To: Greg Challenger, Polaris Applied Sciences, Inc.

From: Jim Hoff, NOAA

Date: 20 June 2006

Re: Trustee Responses to Your 12 April 2006 Comments on the Draft Final Bird and Wildlife Injury Assessment Report

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On behalf of the Bird and Wildlife Technical Working Group, I am responding to your comments dated 12 April 2006 on the Draft Final Bird and Wildlife Injury Assessment Report. The Trustees have considered your comments in their own review of the report and have made appropriate changes to the Final Draft report that will now go out for peer review. To document how we have responded to your comments, we have inserted your 12 April 2006 memo where your suggested edits are highlighted in red, with the Trustee response indicated in **bolded blue text**.

(Begin memo and response)

April 12, 2006

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ATHOS 1 NRDA: General Comments on FINAL DRAFT BIRD AND WILDLIFE INJURY ASSESSMENT: *M/T ATHOS 1* OIL SPILL, DELAWARE RIVER SYSTEM

Dear Jim:

The following letter represents comments from Polaris on the Wildlife report dated March 24, 2006. We submit the relevant portions of the document as they appear in the original text with comments added.

PREFACE

This report was prepared ~~by the~~ in consultation with the Wildlife Technical Working Group (TWG) for the *M/T Athos* oil spill. Membership included the following agencies and individuals: **(distinction made in the preface between trustee and RP representatives)**

EXECUTIVE SUMMARY

Page ES-1, P1 On 26 November 2004, the *M/T Athos 1* struck several uncharted **(will not**

change because it is a legal issue) submerged objects while preparing to dock at the CITGO refinery in Paulsboro, NJ, resulting in the release of an estimated 265,000 gallons of Bachaquero Venezuelan crude oil into the Delaware River. Wildlife rescue efforts were initiated within 24 hours with search teams patrolling oiled shorelines and coordinating observations of dead and oiled wildlife with response/clean up crews. By May 2005, 166 birds were collected dead or died at the rehabilitation center and 401 birds were rehabilitated and released alive. How many days (man-hours) of search between November 26 and May? Do we know? **(We do not know and it will require extensive work, going back to individual timesheets, which we do not believe is necessary).**

P2 To estimate the extent and degree of oiling of non-recovered wildlife, the trustee and RP representatives conducted ground surveys between 30 November 2004 and 21 January 2005. All birds for which the degree of oiling could be determined were counted as an observation, as were visible unoiled birds in open water, adjacent wetlands, spoil banks, and adjacent upland habitats ~~were counted~~. Nearly 157,500 ~~birds were counted~~ bird observations were recorded during the ground surveys, with about 16,500 (10 percent) having some degree of oiling. About 72 percent of all oiled birds observed had trace or light oiling; 19 percent of oiled birds were moderately oiled; and nine percent of oiled birds were heavily oiled. Geese, dabbling ducks, and gulls made up 96 percent of all oiled bird observations. **(agree with all above edits).**

P3 While these counts do not reflect a standard flight time or area covered, in general, more birds moved into the area later in December as it became colder ~~and~~. **(agree)**

P4 Data from ground and aerial surveys were used in a risk-based assessment to determine the full extent of bird and wildlife losses resulting from the M/T *Athos 1* incident**.** **(agree)**

Indirect injury in terms of production foregone due to the loss of future generations was included in the estimation of total injury for the three guilds with the largest injury. This loss was considered as both the discounted loss of production from dead individuals projected 10 or 12 years from the time of the spill, and the discounted loss of production due to individuals that were oiled and survived, but failed to breed in the subsequent spring, and was calculated for one additional generation. Demographic and reproductive statistics for model species from each guild were used to estimate this loss with simple age-structured population models.

We have had numerous discussions about production foregone in a number of cases. We believe both OPA and CERCLA allow for the inclusion of recovery in the injury assessment. While CERCLA is clear about injury being a population level effect, we also believe OPA considers population recovery when assessing overall service loss. From a population standpoint, the ecological services (as indicated by population size and biomass) may recover prior to the 10 to 12-year predicted loss of production had the dead individuals survived. We would expect the population of some affected species to be within normal parameters very soon. Density dependent factors may act to fill the gap in the population with increased growth and survival rates for surviving members. We are not aware of any valid technical arguments as to why the recovery period for bird (or fish) populations affected by a mortality event is equal to the production attained in the lifespan of the longest-lived individuals. We understand that in catastrophic population losses, recovery may not be driven by some density dependent factors. However, we do not believe the injury in the ATHOS represents statistically significant declines in the population of any species. We also understand the trustees give density dependent recovery consideration within this document.

(The influence of density dependence mechanisms on the population dynamics of the three model species is, at best, uncertain. Current expert opinion suggests that these mechanisms play a moderate role in the population dynamics of mallards, and little role in the population dynamics of ring-billed gulls and Canada geese. The Trustees have given consideration to the issue of recovery mechanisms, primarily density dependence. In an effort to address the uncertainty surrounding the presence of such mechanisms, the Trustees conservatively evaluate production forgone only for one-third the maximum lifespan of the youngest adult bird killed in calculating injury. Whether these injuries constituted "statistically significant" declines in the total population is not at issue here.)

