Chapter 3: Injury Determination and Quantification

3.1 Summary of Preassessment and Assessment Activities

Preassessment activities, to determine the scope of injury to Trustee resources, were divided into five tasks:

Task 1: Western Snowy Plover
Task 2: Other Birds (including seabirds, waterfowl, gulls and shorebirds, and the bald eagle)
Task 3: Lost Recreational Use
Task 4: Marine and Estuarine Resources
Task 5: Oil Weathering and Fate assessment

The following is a summary of these preassessment activities. A more thorough account of these and other Trustee activities can be found in the Interim Preassessment Report *M/V New Carissa* Oil Spill, Coos Bay and Waldport, Oregon (Michel 2001).

3.1.1 Western Snowy Plover Assessment (Task 1)

The *M/V New Carissa* went aground on Coos Bay's North Spit within or adjacent to winter and breeding habitat for the western snowy plover. In fact, Coos Bay's North Spit has accounted for 46% of all snowy plover production on the Oregon coast over the previous decade (Castelein 2000). Five other snowy plover sites which were ultimately affected by *M/V New Carissa* oil lie to the north of the grounding location.

Numbers of the threatened snowy plovers are very low along the Oregon coast. Winter populations of snowy plovers have ranged from 36 to 84 during the years 1993 to 1999. The winter survey conducted in January 1999, just prior to the February incident, revealed 67 plovers using the coast of Oregon.

Additional birds begin to arrive in February and total summer snowy plover populations have ranged between 72 and 137 during the years 1993 to 1999. Due to the snowy plover's threatened status, limited numbers, and the unfortunate location of the spill in key plover habitat, Trustees felt that it was important to begin surveys immediately to document injuries to this, as well as other, species.

Trustees immediately enlisted The Nature Conservancy (TNC) to begin documenting the effects upon the plover. TNC was chosen to complete the assessment because of their experience with monitoring the plover for the Trustees for the previous ten years in Oregon. Since 1990, TNC had color banded more than 970 plovers on the Oregon coast and this information proved to be invaluable in determining the effects upon the species following the spill.

The overall purpose of the study was to document any effects of the *M/V New Carissa* oil spill on the western snowy plover. Objectives of the study were to:

- evaluate the abundance and productivity of the Oregon population of snowy plovers for the 1999 breeding season compared to data sets from the past nine years; and

- compare several metrics among individually marked oiled and non-oiled plovers to determine:

    (1) the number of plovers that were oiled, the degree of oiling each bird incurred and the chronology of oiling following the incident;

    (2) the fate of any plovers captured, cleaned, rehabilitated and subsequently released;

    (3) the disappearance rates of marked adult birds, including oiled and non-oiled individuals that were both present at the time of the incident and had nested in Oregon in 1998, and were thus expected to nest in Oregon again in 1999;

    (4) comparative productivity of oiled and non-oiled plovers, and further assess the productivity associated with varying degrees of oiling; and

    (5) specific instances where individual plovers may have been affected by the incident.

Response Efforts: On February 8, 1999 as soon as oil started to be released from the vessel, USFWS and Oregon Department of Fish and Wildlife in cooperation with the RPs, set up a Wildlife Response and Rehabilitation Mobile Facility on the North Spit of Coos Bay. Personnel from the International Bird Rescue and Research Center were mobilized to assist in oiled wildlife rehabilitation. Spill response efforts included trained wildlife survey teams to census bird populations at risk, recover dead birds, report live oiled birds for recovery and rehabilitation and census bird populations at risk. On March 3, 1999, when the bow section grounded near Waldport, a second wildlife rehabilitation facility was set up nearby (Michel 2000).

Emergency Restoration: The grounding of the *M/V New Carissa* occurred in an especially sensitive area for the western snowy plover. A number of plovers were oiled immediately after petroleum products began leaking from the stranded vessel and ultimately more than 45 western snowy plovers were oiled. Because this grounding and spill followed Oregon's worst nesting season for the snowy plover in recent years, there was grave concern among the Trustees for the plight of the species along the Oregon coast. With this in mind, the Trustees approached representatives of the RPs with a proposal to fund and implement emergency restoration measures for the species.

The specific measures (Appendix 5) were to:

- provide on-site interpretation specialists during the nesting season to increase public education/awareness of snowy plover nesting needs;
- provide law enforcement personnel to enforce public closures at snowy plover nesting areas;
- ensure important snowy plover areas were clearly marked with barriers, ropes, and signs;
- protect snowy plover nests from predators by erecting wire exclosures;
- remove some mammalian predators of snowy plovers at New River;
- create 30 acres of new snowy plover nesting habitat on the North Spit.

The Trustees and RPs co-funded implementation of the measures.

