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Sent: Wednesday, April 30, 2014 11:42 AM
To: Wildlife Management
Cc: kenb
Subject: Northern Spotted Owl
Attachments: Burnham NSO Review Report.pdf

Dear Sir/Madam:

Dr. Kenneth Burnham has asked me to submit the attached "Review Report" for him because he is indisposed by a medical situation.

Dr. Burnham's e-mail address and contact information is:

kenb@lamar.colostate.edu

Kenneth P. Burnham
Colorado Cooperative Fish and Wildlife Research Unit
Emeritus Assistant Unit Leader
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Colorado State University
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Please let me know if any further information is required.

Thank you.

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**Review Report of Kenneth P. Burnham
Concerning EPIC's Petition to List the Northern Spotted Owl as
"Threatened" or "Endangered" Under the California Endangered Species Act**

April 25, 2014

I was asked by the California Forestry Association to review and evaluate EPIC's Petition to List the NSO and the Northern Spotted Owl Science Compendium, compiled by the California Forestry Association, for their scientific soundness and, particularly, their respective data and conclusions based on those data regarding NSO population abundance and dynamics in California. My review of EPIC's Petition reveals it to be replete with irrelevant information (e.g., information about NSO in Washington and Oregon), hyperbole (e.g., that the NSO is "close" to extinction), and unsupported assertions (e.g., NSO have been largely extirpated on state and private lands). EPIC's Petition does not reflect science, let alone the best available science, and is simply not credible. The NSO Science Compendium provides reliable information on the status and population trend of NSO in California, including, critically, on private lands. The data in the NSO Science Compendium demonstrates that the California population of NSO is reasonably abundant and stable in numbers over at least the past 15 years.

I. Background and Experience

I am a retired Senior Scientist with the United States Geological Survey, Biological Resources Discipline, Colorado Cooperative Fish and Wildlife Research Unit. *See* Summary Professional Vitae, attached hereto as **Exhibit A**. I held that position from 2004 to 2008, and worked in various positions within the same Unit since 1988. I have a Ph.D. in Statistics from Oregon State University, a Master's of Science in Statistics from Oregon State University, and a Bachelor's of Science in Biology from Portland State University. I taught graduate-level courses such as "The Design of Fish and Wildlife Studies" and "Sampling Biological Populations" for nearly twenty years, and I was most recently a graduate professor in the Department of Fish, Wildlife, and Conservation Biology and affiliate faculty in the Department of Statistics at Colorado State University from 1988 to 2008.

I am the author of some 200 publications, reports, and articles, including Burnham, K.P. and D. R. Anderson, *Model Selection and Multimodel Inference* (2nd ed.), Springer-Verlag (2002). With respect to the NSO, in particular, I have authored numerous publications, including, for example, Burnham, K. P., D. R. Anderson and G. C. White, *Meta-analysis of vital rates of the northern spotted owl*, *Studies in Avian Biology* 17:92-101 (1996); Franklin, A.B., D.R. Anderson, R.J. Gutierrez, and K.P. Burnham, *Climate, habitat quality, and fitness in northern spotted owl populations in northwestern California*, *Ecological Monographs* 70:539-590 (2000); and Forsman, Eric D., et al, *Population Demography of Northern Spotted Owls*, *Studies in Avian Biology* 40 (2011).

I have additional professional experience as an elected committee member of the Western North American Region ("WNAR") of the International Biometric Society from 2004-2006, and served as President of WNAR in 2007. I was an Associate Editor of the journal *Biometrics* from 1997 to 2000. I served on the Editorial Board of the *Ecological Society of America* from 1989 to 1992, acting as an associate editor of the journals *Ecology* and *Ecological Monographs*. In addition, I am a member of several professional societies, including the American Statistical

Association (since 1967, Fellow since 1990), International Biometric Society (since 1968), the Wildlife Society (since 1978), and the International Statistical Institute (elected member since 2007), as well as the Ecological Society of America (1990-2001).