Page ES-2, P1. Table ES-1 summarizes total estimated injury to birds, in individuals, from the spill by species guild. Direct injuries totaled 3,526 birds, the majority (69 percent) of which ~~was~~ were gulls and geese. Additional estimated lost production from mortality and reproductive failure was 8,949 birds, bringing the total injury from the *M/T Athos 1* oil spill to 12,475 birds. **(agree)**

Page 1, **1.0 INTRODUCTION**

At 9:30 PM on 11/26/04, the *M/T Athos 1* struck uncharted submerged objects while preparing to dock at the CITGO refinery in Paulsboro, NJ, puncturing the No. 7 center cargo and the No. 7 port ballast tanks. **(disagree)**

Page 3 **2.1 Wildlife Rescue Efforts**

P1 Wildlife rescue efforts began within 24 hours following the spill. It would be valuable to know how many days, how many people, what was the coordination between cleanup crews, and how many miles were searched on how many days? These data may not be available, but this could be a "lesson-learned". **(see response on page 1)**

P2 There are several factors that lead to a smaller proportion of extant oiled and dead birds being recovered than is typical for many open water spills.

1) Setting: The surrounding area consists of industrial and commercial development, residential housing, forests, and marshes. On the upper river buildings, other structures, uneven terrain, marshes, and tree and shrub lined shorelines provided visual obstructions that made it difficult to see or recover birds. Private property access restrictions limited the areas that could be surveyed. On the lower river difficult to traverse marshes, flooding tides, and a lack of manpower and equipment prevented adequate recovery of oiled wildlife.

We do not believe this is different than many other spills with reported recovery rates.

2) Behavior and appearance: Oiled birds tended to pick up oil on the feet and/or belly. Oil on birds swimming or standing in water is difficult to observe. Oil is also difficult to see on dark colored birds.

This is true for birds in every spill and does not lead to a smaller proportion of dead birds found than in other spills.

3) Oil: The oil was heavy, relatively sticky crude oil. Birds that came into contact with the oil on the water were weighed down and eventually sank. Observers were unable to recover several birds that were pulled under by the weight of the oil. This is speculation. Most of the oil did not sink. There is no way to know if the weight of the oil resulted in birds sinking any more than any other heavy fuel or crude oil spill. Birds that come into contact with such oil tend to behave abnormally and may preen excessively, ingest oil, eat less, and lose the ability to swim or retain body temperature. In this weakened state, birds are more likely to be predated upon. To prevent this, sick birds will hide under vegetation, thus making it more difficult for potential predators and people to detect or recover oiled birds. This is also true in other spills. **(we have edited the sections slightly as appropriate)**

Furthermore, the spill occurred during one of the most dynamic periods for migration. For most species, individuals were migrating through the spill areas, and were not likely to have remained in the oiled areas. Oiled birds were reported in areas far outside of search and rescue areas, such as Bombay Hook National Wildlife Refuge and Avalon Beach on the outer coast north of Cape May. This could also be an indicator that oiled birds may have been double counted in more than one observation region, contributing to the percent of birds estimated to be oiled in two or more areas. In other words, the percent oiled near the spill was initially high and became less over time, while the percent of oiled birds observed could have increased as oiled birds moved out of the spill area. **(Though there is no way to completely account for the movements of oiled birds, the trustees have made best use of available data to avoid potential double counting, including accounting for survival and recounting of lightly oiled birds. In general, the percentages of oiled birds across regions and time periods roughly correspond to known levels of open-water and shoreline oiling. It should also be noted that open water and shoreline oil were documented far south of the southern boundary of this study.)** Marshes froze during the spill forcing birds out and probably causing them to move along on migration.. Migrating oiled birds would have died over a large area, whereas search and recovery efforts were limited to bird concentration areas that were accessible. We have not seen any evidence of a total marsh freeze that caused any birds to move away. A total freeze may also prevent birds from being oiled. In either event, both scenarios are equally based on speculation in the absence of evidence. (**According to Doug Forsell from USFWS, some marshes did freeze overnight on some of the coldest nights, forcing the birds to move to open water areas for those periods. Citation added.)** Scavengers were common, and it would be difficult to find scavenged carcasses in the remote wetland areas. All these factors are likely to have contributed to the low numbers of oiled, dead birds recovered. Scavengers in this area are actually less than in some other areas that have coyotes, fox, corvids and other large predators. We do not see this as being any different than other spills.

