NORTHWEST ENVIRONMENTAL ADVOCATES

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Re: **Oregon Coastal Nonpoint Pollution Control Program; Protection of the Designated Use of Amphibians in Non-Fish-Bearing ("Type N") Streams Through the MidCoast Implementation Ready TMDL**

Dear Messrs. Opalski and King:

Oregon has been seeking final approval of its Coastal Nonpoint Pollution Control Program (CNPCP) since July 1995. Over the years, the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) (hereinafter collectively "federal agencies") have withheld approval of the CNPCP based on, *inter alia*, Oregon's failure to protect small- and medium-sized streams from logging. Among the small and medium perennial and intermittent streams in Oregon's coastal watersheds are those referred to as Type N, or non-fish-bearing streams. While these Type N streams are not habitat for threatened and endangered salmonids of commercial and recreational value, they are key habitat for certain amphibians. The purpose of this letter is to explain why Oregon's on-going efforts to demonstrate that it will meet outstanding conditions for the approval of its CNPCP must address the protection of amphibians in Type N streams in coastal watersheds.

As you know, Northwest Environmental Advocates (NWEA) challenged the federal agencies' ability to issue conditional approvals, such as to Oregon, under the Coastal Zone Act Reauthorization Amendments (CZARA) in *Northwest Environmental Advocates v. Locke*, *et al.*, Civil No. 09-0017-PK. One outcome of the settlement of that case was the federal agencies' agreement to publish on or before November 15, 2013 a proposed decision to approve or disapprove Oregon's program and on or before May 15, 2014 to issue a full and final approval or disapproval. Key to a potential approval of Oregon's CNPCP is completion of the MidCoast "Implementation Ready" Total Maximum Daily Load (IR-TMDL). The MidCoast is a pilot of a new type of TMDL required under the settlement to ensure that the Oregon Department of Environmental Quality (DEQ) both has and uses legal authority to ensure implementation of forest practices in the basin sufficient to meet load allocations and water quality standards over

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and beyond the practices prescribed by the Oregon Department of Forestry, the rules of the latter having been found by the federal agencies to be inadequate to protect water quality and designated uses.

Nowhere could this finding be more stark than with regard to Type N streams for which the Oregon Department of Forestry (ODF) provides very little protection and almost no protection from temperature impacts of logging, much less protection for small non-fish-bearing streams than medium and large ones, and no protection at all for seeps, springs, and intermittent streams. This lack of protection has a direct bearing on the continued existence of certain amphibians:

> The narrow niche requirements, isolated population distributions, and long generation time of these species [of Olympia salamander and tailed frog], in combination with the rapid disappearance of the requisite old-growth coniferous forests and lack of protection for headwater habitats in current forestry regulations, make local populations of these ancient and unique amphibians highly susceptible to extirpation. Furthermore, the combined effects of local extirpations, increased population fragmentation and the accompanying habitat loss, and increased restriction of gene flow and genetic drift make these species vulnerable to extinction throughout their entire range in the long term (Soule 1980; Leigh 1981; Wilcox & Murphy 1985). Small sedentary species with restricted distributions, specialized niches, and narrow climatic tolerances are particularly sensitive to extirpation.[1]

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[1] Hartwell H. Welsh, Jr., Pacific Southwest Forest and Range Experiment Station, U.S. Forest Service, *Relictual Amphibians and Old-Growth Forests*, 4 Conservation Biology 309, 317 (1990).

[2] Bradford Norman, *Southern torrent salamander*, used by permission, http://calphotos.berkeley.edu.

I. Oregon Fails to Protect Amphibians, Their Water Quality and Their Habitat in Non-Fish-Bearing Streams

A. Department of Forestry Riparian Protection Rules

The ODF rules on riparian protection are limited to large and medium Type N streams and provide only the most minimal of protections for small Type N streams.[3] Large and medium Type N streams have riparian vegetation protections that are inadequate for the purpose of providing maximum shade and therefore to minimize anthropogenic warming as necessary to protect cold water species and are inadequate to prevent erosion of sediment from clearcuts from entering and impairing these streams as well as being carried further downstream. Specifically, Oregon's logging rules for large and medium Type N streams require only retention of all understory vegetation within 10 feet and all trees within 20 feet of the high water level, and all trees leaning over the channel[4] unless harvest activities requires their removal.[5] There are additional requirements to retain live conifers along large and medium Type N streams.[6] Protection of vegetation for small Type N streams is limited to retention of all understory vegetation and conifers less than six inches in diameter within 10 feet of the high water level on each side of perennial Type N streams.[7] No protections apply to non-perennial – or intermittent – streams, which the ODF rules state will be determined "by the State Forester based on a reasonable expectation that the stream will have summer surface flow after July 15."[8] Nothing in the rules prevents pre-harvest thinning for all Type N streams.[9] Finally, a logging operator may have all Type N prescriptions waived by seeking alternative measures primarily on the basis that there are insufficient conifers in the riparian area.[10]

There is no riparian management area for seeps and springs, which are important habitat for amphibians.[11] The sole protection afforded by the ODF rules is a statement that "[w]hen conducting operations along other wetlands less than one-quarter acre, springs or seeps, operators shall protect soil and vegetation from disturbances which would cause adverse effects on water

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[3] OAR 629-640-0200(2).

[4] OAR 629-640-0200(2)(a, b, c).

[5] OAR 629-640-0200(4).

[6] OAR 629-640-0200(5).

[7] OAR 629-640-0200(6).

[8] OAR 6290640-0200(6)(a).

[9] OAR 629-640-0200(10).

[10] OAR 629-640-0300(1), (4).

[11] OAR 629-655-0000(1).

quality, hydrologic function, and wildlife and aquatic habitat."[12] Protection of amphibians is explicitly voluntary:

> Amphibians that are sensitive to temperature and moisture fluctuations may live in small Type N streams. Operators are encouraged to retain portions of in-unit green live trees and snags as blocks of intact vegetation along small Type N streams.[13]

B. Type N Streams Compose a Significant Portion of the Coastal Stream Network

Not only are Type N streams, both perennial and intermittent, enormously important to amphibians but they comprise the majority of stream miles in a watershed. A common rule of thumb in evaluating how much of a watershed is composed of Type N streams is 75 percent:

> By definition, headwater streams are small, usually less than 6 feet across. But what they lack in width they make up for in length: more than 75 percent of the total stream network is headwater streams. They are the source of much of the water, gravel, wood, and nutrients that flow through the stream network and eventually to the ocean. Owing to favorable microclimate and availability of water, headwaters provide habitat for distinct assemblages of plants and animals.[14]

It is estimated that more than one quarter of the region's amphibians rely on headwaters.[15] Non-fish bearing streams – both perennial and intermittent – are key habitat for amphibians. For example, torrent salamanders occupy a greater percentage of "hydrotype 4" streams – intermittent waters[16] – than other instream vertebrates.[17]

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[12] OAR 629-655-0000(3).

[13] OAR 629-660-0060.

[14] Pacific Northwest Research Station, U.S. Forest Service, *Saving Streams at Their Source: Managing for Amphibian Diversity in Headwater Forests*, 99 Science Findings 1 (January 2008) available at http://www.fs.fed.us/pnw/sciencef/scifi99.pdf (last accessed October 3, 2012).

[15] *Id*. at 2.

