

Preliminary Methodology for Estimation of Damages to Seabirds From the 24 August 1998 Tesoro SPM Hose Spill

R. Glenn Ford, Ph. D.
R. G. Ford Consulting Company

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DRAFT

BACKGROUND

This report outlines a methodology for estimating the extent of damage to seabird populations that resulted from the Tesoro SPM Hose Spill that occurred on 24 August 1998. This spill was atypical in several regards. At the onset, the length of time between when the spill occurred and when significant numbers of oiled birds were first observed was unusually long. The main impacts on birds began to be observed more than a week after the incident and nearly 150 kilometers away from the spill site. The behavior of the spilled oil between its release on 24 August and its appearance on Kauai beaches on 6 September is poorly understood. Oil samples matching the signature of the spilled oil were collected on the beaches of Kauai and Niihau, and on the feathers of seabirds collected on Kauai. Oiled seabird feathers collected on Laysan and ~~Oahu have not~~ ~~matched the signature of the spilled oil.~~ The NOAA HAZMAT modeling team worked on the spill both at the time of and subsequent to the incident, but did not generate a trajectory that matched the known pattern of oiling. The difficulty of determining the actual area affected by the oil is compounded by the oceanic nature of the Hawaiian Islands, since there is a relatively small land area to retain the oil. An unknown quantity of oil may have bypassed both Kauai and Niihau and been carried westward away from the main islands.

EMC

The area potentially impacted by the spill includes the region around and between Oahu, Kauai, Niihau, and Kaula. Major seabird colonies are present on Oahu, Kauai, Kaula, and Lehua. Post spill aerial surveys showed that seabirds were present throughout most of the area, but were especially abundant in the vicinity of Kauai and Kaula. The effects of the oil on seabird populations were generally consistent with observations made during other small spill incidents. Recoveries of injured and dead seabirds indicate that the most ~~seriously~~ impacted seabird species were Brown and Red-footed Boobies which together accounted for 44 out of 53 birds that were recovered (the next most common species was the White-tailed Tropicbird, of which 3 were recovered). Like the pelican, boobies are large-bodied aerial plunge-divers that spend much of their time on shore. Compared to other seabird species, pelicans are relatively likely to become oiled following a spill, but usually return to land where they may subsequently survive for extended periods of time. We assume that the behavior of boobies is similar. Following the Tesoro SPM Hose Spill, most of the seabirds known to be oiled were either recovered while still alive or observed alive at colonies.

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PRIMARY SOURCES OF INFORMATION

Recovery of Dead and Injured Seabirds

The IBRRC was contracted to recover live and dead birds, and to rehabilitate live birds. Personnel responded to calls regarding oiled wildlife, and when time permitted searched beaches on Kauai for dead or injured birds.

Colony Counts

Colony sites that were within or near the area affected by the spill were visited by biologists who counted the numbers of visibly oiled and unoiled birds. Counts were carried out at colonies on Oahu (7, 9, and 21 October), Kauai (21, 29, and 30 September), Lehua (8 October) and Kaula (16 November). *23 Sept*

At Sea-Surveys

Aerial surveys were conducted around and between Oahu, Kauai, Niihau, and Kaula on 6, 7, and 8 October. Biologists identified and recorded seabirds within 50m of an aircraft flying at 65m ASL.

Coastal Surveys

Between 15 and 23 September, teams surveyed the coast of Kauai for signs of oiling. A portion of Niihau was also surveyed in response to reports of oiling on 21 September.

RATIONALE

During and subsequent to the spill, oiled seabirds were enumerated in two ways: (1) birds were recovered by IBRRC personnel, and (2) colony sites were visited and birds with and without visible oiling were counted. In both cases, the direct count of oiled birds represents a biased estimator of the number of birds that were actually oiled. It is very likely that some oiled beached birds were never found by searchers for at least three reasons:

- Birds died and disappeared due to scavenging or decomposition and were never found
- Birds were beached in areas where searchers did not go.
- Birds were not found on beaches that they visited.

It is also possible that some of the birds recovered on Kauai were not injured by oil released in the Tesoro SPM Hose Spill since there is probably a low but constant base level of bird beachings that occur at all times.

The number of visibly oiled birds seen at the various colonies also represent a subsample of the impacted population since field personnel were only able to check a fraction of the birds at each colony. Birds that were not visible because of their location at the colony or because they were at sea at the time were not enumerated. Since response personnel were unable to gain access to some colonies until well after the spill had occurred, it is also likely that some oiled birds died at the colonies and were not recovered, or that signs of oiling became less detectable with time. Seabird species differ widely in terms of their affinity for land and in terms of their response to injury by oil. Birds that regularly spend time on shore, such as pelicans, appear to come ashore

and remain there once oiled. Pelicans are known to fly for miles even when oiled over their entire body (Anderson *et al.* 1996; D. Jaques *pers com.* 1998), and will remain in the same locale for weeks. We assume that the behavior of boobies and tropic birds is comparable to that of pelicans, and that most of the injured birds returned to land. Other taxa, such as alcids or procellariids (including shearwaters and petrels), however, appear to avoid coming ashore until nearly dead or to die at sea even when near land. If the carcasses of these birds are directed toward land and are beached, they can be recovered and enumerated. But if the carcasses are directed offshore by winds and currents, it is very difficult to determine the extent of the mortality. In most oil spill incidents, relatively few oiled shearwaters and petrels are recovered compared to other taxa, even when large numbers are at risk (see for example Dobbin *et al.* 1986, Ford *et al.* 1991a, Piatt *et al.* 1990). At the time of the Tesoro SPM Hose Spill, however, shearwaters and petrels were known to be forming large aggregations on the water near their colonies prior to migration. It is possible that these populations suffered mortality that will be difficult or impossible to assess quantitatively.