I have received numerous professional awards and recognitions for both my academic work and my work with federal wildlife agencies. I was awarded a Meritorious Service Award from the United States Department of the Interior in 2006, which is the second highest honor awarded within the Department. I was privileged in 2011 to receive the Aldo Leopold Memorial Award from The Wildlife Society.

II. EPIC's Petition

As summarized above, EPIC's Petition fails to meet basic scientific standards, relying on data that is irrelevant, incomplete, and/or whose reliability cannot be assessed. The irrelevance of information about the NSO in Washington and Oregon to the NSO in California, which, among other important differences, has a very different regime for the regulation of timber harvesting and NSO conservation, is too obvious to require elaboration. Perhaps less obvious is EPIC's playing fast-and-loose with other information about the NSO. Only a few highlights of the Petition's misleading treatment of information will be noted here.

EPIC asserts that "in California, populations are declining in two of three long-term monitoring sites, while numerous historic territories have been lost from interior forests in California." Petition at 7. With respect to alleged population declines in California, EPIC fails to account for declines in *detection*, as against actual population declines, as a result of NSO not responding to hooting-based sampling because of exposure to barred owls. EPIC's assertion of alleged "lost territories" is profoundly misleading because it entirely fails to recognize or account for new or reoccupied territories. Any unbiased assessment must include information/evidence on such (re)establishment of new or old territories. As explained below, the NSO Science Compendium does just that, providing data that refute EPIC's "lost territories" claim.

EPIC makes much of the "low reproductive rate" and "high variation in northern spotted owl demographic rates." Petition at 5, 11. However, low reproduction is simply not an issue because the species is long-lived. Indeed, being long-lived, its low reproductive rate is natural; it can reproduce over 10, 15, 20 years. The published science literature shows that adult survival probability is quite stable from year-to-year. Fecundity (reproductive success) is variable because of fluctuating environment, including weather and prey. But, as noted, this variation is not critical because of longevity – if a pair fails to produce one year, they have many more years to succeed.

Also problematic is the Petition's creation of a table of population trends for NSO in different study areas, including three in California, from 1995-2008. Petition at 13, Table 1. Of course, only the three California entries are even potentially relevant, but the Petition seems to engage in hand waving here by describing trends qualitatively instead of quantitatively, and by failing to address the magnitudes of any growth rate changes, which were quite small. See Forsman et al (2011) at page 44 (Table 19) and page 57 (Figure 12 C). What is more, as set forth in the Green Diamond Resource Company Annual Report, submitted to the U.S. Fish and Wildlife Service as required by its Habitat Conservation Plan for NSO (and included in the NSO Science Compendium), any negative trend appears to have been reversed by barred owl control. See NSO Science Compendium at 148.

The last example I will address concerns the Petition's quotation of a U.S. Fish and Wildlife Service document prepared by its Yreka Field Office in 2009. Petition at 20 (quoting USFWS (2009)). Simply put, the 54% (percentage of NSO sites on private lands that declined from pair status to no response) vs. 80% (percentage of NSO pair sites on Forest Service lands that did not change status during the same time periods) figures are not meaningful here. NSO are known to have some year-to-year relocation of nesting. Habitat is generally more stable on federal lands, and perhaps more fluctuating on private lands (which might cause more movement on private lands), but, more important, when owls vacate a territory, for whatever reason, it is not necessarily that they died (this appears to be EPIC's implication). They may have just moved. One needs banded owls, or preferably radioed owls, in order to know precisely what happened. Did they move, are they somewhere else? The observational data quoted in the Petition are logically flawed, as constituting a "study," because it is not known (apparently) what became of displaced, or otherwise vanished owls. As such these numbers (54% vs. 80%) are meaningless as regards the critical demographic parameters of survival and reproduction. Another way to put this: they did not have information on territories not occupied at time 1, then occupied 5-10 years later. So it is like an experiment with a treatment only – no controls. Also, no details of data collection are provided: Was the average time between checking territories the same or not on the federal vs. private lands? If there was a longer average time between checking this could bias the results. In general, one must give relevant study details (which was not done here) in order to know what inferences are justified. Thus, there is no basis to know what 80% vs. 54% means, or does not mean, for NSO population demographics. What matters to the future of the NSO is its population abundance and trend.

