# Appendix A

## Listed/Proposed Threatened and Endangered Species for Humboldt and Del Norte Counties (Candidates Included)

| TYPE | | SCIENTIFIC NAME | COMMON NAME | CATEGORY | CRITICAL HABITAT |
|---|---|---|---|---|---|
| **Plants** | | | | | |
| | | *Erysimum menziesii* | Menzies' wallflower | E | N |
| | | *Layia carnosa* | beach layia | E | N |
| | | *Lilium occidentale* | western lily | E | N |
| | | *Thlaspi californicum* | Kneeland Prairie penny-cress | E | Y |
| | | *Arabis macdonaldiana* | MacDonald's rock-cress | E | N |
| **Invertebrates** | | | | | |
| | | *Polites Mardon* | mardon skipper | C | N |
| | | *Speyeria zerene hippolyta* | Oregon silverspot butterfly | T | Y |
| **Fish** | | | | | |
| | | *Eucyclogobius newberryi* | tidewater goby | E | Y |
| | * | *Oncorhynchus kisutch* | S. OR/N. CA coho salmon | T | Y |
| | * | *Oncorhynchus mykiss* | Northern California steelhead | T | N |
| | * | *Oncorhynchus tshawytscha* | CA coastal chinook salmon | T | N |
| **Reptiles** | | | | | |
| | * | *Dermochelys coriacea* | leatherback turtle | E | Y |
| | * | *Caretta caretta* | loggerhead turtle | T | N |
| | * | *Chelonia mydas (incl. agassizi)* | green turtle | T | N |
| | * | *Lepidochelys olivacea* | olive (=Pacific) ridley sea turtle | T | N |
| **Birds** | | | | | |
| | | *Coccyzus americanus* | Western yellow-billed cuckoo | C | N |
| | | *Pelecanus occidentalis californicus* | California brown pelican | E | N |
| | | *Phoebastris albatrus* | short-tailed albatross | E | N |
| | | *Strix occidentalis caurina* | northern spotted owl | T | Y |
| | | *Haliaeetus leucocephalus* | bald eagle | T | N |
| | | *Charadrius alexandrinus nivosus* | western snowy plover | T | Y |
| | | *Brachyramphus marmoratus* | marbled Murrelet | T | Y |
| **Mammals** | | | | | |
| | * | *Balaenoptera musculus* | blue whale | E | N |
| | * | *Megaptera novaengliae* | humpback whale | E | N |
| | * | *Balaenoptera physalus* | fin whale | E | N |
| | * | *Balaenoptera borealis* | sei whale | E | N |
| | * | *Physeter macrocephalus* | sperm whale | E | N |
| | * | *Eumetopias jubatus* | Steller (=northern) sea-lion | T | Y |
| | | *Martes pennanti pacifica* | Pacific fisher | C | N |

| KEY: | | |
|---|---|---|
| | (PE) Proposed Endangered | Proposed in the Federal Register as being in danger of extinction |
| | (PT) Proposed Threatened | Proposed as likely to become endangered within the foreseeable future |
| | (E) Endangered | Listed in the Federal Register as being in danger of extinction |
| | (T) Threatened | Listed as likely to become endangered within the foreseeable future |
| | (C) Candidate | Candidate which may become a proposed species |
| | Critical Habitat | Y = Designated, P = Proposed, N = None Designated |

* Denotes a species Listed by the National Marine Fisheries Service

**Appendix B**

**Resource Equivalency Analysis (REA) Method**

**Background**
There are two basic approaches to measuring the compensation for natural resources injuries. One is to focus on the demand side, the "consumer valuation approach"; the other is to focus on the supply side, the "replacement cost" approach. In the former, we seek to measure the monetary value that the public puts on the natural resources (i.e., how much the public demands the services of natural resources); in the latter, we seek to measure how much it costs to replace the natural resource services that the public loses as a result of the injury (i.e., how much it costs to supply natural resource services). See the Glossary for complete definitions of some of the terms used here.

**FIGURE 1:** Consumer Valuation versus Replacement Cost Approaches for Natural Resource Damage Calculation

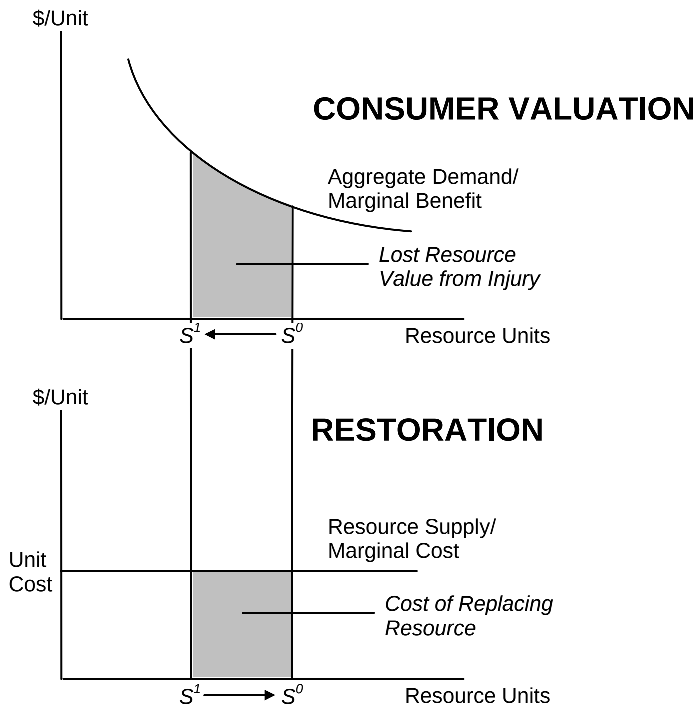


Figure 1 illustrates the difference between these two approaches. In both graphs, the supply of natural resources shifts from $S^0$ to $S^1$ as a result of an incident (e.g., oil spill, sediment discharge into a stream, illegal removal of vegetation). The shaded area in the top graph illustrates the dollar value of the resource loss as measured by the monetary payment that would make the public indifferent to the incident. For example, if each individual in a 30 million person society would need a $.05 payment (on average) to make them indifferent to the resource loss, the shaded area in the top graph would equal $1.5 million. Because the difficulty in observing market prices that reveal the level of cash payment that would compensate individuals for resource losses, the quantitative characteristics of the demand curve(s), and consequently the size of the shaded area in the upper graph, are difficult to measure. Contingent Valuation (CV) and other types of analyses are designed to estimate this dollar value. These methodologies typically involve large surveys and can be costly.

The lower graph illustrates a replacement cost approach. Beyond noting that the injured resource has value, the actual extent to which the public values it is not directly considered. Instead, the determination of adequate compensation depends on the level of natural resource provision (versus monetary payments) that compensates society for what it has lost as a result of the incident. The cost of providing this compensation becomes the estimate of damages. Resource Equivalency Analysis (REA) is the primary methodology for conducting this type of measurement in natural resource damage assessment. It is depicted by a resource supply shift in the lower graph from $S^1$ back to $S^0$. The shaded area is the total monetary cost of funding the supply shift. For example, if 2 acres of wetland enhancement are estimated to compensate for an incident that temporarily reduced the service value of 1 acre of wetland habitat, the cost of performing 2 acres of wetland enhancement becomes the estimate of damages.

It is clear from Figure 1 that the public's valuation of the resource (the shaded area in the top graph) is not necessarily equal to the total replacement cost (the shaded area in the bottom graph). This is especially true when unique resources or rare species are involved, as the slope of the aggregate demand curve (top figure) may be much steeper due to resource scarcity. This would result in a much larger monetary payment being necessary to compensate the public. In such a case, the replacement cost approach of REA may result in damages far less than the losses as valued by the public. However, because it is easier and less costly to measure the total replacement cost than the total public value, REA has an advantage over other methods, especially for small to medium-sized incidents with minimal impact on rare species.

**Resource Equivalency Analysis**

In this assessment, REA has been used to determining compensatory damages. This method is relatively inexpensive and relies primarily on biological information collected in the course of determining natural resource injuries caused by the spill. It is consistent with approaches recommended in the language of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Oil Pollution Act of 1990 (OPA).

REA involves determining the amount of "natural resource services" that the affected resources would have provided had it not been injured, and it equates the quantity of lost services with those created by proposed compensatory restoration projects that would provide similar services. The unit of measure may be acre-years, stream feet-years, or some other metric. The size of the restoration project is scaled to the injury first; the cost of restoration is then calculated after the scaling has been done. The cost of restoring a comparable amount of resources to those lost or injured is the basis for the compensatory damages. In this sense, REA calculates the *replacement cost* of the lost years of natural resource services.

Future years are discounted at 3% per year, consistent with National Oceanic and Atmospheric Administration recommendations for natural resource damage assessments. Discounting of future years is done based on the assumption that present services are more valuable than future services. When it comes to natural resources, the question of whether or not society should value the present more than future is a philosophical question (e.g., one can recall the "greenhouse effect" and the question of how much expense we should incur today to preserve the future). However, the question of how much society actually discounts the value of future natural resources is an empirical one. The 3% figure is currently the standard accepted discount rate for natural resource damage assessments.

REA involves three steps: 1) the debit calculation, 2) the credit calculation, 3) the computation of the costs of restoration. These calculations may be done in a variety of ways, but the most common are to estimate the injury and the restoration benefits in terms of area years of habitat or animal years.

**Habitat Example**

For example, suppose a 10-acre area is degraded due to an oil spill such that it supplies only 30% of its previous habitat services during the year following the incident. In the second year after the incident, the habitat begins to recover, supplying 90% of its baseline services. By the third year it is fully recovered. In this case, the lost acre years of habitat services would be 70% x 10 acres x 1 year + 10% x 10 acres x 1 year = 8 acre years of habitat services. Figure 2 illustrates this example by showing the recovery path of the habitat over time.

As stated above, future years are discounted at a 3% rate, thus the injuries in the second year count a little less. Incorporating this, 7.97 acre years of habitat services were lost. This difference appears minimal here, but becomes significant (due to compounding) if injuries persist many years into the future.

The credit calculation focuses on the gain in habitat services that result from a restoration project. Creating acre years of habitat services is a function of both area and time. Hypothetically, compensation could involve taking 7.97 acres of land with no habitat value (e.g., a parking lot) and turning it into productive habitat for 1 year. Alternatively, we could achieve compensation by creating 1 acre for 7.97 years. In reality, most restoration projects involve taking previously degraded habitat (at another nearby location) and restoring it over a number of years, and maintaining it into the future.

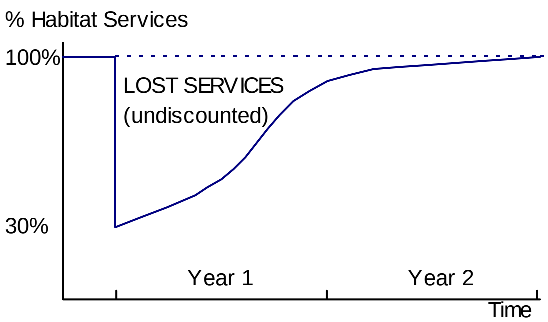


**FIGURE 2:** Biological Injury and Recovery

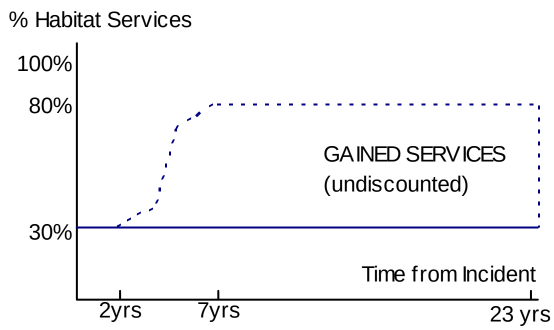


**FIGURE 3:** Restoration Trajectory/Credit

Suppose the restoration project improves the quality of a nearby degraded area, so that, if it previously provided only 30% of potential services, it would provide 80% of potential habitat services after restoration. Also suppose the project begins two years after the incident and it takes an additional 5 years for the 80% level to be achieved. Figure 3 provides an illustration of this restoration trajectory. In our hypothetical example, the project is expected to have a lifespan of 20 years. Note that, with future years discounted, the 20th year of the project (22-23 years after the incident) counts little; years after that are effectively completely discounted due to uncertainty regarding the future.

Mathematically, we seek to restore an area that will provide 7.97 acre years of services over the discounted 20-year phased-in life span of the restoration project. In this example, that would be an area of about 1.3 acres. That is to say, restoration of 1.3 acres for 20 years would compensate the public for the 7.96 lost acre years of habitat services due to the spill. Visually, the area identified in Figure 3 (multiplied by the affected acres and calculated to measure the present discounted value) should equal the area identified in Figure 4 (again, multiplied by the acres targeted for restoration and calculated to measure the present discounted value, thus discounting future years).

The percentage of habitat services lost (or gained, in the case of the restoration project) may be measured in a variety of ways. For our hypothetical oil spill case, three examples might include (1) the use of a habitat-wide evaluation index, (2) the use of one or more surrogate species, or (3) the use of an estimate based on the degree of oiling. Care must be taken when using a surrogate species to represent the entire affected habitat. Ideally, this surrogate is the population of one or more species that is immobile (that is, the animals do not move easily in and out of the affected area) and that has significant forward and/or backward ecological links to other species in the affected ecosystem. For example, the population of red crossbills, a bird that feeds primarily on pine cone seeds and migrates erratically from year to year, would be a poor surrogate for measuring injuries to a streambed. The aquatic macroinvertebrate community within the stream, however, provides an ideal surrogate, as they play a key role in the streambed food chain. Likewise, on the restoration side, care must taken when the project targets one or a few species rather than the entire habitat. Ideally, a project that seeks to restore the population of a key indicator species will also benefit the entire habitat and, thus, other species as well. Indeed, such projects typically focus directly on habitat improvements. However, it is important to verify that such a species-centered project is indeed benefiting the entire habitat.

**Animal Example**

When the injury is primarily to individual animals rather than a complete habitat, the REA may focus on lost animal-years. For example, suppose an oil spill causes negligible injury to a body of water, but results in the death of 100 ducks. Using information about the life history of the ducks (e.g., annual survival rate, average life expectancy, average fledging rate, etc.), we can estimate the "lost duck years" due to the spill. On the credit side, we can examine restoration projects designed to create duck nesting habitat and scale the size of the project such that it creates as many duck years as were lost in the incident.

**Restoration Costs = Natural Resource Damages**

Once the proposed restoration projects are scaled such that they will provide services equal to those lost due to the incident, the cost of the projects can be calculated. Note that this is the first time dollar figures enter the REA process. Until now, all the calculations of the "equivalency" have been in terms of years of resource services. The cost of the restoration projects is the compensatory damage of the incident.

