THE ENVIRONMENTAL RISKS OF TOWING DAMAGED VESSELS: A REVIEW OF PAST CASES

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ABSTRACT

When a damaged vessel is leaking oil and there is significant risk of further release, spill responders often consider towing the vessel into a harbor of refuge in order to protect it from rough seas and thus prevent a catastrophic discharge of oil, or out to sea to protect the coastline. This paper reviews three cases on the west coast of North America where vessels were towed out to sea (the Puerto Rican, Nestucca, New Carissa). Using actual spill data and modeled trajectories, the environmental impacts associated with towing are compared to the likely environmental impacts that would have occurred with alternative scenarios. We conclude that, in at least two of these cases, the environmental impacts may have been magnified as a direct result of towing the vessel. Thus, when towing damaged vessels, the environmental risks and tradeoffs should be carefully evaluated.

INTRODUCTION

A tank vessel is in trouble. It has lost power, suffered cracks to its hull, and has been discharging millions of gallons of oil into the sea. A large storm is forecast. In the calm before the storm, the vessel has been stabilized, the discharge has been stopped, and a large port facility is only five miles away. If the vessel stays at sea, it may break up and lose many more millions of gallons. This was the scenario presented to responders at the 2004 SONS Drill in Long Beach, California. The obvious solution: tow the vessel into port before the storm arrives.

Indeed, that was the decision of the Unified Command at the drill. Despite this apparently obvious course of action, the Environmental Unit at the drill advised the Unified Command against towing the vessel. In fact, environmental experts and economists from various trustee agencies and the various industries were near unanimous in cautioning against moving the vessel. They cited past examples where towing vessels had increased spill impacts. They also noted that three additional ecologically sensitive sites would likely be impacted as a direct result of the towing, even if only small amounts of oil were released. In addition, if moving the vessel into the Port of Long Beach resulted in a closure of the port, the economic impact would likely exceed $20 million/day. However, with 28.4 million gallons of oil remaining on board, the Unified Command was willing to risk it and tow the vessel.

The decision to move a leaking vessel involves a question of tradeoffs. What are the risks and potential impacts of moving the vessel versus leaving it where it is? As it turned out in the drill, the vessel was towed successfully with no leaks or mishaps. In reality, such success has not always been realized. With the advantage of hindsight, this paper examines three cases where vessels were towed: the *Puerto Rican*, the *Nestucca*, and the *New Carissa*. These examples are not necessarily representative of all towing operations. Rather, but they illustrate the potential for negative consequences. For each spill, the environmental impacts associated with the towing operation are presented. The likely impacts of alternative courses of action are analyzed as well. The final section discusses the results and implications for responders of future spills.

THE *PUERTO RICAN*

On October 31, 1984, the *T/V Puerto Rican* suffered an explosion and fire in the Gulf of the Farallones in California, approximately halfway between the Golden Gate Bridge and the Farallon Islands. These islands, home to the largest seabird and marine mammal concentrations in the state, represent one of the most environmentally sensitive sites in the nation. At this point, little oil had been released.

The following day, in rough seas, the ailing tanker was towed out to sea southwestward, leaving a small slick of oil in its wake. The intent was to remove it from environmentally sensitive areas, as NOAA trajectories had indicated this course of action would protect the Farallon Islands. On November 3, while still under tow about 17 km south of the Farallones, the vessel broke in two, releasing 1.47 million gallons of oil. In the following days, south winds moved the oil north into the most environmentally sensitive areas: the Farallon Islands, across the Gulf of the Farallones to Pt. Reyes and Drake's Bay, and eventually north to Bodega Bay and Ft. Ross. An estimated 2,874 birds were killed, including 1,856 common murres (*Uria aalge*) and 548 Cassin's auklets (*Ptychoramphus aleuticus*) (Farallones Marine Sanctuary Association 2004). These are long-lived and slow-reproducing seabirds, and thus slow to recover from major acute mortality events.