[16] Dede Olson, Pacific Northwest Research Station, U.S. Forest Service, Corvallis, OR, *Stream-breeding Amphibians and Forest Buffers* 17 available at http://www.wisconsinwetlands.org/WetlandBufferSymposium/Olson.Dede.pdf (last accessed October 4, 2012).

[17] *Id.* at 19. *See also Saving Streams*, *supra* n. 14 at 2 ("Some headwaters streams are seasonally intermittent, running dry in the heat of the summer. Others periodically flow underground into the 'hyporheic zone' before resurfacing further downstream. These features, along with frequent cascades and obstacles, explain the lack of fish, which turns out to be a boon for some amphibians, such as torrent salamanders, that thrive in fishless headwaters.").

II. <u>Oregon's Water Quality Standards Require Full Protection of Amphibians</u>

A. Oregon's Water Quality Standards

As you know, the definition of meeting Clean Water Act (CWA) water quality standards includes fully supporting designated uses. Water quality standards incorporate the following three elements: (1) designated beneficial uses, (2) narrative and numeric criteria to protect those uses, and (3) an antidegradation policy.[18] Use designations are a required element of water quality standards.[19] A waterbody must fully support the designated uses.[20] In Oregon, the designated uses include "Fish & Aquatic Life" as well as "Wildlife & Hunting."[21]

In addition to meeting full support of designated uses, water quality must meet both numeric and narrative criteria. Oregon's water quality standards contain no numeric criteria that are intended for the purpose of protecting wildlife. However, in addition to a requirement to protect designated uses, Oregon's water quality standards include narrative criteria such as the following:

> Notwithstanding the water quality standards contained in this Division, the highest and best practicable treatment and/or control of wastes, activities, and flows must in every case be provided so as to maintain dissolved oxygen and overall water quality at the highest possible levels and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, odor, and other deleterious factors at the lowest possible levels.[22]
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> * * *
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> The creation of tastes or odors or toxic or other conditions that are deleterious to

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[18] 33 U.S.C. § 1313(c)(2), 1313(d)(4)(B); 40 C.F.R. Part 131, Subpart B; *PUD No. 1 of Jefferson County v. Washington Department of Ecology*, 114 S.Ct. 1900 (1994).

[19] 40 C.F.R. §§ 131.6(a), 131.3(f).

[20] *See, e.g., Advance Notice of Proposed Rulemaking, Water Quality Standards Regulation*, 63 Fed. Reg. 36741 (July 7, 1998); 62 Fed.Reg. 41,162, 41169 (July 31, 1997)(EPA recognized a need to build in "an adequate margin of safety" to protect species, particularly if they are proposed for listing as threatened under the ESA. EPA sought to "*fully* support[] bull trout in setting numeric criteria.)(emphasis added); *id*. at 41174 (temperature criteria could be revised upward if bull trout "would be *fully* supported")(emphasis added); *id*. at 41177 ("[o]ne of the fundamental principles of the CWA is . . . that it is necessary to control pollution at the source to *fully* protect the nation's waters.")(emphasis added). 40 C.F.R. § 131.33(a)(3)(ii)("Any such [site specific] determination shall be made consistent with § 131.11, and shall be based on a finding that bull trout would be *fully* supported at the higher temperature criteria.")(emphasis added).

[21] OAR Division 41, Tables 101A-340A.

[22] OAR 340-041-0007(1).

> fish or other aquatic life . . . may not be allowed.[23]
>
> * * *
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> The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life . . . may not be allowed.[24]

Because all of Oregon's numeric temperature criteria and associated use designation maps apply to fish as a subset of the aquatic life use designation, at locations and times where those criteria and use designations do not provide the necessary protection for other aquatic life, such as amphibians, Oregon is required to evaluate and apply its broad designated uses of Aquatic Life and Wildlife and its broad narrative criteria when evaluating whether an action will meet water quality standards. Specifically, where the Aquatic Life and Wildlife uses involve amphibians which reside in waters that are not covered by the protections afforded salmonids, Oregon is required to use its narrative criteria and use designations. It cannot, instead, rely upon an assumption that protection of salmonids is the same as protection for species that reside outside of salmonid waters and which may, in fact, have lower tolerances for increased temperatures.

Finally, federal law requires states to include in their water quality standards an antidegradation policy that ensures, *inter alia*, that "[e]xisting instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected."[25] "Existing uses" are defined as "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards."[26] In other words, if a use is existing but has not been designated, it must be protected. This existing use provision is referred to as Tier I of the antidegradation policy. According to EPA, "[Tier I is] the absolute floor of water quality" providing "a minimum level of protection" to all waters.[27] Oregon's version of Tier I is as follows:

> The purpose of the Antidegradation Policy is to guide decisions that affect water quality such that unnecessary further degradation from new or increased point and nonpoint sources of pollution is prevented, and to protect, maintain, and enhance existing surface water quality to ensure the full protection of all existing beneficial uses.[28]

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[23] OAR 340-041-0007(11).

[24] OAR 340-041-0007(12).

[25] 40 C.F.R. § 131.12(a)(1).

[26] 40 C.F.R. § 131.3(e).

[27] EPA, *Questions and Answers on: Antidegradation* 4 (August 1985) available at http://water.epa.gov/scitech/swguidance/standards/upload/2002_06_11_standards_handbook_handbookappxG.pdf (last accessed July 30, 2012).

[28] OAR 340-041-0004(1).

A use that may be designated but not afforded CWA protection because the use has been locally extirpated and therefore is likely to be ignored by DEQ staff in regulatory matters is amphibians whose populations have been declining and range diminishing since 1975 and, in many cases, locally extirpated. The antidegradation policy's protection of existing uses requires the protection of both the uses and the water quality necessary to support that species in those locations from which they are now extirpated.

In addition to the requirements of the Clean Water Act, CZARA requires that states

> shall provide for the implementation, at a minimum, of management measures in conformity with the guidance published under subsection (g) of this section, to protect coastal waters generally, and shall also contain the following:
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> * * *
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> The implementation and continuing revision from time to time of additional management measures applicable to the land uses and areas identified pursuant to paragraphs (1) and (2) that are necessary *to achieve and maintain applicable water quality standards under section 1313 of Title 33 and protect designated uses*.[29]

In other words, CZARA not only requires that states demonstrate that they will attain water quality standards in coastal watersheds but also, quite explicitly, that they will "protect designated uses." Amphibians are designated uses.

It is fair to term Oregon's temperature standards entirely salmonid-centric as fish are the only species for which there are specific numeric criteria and times and places, designated on maps, for which specific life cycle stage requirements are associated. Thus, Oregon's temperature standard that applies to impacts of Type N streams on the temperature of downstream waters for the purpose of providing cold water to salmonids,[30] completely ignores the importance of temperatures in Type N streams to other cold-water species, such as amphibians, which actually inhabit those waters. However, because water quality standards include both designated and existing uses as well as narrative criteria, Oregon's water quality standards apply to other non-salmonid species such as the amphibians that are the subject of this letter. Without a specific effort to apply these gap-filling attributes of water quality standards at the time the state takes a regulatory action, however, the use support, narrative criteria, and antidegradation policy have no protective effect. Therefore it is essential that in developing the MidCoast TMDL the DEQ ensures that its interpretations of its standards, its loading capacity and allocations, the development of the best management practices, and enforceable orders all apply to protections for species in Type N streams, both perennial and intermittent.