Prepared by:

Steve Hampton, Ph.D.
Matthew Zafonte, Ph.D.
California Department of Fish and Game
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*For another explanation of the REA methodology (in its more specific form for habitats), see "Habitat Equivalency Analysis: An Overview", prepared by NOAA. Copies of this document are available at http://www.darp.noaa.gov/publicat.htm*

## GLOSSARY

**Aggregate demand**

the demand of all consumers combined; e.g., if there are 20,000 people in a town and each person demands two pieces of bread each day, the aggregate demand is 40,000 pieces of bread per day.

**Compensatory restoration**

a restoration project which seeks to compensate the public for temporal or permanent injuries to natural resources; e.g., if a marsh is injured by an oil spill and recovers slowly over ten years, a compensatory project (which may be off site) seeks to compensate the public for the ten years of diminished natural resources.

**Discount rate**

the rate at which the future is discounted, i.e., the rate at which the future does not count as much as the present; e.g., a dollar a year from now is worth less than a dollar today; if the bank offers a 3% rate, whereby $1.00 becomes $1.03 in one year, the future was discounted at 3%.

**Primary restoration**

a restoration project which seeks to help an injured area recover more quickly from an injury; e.g., if a marsh is injured by an oil spill and would recover slowly over ten years if left alone, a primary restoration project might seek to speed the recovery time of the marsh and achieve full recovery after five years.

**Replacement cost**

the cost of replacing that which was lost; e.g., if fifty acre-years of habitat services were lost due to an oil spill, the cost of creating fifty acre-years of similar habitat services would be the replacement cost.

## Appendix C

## Demographic Parameters for Calculation of Lost Bird-Years

**TABLE 1: Potential Proxy Species for Bird Injury Calculations**

| Bird Category | Species Suffering Mortality from Stuyvesant Spill | Potential Source of Demographic Parameters |
|---|---|---|
| Grebes | Western Grebe<br>Eared Grebe<br>Pie-billed Grebe<br>Unknown Grebe | *North Cape* Grebe |
| Loons | Common Loon<br>Red-throated Loon | *North Cape* Loon |
| Non-Marbled Murrelet Alcids | Tufted Puffin<br>Rhinocerous Auklet<br>Cassin's Auklet<br>Pigeon Gillemot<br>Common Murre | Common Murre |
| Gulls | Glaucous-winged Gull<br>Western Gull<br>California Gull<br>Ring-billed Gull<br>Sabine's Gull<br>Unknown Gull | Western Gull |
| Procellarids | Laysan Albatross<br>Northern Fulmar<br>Pink-footed Shearwater<br>Sooty Shearwater<br>Buller's Shearwater | Northern Fulmar |
| Cormorants | Double-crested Cormorant<br>Brandt's Cormorant<br>Pelagic Cormorant<br>Unknown Cormorant | Double-crested Cormorant |
| Pelicans | Brown Pelican | Brown Pelican |
| Waterfowl and Wetland birds | White-winged Scoter<br>Surf Scoter<br>Greater White-fronted Goose<br>Cackling Goose<br>Caspian Tern<br>Common Tern<br>Great Egret<br>American Coot<br>Red Phalarope<br>Red-necked Phalarope | *North Cape* Scoter |

In the past, Trustees have compiled demographic information and calibrated injury models for various bird families. Several are listed in Table 1 next to species with documented mortality from the Stuyvesant spill. The demographic parameters for each specie group/family presented below have been calibrated to be consistent with a population that is roughly stationary in numbers (i.e., non-declining or non-increasing). The extent to which this sort of calibration is reasonable depends on both the specie being considered and the application of the modeling.

**General Grebe**

The North Cape REA (Sperduto et al, 1999) calculates injury to grebes by averaging demographic estimates for a variety of grebe species. The following set of roughly stationary demographic parameters is based upon their analysis:

- *Age of First Breeding: 2* Years Old
- *Female Offspring per Adult Female (Annual):* 0.91
- *Survivorship (From fledge to one year of age): 60*%
- *Annual Survivorship (Age 1+): 64*.7%
- *Maximum Age:* 24 Years Old

The only difference between these parameters and those used by Sperduto et al (1999) is that annual survivorship beyond the first year has been increased 2.7%. This calibrates the life history to a population that maintains an approximately constant population size.

**General Loon**

The North Cape REA (Sperduto et al, 1999) calculates injuries to loons based upon common loon demographics. The following set of roughly stationary demographic parameters is based upon their analysis:

- *Age of First Breeding:* 5 Years Old
- *Female Offspring per Female (Annual):* 0.27
- *Survivorship (From fledge to one year of age):* 76%
- *Survivorship (Age 1+):* 88.5%
- *Maximum Age:* 24 Years Old

The only difference between these parameters and those used by Sperduto et al (1999) is that annual survivorship beyond the first year has been increased 0.5%. As with the grebe calibration, this adjusts the implied loon life history to maintain an approximately constant population size.

**Western Gull**

Nur et al (1994) create a population model for western gull at the Farallon Islands. The following parameters draw from their analysis:

- *Age of First Breeding:* 3 Years Old
- *Male Offspring per Male (Age 3):* 0.012
- *Male Offspring per Male (Age 4):* 0.152
- *Male Offspring per Male (Age 5):* 0.457
- *Male Offspring per Male (Age 6):* 0.660
- *Male Offspring per Male (Age 7):* 0.695
- *Male Offspring per Male (Age 8):* 0.765
- *Male Offspring per Male (Age 9):* 0.785
- *Male Offspring per Male (Age 10):* 0.750
- *Male Offspring per Male (Age 11):* 0.710

- *Male Offspring per Male (Age 12 and 13):* 0.725
- *Male Offspring per Male (Age 14):* 0.705
- *Male Offspring per Male (Age 15):* 0.660
- *Male Offspring per Male (Age 16+):* 0.610
- *Survivorship (From fledge to one year of age):* 60%
- *Annual Survivorship (Age 1-2):* 75%
- *Annual Survivorship (Age 2-3): 82*%
- *Annual Survivorship (Age 3-4 to 6-7): 84*%
- *Annual Survivorship (Age 7-8 and 8-9): 83*%
- *Annual Survivorship (Age 9-10 and 10-11): 82*%
- *Annual Survivorship (Age 11-12): 81*%
- *Annual Survivorship (Age 12-13 to 14-15): 80*%
- *Annual Survivorship (Age 15-16 and 16-17): 78*%
- *Annual Survivorship (Age 17-18):* 75%
- *Annual Survivorship (Age 18-19): 67*%
- *Annual Survivorship (Age 19-20): 57*%
- *Annual Survivorship (Age 20-21): 50*%
- *Maximum Age:* 21 Years Old

The Nur et al (1994) model tracks males in the population (assuming a 1:1 sex ratio).[1] The difference between the above parameters and those used by Nur et al (1994) is that the survivorship from fledge to one year of age has been increased 4.5% to calibrate the model to approximate stationarity. This 60% survivorship from fledge to Age 1 is still within the range considered by Nur et al (1994).

**Northern Fulmar**

We use Northern Fulmar demographics as the basis for calculating injury to procellarids. Northern Fulmar may be longer lived than other procellarids injured in the spill. As a result, using Northern Fulmar demographics as a proxy for procellarid injury has the potential for over-estimating bird-year loss for the entire procellarid family.

The following northern fulmar demographic parameters have been calibrated to imply a roughly constant population size:

- *Age of First Breeding:* 5 Years Old
- *Female Offspring per Female (Age 5): 0.013*
- *Female Offspring per Female (Age 6): 0.026*
- *Female Offspring per Female (Age 7): 0.039*
- *Female Offspring per Female (Age 8): 0.053*
- *Female Offspring per Female (Age 9): 0.066*
- *Female Offspring per Female (Age 10): 0.079*
- *Female Offspring per Female (Age 11): 0.092*
- *Female Offspring per Female (Age 12): 0.105*
- *Female Offspring per Female (Age 13): 0.118*
- *Female Offspring per Female (Age 14): 0.131*
- *Female Offspring per Female (Age 15): 0.144*

[1] Male western gulls are perceived to be the limiting factor in western gull population growth (Nur et al 1994, Pierotti and Annet 1995). During the 1970s, some western gull populations displayed male-female sex ratios close to 2:3, presumably due to the feminization of male embryos from DDT (Pierotti and Annet 1995). Since that time sex ratios have returned to “near equity” (Pierotti and Annet 1995).

- *Female Offspring per Female (Age 16): 0.158*
- *Female Offspring per Female (Age 17): 0.171*
- *Female Offspring per Female (Age 18): 0.184*
- *Female Offspring per Female (Age 19): 0.197*
- *Female Offspring per Female (Age 20+): 0.21*
- *Annual Survivorship (Age 69-70):* 6.9%
- *Annual Survivorship (Age 68-69):* 16.9%
- *Annual Survivorship (Age 67-68):* 26.9%
- *Annual Survivorship (Age 66-67):* 36.9%
- *Annual Survivorship (Age 65-66):* 46.9%
- *Annual Survivorship (Age 64-65):* 56.9%
- *Annual Survivorship (Age 63-64):* 66.9%
- *Annual Survivorship (Age 62-63):* 76.9%
- *Annual Survivorship (Age 61-62):* 86.9%
- *Annual Survivorship (Age 5-6 to 60-61):* 96.9%
- *Annual Survivorship (Age 4-5):* 89.6%
- *Annual Survivorship (Age 3-4):* 82.4%
- *Annual Survivorship (Age 2-3):* 75.1%
- *Annual Survivorship (Age 1-2):* 67.9%
- *Survivorship (From fledge to one year of age):* 60.6%
- *Maximum Age:* 70 Years

A review by Hatch and Nettleship (1998) provides the basis for these choices. Their summary includes the following information specific to deriving demographic model parameters specific to northern fulmar:[2]

- *Age of First Breeding:* Dunnet (1992) notes first evidence of breeding northern fulmars at five years of age.
- *Female Offspring per Female (Ages 20+):* Hatch and Nettleship (1998) present unpublished data by Nettleship that show the proportion of fulmar pairs that produce a fledgling ranged from 37.2 - 46.9% in three "good" years, and 5.4 % in one "bad" year. If we assume (1) the productivity is at the midpoint of the range in good years (0.4205) and (2) a one-to-one sex ratio, then the full productivity of northern fulmars is (.4205)(.5) = 0.21025,
- *Female Offspring per Female (Age 5-19):* Dunnet (1992) finds evidence that first breeding in northern fulmars occurs when the birds are between five and twenty years of age. We assume that the productive capacity of northern fulmar increases linearly such that it is 6.25% in Year 5, 12.5% in Year 6, etc. until 100% are breeding in Year 20.
- *Annual Survivorship (Age 5-6 to 60-61):* Hatch (1987b) estimates average annual survival rates of northern fulmar at 96.9%.
- *Maximum Age:* With a constant 96.9% adult survivorship it is reasonable for some northern fulmar to live a very long time (greater than 80 years). Evidence of there long-lived life history was found in Scotland where several birds banded in 1951 were still breeding in 1990 at ages likely to be greater than 50 years old (Dunnet 1991). For the purpose of this analysis, we chose a maximum age of 70. Because of our belief that the adult survivorship will decline as a bird reaches the older age classes, we assume that, starting at Age 61, survivorship decreases 10% per year until it reaches zero at 70 years old.

[2] The below citations are cited as referenced in Hatch and Nettleship (1998). They are not cited as primary sources.

To calibrate the model, we assumed that the survivorship from Ages 0-1 to 4-5 increased linearly each year such that 96.9% adult survivorship was achieved at Age 5-6. We then calibrated Age 0-1 survivorship so that the sequence was consistent with a population maintaining a constant population size.

**Double-Crested Cormorant**

The following double-crested cormorant demographic parameters have been calibrated to imply a roughly constant population size:

- *Female Offspring per Female (Age 1):* 0.028
- *Female Offspring per Female (Age 2):* 0.12
- *Female Offspring per Female (Age 3):* 0.58
- *Female Offspring per Female (Age 4+):* 0.54
- *Survivorship (From fledge to one year of age):* 48%
- *Annual Survivorship (Age 1-2):* 74%
- *Annual Survivorship (Age 2+):* 83.2%
- *Maximum Age:* 24 Years

A review by Hatch and Weseloh (1999) provides the basis for these parameter choices.[3] Their summary includes the following information specific to deriving demographic model parameters specific to double-crested cormorants:

- *Female Fledges per Female (Age 1).* Observations by van der Veen (1973) suggest that 4.7% of females first bred at Age 1. Hatch and Weseloh's (1999) summary of numerous studies suggest that each double-crested cormorant nest produces between 1.2-2.4 fledges per nest. If we assume the low end of that range (which we use to calibrate demographic information) and a one-to-one sex ratio, then each Age 1 female produces (.047)(1.2)(.50) = 0.028 fledging females on average.
- *Female Fledges per Female (Age 2).* Observations by van der Veen (1973) suggest that 16.5% of females first breed at Age 2. If we assume that 90% of past breeders nest, a one-to-one sex ratio, and 1.2 fledges per nest, then Age 2 each female produces (.165)(1.2)(.50) + (.047)(1.2)(.50)(.9) = 0.12 fledging females on average.
- *Female Fledges per Female (Age 3).* Observations by van der Veen (1973) suggest that 78.8% of females first breed at Age 3. If we assume that 90% of past breeders nest, a one-to-one sex ratio and 1.2 fledges per nest, than each Age 3 female produces (.788)(1.2)(.50) + (.212)(1.2)(.50)(.9) = 0.59 fledging female on average.
- *Female Fledges per Female (Age 4+).* Observations by van der Veen (1973) suggest that all Age 4 and later females have already breed once. If we assume that 90% of past breeders nest, a one-to-one sex ratio and 1.2 fledges per nest, then each Age 4+ female produces (1.2)(.50)(.9) = 0.54 fledging female on average.
- *Survivorship (From fledge to one year of age).* van der Veen (1973) estimates Age 0 survival at 48%.

[3] The below citations are cited as referenced in Hatch and Weseloh (1999). They are not cited as primary sources.

- *Annual Survivorship (Age 1).* van der Veen (1973) estimates Age 1 survival at 74%.
- *Annual Survivorship (Age 2+).* van der Veen (1973) estimates Age 1 survival at 85%. We chose the slightly lower value of 83.2% to calibrate the model to a population that was maintaining constant numbers over time.
- *Maximum Age.* Klimkiewicz and Futcher (1989) note that the oldest banded bird in 5,589 encounters was 17 years 9 months old. We choose a maximum age of 24 because that is the oldest age that at least 1% of the cormorants will reach given the demographic assumptions presented above.

Overall, choosing low range values for (1) *Age 2+ Survivorship* and (2) *Fledges per Nest* calibrates the model.