This section reads as if the trustees are trying to preemptively address the reason why the loss estimate may seem high compared to other spills. All sorts of hypotheses are put forth to discount the data of observations of dead birds; some of which are not necessarily supported by the data. Another reason why there may not have been as many dead birds as predicted by the trustees' assumptions is that the assumptions may not be correct. **(The Trustees reported field observations made during the spill that affected rescue efforts. We believe that these are valid points).**

2.3 Page 4 Spilled **Oil Characteristics**

The spilled oil was a heavily biodegraded crude oil that was depleted in low molecular weight hydrocarbons (Michel et al., 2004). Donlan et al. (2005) prepared an evaluation of the composition and potential environmental fate and aquatic toxicity of the oil that indicates that the oil poses significant risks to wildlife from ingestion and smothering. This statement leads the reader to believe that this oil poses a significant threat to birds from ingestion and smothering that other oils do not. This characteristic is not unique to this oil. We also found its toxicity to be relatively low compared to other heavy oils. It may be better to simply say that heavy crude oil in general is known to pose a………… **(agree)**

Page 8, **3.0 BIRD INJURY QUANTIFICATION APPROACH**

The trustees considered several approaches to estimate the actual mortality resulting from this incident, including:

1) Selection of a Multiplier. In this approach, data from the oiled and dead bird recovery effort is multiplied by a factor to arrive at an estimate of the total bird mortality. Burger (1993) summarized data for 21 spills where the actual and estimated bird mortalities were reported. On average, the estimates were 4.4 times higher than the actual counts. For the *North Cape* oil spill off Rhode Island, the natural resource trustees used a multiplier of 6, after evaluating the spill conditions (Sperduto et al., 1998). However, this case and many others where seabird mortality has been well-studied occurred in open coastal settings where dead seabirds drifted out to open seas. The trustees did dot feel that it was appropriate to use multipliers for this spill because those that are reported in the literature are generally developed in physical settings different from the riverine and upper estuarine environment of Delaware Bay. Furthermore, most of the birds affected were Canada geese and gulls that spend most of their time on shores or upland areas compared to seabirds that spend most or all of their time on the water.

"Selection of a Multiplier" approach is rejected based on the argument that the type of environment impacted is different from other types of environments for which multiplier approaches have been used (e.g., 4.4 from Berger (1993), that results in 4.4 x 166 = 730 mortalities for the ATHOS I). Using a multiplier from many other spills results in an estimate that is substantially lower then the trustee estimate for the Athos spill. The distinguishing feature cited is the belief that many birds got carried away with tidal action. We believe an open ocean spill can result in even more difficulties in finding birds and often results in a higher multiplier than inshore spills. The fact that more birds spend time on the shoreline means we should find more, not less than an open ocean spill. The suggestion of the North Cape approach is that the multiplier needs to be higher when something as significant as tidal action quickly "hides the evidence" of bird mortality. Since tidal action of the type seen in the North Cape incident is not likely to play as significant a role in "hiding the evidence" of mortality in this case, a reasoned approach may require the use of a multiplier less than 4.4 (or 6, as used in the North Cape).

There are other factors which make a multiplier a valid approach. (1) There were, literally, thousands of workers focused on oil impacts all over every heavily and moderately oiled shoreline for days at a time. This represents a substantially greater level of observation than most other cases and favors a lower multiplier. (2) It was winter and there was less vegetative cover to shelter or hide the birds than in some spills, and (3) It was not an open ocean. Dead organisms that do not sink will wash up on one shore or the other, washing out to sea far less often than in an open ocean environment. Despite these factors, very few dead or heavily oiled birds were found.

(The Trustees disagree. The multiplier approach is used when there are insufficient data on which to assess impacts other than morgue and rehab statistics. During the *M/T Athos 1* spill, large amounts of data on the populations at risk and the degree of oiling at appropriate spatial and temporal scales were collected. The data are quite robust.

There are additional aspects of the *M/T Athos 1* spill that make the multiplier approach invalid. Most of the spills for which the multipliers were developed occurred along linear shorelines, where oiled birds have a relatively narrow shoreline band in which to seek refuge. Often, the impacted birds are marine species that only came ashore because they were oiled. In Delaware Bay, many of the birds that were oiled normally feed and rest in the extensive marshes along the river and bay. They routinely move between the river and the marshes. So, they would widely disperse into these marshes for protection when stressed by oiling. These points will be reinforced in the final draft of the report).

2) Computer Modeling. The trustees also considered developing a computer model using the trajectory of the oil, the spatial distribution of birds, and probability functions to predict the number of oiled birds. These models have been used for spills where large numbers of seabirds were affected or potentially at risk, such as the *Nestucca* spill off Washington where an estimated 56,000 birds were killed (Ford et al., 1991) and the *Apex Houston* spill in central California where over 10,000 birds were estimated to have died (Page et al., 1990). This approach would be difficult to apply to the *M/T Athos 1* oil spill because of the many assumptions that have to be made. The oil quickly broke up and spread into widely distributed patches that moved throughout the river and bay for a long period, making it difficult to estimate the oil's location relative to bird's distribution. Furthermore, during the spill migratory birds were moving through the area and may have only been present for a short period, making it difficult to model daily changes in population.

