Society for Conservation Biology

American Ornithologists' Union

27 June, 2008

FWS Regional Director Ren Lohoefener
U.S. Fish & Wildlife Service: Region 1
Eastside Federal Complex
911 NE 11th Ave.
Portland, OR 97232-4181

Dear Director Lohoefener,

Please find attached a review of the Final Recovery Plan for the Northern Spotted Owl (2008) on behalf of The Society for Conservation Biology (North American Section) and The American Ornithologists' Union. We requested reviews of this Plan from four leaders in the field of avian management and conservation biology, all of whom are familiar with management and conservation of the Northern Spotted Owl. I also coordinated the reviews by the same Societies on the Draft Recovery Plan for the Northern Spotted Owl, which was requested by the USFWS. What follows is a synthesis of the reviews in a single document, and I am submitting it to the USFWS on behalf of these Societies.

Sincerely,

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Medford, MA 02155

On behalf of
The Society for Conservation Biology (North American Section) and
The American Ornithologists' Union

Executive Summary

In some ways, the Final Recovery Plan for the Northern Spotted Owl (Final Plan) is an improvement over the 2007 Draft Recovery Plan (Draft Plan). However, the Final Plan is still inadequate as a conservation strategy.

The primary reason the Final Plan fails as a sufficient conservation strategy for the northern spotted owl is that it represents a reduction in the total area of federal lands dedicate to the species recovery. As best we can determine, the amount of habitat within designated reserves (Managed Owl Conservation Areas, MOCAs) under the Final Plan, even after accounting for the loss of reserves in eastside forests, is about 20-25% less than under the Northwest Forest Plan (NWFP; USDA, USDI 1994). Given that the northern spotted owl has been experiencing about a 4% annual rate of population decline for the last 15 years, any reductions from current levels of habitat protection cannot be justified. In contrast, a sufficient conservation strategy would continue to protect all lands currently designated for spotted owl recovery under the NWFP and consider expansion in the size or number of habitat reserves.

In addition to this basic flaw, we have other concerns about the Final Plan. Although the Final Plan omits the most heavily-criticized misrepresentations of owl biology and habitat relationships contained in the Draft Plan, it retains many of the management guidelines derived from them. The Final Plan ignores previous work suggesting that a shift to a reserve strategy similar to their proposed MOCA network would greatly decrease owl distribution and viability. The Final Plan also appears to selectively interpret fire management recommendations to justify a no-reserve strategy over part of the species' range.

Finally, although the Final Plan provides a solid conceptual framework for recovery, we have genuine concerns about how well those concepts can (or will) be implemented on the ground, especially with regards to the framework established for management of east-side forests. Much appears to have been left to the individual implementation groups with regards to management and monitoring strategies. These groups will influence greatly the potential for owl recovery.

We recommend that the USFWS: (1) Provide a table and accompanying map(s) in the Final Plan that lists reserves currently in LSRs relative to areas that would be designated as Category 1 and Category 2 MOCAs. That is, be totally transparent in illustrating the changes in reserve design between the NWFP and the Final Plan for west side forests.

(2) Assign a team of Forest Service scientists to develop a range-wide, fully spatially explicit population analysis using the most current habitat maps comparing the current reserve design (in terms of occupancy and persistence) with the Final Plan reserve design.

(3) The above science team (2) should seriously consider the recent modeling work of Carroll and Johnson (2008) with a specific focus on the geographic variation in the owl's demographic relations with mature and late seral forest.

(4) Clarify descriptions of suitable habitat to reflect the current state of understanding of habitat relationships and how they vary geographically. Currently the Final Plan defers quantitative habitat standards to a future working group. Since these standards will prove critical in Section 7 consultations and the interpretation of 'take', it is important they be presented in the Final Plan, including guidelines or an agreement on definitions of "older, multi-layered forest" by province.

Review of the Final Recovery Plan for the Northern Spotted Owl (2008) on behalf of The Society for Conservation Biology (North American Section) and The American Ornithologists' Union. What follows is a synthesis of four anonymous reviews of the Final Recovery Plan from four leaders in the field of avian management and conservation biology, all of whom are familiar with management and conservation of the Northern Spotted Owl.

General Comments

In some ways, the Final Recovery Plan (Final Plan) (USFWS 2008) is an improvement over the 2007 Draft Recovery Plan (Draft Plan). The section on "Risk and Uncertainty" in the introduction is well done. However, the Final Plan is still inadequate as a conservation strategy, falling short in both its interpretation of science and application of those interpretations to guide management. The criticisms outlined in the peer reviews of the Draft Plan thus have not been adequately and substantively addressed in the Final Plan. **The primary reason that the Final Plan fails as a sufficient conservation strategy for the northern spotted owl is that it represents a reduction in the total area of federal lands dedicate to the species recovery.**

As best we can determine, the amount of habitat within designated reserves (Managed Owl Conservation Areas [MOCAs]) under the Final Plan, even after accounting for the loss of reserves in eastside forests, is about 20-25% less than under the Northwest Forest Plan (NWFP; USDA, USDI 1994). **Given that the SPOW has been experiencing about a 4% annual rate of population decline for the last 15 years, any reductions from current levels of habitat protection cannot be justified.** In contrast, a sufficient conservation strategy would continue to protect all lands currently designated for SPOW recovery under the NWFP and consider expansion in the size or number of habitat reserves.

Additionally, a few decisions seem to have resulted from interpreting data in a way that is overly simplistic (e.g., distances between MOCAs) which resulted in elimination of lands formerly considered as part of the conservation strategy for owls (e.g., dropping MOCAs or DCAs that were <12 miles from other MOCAs or DCAs). These are described in more detail below.

Lastly, **we wondered how the amount and characteristics** (number, average size, and number of owls potentially supported) **of lands targeted for conservation of owls** (MOCAs, CSAs, etc.) **in the Final Plan compared to lands targeted in previous strategies** such as the 1990 ISC Report and the 1992 Draft Recovery Plan. We were disappointed by the way that USFWS dismissed this concern out of hand when it was expressed in comments provided on the Draft Plant (ST14, p. 7, online responses to comments). USFWS claims that the numbers needed to generate values for comparison are available in tables, but they would be difficult (impossible?) for readers to compile correctly, yet they would be simple to generate for USFWS, who should be intimately familiar with the details each of these efforts. Although we have no idea why USFWS did not do this, it gives the appearance that they prefer to keep these comparisons hidden (perhaps to avoid criticism if the overall area conserved has been lessened).