**Brown Pelicans**

Demographic information on brown pelicans was compiled by the California Office of Environmental Health Hazard Assessment and summarized in the Cal/Ecotox online database (http://www.oehha.org/cal_ecotox/default.htm). The Cal/Ecotox database (and the research papers cited therein) provides the primary data source for the below potential parameter choices:

- *Age of First Breeding:* 3 Years Old
- *Female Offspring per Adult Female:* 0.33
- *Annual Survivorship (Age 3+):* 88%
- *Annual Survivorship (Age 2-3):* 80%
- *Annual Survivorship (Age 1-2):* 72%
- *Survivorship (From fledge to one year of age):* 64%
- *Maximum Age:* 34 Years

These are based upon the following citations from the Cal/Ecotox database.[4]

- *Age of First Breeding:* Lovett and Joanen (1974) note that the age of first nesting is at three years old.
- *Female Offspring per Adult Female:* Anderson et al. (1982) examine six years of data and find 0.18-0.88 fledglings per nest on West Anacapa Island (California) and 0.23-1.20 fledglings per nest on Isla Coronado Norte (California). If we assume (1) a midpoint of the overall 0.18-1.20 fledglings per nest range (0.69), (2) a one-to-one sex ratio, and (3) 95% adults breeding each year, then we get (0.69)(0.5)(.95) = 0.33 female offspring per adult female.
- *Annual Survivorship (Age 3+):* Anderson et al. (1996) find that sixteen of seventeen brown pelicans (94%) from 1986 and 1990 survived 180 days. If we extrapolate to a full year, we find that this is equivalent to approximately an 88% annual adult survival rate.

To calibrate the model, we assumed that the survivorship from Ages 0-2 increased linearly each year such that 88% adult survivorship was achieved at Age 3. We then calibrated Age 0 survivorship so that the sequence of Age 0 to Age 3 survivorship rates is consistent with a population maintaining a constant population size. We choose a maximum age of 34 because that is the oldest age that at least 1% of the brown pelicans would reach given the survivorship assumptions presented above.

[4] The below citations are cited as referenced in the Cal/Ecotox database. They are not cited as primary sources.

**Common Murre**
Nur et al (1994) created a common murre demographic model for the Farallon Islands. The following parameters are based upon their work, but have been calibrated to imply a roughly constant population size:

- *Age of First Breeding:* 5 Years Old
- *Female Offspring per Female (Age 5):* 0.126
- *Female Offspring per Female (Age 6):* 0.310
- *Female Offspring per Female (Age 7):* 0.405
- *Female Offspring per Female (Age 8+):* 0.420
- *Survivorship (From fledge to one year of age):* 40%
- *Annual Survivorship (Age 1-2):* 80%
- *Annual Survivorship (Age 2-3):* 87%
- *Annual Survivorship (Age 3+):* 91.6%
- *Maximum Age:* 35 Years

The difference between these parameters and those used by Nur et al (1994) is that annual survivorship beyond the first year has been decreased 1.7%.

**General Scoter**
The Noth Cape REA (Sperduto et al, 1999) calculates injury to scoters by combining demographic information for both surf scoters and black scoters. For the purpose of settlement, we suggest drawing on their parameters for calculating injuries for waterfowl/wetland birds. Specifically:

- *Age of First Breeding: 2* Years Old
- *Female Offspring per Adult Female (Annual): 1.2025*
- *Survivorship (From fledge to one year of age): 37*%
- *Annual Survivorship (Age 1+): 69.375*%
- *Maximum Age:* 15 Years Old

The difference between these parameters and those used by Sperduto et al (1999) is that fecundity and survivorship parameters have been decreased by 7.5% of the *North Cape REA* values (1.3, 40%, 75%) to calibrate the life history parameters to be consistent with a constant population size.

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# Appendix D

## Loon/Grebe REA Details

INJURY CALCULATION

| Species | Total Estimated Dead | Bird-Year Multiplier | Total Lost Bird-Years |
|---|---|---|---|
| Red-throated Loon | 7 | 7.22 | 50 |
| Common Loon | 38 | 7.22 | 274 |
| Pied-billed Grebe | 1 | 2.78 | 3 |
| Eared Grebe | 6 | 2.78 | 17 |
| Western Grebe | 24 | 2.78 | 67 |
| grebe, sp. | 1 | 2.78 | 3 |
| **TOTAL** | **77** | | **414** |

See Appendix C for derivation of bird-year multipliers.

CREDIT CALCULATION (projected restoration benefits)

| Year | Nests Protected | Increased Fledges | Increased Bird-Years | Discounted to 1998 |
|---|---|---|---|---|
| 2003 | 940 | 278 | 750 | 592 |
| | | Based on 1.82 fledges per nest. | Based on 2.70 bird-years per fledge (life expectancy of a fledge) | Discounted at 3% per year |
| | | | **Total:** | **592** |

Contribution toward one year of the project would provide sufficient compensation.

# Appendix E

## Cormorant/Gull/Pelican REA Details

INJURY CALCULATION

| Species | Total Estimated Dead | Bird-Year Multiplier | Total Lost Bird-Years |
|---|---|---|---|
| Brown Pelican | 3 | 6.20 | 19 |
| Brandt's Cormorant | 23 | 4.44 | 102 |
| Double-cr. Cormorant | 25 | 4.44 | 111 |
| Pelagic Cormorant | 8 | 4.44 | 36 |
| cormorant, sp. | 4 | 4.44 | 18 |
| Western Gull | 52 | 4.50 | 234 |
| Glaucous-winged Gull | 6 | 4.50 | 27 |
| gull, sp. (large) | 18 | 4.50 | 81 |
| **TOTAL** | **139** | | **627** |

See Appendix C for derivation of bird-year multipliers.

CREDIT CALCULATION (projected restoration benefits *per nest*)

| Year | Increased Fledges | Increased Bird-Years | Discounted to 1998 |
|---|---|---|---|
| 2006 | 0 | 0 | 0 |
| 2007 | 0.78 | 2.50 | 1.9 |
| 2008 | 0.78 | 2.50 | 1.9 |
| 2009 | 0.78 | 2.50 | 1.8 |
| 2010 | 0.78 | 2.50 | 1.8 |
| 2011 | 0.78 | 2.50 | 1.7 |
| 2012 | 0.78 | 2.50 | 1.7 |
| 2013 | 0.78 | 2.50 | 1.6 |
| 2014 | 0.78 | 2.50 | 1.6 |
| 2015 | 0.78 | 2.50 | 1.5 |
| 2016 | 0.78 | 2.50 | 1.5 |
| 2017 | 0.78 | 2.50 | 1.4 |
| Continues to 2057. | Based on 0.78 fledges per nest. | Based on 3.2 bird-years per fledge (life expectancy of a fledge) | Discounted at 3% per year |
| | | **Total:** | **51** |

Number of nests needed for project would be 627/51 = **12**.

# Appendix F

## Murre REA Details

INJURY CALCULATION

| Species | Total Estimated Dead | Bird-Year Multiplier | Total Lost Bird-Years |
|---|---|---|---|
| Laysan Albatross | 2 | 12.7 | 25 |
| Northern Fulmar | 10 | 12.7 | 127 |
| Pink-footed Shearwater | 3 | 12.7 | 38 |
| Buller’s Shearwater | 10 | 12.7 | 127 |
| Sooty Shearwater | 27 | 12.7 | 343 |
| Common Murre | 1,600 | 7.2 | 11,488 |
| Pigeon Guillemot | 74 | 7.2 | 531 |
| Cassin’s Auklet | 60 | 7.2 | 431 |
| Rhinoceros Auklet | 150 | 7.2 | 1,077 |
| Tufted Puffin | 1 | 7.2 | 7 |
| **TOTAL** | **1,937** | | **14,194** |

See Appendix C for derivation of bird-year multipliers.

CREDIT CALCULATION (projected restoration benefits)

| Year | Increased Nests | Increased Fledges | Increased Bird-Years | Discounted to 1998 |
|---|---|---|---|---|
| 2006 | 0 | 0 | 0 | 0 |
| 2007 | 6 | 5 | 18 | 14 |
| 2008 | 9 | 7 | 27 | 20 |
| 2009 | 13 | 10 | 39 | 28 |
| 2010 | 70 | 54 | 211 | 148 |
| 2011 | 98 | 75 | 296 | 201 |
| 2012 | 106 | 81 | 320 | 211 |
| 2013 | 110 | 84 | 332 | 213 |
| 2014 | 115 | 88 | 347 | 216 |
| 2015 | 123 | 94 | 371 | 225 |
| 2016 | 132 | 101 | 397 | 233 |
| 2017 | 141 | 108 | 425 | 242 |
| Continues to 2107 | Continues at 7% annual growth until maximum at 1,800 nests. | Based on 0.7663 fledges per nest. | Based on 3.938 bird-years per fledge (life expectancy of a fledge) | Discounted at 3% per year |
| | | | **Total:** | **49,184** |

Note: First six years of nest numbers and fledges per nest based on data from Devil’s Slide Rock Murre Re-colonization Project.

Contribution toward similar project would be 14,194/49,184 = **29%**.

## Appendix G

## Marbled Murrelet REA Details

INJURY CALCULATION

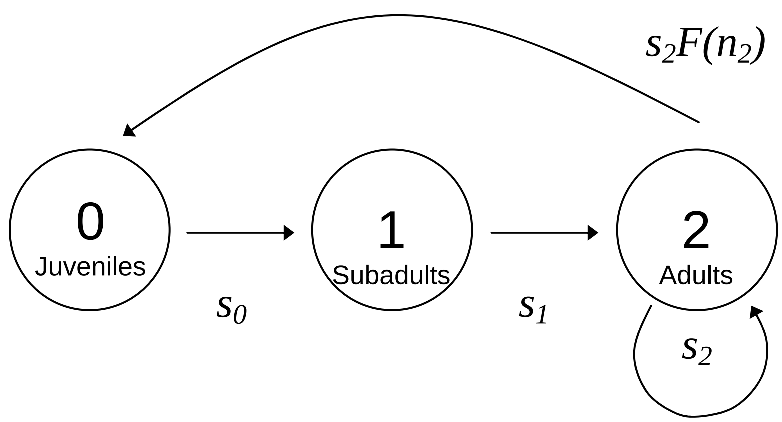
The Trustees calculated the injury based upon female bird-years, assuming a 1:1 sex ratio. This implies that a 135 bird acute mortality translates into an immediate loss of 67.5 female birds from the local population. We used 67 females for our injury modeling.

The discounted bird-year injury (or debit, *D*) was based upon the following formula:

$$D = \sum_{t=1999}^{2099} \frac{N_{BI,t} - N_{I,t}}{(1+d)^{t-1999}} \qquad (1)$$

Here, $N_{BI,t}$ is the numbers of female birds in the subpopulation in period *t* had the spill not occurred, and $N_{I,t}$ is the number of female birds in the subpopulation at period *t* after the spill. For example, if we assume that the size of the injured population was 2100 females at the time of the spill and 67 females were killed, then $N_{BI,1999} = 2100$ and $N_{I,1999} = 2100 - 67 = 2033$. The parameter *d* is the discount rate. This is set at $d = 0.03$, consistent with federal NRDA guidance for a risk-free discount rate.

To calculate the trajectories $\{N_{BI,t}\}$and $\{N_{I,t}\}$, we use the following re-parameterization of the Beissinger (1995) model.




(2)

The parameters $s_0$, $s_1$, and $s_2$ are the survivorships for juveniles, subadults and adults, respectively. The term $s_2F(n_2)$ reflects the “post-breeding” census convention (i.e., bird-years are counted in the Fall). This implies that adult Murrelets ($n_2$) must survive ($s_2$) before they are able to attempt successful breeding ($F(n_2)$). In the model, fecundity increases as the population becomes smaller (i.e., $dF(n_2)/dn_2 < 0$). This reflects the possibility that, as a population declines, it will tend to decline faster in more marginal areas leaving the remaining birds in higher quality habitat.

Combining the trajectories projected from (2) into Equation (1) yields our injury estimate of lost bird-years.

CREDIT CALCULATION (projected restoration benefits)

The overall benefit of the land acquisition and management is scaled based upon the benefit of the project at an individual nest (in discounted female bird-years). The number of nests that need to be protected to compensate for the injury ($N_{Acquire}$) is based upon: (1) the size of the bird-year injury; and (2) the benefit of land acquisition to nesting birds and their offspring (in discounted female bird-years). This is written as:

$$N_{Acquire} = \frac{D}{B_{nest}} \qquad (3)$$

where $D$ is the marbled Murrelet injury from (1) (measured in discounted female bird-years), and $B_{Nest}$ is the benefit of the project per nest affected (in discounted female bird-years per nest).

The benefits per nest ($B_{Nest}$) are calculated over a 100 year period after logging, according to the formula:

$$B_{Nest} = \sum_{t=t_{\log}}^{t_{\log}+100} \frac{N_{R,t} - N_{BR,t}}{(1+d)^{t-1999}} \qquad (2)$$

Here, $N_{R,t}$ is the expected numbers of female birds supported by a nest within an acquired site at time $t$.[1] $N_{BR,t}$ depicts the fate of the birds supported by the acquisition site at time $t$ after logging. $t_{log}$ is the number of years between spill and logging without the acquisition project. The parameter $d$ is the discount rate, which is set at 0.03.

The trajectories for $N_{BR,t}$ and $N_{R,t}$ are based upon the same basic modeling framework as used in the injury calculation. However, there are two main differences between the calculation performed here and the calculation used in the injury model. First, the model is applied at the "nest" scale, versus a local population scale. This implies that we follow the number of birds associated with a given nest (versus the entire local female MAMU population). Second, we assume that: (a) with acquisition, nests are sufficiently productive to maintain population levels ($\lambda = 1.0$); and (b) without acquisition, associated birds will reproduce at lower fecundity ($\lambda < 1.0$) after logging occurs ($t_{log} = 2007$).

[1] This would include one adult female per nest, along with corresponding sub-adults, juveniles, and potentially non-breeding adults.

