Review of
Proposed Rule to Remove the Idaho Springsnail
from the List of Threatened or Endangered Wildlife

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In preparation for this review, members of our aquatic conservation research group (professor, postdoctoral scholar, and three Ph.D. students, all engaged in research on conservation of aquatic invertebrates) read the *Proposed Rule*, *Version 2.0 Best Available Biological Information for Four Petitioned Springsnails in Idaho, Oregon, Washington, and Wyoming* (USFWS 2005; hereafter "*BAI*"), *Interior Columbia Basin Mollusk Species of Special Concern* (Frest and Johannes 1995), papers by Hershler and Liu (2004a, b), and a variety of related papers from the peer-reviewed ecology and conservation literature. We held weekly discussions of this material throughout October and November, 2006. This review represents our consensus opinion on the *Proposed Rule*. We specifically address the four questions provided by the U.S. Fish and Wildlife Service and also offer general comments on the *Proposed Rule*.

The *Proposed Rule* seeks to delist the Idaho springsnail (*Pyrgulopsis robusta*) based on taxonomic research suggesting that four snail entities (3 named, one unnamed) are a single species (Hershler and Liu 2004a). This conclusion was based on surveys of DNA sequences from genes in the mitochondrial and nuclear genomes, as well as morphological evidence. This research and the *Proposed Rule* raise two questions: 1) Is the case for synonymy of the taxa convincing? 2) If evidence of synonymy is convincing, does this more-broadly defined species merit removal of protections afforded by the Endangered Species Act?

<u>Are the four snails members of the same species?</u>

The conclusion that the Idaho, Harney Lake, Jackson Lake, and Columbia springsnails are members of the same species is based on sequences at the COI locus of the mitochondrial DNA and the ITS-1 locus of the nuclear DNA, and morphological data (Hershler and Liu 2004a). Phylogenetic hypotheses developed from both sets of genetic data show that all four snail entities form a well-defined monophyletic group when compared with other members of the genus used as outgroups. Within this monophyletic group, weakly supported clusters were inconsistent with species names. The morphological data failed to show consistent differences among the four snail groups.

The *Proposed Rule* includes sufficient background information that clearly explains the basis for the proposed action. However, the conclusion that these entities are a single species is based primarily on genetic data. Because the morphological data were not placed into a phylogenetic framework, nor were outgroups considered in this analysis,

these data do not lead to generation of a formal phylogenetic hypothesis. Significant information gaps are present, including the lack of any **comparative** data on breeding biology (including tests for reproductive isolation), behavior, and ecology. These sorts of data would have provided additional strong evidence for determining taxonomic status. The *Proposed Rule* downplays the significance of geographic isolation of these populations, and largely omits discussion of snail dispersal. Population genetic studies (done in addition to the systematic studies that are discussed in the *Proposed Rule*) would have allowed estimation of rates of gene flow within and among these four groups. In particular, assignment tests using microsatellite loci can be used to estimate current levels of gene flow. We agree that the data presented support the case for synonymy of the four entities, but believe that further ecological, biological, and population genetic evidence would greatly strengthen this case.

Should *P. robusta* be delisted, assuming that it does have a broader distribution?

If one accepts the hypothesis that the four snail entities comprise a single species, then this species consists of a number of isolated populations within the Columbia basin and the Oregon interior basin. The *Proposed Rule* considers threats to each of these four groups individually and in isolation. The *Proposed Rule* arbitrarily defines populations as the four groups previously considered species, misinterprets habitat data, fails to discuss modern understandings of population biology including metapopulation theory, and simply dismisses the lack of knowledge about dispersal among populations. A serious flaw in this analysis is that it fails to consider the possibility that threats may act simultaneously, greatly increasing the extinction risk for the species. In fact, the general tone of the *Proposed Rule* is that if something is not known about the biology of the snails, this lack of knowledge supports the case for delisting. Not only is this biologically unsound, but it completely violates the Precautionary Principle, which should favor maintaining the listing *unless* strong evidence is presented that the species merits delisting. In the current situation, lack of information should serve to maintain the listing of *P. robusta*

1) Does the *Proposed Rule* include sufficient background information that clearly explains the basis for the proposed action?

The *Proposed Rule* lacks background information in several areas. It states that the Expert Panel "estimated the probable extinction risk to *P. robusta*" (pg. 56942, column 1), but does not provide details. Was this a formal risk assessment? Were extinction risks explicitly calculated? If so, what were these risks and how were they determined? The more glaring omission of information is evident in the overall attitude of the *Proposed Rule*. Whenever information on a particular topic is lacking, the *Rule* acknowledges this lack and then proceeds with the implicit assumption that this lack of information provides further reason to delist the species. Because *P. robusta* is already listed, it would seem logical that the burden of proof should be on the groups proposing delisting. The *Proposed Rule*, as written, clearly places the burden of proof on the case for remaining listed. An example of this shift in burden of proof is the statement "However, direct cause and effect information that non-native species are endangering

or threatening *P. robusta* populations does not exist." (page 56947, column 1). While technically correct, it ignores the fact that the New Zealand mudsnail has had devastating consequences on aquatic communities (discussed further below) and that there is no evidence that such effects will be absent in communities containing *P. robusta*. Nowhere does the *Proposed Rule* show that condition of any of these four entities has improved since 1992.