3.1.2 Other Bird Species Assessments (Task 2)

3.1.2.1 Seabirds, Gulls and Shorebirds

In addition to the western snowy plover study referenced above, the Trustees initiated a number of studies and actions to help assess the injuries to other birds:

1. *Seabird Mortality Resulting from the M/V New Carissa Oil Spill Incident, February and March 1999*. This study assessed injuries to seabirds and shorebirds as a result of the *M/V New Carissa* spill. The study used data gathered during both the spill response period and in separate field studies to estimate the total number of seabirds and shorebirds injured by the *M/V New Carissa* spill. In addition to the morgue and rehabilitation records and NOAA buoy records, sources for this study included the following:

2. *Shorebird Survey Results. M/V New Carissa Oil Spill Incident Coos Bay and Waldport, Oregon.* Purpose of this study (Jacques 1999) was to provide an estimate of the total number of live shorebirds potentially present in the spill area and susceptible to oiling, and to provide an estimate of the percentage of live shorebirds oiled during the incident.

3. *M/V New Carissa* Morgue Data. A compendium of all dead birds collected during the spill. Carcasses were maintained frozen in a locker rented by the RPs in Waldport. Trustees managed the morgue and database, with Oregon Department of Fish and

Wildlife as lead representative (Appendix 8).

4. *Distribution of Marbled Murrelets and Other Seabirds in the Vicinity of the New Carissa Shipwreck Based on Near-shore Vessel Surveys in February and March, 1999.* Purpose of this study (Strong 2000) was to determine what seabirds might be at risk from oil spilled from the *M/V New Carissa.*

5. Various wildlife observations by Trustee biologists. Unpublished data in agency files.

6. *M/V New Carissa oil spill aerial surveys of marine birds and mammals.* Aerial surveys were conducted to determine marine birds and mammals potentially susceptible to oiling from the *M/V New Carissa* (Ford 1999).

7. *Background Oiling Rate and Historic Beached Bird Deposition Rate Study* (Ford et al. 2004). The study determined the background deposition rate of bird carcasses along the Oregon coast in March of 2003 and compared it to the value used in the seabird injury model (Ford et al. 2001). As part of this investigation, the Trustees were able to determine a correction factor that could be applied to a long-term data set of bird mortality in the vicinity of Newport, Oregon. Bird mortality recorded during the spill could then be compared to this historical data.

The following study and memo as well as other observations led the Trustees to conclude that the original characterization of the *M/V New Carissa* source oils was incomplete and that further analysis of oiled feathers from birds collected during the incident could not be scientifically justified.

8. *Interpretation of Oiled Feather Data from the M/V New Carissa Spill.* Trustees initiated this blind study to verify the completeness of the oil reference samples collected during the initial days of the incident. The Trustees selected for analysis feathers from oiled birds collected proximate to either *New Carissa* grounding sites or known releases of New Carissa oil. Each sample was assigned a non-descriptive identifier and was sent to Battelle Laboratories for chemical analysis. Trustees then subsequently sent the results to Payne Environmental Consultants to determine whether the samples matched the five source oils collected from the *New Carissa* (Payne and Driskell 2003). Payne Environmental also determined the number of additional oil sources found on these birds.

9. Memo from USFWS to BLM Case Manager indicating that any further oil sampling could not be scientifically justified because the set of reference samples was incomplete.

10. Trustees' response (Ford 2004) to RPs' earlier comments (Polaris 2002) on Trustees Seabird Report (Ford 2001).

3.1.2.2 Bald Eagle

During the Waldport phase of the incident, two bald eagles were observed in the area with oil on their feathers. Trustees initiated a study to determine if bald eagles were injured by the *M/V New Carissa* oil spill.

Analysis of the Impacts of Oil on Bald Eagles Nesting in the New Carissa Incident Areas.

The study observed 10 bald eagles, 4 breeding pair and two apparently non-breeding adults, in the vicinity of the *M/V New Carissa* spill to determine any injuries caused by the incident (Anthony and Isaacs 1999).

3.1.3 Lost Recreation Assessment (Task 3)

As a result of the *M/V New Carissa* incident, beaches and areas were closed to the public in the vicinity of Coos Bay's North Spit and Dunes National Recreation Area and a series of shellfishing closures/advisories were issued for beaches and estuaries in Coos and Douglas Counties. Similarly, when the ship re-grounded near Waldport, Governor Patterson Memorial State Recreation Site was closed to the public on March 3 and shellfishing closures/advisories were issued for specific beaches and estuaries in Lincoln and Lane Counties. Trustees initiated a study (*New Carissa Recreational Loss Pre-Assessment Report*), jointly funded by the Trustees and the RPs, to document the nature and extent of recreation site closures and to document the historical recreation use levels at locations affected and potentially affected by this incident to be able to quantify the losses to the public. (Carlson and Fujimoto 2001).