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[29] 16 U.S.C. § 1455b(b)(3)(emphasis added).

[30] OAR 340-041-0028(11)(c)(A), (C).

B. Torrent Salamander and Tailed Frog are Key Amphibians Dependent Upon Water Quality of Oregon's Type N Streams

This letter addresses two species of amphibians that are present in the MidCoast Basin that require cold water and inhabit waters in the so-called Type N (no fish) streams that are *upstream* of the Type F (fish bearing) streams in which salmonids are present: the Southern torrent salamander, *Rhyacotriton variegatus*, and the Coastal tailed frog, *Ascaphus truei*.[31] While there are other species of importance in Oregon's Type N streams, this letter concerns these two by way of demonstration. Amphibians act as both predator and prey in ecosystems, feeding on small invertebrates, and being fed upon by birds and mammals. In this way, measuring declining populations of amphibians reflects changes in other animal and plant populations.[32]

Most amphibians need both an aquatic and a terrestrial environment to complete their life cycle. Water is required for laying eggs and metamorphosing from a juvenile, water-breathing form to an adult, air-breathing form. Because, in addition, amphibians have permeable skin through which they breath, they are highly sensitive to changes in aquatic conditions.[33] Logging activities, which are at issue in the MidCoast TMDL, have significant impacts on both aquatic and upland conditions.

III. Southern Torrent Salamander and Coastal Tailed Frogs Are Dependent Upon Type N Streams, Are Suffering Depleted Populations, and Are Put at Risk for Extirpation by Water Quality Impacts of Logging

A. The Southern Torrent Salamander and Coastal Tailed Frogs are Species Present in Type N Streams

Amphibians that live only in or near headwaters include the Southern torrent salamander and the Coastal tailed frog.[34] The former lives only in "the uppermost reaches of headwater areas" and the latter "breeds in high mountain streams."[35]

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[31] Pacific Northwest Research Station, U.S. Forest Service, *Linked in: Connecting Riparian Areas to Support Forest Biodiversity*, 120 Science Findings 3 (February 2010).

[32] *Id*. at 5 ("Hundreds of rare species, understudied species, and species with low dispersal capabilitites (such as mollusks, lichens, and bryophytes) populate Pacific Northwest forests.").

[33] Pacific Northwest Research Station, U.S. Forest Service, *Engineering a Future for Amphibians Under a Changing Climate,* 136 Science Findings 2 (October 2011).

[34] *Linked In, supra* n. 31 at 3.

[35] *Id.*

1. Southern Torrent Salamanders

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The Southern torrent salamander was previously known as the Olympic salamander but has since been divided into three genetically separate species.[37] In addition, with regard to the Southern torrent salamander

> Good and Wake (1992) found high genetic variability within *R. variegatus* and Wagner (2000) posited the existence of three intraspecific clades: the North Coastal, Oregon, and California, with genetic divergences between clades as great as those between *R. kezeri* and *R. olympicus*. This predicts that populations of *R. variegatus* that are widely separated geographically should have divergent genetic affinities.[38]

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[36] Dr. Harry Greene, Cornell University, *Southern torrent salamander*, by permission, http://calphotos.berkeley.edu.

[37] The older literature did not distinguish between three species of Torrent salamanders that occupy similar habitat in Oregon and have similar characteristics but are now known as genetically three separate species: (1) the Southern Torrent salamander, *Rhyacotriton variegatus* (2) the Columbia Torrent salamander, *Rhyacotriton kezeri* and (3) Cascade Torrent salamander, *Rhyacotriton cascadae*. *See* R. Steven Wagner, Mark P. Miller, Susan M. Haig *League Phylogeography and Genetic Identification of Newly-Discovered Populations of Torrent Salamanders (Rhyacotriton cascadae and R. variegatus) in the Central Cascades,* 62 Herpetologica 63-70 (March 2006).

[38] Cynthia K. Tait and Lowell V. Diller, *Life History of the Southern Torrent Salamander (Rhyacotriton variegatus) in Coastal Northern California*, 40 Journal of Herpetology 43 (2006).

The Southern Torrent salamander has been described as a

> small salamander [that] is restricted to the splash zone and shallow water of seeps, waterfalls, and creeks[.] Eggs and larvae require cool waters, and both juveniles and adults rarely venture farther than 1 m[eter] from water (Nussbaum and Tait 1977, Nussbaum et al. 1983). This species is restricted to forests west of the Cascades.[39]

Researchers all agree that "Olympic salamanders are closely tied to headwater streams and seeps"[40] and that "[t]hey are most abundant in first- and second-order headwater streams that frequently do not support salmonids,"[41] and have a "strict association with headwaters and low order tributaries (Welsh and Lind, 1988, 1992)."[42] Likewise, prior to its being divided into different species, researchers concluded that

> The Olympic salamander occurs in isolated populations in coniferous forests at elevations below 1,200 m, throughout much of the Pacific Northwest (Stebbins 1985; Nussbaum et al. 1983). In these forests they are restricted to springs, headwater seeps, and small streams. They are rarely found in open water in even the smallest creek, preferring the cover of moss, rocks, and organic debris in shallow, cold, percolating water (Anderson 1968; Nussbaum & Tait 1977; Stebbins 1985). They require a minimum of 4.5 years to reach sexual maturity; 3.5 years in the larval form and 1 to 1.5 years after metamorphosis (Nussbaum & Tait 1977).[43]

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[39] R. Bruce Bury and Paul Stephen Corn, *Responses of Aquatic and Streamside Amphibians to Timber Harvest: A Review*, in *Streamside management: riparian wildlife and forestry interactions*, K. J. Raedeke, editor, University of Washington Institute of Forest Resources Contribution, 165, 169 Seattle,(1988) available at http://www.rmrs.nau.edu/awa/ripthreatbib/bury_corn_respaquaamph.pdf (last accessed October 1, 2012).

[40] Paul Stephen Corn and R. Bruce Bury, *Terrestrial Amphibian Communities in the Oregon Coast Range*, in: L. F. Ruggiero, K. B. Aubry, A. B. Carey and M. H. Huff, editors, *Wildlife and Vegetation of Unmanaged Douglas Fir Forests*, U.S. Forest Service General Technical Report PNW-GTR-285 at 305, 314 (1991) available at http://www.fs.fed.us/pnw/pubs/gtr285/gtr2856a.pdf (last accessed October 5, 2012).

[41] Bury and Corn, *supra*, n. 39 at 166.

[42] Hartwell H. Welsh and Amy J. Lind, *Habitat Correlates of the Southern Torrent Salamander, Rhyacoriton variegatus (Caudata: Rhyacotritonidae), in Northwest California*, 30 Journal of Herpetology, 385 (1996).

[43] Welsh, *supra* n. 1 at 312.