The conclusion of the Service that "the actions in this plan will put the species on a trajectory toward recovery" (p. 3) is not supported by existing knowledge of the species' biology. **A new recovery plan should be developed that builds on existing science and on the experience gained from effectiveness monitoring of past recovery efforts, and that uses such information in the appropriate context for decision support.**

Habitat Definitions, Standards, and Relationships

A definition of suitable habitat and management standards for its maintenance and restoration are key elements of a recovery plan. For many species, sufficient information is lacking to completely accomplish this task. This is not the case with the Northern Spotted Owl. Despite improvements over the Draft Plan, however, **the Final Plan does not use the best available data or modeling tools in its habitat and population planning; in particular they failed to do spatial modeling comparing different conservation reserve strategies.**

In a recent range-wide habitat analysis, Carroll and Johnson (2008) found that maximum owl abundance is associated with landscapes with high proportions of old-growth and mature forest. This finding, and similar findings in other studies, is relevant for several reasons. The problematic standards in the Draft Plan were dropped in response to critical peer review comments, but no broad-scale habitat standards are now present for westside ecoprovinces in the Final Plan. This is in contrast with standards for eastside provinces (Recovery Criterion 3: High-quality habitat to constitute 30% of landscape). Perhaps no such standards are considered necessary for westside provinces, as the plan appears to propose a prescriptive goal within reserves (MOCAs) for maintenance of the maximum proportion (given site capability) of older forest, coupled with a more aspirational goal (i.e., a goal one should aspire to achieve) for maintaining such habitat in the landscape matrix. However, the attempt in the Draft Plan to set such standards (e.g., x% of MOCAs will have at least x% of suitable habitat as defined by e.g., the habitat model of Davis and Lint [2005]), although flawed, did provide guidelines for linking habitat monitoring with recovery planning.

It is also problematic that the Final Plan poorly defines the key characteristics, at the various spatial scales, of the "high-quality" habitat that is the target to be conserved (e.g., Recovery Action 5: Manage habitat-capable lands within MOCAs to produce the highest amount and highest quality spotted owl habitat the lands are capable of producing). On p. 10, high-quality habitat is defined as indicating "older, multi-layered structurally complex forests that are characterized as having large diameter trees, high amounts of canopy cover, and decadence". This appears to adapt the definition of "superior" habitat in Thomas et al. (1990, page19). However, the Final Plan's definition lacks quantitative criteria for categorizing forest stands as high-quality habitat.

In regards to Recovery Action 32 (Maintain substantially all of the older and more structurally complex multi-layered conifer forests on Federal lands outside of MOCAs), it is unclear whether this refers to the "superior" habitat class as defined by Thomas et al. (1990). The Final Plan states "Identification of forest stands meeting this Recovery Action will be conducted by the agencies that administer lands" (e.g., USFS, BLM) and

"Forest stands meeting the described conditions are a subset of suitable habitat". By deferring both definition and mapping of habitat, the plan makes it impossible to assess important factors relevant to evaluating the effect of proposed recovery actions, e.g., what proportion of MOCA area is currently high-quality habitat, and what proportion of the matrix would be conserved as high-quality habitat. Given the availability of data from 14 years of habitat monitoring under the Northwest Forest Plan (e.g., Moeur et al. 2005, Strittholt et al. 2006), combined with the extensive information available from past owl habitat studies, definition and mapping of these habitats should have been possible during the recovery planning process.

Guidelines stated in Recovery Action 32 are inadequate for several reasons. Firstly, **they are aspirational rather than prescriptive**, which could lead to a return to the problems associated with poor multi-jurisdiction consistency in habitat management ("inadequate regulatory mechanisms") that were prevalent before implementation of the Northwest Forest Plan. Secondly, **the habitat definition described above ignores the importance at the landscape scale of late mature stands to owl habitat** (Dugger et al. 2005, Carroll and Johnson 2008). Old-growth forest (> 150 years in age) is highly fragmented in many ecoprovinces, with remnant stands being composed of primarily edge habitat (within 100 meters of younger or non-forest). Late mature and mature stands thus play a key role in augmenting the value of old-growth habitat to owls and are an appropriate conservation target within both reserves and the landscape matrix.

The Final Plan has largely omitted reference to the question of owl-habitat relationships at the territory scale and above, and definition of habitat standards is generally deferred to a to-be-created working group (Recovery Action 12). T**he lack of substantive discussion and analysis of this question is overall a shortcoming of the Final Plan, given the extensive body of knowledge available on this species' habitat relationships. Lack of detailed habitat analysis and standards weakens ability to assess compliance with relevant recovery actions** (e.g., Recovery Action 5: Manage habitat-capable lands within MOCAs [Managed Owl Conservation Areas] to produce the highest amount and highest quality spotted owl habitat the lands are capable of producing).

Reserve Area and Location

At least as an initial hypothesis, if owl population status is more precarious than in 1994, necessary **conservation measures should equal or exceed in effectiveness those in the Northwest Forest Plan. Instead, the Final Plan proposes, without substantive justification, a major reduction in the area of reserves from the current status, reverting to a reserve system** (the DCA system; USFWS 1992) **that was analyzed and discarded during the Northwest Forest Plan's development as posing unacceptable risks to owl viability** (Raphael et al. 1994, Noon and Blakesley 2006).

In order to derive guidelines on the impact of the size and spacing of reserves on owl viability, the Final Plan ignores relevant material developed in support of the Northwest Forest Plan that suggested that the DCA system (Northwest Forest Plan Alternative 7) failed to ensure a well-distributed viable owl population (Raphael et al. 1994). Instead the recovery plan re-created older, more simplistic analyses (Lamberson et al. 1994). The results of these analyses are then applied out of context in the Final

Plan. Peer-reviews of the Draft Plan identified as problematic the proposal for a substantial decrease in reserve area from the current LSR system (TWS 2007, Carroll and Johnson 2008). In the Final Plan, total MOCA area for the westside ecoprovinces dropped slightly (-1.5%) from that in the Draft Plan and all eastside MOCAs are dropped in favor of a non-reserve strategy.

Not considering MOCA area within existing congressional reserves, whose management is unaffected by the Plan, reserve area drops ~22% for the westside, and ~38% overall when compared to the LSR network (Table 1). Certain ecoprovinces are disproportionately affected by these losses (e.g., Oregon Klamath, 44% loss [Table 1]). The effect of the final recovery plan on other reserve allocations (e.g., riparian reserves [USFWS 2008; p. 84, Table C-5]) within the Northwest Forest Plan is not considered here. In addition, as in the draft, the role of non-federal lands is not substantively analyzed in the Final Plan, and **the extent of and standards for Conservation Support Areas (CSA) on non-federal land are inadequate, especially in Oregon**.

