

## Appendix C: Shorebird Injury Assessment

Prepared by the *Cosco Busan* Oil Spill Natural Resource Trustees

For purposes of this injury assessment, we assessed the oiling rates and mortality caused by the oiling to two groups: Snowy Plovers and all other shorebirds (referred to as “General Shorebirds”). Shorebirds are defined as charadriiformes in the families Charadriidae, Haematopodidae, Recurvirostridae, and Scolopacidae (gulls are not included).

### OILING RATES

We used a study of observed oiling rates of shorebirds during the spill period, combined with a total population estimate, to estimate total number of shorebirds oiled.

#### *Oiling Rates for General Shorebirds*

There were two studies of shorebird oiling rates: 1) GFNMS conducted surveys for shorebirds on Ocean Beach daily from 9 to 21 November 2007, noting number of oiled shorebirds (Table 1), and 2) PRBO Conservation Science conducted focused studies of shorebird oiling rates in the East Bay (Emeryville area) and Bolinas/Stinson Beach, from 29 November to 16 December 2007. GFNMS also conducted surveys elsewhere on the outer coast, but not daily. Only the GFNMS Ocean Beach data covered the first few weeks after the spill, when oiling was likely most severe. By late November and early December, when the PRBO studies were conducted, the observed oiling rate of shorebirds on Ocean Beach had fallen to zero (Table 1), but rates at Bolinas/Stinson Beach (5-18%) and the East Bay (4-8%) were still measurable. Thus, the initial oiling rates during the first two weeks may have been considerably higher inside the Bay and in the Bolinas/Stinson area, than at Ocean Beach. To be conservative, the Trustees will apply the maximum oiling rate at Ocean Beach (14.6%) to the other sites as well. For reasons described above, this may be an underestimate.

Table 1. Oiling rate of shorebirds at Ocean Beach (GFNMS data).

Week	Date Range	Number of Surveys	Total Birds Seen	Number Oiled	Oiling Rate
1	11/9-11/15	7	1,315	192	14.6%
2	11/16-11/23	7	1,850	150	8.1%
3	11/24-12/1	2	238	0	0
4	12/2-12/9	1	264	0	0
5	12/10-12-7	2	260	0	0

Surveys were conducted for overall shorebird abundance within San Francisco Bay and at Bolinas/Stinson Beach and Ocean Beach to Sharp Park by various groups (Table 2). For Bolinas/Stinson and Ocean Beach to Sharp Park, we used maximum counts from several surveys conducted during November 2007. Data within San Francisco Bay (between the Richmond-San Rafael Bridge and the Bay Bridge) came from a one-day census coordinated by California Audubon and PRBO Conservation Science. Using the oiling

rate from the first week of Ocean Beach surveys (14.6%), we obtained a conservative estimate of 2,841 oiled shorebirds (Table 2).

Table 2. Estimate of total number of shorebirds oiled by the Cosco Busan spill.

Location	Survey	Survey Date	Total Shorebirds Counted	Oiling Rate	Oiled Birds
SF Bay	Audubon/PRBO	11/10	17,941	14.6%	2,619
Bolinas/Stinson	OSPR (Henkel)	11/10	934	14.6%	136
Ocean Beach to Sharp Park	GFNMS	11/11	582	14.6%	85
<b>TOTAL</b>			<b>19,456</b>	<b>14.6%</b>	<b>2,841</b>

#### *Oiling Rates for Snowy Plovers*

PRBO Conservation Science was contracted to conduct additional studies to assess oiling rates and effects of oiling on Western Snowy Plovers. Surveys were conducted at six sites: Half Moon Bay State Beach, Pacifica (Linda Mar), Ocean Beach, Crissy Field, Stinson Beach, and Limantour Beach. Between 6 and 26 surveys were conducted at each site between 21 November 2007 and 17 January 2008. Total number of Snowy Plovers at each site varied slightly over time. During each survey, all or some of the Snowy Plovers were assessed visually for signs of oiling.

We considered two methods of assessing total number of Snowy Plovers affected: an estimate based on oiling rate multiplied by mean flock size, and the maximum number of oiled birds observed at each site, corrected for potential movement between sites. We consider the second method to be more reliable.

For the estimate based on oiling rate we used overall oiling rate (total number of oiled birds seen divided by total number of birds inspected). To assess numbers of Snowy Plovers affected, we used mean flock size at each location multiplied by mean oiling rate (Table 3).

Table 3. Estimated number of Snowy Plovers Oiled during the Cosco Busan spill.