We believe it is true that the oil quickly broke up. There is no attempt to quantify the "widely distributed patches" or their movement throughout the bay. We believe most of the heavier oil stranded on the shorelines pretty quickly, and some of it sank. It was mainly sheen and tar balls that were observed in most downstream stretches of the river and bay. This may have posed less of a threat to birds, especially those that "may have only been present for a short period".

(The Trustees will reinforce their comments on why modeling was not chosen. Most models such as the one used by Glen Ford require data on the concentrations of birds on the water and the distribution of the oil to predict the number of birds oiled. These data are lacking for the *M/T Athos 1* spill, where the surveys mostly counted birds when they were in the marshes. Also, many of the birds oiled during the *M/T Athos 1* spend as much or more time in marsh and other inland habitats. They are exposed to oil on the surface of the marshes, not just to floating oil slicks on open water areas.)

3) Risk–based Assessment Approach. In this approach, both bird recovery data and field data collected during the spill are used to estimate the bird population at risk and the percent of the population oiled, and data from the literature are used to estimate total mortality. It considers the life history and behavior of different groups of birds. This approach is appropriate where field teams can make good field observations during the spill. It uses a combination of field data and literature reviews, which are two of the assessment methods listed in the NRDA regulations (15 CFR Part 990). This approach was used to quantify injury to birds and diamondback terrapins at the Chalk Point spill of 126,000 gallons of a mixture of No. 2 and No. 6 fuel oils into the Patuxent River, Maryland in April 2000 (Michel et al., 2003).

While this comment is likely a "lesson-learned", we believe it is important to consider. During development of this approach, the trustees informed the RP that team members were all qualified bird observers. After completion of the assessment and data report, we learned that some observers could not identify birds. If observers cannot identify birds or life stages, they cannot identify whether or not a bird is supposed to have mottled feathers, brown or black spots, etc. bird enthusiast may be likely to err in favor of the birds. The data we have are "the data we have", but in the future, we recommend better scrutiny of the qualifications and possible bias of the observers. We note that one of the main problems cited by the trustees for using other approaches was bird movement. This is as much a factor for error in the risk based approach as the potential error of other approaches, which is why the consideration of the results of other approaches for corroboration may be valuable. **(Noted)**

Page 9, P1 The Bird and Wildlife TWG agreed that injuries to birds resulting from the *M/T Athos 1* oil spill would be estimated using the risk-based assessment method.

The TWG "agreed" that the risk based approach would be used to estimate injury, but this does not mean that we could not corroborate and evaluate the assumptions in this approach by using comparisons with other approaches. Corroboration is one of the strengths of any assessment. The multiplier approach from other cases should be considered when lending support to the risk-based estimates or to evaluate the likelihood of the risk-based assumptions.

The risk based approach used a number of untested and unverified assumptions about the detectability of birds, extrapolation to populations, aggregations to regions, movement and mortality of oiled birds. The greater the number of assumptions, the greater the potential for error. A multiplication factor uses the assumption of findability. The Star Eviva spill occurred many miles off the coast of South Carolina in 2000. Birds washed ashore days after the spill on a highly complex marshy coastline. Comparatively less search effort was conducted than in the ATHOS I. The multiplier in that incident was 10:1. **(The Trustees believe that the risk-based approach is the best because of the extensive spill-specific data that were collected. The aerial surveys were conducted by experienced agency scientists, and the methods used to analyze the population data are well established. It is much better to use field datasets than simple multipliers that are inherently weak.)**

Page 12 **4.2 Ground surveys**

Page 8

Site locations were selected based on accessibility, review of oil distribution maps and trajectory models produced as part of the response, and observations from aerial surveys. It is possible that using trajectory maps and oil distribution to select observation points will result in the observation of higher numbers of oiled birds, unrepresentative of the entire affected area (if heavily oiled shorelines were searched disproportionately). Site selection should be random within the entire area for which the data will be extrapolated and not focus on oiled shorelines. If not, a relative weighting could be applied. It would be helpful to document the number of observation sites adjacent to heavy, moderate, light, and unoiled shorelines, with a comparison of percent of oiled birds at each. **(The Trustees agree that graphics are needed to show the distribution of the site locations relative to shoreline oiling. Maps and text have been added to the report. The aggregation of data to survey segments and to regions was based, in part, upon homogeneity of shoreline oiling in those regions in an effort to address this question.)**

Page 21 **6.0 DIRECT INJURY ESTIMATION**

6.1 Oiling Estimates

P1 Oiling estimates for non-recovered birds were derived from ground survey data collected by state and Federal agency and other personnel. Ground surveys were conducted on a range of dates spanning nearly the entire study period. All data after techniques were standardized (5 December) were located to the highest accuracy possible using a variety of data sources. Approximately 50 percent of the unique survey locations were located using latitude and longitude coordinates and approximately 45 percent were located only as being within a particular survey segment. Approximately 5 percent remained un-located and thus were not considered further.