Table 1. Comparison of area in hectares by ecoprovince for the current LSR network (USDA and USDI 1994) and final MOCA network (USFWS 2008). Because management of congressional reserves remains unchanged between alternatives, area of MOCA or LSR falling within congressional reserves is not considered. The effect of the final recovery plan on other reserve allocations within the Northwest Forest Plan (e.g., riparian reserves [USFWS 2008; p. 84, Table C-5]) is not considered here. Ecoprovinces in italics fall under the final recovery plan's eastside no-reserve strategy and thus had their MOCAs eliminated in the Final Plan.

PROVINCE NAME	LSR hectares	MOCA hectares	Change,%
California Cascades	97666	-	*
Eastern Oregon Cascades	154623	-	*
Western Oregon Cascades	504560	395044	−21.71
California Coast	50145	53354	+6.40
Oregon Coast Range	306594	259412	−15.39
Eastern Washington Cascades	359111	-	*
California Klamath	499839	376697	−24.64
Oregon Klamath	339288	187565	−44.72
Olympic Peninsula	167473	134722	−19.56
West. Washington Cascades	413645	371604	−10.16
TOTAL (Westside only)	2281544	1778398	−22.05
TOTAL	2892944	1778398	−38.53

Although the Final Plan is an improvement over the Draft Plan in identifying the importance of older forest in the matrix between reserves, **the relevant guideline** (Recovery Action 32: Maintain substantially all of the older and more structurally complex multi-layered conifer forests on Federal lands outside of MOCAs) **is an**

aspirational guideline (p. 35 "managers are encouraged to meet the intent to maintain substantially all of the described forests" in future project planning) **rather than an effective prescriptive standard, and it is hindered by the lack of habitat definitions as described above**.

Past conservation planning efforts for the Northern Spotted Owl stimulated ground-breaking research that used spatial models to assess the potential effects of reserve size and spacing on viability. Initially, Lande (1991) used a non-spatial model to demonstrate that a territorial species such as the owl could reach an extinction threshold while habitat still remained. The Lande (1991) model also highlighted the importance of suitable but unoccupied habitat to persistence. Lamberson et al. (1994) then developed a dynamic spatial model which analyzed owl viability on idealized landscapes with territory clusters of varying size and spacing. This model suggested general rules for the size and spacing of habitat blocks that informed early reserve design proposals for the owl (Thomas et al. 1990). As computational power and data on landscape composition improved, modelers were able to significantly refine these early efforts by modeling the relative viability of owl populations on detailed representations of real landscapes. Input data could now include the actual location and boundaries of proposed reserves and spatial data on habitat quality across the landscape (Raphael et al. 1994, Schumaker et al. 2004). This is important because, rather than delineating reserves based on absolute size criteria, planners could use habitat information to assess what percentage of each reserve currently provided, and could over the long-term provide, suitable owl habitat. These more realistic models are now considered the "state-of the-art". Thus the statement on p. 70 "While the 1992 draft Recovery Plan was never finalized, the plan remains the most-recent spotted owl-specific analysis of habitat needed to provide for a sustainable population of spotted owls across the species' range" is demonstrably false (see e.g., Raphael et al. 1994). **One of the biggest surprises of the Final Plan was its failure to do some spatial modeling comparing different conservation reserve strategies.**

Although in their day, models of idealized landscapes (Lamberson et al. 1994) were useful aids to planning, few would support their use today to the exclusion of simulations of viability on more realistic landscapes. Those involved in the current recovery planning process inexplicably chose to forego more recent modeling methods and instead re-create the work of Lamberson et al. (1994). For this effort they used a modeling software, HexSim (Schumaker 2008), that, while capable of modeling idealized landscapes, had been expressly developed for producing models based on realistic landscapes similar to those in Raphael et al. (1994).

It is important to keep in mind how such modeling results can appropriately inform planning and reserve design. Because the owl population is currently in decline at ~3.7% per year (Anthony et al. 2006), a simulation using current observed vital rates (e.g., from Anthony et al. 2006) will predict deterministic extinction irrespective of reserve size and spacing. It is appropriate to "boost" input demographic parameters (survival rates and reproduction), as did Lamberson et al. 1994 and Marcot and Raphael in prep., to assess the potential effect of reserve size and spacing independent of the currently negative population trend. In this sense the Final Plan's assertion (p. 78) that the model of Marcot and Raphael (in prep.) improves on the work of Lamberson et al. (1994) through its use of updated demographic rates is not highly relevant as observed demographic rates generally could not be used due to "boosting". This "boosting" necessarily limits the ability to interpret model results as predictions of viability on real landscapes. This point was acknowledged by the researchers involved (p. 77) but was not acknowledged in the subsequent evaluation of management implications (p. 81). Even given, as in this plan, the exclusive use of the simplistic model of idealized landscapes, a more thorough assessment could have been performed to help evaluate the adequacy of the MOCA reserve system. Such an assessment would have used a broader suite of metrics to evaluate model results, and would have evaluated alternate hypotheses proposed in the literature and peer review of the Draft Plan (e.g., Noon and McKelvey's [1996] finding that one or more large reserves increased viability). Given that such analyses were excluded from the plan, one of the reviewers conducted analyses of both of these aspects; the results are presented and discussed below.

Protection of Habitat and Owls

The establishment of reserves and the protection of older, multi-layered forests are important in the strategy for long term conservation of the spotted owl. These provisions would require there to be an interactive approach whereby agency biologists communicate to the USFWS when definitions and guidelines are being misinterpreted or misapplied in a way that would undermine the intent of the recovery plan, particularly where the older-forest identification is determined. It is possible that agencies could try to keep as much of the timber base out of the protected category as possible. **There needs to be some safeguards and oversight on how the "older forest" is designated so that it can be protected from harvest activities.** The Recovery Plan should recommend some guidelines or an agreement on definitions of "older, multi-layered forest" by province.