# Appendix H

## Wetland Birds REA Details

INJURY CALCULATION

| Species | Total Estimated Dead | Bird-Year Multiplier | Total Lost Bird-Years |
|---|---|---|---|
| Great Egret | 2 | 2.60 | 5 |
| Gr. White-fronted Goose | 2 | 2.60 | 5 |
| Cackling Goose | 4 | 2.60 | 10 |
| White-winged Scoter | 16 | 2.60 | 42 |
| Surf Scoter | 27 | 2.60 | 70 |
| American Coot | 2 | 2.60 | 5 |
| Red-necked Phalarope | 3 | 2.60 | 8 |
| Red Phalarope | 5 | 2.60 | 13 |
| Ring-billed Gull | 9 | 4.44 | 40 |
| California Gull | 7 | 4.44 | 31 |
| Sabine's Gull | 10 | 4.44 | 44 |
| gull, sp. (small) | 5 | 4.44 | 22 |
| Caspian Tern | 3 | 2.60 | 8 |
| Common Tern | 1 | 2.60 | 3 |
| unknown | 21 | 2.60 | 55 |
| **TOTAL** | **117** | | **361** |

See Appendix B for derivation of bird-year multipliers.
Total lost bird-days = 361 bird-years x 365 days = **131,853**

CREDIT CALCULATION (projected restoration benefits *per acre*)

| Year | Increased Bird-User Days/Year | Discounted to 1998 | Year | Increased Bird-User Days/Year | Discounted to 1998 |
|---|---|---|---|---|---|
| 2006 | 0 | 0 | 2015 | 782 | 473 |
| 2007 | 87 | 67 | 2016 | 869 | 510 |
| 2008 | 174 | 129 | 2017 | 956 | 545 |
| 2009 | 261 | 188 | 2018 | 1,042 | 577 |
| 2010 | 347 | 244 | 2019 | 1,129 | 607 |
| 2011 | 434 | 296 | 2020 | 1,216 | 635 |
| 2012 | 521 | 345 | 2021 | 1,241 | 629 |
| 2013 | 608 | 390 | 2022 | 1,241 | 610 |
| 2014 | 695 | 433 | 2023 | 1,241 | 593 |
| Continued on next three columns ↗ | | | Continues to 2107 | Based on year-round average of 3.4 birds per acre per day | Discounted at 3% per year |
| | | | | **Total:** | **25,378** |

Note: Average of 3.4 birds per acre derived from a conservative estimate using DFG waterfowl surveys in Humboldt Bay. Note that winter density is much greater than summer density. This estimate reflects a year-round average. Gradual phase-in is meant to reflect gradual increases in populations, as well as the gradual improvement in the restored habitat.

Number of acres needed for project would be 131,853/25,378 = **5.2 acres**.

## Appendix I

## Water Column to Wetlands REA Details

INJURY CALCULATION

| species | mortality | kg/animal | animal-year multiplier | lost kg-years (discounted) | ecological efficiency | kg of biomass needed |
|---|---|---|---|---|---|---|
| unknown epipelagic fish | 5 | 1 | 0.8333 | 4 | 0.0016 | 2,604 |
| shrimp | 4,600,000 | 0.0007143 | 0.8333 | 2,738 | 0.008 | 342,250 |
| epipelagic anchovy | 6,000 | 0.0201667 | 0.8333 | 101 | 0.008 | 12,625 |
| | | | Based on life expectancy of average age individual | Note: no discounting was used because life expectancy is less than one year | | |
| | | | **TOTAL:** | **2,843** | | **357,486** |

CREDIT CALCULATION (projected restoration benefits *per square meter*)

| Year | % of Potential Marsh Productivity | Annual Production ($kg/m^2$) | Discounted to 1998 |
|---|---|---|---|
| 2006 | 0% | 0.00 | 0.00 |
| 2007 | 5% | 0.26 | 0.20 |
| 2008 | 10% | 0.52 | 0.39 |
| 2009 | 15% | 0.78 | 0.57 |
| 2010 | 20% | 1.04 | 0.73 |
| 2011 | 25% | 1.31 | 0.89 |
| 2012 | 30% | 1.57 | 1.04 |
| 2013 | 35% | 1.83 | 1.17 |
| 2014 | 40% | 2.09 | 1.30 |
| 2015 | 45% | 2.35 | 1.42 |
| 2016 | 50% | 2.61 | 1.53 |
| 2017 | 55% | 2.87 | 1.64 |
| 2018 | 60% | 3.13 | 1.73 |
| 2019 | 60% | 3.13 | 1.68 |
| 2020 | 60% | 3.13 | 1.63 |
| 2021 | 60% | 3.13 | 1.59 |
| Continues to 2107. | | Based on a potential maximum benefit of 5.22 $kg/m^2$ | Discounted at 3% per year |
| | | **Total:** | **66.3** |

Number of sq. meters needed for project would be 357,846/66.3 = **5,396 $m^2$ = 1.3 acres**.

**Appendix J**

**Habitat Injury Assessment Report**

# WORKING DRAFT

# HABITAT INJURY ASSESSMENT REPORT
# DREDGE STUYVESANT OIL SPILL
# HUMBOLDT COUNTY, CALIFORNIA

*Prepared for:*

**BEAN DREDGING, LLC**
1055 St. Charles Ave., Suite 500
New Orleans, LA 70130

*Prepared by:*

**ENTRIX, INC.**
590 Ygnacio Valley Road, Suite 200
Walnut Creek, California 94596

**U.S. Fish and Wildlife Service**
Sacramento, CA
**California Department of Fish and Game**
**Office of Spill Prevention and Response**
Sacramento, CA
**California State Lands Commission**
Long Beach, CA

Project No. 376501

**April 2001**

# LIST OF FIGURES

Page

This Habitat Injury Assessment Report serves to document the injury assessment process conducted cooperatively between the trustees and the representatives for the responsible party to the Dredge *M/V Stuyvesant* oil spill. This assessment process has been conducted by members of the Stuyvesant Technical Group. The trustees were represented by individuals from the U.S. Fish and Wildlife Service, California Department of Fish and Game, and California State Lands Commission. The responsible party was represented by individuals from ENTRIX, Inc.

This report will ultimately include four Chapters. Chapter 1.0 includes the Introduction and brief background of the spill, Chapter 2.0 the Shoreline Injury Assessment, Chapter 3.0 the Water Column Injury Assessment, and Chapter 4.0 the Shoreline and Water Column Credit Analysis. Chapters 1.0 and 2.0 are presented herein. Chapters 3.0 and 4.0 will be prepared seperately as the assessment work is completed.

## 1.1 SPILL SCENARIO

On September 6, 1999, the Dredge *M/V Stuyvesant* spilled approximately 2,000 gallons of Intermediate Fuel Oil 180 (IFO-180) into the Pacific Ocean off Humboldt Bay, near Eureka, California. The incident occurred when a dredge arm on the *M/V Stuyvesant* punctured one of its fuel tanks. The spill occurred on an outgoing tide and was not contained. Overflights identified oil slicks and tarballs in the ocean as far north as Patrick's Point, with the majority of the oil washing ashore between the North Spit and Trinidad Head (Figure 1-1). Shoreline Clean-up and Assessment Teams (SCAT) were mobilized on September 7, 1999 and conducted surveys daily through September 15. Beach sign-off surveys were conducted between September 14 and September 18, 1999, though selected sites were revisited November 30, 1999. From the time of the release, the oil was at sea for three days before it was observed on shore, as documented on the SCAT forms starting September 9, 1999.

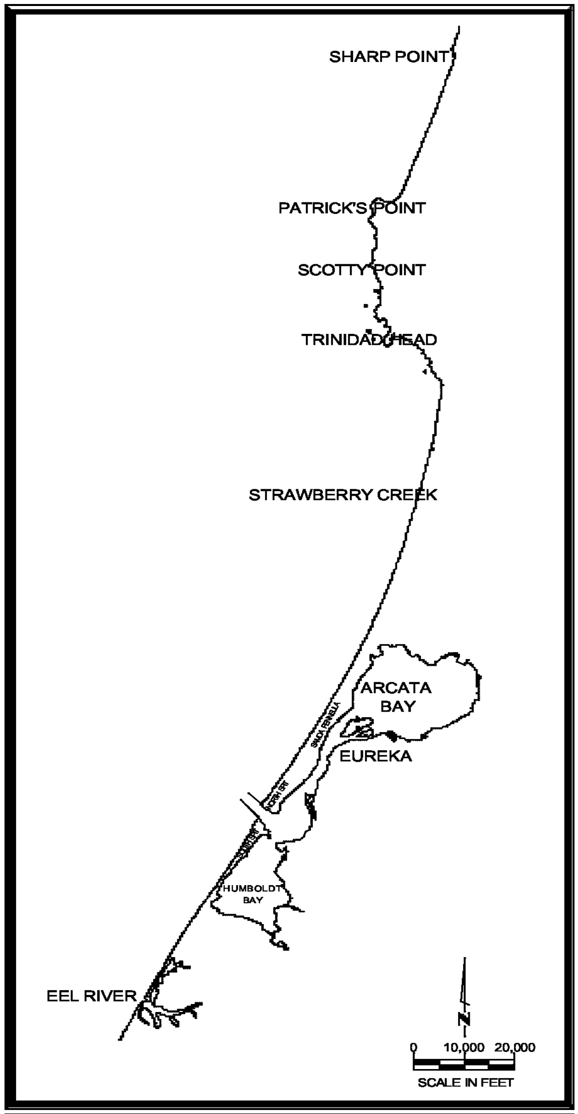



**Figure 1-1. Stuyvesant Spill Area**

This chapter of the Habitat Injury Report focuses on the injury assessment for the shoreline habitats. The approach used for the shoreline injury assessment is discussed first. A description of the habitats (i.e., natural resources) and ecological services provided by those habitats, the degree of injury to these services, the considerations for the kinds of recoveries of these services, and finally, a summary of the service losses are also presented in this chapter. This report does not address active human use services of those habitats. Recreation use services are covered in a separate report prepared for this damage assessment.

## 2.1 APPROACH FOR ASSESSING SHORELINE INJURY

The Stuyvesant oil spill caused injury to the services provided by the shoreline habitats in the spill area. To evaluate the magnitude of these injuries and to determine the appropriate level of compensation for these lost services, the Stuyvesant Technical Group employed the Habitat Equivalency Analysis (HEA) model. Through the HEA process, the ecological services provided by each of the shoreline habitats and the subsequent injury sustained by the Spill were used to scale the size and determine the types of restorations projects needed for compensation.

HEA focuses on the ecological services provided by the affected habitats. The first step of HEA is to identify the services that the affected habitat would have provided had it not been injured. Second, the amount of service reduction caused by the oil spill is estimated over time. The input parameters needed for this model were the percent of services lost, acres of injured habitat, and duration of recovery for those service. The sum of service losses over time is called a HEA "debit." Next, the amount of service gain that will be produced by the restoration project(s) is determined, which gives a HEA "credit" per acre of restoration project. Finally, dividing the debit by the credit per acre of restoration project results in the acres of restoration project needed to compensate for the injuries. A detailed description of the HEA methodology can be found in Appendix A.

## 2.2 DIVISION OF HABITATS

Pursuant to the Cooperative Natural Resource Damage Assessment Agreement, Exhibit A, Task 5, and as an integral component to the HEA process, the Technical Group documented the types of shoreline habitats present in the spill area. For purposes of this assessment, the spill area was defined as the shoreline between Sharps Point to the north and Eel River to the south. Based on the U.S. Geologic Survey Environmental Sensitivity Index maps, 16 different shoreline habitats were identified. To streamline the HEA process, the technical group agreed that the shoreline habitats would be grouped into four categories of habitats, which provide similar types of services.

The shoreline habitats were grouped into two main categories: Beaches, and Rocky Habitat. The Beach category includes sand, gravel, and cobble beaches. The Rocky Habitat, however, was divided into three sub-categories based on substrates and types of services provided. The combination beach/rocky intertidal are habitats consisting of a beach backed with a rocky substrate so that on a lower tide a beach is exposed and at a higher tide only rocky substrate is exposed. These rocky intertidal areas provided service flows from both the beach and the rocky components of the habitat. The cliffs/offshore rocks/artificial habitat (e.g., riprap and jetties) were grouped together as the services of the vertical hard rock surfaces, regardless of origin or location, would provide similar services. The tidepools, though the substrate is similar to the hard rock surfaces of the cliffs, provides a unique habitat and service flow.

## 2.3 SERVICES AND TYPES OF INJURY FOR EACH HABITAT

This section addresses the first two steps of the HEA process. The first step is to identify the services that the affected habitat would have provided had it not been injured. The second step is to identify the types of injuries these services sustained as a result of the spill.

### 2.3.1 LIST OF SERVICES PROVIDED

Generally, the services provided by the shoreline habitats include habitat for invertebrates, birds, and plants; nesting and roosting for birds; food services and shelter; and marine mammal haul out. Each habitat grouping provided the above types of services to a unique set of organisms in varying quantities and qualities.

For the beaches, the intertidal sands in the beaches served have habitat for aquatic invertebrates. The lower beaches between the dunes and the high tide line were mainly used by birds for nesting and roosting. The wrack and debris found on the beaches provided food and shelter for terrestrial invertebrates and in turn food for birds. Marine mammals were observed using the gravel and cobble beaches for resting.

For the rocky habitats, during the lower tides, the rocky intertidal area provided similar services to the beaches. Otherwise the rocky habitats provided habitat for invertebrates, birds, and plants, particularly in the cracks and crevices in the rocks. The harbor snails, kelp, other invertebrates make up a substantial aspect of the biota in an intertidal rocky habitat outside the crevices and pools. The upper intertidal area and above the splash zones also provided some habitat for plants and invertebrates, but more likely provided nesting and roosting services. The tidepools and cracks in the rocks provided shelter to plants and invertebrates, and therefore food services to birds and mammals.

### 2.3.2 TYPES OF INJURIES SUSTAINED

The injuries sustained by shoreline habitats were presented in terms of reduction in quantity and/or decrease in quality of services provided by each habitat. The provision of habitat for invertebrates, birds and plants was reduced by the organisms being smothered by the oil, the cleanup crews trampling habitat during the response effort, and the removal of oiled plants and sand. The nesting and roosting services were reduced by disturbance to the birds by cleanup crews and increased vehicular traffic, and avoidance of the oiled areas. The quantity of food services were diminished by a potential mortality of prey or plants items, by avoidance of the oiled area by either the foraging organism or prey item, and the fouling and removal of vegetation and debris. The oiling of edible food tissue reduced the quality of the food items.

### 2.4 ESTIMATION OF INJURY

The magnitude of injury to the services provided by the shoreline habitats is based on the degree, extent, and duration of oiling. The degree of oiling was based on the density of oil stranded on the shore. The location and acreage of the observed oil and length of time the oil remains on the shore represent the extent and duration of oiling, respectively. The technical group developed the various methodologies for estimating the degree, extent, and duration of oiling and the overall shoreline acreage. These parameters were derived from a refinement and/or extrapolation from the available response data listed below.

The technical group reviewed data collected during the response as part of Tasks 1 and 2 in Exhibit A of the Cooperative Assessment. The source of data used to estimate degree, extent, and duration of oiling included, but was not limited to SCAT reports, wildlife reconnaissance reports, field notes and photographs, NOAA overflight maps, aerial photographs, additional field surveys, institutional knowledge from local scientists, tide data from NOAA, and other available data.