We are not certain if this comment has been addressed so forgive us if we are covering old ground. As mentioned, it would be helpful to know the frequency of surveys near heavily oiled beaches versus other types. If we are applying the data to the entire area, survey sites should be positioned near heavy, moderate, light, and unoiled beaches in the proportion they occur in the environment. If survey areas are biased in areas with more oil, it may be inappropriate to extrapolate them to the entire population in the area. It is possible there is no correlation between nearby degree of oiling and percent of oiled birds, but it would be valuable to know. **(See response to comment just above)**

P2 The majority of data were aggregated into two time periods:

Page 23 **6.2 Mortality Estimates by Guild by Degree of Oiling**

P2 The two major pathways of oil exposure for birds are ingestion and fouling of the feathers (NRC, 2003). Birds can ingest oil during preening or ingestion of oil adhered to food items. Potential effects of ingestion include Heinz-body hemolytic anemia, immunosuppression, pneumonia; intestinal irritation, kidney damage, altered blood chemistry, impaired osmoregulation, decreased growth, decreased production and viability of eggs, and abnormal conditions in the lungs, adrenals, liver, nasal salt gland, and fat and muscle tissue (Fry and Addiego, 1987; NRC, 2003). **(agree)**

P3 The effects of oil on birds vary by behavior, ecology, and life history. Fry and Lowenstine (1985) reported 2 of 3 Cassin's auklets died from application of 3-5 milliliters of oil to the feathers.

Tuck (1961) reported that only a small spot of oil on the belly was sufficient to kill murres. Birkhead et al. (1973) reported observations of visibly oiled gulls successfully cleaning themselves after several weeks. The trustees cite bird mortality studies, most of which suggest higher mortality rates for oiled birds. The study not documenting higher mortality rates was for gulls. Gulls in this case constitute a large percentage of the injured birds. We also believe Canada Geese are likely to have higher survival rates than other species. **(The Trustees agree that gulls and swans/geese have higher survival rates after oiling, which is reflected in the mortality rates for the different guilds in Table 7.)**

P4 Further information on the effects of oiling of feathers and oil ingestion can be derived from recent publication on the survival of oiled, rehabilitated, and released birds. There are four studies, all conducted in California, of oiled, rehabilitated, and released birds: brown pelicans, American coots, common murres, and western gulls. The survival rate for 112 oiled, rehabilitated, and released brown pelicans following the *American Trader* oil spill in southern California was compared to 19 unoiled control birds (Anderson et al., 1996). After about six months, the survival rate for unoiled control birds was 91 percent compared with 69 percent for the oiled and rehabilitated birds. After two years, the survival rate for unoiled birds was 53 percent (10 out of 19 birds) compared to 9 percent (8 out of 91 birds; 6 were juveniles) for oiled and rehabilitated birds. The oiling of large birds, such as pelicans, results in high mortality even when the animals are rehabilitated. Oiled birds remaining in the wild will likely have very low survival rates, particularly during winter conditions. Rehabilitation has changed in many ways since the American Trader oil spill. The prognosis for survival of oiled and released pelicans in the M/V EVER REACH spill in Charleston in 2002 was very good according to the Tri-State veterinarians. These birds roost on a small island in Charleston and are easily observed. There was no evidence of mortality. In addition, many of the moderately and lightly oiled pelicans could not be captured to be treated. There was also no evidence of their mortality. **(The survival rates were based on input by Tri-State veterinarian Heidi Stout. Also, it is important to consider the effect of temperature. The temperatures during the *M/T Athos 1* spill were very cold, whereas the *Ever Reach* spill occurred during mild temperatures.)**

Pag 24, P3 These studies show that some rehabilitated oiled birds have high mortalities after oiling and rehabilitation and some do not. Birds that spend most of their time on the water may have the highest mortalities. Birds such as gulls, that spend less time on the water, had the lowest mortalities. Do gulls spend less time on the water than geese? **(No, gulls and geese spend about the same amount of time on water. They roost at different times.)** Oiled birds that remain in the field are expected to have even higher mortalities than rehabilitated oiled birds. Data? **(References have been added on impacts of oil on birds to support this statement.)**

Oiling Category	Swans/ Geese	Wading Birds	Gulls	Dabbling Ducks	Diving Ducks	Shore Birds	Diving Birds
Heavy	100	100	100	100*	100*	100*	100*
Medium	75	100	100	100*	100*	100*	100*

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Light	0	50	50	75	100*	100*	100*
Trace	0	0	0	25	50	50	50

As discussed previously, this is where significant uncertainty is introduced. Added to the cumulative uncertainty of population estimates, detectability, possible double or under counting, bird movement, whether the survey locations are sufficiently representative, and the qualifications of observers, among others, it is not unreasonable to refer to the results of other methods that use less variables to corroborate the assessment technique. **(Refer to previous responses on the limitations of other methods and the robustness of the datasets used in the analysis.)**

