DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R8–ES–2011–0076: 4500030113]

Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List 14 Aquatic Mollusks as Endangered or Threatened

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Notice of 12-month petition finding.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), announce a 12-month finding on a petition to list the basalt juga (*Juga* new species (n. sp.) 2), canary duskysnail (*Colligyrus convexus*), cinnamon juga (*Juga* n. sp. 3), Columbia duskysnail (*Colligyrus* n. sp. 1), Fredenburg pebblesnail (*Fluminicola* n. sp. 11), Goose Valley pebblesnail (*Fluminicola anserinus*), Hat Creek pebblesnail (*Fluminicola umbilicatus*), Klamath Rim pebblesnail (*Fluminicola* n. sp. 3), knobby ramshorn (*Vorticifex* n. sp. 1), masked duskysnail (*Colligyrus* n. sp. 2), nugget pebblesnail (*Fluminicola seminalis*), Potem Creek pebblesnail (*Fluminicola potemicus*), Shasta pebblesnail (*Fluminicola multifarius*), and tall pebblesnail (*Fluminicola* n. sp. 2) as endangered or threatened, and to designate critical habitat, under the Endangered Species Act of 1973, as amended (Act). The Fredenburg pebblesnail and the Klamath Rim pebblesnail were referred to in the petition and in our 90-day finding (76 FR 61826) as the nerite pebblesnail and the diminutive pebblesnail, respectively (see *Clarification Regarding Common Names for Two Petitioned Aquatic Mollusks,* below). After review of the best available scientific and commercial information, we find that listing the basalt juga, cinnamon juga, Columbia duskysnail, Fredenburg pebblesnail, Klamath Rim pebblesnail, knobby ramshorn, masked duskysnail, and tall pebblesnail is not warranted at this time because these snails do not constitute listable entities under the Act (see Listable Entity Evaluation, below). We ask the public to submit to us new information that becomes available concerning the taxonomic status of these mollusks. We find that listing the canary duskysnail, Goose Valley pebblesnail, Hat Creek pebblesnail, nugget pebblesnail, Potem Creek pebblesnail, and Shasta pebblesnail is not warranted at this time. We ask the public to submit to us new information that becomes available concerning threats to these mollusks.

DATES: The finding announced in this document was made on September 18, 2012.

ADDRESSES: This finding is available on the Internet at *http://www.regulations.gov* at Docket Number FWS–R8–ES–2011–0076. Supporting documentation we used in preparing this finding is available for public inspection, by appointment, during normal business hours at the U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, 2800 Cottage Way, Room W–2605, Sacramento, California 95825. Please submit any new information, materials, comments, or questions concerning this finding to the above address.

FOR FURTHER INFORMATION CONTACT: Listing Coordinator, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office (see **ADDRESSES**); by telephone at 916–414–6600; or by facsimile at 916–414–6712 *mailto:*. If you use a telecommunications device for the deaf (TDD), please call the Federal Information Relay Service (FIRS) at 800–877–8339.

SUPPLEMENTARY INFORMATION:

List of Acronyms

To assist the reader, the following is a partial list of acronyms that are used in this document.

ACS = Aquatic Conservation Strategy
ANSTF = Aquatic Nuisance Species Task Force
BNSF = Burlington Northern and Santa Fe
CAL FIRE = California Department of Forestry and Fire Protection
CBD = Center for Biological Diversity
CDFG = California Department of Fish and Game
CDPR = California Department of Parks and Recreation
CNDDB = California Natural Diversity Database
DPS = distinct population segment
FERC = Federal Energy Regulatory Commission
FPA = Forest Practice Act
FRRCD = Fall River Resource Conservation District
IPCC = Intergovernmental Panel on Climate Change
NBII = National Biological Information Infrastructure
NWP = Northwest Forest Plan
OHV = off-highway vehicle
ORNHIC = Oregon Natural Heritage and Information Center
PDA = Public Domain Allotment
PGE = Pacific Gas and Electric Company
RCAs = Riparian Conservation Areas
SHU = Shasta–Trinity Unit
SMP = Survey and Manage Program
SNFPA = Sierra Nevada Forest Plan Amendment
SPR = significant portion of the range
SWRCB = State Water Resources Control Board
THP = Timber Harvest Plan