Protection of the older forest is important, but the protection of known sites is also important. Due to the high degree of habitat fragmentation in some areas, spotted owl sites may have their center in older forests, but the core area incorporates some forests in younger age classes that are not protected but still suitable habitat. Yearly shifts in the site center are common as spotted owls often choose different nest trees within the core area. A nesting pair could select an area on the edge of an older forest stand. **It is important that in addition to protecting older forests, harvest activities within close proximity to the site be prohibited to prevent a negative effect on the site.** Because barred owls are influencing where spotted owls occur, spotted owls may be using habitat that is atypical, yet their protection is also important. It is important that sites where reproduction has occurred be protected, even if the site is not in a MOCA or in older forests. As competitive pressure with the barred owl occurs, new locations of spotted owl nest sites are being discovered. Sites that historically had little or no spotted owl activity are being found to support nesting activity. Immediate protection of these sites should be incorporated into the conservation of this species. **Management plans and projects should be written with language that would enable the management agency to terminate or indefinitely suspend any project that would negatively impact a site.**

It is important that every nesting pair be considered essential for the recovery of the spotted owl. A recent study of the lifetime reproductive output of spotted owls by Pete Loschl, a Masters student at Oregon State University, found that a little less than 20% of the individuals in the population were responsible for about approximately 50%

of the reproduction. Failure to protect key nesting pairs could seriously curtail the overall recruitment to the population. The Final Plan for the spotted owl does not directly address the need to protect the active sites except briefly on page 2. Some sideboards should be specified so that old growth timber sales that are two years out in the planning process are not considered exempt from this protection. There are current harvest plans where little effort has been invested in the planning and implementation process.

Habitat Management of East-side and West-side Forests

Development of the prescription necessary to manage east-side forests to support owls (pages 12, 17, 20-23, Appendix E) **will be biologically complex and, perhaps more importantly, extremely challenging to implement and difficult to monitor.** Given the complexity of development and implementation, this entire strategy seems questionable despite the fact that the basic principles seem reasonable. Management of east-side forests surely could be approached differently than west-side forests, but the structure provided in the Final Plan seems too loose to ever work in practice.

The group responsible for designing and overseeing the adaptive management frameworks for this Plan (page 17) will have a strong influence on the potential success of the Plan in these forests. They also have a wide berth in terms of potential strategies, having been provided only very general targets in the Final Plan. The framework and background provided (pages 22-23) seem fine, but there are many specifics that need to be established for this to be implemented meaningfully. We are concerned that the proposed management strategy may not be feasible. For example, Recovery Criterion 3 (page 18) states that: "at least 30 percent of the Province contains high-quality habitat and 75 percent of that habitat is within at least one home-range radius of an activity center..." We understand and appreciate the logic in trying to manage east-side forests as a dynamic landscape, but we are concerned about the Agencies ability to implement such a strategy across large areas and multiple ownerships. The degree of required coordination alone seems overwhelming.

Forest Thinning

It is commonly accepted that clearcutting negatively affects the spotted owl. However, forest thinning also can have negative affects. Unlike the practice of clearcutting, thinning can result in a variety of conditions from those that, functionally, are little different from clearcuts, to those that have few adverse effects on forest wildlife. Depending on the prescription, thinning opens stands up and may attract predators of the spotted owl. The Final Plan does not discourage thinning even though comments from the SEI Scientific Review Team contain statements and cautions about thinning in forests on the west side of the Cascades. Determining the effects from thinning on spotted owls is complicated by the wide variety of harvest prescriptions. Risk increases with the size of the planning unit, the amount of canopy trees removed, and the proximity to the activity center. Stands that are thinned in close proximity to nest sites expose the nest stand to edge affects of temperature and wind-throw. The proposal for thinning includes the need to reduce fire danger – less canopy closure can actually increase fire danger. As the canopy is opened up, fuels on the forest floor can dry out faster, potentially increasing fire likelihood. **In areas where there is 50% federal ownership, the cumulative**

effects of harvest on private land and the habitat degradation from thinning on private land could be more than the spotted owl can sustain.

The Final Plan claims that it used the best scientific information available. The SEI (2008), Scientific Review of Draft Northern Spotted Owl Recovery Plan and Reviewer comments, included recommendations and cautions about thinning on the west side of the Cascades. **Cautions about thinning have apparently been ignored, as the Recovery Plan does not discourage or prohibit thinning in close proximity to active spotted owl sites.** Clearly we have much to learn about the effect of thinning on spotted owls and the time for experimentation is no longer available because the barred owl effect on the spotted owl makes experimentation too risky. On page 23, the Recovery Plan encourages thinning to accelerate the development of large trees. Large trees alone do not constitute spotted owl habitat. The multi-story component indicates that there should be a variety of tree sizes (ages) in suitable spotted owl stands.

Reserve Design

For unexplained reasons, the Final Plan builds off of the 1992 Draft Plan rather than the more current NWFP. In term of reserve design principles, the 1992 Draft Plan was grounded in the 1990 Interagency Scientific Committee Report (Thomas et al. 1990). Reserve design principles in Thomas et al. (1990) were, in turn, based on modeling work conducted by Drs. Lamberson, McKelvey, and Noon (Lamberson et al. 1992, 1994). The work reported in Lamberson et al. (1994) is particularly relevant to the Final Plan. As mentioned earlier, for reasons that are not entirely clear, the modeling work reported in Lamberson et al. (1994) was redone by Drs. Marcot and Raphael using program HexSim (Schumaker 2008). Marcot and Raphael report results both qualitatively and quantitatively very similar to Lamberson et al (1994)—that is, no new insights arose from this work. We are very surprised that the Recovery Team adopted this approach since **the methods and models used by Lamberson et al. (1994) no longer represent the state of the art in spatial modeling.** In fact, the Lamberson et al. (1994) model is not spatially explicit but only spatially implicit. That is, it is a highly stylized model unable to be integrated with real landscapes.

Much better insights into the relative conservation benefits of the reserve design proposed in the Final Plan and that provide by the NWFP can be found by going all the way back to the 1994 report of Raphael et al. (1994). In this analysis, Raphael et al. use a spatially explicit model to compare various land management alternatives in terms of their relative benefits to SPOW conservation. One relevant comparison is between alternative 7 (basically the design proposed in the 1992 Draft Plan) and alternative 9, the NWFP selected alternative. Alternative 7 was found to provide less conservation benefit to spotted owls particularly in Oregon and California. Based on this result, **it is clear that the proposed reserve strategy in the Final Plan will provide less conservation benefit than the NWFP.**

A useful modeling exercise to better inform the recovery planning process would have used a fully spatial model that can incorporate real landscape maps through a GIS-interface (e.g., HexSim), initialized this model with the known spatial distribution of owls, and parameterized the stage structure with the most current demographic estimates that reflect geographic variation in the vital rates. This is not an unreasonable suggestion since steps in this direct had been done more than ten years ago (reported in Raphael et al. 1994 and Noon and McKelvey 1996). The goal of such a modeling exercise would be to ordinally rank competing conservation designs (e.g., MOCAs vs LSRs) in terms of mean reserve occupancy rates, metapopulation persistence likelihoods, and long term growth rates.