Page 27 **6.4 Overall Mortality Estimates**

P2 For birds from sensitive guilds (dabbling ducks, diving ducks, diving birds, shorebirds, and kingfishers), mortality was tracked in two categories: short-term mortality, where death was expected in less than 2 weeks, and longer-term mortality. It was assumed that short-term mortality would result in those birds being lost from the estimated population at risk before the surveys in the next time period. Thus, for these guilds, mortality was considered as the cumulative sum of short-term mortality estimated in time period 1 and total mortality estimated in time period 2. For diving ducks, the same process was assumed to take place, but over 3 time periods. In this case, mortality was considered as the cumulative sum of short-term mortality estimated in time periods 1 and 2, and total mortality estimated in time period 3. It was assumed that individuals from the more robust guilds that were oiled in time period 1 would survive to time period 2. For these guilds, the time period with the largest total mortality was selected as most representative indicator of estimated impact. Is there any data on the time to mortality for these birds at various oiling levels? We understand that more heavily oiled birds are likely to die within several weeks. However, this may not be an appropriate assumption for lightly oiled birds. **(The time to mortality was based on input by Heidi Stout of Tri-State and represents the best information available.)**

Approximately 2430 of 3,526 (69%) estimated dead birds were geese and gulls. These numbers do not likely reflect a population-level effect. We would expect that restoration planning efforts will consider their relative service value and the collateral benefit of other projects to birds. **(The Trustees explicitly decided to include all birds in the injury assessment regardless of their perceived service value. However, the report was modified so that production foregone was not included for the Atlantic Flyway Resident Population, which represents an estimated 50% of the Canada geese affected by the spill.)**

Page 29 **7.0 INDIRECT INJURY ESTIMATION**

P1 In addition to estimating direct injury in terms of mortality due to oiling from the spill, indirect injury in terms of production foregone due to the loss future generations was included in estimation of total injury. This loss was calculated for one additional generation. This loss was considered as both the loss of production from dead individuals throughout the rest of their expected lifetimes, and the loss of production due to individuals that were oiled and survived, but failed to breed in the subsequent spring. Why aren't the density dependent factors that bring the populations back to normal levels prior to the expected lifetime production of the dead birds considered as part of recovery under OPA? If we debit the future lost biomass of every dead bird, we should credit the biomass foregone by their expected consumption and the ability of the population to recover biomass losses with surviving individuals. **(The existence and influence of density dependence, or other biological recovery mechanisms, in regard to population dynamics of the three model species is strongly uncertain. See previous comment. In the face of this uncertainty, the Trustees have made conservative estimates of production foregone in calculating injury. Currently, injury is calculated in units of individuals, not biomass,)** The assumption of post-oiling reproductive failure is based largely upon studies by Anderson et al. (1996). The authors report that oiled and rehabilitated brown pelicans did not attempt to breed for two years after release. Waterfowl are typically smaller than pelicans, and undertake substantial migration, placing them under greater physiological stress from oiling. As such, these guilds were assumed not to breed for one year after oiling, as a conservative estimate of such reproductive failure. Golightly (2005) reports that similar effects may be expected for gulls and other guilds. Do *all* oiled birds not attempt to breed after oiling or do only *some* oiled birds not attempt to breed? What difference does oiling level make on reduced reproduction? Have this been taken into account? As discussed, the services losses stop when population levels return to baseline. Killing the next generation in a computer may have little relation with what is happening to the population services in the field. **(The Trustees relied on information provided by Golightly who stated that he expected all oiled birds to not attempt breeding; that oil caused physiological changes to birds that applied across all species.)**

Page 29 **7.2 Age-Structured Population Models**

Page 30, P3 Fecundity, typically measured reported as number of fledged females produced by each female per year, is a summary statistic that integrates the variable effects of likelihood of breeding, nesting density, multiple nesting, likelihood of re-nesting, nest success, clutch size, egg survival, brood survival, and other factors. For this analysis, fecundity is considered to be number of all fledged chicks, rather than only females, as the sum injury to the population is at issue. We agree, the injury is to the population. When the population recovers, service losses stop accruing. However, the loss of individuals and biomass in a population over time is not the same as the estimated production foregone of the dead individual and their offpring over their lifetime of 20 years. We believe population recovery will occur long before time estimated by a production foregone model. **(The draft report included production foregone for half of the maximum lifespan [10-12 years] for the guilds where production foregone was calculated. However, upon review, the Trustees have reduced production foregone to one-third of the lifetime [7-9 years] for the appropriate guilds. It should be noted that there is no justification for the stated belief that populations will recover "long before" the period used by the trustees, or "very soon" after the injury, as stated above.)**