Background

Section 4(b)(3)(B) of the Act (16 U.S.C. 1531 *et seq.*) requires that, for any petition to revise the Federal Lists of Threatened and Endangered Wildlife and Plants that contains substantial scientific or commercial information that listing a species may be warranted, we make a finding within 12 months of the date of receipt of the petition. In this finding, we will determine that the petitioned action is: (1) Not warranted; (2) warranted; or (3) warranted, but the immediate proposal of a regulation implementing the petitioned action is precluded by other pending proposals to determine whether species are endangered or threatened, and expeditious progress is being made to add or remove qualified species from the Federal Lists of Endangered and Threatened Wildlife and Plants. Section 4(b)(3)(C) of the Act requires that we treat a petition for which the requested action is found to be warranted but precluded as though resubmitted on the date of such finding, that is, requiring a subsequent finding to be made within 12 months. We must publish these 12-month findings in the **Federal Register**.

Previous Federal Actions

On March 17, 2008, we received a petition dated March 13, 2008, from five conservation organizations: The Center for Biological Diversity (CBD), Conservation Northwest, the Environmental Protection Information Center, the Klamath-Siskiyou Wildlands Center, and Oregon Wild. The petition asked us to list 32 species and subspecies of snails and slugs (mollusks) in the Pacific Northwest as threatened or endangered under the Act. Additionally, the petition requested that we designate critical habitat concurrent with listing. The petition clearly identified itself as a petition and included identification information regarding the petitioners, as required by title 50 of the Code of Federal Regulations (CFR) in 424.14(a). The petition included the 14 aquatic mollusk species addressed in this finding, and provided supporting information regarding the species' taxonomy and ecology, range, present status, and actual and potential causes of decline.

In a June 27, 2008, letter to the petitioners, we responded that we had reviewed the information presented in the petition and determined that issuing an emergency regulation temporarily

listing the species as per section 4(b)(7) of the Act was not warranted. We also stated that we could not address their petition at that time due to court orders and judicially approved settlement agreements for other listing and critical habitat determinations under the Act that required nearly all of our listing and critical habitat funding for fiscal years 2008 and 2009. We indicated that we anticipated making an initial finding on their petition in fiscal year 2010.

On April 13, 2009, we received a signed email from CBD providing updated taxonomic information regarding some of the 32 petitioned mollusk species (Curry 2009, pp. 1–2). The email indicated that two of the species had been formally described, two others had been combined into a single species that had been formally described, and three additional petitioned species had been combined into a single species that had been formally described. The email provided a citation to the article making the taxonomic changes, and asked us to consider the revised species for listing as endangered or threatened under the Act. We treated this email message as an amendment to the original petition. Therefore, the amended petition asked us to list 29 species and subspecies of mollusks, including the 14 aquatic species addressed here.

We addressed the petition as funding permitted beginning in late 2009, and published a 90-day finding on October 5, 2011 (76 FR 61826). We found that substantial scientific and commercial information had been presented in the petition and existed in our files to indicate listing may be warranted for 26 of the 29 petitioned mollusks. Fourteen of those 26 mollusks are aquatic and 12 are terrestrial. We have initiated a status review of the 14 aquatic mollusks, and present the results here. We intend to review the status of the remaining 12 terrestrial mollusks in fiscal year 2013. This notice constitutes our 12-month finding on the June 27, 2008, petition (as amended on April 13, 2009) to list 14 aquatic mollusks as endangered or threatened.