2) Is the discussion regarding Idaho springsnail's population distribution, status, and "summary of factors affecting the species" clear, reasonable, and supported by the best scientific and commercial information available?

The discussion of the ecology and life history in the *Proposed Rule* has significant flaws in it. These flaws include the discussions of distribution and population structure, habitat preference, and threats.

Distribution and population structure
Ecologically, a population consists of members of a single species found in a single location, with the size of that location dependent on the vagility of the organisms. Such locations should be small enough that individuals retain the possibility of interacting with each other. Given this understanding of populations, the definition of each of the four snail entities as a population is arbitrary and made only for purposes of convenience. The fact is that *P. robusta,* as now defined by USFWS, consists of more than four populations, with each one probably isolated from the others (unless long-distance dispersal can be demonstrated). For instance, occupied sites within Oregon are in separate drainage basins and separated by 60 or more miles. Snails at these sites cannot all be considered members of the same population! Our understanding of metapopulation biology emphasizes the ability of individuals to disperse among habitat patches in order to "rescue" groups that have begun to decline or become extirpated. Because such dispersal in Oregon would have to be overland, it is highly unlikely that it can occur. Thus, Oregon contains at least three isolated populations (Lake Abert area, Harney and Malheur Lake area, and South Fork Malheur River). The Columbia basin locations may have represented a single large, continuous population that became a metapopulation when the river was impounded, or alternatively, gaps in the current distribution of snails may indicate the historical presence of multiple populations with limited interpopulation dispersal. Based on the present distribution inferred from the BAI and other documents, there are likely to be a number of isolated populations within each of the former taxa and these populations are far enough apart that dispersal among them is probably very rare. Table 1 of the *BAI* lists only 30 extant "colonies" (or populations?), with most of them in the Snake River. Each of the other entities contains only 2 extant colonies. This is a very small number of populations given that we know nothing about population turnover. Thus our view of this species should be one consisting of a small number of isolated populations with limited dispersal between them. The result of this is that the demography of each population is independent of the others and each of these populations, therefore, has extinction vulnerabilities that are proportional to **local population size** and **local risks**. It is unlikely that there will be much of an opportunity for "rescue" of Jackson Lake, Harney Lake, or Columbia River populations if they suffer catastrophes. The Snake River populations, while likely

connected, will be vulnerable due to habitat fragmentation resulting from dams along the river. Mitochondrial DNA data suggest limited admixture among *P. robusta* populations from Oregon, Washington, and Idaho (Hershler and Liu 2004a). Until population genetic or dispersal studies are performed, this scenario represents the best understanding of the population biology of this snail species. The statement "…did not expect these populations to become extirpated due to possible barriers to dispersal in the foreseeable future" (page 56943, column 2) is completely speculative, lacking evidence to support it. Our expectation is that barriers to dispersal represent a significant threat unless evidence demonstrates otherwise.

Habitat preference

The discussion of habitat preferences is misleading. At a number of places in the *Proposed Rule*, the Idaho springsnail is said to be found in C. J. Strike Reservoir and these records are evidence that snails can live in "slower moving reservoir reaches" (page 56943, column 1). However, the locations described (page 56942, column 3) are not really reservoir habitat, but rather, river habitat just above entrance into reservoirs. Snails are almost completely absent from the reservoirs themselves, and thus, the reservoirs probably fragment populations. The statement "Our previous concern, stated in the 1992 listing rule, regarding the historic range of the Snake River having been reduced nearly 80 percent by dams and reservoirs, does not apply to *P. robusta*" is completely unsubstantiated. Springsnail habitat in the Snake River has most likely been significantly reduced by damming the river.

Threats

The discussion of threats to the springsnail is overly simplistic because it deals only with individual threats to individual populations. It fails to consider the combined effects of threats across populations and the likelihood that threats will spread, and it presents no evidence that state protections will ensure survival of the species in the absence of ESA protection.