Page 31 P1 Note that the actual demographic parameters for the members of the sub-population of the surrogate species killed in the *M/T Athos 1* oil spill are unknown. The parameters used in these models are, in most cases, averages of widely varying data, collected in different time periods, possibly from different sub-populations in different geographic regions. It is also important to consider that changes in these parameters over time drive complex annual fluctuations in populations of these species. Other than averaging parameters for recent years, no attempt has been made to reconcile the values used in these models with the anticipated future status of the real populations of these surrogate species in the region of interest. We agree that these parameters do not reconcile with real populations and we further believe they are not a reasonably supportable measure of actual future service losses of the population. This exercise disregards density dependent ecological principles. If we examined the estimated production foregone of lost fish in this manner applied to the total catch in the fishing industry every year, we may expect all the biomass of fish to be missing from the sea in a matter of a few years if it were true that production foregone estimates of biomass calculated in perpetuity would actually be missing from the future populations. For populations within a normal range of sustainable levels, production tends to keep pace with production foregone with a dynamic equilibrium of density independent effects. If more habitat and less competition are the result of a loss of a segment of the population, surviving members fill the gaps of lost production through decreased competition, increased food availability, etc, and do not always require generations to recoup the losses. **(The trustees maintain that no attempt has been made to adjust these population parameters with *anticipated future trends*. However, the parameters used are derived from rigorous field sampling efforts and well describe actual populations. The issue of biological recovery mechanisms has been addressed above.)**

Page 31 **7.3 Production Foregone**

Production foregone was calculated as a two-step process. First, production lost due to direct spill mortality was calculated. For each of the three guilds, the total number of birds estimated to have died as a result of the spill from Table 9 was distributed among age-classes according the stable age distribution described above. These numbers were used as inputs to the age-structured model for that species, which was iterated for either 10 or 12 years – one half of the maximum amount of time the youngest age class could have lived in whole years. At each yearly time step, estimated discounted lost production was calculated from birds killed in the spill that would otherwise have survived to that year discounted using a 3 percent annual discount rate. Note that for mallards the total numbers from Table 9 were divided into males and females based upon average Atlantic Flyway sex ratio reported by USFWS (2005b) from 2004 hunting season surveys. Each sex was then assigned age classes from the stable age distribution described above, and used as model input.

Additionally, discounted production lost due to reproductive failure was calculated. For each of the three guilds, the total number of birds estimated to have been oiled but survived from Table 9 was assigned age classes according to the modeled stable age distribution. These numbers were used as inputs to the same model to calculate discounted lost production for only the single year following the spill due to reproductive failure discounted using a 3 percent annual discount rate. Production lost from mortality and reproductive failure was then summed together to calculate total production foregone for each of the three guilds, as in Table 11. Note that calculations were carried out in units of fractional individuals, while results are reported in units rounded to whole individuals. Some small apparent arithmetic error may result.

TABLE 11. Production foregone (fledged young using 3% annual discount rate) for three surrogate species due to direct spill mortality and reproductive failure from the *M/T Athos 1* oil spill, as derived from age-structured population models iterated for one half of the maximum lifespan (10 or 12 years) of youngest individual killed in whole years. #

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Killed Surviving is the number of birds killed in the spill that would otherwise have survived to that year.

Do we understand that direct mortality is the number of dead birds distributed into age-classes, and production foregone is the number of fledged birds? Will the trustees look at restoration in terms of bird-years or biomass? Should this be clarified in the section on total injury? **(The Trustees have not yet evaluated restoration options, but appropriate metrics (biomass versus bird years) will be used based on the preferred restoration options. Appropriate methods will be used for scaling of restoration.)**

Page 34 **8.0 INJURY ASSESSMENT OF OTHER BIRDS AND WILDLIFE**

P2 There are five bald eagle nesting territories in the region affected by the *M/V Athos 1* oil spill, between Petty Island and Salem, New Jersey. In the period after the oil spill, November 28, 2004 through January 6, 2005, at least one bald eagle in each of the five territories was observed with oil, as was one migrant eagle. However, all of the nesting adults survived and no impacts to nesting success were attributable to the spill. Thus, injuries to bald eagles were probably minimal.

This is in contrast to the trustees' assumptions regarding reproductive failure and mortality to other birds as a result of the spill. There were five birds observed with oil, with evidence of mortality or loss of reproduction. Mortality and reproductive failure are only two of the many uncertain assumptions used by the trustees that may result in the disparity of this assessment with other spills multiplication factors of birds found to total estimated dead birds. **(The report has been edited to provide additional information on eagles that justifies the approach used. The oiling of the four nesting eagles was "trace" and the one migrant eagle had "light" oiling. Since they spend so little time on the water, they would not be susceptible to death by hypothermia. Also, they had already started nesting. So, the impacts are different.)**

Page 35 **9.0 TOTAL INJURY ESTIMATION**

Total injury to birds from the *M/T Athos 1* oil spill is estimated by combining direct injury due to mortality, as in Table 9, with indirect injury due to production foregone, as in Table 11. Table 12 summarizes total estimated injury to birds, in individuals, from the spill by guild and injury category. The total estimated bird injury from the *M/T Athos 1* oil spill is 12,475 individuals. Should we clarify the differences in age distribution of the direct and indirect injury? **(The report has been edited to clarify that the injury from direct mortality was to oiled adults and the production foregone is measured as lost fledged young. The age distribution of these two categories of injury will be considered in restoration scaling.)**

Page 36 **10.0 UNCERTAINTY ANALYSIS**

The volume of data that exists to quantify bird and wildlife injury for the *M/T Athos 1* oil spill is significant, and these data are of relatively high quality as compared with other oil spills. The Trustees have attempted to make best use of these data as supplemented with reasonable assumptions, but it is helpful to acknowledge uncertainties in this analysis.