Clarification Regarding Common Names for Two Petitioned Aquatic Mollusks

The mollusks petitioned for listing included the ''diminutive pebblesnail (*Fluminicola* n. sp. 3)'' (CBD *et al.* 2008, pp. 9, 44) and the ''nerite pebblesnail (*Fluminicola* n. sp. 11)'' (CBD *et al.* 2008, pp. 9, 46). In our 90-day finding, which was limited in scope to information provided by the petition and available in our files, we noted that these mollusks were sometimes referred to by cited sources other than the petition as the Klamath Rim pebblesnail and the Fredenburg pebblesnail, respectively (76 FR 61836, 61843). Information that we reviewed for this status review indicates that the only accepted common names for these mollusks are the Klamath Rim pebblesnail and the Fredenburg pebblesnail. The only sources that refer to these two mollusks by the common names used in the petition are the Oregon Natural Heritage and Information Center (ORNHIC) (2004d, p. 1) for the diminutive pebblesnail, and ORNHIC (2004j, p. 1) for the nerite pebblesnail. However, these must be incorrect rather than simply alternate common names because Frest and Johannes (the original discoverers of these snails) refer to all four named mollusks as separate species (Frest and Johannes 1993, pp. 46, 47, 49; Frest and Johannes 2000, pp. 181, 264, 267, 273).

They note that the Klamath Rim and Fredenburg pebblesnails are protected under the Survey and Manage Program (SMP) of the Northwest Forest Plan (NWFP) (see *Generally Applicable Federal Regulatory Mechanisms,* below), whereas the diminutive and nerite pebblesnails ''should be'' included in that program (Frest and Johannes 2000, pp. 264, 265, 268, 274). The petition only included mollusks that had been protected under the SMP (CBD *et al.* 2008, p. 12). An Environmental Impact Statement (EIS) on which we relied in our 90-day finding for information regarding occupied locations of various mollusks, identifies all the petitioned mollusks by their scientific names alone, without providing common names (for example, U.S. Department of Agriculture (USDA) and U.S. Department of the Interior (USDI) 2007, pp. 92, 251).

In the case of these two mollusks, the ''scientific names'' were provisional and subject to change in different documents (Frest and Johannes 1993, pp. 46, 49; Frest and Johannes 2000, pp. 264, 273) (see Listable Entity Evaluation, below). However, we have subsequently obtained the survey protocol for aquatic mollusk species under the SMP, and that document identifies *Fluminicola* n. sp. 3 and n. sp. 11 as the Klamath Rim and Fredenburg pebblesnails, respectively (Furnish *et al.* 1997, p. 29). It does not mention the diminutive or nerite pebblesnails, presumably because they were not protected by the SMP. Accordingly, in this document we will refer to the petitioned mollusk *Fluminicola* n. sp. 3 as the Klamath Rim pebblesnail and to the petitioned mollusk *Fluminicola* n. sp. 11 as the Fredenburg pebblesnail, rather than as the diminutive and nerite pebblesnails, respectively.

Listable Entity Evaluation

Section 3(16) of the Act defines the term ''species'' to include ''any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate fish or wildlife which interbreeds when mature.'' Taxonomic groups or entities that meet the Act's definition of a ''species'' can be considered for listing under the Act and are, therefore, referred to as ''listable entities.'' Listable entities can then be listed if they are determined to meet the definition of either an endangered or threatened species.

Of the 14 aquatic mollusks considered in this review, 8 have not been formally described as species or subspecies in a peer-reviewed journal, or in any other source commonly accepted by the scientific community. This is why they have provisional scientific names, including ''new species'' (or ''n. sp.'') and a number, rather than accepted species names. Formal peer-reviewed description, with its opportunities for further review and comment, is the process by which proposed new species and subspecies become generally recognized or rejected by the taxonomic community. We must therefore evaluate whether the best available scientific and commercial information indicates that these eight mollusks constitute valid species, despite their lack of formal descriptions, for the purpose of determining whether the mollusks in question constitute listable entities (16 U.S.C. 1533(b)(3)(A) and (B)). It is rare for us to list entities that have not been formally described, but we have occasionally done so in the past. Examples include two fish: The Hutton tui chub (*Gila bicolor* ssp.) and Foskett speckled dace (*Rhinichthys osculus* ssp.) (50 FR 12302; March 28, 1985). In those instances, there was general agreement among biologists familiar with these fish that they constituted listable subspecies, and formal descriptions of the subspecies were in preparation. Additionally, if our determination of the status of these fish as valid subspecies had been incorrect, the fish would still likely have constituted distinct vertebrate population segments, and thus qualified as listable entities under section 3(16) of the Act. Mollusk populations are not listable entities, unless they also constitute valid species or subspecies, because the provision in section 3(16) allowing DPSs to be listed only applies to vertebrates (16 U.S.C. 1532(16)).

