust Fund (US Coast Guard 2005).

^eNo beached birds recovered, but more than 4000 shorebirds observed oiled, including 51 Piping Plovers *Charadrius melodus* (federally listed as Threatened).

^fAn additional 1679 birds observed oiled but not recovered.

public collected large numbers of live oiled birds for rehabilitation (PRBO 1985, Carter *et al.* 1987, Page *et al.* 1990). Ford *et al.* (1987) used collected and counted beached birds, at-sea weather patterns, distribution of birds at sea, and predicted spill rates to develop a model that estimated the total number of seabirds affected by the *Apex* spill. That model was one of the first attempts to estimate the total impact that an oil spill had on seabirds. Several subsequent west coast oil spills provided additional opportunities to further refine the data inputs into seabird mortality models. The number of data inputs is limited in scope (Table 6), and yet this subject is actively evolving and too complex to address adequately in this paper.

Recovered beached birds have become the fundamental unit of measure to assess the impact of an oil spill on seabirds. Nearly all scientists and attorneys involved in assessing the impact of vessel oil spills on seabirds accept that a beached bird collected within days of an oil spill, in the vicinity of the vessel, and coated with the same type of oil spilled was injured as a result of oil released from the vessel. There also tends to be general agreement that all the seabirds affected by a spill are not recovered. However, as any variable (e.g. time, space, degree of oiling, or oil fingerprint) deviates substantially from the prototypical injured bird, or as a combination of the variables so deviates, little further consensus is reached.

Disputes over which beached birds were actually affected by a particular spill become more vigorous when recovered beached birds are used as data inputs into models that estimate the total impact of a spill on seabirds. Typically, as more beached birds are added into models, particularly birds collected further away in either space or time from the spill, the estimated total bird mortality caused by the incident increases. That larger estimate becomes of increasing concern to the spiller and the spiller's insurer, because under OPA 90, they are strictly liable to pay for rehabilitating, restoring, replacing, or acquiring the equivalent of the natural resources injured as a result of their spill. Given that seabird restoration activities can be expensive, each beached bird takes on an increasingly greater importance in resolving NRD claims.

FUTURE OF OIL SPILLS AND SEABIRD-ASSOCIATED NRD CLAIMS ON THE US WEST COAST

Oil tanker and oil barge spills can be massive, overwhelming events that cause substantial visible injury to natural resources. When these spills occur in areas with large seabird populations, thousands to hundreds of thousands of birds can be killed. In contrast, spills

from non-oil-carrying vessels typically release less petroleum product, response agencies are usually not overwhelmed and respond capably, and visible impacts to the environment are often rapidly addressed. Nevertheless, impacts from these smaller spills on seabirds can be significant. Not only do such vessels regularly spill several thousand gallons of a mixture of poorly characterized, acutely and chronically toxic petroleum products (i.e. various combinations of different types of fuel oils), but these incidents can involve groundings in which both the fuel oil and the vessel's cargo are released. Sometimes the vessel itself breaks up and is left in the environment. Even relatively small-volume oil spills from non-oil-carrying vessels have resulted in tens to hundreds of oiled seabirds washing ashore and estimates of hundreds to thousands of birds killed (Burger 1993, Carter 2003, Ford & Reed 2003, Table 4).

Each year more than 8 000 foreign flagged vessels from more than 100 countries enter US ports, and these vessels constitute more than 80% of all vessels entering the United States (US MARAD 2004). Data from Lloyd's of London, one of the largest vessel insurance brokerage houses in the world, show that 170 foreign-flagged vessels filed a loss claim between 2002 and 2004, as compared with only three US-flagged vessels (www.solarnavigator.net/marine_insurance/cargo_ship_insurance.htm). Since OPA 90, vessel oil spills on the US west coast that caused consequential injury to seabirds have come almost entirely from foreign-flagged and insured non-oil-carrying vessels (Table 4).

With the phasing out of single-hulled oil tankers and barges worldwide, ongoing rigorous inspections of oil-carrying vessels entering US waters by the US Coast Guard, and improvements in industry practices, spills from large oil-carrying vessels likely will remain exceedingly rare events (IMO 2005). In contrast, non-oil-carrying vessels, which are far more numerous, are subject to less regulation, range much more widely, are required to carry considerably less oil spill liability insurance, and are typically crewed by seamen with less rigorous training than those that crew oil-carrying vessels, likely will continue to be a major source of consequential oil spills (US Commission on Ocean Policy 2004). We predict that on the US west coast, future oil spills causing consequential injury to seabirds will continue to result mostly from foreign-flagged non-oil-carrying vessels.

OPA 90 established new and higher liability limits for vessels based on the gross tonnage of the vessel (Public Law 101-380). These new liability limits increased the potential financial exposure of a vessel

TABLE 6
Summary of variables examined in specific oil spill natural resource damage assessment cases to refine beached bird data inputs into total seabird mortality model estimates

Incident name	Date	Scavenging rate	Detection rate	Background deposition	Refloating of beached carcass	Carcass loss at sea	Search effort	Oil fingerprint on feathers	Sources ^a
<i>Nestucca</i>	Dec 1988	X			X	X	X		1
<i>Exxon Valdez</i>	Mar 1989	X			X	X	X		2,3
<i>Kure</i>	Nov 1997	X	X				X		4
<i>New Carissa</i>	Feb 1999			X			X		5,6
<i>Stuyvesant</i>	Sep 1999	X	X				X	X	7
<i>Luckenbach</i>	Chronic			X	X		X	X	8

^aSources: (1) Ford *et al.* 1991; (2) Ford *et al.* 1996; (3) Van Pelt & Piatt 1995; (4) Ford *et al.* 2001a; (5) Ford *et al.* 2001b; (6) Payne & Driskell 2003; (7) R.G. Ford, unpubl. data; (8) Hampton *et al.* 2003.

owner or operator, but they are limited, indicating that OPA 90 was not intended to hold a spiller fully liable for the costs of a very large or catastrophic oil spill like that from the *Exxon Valdez*. Based on the actual and pending outcomes of recent oil spills involving non-oil-carrying vessels (and in two cases involving oil-carrying vessels), the liability limits established in OPA appear to be set too low to hold spillers accountable for clean-up and natural resource restoration costs for even moderate-size oil spills (Tables 4 and 5).

For example, in two of five recently settled NRD cases involving non-oil-carrying vessels, an uncompensated claim for natural resource damages was submitted to, and paid by, the US Coast Guard-administered Oil Spill Liability Trust Fund (OSLTF). In addition, government agencies involved in four of five pending non-oil-carrying vessel cases and two of three pending oil-carrying vessel cases have declared their intention to submit an uncompensated NRD claim to the OSLTF. We believe that this trend will continue in the future, especially for the non-oil-carrying vessels responsible for consequential oil spills on the US west coast. If our hypothesis is correct, then a proportionately larger share of future oil spills along the US west coast, and perhaps nationwide, will be borne by the public, through the OSLTF, rather than by the spiller and their insurer.

DISCLAIMER

The opinions expressed in this article are those of the authors and do not represent any official position or statement of the US Fish and Wildlife Service or the Federal Government.

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