The beach habitat sustained three types of injury related to stranded oil, moving oil, and wrack-line oil. On a receding tide, the oil stranded on the beach with each wave, leaving the oil in place on the shore until the next incoming tide. This type of injury was represented by the stranded oil injury. The estimation of the stranded oil acreage was based on the band of stranded oil observed on the beach. However, as oil washed ashore with an incoming tide, the oil moved across the beaches with each wave. As each wave receded, the oil stranded momentarily. With the next wave, the oil re-suspended and moved to another location on the beach. The injury caused by this oiling scenario was represented by the moving oil injury. The moving oil acreage was calculated by subtracting the stranded oil acreage from the total intertidal or “wetted zone” acreage. As limited field data was available about the location, oiling, and removal of wrack material on the beaches, it was assumed that wrack material was present on all beaches and that its degree of injury was proportional to the corresponding degree of stranded oil.

For the rocky habitats, the injuries to the different types of habitats are included in the overall percent loss of services. Therefore, injured rocky habitat acres are for the entire rocky habitat intertidal area including splash zones.

Many beaches were surveyed by SCAT teams multiple times during the response leading to documentation of varying degrees of oiling. Based on the weight of evidence from the SCAT data, the technical group derived one consensus level of oiling. To be conservative, a process was developed for characterizing and quantifying the oiling that represented the heaviest density and acreage of observed stranded oil for each area with multiple SCAT
data. Typically, a beach segment observed to have a considerably larger

band of oiling at a higher density was selected. This degree of oiling was then applied to all injury types within that beach segment.

### 2.4.1 Degree of Oiling

The degree of oiling was categorized using the SCAT classifications. These classifications represent the percent of oiling present in bands of oil observed on the beaches. The SCAT forms indicated four categories of oiling observed during response, which are described below in Table 2-1. The highest degree of oiling observed during the response was the Broken category or 51 to 90% coverage.

| SCAT Categories | Percent Coverage for Category |
|---|---|
| Broken | 51% to 90% |
| Patchy | 11% to 50% |
| Sporadic | 1% to 10% |
| Trace | Less than 1% |

**Table 2-1. Degree of Oiling Categories**

Most beaches were accessible to the SCAT teams during the response. The degree of oiling categorization of these beach segments was based on direct observations documented on the SCAT forms. For inaccessible beaches, the degree of oiling was extrapolated from the nearest surveyed beaches. The beaches were observed to have oiling in all four categories listed above. The rocky habitats, however, were largely inaccessible to SCAT teams, and oiling of the rocks was difficult see. Therefore, the degree of oiling for the rocky habitats was extrapolated from the surrounding beach categories. The rocky habitats north of Trinidad Head were assumed to have “sporadic” oiling, and the rocky habitats south of Trinidad Head were assumed to have “patchy” oiling.

### 2.4.2 Extent of Oiling

Once each segment of shoreline was assigned a degree of oiling described above, the next step was to estimated the acres or extent for each injury type: stranded oil, moving oil, and wrack for the beaches, and the rocky habitats.

The acreage of stranded oil was estimated based on the dimensions of the band of oil observed and noted on the SCAT forms. Each band of oil on the beach was observed to have a percent of oil coverage or degree of oiling as described in the above section. The acres within each oiling category were summed to obtain a total acreage of stranded oil within each category.

For this assessment it was assumed that wrack material was stranded on all the beaches at a constant width. The acreage for the wrack line was estimated for each segment defined above, by assuming that the wrack line width was five (5) feet wide and extended the full length of the defined segment.

The next step undertaken was to determine the acreage of moving oil. This was calculated by subtracting the stranded oil and wrack acreage within each beach segment from the intertidal zone (i.e., wetted zone) acreage for that segment. The width of the wetted zone was defined as the area of the beach from the lowest tide to the highest tide observed during the response period. The width varies for each segment depending on the slope of the beach. The wetted zone acres were determined by estimating the length and width of each segment using GIS, aerial photographs, additional field survey, institutional knowledge from local scientists, tide data from NOAA, and other available data. A summary of the acres for each injury type and oiling category is provided in Table 2-2.

| Oiling Category | Stranded (acres) | Moving (acres) | Wrack (acres) | Total Wetted Zone (acres) |
|---|---|---|---|---|
| BROKEN | 48 | 785 | 3 | 836 |
| PATCHY | 17 | 115 | 1 | 133 |
| SPORADIC | 29 | 268 | 2 | 299 |
| TRACE | 37 | 1739 | 11 | 1787 |

**Table 2-2. Beach Habitat Acres**

The rocky habitat contains microhabitats, such as crevices, tidepools, and rock faces. Although the crevices and pools can trap weathered oil, the rock surface areas and faces, between the crevices and pools, have little ability to gather floating residuals and thus would be less likely to suffer impacts to service flows from the weathered residuals. These areas of crevices and pools, where residual solids may collect, do not affect the service flows from the rock surfaces. For the HEA evaluation, the impacts to the different service flows are taken into account in the overall percent loss of services. Therefore, rocky habitat acres are for the entire rocky habitat intertidal area including splash zones. A summary of the acres for each combination of oiling category and habitat is provided in Table 2-3.

| Habitats | Oiling Category | Acres |
|---|---|---|
| tidepools - north | SPORADIC | 25 |
| rocky intertidal/combo north | SPORADIC | 70 |
| rocky intertidal/combo south | PATCHY | 10 |
| cliff north w/ offshore rocks | SPORADIC | 30 |
| cliff south w/ riprap & offshore rocks | PATCHY | 27 |

**Table 2-3. Rocky Habitat Acres**

### 2.4.3 DURATION OF OILING

For the purposes of the HEA evaluation, the duration of oiling began on the first day the oil was observed on the shore and ended when the beach signoff forms were completed for the affected beaches. The oil came ashore on the third day after the release, September 9, 1999 and the beach forms were signed off on approximately September 16, 1999. Therefore, the duration of the oiling was considered to be 7 days.

## 2.5 DEVELOPMENT OF RECOVERY CURVES

For each habitat type and degree of oiling, a recovery curve was developed to calculate the total loss of services, or HEA debit. For the beach habitats, the moving oil injured the services differently than the stranded oil. Therefore, separate recovery curves were developed for both of these types of injury for the beach habitats. The type of injury to the wrack line is similar to the injuries of the stranded oil, therefore, wrack line acres and services losses are grouped with the stranded oil.

The factors influencing the curve inflections and duration are discussed below.

### 2.5.1 TYPES OF INJURIES AND RECOVERIES FOR EACH INFLECTION OF CURVE

The recovery curves vary depending on the services affected, the nature of the oiling, cleanup efforts, and other factors. For the Stuyvesant HEA, there were three general phases of recovery: initial injury, post-response recovery, and long term recovery (Figure 2-1). The duration of each phase of the recovery curve was influenced by the degree of oiling. The greater the degree of oiling, the longer the recovery time.

General Recovery Curve

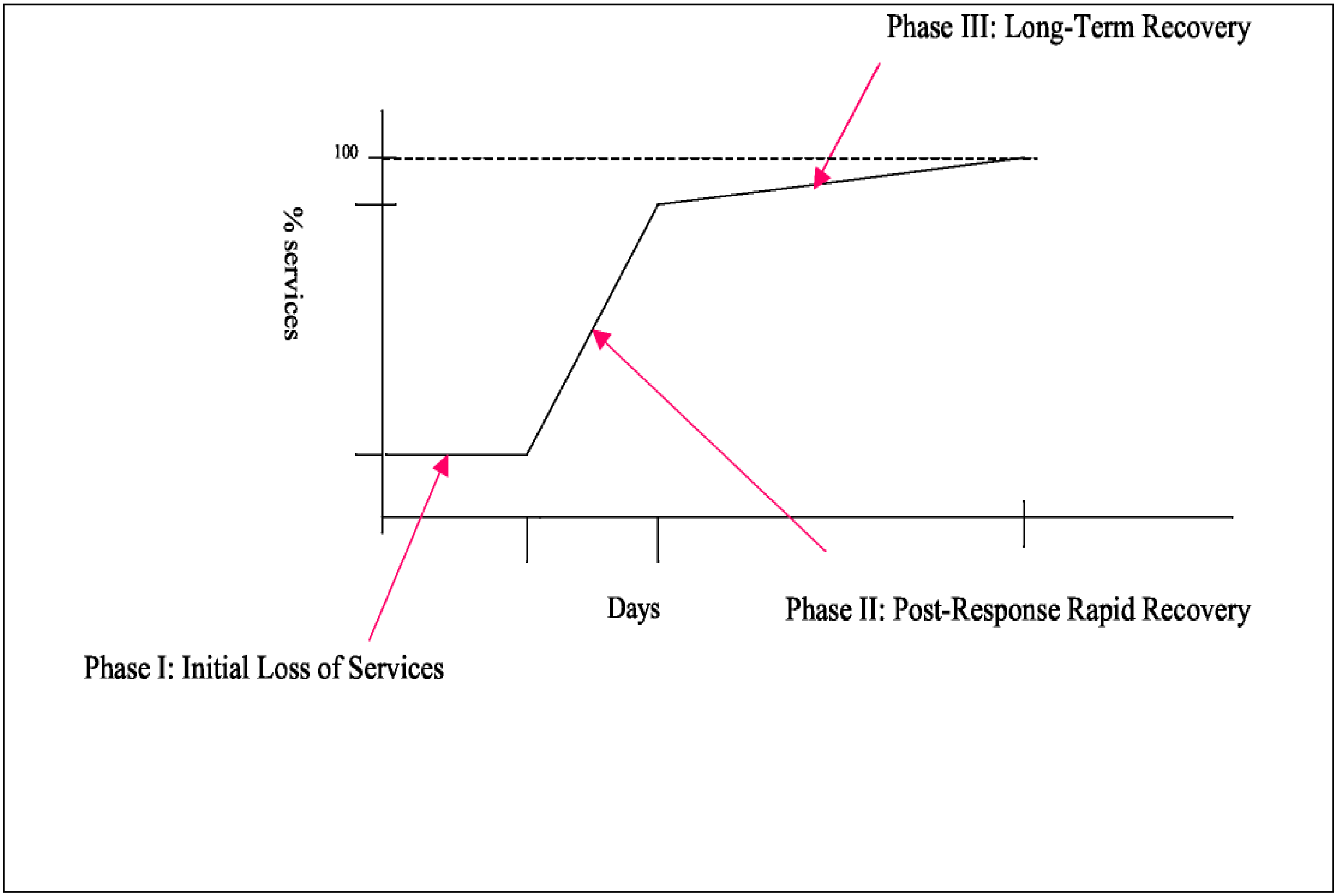



**Figure 2-1. General Recovery Curve for Beach and Rocky Habitats**

### 2.5.2 RATIONAL FOR DURATION OF EACH INFLECTION

The rational for percentage loss of services and the duration of those losses are presented in the following section, including the considerations influencing the inflections of the curves for each habitat.

#### 2.5.2.1 Beaches

From the time of the release, the oil was at sea for three days before it was observed on shore, as documented on the SCAT forms starting September 9, 1999. Therefore, 100 percent of the services were available for three days after the release. The initial injury was based on the degree of oil observed stranded on shore. The highest density observed was assigned to that shoreline segment from when the oil came ashore until the end of the response period, which was 7 days in duration (or until 10 days post-spill). The postresponse recovery reflects the rapid recovery of services and was primarily due to the termination of disturbances caused by the cleanup effort and the reduced amount of oil on the beach. The limited amount of oil remaining on shore or coming ashore was weathered, and no longer tacky. The duration of the rapid recovery ranged from 15 to 30 days from time of spill depending on the type of injury and degree of oiling. The longterm recovery was based on the slower recovery of organisms from the presence of residual oil on shore and re-colonization of affected habitat. The more densely oiled areas recovered by 120 days after the release, while the less densely oiled areas recovered in 33 days after the release.

The percentage of service loss due to the initial phase of the recovery curve was dependent on the degree of stranded oiling. The degree of oiling was applied to all injury types within a beach segment. The greater the density of oil, the greater the services were injured. The initial loss due to the stranded and wrack injuries were a result of smothering and fouling of organisms beneath the stranded oil as well as the disturbance by the cleanup and response efforts. The initial loss due to the moving injury was caused by the oil mixing in each incoming wave. The moving oil presented toxicity to the organisms that inhabited the surf area of the beaches. For the HEA assessment, the "worse-case" degree of oiling was assigned to each segment of beach for the duration of the oiling (i.e., 7 days). Once the oil was presumed to no longer be coming ashore and removed from the shores to the extent practical, only residual oil remained on the shore, primarily in areas inaccessible to cleanup crews.

During the second phase, the service losses rapidly recovered to some percentage below the baseline of services. This rapid recovery is due mainly to these factors: the weathering and hardening of the oil remaining on shore and/or the limited amounts of oil still coming ashore, and the end of the cleanup/response effort. The weathered oil no longer had a sticky consistency; therefore, incidental contact with the oil would not cause fouling of an organism. The cleanup crews, SCAT teams, and other reconnaissance teams were no longer present on the beaches. Vehicular and pedestrian traffic activity levels had substantially increased during the response effort, but injury from this disturbance quickly returned to baseline level once this increased activity ceased.

The third phase, the long-term recovery, involved the depuration of oil and toxins from the organisms affected by the moving oil. During the cleanup efforts of the stranded oil, sand, vegetation, and debris were removed from the beaches. The duration of the long-term recovery was dependent on the re-establishment of the vegetation and debris on the beaches and the re-colonization of this wrack material. A summary of the percent service losses and duration of each phase of recovery are shown in Table 2-4.

| **Broken Stranded w/ Wrack** | | **Broken Moving** | |
|---|---|---|---|
| Time (days) | % Services | Time (days) | % Services |
| 0 | 100 | 0 | 100 |
| 3 | 100 | 3 | 100 |
| 3 | 0 | 3 | 10 |
| 10 | 0 | 10 | 10 |
| 33 | 50 | 24 | 80 |
| 120 | 100 | 90 | 100 |
| | | | |
| **Patchy Stranded w/ Wrack** | | **Patchy Moving** | |
| Time (days) | % Services | Time (days) | % Services |
| 0 | 100 | 0 | 100 |
| 3 | 100 | 3 | 100 |
| 3 | 50 | 3 | 50 |
| 10 | 50 | 10 | 50 |
| 33 | 80 | 24 | 90 |
| 120 | 100 | 60 | 100 |
| | | | |
| **Sporadic Stranded w/ Wrack** | | **Sporadic Moving** | |
| Time (days) | % Services | Time (days) | % Services |
| 0 | 100 | 0 | 100 |
| 3 | 100 | 3 | 100 |
| 3 | 85 | 3 | 90 |
| 10 | 85 | 10 | 90 |
| 33 | 95 | 17 | 95 |
| 120 | 100 | 33 | 100 |
| | | | |
| **Trace Stranded w/ Wrack** | | **Trace Moving** | |
| Time (days) | % Services | Time (days) | % Services |
| 0 | 100 | 0 | 100 |
| 3 | 100 | 3 | 100 |
| 3 | 95 | 3 | 95 |
| 10 | 95 | 10 | 95 |
| 33 | 100 | 15 | 100 |

Day 0 = time of release -10

Day 3 = first observation of oil on shore

**Table 2-4. Beach Habitat Percent Service Losses and Duration**

#### 2.5.2.2 Rocky Habitats

Based on the service flows injured and the mechanisms for oiling, the tidepools and rocky intertidal habitats had similar recovery curves. Though the offshore rocks, riprap and cliffs recovery curves differed from the tidepools/rocky intertidal, they were similar to each other. These curves are described below.