Figure 1 illustrates the locations of the vessel, the towing path, the direction of the oil, and the seasonal concentrations of common murres, Cassin's auklets, and Pacific loons (*Gavia pacifica*) at the time of the spill. Unfortunately, moving the vessel to the southwest probably increased the environmental impacts compared to its original position. In hindsight, the vessel probably could have been towed into Drake's Bay or San Francisco Bay and been lightered in calm waters. Those options, however, would have put other resources and locations at a level of risk that was likely considered unacceptable. Drake's Bay is in the midst of Point Reyes National Seashore, one of the most pristine areas on the California coast. San Francisco Bay is not only a major metropolitan area, but is also subject to strong tidal currents that can move oil throughout the bay and adjacent coast. Given these choices, as well as a

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trajectory forecast that predicted a slick would move to the south, spill responders gambled that they could tow the vessel seaward beyond the Farallon Islands and lost.

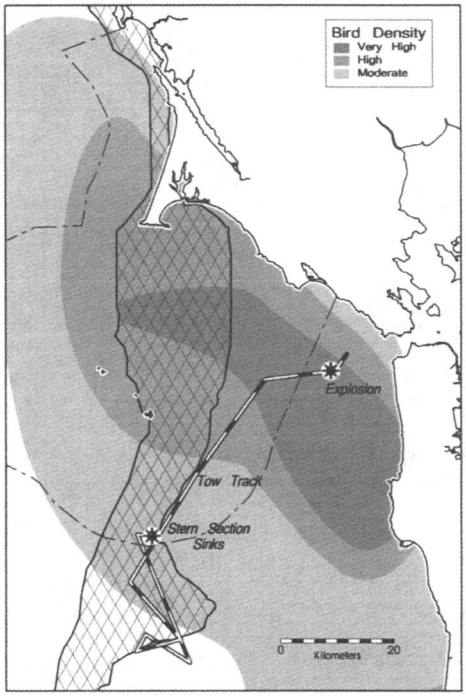

FIGURE 1. A summary of the *Puerto Rican* oil spill incident. The dashed line shows the track of the towed vessel from the position where the tanker exploded to the position where the stern section sank. The cross-hatched polygon represents the area affected by the spill reconstructed from overflight observations. Combined density of common murres, Cassin's auklets, and Pacific loons, the species most seriously affected by the spill, is shown as a three-level gray scale. The boundary of the Gulf of the Farallones National Marine Sanctuary is shown as a broken line.

THE *NESTUCCA*

On December 23, 1988, the tug *Ocean Service* collided with its tow, the barge *Nestucca*, while trying to replace a broken tow line. The collision occurred near the Grays Harbor bar off the Washington coast and resulted in the puncture of a cargo tank. The barge was subsequently towed out to sea, patched, and eventually taken to a Columbia River port for repairs. At the time of the initial impact and during its transit south, approximately 231,000 gallons of fuel oil were spilled into Grays Harbor and the Pacific Ocean. Oil began coming ashore early on December 23 on the beaches north of Grays Harbor. As the partially submerged oil moved north, it was deposited on the beaches of the outer Washington coast, reaching the more northerly beaches of Olympic National Park in early January. Oil was reported on Vancouver Island, B.C., beginning January 1, 1989. New areas of oiling continued to be reported in the northern part of that island until January 20.

A major consequence of the oil spill was widespread oiling of seabirds and waterfowl. An estimated 55,912 seabirds were killed in this incident, of which approximately 30,000 were common murres. This level of mortality represented 11% of the murre population in the affected area at the time. Other species included Cassin's auklets, grebes, and scoters (Ford et al. 1991). Figure 2 demonstrates that towing the leaking barge out to sea greatly magnified the size extent of the oiled ocean surface and impacted some of the most heavily utilized seabird habitat on the Pacific coast. Because winds and currents were driving the oil northward, towing the barge south-west resulted in oil affecting large seabird concentrations south and west of the spill site which otherwise would not have been affected. This, in turn, led directly to the large wildlife impacts. An alternative course of action would have been to move the barge into Gray's Harbor for repair rather than towing it seaward and then into the Columbia River.