3.1.4 Marine and Estuarine Resources Assessment (Task 4)

Trustees initiated and implemented a series of studies to identify injuries to marine and estuarine resources caused by the *M/V New Carissa* spill. Objectives of the studies were to identify injuries to marine and estuarine physical resources (surf-zone/estuary water and sediments) and biotic communities (shellfish, burrowing invertebrates, submerged and emergent aquatic vegetation, hard-bottom assemblages) from spilled oil from the *M/V New Carissa*. Specifics of the Trustee implemented studies (*Pre-Assessment Surveys of Marine and Estuarine Natural Resources At Risk from Damage*) can be found in Michel (2000).

3.1.5 Oil Fate and Weathering Assessment (Task 5)

Trustees initiated a compilation and analysis of the distribution and fate of oil spilled from the double grounding incident. The Trustees collected and organized all data on oil observations (over flights and SCAT surveys) sampling locations and chemical results. The study also calculated summary statistics on the areal extent of oiling by degree categories for shoreline environments, provided summaries and preliminary interpretations of chemical results and also included a model to predict the potential for impacts to water-column and benthic resources and

a preliminary assessment of those impacts. Specifics on the oil sampling and design are contained in the Interim Pre-Assessment Data Report (Michel 2000) and in *Preassessment NRDA Analysis: Preliminary Modeling of the Fates and Effects of Oil Released from the M/V New Carissa in February-March 1999* (French 1999).

The RPs independently prepared a report *Fate and Persistence of Spilled Oil, Response to the M/V New Carissa Oil Spill* (Polaris 1999) which compiled data on oil estimated to have stranded on the beaches.

3.2 Injured Natural Resources and Resource Services

3.2.1 Western Snowy Plover

Stern et al. (2000) provide a complete assessment of impacts to the western snowy plover as a result of the *M/V New Carissa* incident. Their findings are summarized here.

Oiled snowy plovers were first observed on February 8, the day after the ship began releasing oil. During the period of February 8 to April 18, 1999, a total of 45 different banded snowy plovers were observed with some degree of oiling, representing 62% of the total (73) banded snowy plovers observed during that time period. Table 1 summarizes the degree of oiling of these 45 birds.

Table 1: Maximum level of oiling of 45 banded snowy plovers observed from February 8 to April 15, 1999, Oregon coast, as a result of the *M/V New Carissa* spill.

Level of Oiling[3]	**Number of Banded Snowy Plovers**
1 (light)	28
2	11
3	6
4 (severe)	0
Total	**45**

During that same time period, researchers estimated that there were an additional 17 to18 unbanded plovers and at least 7 of these were oiled resulting in a minimum of 57 to 58% (52/90 or 91) of all known snowy plovers on the Oregon coast affected directly by oil.

[3]See Stern et al. (2000) for specific descriptions of the various levels.

Seventeen of the more heavily oiled birds were captured and transported to a mobile rehabilitation center on the North Spit operated by the International Bird Rescue Research Center. Following treatment, all birds were released by March 7 to areas where the likelihood of re-oiling was reduced.

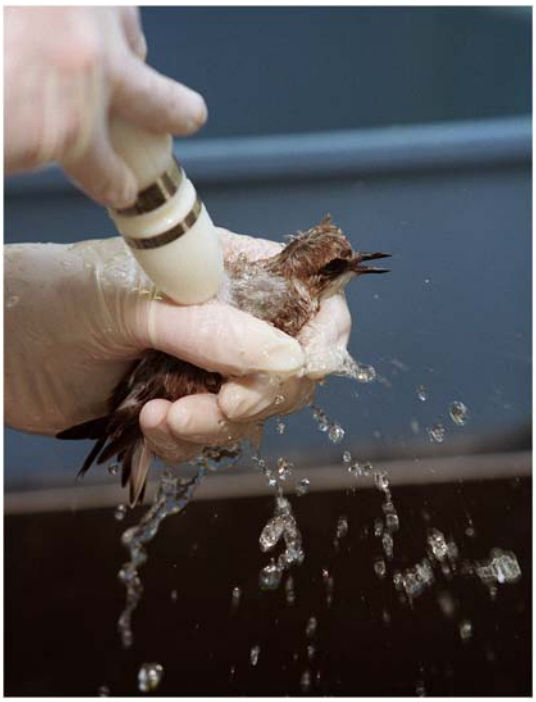

Figure 8: Western snowy plover being cleaned at International Bird Rescue Research Center facility on Coos Bay's North Spit

Based on analyses of historical data and data collected during this study by TNC, Stern et al. (2000) made the following conclusions regarding snowy plovers in Oregon following the *M/V New Carissa* spill:

Distribution. The distribution and relative abundance of snowy plovers at coastal sites in Oregon for 1999 was similar to what has been observed in the past years, with a majority of the plovers occurring at sites within three stretches of beach.