##### 2.5.2.2.1 Tidepools and Rocky Intertidal

From the time of the release, the oil was at sea for three days before it was observed on shore, as documented on the SCAT forms starting September 9, 1999. Therefore, 100 percent of the services were available for three days after the release. The initial period of service loss extends to 30 days, since crews were unable access or effectively clean these areas. However, by 30 days, the oil became weathered and volatile components dissipated, and any residuals either stranded themselves in crevices or on shorelines. Examples of the types of injuries that might be associated with these weathered residuals include ingestion of the oil by mobile organisms such as snails and starfish, and/or oil stranding on stationary organisms such as sea urchins and mussels. This middle phase of recovery was estimated to take 60 to 120 days after spill for the rocky intertidal depending on the degree of oiling. The middle phase of recovery was estimated to take 90 days for the tidepools because of the pooling characteristics of this habitat. The remainder of the recovery (long term recovery) occurred over the next 210 days (270 days from time of spill).

##### 2.5.2.2.2 Offshore Rocks, Riprap, and Cliffs

From the time of the release, the oil was at sea for three days before it was observed on shore, as documented on the SCAT forms starting September 9, 1999. Therefore, 100 percent of the services were available for three days after the release. Because of the high wave action associated with, and non-porous surfaces of the offshore rocks, riprap and cliffs, the overall percent service losses and duration of injuries are considerably less than with the other habitats, given the degree of oiling. The initial injury caused by the oil splashing against the rock surfaces extended for a period of 10 days. The flushing effects of the high wave action in these areas resulted in a rapid post spill recovery of 24 days, with the long-term injuries recovering in a total of 60 days after spill. A summary of the percent service losses and duration of each phase of recovery are shown in Table 25.

**Tidepool Habitat North of Trinidad Point – Sporadic**

| Time (days) | % Services |
|---|---|
| 0 | 100 |
| 3 | 100 |
| 3 | 50 |
| 30 | 50 |
| 90 | 90 |
| 270 | 100 |

**Rocky Intertidal North of Trinidad – Sporadic**

| Time (days) | % Services |
|---|---|
| 0 | 100 |
| 3 | 100 |
| 3 | 75 |
| 30 | 75 |
| 60 | 90 |
| 270 | 100 |

**Rocky Intertidal South of Trinidad - Patchy**

| Time (days) | % Services |
|---|---|
| 0 | 100 |
| 3 | 100 |
| 3 | 50 |
| 30 | 50 |
| 120 | 90 |
| 270 | 100 |

**Offshore Rocks and Cliff North of Trinidad - Sporadic**

| Time (days) | % Services |
|---|---|
| 0 | 100 |
| 3 | 100 |
| 3 | 75 |
| 10 | 75 |
| 24 | 90 |
| 60 | 100 |

**Offshore Rocks, Riprap and Cliff South of Trinidad – Patchy**

| Time (days) | % Services |
|---|---|
| 0 | 100 |
| 3 | 100 |
| 3 | 50 |
| 10 | 50 |
| 24 | 80 |
| 60 | 100 |

**Table 2-5. Rocky Habitat Percent Service Losses and Duration**

## 2.6 Calculation of Debit

The degree, extent, and duration of oiling parameters presented above were used in the HEA model. This model is discussed in Appendix A. The HEA model allows for the various injury types to be summed within each habitat. For the beaches, the debit for each of the four degrees of oiling for the stranded/wrack and moving injury types were calculated and then summed. The total debit for the beach habitats is 58.6 discounted services per acres per years (DSAYs). The HEA debit for the rocky habitat sums the injuries from the tidepools, and the two degrees of oiling to both the rocky intertidal and the offshore rock/riprap/cliff habitat. The total debit for the rocky habitats is 10.4 DSAYS. A summary of the debits for each individual category/habitat pair is presented in Tables 2-6 and 2-7.

| | DEBIT | | |
|---|---|---|---|
| Oiling Category | Stranded (DSAYs) | Moving (DSAYs) | Total (DSAYs) |
| BROKEN | 6.5 | 44.0 | 50.4 |
| PATCHY | 0.9 | 3.0 | 3.9 |
| SPORADIC | 0.5 | 1.2 | 1.6 |
| TRACE | 0.1 | 2.5 | 2.6 |
| TOTAL | 8.0 | 50.6 | 58.6 |

**Table 2-6. Beach Habitat Debit Summary**

| Habitats | Oiling Category | DSAYs |
| --- | --- | --- |
| tidepools - north | SPORADIC | 2.9 |
| rocky intertidal/combo north | SPORADIC | 4.4 |
| rocky intertidal/combo south | PATCHY | 1.7 |
| cliff north w/ offshore rocks | SPORADIC | 0.5 |
| cliff south w/ riprap & offshore rocks | PATCHY | 0.9 |
| TOTAL | | 10.4 |

**Table 2-7. Rocky Habitat Debit Summary**

## 2.7 SUMMARY

This chapter of the Habitat Injury Report described the injury assessment for the shoreline habitats for the Dredge *Stuyvesant* oil spill, which occurred on September 6, 1999. The approach used for the shoreline injury assessment included a description of the habitats (i.e., natural resources) and services provided by those habitats, the degree of injury to these services, the considerations for the kinds of recoveries of these services, and finally, a summary of the service losses.

The Stuyvesant Technical Group worked cooperatively to develop this approach and to estimate the input parameters used in the calculations of total service losses. The HEA model was agreed upon as an appropriate approach for the shoreline injury assessment. HEA focuses on the ecological services provided by the affected habitats. The first step of HEA is to identify the services that the affected habitat would have provided had it not been injured. Second, the amount of service reduction caused by the oil spill is estimated over time. The sum of service losses over time is called a HEA "debit." Next, the amount of service gain that will be produced by the restoration project(s) is determined, which gives a HEA "credit" per acre of restoration project. Finally, dividing the debit by the credit per acre of restoration project results in the acres of restoration project needed to compensate for the injuries.

The HEA debits are expressed in debit service acre years (DSAYs). The shoreline habitat injury debit was calculated to be 58.6 and 10.4 DSAYs for the beach and rocky habitats, respectively. The HEA debits will be used to scale the restoration projects needed to compensate for the injuries. The HEA credit analysis will be completed in a cooperative process, and summarized in subsequent chapters in this report as it is completed.

Pending

# 4.0
# SHORELINE/WATER COLUMN CREDIT ANALYSIS

Pending

## Appendix K

## Rocky Intertidal Injury to Wetlands REA Details

INJURY CALCULATION
Injury to rocky intertidal habitat is **10.4** discounted acre-years of resource services (see Appendix J for details).

CREDIT CALCULATION (projected restoration benefits *per acre*)

| **Year** | **% of Potential Resource Services** | **Resource Services Per Acre** | **Discounted to 1998** |
|---|---|---|---|
| 2006 | 0% | 0.00 | 0.00 |
| 2007 | 5% | 0.05 | 0.04 |
| 2008 | 10% | 0.10 | 0.07 |
| 2009 | 15% | 0.15 | 0.11 |
| 2010 | 20% | 0.20 | 0.14 |
| 2011 | 25% | 0.25 | 0.17 |
| 2012 | 30% | 0.30 | 0.19 |
| 2013 | 35% | 0.35 | 0.22 |
| 2014 | 40% | 0.40 | 0.24 |
| 2015 | 45% | 0.45 | 0.26 |
| 2016 | 50% | 0.50 | 0.29 |
| 2017 | 55% | 0.55 | 0.30 |
| 2018 | 60% | 0.60 | 0.32 |
| 2019 | 60% | 0.60 | 0.31 |
| 2020 | 60% | 0.60 | 0.30 |
| 2021 | 60% | 0.60 | 0.30 |
| Continues to 2107. | | | Discounted at 3% per year |
| | | **Total:** | **12.3** |

Number of acres needed for project would be 10.4/12.3 **= 0.8 acres**.

# Appendix L

## Sandy Beach Injury to Dunes REA Details

INJURY CALCULATION
Injury to sandy beach habitat is **58.6** discounted acre-years of resource services (see Appendix J for details).

CREDIT CALCULATION (projected restoration benefits *per acre*)

| **Year** | **% of Potential Resource Services** | **Resource Services Per Acre** | **Discounted to 1998** |
|---|---|---|---|
| 2006 | 0% | 0 | 0.00 |
| 2007 | 10% | 0.10 | 0.08 |
| 2008 | 20% | 0.20 | 0.16 |
| 2009 | 30% | 0.30 | 0.24 |
| 2010 | 40% | 0.40 | 0.31 |
| 2011 | 50% | 0.50 | 0.37 |
| 2012 | 60% | 0.60 | 0.43 |
| 2013 | 60% | 0.60 | 0.42 |
| 2014 | 60% | 0.60 | 0.41 |
| Continues to 2036. | | | Discounted at 3% per year |
| | | **Total:** | **8.3** |

Number of acres needed for project would be 58.6/8.3 = **7.1 acre**

## Appendix M

## Synopsis of Written and Oral Public Comments with Trustee Responses

The Stuyvesant Trustees received thoughtful and relevant comments on the Draft DARP during the public review process. In reviewing and evaluating public comments and proposals, the Trustees have applied the Restoration Project Selection Criteria (Section 4.2.4). Although some of the suggestions were not incorporated into the final plan, others have enhanced the final plan. The comments received have been grouped below into similar subject matter headings and the Trustees' responses are presented below each comment.

**1. How many marbled murrelets are there in Grizzly Creek compared to Redwood National and State Parks?**

While both the Grizzly Creek complex and Redwood National and State Parks (RNSP) both contain marbled murrelet habitat, there are no precise estimates of the numbers of marbled murrelets nesting in either area. However, since RNSP is considerably larger and at-sea surveys find greater numbers offshore, it is reasonable to infer that RNSP supports more marbled murrelet nesting than does Grizzly Creek.

**2. The trustees should consider Redwood National and State Parks as a restoration site to compensate for marbled murrelet injuries.**

The trustees have considered Redwood National and State Parks (RNSP) as a potential site for restoration. In fact, the corvid control restoration concept and costs are based in part upon information provided by RNSP staff.

The large contiguous area of murrelet habitat in RNSP makes it one of the most ecologically significant murrelet nesting areas in California and offers the potential for achieving relatively long term benefits from restoration actions. In addition to being the likely nesting area of many Northern California marbled murrelets, its geographic relationship to the spill trajectory suggest that many of the murrelets killed by the spill probably nested in RNSP (although some may also nested in southern Humboldt County).

However, because the Mamu habitat under the jurisdiction of RNSP is already in public ownership and therefore relatively well protected, the trustees believe that greater benefits to this species can be provided by preserving relatively less protected habitat that is in private ownership. On the other hand, the Trustees have selected as a preferred project corvid control activities in RNSP.

**3. The responsible party should pay the price of the Grizzly Creek MMCA at the time of settlement.**

The primary responsibility of the trustees is to attempt to obtain for the public fair compensation for the injuries resulting from the *M/V Stuyvesant Oil* spill. For the human recreational use impact, this is the estimated dollar value of lost and devalued recreational use. For biological resources, this compensation can take the form of either biological restoration projects that provide equivalent service value or the dollar cost of performing such restoration projects. When compensation is achieved through implementation of a biological restoration project, the specific dollar price of the project is not directly relevant, so long as the appropriate resource gains are achieved.

4. **Protection of second-growth forest should be considered one of the "preferred alternatives" for compensating for marbled murrelet injuries.**

Protection of second-growth forest is not considered one of the "preferred alternatives" primarily because of the uncertainty and timing of the benefits to marbled murrelets.

While relatively young second-growth forest can be used to buffer current old-growth habitat, the primary motivation behind protecting expansive stands of second-growth is the future, successful nesting of marbled murrelets at those sites. Under natural conditions, the development of nesting structures in these trees will occur in the far future (i.e., many second growth trees are younger than 50-years old, and the trustees do not expect benefits to marbled murrelets until stands are older than 200 years in age). If current restoration actions are not successful in increasing the population numbers in the short-term, marbled murrelet populations will either maintain current numbers or continue to decline. If this is the case, restoration strategies focused on second-growth protection run the risk of producing habitat far in the future that will not be utilized by marbled murrelets because there are insufficient numbers to fully occupy those areas.

5. **The silvicultural management of second-growth forest should be considered one of the "preferred alternatives" for compensating for marbled murrelet injuries.**

Similar to second-growth protection, silvicultural management of second-growth forest is not considered under the preferred alternative because of the uncertainty and timing of the benefits to marbled murrelets.

It has been suggested that second-growth stands in the redwood region can be successfully managed to decrease the time it takes for marbled murrelet habitat to develop. Carey et al.(2003) argue that "there is sufficient scientific knowledge to warrant implementation of restoration thinning projects on a large scale (i.e., involving hundreds to thousands of acres)" (p.2). This conclusion is based primarily upon the observations that silviculture can (1) increase the growth of large limbs and (2) provide canopy cover to prevent growth of understory used by predators of murrelet nests. While these methods have yet to be tested for the enhanced creation of murrelet habitat, it is reasonable to believe that silvicultural management can achieve these two goals, given success in adapting the range of possible management options to "specific stand conditions" [p.2])

Success in enhancing platform nesting branches and reducing habitat for nest predators does not, however, address two fundamental concerns that the trustee council had with "second-growth management" restoration concept.

First, as long as the successfully managed second-growth is in the close proximity of unmanaged second-growth (or other sources of nest predators), reduction of onsite habitat will have very uncertain impact on the actual rate of nest predation, and thus, runs the risk of providing little benefit to marbled murrelets.

