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Source: *The Condor*, 103(4) : 892-894

Published By: American Ornithological Society

URL: [https://doi.org/10.1650/0010-5422\(2001\)103\[0892:ABRTWE\]2.0.CO;2](https://doi.org/10.1650/0010-5422(2001)103[0892:ABRTWE]2.0.CO;2)

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The Condor 103:892–894
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A BRIEF RESPONSE TO WIENS ET AL., TWELVE YEARS AFTER THE EXXON VALDEZ OIL SPILL

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Abstract. We briefly address the four main issues that Wiens et al. (2001) present in their commentary on Irons et al. (2000). In summary our response is: (1) We discussed before-after control-impact design assumptions at length in our paper. Data do not exist to resolve this issue and Wiens et al. fail to shed new light on it. (2) Contrary to Wiens et al.'s assertion, we discussed only statistically significant results. (3) Wiens et al. disagreed with our interpretations of a few select results. We stand by our interpretations. (4) Wiens et al. believe that the evidence we presented from other studies showing that *Exxon Valdez* oil still exists in Prince William Sound (PWS), and that birds are still ingesting it, is equivocal in demonstrating cause and effect. We agree, but arguments to the contrary are equally equivocal. Data from continued monitoring of marine birds in PWS support the conclusion that as of July 2000 one taxon is recovering from effects of the *Exxon Valdez* oil spill and eight taxa are not.

Key words: Alaska, Exxon Valdez oil spill, marine birds, Prince William Sound.

Breve Respuesta a Wiens et al., Doce Años después del Derrame de Petróleo del Exxon Valdez

Resumen. Nos referimos brevemente a los cuatro puntos principales que Wiens et al. (2001) presentan en su comentario sobre Irons et al. (2001). En síntesis, nuestra respuesta es: (1) En nuestro artículo abordamos de manera extensa los supuestos del diseño de evaluaciones pre y post impacto. No existen datos que permitan resolver este tema y Wiens et al. fallan en aportar nuevas ideas. (2) Contrariamente a lo afirmado por Wiens et al., solamente discutimos los resultados que

Manuscript received 10 July 2001; accepted 31 July 2001.

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son estadísticamente significativos. (3) Wiens et al. discienden con nuestras interpretaciones sobre unos pocos resultados seleccionados. Nosotros sostenemos nuestras interpretaciones. (4) Wiens et al. opinan que la evidencia que nosotros presentamos de otros estudios, que muestran que el petróleo de *Exxon Valdez* todavía existe en Prince William Sound (PWS) y que las aves aún están ingiriéndolo, es ambigua en demostrar causa y efecto. Coincidimos con esto, pero los argumentos en contraposición son igualmente ambiguos. Datos provenientes del monitoreo continuo de aves marinas en PWS apoyan la conclusión que hasta julio del 2000 un taxón se está recuperando de los efectos del derrame de petróleo del *Exxon Valdez* y ocho taxa no lo están.

This paper responds to a commentary written by John Wiens and his coauthors, with assistance from Al Maki of ExxonMobil Corporation and David Page from Bowdin College (Wiens et al. 2001), about a paper titled "Nine years after the *Exxon Valdez* oil spill: effects on marine birds in Prince William Sound, Alaska", which we published last year (Irons et al. 2000). In our paper we compared post-spill densities of marine birds in Prince William Sound (PWS) to pre-spill densities in oiled and unoled areas or transects. The basic analysis methods are those first used by Wiens and coauthors in Murphy et al. (1997). We found that post-spill densities of nine taxa in oiled areas or transects were lower than expected when compared to adjacent unoled areas or transects of PWS. The densities of five taxa remained low through 1998 (Irons et al. 2000).