In order to estimate the impacts of the Tesoro SPM Hose Spill on seabirds, it is necessary to address the following:

- How many injured, beached seabirds were not recovered during the response phase?
- How many oiled seabirds were present at colonies but were not enumerated?
- How many dead or injured seabirds were carried offshore and were never enumerated?

MODEL CALCULATIONS AND PARAMETERS

Estimating the Number of Birds Beached but not Recovered

Beached seabird carcasses seabirds do not persist indefinitely on the beach; eventually, they will be removed, scavenged, or decomposed. Live stranded seabirds on beaches are usually in poor health, and unless removed are likely to die *in situ* and eventually disappear. Ford *et al.* (1991b) describes a model for estimating the proportion of carcasses that are not recovered based on the frequency with which segments of beach are searched. The model assumes a constant disappearance rate per day, varying intervals between searches, and complete checking of beach segments each time they are searched. It also assumes that the arrival rate of birds is the same along adjacent sections of beach. In this case, we assume that birds arrive at the same rate within one of the sectors used by the SCAT teams. (For example, we assume that the arrival rate in subsectors A1, A2, and A3 are the same.)

The rate at which dead seabirds disappear from the beach has been studied in a variety of circumstances. Average day to day persistence rates vary from 45% to 84% at sites in Washington, Alaska, and British Columbia (Burger and Fry 1993). Application of these rates to the Tesoro SPM Hose Spill, however, should be done with care since persistence rates have not been studied in tropical habitats or with live beached birds. The relationship between the daily persistence rate of beached birds and the estimated number of birds that were actually beached is non-linear. If 43 birds were actually recovered on Kauai, daily persistence rate estimates of 99%, 95%, 90%, and 80% result in model estimates of 71, 80, 95, and 143 beached birds respectively.

too high
 Cerypoda crabs completely bury & eat
 albatross carcasses on sand
 2/11, 2 or 3 days
 persistence rates may vary
 much lower

Estimating the Number of Oiled Seabirds Present at Colonies

Following the spill, biologists visited seabird colonies within or near the affected area in order to count the numbers of visibly oiled and unoled seabirds. These counts are minimal estimates since some of the birds would not have been visible from the position of the observers, and because some of the counts occurred long enough after the spill that oiled birds may already have died or visible oiling may have become difficult to detect. Assuming that the birds that could be seen comprise a representative sample of the various populations, the observed ratio of oiled birds to unoled birds can be applied to the entire colony to derive an estimate of the total number of oiled birds. For example, on 29 September at Kilauea Point, observers checked 1,150 Red-footed Boobies and counted 58 (5.0%) with visible oiling. Since the estimated size of the colony is about 5,000 birds, we would calculate that $0.05 \times 5,000 = 250$ birds were actually visibly oiled. While this method of estimation is straightforward, it is biased by the ability of the observers to discern oiled plumage. The number of oiled birds will be underestimated if colonies were censused from too great a distance to distinguish signs of oiling, or if enough time had elapsed since the spill that some of the oiled birds died or the oil marks had become less visible. Data from repeated counts of oiled birds at the Kilauea Point colony can be used to estimate the rate at which the number of oiled individuals declines, and these data can be used to correct counts of oiled birds for the length of time between the spill and the colony visits.

Estimating the Number of Injured Seabirds Not Beached

Birds that become oiled at sea may drift passively with winds and currents, or they may choose to swim or fly toward land if their condition allows. Large birds that normally roost ashore such as boobies are likely to do so even if heavily oiled. Under these circumstances, it is reasonable to assume that most oiled birds that are not killed immediately eventually come ashore. But birds that are relatively helpless on shore, such as shearwaters and petrels, may avoid doing so until near death or may choose to die at sea. If their bodies are not eventually directed shoreward by winds and currents (this is usually the case in mainland spills) it is difficult to determine the numbers of birds that might have been carried offshore.

In the Tesoro SPM Hose Spill, there are two instances where this might have been a significant factor. Along the northern and western sides of Kauai, large numbers of Newell's Shearwaters and Hawaiian Petrels form rafts at dusk, waiting for darkness before coming in to their colonies. These rafts may have been at risk, but because of the burrow nesting habit of these species and the fact that they had largely left the area by the time colony census took place, it is unlikely that they would have been enumerated at the colonies. Birds that were injured may have drifted eastward and never made landfall.

PRIORITIES

- 1.) Estimate the day to day persistence rate of dead and injured birds on Kauai beaches. This information will be used to estimate the number of birds that were missed by bird recovery personnel.
- 2.) Obtain data from USFWS showing the decline in the numbers of oiled birds at Kilauea Point through time. This information will be used to estimate the number of birds that would be expected to have died or become (visibly) clean by the time various colonies were checked.

- 3.) Obtain data from USFWS if available that could be used to estimate the "background" rate at which oiled birds appear on Kauai.
- 4.) Determine whether or not it is likely that rafts of Newell's Shearwaters and Hawaiian Petrels near Kauai were impacted by the spill.
- 5.) Determine whether or not it is likely that birds were oiled near either Kaula or Lehua but were missed when the colonies were visited because too much time had elapsed between the spill and the visitation.

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