III. NSO Science Compendium

The NSO Science Compendium, taken as a whole, is a comprehensive collection of high-quality data. Overall, the effort expended in monitoring and data collection on private timberlands as regards the NSO in California is, in my opinion, exemplary. With more than a dozen NSO monitoring documents, it is to be expected that some of those studies are more informative (i.e., "stronger") than others. A critic might focus on weaknesses, or even look for the weakest study and make the analogy that a chain is only as strong as its weakest link. This would be a very flawed analogy. The proper analogy is that each document (area study) is like a strand in a tapestry and said "tapestry" is much stronger than any one strand. In fact, the strength of evidence arising from the combined strengths of all the information is much greater than in any one document. Thus, the focus should be on the picture presented by the totality of the documents.

Overall, just the quantity of evidence (call it that) is impressive, and shows that NSO occur all over their putative range in northwest CA (in a somewhat uniform manner). Assuming the 3,061 known NSO pair territories number is well-documented (and I believe it is), this is robust abundance. While the dramatic increase in known NSO pair territories since 1988 is likely due principally to more survey effort and more places surveyed, it is consistent with the dynamic but stable and robust NSO population in California evidenced by the data collected in the Compendium. Such a dynamic but stable, in the long term, and robust, population is also consistent with the long-lived character but variable reproductive success (due to weather and other environmental factors) of the species, discussed above.

The data show that NSO abundance has been stable in California. As already discussed above, the Petition's "lost territories" assertion is fallacious and misleading because it fails to account for (re)establishment of old or new territories as owls move on the landscape. A number of the studies in the NSO Science Compendium, including those of some of the largest timberland owners, provide credible density data showing a stable NSO population in California. For example, the Sierra Pacific Industries contribution to the Compendium (at pages 49-59) shows a stable NSO density in the study area. Indeed, for this study area, if the percentage of site occupied were estimated, it would be steadily decreasing even though the actual number of *occupied* activity centers remained stable over the ten years of the study. The fundamental stability of the NSO population in California is critical.

The data also show that the NSO has been widely distributed throughout its range in California since it was federally listed in 1990. It appears that any potential threat to this wide distribution posed by the barred owl can be effectively addressed by invasive species control efforts, as evidenced by the success of Green Diamond Resource Company in this regard. See NSO Science Compendium at 3-4, 150-54.

The data in the NSO Science Compendium justify Calforests' conclusion that:

The original and applied science and monitoring activities our members' biologists and foresters have been conducting over the past years, decades, and in some cases quarter century of monitoring Northern spotted owl habitat needs and populations have led to the conclusion that California's NSO population is well distributed across the landscape [and] is dynamic yet stable over the past quarter century.... [NSO Science Compendium at 15]¹

IV. Is Listing the NSO Under CESA Warranted?

No. Based on my review of EPIC's Petition and the NSO Science Compendium, there is no credible basis for finding listing the NSO under CESA warranted. The available data on NSO in California show the population to be dynamic, but stable and robust. Contrary to EPIC's unsupported assertions, timber harvesting on private lands in California does not threaten the NSO. Finally, the barred owl will indeed be a threat to the NSO if measures are not implemented to halt its invasion of California forests, but the Green Diamond Resource Company barred owl control measures show this can be done successfully.

¹ I will not opine specifically on the third clause of Calforests' conclusion (at page 15 of the Compendium) that the NSO in California also "is subject to a regulatory system that protects against mortality while providing high quality nesting, foraging, and roosting habitat that moves across the landscape over time" because I was not tasked with evaluating the efficacy of California's timber harvesting regime in conserving NSO. Having said that, from my prior involvement with NSO studies, including those of Forsman et al, it is obvious that California's regime for the regulation of timber harvesting has shown itself to be significantly more effective in conserving NSO than those of its sister states. The data are saying that the California regulators and timberland owners and operators are doing a lot of the right things for NSO conservation on private timberlands in California; in other words, the data support an inference of the efficacy of that regulatory regime.