2. Coastal Tailed Frogs

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Ascaphus are adapted to fast, rocky streams and their requirements have been described as follows:

> Eggs and tadpoles of this species require cool, flowing waters (Metter 1964, Bury 1968, de Vlaming and Bury 1970, Brown 1975, Nussbaum et al. 1983). The length of the larval period is reported to be 2-3 years (Metter 1967), and thus this species is dependent on permanent water. Adults may not breed until 7-8 years of age (Daugherty and Sheldon 1982).
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> Tailed frogs in interior areas occur in disjunct populations (isolated in streams with favorable conditions) and dispersal between populations is rare (Metter 1967, Daughtery and Sheldon 1982). Our recent research (Bury et al., in prep.) indicates that at least some juveniles and adults disperse overland in western Oregon and Washington, perhaps because of the increased precipitation, longer periods of rainfall, and greater moisture in the dense forest canopy of areas closer to the ocean.[45]

As with the Southern torrent salamander, the Coastal tailed frog is highly dependent upon non-fish-bearing streams:

> The tailed frog occurs in isolated populations in and along streams in the coniferous forest habitats throughout the Pacific Northwest (Nussbaum et al. 1983; Stebbins 1985). Its natural history has been investigated by Gaige (1920), Metter (1964, 1967), and Daugherty and Sheldon (1982a, b). This frog is highly specialized for life in cold, clear, fast-flowing mountain streams. It has evolved a strategy of internal fertilization, rare among frogs, that enables the adults to breed

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[44] Adam Clause, *Coastal tailed frog*, californiaherps.com.

[45] Bury and Corn, *supra* n. 39 at 166.

> in fast-flowing water. Larvae are found primarily on rocky substrates in fast-flowing water. Larvae metamorphose at two to three years of age (Metter 1967). The adult frogs may take as long as seven years to reach sexual maturity; life expectancy is thought to be greater than 14 years (Daugherty & Sheldon 1982a).[46]

B. Amphibians' Sensitivity to Water Temperatures

Research into the habitat and water quality needs of Southern torrent salamanders and Coastal tailed frogs has evaluated their distribution in old-growth and managed forests, relative abundance in forested stands of different ages, response to warm waters, among other variables. Regardless of the type of study, the results all point to the importance of cold water temperatures to these species.

Researchers have concluded that "[t]emperature has a profound effect on survival and ecology of amphibians,"[47] specifically concluding that "[o]f all the physical parameters in the aquatic environment, temperature is perhaps the most dramatic in its effect on the physiology, ecology, and behavior of anuran larvae"[48] and the "thermal tolerances of *Ascaphus* and *Rhyacotriton* are among the lowest known for amphibians[.][49] As a result of these thermal tolerances, "the combined distributions of water temperatures from this and an earlier study (Welsh, unpub. data) indicated the highest abundances of salamanders occurred in a narrow range from about 8-13°C[.]"[50] Research bears this out repeatedly:

> *Ascaphus* deposits its eggs in mid-summer in the warmest part of the year and, thus, face stress immediately. *Rhyacotriton* appears to deposit eggs in spring and early summer, and it may take 200 d[ays] for hatching (Nussbaum and Tait, 1977; Nussbaum et al., 1983). Currently, we lack any data on the thermal tolerance of the eggs of *Rhyacotriton*.
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> Perturbations caused by natural (e.g., wildfires) and human (e.g., timber harvest) events in the Pacific Northwest may cause elevated stream temperatures to levels of 24°C or more in summer. These have potential to stress or harm cold-adapted species such as stream amphibians. Similar to salmonid fishes of the Pacific Northwest (Carline and Hachung, 2001), *Ascaphus* or *Rhyacotriton* rarely occur in streams that have water temperatures > 16°C (Welsh, 1990; Diller and Wallace, 1996; Welsh et al., 2001). In Oregon streams, Huff et al. (2005) reported that

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[46] Welsh, *supra* n. 1 at 314.

[47] R. Bruce Bury, USGS Forest and Rangeland Ecosystem Science Center, Corvaliis, OR, *Low Thermal Tolerances of Stream Amphibians in the Pacific Northwest: Implications for Riparian and Forest Management,* 5 Applied Herpetology 63 (2008).

[48] *Id*. at 64.

[49] *Id*.

[50] Welsh and Lind, *supra* n. 42 at 394.

stream amphibians were consistently found in streams with low temperatures (averages): larval *Dicamptodon* (12.0-14.3°C) and *Ascaphus* (11.7-15.3°C). Some *Ascaphus* have been found in streams with water temperatures up to 21°C where groundwater seeps create cold pockets and spatially complex thermal environments(Adams and Frissell, 2001). Recently, Dunham et al. (2007) report *A. montanus* occurring in streams with a maximum daily peak in summer up to 26°C but most waters (54%) were cooler (<20°C). Sites in burned, reorganized stream beds had a high probability (>0.75) of exceeding 20°C whereas streams in unburned areas were low (<0.25)."[51]

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Cascade torrent salamanders were nearly absent from streams where temperatures were ≥14°C for ≥ 35 consecutive hours.[52]

* * *

Cascade torrent salamanders were present in 17 of 19 (90%) of the streams with <35 consecutive hours ≥14°C, but in only 1 of 8 (13%) streams with >35 consecutive hours of temperatures ≥14°C[.][53]

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Tailed frogs are likely to be affected by the increased water temperature in streams in c1ear-cuts. Tailed frog tadpoles are less mobile than salmonids and have low temperature preferences. Tadpoles from northern California selected water temperatures of about 10°C in the laboratory, and tadpoles acclimated to 5°C had a critical thermal maximum (lethal limit) of 29°C (de Vlaming and Bury 1970). Embryos have even narrower thermal tolerances. Brown (1975) found that normal development of tailed frog embryos occurred only below 19°C.[54]

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The Olympic salamander has one of the narrowest tolerance ranges for temperature of any salamander (thermal maximum of 27.8-29.0°C) (Brattstrom 1963) and is also the most sensitive terrestrial salamander to loss of body water (Ray 1958). Both its narrow temperature requirements and susceptibility to water

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[51] Bury, *supra* n. 47 at 70-71.

[52] Kathleen L. Pollett, James G. MacCracken, James A. MacMahon, *Stream Buffers Ameliorate the Effects of Timber Harvest on Amphibians in the Cascade Range of Southern Washington*, 260 Forest Ecology and Management 1083 (2010).

[53] *Id*. at 1085.

[54] Bury and Corn, *supra* n. 39 at 170.

> loss probably limit its use of upland habitats and its ability to disperse overland.[55]
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> Temperature plays a critical role in all life stages of the tailed frog, and evidence suggests it is a key environmental factor determining its distribution. Brattstrom's (1963) data indicate that the tailed frog has one of the lowest and narrowest ranges of tolerance for temperature of all the world's frogs. Brown (1975) reported that 18.5°C is the upper limit for egg development. deVlaming and Bury (1970) observed that one- to two- year-old tadpoles preferred 5-8°C and two- to three-year-old tadpoles preferred 12-16°C water. Claussen (1973) showed that the lethal thermal maxima for adults was 23-24°C. I found stream temperature to be an excellent predictor of tailed frog abundance, accounting for 37.3 percent ($F = 23.56$, $P = 0.00002$) of the variation observed, with higher numbers of tailed frogs occurring in streams with lower temperatures[.] The highest stream temperature I observed with *Ascaphus* was 14.3°C.[56]

C. The Habitat and Water Quality Requirements of the Southern Torrent Salamander and Coastal Tailed Frog

Temperatures and moisture requirements restrict the locations in which the Southern torrent salamander and Coastal tailed frog are found in Oregon's coastal range. Researchers have described the narrow habitat requirements of Southern torrent salamanders as

> associated with seeps and low order streams of forested regions of the Pacific Northwest. Typically, *Rhyacotriton* inhabits high gradient systems with coarse substrates and low sedimentation (Corn and Bury, 1989; Diller and Wallace, 1996; Welsh and Lind, 1996), some level of forested canopy cover (Steele et al., 2003), and cold water temperatures (8-13°C; Welsh and Lind, 1996), although Steele et al. (2003) found temperatures near 9°C to be a threshold for occurrence of Cascade Torrent Salamanders in some Washington streams. Based on habitat associations, salamanders of this genus are among the stream amphibians that have been reported to be most at risk in the Pacific Northwest because of timber harvest and other land management activities. It has been suggested that local extinction can occur after clearcutting (Bury and Corn, 1988; Corn and Bury, 1989) and that recolonization may take decades.[57]

Others have described the salamander's habitat as

> a relatively narrow range of physical and microclimatic conditions and is associated with cold, clear headwater to low-order streams with loose, coarse substrates (low sedimentation), in humid forest habitats with large conifers,

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[55] Welsh, *supra* n.1at 314.