Nesting Activity. The timing and magnitude of nesting activity in 1999 was within the 95% confidence intervals of the previous six years, 1993 to 1998.

Nests. The total number of nests found in 1999 was identical to 1998. However, the South Beach nesting area of the North Spit had no nests for the first time since 1990. The South Beach nesting area was closest to and most directly impacted by oil released from the *M/V New Carissa* grounding as well as subsequent monitoring, cleanup, and salvage activities.

Nest Success. Nest success for snowy plovers along the Oregon coast in 1999 was 56% based on apparent nest success (nests hatched / nests found = 44/78), and 61% using the Mayfield method. Overall nest success in 1999 was nearly identical to 1998; both 1998 and 1999 were higher than the 10 year mean but within limits of one standard deviation (44.9% +/-17.8%).

Nest Failure. Known nest failures appeared to have no relation to the oil spill.

Fledging Success. Fledging success (young fledged/eggs hatched) for the 1999 breeding season was 43%, and while slightly higher than the long term mean fledging success for 1991 to 1999, was within the 95% confidence interval. Production was especially high on the Coos Bay's North Spit Habitat Restoration Areas (HRAs) although notably there were no young fledged on the South Beach of Coos Bay's North Spit for the first year since 1990. The South Beach was the closest nesting area to the wreck and, despite it being closed to the public, experienced heavy oil spill response activity.

Rehabilitated Plovers. Seven of the 17 oiled plovers that were trapped, rehabilitated and then released remained on the Oregon coast and nested. Another five of the 17 were sighted multiple times through March but then all were only sporadically sighted through the nesting season. Researchers felt that these 5 left the Oregon coast and nested elsewhere, returning to Oregon in late summer. One plover was found dead and a necropsy indicated that it may have died of a condition not related to the oiling or rehabilitation, but the results were inconclusive. The fate of the remaining four is less certain; two have not been observed since their release on March 7. An additional two, although re-sighted several times shortly after their release, have not been observed since March 21 and 25, 1999 respectively, and have remained unaccounted for through January 2005 and likely perished as a result of the incident.

Presence/Absence of Oiled and Non-oiled Breeding Plovers. Three marked plovers, known to be present in January, were never seen again following the spill and may have perished as a result of it. Conspicuously missing was the female that had been sighted with six other plovers in January on the Coos Bay's North Spit in the immediate vicinity of the oil release.

Another conspicuous absence was a severely oiled (level IV) unbanded plover originally observed as part of a large flock at North Siltcoos on February 16, 1999. A follow-up visit the next day to capture the bird for rehabilitation found the original group of plovers, but not the severely oiled bird, nor was it sighted subsequently.

No nesting was detected for three additional plovers that had been oiled and remained along the Oregon coast and were observed regularly during the breeding season.

Productivity of Oiled and Non-oiled Plovers. Generally, oiled and rehabilitated plovers produced equal to, or in some instances, better than non-oiled plovers. The only notable exception was that the percent of egg hatching for both male and female rehabilitated plovers was less than that of non-oiled or oiled (and not rehabilitated) plovers (Stern et al. 2001).

There was no apparent difference in nest success among oiled and non-oiled plovers and no apparent adverse effect due to the degree of oiling, a finding which may be tied to the success of the emergency restoration.

Productivity of Oiled and Non-oiled Plovers in 1998 and 1999. Virtually all measures of productivity for oiled plovers were equal to or higher than for the non-oiled group. The non-oiled plovers appeared to be more productive in 1998 than 1999, while productivity for the oiled plovers was higher in 1999 than 1998. These differences in productivity appear to be associated with individual nesting sites rather than patterns of oiling.

Overall Effects of Spill on Snowy Plovers

- At the population level, the abundance and productivity of snowy plovers breeding along the Oregon coast in 1999 was comparable to past years and generally did not appear to be impacted by the *M/V New Carissa* incident. This may, in part, be due to the emergency restoration measures enacted by the Trustees and Responsible Parties.

- For the first time since 1990, there was no nesting by plovers and only extremely limited use by plover broods, on Coos Bay's North Spit South Beach, the area most immediate to the *M/V New Carissa* incident and associated response activity. However, despite this, no specific loss of production was documented as birds nested and raised broods very successfully in the adjacent HRA.

- Three marked birds present in January and not sighted again, may have perished as a result of the spill; one of these in particular, a female sighted with six other plovers on the North Spit in the immediate vicinity of the oil release, is considered a likely fatality.

- A severely oiled unbanded plover with a large flock of others at North Siltcoos on February 16 likely perished as a result of the incident.