EXHIBIT A

Kenneth P. Burnham

22 October 2012

Retired from being Statistician, and Senior Scientist
USGS, Biological Resources Discipline
Colorado Cooperative Fish and Wildlife Research Unit
201 Wagar Bldg
Colorado State University
Fort Collins, Colorado 80523

EDUCATION

Undergraduate: B.S., Portland State University, Biology, 1960-1966
Graduate: M.S., Oregon State University, Statistics, 1966-1969
Ph.D., Oregon State University, Statistics, 1969-1972

PREVIOUS POSITIONS

Laboratory Technician, Department of Microbiology, University of Oregon Medical School,
1963-1965 (Portland, Oregon).

Mathematical Statistician, Institute of Northern Forestry, U. S. Forest Service,
1972-1973 (Fairbanks, Alaska).

Statistician, Migratory Bird and Habitat Research Lab, U. S. Fish and Wildlife Service,
1973-1975 (Laurel, Maryland).

Biometrician, Western Energy and Land Use Team, U. S. Fish and Wildlife Service,
1975-1983 (Fort Collins, Colorado).

Area Statistician, USDA-Agricultural Research Service, South Atlantic Area, from August,
1983 until September, 1988 (Raleigh, North Carolina).

Then 21 years in the Colorado Coop-Unit:

Assistant Unit Leader, Colorado Cooperative Fish and Wildlife Research Unit, (Fort Collins, CO)
since September, 1988. The Units were under the U.S. Fish and Wildlife Service from their
inception in 1935 until late 1993. November 13, 1993 the Units, hence my position, was transferred
to the newly created National Biological Survey agency within USDI. Later, the name was changed
to National Biological Service. The on October 13, 1996 all of NBS was eliminated as a free-
standing agency by being merged with the US Geological Survey as a fourth division within
USGS: then Biological Research Division (BRD); now called Biological Resources Discipline.
August 8, 2004 I was promoted to Senior Scientist.

PRESENT POSITION

Emeritus professor at CSU, and independent consultant.

ACADEMIC APPOINTMENTS

Adjunct faculty, as assistant professor of statistics, University of Alaska (Fairbanks), 1972-1973 academic year.

Affiliate faculty, Department of Fisheries and Wildlife, Colorado State University, 1978-1982 academic years.

Associate Professor (USDA), Statistics Department, North Carolina State University, 1983-1988 academic years.

Faculty, Department of Fishery and Wildlife Biology, and affiliate faculty Department of Statistics, Colorado State University, since September 1988 through December 2008.

See my vitae information "*Academic*" for information on courses taught and students mentored.

AWARDS AND FELLOWSHIPS RECEIVED

See my vitae information "*Awards, honors and special activities.*"

PROFESSIONAL SOCIETIES

American Statistical Association (since 1967; lifetime member since 2009)

The International Biometric Society (since 1968)

Institute of Mathematical Statistics (since 1973; lifetime member since 2011)

International Statistical Institute, elected member (since 2007)

The Wildlife Society (since 1978; lifetime honorary member since 2011)

Ecological Society of America (1990-2001)

On the Editorial Board of the Ecological Society of America, Oct. 1, 1989 to Dec. 31, 1992; basically, this meant being an associate editor of the journals Ecology and Ecological Monographs, hence making the accept/reject decision on manuscripts assigned to me by the Managing Editor.

Associate Editor of Biometrics from May 1997 to Jan. 2000.

Elected to the Regional Committee of the Western North American Region (WNAR) of the International Biometric Society (IBS) for 2004-2006.

President-elect of WNAR for 2006.

President of WNAR in 2007.

Past-President of WNAR in 2008.

RESEARCH INTERESTS

Design of studies for sampling biological populations, especially for estimation of population abundance and population dynamics parameters.

Statistical inference methods for ecological, wildlife, and fisheries studies, and data-based modeling of biological processes, including model selection and assessing model selection uncertainty. Some specifics:

Dynamics of exploited populations, especially the question of additivity of exploitation and natural mortality.