Size and Boundaries of MOCAs

The Final Plan's proposes use of the reserve size rule that MOCAs be large enough to hold 20 owl territories. This, despite revised recommendations from Noon and McKelvey to increase the size of MOCAs to support 35-40 owls after revisiting their previous work, as well as the new modeling results that also suggest MOCAs should be larger (page 77), USFWS apparently ignored these findings (and if they did follow it, they do not provide summary information in a form that illustrates this). Similarly (p. 83), the two criteria used to eliminate DCAs seem unreasonable in that they target the minimum values considered thought to be reasonable; for a species that is clearly in decline, this seems unjustifiable.

> "The original DCA was not needed to satisfy the maximum spacing of 12 miles between category 1 DCAs and 7 miles between category 2 DCAs"

"Not needed?" Does this mean that if two or more MOCAs were within the limits of the distances specified that one or more were eliminated? Although owls are clearly capable of dispersing 12 miles, most do not disperse this far (Table C4, p. 76). Eliminating these areas and increasing the mean distance between areas will surely increase mortality during dispersal.

> "The original DCA was not needed to provide for a cluster of reproducing spotted owls"

Again, what does "not needed" mean? **There seems to me to be no reasonable justification for choosing fewer reserve areas that will be spaced farther apart for a species with the demographic trajectories of NSO.** In the end, how many DCAs were eliminated?

The Final Plan describes PVA modeling that is interpreted to demonstrate that their reserve size rule ensures viability. The Final Plan states, however, that it was not possible to test the performance of 20 territory clusters ("The cluster sizes and cluster spacings were dictated by the sizes of the hexagons in the model. That is, they could not test round numbers such as 5, 10, 15, 20"). This is not correct, as the HexSim model allows creation of hexagons and hence territory clusters of arbitrary size. In fact, a 19 territory cluster approximates the circular clusters used in Lamberson et al. (1994). The Final Plan reports results from simulations using 4, 9, 25, 36, and 49 territory clusters, and states "simple interpolation suggests that a cluster size of 20 territories/cluster would fare only slightly worse than that of 25". Even given the incorrect assumption that only clusters of squared numbers (4, 9, 16, 25, 36, 49) could be analyzed, it is unclear why results were omitted from a 16-territory cluster, which more closely approximates MOCA size than does a 25-territory cluster. Evaluation of the performance of 20-territory clusters based on interpolation from results with larger sized clusters may give overoptimistic results if, as expected, the decline in occupancy steepens at small cluster sizes (p. 79, Figure C1).

Two additional aspects of the conclusions of Lamberson et al. (1994) are relevant. Firstly, while Marcot and Raphael (in prep.) assumed territory clusters to be composed of 100% suitable habitat, Lamberson et al. (1994) chose to vary the percentage of the cluster containing highest suitability habitat. They found, not surprisingly, that as less of the cluster was composed of highest quality habitat, a larger cluster size was needed to achieve same occupancy probability (Figure 7; Lamberson et al. 1994). Secondly, Lamberson et al. (1994) stated that although they (like Marcot and Raphael in prep.) used a females-only model, a two-sex model would likely suggest the need for larger clusters as lower mate-finding success would cause lower occupancy in smaller clusters.

Persistence/extinction metrics and the influence of large clusters not analyzed

More significantly in terms of substantive defects in the plan's analysis, **the reserve modeling results focus on a single metric, occupancy, and do not analyze metrics relevant to evaluating persistence and extinction**, including the influence of large clusters on persistence. Several peer reviewers of the Draft Plan, as well as the Final Plan itself, cited Noon and McKelvey's (1996) finding that adding one to several larger reserves to a reserve network composed of 20-territory clusters significantly improved persistence. In any case, one of the reviewers was able to fairly easily address this question by modification of simulations of an idealized landscape of 19-territory clusters. The reviewer aggregated 5 of those clusters into a single cluster of 95 territories, without adding or subtracting from the total amount of habitat. The reviewer used a parameter set with a deterministic lambda (population growth rate as calculated from the Leslie matrix which parameterized the model) slightly above 1 (1.001), which would represent a stable population absent any reserve area or isolation effects. Although higher than observed demographic rates (Anthony et al. 2006), this lambda value does not involve as high a level of “boosting” at that necessary to ensure stable demographic rates in a fragmented landscape (i.e., as in the analysis of Marcot and Raphael in prep.). This contrast is appropriate because here the goal was to assess relative probability of metapopulation persistence rather than relative occupancy given persistence. Both types of analyses (occupancy and persistence) should be used complementarily in informing reserve design.

Under the input demographic parameter sets used, persistence was relatively low (20%) when only smaller (19-territory) clusters were present. In contrast, the single large reserve significantly increased the persistence likelihood of the metapopulation. These simulations are necessarily exploratory given the timeframe of the peer review process, and would need to be subject to further sensitivity analysis before use in the recovery planning process. However, the results do have several implications. Firstly, **the assertion in the Final Plan that the HexSim modeling supports the contention that the Final Plan's reserve size and spacing are sufficient for owl persistence** (p. 81) **is unwarranted; in fact the Final Plan's reserve design is anticipated to involve a high risk of extinction.** This analysis reinforces Noon and McKelvey’s (1996) conclusion that larger carrying capacities (perhaps 30–40 pairs per HCA) are needed. In addition, a few large reserves (>100 pairs) significantly safeguard against population extinction. For these reasons, the original reserve design proposed by the ISC represents a minimum system, with greater risks to persistence then initially envisioned. Secondly, based on these preliminary model results, the shrinkage in size of the largest current reserves (LSRs) to accommodate the proposed MOCA network in the Final Plan (especially in the Western Oregon Cascades and Oregon Klamath ecoprovinces) can be expected to significantly increase the metapopulation's extinction risk.

No scientific justification given for proposed changes in reserve network

Currently, the reserve system on federal lands (congressional reserves and LSRs) holds approximately 27% of the region's area (considering all ownerships), and 32% of its owl habitat value, according to two modeling studies (Davis and Lint 2005, Carroll and Johnson 2008). The MOCA network (when combined with congressional reserves) proposed in the Draft Plan would have reduced this to approximately 24% of the region's area and 27% of the owl habitat value (Carroll and Johnson 2008). The Final Plan proposes a further reduction of the area of MOCAs as compared to the Draft Plan, primarily due to the Final Plan's decision to exclude eastside ecoprovinces from the MOCA network.