- Four of the rehabilitated birds may have perished as a result of the incident: two have never been sighted since their release and likely perished; the other two were sighted through late March, 1999 and have not been sighted again, putting their fate in question.

Table 2: Summary of Overall Effects of the *M/V New Carissa* incident on western snowy plovers on the Oregon Coast.

Snowy Plover Component	**Circumstances**	***May Have Perished* as a Result of Incident**	***Likely Perished* as a Result of Incident**
Population Level	No overall effect detected		
South Beach North Spit non-nesting	No documented effect on number of plovers		
Three marked birds	Seen in January 1999, but not sighted after initial spill	Two birds	One female sighted on North Spit prior to grounding
One severely oiled bird	Seen at Siltcoos on Feb. 16, 1999 but not next day		One severely oiled bird
Four rehabilitated birds	Two re-sighted since their release; two not observed	Two re-sighted plovers	Two unobserved plovers
Summary		**Four plovers**	**Four plovers**

Western Snowy Plover Emergency Habitat Restoration

As part of emergency restoration, representatives of the RPs contributed toward creating nesting habitat for the snowy plover on Coos Bay's North Spit (Figure 9). Although the RPs' contribution in heavy equipment and manpower accounted for only 30% of the total nesting habitat restoration costs of completing the 1998 HRA[4], they also contributed substantial funds ($87,000) for predator management, signs, fencing, and enforcement personnel for nesting areas along the Oregon coast.

[4] Work on the 1998 HRA was initiated by the BLM in the fall of 1998 and was finished in the spring of 1999 as part of the emergency restoration by a contractor funded by the RPs and supervised by the BLM.

Figure 9: Emergency Restoration for the western snowy plover on Coos Bay's North Spit

Table 3 lists snowy plover production figures for the 1998 HRA (Lauten pers. comm.).

Table 3: Western snowy plover production on 1998 HRA (1999-2001)

Year	# Nests	# Nests Hatching	# Fledglings
1999	0	0	0
2000	2	1	1
2001	5	2	1

Western Snowy Plover Restoration Scaling

A Resource Equivalency Analysis (REA) was used to scale the snowy plover injury. Typically scaling (quantifying the resources lost as a result of the spill and quantifying the appropriate amount of restoration selected to offset the resource losses) is done prior to the restoration and is

used to determine the amount and type of restoration needed to offset the injury. Since the Emergency Restoration was completed within a few months of the incident, the scaling was done after the restoration was completed. Consequently the western snowy plover scaling, unlike the other scaling for this case, was done with data from the completed restoration, and determined if the emergency restoration that was completed was enough to offset the losses to the plovers from the spill.

The REA was based on estimates that 4 to 8 western snowy plovers perished as a result of the incident and that the restoration area would produce from 1 to 2 fledglings per year for the life of the project. Every envisioned outcome, except for the very unlikely worst-case scenario[5], indicated that the emergency restoration compensated for the original injury (Skrabis 2005). However, the annual habitat maintenance work, needed to ensure that the habitat continues to function as productive, nesting habitat, was not funded under the emergency restoration measures. It will need to be funded for the restoration to compensate for the original injury.

3.2.2 Injury to Seabirds and Shorebirds (other than Western Snowy Plover)

During the response efforts, Trustees, contractors, and representatives of the RPs collected a total of 1,314 dead birds on Oregon beaches (ODFW 1999). However, because many of the birds typically killed by an oil spill do not end up on the beaches, and some of those that end up on the beach are not collected, the Trustees conducted additional work to estimate the actual number of birds killed by the spill (Figure 10).

Birds oiled by the *M/V New Carissa* spill met with one of three potential fates: (1) they died and were not recovered; (2) they died and were recovered; or (3) they were recovered, rehabilitated and survived. Detailed records were kept in morgue and rehabilitation databases regarding the number of dead and injured birds collected during the spill; however, the number of unrecovered birds and the total number of birds experiencing sub lethal impacts could not be directly observed and quantified. To address this, Ford (2001) used data collected during the response phase of the incident and data from post response studies to arrive at an estimate of the total number of birds adversely impacted by the *M/V New Carissa* oil spill. In addition to the morgue and rehabilitation records, data sources from the response phase included: (1) offshore (aerial and boat) surveys for seabirds; (2) beach surveys for live and dead birds; (3) spill response beach surveys (SCAT) for live and dead birds; (4) shorebird population and oiling surveys; (5) oil fate and weathering studies; and (6) data from NOAA buoy. Following the spill, Trustees conducted studies to determine: (1) bird carcass deposition rates; (2) bird carcass scavenging rates; and (3) background oiling rate of seabirds using current and historical data (Ford 2004).