[56] *Id*. at 315.

[57] Tait and Diller, *supra* n. 38 at 43.

> abundant moss, and >80% canopy closure. Thus, the southern torrent salamander demonstrates an ecological dependence on conditions of microclimate and habitat structure that are typically best created, stabilized, and maintained within late seral forests in northwestern California.[58]

And

> Anecdotal and general accounts indicate that *R. variegatus* occur in springs, seeps, small streams, and margins of larger streams. They avoid open water and seek the cover of moss, rocks, and organic debris in shallow, cold, percolating water (Anderson, 1948; Nussbaum and Tait, 1977; Nussbaum et al., 1983; Stebbins, 1985; Bury, 1988; Bury and Corn, 1988; Corn and Bury, 1989; Welsh, 1990; Bury et al., 1991; Good and Wake, 1992; Leonard et al., 1993). Substrate conditions described for this species consist of water flowing through gravel, pebble, and cobble with little fine sediment.[59]

Similarly, the Coastal tailed frog has narrow habitat requirements:

> They are primarily found in or associated with relatively cold, clear, rocky steams in mature forests. All life stages are adapted for life in fast flowing streams. The male's "tail" is used for internal fertilization to prevent sperm from being washed away. Eggs are attached to the undersides of rocks to keep them in place. The tadpoles have a large ventral suctorial mouth that allows them to feed and move in high-energy streams without loosing contact and unintentionally drifting.[60]

And, they are highly vulnerable to changes in habitat:

> This species is vulnerable to management practices that alter the riparian or aquatic zones of streams, especially those that change the moisture regime, increase stream temperature, increase sediment load, reduce woody debris input and change stream bank integrity. Protection of the upper reaches of streams is particularly important for this species.[61]

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[58] Welsh and Lind, *supra* n. 42 at 385.

[59] *Id*.

[60] Washington Department of Natural Resources, *Coastal Tailed Frog*, http://www1.dnr.wa.gov/nhp/refdesk/herp/html/4astr.html (last accessed October 4, 2012).

[61] *Id*.

D. Status of Populations of the Southern Torrent Salamander and Oregon Tailed Frog

As a general matter, amphibians are suffering dramatic declines in populations worldwide.[62] The primary cause of amphibian declines and species extinctions is habitat destruction, alteration, and fragmentation.[63] Clearcutting timber, leaving little or no protection for non-fish-bearing streams, both perennial and intermittent, which is allowed under Oregon's forest practices rules,

> alters habitats drastically and can have devastating affects on species richness and abundance. Petranka et al (1993) compared species richness and abundance of salamanders on six recent clearcuts with salamander densities in mature forest stands in the Appalachian Mountains. They found that salamander densities in the mature stands were five times higher than those in the recently cut plots. From these surveys, Petranka et al. (1993) estimated that timber harvesting in the Appalachian Mountains resulted in the loss of 14 million salamanders annually.[64]

The Southern torrent salamander "has limited rates of population increase because of relatively long generation times and low fecundities . . . [rendering them] highly sensitive to frequent habitat disturbances that impact their numbers, especially if capacity for recolonization is limited."[65] In California, the Southern torrent salamander is listed as a state "species of special concern" based on the following factors: "(1) distributional limits imposed by this habitat specificity; (2) an unusually high degree of genetic heterogeneity among sub-populations (Good and Wake, 1992); (3) the apparent association of this species with late seral attributes; and (4) the rapid loss of late seral forests due to timber harvesting (Thomas et al., 1988)."[66] In Oregon, the

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[62] Amphibiaweb, *Worldwide Amphibian Declines: How big is the problem, what are the causes and what can be done?*, http://amphibiaweb.org/declines/declines.html (last accessed October 2, 2012)("Amphibians, a unique group of vertebrates containing over 6,300 known species, are threatened worldwide. A recent assessment of the entire group (iucnredlist.org/amphibians) found that nearly one-third (32%) of the world's amphibian species are threatened, representing 1,856 species. Amphibians have existed on earth for over 300 million years, yet in just the last two decades there have been an alarming number of extinctions, nearly 168 species are believed to have gone extinct and at least 2,469 (43%) more have populations that are declining. This indicates that the number of extinct and threatened species will probably continue to rise (Stuart et al. 2004)."). *See also* Paul Stephen Corn, R. Bruce Bury, Erin J. Hyde, *Conservation of North American Stream Amphibians* in *Amphibian Conservation*, Raymond D. Semlistch, Editor, Smithsonian Books, (2003), available at http://leopold.wilderness.net/pubs/477.pdf (last accessed October 5, 2012).

[63] *Id*. at *Habitat destruction, alteration and fragmentation*, http://amphibiaweb.org/declines/HabFrag.html (May 7, 2008)(last accessed October 3, 2012).

[64] *Id*.

[65] Tait and Diller, *supra* n. 38 at 53.

[66] Welsh and Lind, *supra* n. 42 at 386.

Southern torrent salamander is considered to be "Sensitive-Vulnerable."[67] This status denotes that the species is "facing one or more threats to their populations and/or habitats. Vulnerable species are not currently imperiled with extirpation from a specific geographic area or the state but could become so with continued or increased threats to populations and/or habitats."[68] The U.S. Fish and Wildlife Service considers the Southern torrent salamander a "species of concern."[69]

The Coastal tailed frog is likewise listed as a "species of concern" by the U.S. Fish and Wildlife Service.[70] In Oregon, the Coastal tailed frog is considered "Sensitive-Vulnerable."[71]

IV. Logging Has Had a Significant Effect on Populations of Southern Torrent Salamander and Coastal Tailed Frog

Because of the narrow habitat requirements of the Southern torrent salamander and the Coastal tailed frog, as described above, researchers have evaluated the effects of logging non-fish bearing streams on their populations. Study after study concludes that these two species are likely to be locally extirpated where there are clearcuts, that their populations are not likely to recover, and that re-colonization is difficult if not impossible under such circumstances. As stated by the U.S. Forest Service,

> Because amphibians require cool, moist microclimates and often divide their life history between the stream and the upslope forests, they can be quite sensitive to forest disturbances, particularly logging.[72]

A. Researchers Note Extirpations of Species Following Logging

Local extirpations of headwaters-dependent amphibians has frequently been detected following logging activities. In particular, tailed frogs disappear:[73]

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67 Oregon Department of Fish and Wildlife, *Sensitive Species: Frequently Asked Questions and Sensitive Species List*, available at http://www.dfw.state.or.us/wildlife/diversity/species/docs/SSL_by_category.pdf (last accessed October 2, 2012).