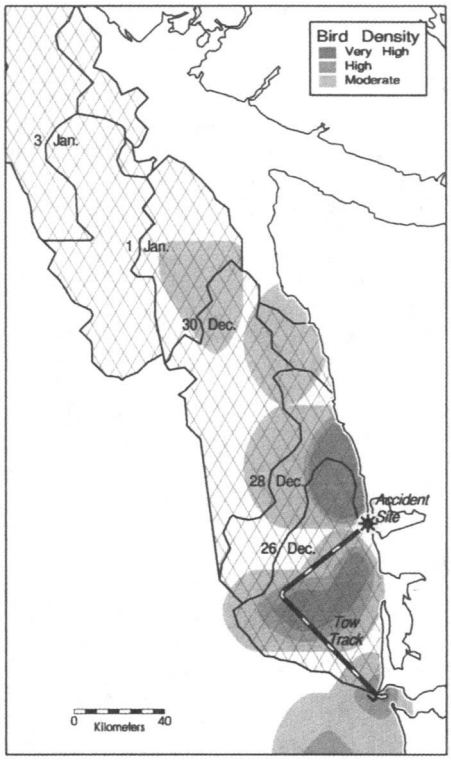

FIGURE 2. A summary of the *Nestucca* oil spill incident. The dashed line shows the track of the towed vessel from the position where the barge was holed to the Columbia River where it was towed for repair. The cross-hatched polygon represents the area affected by the spill based on a NOAA HAZMAT hindcast of the trajectory. The position of the slick at two day intervals is indicated by subdivisions of the polygons. The density of common murres, the species most seriously affected by the spill, is shown as a three-level gray scale.

THE *NEW CARISSA*

On February 4, 1999, the freighter *M/V New Carissa* ran aground north of the entrance to Coos Bay, Oregon while the crew was trying to wait out a storm. About 400,000 gallons of fuel oil was on board at the time of the grounding. Oil was observed leaking from the ship by February 8. Between February 10 and February 15, attempts were made to burn the remaining oil, but the ship subsequently broke in half and exposed two more of its holds to the sea. Efforts to refloat the vessel began on February 26 when a tow line was attached to the bow section. Oil was again observed coming from the hull that afternoon. After three more days of periodic tugging, the bow was freed from all sandbars and towed

seaward on the morning of March 2 (Figure 3). Unfortunately, extreme winds caused the towline to break that evening and the bow section was blown back to the coast, beaching again the following day 80 miles to the north, near Waldport, Oregon, where it continued leaking oil. On March 8, the bow section was again towed offshore, where it was sunk on March 11 by a naval vessel. Little oil was released during the second tow. An estimated 70,000 gallons was released during the entire spill event. Oil released during the first grounding remained relatively nearshore, and most of the impacts to wildlife occurred between the grounding site and the Siuslaw River about 40 miles to the north. But oil released during the first towing attempt reached well north of Newport, and may have had effects as far north as the south spit of the Columbia River.