[5] The worst-case scenario would be that eight plovers were killed and their fledglings would have had the highest survival rate under their pre-spill natural conditions and only 1 snowy plover per year would be fledged from the HRA and those fledglings would have the lowest survival rate.

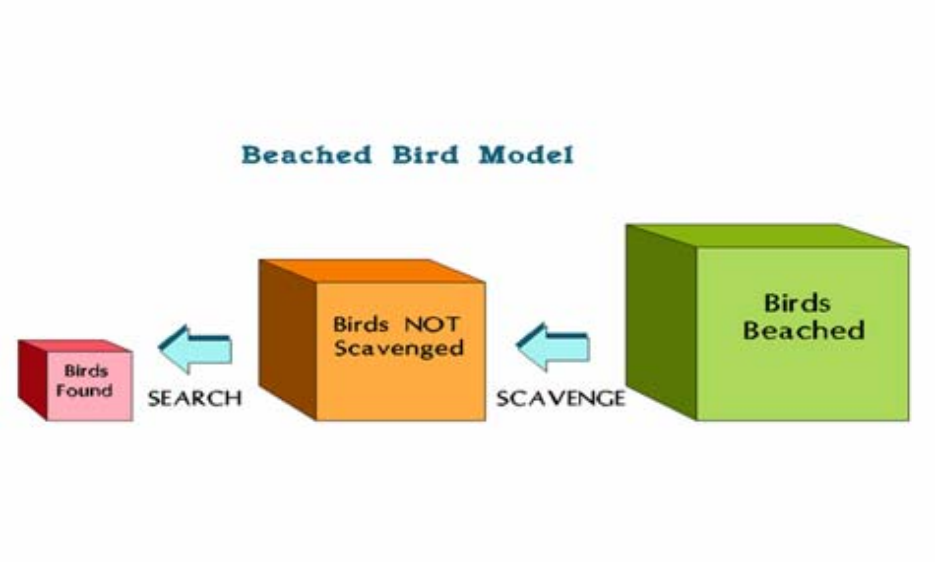

Figure 10: Depiction of the typical relationship used in the beached bird model between the relative number of dead birds beached and the relative number of dead birds ultimately found by searchers following an oil spill (Ford pers. comm.).

3.2.2.1 Seabird and Waterfowl Mortality

Ford (2001) estimated seabird mortality by size class and for selected species. These estimates are included in Tables 4 and 5.

Table 4: Estimates of total mortality for seabirds by size class (Ford et al. 2001)

Bird Size Class	Number Recovered[6]	Corrected Total[7]	Mortality Attributed to *M/V New Carissa*[8]
Large	993	2,728	1,547
Small	88	1,257	713
Unknown	51	140	79
Land Birds	8	0	0
Unsearched Areas	0	33	19
Total	**1,140**	**4,158**	**2,358**

[6] Number of birds actually recovered and placed in the bird morgue.
[7] Total number of birds which accounts for birds scavenged, birds missed by searchers and background natural deposition rate (the rate at which dead birds typically wash up onto beaches when no oil spill is present).
[8] Corrected total minus background natural deposition rate.

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Table 5: Estimates of total mortality and injury for seabird species and seabird groups from the *M/V New Carissa* spill (Ford et al. 2001).

Species	Number Recovered[9]	Corrected Total[10]	Mortality Attributed to M/V New Carissa[11]	Injury Attributed to M/V New Carissa[12]	Total Number Killed or Injured	Species-group	Total Number Killed or Injured
Common Loon	58	159	90	2	92	Loons	127
Pacific Loon	11	30	17	0	17		
Red-throated Loon	9	25	14	1	15		
unknown Loon	2	5	3	0	3		
Western Grebe	64	144	82	3	85	Grebes	112
Horned Grebe	8	18	10	1	11		
Red-necked Grebe	3	7	4	1	5		
Eared Grebe	2	4	3	0	3		
unknown Grebe	6	14	8	0	8		
Brandt's Cormorant	84	280	159	1	160	Cormorants	180
Double-crested Cormorant	1	3	2	1	3		
Pelagic Cormorant	2	7	4	0	4		
unknown Cormorant	7	23	13	0	13		
Common Murre	83	236	134	26	160	Murres & Puffins	226
unknown Murre	1	3	2	0	2		

[9] Number of birds actually recovered and placed in the bird morgue.
[10] Total number of birds which includes birds scavenged, birds missed by searchers and background natural deposition rate.
[11] Corrected total minus background natural deposition rate.
[12] Birds observed oiled but not captured or birds treated and released by rehabilitators.

Table 5: Estimates of total mortality and injury for seabird species and seabird groups from the *M/V New Carissa* spill (Ford et al. 2001).