The threat posed by the New Zealand mudsnail is greatly underestimated. While the *Proposed Rule* acknowledges this exotic species as a threat to Jackson Lake populations, it dismisses this species as a threat throughout the remainder of the range of *P. robusta*. This is an entirely unreasonable conclusion. Figure 11 of the *BAI* illustrates the great range expansion of this exotic species in the 10-year period 1995-2005. Given the rapid spread of this species so far, it seems likely that it will continue to spread and thus, will eventually be found in the lower Columbia and Oregon interior basins. It is known that New Zealand mudsnails have reduced abundance of Jackson Lake springsnails, as well as other species of springsnails (*BAI*, page 41). Furthermore, the peer-reviewed literature is filled with research describing detrimental effects resulting from establishment of New Zealand mudsnails. These exotics have the potential to decrease colonization rates of other macroinvertebrates (Kerans *et al.* 2005), and can dominate biomass and nutrient cycling within invaded ecosystems (Hall *et al.* 2003). The studies presented in the *Proposed Rule* are all short-term; this document fails to mention research indicating loss of "natural" levels of biodiversity in a number of habitats that have been occupied by New Zealand mudsnails for two decades (Strzelec 2005). Furthermore, New Zealand mudsnails represent a substantially larger proportion of the secondary production in many of these systems

and a larger percentage of stream resources were used by this single invasive species than by any native species in a non-invaded system (Hall *et al.* 2006). The "best available biological information" needs to include more than just direct measures of interaction between the mudsnail and *P. robusta*; it should also include knowledge generated from other ecosystems and from similar groups of organisms. Given the rapid spread of the New Zealand mudsnail, its broad ecological tolerances and important ecosystem effects, the known direct effects on *P. robusta*, and the long-term nature of its effects on biodiversity, it is very naïve to conclude that "…the New Zealand mudsnail does not appear to currently endanger or threaten *P. robusta* throughout all or a significant portion of its range." We would argue the opposite – the threat is real and very significant, and it occurs throughout the range of *P. robusta*.

Because it is likely that populations of *P. robusta* are isolated from each other and that rescue effects (i.e., interpopulation dispersal) are not likely, extirpation risks need to be considered across populations. Once any one of these populations is extirpated, it is likely that it will not be reestablished by dispersal from another one. Given this situation, we will see a gradual decline in the number of populations ultimately leading to extinction. Individual populations will be subject to threats identified for each (and others not explicitly identified – see paragraph above) and in addition, small populations will also be subject to the vagaries of demographic stochasticity, genetic drift, and environmental stochasticity. Little or no population abundance data are provided (i.e., total population sizes rather than just density) and the discussion completely fails to consider interactive effects of these threats across populations. Once again, the burden of proof seems to be on proving that this species needs to continue to be listed, rather than proving that it no longer merits listing. Even if this is the case, the evaluation of threats must be more than just single cases for each population.

One future threat that is completely ignored by the *Proposed Rule* is increased urbanization within the Snake and Columbia basins. The Snake River basin is the most densely settled area of Idaho, and it includes the Boise Metropolitan Area (*BAI*). Idaho is also one of the fastest-growing states (United States Census 2000). Two *P. robusta* habitats on the Columbia River are near Kennewick and Richland; another one is near Portland, the largest city in Oregon. Projected population growth in the Northwest should be taken into account when considering the environmental factors that may threaten *P. robusta* populations in the future (e.g., groundwater withdrawal, water quality management, pollution, livestock grazing); it is inappropriate to assume that the present intensity of those threats will remain the same into the foreseeable future. Urbanization has devastating effects on stream quality, second only to agriculture as a major cause of stream impairment, and its impact is disproportionate to its total area (Paul and Meyer 2001). Many *P. robusta* habitats exist where water quality is impaired (*BAI*); larger human populations will only increase threats to the survival of these snail populations.

A number of steps taken to protect *P. robusta* by other organizations are described (ID Dept. of Water Resources, BOR, ID Power). As written, the *Proposed Rule* assumes that such protective activities will continue once the species is delisted, but that seems highly unlikely. For instance, the 1992 listing rule caused withdrawal or rejection of proposals for hydroelectric projects on the Snake River. There is no guarantee that,

once delisting has occurred, these projects will not be proposed again. Without the protection of ESA and the required consultations with USFWS, is there any chance that FERC will reject these proposals? We do not think so. Similarly, the moratorium on water withdrawals from the Snake are temporary and do not preclude future diversions and U.S. Army Corps of Engineers mandates to meet federal environmental requirements will not require consideration of *P. robusta* once it is delisted. The *Proposed Rule* unrealistically assumes that all of these regulatory activities are motivated by a desire to protect the resource, rather than simply by necessity to comply with ESA listing of *P. robusta*. This document does not consider the possibility that removal of ESA protection will cause all of these protective measures to disappear.

3) Are there areas of uncertainty or significant information gaps or omissions that should be discussed in our review to determine whether the Idaho springsnail should be removed from the list?

See discussion above.

4) Are you aware of other documents (journal articles or unpublished information) relevant to the Idaho springsnail including threat factors affecting this species that we have not considered?

See discussion above and Literature Cited below.

General Comments

The case provided for delisting consists simply of "the species is more wide-ranging than we previously thought, we know relatively little about the species as a whole, and therefore, it should be delisted." We conclude that this *Proposed Rule* fails to convey the best available information on the biology of springsnails. Using the best available information, we conclude that these springsnails, regardless of whether the entity consists of *P. robusta* alone or four species, still merit inclusion on the list of Endangered and Threatened Species.

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