The effect of heterogeneity in population dynamics (models), population sampling (i.e., size-biased sampling in ecology), and data analysis.

Theory and application of release-resampling (i.e., capture-recapture) studies.

Ecological experiments utilizing release-recapture methodologies.

Estimation of parameters from bird banding studies.

Theory and application of distance sampling (line and point transects) of wildlife and plant populations.

Closed-model capture-recapture theory.

Open-model capture-recapture theory.

Statistical design of environmental biotic studies.

Model selection in population parameter estimation, especially using AIC in capture-recapture.

Applied population sampling in natural resources based on finite population sampling theory.

Theory and application, in general, of information theoretic (e.g., AIC) model selection.

SEE ALSO

Publications

Awards, honors and special activities

Academic

Meetings

- Burnham, K. P. and W. S. Overton, 1969. A simulation study of livetrapping and estimation of population size. Technical Report 14, Dept. of Statistics, Oregon State University (69 pages plus Appendix tables and figures).
- Burnham, K. P. 1972. Estimation of population size in multiple capture-recapture studies when capture probabilities vary among animals. Ph.D. Dissertation, Oregon State University, Corvallis, Oregon.
- Cushwa, C. T. and K. P. Burnham, 1974. An inexpensive live trap for snowshoe hares. *Journal of Wildlife Management* 38(4):939-941.
- Krohn, W. B., F. W. Martin and K. P. Burnham, 1974. Band-recovery distribution and survival estimates of Maine woodcock. Proceedings of the Fifth American Woodcock Workshop (held December 3-5, 1974, Athens, Georgia) (8 pages).
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- Burnham, K. P. and D. R. Anderson, 1976. Mathematical models for nonparametric inferences from line transect data. *Biometrics* 32(2):325-336.
- Anderson, D. R. and K. P. Burnham, 1976. Population Ecology of the Mallard VI. The effects of exploitation on survival. U. S. Fish and Wildlife Service, Resource Publication 128 (66 pages).
- Anderson, D. R., J. L. Laake, B. R. Crain and K. P. Burnham, 1976. Guidelines for line transect sampling of biological populations. Utah Cooperative Wildlife Research Unit, Utah State University, Logan, Utah (28 pages).
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- White, G. C., K. P. Burnham, D. L. Otis and D. R. Anderson, 1978. User's manual for program capture. Utah State University Press, Logan, Utah (40 pages).
- Otis, D. L., K. P. Burnham, G. C. White and D. R. Anderson, 1978. Statistical inference from capture data on closed animal populations. *Wildlife Monographs* 62 (135 pages).
- Anderson, D. R. and K. P. Burnham, 1978. Effects of hunting mortality on waterfowl populations. Pp 119-129 in *Transactions of the Third International Waterfowl Symposium, Ducks Unlimited, Inc., Chicago, Illinois*.
- Anderson, D. R. and K. P. Burnham, 1978. Effect of restrictive and liberal hunting regulations on annual survival rates of the mallard in North America. Pp 181-186. in *Transactions of the 43rd North American Wildlife and Natural Resources Conference. Wildlife Management Institute, Washington, D.C.*
- Anderson and Burnham (1978) was reprinted, Pp 537-542, in Ratti, J. T., L. D. Flake and W. A. Wentz (eds.), 1982. *Waterfowl ecology and management: selected readings. The Wildlife Society, Bethesda, Maryland.*
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- Anderson, D. R., J. L. Laake, B. R. Crain and K. P. Burnham, 1979. Guidelines for line transect sampling of biological populations. *Journal of Wildlife Management* 43(1):70-78.
- Burnham, K. P. and D. R. Anderson, 1979. The composite dynamic method as evidence for age-specific waterfowl mortality. *Journal of Wildlife Management* 43(2):356-366.
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- Patil, S. A., K. P. Burnham and J. L. Kovner, 1979. Non-parametric estimation of plant density by the distance method. *Biometrics* 35(3):597-604.
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Number of publications above here is **199**

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