Looking at federal lands alone and ignoring congressional reserves, the MOCA network in the Final Plan protects 22% (westside) to 38% (overall) less area (Table 1) and more than 20% less owl habitat value than do current LSRs (Carroll and Johnson 2008). Based on the findings of Marcot and Raphael (in prep.), the Final Plan (p. 77) states that, for the idealized landscapes described in the previous section, irrespective of reserve size, "occupancy rate drops more precipitously in landscapes consisting of less than approximately 35–40 percent habitat." Although it is not possible to directly apply a quantitative threshold from modeling of idealized landscapes to real-world landscapes, the **model results do suggest that we may be near or have exceeded thresholds where small losses in reserve area may trigger steep decline in populations**. Therefore, one would expect that any proposal to substantially reduce the area of the reserve network would be rigorously analyzed for its effects on owl viability. However, the Final Plan contains little reference to the current reserve system of the Northwest Forest Plan, beyond the erroneous claim that the current reserve system was not designed to ensure owl viability (Franklin 2008).

Rather, the Final Plan primarily refers to the Designated Conservation Area (DCA) strategy that pre-dated the Northwest Forest Plan (USFWS 1992). Raphael et al. (1994), in a simulation using detailed landscape data, found alternative 7, which was based on the DCA strategy, to have a poorer likelihood of meeting viability goals than did alternative 9 (the current system). Alternative 7 protected 27% less area within LSRs than did alternative 9, a similar contrast to that between the current LSR and MOCA system (USDA and USDI 1994). The Raphael et al. (1994) analysis predicts significantly lower occupancy under alternative 7 as compared to current management (Alternative 9) in both Oregon (drop of ~60%) and California (drop of over 80%). The Final Plan does not address why these analyses, which are significantly more realistic than those used in the plan, are no longer relevant to assessing the effects of the proposed MOCA reserve system on owl viability.

Option 2 of the Draft Plan proposed that managers designate owl management areas, termed habitat blocks, based on several design rules. The primary rule capped reserve size at that sufficient to hold 20 owl territories. The Final Plan dropped the heavily criticized Option 2 and with it the explicit 20-territory reserve size cap. However, the Final Plan appears to implicitly rely on this guideline as justification for the design of the MOCA network. Although many of the MOCAs still exceed in size the area thought necessary to hold 20 territories, the overall reduction in reserve area (as compared to the LSR network) results in a fragmenting of many of the largest LSRs, especially in the western Oregon Cascades and Oregon Klamath. Due to the inherent limitations of any analysis based on idealized landscapes (e.g., Lamberson et al. 1994, Marcot and Raphael in prep.), modeling results should not be interpreted as suggesting that 20 territories is a adequate size to ensure persistence, but rather that this size is a minimum goal because smaller territory clusters may have occupancy more strongly limited by area effects.

Adding to the relevance of this precautionary interpretation of model results is that the capability of MOCAs to support owls is not adequately captured by absolute size criteria based on median territory size (Thomas et al. 1990). Based on the model of Carroll and Johnson (2008), MOCA-1 reserves, designed to support 20 owl territories, generally fail to support enough habitat for 20 pairs of owls. Most (82%; Appendix 2) of the MOCA-1 reserves delineated in the Final Plan currently lack the habitat to support 20 pairs of owls. Only 45% (18 of 40) of the westside MOCAs meet the Final Plan's population abundance recovery criteria (Recovery Criteria 2: at least 80% of MOCA 1's contain at least 15 owl pairs). Although habitat-model-based estimates of abundance cannot substitute for abundance data from field surveys, they do suggest a wide variation in the capacity of MOCA-1 reserves to support 20 pairs. Thus **the Final Plan's simulations of viability based on a network of 20-pair habitat clusters may be significantly overoptimistic**. The deficiency in MOCA habitat capacity (low numbers of owls supported) is especially notable in the Oregon MOCAs (Appendix 2). This suggests that the reduction in size of reserves in Oregon from the current system (LSRs) is unwise. A metapopulation inhabiting a reserve system such the MOCAs composed primarily of smaller reserves would be expected to be highly dependent for its persistence on maintenance of the large high-quality reserves as source patches.

Non-Reserve Strategy for Eastside Provinces

The Final Plan departs most dramatically from the Draft Plan in the management framework proposed for the three eastside ecoprovinces (Eastern Cascades, Washington; Eastern Cascades, Oregon; Cascades, California). No reserves (MOCA) are proposed for these areas; instead, the Final Plan proposes a "landscape-level" strategy to reduce fire risk through aggressive silvicultural treatments while maintaining sufficient area in transient patches (i.e., stands) of spotted owl habitat. These three ecoprovinces represent 18.4% of the total plan area. The Final Plan also proposes possible extension of such a no-reserve strategy to the Oregon and California Klamath ecoprovinces, which compose an additional 17.7% of the plan area. It is unusual for such a major aspect of the overall recovery strategy to be absent from the Draft Plan but implemented in the Final Plan. The USFWS bases the change to a no-reserve strategy on an interpretation of portions of the SEI report (SEI 2008) calling for more aggressive restoration of historic fire regimes in eastside ecoprovinces.

However, several flaws are evident in how science was applied here to support management planning. Firstly, the Service selectively embraced those portions of SEI report calling for more aggressive fuels management while ignoring significant doubts by owl biologists on the SEI team and within the federal owl recovery planning effort concerning land management agencies' abilities to implement the proposed strategy. The SEI review effort was marred by a lack of integration between the work of the separate teams reviewing fire management and owl biology. Similar to the heavily criticized proposal in the Draft Plan for widespread barred owl control, **the Final Plan's "fireproofing" strategy proposes widespread application of new management techniques without initial testing of their feasibility or impacts on owls.**

Current management (the Northwest Forest Plan) also considers the effect of major management proposals on the rare and endemic species associated with older forest (e.g., FEMAT's "Survey and Manage" species). Many of these species evolved in fire-adapted communities, but historically occurred over a much wider range than they currently occupy. This would suggest that large-scale fuels management (e.g., thinning) might pose a risk to the viability of some species given their currently restricted distribution. These rare and endemic species are concentrated in two ecoprovinces, the Oregon and California Klamath, to which the Final Plan considers extending a no-reserve strategy in the future.