Location	Checked for Oil	Oiled	Mean Oiling Rate	Mean Flock	Estimated Oiled	Max. Observed Oiled	Corrected Max.	Date of Max.
Crissy Field	80	53	0.66	3.4	<b>2</b>	4	<b>4</b>	12/1 & 12/10
Half Moon Bay	218	12	0.06	41.2	<b>2</b>	5	<b>4</b>	12/17
Limantour	481	10	0.02	48.7	<b>1</b>	4	<b>4</b>	11/26
Pacifica	208	55	0.26	21.2	<b>6</b>	10	<b>9</b>	12/4
Ocean Beach	458	340	0.74	26.2	<b>19</b>	27	<b>24</b>	11/29
Stinson Beach	169	27	0.16	16.9	<b>3</b>	8	<b>7</b>	11/30
<b>TOTAL</b>					<b>33</b>		<b>52</b>	

Maximum numbers of oiled Snowy Plovers at each site were slightly higher than estimates of oiled birds based on mean values; maximum counts could be biased if birds moved between locations and the same birds were counted at multiple locations. Sightings of banded birds showed that of 45 individuals identified, 5 were seen at more than one location (11.1%; most overlap was between Ocean Beach and Crissy Field). To correct maximum values for potential double-counting of individuals that moved between sites, we decreased maximum values at each site by 11.1% for corrected maximum values (Table 3).

We consider the corrected maximum values to be the best estimate of total number of Snowy Plovers oiled. The estimates based on oiling rate include values through mid-January, by which time some oiled birds may have died or moved out of the area. Thus, we estimate that at least 52 Western Snowy Plovers were oiled as a result of the Cosco Busan oil spill in November 2007.

### ESTIMATED MORTALITY

This section begins with the oiling rates described above and estimates how many of those birds may have died. We begin with the Snowy Plovers, which were intensively studied.

#### *Mortality Estimate for Snowy Plovers*

The same study that surveyed the Snowy Plovers also tracked 45 banded birds (14 of which were banded immediately after the spill for this purpose), so as to understand their fate after oiling. This included 23 oiled and 22 unoiled plovers. Only one of the birds was deemed sufficiently oiled as to require rehabilitation. This bird was captured and cleaned before being released. The others had limited oil on their plumage and were not cleaned. These birds were surveyed regularly thru the winter of 2007-2008, following the spill, and again in the following winter. As 52 plovers were estimated oiled, this study represented a significant percentage of the affected birds. [Note: numbers are based on Table 2 of the PRBO report.]

All of the banded oiled plovers were seen alive thru December 23, 6 ½ weeks after the spill. The following winter (2008-2009), the banded birds were expected to return. A follow-up survey focused on plovers in the San Francisco area. 6 of 14 unoiled plovers were found (43%), and 12 of 21 oiled plovers were found (57%). It thus appears there was not significant mortality among the Snowy Plovers as a result of the oil spill. This is likely due to the fact that all but one of the plovers was only very lightly oiled, and that Snowy Plovers forage high on the beach and do not need to get in the water to obtain food. The one moderately oiled Snowy Plover that had been cleaned and released was not observed the following winter. It is possible that this bird may have died. In other oil spills, repeated daily surveys of oiled plovers found that lightly oiled plovers tended to survive from day to day, while moderately oiled plovers disappeared. Due to their small size and cryptic coloration, dead Snowy Plovers are almost never found.

We have no observations of banded oiled plovers from the breeding grounds, although such observations would have been serendipitous, as they birds disburse widely. Thus, we are unable to assess impacts to reproduction. However, there have been anecdotal stories, from other oil spills, of plovers surviving oiling going on to nest the next summer.

Based on this information, the Trustees believe that only a small number, perhaps no more than five, Snowy Plovers may have died due to the spill.

*Mortality Estimate for General Shorebirds*

Unlike the Snowy Plover, none of the other species were banded and studied intensively. They were predominately Western Sandpipers, but also included significant numbers of Black-bellied Plovers, Dunlin, Willets, Sanderlings, and dowitchers. All of these species forage lower in the intertidal area than Snowy Plovers, often in the active intertidal swash zone. Thus, they are more susceptible to oiling and more vulnerable to hypothermia as a result of it.

2,841 shorebirds were estimated oiled. Only one shorebird (a Black Turnstone) was collected live, and only four were collected dead, likely due to their small size and cryptic coloration. In many oil spill cases, all oiled shorebirds are assumed to have died. However, given the results of the Snowy Plover banding study described above, and the fact that many of these other shorebirds were only lightly oiled, the Trustees estimate that approximately 50% (or 1,421) of these shorebirds died or were lost to the breeding population as a result of the spill.