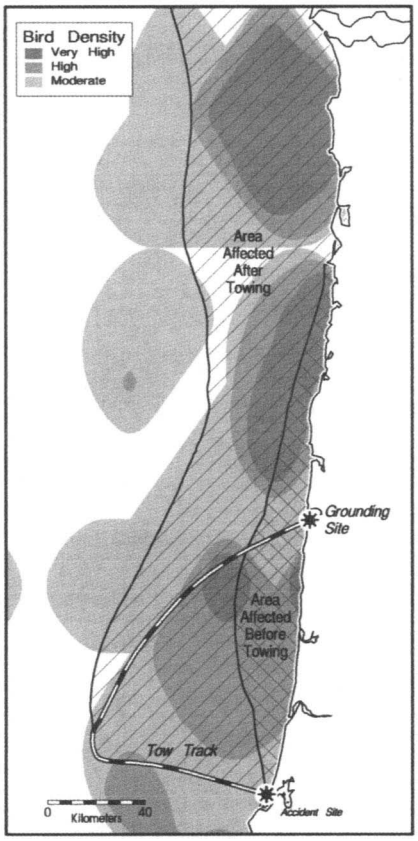

FIGURE 3. A summary of the *New Carissa* oil spill incident. The dashed line shows the track of the bow section from the original accident site where the vessel broke up to the second grounding site. The cross-hatched polygons represents a trajectory model reconstruction of the area potentially affected by oil before and after the attempted tow. Diagonal hatching extending from the upper right to lower left represents oiling occuring after the tow; diagonal hatching extending from the upper left to lower right represents the area affected before the tow. Combined density of rhinoceros auklets, surf scoters (*Melanitta perspicillata*), northern fulmar (*Fulmarus glacialis*), Brandt's cormorant (*Phalacrocorax penicillatus*) and common murres, the five species most commonly recovered after the spill, is shown as a three-level gray scale.

Impacts to birds occurred throughout both phases of the spill, but peaked after the second grounding. Birds and other oiled wildlife were observed from just south of the Columbia River to Cape Arago south of the original grounding site. An estimated 2,358 birds were killed, including 272 Cassin's auklets, 251 rhinoceros auklets (*Cerorhinca monocerata*), and 262 marbled murrelets (*Brachyramphus marmoratus*), an endangered species (Ford et al. 2001).

As in the case of the *Nestucca*, towing the leaking bow increased the aerial extent of oiling on the ocean's surface. Prior to the towing, oiling was limited the coastline and surf in the immediate vicinity of the beached vessel. When the bow section was towed seaward and the towline broke, the drifting hulk created yet another vessel track of release points and a second concentrated spill at a beach. The majority of the wildlife impacts occurred immediately after the towing. In hindsight, efforts to remove oil from the original beaching location, however difficult, would have greatly reduced the aerial extent of the oiling and resulted in much less mortality to marine wildlife.

DISCUSSION

These stories serve as a reminder that, when towing a vessel, things go wrong. In general, no one plans to tow a leaking vessel. Nevertheless, the vessel may leak. In fact, a towed vessel often results in the discharge of oil over a far greater area than had it not been towed, even though the amount of oil released during towing may be relatively small. Even the release of a few thousand gallons may result in a significant increase in impacts. Note that the *Kure*, *Stuyvesant*, and *Command* oil spills in California each involved only a few thousand gallons, yet resulted in significant impacts to natural resources, largely as a function of the location of the oil. The case of the *Apex Houston* serves as a useful example, as it mimicked a towed vessel slowly leaking while in transit. In January 1986, this tank barge lost a hatch cover and released 25,800 gallons of crude oil as it traveled from northern to southern California, resulting in a long narrow slick that moved inshore, killing an estimated 10,500 seabirds along the Central California coast (Page *et al.* 1990). Because the oil, however limited in volume, is spread over a large area from the transiting vessel, it may pose a disproportionately large threat to wildlife. The problem is compounded when the vessel is towed through or upwind from large concentrations of seabirds as occurred in the *Puerto Rican*, *Nestucca*, and *New Carissa* incidents.

This is not meant to imply that towing a damaged vessel is always bad from an environmental standpoint. In some cases, towing a vessel may reduce impacts. For example, had the *T/V Prestige* been towed into a harbor on the Spanish or Portuguese coast, rather than sent out to sea, the environmental impacts would likely have been much reduced. Towing may be the best course of action in some cases, but responders need to carefully consider the potential effects on wildlife and to avoid excessive optimism regarding the likelihood and extent of leakage.

From an environmental and economic perspective, the release of a lot of oil at one location is often preferable to many small releases of oil dribbled across a larger area, especially if the larger area contains dense aggregations of marine wildlife. In general, a single release of oil, especially if the release occurs nearshore with an onshore wind, is likely to impact a smaller area than would many smaller releases further offshore. A decrease in the impacted area, in turn, is likely to translate into decreased environmental and economic impacts. This logic is central to the notion of "places of refuge", where an ailing vessel may come to in order to avoid more widespread impacts. When the ailing vessels examined in this paper were towed out to sea, as well as when the *Prestige* was sent out to sea, it is likely that environmental impacts were magnified. Regardless of the direction that a damaged vessel is sent or towed, responders should consider the potential for greatly increased impacts, even though the amount of oil released while in transit is small.

BIOGRAPHY

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