Many papers have been written about the effects of the *Exxon Valdez* oil spill. The difficulty of accurately assessing the extent and duration of damage caused by the spill is well known. In our paper we discussed at length the difficulties in detecting effects of an oil spill on mobile animals such as birds in an ecologically diverse area like PWS (Irons et al. 2000). It is not possible to conduct a replicated experiment in controlled conditions when studying the effects of an accidental oil spill; rather, it is necessary to work with the existing situation. In this case we were fortunate to have pre-spill data on marine birds from throughout PWS in 1984 and 1985. These pre-spill data allowed pre- and post-spill comparisons of marine bird densities on oiled and unoled areas or transects at three spatial scales.

Wiens et al. commented extensively on our paper. However, we found little new information in their comments; therefore we do not respond point by point, but rather briefly address the four main issues that Wiens et al. presented: (1) assumptions of the before-after-control-impact (BACI) design; (2) use of statistics; (3) interpretation of results; and (4) whether the lack of recovery of marine bird populations in the oiled areas may have been caused by *Exxon Valdez* oil persisting in the environment.

Wiens et al. echoed concerns regarding assumptions of the BACI design that we ourselves raised in Irons et al. (2000). We discussed the assumptions of the BACI design, whether they were met, and the implications of not meeting the assumptions (Irons et al.

2000:728). We acknowledged that "densities of some birds are different on islands and in fiords" (p. 725). "To help ensure that our reference area was similar to the oiled area, we used cluster analysis to select a group of transects with similar pre-spill bird densities that was then split into oiled and reference groups." (p. 725). BACI design issues have complicated all *Exxon Valdez* oil spill studies that compared oiled areas to unoled areas. There are possible confounding factors in all observational studies, particularly with our coarse scale analysis (one big oiled region compared to one big reference area), but less so with our medium and fine scale analyses. Data do not exist to resolve this issue and Wiens et al. fail to shed new light on it.

Wiens et al. stated that we used both statistically significant and nonsignificant results to demonstrate changes in marine bird densities. That is not correct. The only results that we discussed were statistically significant (see Fig. 2 in Irons et al. 2000).

Wiens et al. generally agreed with our interpretation of our results, but they disagreed with a few select statements concerning whether a taxon was recovering. Our definition of an oil spill effect was a statistically significant, lower post-spill density in the oiled area relative to the unoled area. Recovery of a taxon was defined as when that taxon no longer exhibited a statistically significant negative oil spill effect. As we stated in our original paper, this approach to detecting effects and recovery puts the burden of proof on the data to demonstrate an effect, but not to demonstrate recovery (Irons et al. 2000). This is a fairly liberal definition of recovery. We stand by our interpretations.

Wiens et al. discussed the uncertainty as to whether the *Exxon Valdez* oil spill continues to inhibit recovery of bird populations diminished by the spill. They believe that the evidence we presented from other studies showing that *Exxon Valdez* oil still exists in PWS, and that birds are still ingesting it, is equivocal in demonstrating cause and effect. We agree, but we cannot ignore the fact that declines in marine birds in PWS have occurred relative to abundance in unoled areas or transects, that some damaged marine bird populations have failed to recover, and that the *Exxon Valdez* oil spill may well be the cause for the failure of recovery. Arguments to the contrary are equally equivocal.

The issues that Wiens et al. continue to debate cannot be resolved with certainty using available data. We continue to monitor the populations of marine birds in PWS (Lance et al. 2001, Stephensen et al. 2001). As of July 2000 the densities of only one of the nine taxa that we reported as showing negative effects from the spill, (Black Oystercatcher [*Haematopus bachmani*]) has increased significantly in oiled areas since the spill. Four taxa (murre, cormorants, Harlequin Duck [*Histrionicus histrionicus*], and loons) have not changed significantly, and four taxa (Pigeon Guillemot [*Cepphus columba*], goldeneyes [in winter], mergansers, and Black-legged Kittiwake [*Rissa tridactyla*]) have decreased significantly in oiled areas. These data support the conclusion that as of July 2000 one taxon is recovering from effects of the *Exxon Valdez* oil spill and eight taxa are not (Stephensen et al. 2001).

We thank David Dobkin, Bob Leedy, Hugh Powell, and Dan Roby for their comments on earlier drafts of this response.

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