Species	Number Recovered[9]	Corrected Total[10]	Mortality Attributed to M/V New Carissa[11]	Injury Attributed to M/V New Carissa[12]	Total Number Killed or Injured	Species-group	Total Number Killed or Injured
Horned Puffin	20	103	58	0	58		
Tufted Puffin	1	5	3	0	3		
unknown Puffin	1	5	3	0	3		
Cassin's Auklet	36	480	272	0	272	Auklets & Ancient Murrelets	588
Parakeet Auklet	3	8	5	0	5		
Rhinoceros Auklet	159	443	251	1	252		
unknown Alcids	12	33	19	0	19		
Ancient Murrelet	4	87	40	0	40		
Marbled Murrelet	26	565	262	0	262	Marbled Murrelets	262
Bufflehead	4	12	7	0	7	Ducks & Scoters	414
Wood Duck	1	3	2	0	2		
Mallard	1	3	2	0	2		
Greater Scaup	1	3	2	0	2		
unknown Duck	3	9	5	0	5		
American Coot	2	6	3	0	3		
Surf Scoter	131	375	213	17	230		
White-winged Scoter	41	181	103	23	126		
Black Scoter	5	15	9	5	14		
unknown Scoter	13	39	22	0	22		

Table 5: Estimates of total mortality and injury for seabird species and seabird groups from the *M/V New Carissa* spill (Ford et al. 2001).

Species	Number Recovered[9]	Corrected Total[10]	Mortality Attributed to M/V New Carissa[11]	Injury Attributed to M/V New Carissa[12]	Total Number Killed or Injured	Species-group	Total Number Killed or Injured
Short-tailed Shearwater	3	9	5	0	5	Shearwaters & Storm-petrels	36
Sooty Shearwater	3	9	5	0	5		
Wedge-tailed Shearwater	1	3	2	0	2		
Fork-tailed Storm-petrel	9	27	15	0	15		
Leach's Storm-petrel	5	15	9	0	9		
Northern Fulmar	109	313	178	1	179	Fulmars	179
Western Gull	39	114	65	7	72	Gulls & Kittiwakes	341
Glaucous-winged Gull	7	20	12	3	15		
GW/WG Hybrid	9	26	15	1	16		
Herring Gull	3	9	5	0	5		
Mew Gull	2	6	3	0	3		
Bonaparte's Gull	1	3	2	0	2		
unknown Gull	21	61	35	72	107		
Black-legged Kittiwake	67	206	117	2	119		
Red-legged Kittiwake	1	3	2	0	2		
Total	**1085**	**4157**	**2296**	**168**	**2465**		**2465**

3.2.2.2 Shorebirds and Gulls

While a large portion of birds oiled in the *M/V New Carissa* oil spill can be accounted for by examining morgue and rehabilitation center records, many birds were observed on the shoreline with oil on them but were not recovered. Therefore, the number that ultimately perished cannot be extrapolated simply by using the method used for seabirds which relies on having birds in hand. Following coastal or marine oil spills, it is common to observe large numbers of visibly oiled birds, primarily gulls and shorebirds, roosting on shore. Because these primarily land birds are more apt to move away from the water and the beaches, and because shorebirds are so small and are easily missed, usually only a fraction of these birds are captured or recovered dead. Some of these oiled birds probably die where they cannot be located, while others survive but experience deleterious sub-lethal effects, often for more than one nesting season (Ford et al. 2001).

To more accurately estimate the number of shorebirds and gulls oiled by the *M/V New Carissa,* Ford relied on surveys conducted during the incident (Phillips 1999 and Pitkin 1999) (Jacques 1999). These surveys recorded the total number of shorebirds observed in the incident area (97% were sanderlings) and the percentage within each flock that were oiled. From these data, Ford (2001) estimated that between 460 to 809 shorebirds and 35 to 108 gulls were oiled during the *M/V New Carissa* incident (Table 6).

Table 6: Estimated number of shorebirds and gulls oiled during the *M/V New Carissa* oil spill on the Oregon coast (Ford et al. 2001).

Northern Segment Extent	Southern Segment Extent	Total Shorebirds Oiled	Total Gulls Oiled
Otter Rock	Newport	0	1-3
Thiel Creek Coastal	Yachats Coastal	250-439	13-40
Yachats River Coastal	Heceta Head	22-39	5-15
Horse Creek Coastal	Siuslaw River Coastal	30-53	0-1
Woahink	Threemile Coastal	67-119	1-4
Umpqua River Coastal	Hauser	73-128	13-40
Horsfall Beach	Bastendorf Beach	18-31	2-6
Total		**460-809**	**35-109**

3.2.2.3 Bald Eagle

During the initial assessment in early March, Anthony and Isaacs (1999) observed 10 bald eagles in the Waldport incident area. Eight were members of four breeding pairs, and two apparently were non-breeding subadults. Researchers detected oil only on the female at the Beaver Creek nest site. Other than being visibly oiled, she appeared healthy and seemed to behave normally. All four pairs were exhibiting normal pre-nesting behavior.