68 *Id*. at 2.

69 U.S. Fish and Wildlife Service, *Federally Listed, Proposed, Candidate, Delisted Species and Species of Concern Under the Jurisdiction of the Fish and Wildlife Service Which May Occur Within Oregon* (September 29, 2012) available at http://www.fws.gov/oregonfwo/Species/Lists/Documents/OregonStateSpeciesList.PDF (last accessed October 2, 2012).

70 *Id*.

71 ODFW, *supra* n. 67 at 12.

72 *Saving Streams*, *supra* n. 14 at 2.

73 *Id*. at 4.

> Nussbaum et al. (1983) reported that the tailed frog disappeared from streams when areas were logged. They speculated that this was due to higher water temperatures and increased siltation. Other workers have reported that this species appears to be sensitive to watershed disturbances (Noble & Putnam 1931; Metter 1964, 1968; Bury 1968, 1983; Bury & Corn 1988). I found tailed frogs in only one stream in a managed young forest. This site was downstream from an extensive area of old-growth forest and my sampling yielded only a few larvae and no adults. Although no clearcut areas were sampled, data from other workers (Bury & Corn 1988) indicated that tailed frogs were absent from such sites. Tailed frogs are, however, common in streams in naturally regenerated young forests in Oregon and Washington (Bury et al., in press).[74]

* * *

> Presumed increase in water temperature associated with forest management are often cited as an important factor in stream amphibian distribution and abundance (Hawkins et al., 1988; Welsh and Lind, 1996; Steele et al., 2003; Olsen et al., 2007).[75]

* * *

> They indicated that low densities of tadpoles "appeared to be most clearly related to heavy embeddedness within streams and complete loss of wa tershed forest among streams" (p. 250). Both of these conditions can result from clearcut logging near streams (Murphy et al. 1981).[76]

* * *

> Population densities [of Coastal tailed frog] vary considerably (Lohman, 2002), but lower abundances have been documented following timber harvest (Gaige, 1920; Noble and Putnam, 1931; Metter, 1964a; Bury and Corn, 1988b; Corn and Bury, 1989a; Bury et al., 1991b; Bull and Carter, 1996; Aubry, 2000) and road construction (Welsh and Ollivier, 1998).[77]

Logging affects stream temperatures, stream microclimates, and eliminates habitat especially seeps, springs, and small non-fish-bearing streams with predictable outcomes on amphibian populations. Sites with late seral features have been found to support amphibians and, on the opposite end of the spectrum, clear-cut sites do not:

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[74] Welsh, *supra* n. 1 at 314.

[75] Pollett et al., *supra* n. 52 at 1083.

[76] Welsh, *supra* n. 1 at 314.

[77] Amphibiaweb, *Search the Database: Ascaphus truei*, http://amphibiaweb.org (last accessed October 2, 2012).

> The majority of sites with salamanders were found in areas with 80% or higher of canopy closure[.] The two outliers were cold springs (10.8°C) on clearcut sites with north-facing aspects and relatively high elevations (884 m and 1029 m).[78]
>
> * * *
>
> [Percent forest canopy closed] also indicated an association of *R. variegatus* with canopy conditions and resulting microclimates typical of late seral sites[.] Open sites show a wide range of relative humidities and high mean air temperatures over time (Chen et al. 1993b). Sites with greater canopy cover, by virtue of the ameliorating effects on daily solar incidence, wind speed, and precipitation, tend to maintain cooler tempeatures and higher humidity at ground level compared with sites with less canopy cover (Chen et al., 1993a). Canopy conditions in turn directly influence temperatures in associated streams, with greater canopy closures providing cooler and more stable water temperatures (Brown and Krygier, 1970; Beschta et al., 1987).[79]

Put another way, "higher numbers of stumps and more grass, respectively, indicated a lack of salamanders at a given site[.]"[80] Researchers report that it is possible the effects of logging will have less impact on temperatures in coastal areas where the climate is mild but note concurrently that smaller Type N streams are the most susceptible to increased temperatures from clear-cutting:

> *Rhyacotriton* experience the largest losses of any stream amphibian in the Pacific Northwest following clear-cut logging (Corn and Bury, 1989; Welsh and Karraker, 2005). One explanation may be absence or reduction of forest canopy after logging that result in increased stream temperatures, which may be stressful or lethal to *Rhyacotriton*. Effects appear to be ameliorated in areas with a coastal marine climate (see Diller andWallace, 1996; Russell et al., 2004) or in small streams that have cool groundwater flows (Steele et al., 2003). In Oregon, Everest et al. (1985) stated that small streams are more subject to temperature changes (i.e., increases) than large streams.[81]

Others point out that clear-cutting has striking impacts on stream temperatures of Type N streams even in the mild Oregon Coast Range:

> Both *Rhyacotriton* and *Ascaphus* face risk where there are elevated stream temperatures. In the Oregon Coast Range, one small stream in summer rose from 14° to 22°C at mid-day following clear-cutting of the drainage, with a peak in a pool at 30°C (Brown and Krygier, 1970). In the Oregon Cascades, Johnson and

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[78] Welsh and Lind, *supra* n. 42 at 390 (internal references omitted).

[79] *Id*. at 392.

[80] *Id*. at 393.

[81] Bury, *supra* n. 47 at 69.

> Jones (2000) reported maximum water temperatures of 23.9°C in two streams flowing through a clear-cut in a small watershed and in a stand with three small patch-cuts plus construction of logging roads. Both logged areas were burned post-harvest, which is a common forestry practice in the region. Streams in nearby mature forests did not have temperatures exceeding 19°C ($\bar{x}$ = 16.7°C) in summer. Temperatures in streams in logged plots did not return to the pre-harvest levels until ca. 15 yr later, coinciding with return of the riparian zone and canopy closure.[82]
>
> * * *
>
> Increases in water temperature following c1ear-cutting can be significant. Mean July temperature of Needle Branch, a second-order Coast Range stream, increased from 14°C to 22°C following clear-cutting of the entire drainage; the maximum temperature was 30°C (Brown and Krygier 1970)."[83]

While temperature is a major feature of changes in amphibian habitat created by clear-cutting of Type N streams without riparian buffers, sedimentation of streams is also a problem. In high gradient streams, such as Type N streams in the Oregon coast range, sediment tends to move downstream before it is captured in lower gradient waters. This enhances the potential for high gradient streams to remain good amphibian habitat where logging is causing or contributing to increased sedimentation levels but only if temperatures are controlled and habitat protected:

> High gradient streams, those on north-facing slopes, and those on less erosive geologic types, would be more likely to sustain populations of *R. variegatus* post-harvest, compared with streams on low gradients, southfacing slopes, or unconsolidated geologies, because of differences in characteristics of sediment transport and microclimate (e.g., Corn and Bury, 1989). While *R. variegatus* clearly still occurs on private timberlands in the north coastal zone, Diller and Wallace (1996) noted that this species has been impacted in their study area by alterations to low gradient stream reaches and possibly to springs and seeps.[84]

And these species are sensitive to sedimentation:

> Density was four times greater in streams in old-growth forests than in streams in young stands. Abundance of Olympic salamanders was greatly reduced in streams in the Coast Range that flowed through logged stands (Corn and Bury 1989). possibly resulting from increased siltation. Olympic salamanders may be very slow to recolonize areas from which they have been extirpated (Bury and Corn 1988b).[85]

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[82] *Id*. at 70.