In addition, **relevant fire ecology references are misinterpreted in the Final Plan as supporting the new approach.** In multiple places the Final Plan cites work by Hessburg et al. (2007), who suggest "that low, mixed, and high severity fires each occurred in dry (and moist) mixed conifer forests of eastern Washington. The scope of management and restoration activities could be broadened to not only accept many such wildfire effects, but to manage for them. This should be good news for forest managers because it suggests that some contemporary wildfire effects will meet management objectives, and a broader suite of forest structural conditions and a broader range of patch sizes supported native fire regimes of mixed conifer forest." The Final Plan also justifies its no-reserve strategy for eastside ecoprovinces by reference (e.g., on p. 97) to the relatively high acreage within these ecoprovinces experiencing fire during the period 1994-2003 (Moeur et al. 2005).

The Final Plan misrepresents the cited studies (Moeur et al. 2005, Haynes et al. 2006) in several aspects. Firstly, the plan extrapolates data from a single decade that experienced a historically unusual large fire event in the Oregon Klamath (the Biscuit fire) to predict fire occurrence over a century. Similar extrapolation from a decade that experienced low fire extent would have provided a very different interpretation. Secondly, decadal fire extent totals would not be additive, but rather would involve more frequent re-burn of fire-prone areas coupled with longer fire return intervals for areas with aspect, elevation, and other site characteristics less conducive to high-severity fire. The Final Plan also assumes that fire events translate into "losses [of habitat] to fire" whereas recent research suggests extensive use by owls of burned areas (see references cited in TWS 2007). Finally, a recent analysis suggests that the actual areal extent of forest burned in high-severity fire in the eastside ecoprovinces is substantially lower than that claimed in the Final Plan, and **thus actual fire rotation intervals are orders of magnitude longer than those stated in the recovery plan** (Hanson et al. in review).

The Final Plan thus provides inadequate support for the hypothesis that the high level of fire risk in eastside ecoprovinces precludes a reserve-based strategy. A plausible alternative approach would be that, given the low proportion of older forest habitat on eastside forest landscapes when compared to historic levels (Hessburg et al. 2007), and the potential for a no-reserve strategy to increase risk of a return to inadequate coordination of habitat planning across jurisdictions, **reserves should be retained until at least such time as proposed landscape-level fire restoration strategies have been tested for feasibility and impacts on owl viability.** This evaluation could involve realistic population viability analysis (e.g., Raphael et al. 1994) as has been suggested above for evaluating alternative range-wide reserve network proposals. In the interim, those fire restoration treatments less likely to impact owl habitat suitability could be permitted within reserves.

Other Issues, including errors, omissions, and inconsistencies

- The Final Plan fails to substantively analyze the relevance, as a new threat to population viability, of genetic "bottlenecks" in current owl populations possibly due to rapid population decline (Funk et al. in review, Haig et al. in review). These new data could be especially relevant because the shrunken reserve network proposed in the Final Plan may result in long-term maintenance of a meta-population composed of relatively small and isolated subpopulations. We suggest that a rigorous analysis of genetic threats, potentially including quantitative modeling of the effect of alternate reserve proposals on the genetic structure of the owl metapopulation (e.g., with the program VORTEX [Lacy 1993]) would be a valuable addition to recovery planning.
- The Final Plan lacks any reference to integrating owl recovery needs within an ecosystem-based approach. The Northwest Forest Plan sought to integrate multiple conservation goals (conservation of wide-ranging focal species, rare and endemic species, freshwater aquatic species and systems, and forest ecosystem processes and disturbance dynamics) into regional-scale forest planning by drawing on expertise from a variety of disciplines. Any proposal, such as this owl recovery plan, that suggests substantially revising the NWFP planning framework should be evaluated by experts from the relevant disciplines to assess its effects on this diverse set of forest ecosystem conservation goals. To do otherwise invites development of multiple land management strategies based on potentially conflicting species-level recovery needs.
- We anticipate that the contribution by private land owners, in general, will be low if profit is the driving force for land management. Federal agencies could work with state legislature to change forest practices laws that are detrimental to the spotted owl. Smaller units, fewer clearcuts, and more diverse species composition would be an improvement. Currently, Oregon law protects 70 acres around the most recent activity center on private lands as long as the site is occupied by a pair. After 3 years of no occupancy, harvest is allowed in the core area. An increase in the size of the core area and the length of time the core area is protected would be a great improvement in the protection of spotted owl sites on private land. Guidelines should consider that spotted owls may still be present when barred owls have been detected. Current guidelines consider only spotted owl presence and absence when considering forest practices on private land in Oregon.

- Related to this, on page 2, details are lacking on how federal agencies are planning to encourage non-federal landowners to maintain and protect spotted owl sites.
- The Recovery Plan indicates that Raphael and Marcot used the best available data, but it is not clear where they got the data for their analysis. Since we are under the impression that they did not get it directly from the demography study area leaders, the data are most likely incomplete and not up to date. There are databases with spotted owl information available on-line, but those data contain only federal sites and are not inclusive of private sites or areas of use that are not fully designated with site status. Singles and floaters outside of designated sites are not included in those datasets. The impact on the analysis might be inconsequential, but we take issue with the statement that the best available data were used.
- In the Executive Summary, the sentence "Past habitat loss and current habitat loss are also threats to the spotted owl, even though loss of habitat due to timber harvest has been greatly reduced on Federal lands for the past 2 decades" speaks only to the rate of habitat loss; **the overall amount of habitat has continued to decline**.
- Page IX and page 18: Recovery Criterion 2 states that at least 80% of the MOCA 1's would contain at least "15 occupied spotted owl sites when surveyed over a 5-year period." This is an unclear specification. Theoretically, 3 single individual spotted owls could move to a different site each year, not previously occupied, and over a five year period, those 3 spotted owls will have occupied 15 sites. The more appropriate criteria would be to have at least 15 different sites occupied by a pair of owls in any one year for 5 years. Also, why is the target number here 15 rather than 20 pairs of owls?
- On page 10: High Quality Habitat contains no reference and no definition of "large diameter trees." This leaves too much discretionary interpretation to the agencies and will result in less than expected protection of older forests. It should also include in the category, any stand currently or previously occupied by a pair when the information is available.
- Page 6: In light of all the recent information on spotted owl demographics and the urgency of action due to the barred owl range expansion, the recovery priority number should be restored to 3C. The 6C designation was not consistent with the status review that indicated that the population of spotted owls was declining in several areas across the range.
- Page 11: there is a statement that seems to be requesting feedback on what actions are not working as planned. This seems to be left open to interpretation and should be more specific as to who they want to hear from and through what means. For example, is USFWS asking employees of the land management agencies to come forward with information?
- Page 12: One Recovery Objectives states: "The effects of threats have been reduced or eliminated such that spotted owl populations are stable or increasing and spotted owls are unlikely to become threatened again in the foreseeable future." This might be better considered as two separate objectives, as they are not necessarily related to each other: (1) elimination of threats and (2) populations status.