Second, by all accounts, the emergence of suitable nesting characteristics will occur far into the future. Carey et al. (2003) suggest that silvicultural management take place when stands are 40- to 80-years-old (p.2), and that it is their "best professional judgment" that new nesting habitat will begin to emerge in "the $40^{th}$ year post-treatment" (p.48). The trustees believe that this assessment is optimistic, as well as unclear on how habitat with newly "emerging" characteristics compare to currently established nesting areas. However, it is still straightforward to conclude that the likelihood that murrelets actually expand into these "emerging areas" (and therefore derive benefit from them) will be a function of a very uncertain population trend in the near term.

If current restoration efforts are not successful in increasing the population numbers in the next 40 to 120 years, than management of second growth is unlikely to be of much benefit to marbled murrelets, even if such management is extremely successful at achieving its habitat construction objectives.

6. **How does the recent purchase of Grizzly Creek MMCA by the Wildlife Conservation Board (WCB) affect the proposed acquisition project contained in the M/V Stuyvesant Natural Resource Damage Assessment Restoration Plan?**

Acquisition of the Grizzly Creek Marbled Murrelet Conservation Area (MMCA) began in 1999 with State funds allocated through Assembly Bill 1986. At that time, approximately 716 acres were purchased from Pacific Lumber Company. The State funds were insufficient to buy the entire MMCA, which is approximately 1400 acres in size. The State and federal incidental take permits associated with the Headwaters Forest project, including the associated Pacific Lumber Company Habitat Conservation Plan and the Implementation Agreement, prohibited logging of the MMCA for a five-year period in order to provide an opportunity for purchase and permanent protection of any unacquired lands.

In the fall of 2003, the Wildlife Conservation Board (WCB) approved the acquisition of, and the state acquired, the remaining 691 +/- acres of the MMCA with bond monies from the California Clean Water, Clean Air, Safe Neighborhood Parks and Coastal Protection Act of 2002 (Prop. 40), California Public Resources Code Section 5096.650. This acquisition was undertaken with the understanding that funds earmarked for marbled murrelet habitat acquisition obtained by the trustees through a settlement or civil judgment might be used to reimburse the Prop. 40 funds with which WCB acquired the MMCA. Consequently, acquisition of the Grizzly Creek MMCA remained one of the preferred restoration alternatives in the draft Restoration Plan. However, the Trustees retained the authority to select and implement alternative restoration projects after considering public comments as provided by the Oil Pollution Act, the National Environmental Policy Act, the California Environmental Quality Act, and court approval.

Acquisition of the remainder of the Grizzly Creek MMCA remained one of the preferred restoration alternatives in the draft Restoration Plan. The draft Restoration Plan contemplated reimbursing all or a portion of the Propostion 40 funds that were used to acquire the remaining MMCA acres before the 5-year option expired in March 2004. The funds would have then be used by WCB to fund future Proposition 40 qualifying projects.

After the draft DARP was completed, the Responsible Party submitted to the Trustees an alternative Marbled Murrelet habitat preservation project. This project proposal was released for public review concurrently with the draft DARP. The project is for a conservation easement on old growth parcels and surrounding second growth timber, known as the Miracle Mile Complex, currently owned by Green Diamond Resource Company (Miracle Mile project; Humboldt County). After consideration of public comment regarding, and other factors related to, the Grizzly Creek and Miracle Mile projects, the Trustees selected the Miracle Mile project as the preferred restoration project. Rationale for the Trustees' decision include the larger acreage of unentered old growth acreage contained in the Green Diamond parcel, increased cost-effectiveness of the Green Diamond project, and considerably greater threat of harvesting in Green Diamond parcel versus the MMCA.

7. **Is the Redding Rock common murre project site abandoned, or are the trustees proposing to enhance an existing colony?**

Currently, there is a very small colony at Redding Rock. It is in danger of extirpation due to its small size and proximity to disturbance sources. It addition to reducing this disturbance, the trustees plan to implement social attraction using decoys. This aims at increasing the area of the rock used by common murres.

8. **Would there still be benefits to the Redding Rock common murre project if the USCG voluntarily decommissions (or alters the management of) their navigational light outside of this scope of the project?**

Trustee agencies have already been in contact with the USCG regarding the light because of its potential contribution to the decline in the common murre colony. While this is an important element of the Redding Rock project, it is only one of the elements. If management of the light is decommissioned outside the scope of the trustee restoration project, the Redding Rock project would still likely include other disturbance reduction measures, as well as social attraction elements (as needed).

9. **Would the human use project at Patrick's Point be completely funded by the M/V Stuyvesant oil spill settlement funds?**

At the time of the Draft DARP, the trustees believed that a portion of the settlement funds received to compensate for human use losses would be sufficient to completely fund the Patrick's Point project. However, the project proponent has since advised the Trustees that the available funds may not be sufficient to fund all components of the Patrick's Point project; the Trustees will work with the proponent to ensure that funds are used efficiently to maximize human use benefits gained from this project.

10. **Consider implementing the following projects in the Clam Beach area to compensate for impacts to western snowy plovers:**

    a. **Installation and maintenance of exclosures around snowy plover nests;**
    b. **Preparation and installation of education signs related to the western snowy plover;**
    c. **Funding of weekly surveys for western snowy plover nests and chicks during the breeding and nesting season (March 1 to September 1);**

d. **Installation of a new chain link fence at the base of the hill north of the Vista Point Overlook to control public access to Clam Beach during the breeding and nesting season of western snowy plovers;**
e. **Funding of a beach patrol ranger from March 1 to September 1; and**
f. **Preparation of a multi-species habitat conservation plan for the Clam Beach area**

The Trustees agree that Clam Beach is an appropriate location for projects to compensate for impacts to snowy plovers and beach habitat. Clam Beach was one of the most heavily oiled beaches and observers estimated that 10 of the 30 snowy plovers observed at Clam Beach during the spill were oiled. In the Draft DARP, the Trustees considered several measures to benefit snowy plovers at Clam Beach, including restriction of vehicle access to protect dune species, eradication of European beach grass, installation of signs and fencing to protect nests from human disturbance, and predator control.

Beach grass eradication and disturbance reduction (signs and fencing) were identified as tentatively preferred projects. Monitoring nesting areas and plover nests to evaluate effectiveness of the restoration measures at enhancing plover fledging success was also included as part of the tentatively preferred projects. These measures encompass items (a) – (c) from the list recommended by the commenter. The construction of a chain link fence at the base of the hill north of the Vista Point Overlook (d) was not one of the measures considered by the Trustees, but fencing nesting areas with a less obtrusive material was considered and identified as a tentatively preferred alternative.

The Trustees continue to prefer the combination of nesting habitat enhancement through European beach grass eradication and nest protection through installation of signs and fencing as the best approach for compensating for the impacts of the Stuyvesant spill on snowy plovers and sandy beach habitats. If monitoring data indicate that snowy plover reproduction is not improved by these measures, the Trustees would consider contributing towards the funding of a seasonal ranger to patrol Clam Beach and assist with public outreach and other plover protection measures (item [e] on the above list).

The Trustees consider item (f), development of a multi-species habitat conservation plan for the Clam Beach area, to be beyond the scope of restoring resources injured by this oil spill.

11. **Consider implementing the following projects in the Clam Beach area to compensate for lost recreational uses resulting from the spill:**

    a. **Install infrastructure for a seasonal camp host/beach ranger;**
    b. **Install a pay phone;**
    c. **Construct a ten car parking lot with stairways at the west end of Crannell Road to provide access to Little River State Beach and install chemical restrooms; and**
    d. **Build a changing room/rinse off station/restroom at Moonstone Beach.**

The Trustees considered several different options for compensating for human use. Based upon our restoration project selection criteria (see Section 4.2.4.) and public comments, the Trustees selected both the Patrick's Point and the McDaniel Slough projects to compensate for lost recreational uses.

**12. The City of Arcata supports salt marsh and bird restoration projects in Humboldt Bay and would be willing to work cooperatively with the Trustees on these projects, including the Old Arcata Wharf pelican and cormorant enhancement project.**

The Trustees appreciate the City's support. However, since the preparation of the draft DARP the Trustees have reconsidered the Old Arcata Wharf Project and now prefer the Pelican Roost Site Protection Project. The Pelican Roost Site Protection Project will rely on a more natural solution and will not cause construction disturbance to the shoreline habitat of the Old Arcata Wharf area.

**13. The Trustees should consider the McDaniels Slough Wetland Restoration project as an alternative to the Hookton Slough Wetland Restoration project, or as a project to compensate for recreational use losses that resulted from the spill.**

The Final DARP has been updated to include the McDaniels Slough Wetland Restoration project as a preferred alternative, replacing the Hookton Slough project which was a preferred alternative in the Draft DARP. Comparison of the two projects indicate that they would achieve comparable benefits and the McDaniels Slough project would probably provide these benefits faster because it is further along in the planning and permitting process. It also offers possibilities for simultaneously addressing some of the human use losses resulting from the spill.

**14. Regarding the Humboldt Trails project concept, what aspect of the larger plan would be funded? The Trustees should consider Elk River Wildlife Area as a Humboldt Trails project.**

In the Draft DARP, the Trustees had not identified a specific component of the Humboldt Trails plan for funding. For the Final DARP (after legal settlement of the Stuyvesant case), the Trustees re-evaluated the human recreation use projects (see Section 4.2.4 of the Final DARP for project selection criteria), including access improvements for various wildlife areas. As a result of this re-evaluation, the Trustees selected the McDaniels Slough Wetland Restoration project as a preferred alternative. The basis for this decision, as indicated above, was due in large part to a relatively broad array of benefits offered by the project, including marsh habitat, wetland bird foraging, and human recreational use.

**15. Does the settlement consider "interest" that could be earned between the time of the spill and the time of restoration?**

The calculations used to assess the biological restoration and human use compensation incorporate the lag between the spill and restoration. In general, the farther settlement and restoration occur in the future, the more restoration is needed to compensate the public. This practice is called "discounting" and it is similar to the idea of compounding interest.

**16. Did the trustees work with the responsible party on developing the restoration plan?**

The information provided to the public in the Draft DARP and discussed at the public meeting accurately represents, in summary, the dialogue between the trustees and the RP. In addition, shortly before the public meeting, the RP proposed, and the trustees sought comment concerning, protection of a privately held parcel of forest habitat to compensate for the injury to marbled murrelets. The trustees, having considered all relevant factors, concluded that the RP's proposal to protect approximately 625 acres of timber known as the Miracle Mile complex is superior to their proposed project to reimburse WCB for the acquisition of a portion of the Grizzly Creek MMCA. As to the other injuries, the parties worked closely in "scaling" the size of the restoration projects, and the RP has, in general, deferred to the trustees as to particular projects.

**17. What is the status of the M/V Kure settlement?**

In general, the Kure matter is proceeding at a slower pace than Stuyvesant. Both sides hope that they can reach a settlement without the need for litigation, however.

**18. Is there a way to combine Kure and Stuyvesant Settlements to get more efficient restoration?**

Although there is probably no realistic way to combine the two settlements in the same court proceeding, in the restoration planning processes, the trustees will seek complementary restoration approaches.

**19. Comments regarding the Trustees' Marbled Murrelet mortality estimates and population assumptions:**

**a. Ford's model has considerable "error bars" around the mortality estimate.**
**b. Headwaters "protected as many birds" as estimated killed in the M/V Kure (Stuyvesant?) spill. The Headwaters transaction should be used as a basis for determining the size of the old growth parcel to be protected to restore MAMUs killed by the spill.**
**c. The new MAMU population estimates for the Southern Humboldt areas are lower than we previously thought making the impact of the oil spill(s) on the local MAMU population even graver.**

Responses:

a. There is considerable uncertainty in the acute mortality estimates for Marbled Murrelets. Estimating total acute mortality from bird carcasses collected at a spill is a complicated process. The Trustees relied upon a peer-reviewed modeling framework (Ford et. al 1987, Page et al.1990, Ford et. al 1996) that incorporates correction factors to address various factors that can have a significant downward influence on the number of dead birds collected from beaches (and other shoreline areas). Specifically, the correction factors address carcass scavenging, searcher efficiency, and unsearched areas. Inputs to the modeling framework were derived from studies conducted in the Humboldt area.

Unfortunately, all scientific modeling inevitably has some degree of uncertainty. For the Stuyvesant spill, there is greater uncertainty in the Marbled Murrelet acute mortality estimate than for estimates of some of the other species (e.g., Common Murre). This is because: (1) there were fewer carcasses available upon which to base an extrapolation; (2) Marbled Murrelets are more difficult to find because they are relatively small; and (3) Marbled Murrelets are more quickly removed by scavengers. The second and third factors cause smaller absolute variation in acute mortality model inputs to have larger proportional impacts on output estimates.

The Trustees reduced error from uncertainty by choosing “average values” of inputs where possible. This helps balance the possibility of over-estimating versus underestimating mortality loss. Although uncertainty exists in the estimate, the Trustees believe the estimate is a defensible number based on the available information and data.

Citations

Ford, R. G., G. W. Page, and H. R. Carter. 1987. Estimating mortality of seabirds from oil spills. Proceedings of the 1987 Oil Spill Conference, Baltimore, MD. American Petroleum Institute. pp. 547-551.

Ford, R.G., M.L. Bonnell, D.H. Varoujean, G.W. Page, H.R. Carter, B.E. Sharp, D. Heinemann, and J.L. Casey. 1996. Total direct mortality of seabirds from the *Exxon Valdez* oil spill. Pages 684-711 in S.D. Rice, R.B. Spies, D.A. Wolfe, and B.A. Wright, editors. Proceedings of the *Exxon Valdez* oil spill symposium. American Fisheries Society Symposium 18.

Page, G. W., H. R. Carter, and R. G. Ford. 1990. Numbers of seabirds killed or debilitated in the 1986 Apex Houston oil spill in central California. Studies in Avian Biology No. 14: 164-174.

b. Compensation for Marbled Murrelet injuries in the M/V Stuyvesant spill is derived from restoration projects that benefit Marbled Murrelets. Calculations are based upon established and appropriate methodologies for addressing this mortality. The public purchased the Headwaters property from Pacific Lumber Company (PALCO) to preserve a specific old-growth tract and to remove it from the prospect of commercial timber management. The purchase was part of the Headwater's Forest Agreement, which also included a requirement that PALCO develop a Habitat Conservation Plan (HCP) on their remaining PALCO timberlands. This subsequent HCP addresses management of several special-status species, including Marbled Murrelets, in the context of ongoing commercial timber management. Since the Headwaters purchase was neither compensation for specific impacts to nor specifically focused on Marbled Murrelets, it is not appropriate to compare it to the murrelet component of the M/V Stuyvesant spill settlement. The Trustees cannot verify whether or not the same number of birds was protected in the Headwaters Acquisition as was killed by the Stuyvesant spill.

c. The Trustees believe that the loss of 135 Marbled Murrelets, as described in the DARP, is a significant impact to Marbled Murrelets in the vicinity of the Humboldt County. To the extent that the affected birds were part of a smaller (and more isolated) subset of Marbled Murrelets off the coast of California, the Trustees agree that this impact was probably even more significant.