[83] Bury and Corn, *supra* no. 39 at 170.

[84] Welsh and Lind, *supra* n. 42 at 396.

[85] Corn at Bury, *supra* n. 40 at 314.

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> Coastal Tailed Frogs are habitat specialists and occur only in suitable mountain streams. Due to these specialized habitat requirements, the Coastal Tailed Frog is vulnerable to habitat loss and alteration associated with logging. Logging impacts include stream exposure (e.g., Holtby 1988), increased sedimentation (e.g., Beschta 1978; Reid and Dunne 1984), bank erosion (e.g., Beschta 1978), and windfall,as well as reduced summer flow rates and increased peak discharges (Jones and Grant 1996). Sedimentation fills the spaces between rocks, reducing the availability of refuge sites used to escape floods, bedload movements, predation, and warm temperatures.[86]

In combination, increased temperatures and increased sedimentation caused by logging can and do extirpate amphibian populations:

> Populations of Olympic salamanders probably respond to increased sedimentation and water temperature. Our research in the Oregon Coast Range suggests that this species and the Pacific giant salamander react to the accumulation of fine sediments in similar fashions (Com and Bury, in prep.). Olympic salamanders also have narrow, low temperature tolerances (Nussbaum et al. 1983). They may be eliminated or stressed by increased water temperatures.[87]

Finally, it is not only the direct effect of logging on stream temperatures and sedimentation that affects the Oregon tailed frog. Clear-cutting also affects their food sources which

> may be altered by increased insolation of the stream after clear-cutting. Larval frogs (tadpoles) are filter feeders, relying almost exclusively on diatoms that they scrape off rocks (Altig and Brodie 1972, Nussbaum et al. 1983). Beschta et al. (1987) suggest that increased sunlight and/or stream temperatures resulted in blooms of filamentous green algae and a shift in the species composition of the periphyton away from diatoms. The scraper guild of aquatic invertebrates also feeds on the thin layer of aufwuchs (algae, bacteria, detritus, and diatoms) that cover rocks in streams. Hawkins et al. (1983) observed reduced densities of these species in riffles of unshaded versus shaded stream reaches. Dense growths of green algae in unshaded streams may interfere with access to the rock surfaces and thus to the primary food of tailed frog tadpoles.[88]

In order to address the direct and indirect effects of logging, researchers have made

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[86] Agi Mallory, *Coastal Tailed Frog*, in *Accounts and Measures for Managing Identified Wildlife – Accounts V. 2004 a*t 6 available at http://www.env.gov.bc.ca/wld/frpa/iwms/documents/Amphibians/a_coastaltailedfrog.pdf (last accessed October 5, 2012). See also *Linked In*, *supra*, n. 31, at 3 (“[Coastal tailed frog] species is vulnerable in areas where its habitat has been disturbed by past logging activities that increased sedimentation in streams[.]”).

[87] Bury and Corn, *supra* n. 39 at 171.

[88] *Id*. at 171.

recommendations for buffer zones around, at a minimum, headwaters and seeps:

> To provide suitable habitat conditions for coldwater species, several authors (see Vesely and McComb, 2002; Bury, 2004; Sarr et al., 2005; Olson et al., 2007) recommend buffer zones along headwaters and around seeps to provide shade and reduce sedimentation from management activities. These are now prescribed to protect fish habitat on larger streams (Beschta et al., 1987; Hawkins et al., 1983; Sedell and Swanson, 1984), but are inconsistently applied across geographic regions (Olson et al., 2007) or rare on non-fish bearing streams (see Sheridan and Olson, 2003). Current forest practices increasingly recommend or require riparian buffers along headwaters and small streams (see Bury, 1994; de Maynadier and Hunter, 1995; Diller and Wallace, 1996). These are critical steps toward maintenance of stream conditions and adjacent riparian habitat favorable to amphibians and other forest wildlife.[89]

B. Headwater Species Face Severe Difficulties in Recolonization After Logging

The very specific habitat requirements combine with long life cycle stages, such as time to reproductive maturity, to limit the ability of the Southern torrent salamander to move and recolonize:

> Previous studies have shown that species of *Rhyacotriton* are susceptible to habitat fragmentation by timber harvest or other land management activities because of low vagility, narrow physiological requirements, and demographic parameters such as low fecundity and long developmental times (Nussbaum and Tait, 1977; Good and Wake, 1992; Nijhuis and Kaplan, 1998).[90]

Connectivity of populations is essential to maintain genetic diversity in species. As noted in a U.S. Forest Service publication

> "Connectivity of habitat, both longitudinally along streams and laterally away from streams into uplands, is also important or long-term persistence of headwater amphibian species and assemblage," [Dede Olson] adds. "Amphibians are surprisingly mobile, and in order for populations to persist over the long term, there needs to be linkages connecting adjacent headwater streams. This means extending some of the buffers protecting adjacent headwater streams up to the ridgeline where they would connect."[91]

The Forest Service is involved in evaluating how to ensure that amphibians such as torrent salamanders can move between headwaters streams to colonize and reproduce.[92] One approach

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[89] *Bury, supra* n. 47 at 71.

[90] Tait and Diller, *supra* n. 38 at 44.

[91] *Saving Streams, supra* n. 14 at 5.

[92] *Linked In, supra* n. 31 at 1.

to establishing headwater connectivity is the creation of overland chains of habitat:

> Our headwater studies and the thinning and buffer designs that we are examining have application to management of headwater connectivity areas. Amphibians occurring within and along headwater streams have terrestrial dispersal life stages, with over-ridge dispersal needed to maintain gene flow among sub-populations in adjacent drainages. Headwater linkage area designs that extend riparian buffers and connect them up and over ridgelines to neighboring drainages may reduce fragmentation of these habitats and populations in managed forests. 'Chains' of connectivity can be envisioned with riparian and overland links. Green tree retention in these linkage areas and down wood placement with log orientation from ridgelines toward headwater streams may aid overland dispersal of low-mobility species, including amphibians and a variety of other ground-dwelling taxonomic groups (mollusks, lichens, bryophytes, fungi, small mammals). Although retained stands may anchor habitats in headwater linkage areas, our thinning designs with leave islands and down wood management might be considered as an effective management alternative for overland chains.[93]

C. Role of Riparian Buffers in Protecting Water Quality for Amphibians

The Density Management and Riparian Buffer study is a collaborative effort among the Bureau of Land Management (BLM), Pacific Northwest Research Station (PNW), US Geological Society (USGS), the U.S. Forest Service, and Oregon State University (OSU) to develop and test options for young stand management to create and maintain late-successional forest characteristics in western Oregon.[94] It has generated information on the effect of riparian buffers on headwater-dependent amphibians. The study tested four riparian buffers widths in federal forests, ranging from 20 feet wide on both sides of a stream up to 475 feet.[95] In the earliest results, the study has demonstrated that even the narrowest 20-foot buffer appeared to protect amphibian populations.[96] But a wider buffer – in the range of 50-75 feet – was needed to maintain headwater stream microclimates.[97]

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[93] U.S. Forest Service, Aquatic Ecology and Management Team, *Density Management and Riparian Buffer Study, Headwater Connectivity: Up and Over*, http://www.fs.fed.us/pnw/lwm/aem/projects/riparian_buffers.html#key_findings2 (last accessed October 4, 2012).