As of late August 1999, Anthony and Isaacs determined that three of the five bald eagle nests checked in the area of the *M/V New Carissa* spill failed, a 60% failure rate for the five nests examined. Average failure rate for Bald Eagle Recovery Zone 13 (where all 5 nests resided) was 40% for 1971 to 1998 (Anthony and Isaacs 1999).

To determine if oil contamination was a possible cause of nesting failure for the three subject sites (Alsea Bay, Beaver Creek and Yaquina Bay) researchers climbed nest trees and searched nests for evidence of oil. No visible oil was detected, but trace organic chemistry studies were not conducted.

Although the Trustees could not conclusively rule out oil contamination as a factor in the three bald eagle nest failures, we have concluded that at this point there was no direct evidence the *M/V New Carissa* incident caused the failures. Due to the lack of obvious direct evidence and the limited scope of the potential injury, the Trustees decided not to pursue this potential injury further.

3.2.3 Public Recreational Use

After determining historic human use levels for the corresponding times of the year for the North Spit, Oregon Dunes National Recreation Area (ODNRA), Governor Patterson Memorial State Recreation Site, and other coastal and estuarine areas affected by the various closures associated with the *M/V New Carissa* oil spill, Trustees (Carlson and Fujimoto 2001) estimated the number of recreation trips affected by the closures attributable to the incident (Tables 7 and 8). In total, the Trustees estimated that 27,974 to 29,204 public recreational trips were affected by the *M/V New Carissa* incident.

Table 7: Information on Closures resulting from the *M/V New Carissa* incident.

Affected Area	Closure Date	Opening Date	Types of Activities	Estimated Number of Affected Trips
North Spit (Full Closure)	February 4th	March 25th	Off Hwy Vehicles Wildlife Viewing Horse Riding Target Shooting Day Hiking, Surfing Clamming Crabbing/Fishing	3,968 Lost Trips
North Spit (Partial Re-opening)	March 26th	August 1st	See Above	4,491 Lost Trips
North Spit (Limited Access)	August 2nd	September 15th	See Above	690-920 Lost Trips

ODNRA Horsfall	February 4th	March 5th	Camping Off Hwy Vehicles Horse Camping / Horse Riding Shellfish Harvesting Beach Combing Wildlife Viewing	10,125 Lost Trips
ODNRA Beach and Coast Guard Road between Horsfall and Tenmile Creek	February 12th	February 21st	Off Hwy Vehicles Shellfish Harvesting Beach Combing	1,000 Diminished Trips
ODNRA Umpqua Beach Parking Lot #2 and south[13]	February 21st	April 16th	Wildlife Viewing Beach Combing Off Hwy Vehicles Picnicking Sight-seeing Shellfish Harvesting	3,550 Lost Trips
Governor Patterson Memorial State Recreation Site	March 3rd	March 10th	Beach Combing Picnicking Sight-seeing	3,950 Lost Trips

[13] Area was also closed due to high water in February and March.

Table 8. Recreational Shellfish Harvesting Losses from the *M/V New Carissa* spill.

Coos and Douglas Co. Beaches Closure	February 11th	March 3rd	100-500 Lost Trips
Bastendorf Beach Closure	February 11th	March 22nd	
North Spit - Grounding Site Closure (access through BLM areas)	February 11th	Ongoing	
Lower Coos Bay (Downstream of railroad bridge) and Charleston Boat Basin (downstream of Charleston Bridge)	February 12th	March 4th	
Yaquina Bay Closure	March 4th	March 8th	
Alsea Bay Closure	March 4th	March 22nd	
Winchester Bay Advisory	February 12th	March 4th	
Bays and Beaches in Lane and Lincoln Co. Advisory	March 3rd	March 22nd (Lincoln Co. Beaches also closed due to presence of domoic acid)	
Alsea Bay and Yaquina Bay Advisory	March 3rd	March 3rd (Changed to closure on the 4th)	
Coos Bay and Winchester Bay	February 12th	March 4th	100 – 700 Lost Trips
Total Lost Trips			**26,974 – 28,204**
Total Diminished Trips			**1,000**
Overall Total Lost and Diminished Trips			**27,974 – 29,204**

3.2.4 Marine and Estuarine Resources

Substantial effort was invested in collecting multiple water, substrate, and organism samples in various locations and to model the path and impacts of the oil as it moved along the coast and through the water column (Michel 2000). These studies indicated that a limited biomass of a few mussel and clam samples had some hydrocarbon residue, and overall, the hydrocarbon levels were low. Consequently, the Trustees decided not to pursue this injury further.