We agree there is a lot of information. Data not presented herein includes the number of man-hours on the shorelines and the number of miles searched. Even if birds will hide beyond the shoreline, there may be methods to extrapolate the shoreline loss to the interior as a means of corroborating the trustee's assumptions in the risk-based approach. **(The Trustees do not have any information on which to make these calculations.)**

1) **Extrapolation from ground surveys to overall degrees of oiling:** The extrapolation of the ground survey data to the entire population of potentially oiled birds is based upon a large and fairly high quality dataset. The average across-guild, across time period oiling rate for all birds is 4 percent – a conservative rate of oiling. We assume that the degree of oiling does not affect probability of observation.

As mentioned, it would be interesting and potentially valuable to see how many of the 300 ground survey locations were near heavily oiled shorelines, what percentage of the affected area had heavily oiled shorelines, and do the data provide an improper weighting to areas more likely to have oiled birds? We apologize if the trustees already considered this. **(See previous response. The report has been edited to include this information.)**

2) **Non-recovered bird outcome estimates by degree of oiling:** The estimation of outcomes by degree of oiling is based on published laboratory and field data, as well as extensive practical experience. However, for a number of categories of oiling and guilds of birds there are no good data or experiential information. **(Agree, but best professional judgments were used, as presented in the last sentence in this paragraph.)** Considering the degree of oiling descriptors for oiled birds (e.g., "lightly" oiled birds had 6-20 percent of their body coated with oil, and "trace" oiling was up to 6 percent coverage), the harsh weather conditions at the time of the spill, and the migratory status of many species that were affected, the outcome estimates presented here are fairly conservative. We did not make the frequent assumption that "an oiled bird is a dead bird," but made considerable effort to account for the life history of different species guilds to allow for survival of large or hardy species.

3) **Rehabilitated and released bird outcome estimates:** The estimation of outcomes for rehabilitated and released birds is based upon literature and the extensive experience of leading rehabilitation scientists who worked on this spill (Heidi Stout, Tri-State Bird Rescue and Rehabilitation). We were conservative in estimating sublethal impacts of exposure. Did Heidi provide estimates of sublethal exposure effects? **(No, the sublethal effect, breeding failure, was based on the literature and comments by Golightly.)** For example, Anderson (1996) reports that oiled and rehabilitated pelicans did not attempt to breed for two seasons following exposure. Here, only a single season of reproductive failure for rehabilitated birds is considered for guilds with smaller body masses and increased vulnerability to oiling – a conservative estimate of impact. Weren't reproductive failures considered for large birds as well? **(Yes. The report has been edited to include this information.)**

4) **Age-structured models:** The demographic parameters used as input to this model were derived from the best available USFWS data averaged for last 5 years for waterfowl. For gulls, these values were derived from the best available literature studies. These

parameters fit in the center of the range of parameters reported in the literature and agree with the overall understanding of the population structure of that species.

5) **Production foregone:** The estimation of production forgone accounts for a single lost generation produced by birds killed by the oil spill. It is important to note that density-dependent population dynamics (the theory that compensatory mechanisms will result in higher production by remaining individuals after the removal of some individuals by a population injury) are currently in debate and differ by species. Hampton and Zafonte (2003) concluded that many bird populations are not density dependent at the scale of injury from oil spills, and that lost production should be calculated for perpetuity to the limits of the annual discounting process. The key here is "scale". A catastrophic effect on the population can result in losses that are not recovered by density dependent factors. Populations that suffer a statistically insignificant population-level effect are not the same as those that suffer large losses, or are confined to an island. **(Hampton and Zafonte actually make the opposite point – that without biological recovery mechanisms, injuries persist into perpetuity, or at least the limits of the discounting process, regardless of the scale of the injury. As mentioned extensively above, biological recovery mechanisms, including density dependence and the uncertainty surrounding its validity here, were given strong consideration by the Trustees when evaluating a reasonable length of time to use in production forgone calculations.)** We consider only production lost from the first generation of offspring from those individuals killed, and for only half the maximum lifespan of each model species. Also, all lost future production from guilds with mortalities of less than 100 individuals were not included in calculations of production foregone.

We appreciate the consideration of density dependent factors. It is difficult to quantify recovery and lost service for fractions of populations that may not be statistically significant and are not likely measurable or observable in the field. We believe the direct mortality assessment is a potentially valid approach overall. However, like any approach, uncertainties and invalid assumptions can lead us to incorrect answers. It is preferable to have corroboration from other approaches and other oil similar oil spills. We do not believe there are valid reasons why the multiplication factor in this spill should be higher than others. The rationale provided does not substantiate that this spill has important differences from many others in terms of multiplication factors. The search effort and ground coverage was high and the site was not on an open ocean. There were many places for birds to hide, but that is often the case in other spills. **(See previous comments.)**

We look forward to the opportunity to continue to provide technical comment.

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