[94] Bureau of Land Management, Bureau of Land Management's Density Management Study, http://ocid.nacse.org/nbii/density/pdfFiles/DMS.pdf (last accessed October 4, 2012).

[95] *Saving Streams*, *supra* n. 14 at 3.

[96] *Id.* at 5.

[97] *Id.* at 1.

D. A Recent Study on Logging in the Oregon Coast Range and the Presence of Amphibians

Finally, a recent study evaluated the efficacy of stream buffers on Cascade torrent salamanders and Coastal tailed frogs, finding that tailed frog were two-fold lower and Cascade torrent salamander densities were seven-fold lower in managed forests than in streams of unharvested forests. In addition, both species were less abundant in streams without buffers than streams with buffers in in second growth forests.[98] Specifically, Cascade torrent salamanders densities were three-fold lower in streams without buffers than streams with buffers.[99] Tailed frogs were entirely absent logged streams without buffers and densities of tailed frogs were 125-165 percent lower in managed than unharvested streams. Densities between buffered streams and second-growth unlogged streams varied by 50 percent. The authors conclude that "[b]uffers had a significant ($P<0.05$)m and ecologically important, positive effect on tailed frog abundance" and conclude that "[t]he efficacy of riparian buffers in terms of maintaining headwater stream amphibians in clearcut forests is supported by our study."[100] The authors further comment that "[t]he results of this study suggest that buffering headwater streams reduces the impacts of clearcut logging on Cascade torrent salamanders, and larval tailed frogs."[101]

The presence of a 46 meter wide buffer was found to be a good predictor of the occurrence of Coastal tailed frogs and Southern torrent salamanders in the Oregon Coast Range.[102] Similarly, tailed frogs occurred in higher densities in streams with old growth buffers that were 5–60 meters wide relative to clearcuts.[103]

In addition to living riparian buffers, logs are essential to the summer survival of amphibians. In a study in the Oregon Coast Range, researchers found that one species of salamander sought out large cover, such as logs, as summer temperatures decreased moisture and increased ambient water temperatures.[104]

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98 Pollett et al., *supra* n. 52 at 1083.

99 *Id*. at 1085.

100 *Id.*

101 *Id.* at 1086.

102 Margo A. Stoddard and John P. Hayes, *The Influence of Forest Management on Headwater Stream Amphibians at Multiple Spatial Scales*, 15 Ecological Applications 811 (2005) available at http://www.fsl.orst.edu/cfer/products/pubs/StoddardHayes2005.pdf (last accessed October 4, 2012).

103 L. Dupuis and D. Steventon, *Riparian Management and the Tailed Frog in Northern Coastal Forests,* 124 Forest Ecology and Management 35 (1999).

104 L. Shoo, D. Olson, S. McMenamin, *Engineering a Future for Amphibians Under Climate Change*, 48 Journal of Applied Ecology 487 (2011).

V. The State of Washington Provides Some Protection to Amphibians in Non-Fish-Bearing Streams

In contrast to Oregon's lack of protections, Washington State's logging regulations do address non-fish-bearing streams. In Western Washington, protection is provided for two types of non-fish-bearing streams. The Type Np are streams without salmonids that are perennial in flow and the Type Ns waters do not have year-round flow but, rather, have seasonal flow and connect to streams that are fish-bearing or perennial. Type Np waters are provided with Riparian Management Zone – riparian buffer – protection as well as Sensitive Site protection. Specifically, various lengths of 50-foot buffers are required for Type Np waters based on the distance of the waterbody from the confluence with a Type S (shorelines) or Type F (fish habitat) waters.[105] The establishment of this 50-foot no-harvest buffer also specifically includes the following prohibitions established to protect seeps, springs, alluvial fans, and stream connectivity:

> (ii) No timber harvest is permitted in an area within fifty feet of the outer perimeter of a soil zone perennially saturated from a headwall seep.
> (iii) No timber harvest is permitted in an area within fifty feet of the outer perimeter of a soil zone perennially saturated from a side-slope seep.
> (iv) No timber harvest is permitted within a fifty-six foot radius buffer patch centered on the point of intersection of two or more Type Np Waters.
> (v) No timber harvest is permitted within a fifty-six foot radius buffer patch centered on a headwater spring or, in the absence of a headwater spring, on a point at the upper most extent of a Type Np Water as defined in WAC 222-16-030(3) and 222-16-031.
> (vi) No timber harvest is permitted within an alluvial fan.[106]

In addition to the requirements above, at least 50 percent of a Type Np water's length must have two-sided buffers of minimum length. Among the bases for a landowner's selection of these additional two-sided buffers is

> Perennial water reaches of nonsedimentary rock with gradients greater than twenty percent in the tailed frog habitat range.[107]

The purpose of the protection of seeps, stream intersections, springs, and alluvial fans in Washington's forest practices that apply to perennial non-fish-bearing streams is to protect amphibians. In the case of the last of the priorities for two-side buffers, the purpose is specifically for the protection of tailed frogs. At the time these rules were adopted, there was "scant information . . . available on parameters which influence responses of amphibians or

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105 WAC 222-30-021(2)(b)(vii).

106 WAC 222-30-021(2)(b).

107 WAC 222-30-021(2)(b)(vii)(B).

reptiles to forest treatments at the landscape level in the Pacific Northwest”[108] yet even so, Washington provided some protection. Oregon has none.

Conclusion

The MidCoast TMDL must demonstrate that the Oregon Department of Environmental Quality can and will protect the designated use of amphibians in Oregon’s non-fish-bearing streams in coastal watersheds consistent with the CWA and CZARA. While the numeric and narrative criteria in Oregon’s temperature standard are entirely salmonid-centric, the omissions of explicit protection for thermally-sensitive amphibians inhabiting Type N streams is addressed through the requirement to fully support designated uses, protect existing uses, and meet narrative criteria that are included in Oregon’s water quality standards. In order to meet these water quality standards, the DEQ must establish practices and issue enforceable orders to timber operators that ensure the protection of amphibians in non-fish-bearing streams. If the MidCoast TMDL fails to do so, DEQ will not have demonstrated its ability to comply with the requirements of CZARA, 16 U.S.C. § 1455b(b)(3).

Sincerely,

Nina Bell
Executive Director

cc: Dick Pedersen, Director DEQ
Bill Blosser, Chair, EQC
Greg Aldrich, Water Quality Division Administrator DEQ
Gene Foster, TMDL Program, DEQ
Allison Castellan, NOAA
David Powers, EPA
Kim Kratz, NMFS
Mary Lou Soscia, EPA
Jeff Lockwood, NMFS
Dave Croxton, EPA
Alan Henning, EPA
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Will Stelle, NMFS
Rob Walton, NMFS
Dennis McLerran, EPA

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108 Larry Irwin, Joseph Buchanan, Tracy Fleming, Steven Speich, *Wildlife Use of Managed Forests in Washington: A Review, Appendix A, Review of Literature on Parameters Influencing Wildlife use of Managed Forests in Washington* 50, Timber Fish and Wildlife (June 1989) available at http://www.dnr.wa.gov/Publications/fp_tfw_017_89_004.pdf (last accessed October 5, 2012).