- Page 15: The monitoring of population trend should be continued on an annual basis. The omission of the word "annual" leaves open to interpretation that a trend could be based on some other time period. The life history of the spotted owl is based on an annual cycle and to monitor the population trend more infrequently than annual, would be statistically unsound. In places where the plan refers to trend data, it should read "annual" trend data.
- Page 18: The specifics of Recovery Criterion 1 might have been developed more specifically, including what "statistically reliable method" and what "probability" should be used. The actual methods and values chosen will affect the value of this criterion.
- Page 18: Recovery Action 3. Modeling surely has value in predicting the amount of potential habitat, but modeling can never replace collection of empirical data on occupancy. Therefore, the "modeling" section of this action should be deleted, or modified so as not to imply that modeling can replace field data in regards to occupancy rates.
- On page 20: There is no citation for the "Activities with demonstrated long-term benefits for spotted owls…" Given its importance in the Final Plan, there should be references for where thinning activities are asserted to demonstrate benefit to spotted owls.
- Page 23: Not all naturally regenerated stands would need to be thinned. Young stands that naturally regenerate can have many of the components that make the stand more structurally diverse and species rich.
- Page 27: "Encourage applicants to develop Habitat Conservation Plans." It is not clear what the application process is for.
- Page 27: Recovery Actions 13 (HCPs) and 14 (incentives) seem innovative, but like other aspects of the Plan, they need to be developed more fully to be implemented meaningfully.
- Page 31, Recovery Action 24 alludes to modification of protocols to require increased survey effort due to declines in spotted owl detectability when barred owls are present. The Recovery Action also should indicate that the funding for this increase would also be available for the federal studies that are affected.
- Page 50: The statement that spotted owls generally rely on older forested habitats has but one citation, when there are numerous citations that are already published that could have been cited.
- Page 56: The reference to the Oregon Forest Practices rules governing the protection of spotted owl core areas left out the provision that when the 70 acre core area goes unoccupied for three years as documented by surveys, or if the pair of spotted owls selects a different nest tree outside the 70 acre core area, the protected core area could be harvested. Also, if the barred owl occupies the site, the site is considered abandoned. This also leads to harvesting of the core area. Instead, state regulations should consider that the barred owl displaces spotted owls and therefore protection of the core area should continue since the spotted owl could reoccupy.

- Page 76: Table C4 is out of order and should be inserted between Table C3 and C5.
- Page 84: Table C5 lists MLSA:Managed Late Succcessional Areas. We could not find any MLSA within the table.
- Page 90: First sentence indicates that some federal land managers are expected to increase the likelihood that spotted owl recovery is achieved. It may be more appropriate to use the term "federal land management agencies" instead of land managers because the consistency of managers is less than agencies.
- Table C7 lists private land HCPs in California but does not list the HCPs in Oregon or Washington.
- Page 91: CSAs in Oregon should include the Millicoma Tree Farm, Weyerhaeuser Co. HCP. The Elliott State Forest in Western Douglas County could have been included as a CSA.
- Page 94: There seems to be a large void of no MOCAs in the Klamath Province on the west side of the Cascades and east of I-5. There should be a few in this area to maintain the maximum distance between the MOCAs.

Recommendations

Based on our review of the Final Plan, we have several recommendations for improving the Recovery Plan for the Northern Spotted Owl.

1) Provide a table and accompanying map(s) in the Final Plan that lists reserves currently in LSRs relative to areas that would be designated as Category 1 and Category 2 MOCAs. That is, be totally transparent in illustrating the changes in reserve design between the NWFP and the Final Plan for west side forests.

2) Assign a team of Forest Service scientists to develop a fully spatially explicit population analysis comparing the current reserve design (in terms of occupancy and persistence) with the Final Plan reserve design. That is, update and redo analyses reported in Raphael et al (1994) and Noon and McKelvey (1996) using, for example, the current version of HexSim (Schumaker 2008). This needs to be a range-wide analysis using the most current habitat maps (e.g., as in Lint 2005). This analysis would need to address both habitat and Barred Owls as drivers of SPOW population dynamics.

3) The above science team (2) should seriously consider the recent modeling work of Carroll and Johnson (2008) with a specific focus on the geographic variation in the owl's demographic relations with mature and late seral forest.

4) Clarify descriptions of suitable habitat to reflect the current state of understanding of habitat relationships and how they vary geographically. As it now stands, the Final Plan defers quantitative habitat standards to a future working group. Since these standards will prove critical in Section 7 consultations and the interpretation of 'take', it is important they be presented in the Final Plan. The Recovery Plan should recommend some guidelines or an agreement on definitions of "older, multi-layered forest" by province.

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Appendix. Proposed MOCA-1 reserves (as delineated in USFWS 2007) and the number of owl territories they are predicted to support based on the model of Carroll and Johnson (2008). MOCAs in bold fall in the eastside ecoprovinces and were dropped from the Final Plan.

CMOCA-27 : 22
CMOCA-28 : 15
CMOCA-32 : 29
CMOCA-34 : 11
CMOCA-35 : 13
CMOCA-44 : 13
CMOCA-45 : 19
CMOCA-50 : 13
CMOCA-51 : 14
CMOCA-54 : 18
CMOCA-55 : 12
OMOCA-01 : 28
OMOCA-02 : 17
OMOCA-03 : 16
OMOCA-04 : 11
OMOCA-05 : 11
OMOCA-07 : 19
OMOCA-08 : 12
OMOCA-09 : 12
OMOCA-10 : 10
OMOCA-11 : 6
OMOCA-12 : 8
OMOCA-13 : 11
OMOCA-14 : 9
OMOCA-15 : 10
OMOCA-16 : 10
OMOCA-17 : 11
OMOCA-19 : 6
OMOCA-21 : 13
OMOCA-22 : 13
OMOCA-23 : 25
OMOCA-24 : 16
OMOCA-25 : 16
OMOCA-37 : 12
OMOCA-45 : 6
WMOCA-01 : 27
WMOCA-03 : 26
WMOCA-06 : 30
WMOCA-07 : 15
WMOCA-21 : 16
WMOCA-33 : 10
WMOCA-34 : 10
WMOCA-38 : 9
WMOCA-46 : 163