## B. Written Comments Received During Public Review Period

**United States Department of the Interior**
**California Department of Parks and Recreation**
Redwood National and State Parks
1111 Second Street
Crescent City, California 95531

CALIFORNIA STATE PARKS

A7615

July 7, 2004

Ms. Charlene Hall
U.S. Fish and Wildlife Service
2800 Cottage Way, Suite 2605
Sacramento, California 95825

Dear Ms Hall:

We have reviewed the draft Stuyvesant/Humboldt Coast Oil Spill Draft Damage Assessment and Restoration Plan and commend the technical work group for their efforts in producing this excellent document.

The Plan recommends Redwood National and State Parks (RNSP) and vicinity as the primary site for initiating corvid management, one of two preferred restoration concepts as compensation for marbled murrelet mortalities resulting from the oil spill. The other preferred concept is acquisition of additional old-growth/residual/younger-aged habitat at either Grizzly Creek Marbled Murrelet Conservation Area or Green Diamond Miracle Mile forest complex in Klamath. Three other restoration concepts mentioned in the plan that were not selected as preferred concepts by the technical work group were silviculture of second-growth forest to create nesting habitat, captive breeding, and artificial nest platforms.

RNSP supports the corvid management concept of limiting anthropogenic food sources that may result in unnaturally large corvid populations. There are two ways to attack this problem, by limiting access by corvids to anthropogenic foods, and by educating the public about the importance of proper handling and disposal of food and waste.

RNSP is currently seeking funds to complete bear-proofing all RNSP campgrounds and visitor use facilities. Bear-proofing has the desired effect of corvid-proofing by limiting corvid access to anthropogenic food sources. We estimate that $85,000 is needed to finish bear-proofing all of our campgrounds and visitor use facilities.

We also believe that increased public education programs focused on corvid management can have a positive influence on limiting anthropogenic foods in and around the parks. Currently we are educating the public through limited campfire talks, roving patrols, and brochures explaining the relationship of trash and corvid numbers, and the impacts of corvids to nesting marbled murrelets. Unfortunately, budget challenges are hampering our ability to continue these seasonal programs at effective levels. With additional staffing, we should be able to greatly improve our existing corvid educational programs and also do outreach with the surrounding communities and state and county agencies in dealing with trash management at landfills and other areas that attract corvids. Education programs can include production of videos, signs, increased campfire or evening talks, television/radio coverage, and increased roving patrols to improve direct public contact. We estimate that these efforts would require approximately $250,000 for five years to hire 4-5 seasonal interpretive staff and to produce educational programs, videos, television/radio coverage, increase campfire and evening talks, and increase public contact through roving patrols and signage.

We recommend that silviculture of second-growth forest to create potential future murrelet nesting habitat be elevated to a preferred project concept, and that RNSP be given consideration as the primary site for implementation. About 50,000 acres of second-growth forest habitat exists within the boundary of RNSP. We are currently working on completing a second-growth forest management plan that will focus on accelerating the return of old-growth forest characteristics to these second-growth stands. A scientific panel to assess restoration of marbled murrelet habitat consisting of Dr. Andrew Carey, Dr. Steven Courtney, Dr. Jerry Franklin, Dr. John Marzluff, Dr. Martin Raphael, Dr. John Tappeiner, and Dr. Dale Thornburgh stated that "there is sufficient scientific knowledge to warrant implementation of restoration thinning projects on a large scale" to accelerate murrelet nesting habitat as appropriate to specific stand conditions. Therefore, we feel that second-growth thinning is a viable technique with likelihood of success in accelerating stand structure that would benefit nesting marbled murrelets. Marbled murrelet populations in RNSP are recognized as the keystone to the recovery and long-term survival of the species in northern California. More than 75 percent of the remaining marbled murrelets left in California may use RNSP at some point in their lives. As such, protection, conservation and recovery of these populations and their habitat in RNSP are critical to accomplishing goals of the marbled murrelet recovery plan.

We also believe that there is recent research that supports the notion that many of the 135 total marbled murrelet oil spill mortalities were murrelets that either nested in RNSP forests or utilized the offshore waters within the park. Dr. Richard Golightly at Humboldt State University studied offshore movement patterns of radio-tranmittered marbled murrelets captured offshore of RNSP and found that they ranged as far south as Trinidad Bay and some beyond Humboldt Bay. Therefore, this could be another supporting rationale for conducting additional restoration work within the RNSP.

We thank you for the opportunity to provide comments on the draft plan. If you have any questions, please contact Howard Sakai at 707 464-6101, extension 5270.

Sincerely,

*/s/ Bill Pierce*
Bill Pierce
National Park Superintendent

*/s/ Richard C. Sermon*
Richard C. Sermon
State Parks Superintendent

"Geist, Jill" <Jill.Geist@co.humboldt.ca.us>

06/17/2004 06:00 PM

To: <Charlene_Hall@fws.gov>

cc: "Tuttle, Don" <DTuttle@co.humboldt.ca.us>, "Hofweber, Tom" <THofweber@co.humboldt.ca.us>, "Riccomini, Kathy" <KRiccomini@co.humboldt.ca.us>, "Neely, Bonnie" <Bonnie.Neely@co.humboldt.ca.us>

Subject: Stuyvesant Spill

Charlene,

I attended the FWS public meeting last night held in Eureka regarding the damage assessment report on the Stuyvesant spill of 1999 . Following the presentation, which outlined various proposed restorations, I queried County staff as to whether we (the County of Humboldt) had submitted any proposed mitigations measures.

In response, Don Tuttle-Deputy Director, provided me with a copy of a letter submitted October 4, 1999 that detailed a series of mitigations. I am unable to discern whether those proposed mitigations had been reviewed and evaluated in the final draft plan.

I will be preparing a formal letter referencing the previous correspondence, but wanted to let you know ASAP of additional pending public comment. If you have any questions, please contact me at (707) 476-2395 or Don Tuttle at (707) 268-2686.

Sincerely,

Jill K. Geist
Humboldt County Supervisor - Fifth District

BOARD OF SUPERVISORS
COUNTY OF HUMBOLDT
825 5TH STREET
EUREKA, CALIFORNIA 95501-1153 PHONE (707) 476-2390 FAX (707) 445-7299

June 18, 2004

RECEIVED
JUN 2 8 2004
SACRAMENTO FISH & WILDLIFE OFFICE

Charlene Hall
U.S. Fish and Wildlife Service
1655 Heindon Rd.
Arcata, CA 95521

**RE: Stuyvesant/Humboldt Coast Oil Spill
Damage Assessment and Restoration Plan**

Dear Ms. Hall:

Pursuant to my e-mail communication to you on June 17, 2004, enclosed are comments from Humboldt County regarding mitigation measures related to the above referenced oil spill. As these comments were originally submitted in October 1999 please assure that they are considered in the final plan.

Should you have any questions, please contact me at 707-476-2395.

Sincerely,

Jill Geist, 5th District Supervisor
County of Humboldt

JG/kr

610.6013
610.6093
Clam Beach

DEPARTMENT OF PUBLIC WORKS
COUNTY OF HUMBOLDT
MAILING ADDRESS: 1106 SECOND STREET, EUREKA, CA 95501-0579
AREA CODE 707

| ARCATA EUREKA AIRPORT TERMINAL McKINLEYVILLE | | PUBLIC WORKS BUILDING SECOND & L ST., EUREKA | | | | CLARK COMPLEX HARRIS & H ST., EUREKA | |
|---|---|---|---|---|---|---|---|
| AVIATION | 839-5401 | ADMINISTRATION | 445-7491 | NATURAL RESOURCES | 445-7741 | REAL PROPERTY SERVICES | 445-7205 |
| | | BUSINESS | 445-7652 | PARKS | 445-7652 | | |
| | | ENGINEERING | 445-7493 | ROADS & EQUIPMENT MAINT. | 445-7421 | | |

October 4, 1999

Alix Van Geel
Industrial Economics, Incorporated
2067 Massachusetts Avenue
Cambridge, MA 02140

Re: Mitigation Measures Related to Oil Spill on September 9, 1999 in Humboldt County, CA

Dear Ms. Van Geel:

The purpose of this letter is to provide you with a list of potential mitigation measures for the Clam Beach area to compensate for impacts to the western snowy plover and local users of this county park area. To reiterate some of my comments during our phone conversation, impacts to the western snowy plover could have consisted of oil picked up while walking in polluted areas of the beach, breathing hazardous vapors which had been detected by county environmental health specialists, and eating insects polluted with spill residue. Impacts to local beach users consisted of loss of use of the Clam Beach/Moonstone Beach County Parks during the few weeks clean up crews cleaned up the beaches.

Following is a list of potential mitigation measures:

1. Infrastructure for a seasonal camp host/ beach ranger - $40,000
2. Installation of pay phone- $8,000
3. New chain link fence at base of hill north of Vista Point Overlook to control public access to Clam Beach during the breeding and nesting season of western snowy plovers. $15,000
4. Preparation and installation of education signs related to the western snowy plover. $2,000
5. Weekly surveys for western snowy plovers' nests and chicks during the breeding and nesting season in the year 2000. $5,000
6. Beach patrol ranger March- August 2000. $50,000

7. Preparation of a multi species habitat conservation plan for the Clam Beach area. $40,000
8. Installation of exclosures around western snowy plover nests discovered during surveys in year 2000. $10,000
9. Construction of a ten car parking lot with stairways at west end of Crannell Road to provide access to Little River State Beach. Chemical restrooms. $40,000
10. A changing room/ rinse off station/ restroom at Moonstone Beach. $50,000

It is our understanding 90% of the impact of the oil spill occurred on the Clam Beach to Moonstone Beach area. If you need further details and clarification I can be reached at (707) 445-7652.

Thank you for your cooperation.

Very truly yours,

Donald C. Tuttle

Donald C. Tuttle
Deputy Director

DCT/jrr

G:\Tuttle\snowyplover

DEPARTMENT OF PUBLIC WORKS
COUNTY OF HUMBOLDT
MAILING ADDRESS: 1106 SECOND STREET, EUREKA, CA 95501-0579
AREA CODE 707

ARCATA EUREKA AIRPORT TERMINAL McKINLEYVILLE
AVIATION 839-5401

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BUSINESS 445-7652 PARKS 445-7651
ENGINEERING 445-7377 ROADS & EQUIPMENT MAINT. 445-7421
ARCHITECT 445-7493

CLARK COMPLEX HARRIS & H ST., EUREKA
LAND USE 445-7205

January 29, 2001

Joe Lesh
California Department of Fish and Game
619 2nd Street
Eureka, CA 95501

Re: Project Related To Stuyvesant Spill

Dear Mr. Lesh:

Attached is a sheet describing a proposed project, hopefully to be funded by the insurance company for the owner of the Stuyvesant ship which suffered an oil spill a few years ago. Preparation of this project description sheet is in response to our meeting of January 19th, 2001, in which you requested each attendee to send you a project description in a format agreed upon at that meeting.

Very Truly Yours,

Donald C. Tuttle
Deputy Director of Public Works-General Services

cc: Bob Walsh, Parks Supervisor
Jim Watkins, U.S. Fish and Wildlife Services
Karen Kovacs, Dept. of Fish and Game
Lynda Roush, Bureau of Land Management
Paul Kirk, 5th District County Supervisor
John Woolley, 3rd District County Supervisor
Jimmy Smith, 1st District County Supervisor

COPY

DEPARTMENT OF PUBLIC WORKS

COUNTY OF HUMBOLDT

MAILING ADDRESS: 1106 SECOND STREET, EUREKA, CA 95501-0579
AREA CODE 707

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BUSINESS 445-7652 PARKS 445-7651
ENGINEERING 445-7377 ROADS & EQUIPMENT MAINT. 445-7421
ARCHITECT 445-7493

CLARK COMPLEX
HARRIS & H ST., EUREKA
LAND USE 445-7205

# ACCESS CONTROL PROJECT FOR CLAM BEACH COUNTY PARK

Project description: The project would consist of placing four-ton or larger boulders four feet apart to control vehicles accessing Clam Beach County Park. In addition a strong metal gate would be installed along with an information Kiosk.

Purpose: The purpose for controlling access to Clam Beach County Park is to protect three listed species, namely the Western Snowy Plover, Menzies Wallflower and Sand Verbena. Currently several vehicles have uncontrolled access to Clam Beach, Little River State Beach to the north, and other beaches to the south. These beaches and their related dunes, provide habitat for the Western Snowy Plover, Menzies Wallflower and Sand Verbena. U.S. Fish and Wildlife Service has requested the County of Humboldt provide access control in order to protect these species.

Link to spill: Controlling access would protect the three listed species noted above and also provide crowd control during various emergencies such as oil spills. Recently the beach needed to be closed in order to allow spill clean up crews unhampered access to perform cleanup duty.

Cost: $15,000.

Contact person: Donald C. Tuttle, Deputy Director of Public Works, General Services

COPY

DEPARTMENT OF PUBLIC WORKS
COUNTY OF HUMBOLDT
MAILING ADDRESS: 1106 SECOND STREET, EUREKA, CA 95501-0579
AREA CODE 707

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CLARK COMPLEX
HARRIS & H ST., EUREKA
LAND USE 445-7205

## HABITAT CONSERVATION PLAN FOR WESTERN SNOWY PLOWER, MENZIES WALLFLOWER, AND SAND VERBENA

Project description: The project consists of the preparation of a habitat conservation plan for the Western Snowy Plover, Menzies Wallflower, and Sand Verbena, all of which are listed species.
The geographical area covered by the Habitat Conservation Plan(HCP) would be from Centerville Beach, north to Moonstone Beach in the County of Humboldt, California.

Purpose: The purpose of the HCP is to allow the County of Humboldt to apply for an incidental take permit from the U.S. Fish and Wildlife Service, covering the above listed species. Currently the U.S. Fish and Wildlife Service believes that "take" is occurring to the species from activities permitted on these beaches by the County of Humboldt, California Department of Parks and Recreation, Bureau of Land Management, State Lands Commission, Dept. of Fish and Game and U.S. Fish and Wildlife Service. All of these agencies need to receive an 'incidental take' permit in order for certain activities to continue to occur which will, in all probability lead to incidental take type impacts on the three listed species.

Link to spill: As part of the HCP it would be necessary to develop protocols to be followed by the spill clean up crews and containment agencies, following various types of emergencies such as oil spills. These protocols would be necessary to protect listed species during clean up operations.

Cost: $80,000.

Contact person: Donald C. Tuttle, Deputy Director of Public Works, General Services

COPY