The eight aquatic mollusks reviewed here that have not been formally described are: Basalt juga, cinnamon juga, Columbia duskysnail, Fredenburg pebblesnail, Klamath Rim pebblesnail, knobby rams-horn, masked duskysnail, and tall pebblesnail. Table 1 below summarizes basic taxonomic and biological information for these purported species.

TABLE 1—BASIC BIOLOGY OF MOLLUSKS LACKING FORMAL DESCRIPTIONS

Common name	Description	Habitat	Known sites
Basalt juga.	Shell about 22 by 10 mm*; color bands of yellow, brown, pink, white, or tan (Frest and Johannes 1999, p. 85).	Small, gravelly springs with unpolluted water (Frest and Johannes 1995a, p. 179).	31 sites in Hood River, Sherman, and Wasco Counties, OR; and Klickitat and Skamania Counties, WA (BLM 2011, entire).
Cinnamon juga.	Shell about 15 by 8 mm; cinnamon red but can appear black in the field (Frest and Johannes 1999, p. 89).	Large cold springs and spring runs, with sand-cobble substrate or exposed basalt bedrock (Frest and Johannes 1999, p. 90).	8 sites in the Shasta Springs complex, upper Sacramento River, Siskiyou County, CA (Frest and Johannes 1999, p. 90).
Columbia duskysnail.	Shell about 1.7 by 1.4 mm; translucent, off-white, often with rust to black coating (Frest and Johannes 1999, p. 69).	Cold, shallow, well-oxygenated, slow-flowing springs and outflows with soft substrates. (Duncan 2005b, p. 10).	64 sites in Clackamas, Wasco, Hood River, and Multnomah Counties, OR; and Skamania County, WA (USDA and USDI 2007, p. 93).
Fredenburg pebblesnail.	Shell about 3 by 2.5 mm; white with greenish-yellow outer layer; white, sickle-shaped penis. (Frest and Johannes 1999, p. 29).	Small, shallow, cold spring runs with cobbled substrate (Frest and Johannes 1999, p. 30).	19 sites in Jackson County, OR. (Frest and Johannes 1999, p. 30; USDA and USDI 2007, p. 92).
Klamath Rim pebblesnail.	Shell about 2 by 2 mm; white with greenish-yellow outer layer; sickle-shaped penis (Frest and Johannes 1999, p. 25).	Shady areas in small, cold, shallow spring runs with gravel-cobble substrates and no large water plants (Frest and Johannes 1999, p. 26).	6 sites in southern OR and possibly northern CA (USDA and USDI 2007, pp. 92, 251).
Knobby rams-horn.	Shell about 6 by 6 mm; reddish-brown outer layer, keeled with ribs and protuberances (Frest and Johannes 1995b, p. 57; Frest and Johannes 1999, p. 98).	Rocky substrates in cold, clear water with high dissolved oxygen levels (Frest and Johannes 1999, p. 99).	2 sites in Shasta County, CA (USDA and USDI 2007, pp. 94, 268).
Masked duskysnail.	Shell described as up to 2 mm long (Frest and Johannes 1995a, p. 185) or as 3 to 5 mm long (Frest and Johannes 1999, p. 73); mask of black pigment on neck and around eyes (Frest and Johannes 1999, p. 73).	Cool-water kettle lakes with oxygenated mud substrates and aquatic plant growth (Duncan 2005e, p. 3).	3 to 4 sites at two lakes: Curlew Lake, Ferry County, WA, and Fish Lake, Chelan County, WA (Duncan 2005e, p. 3; USDA and USDI 2007, p. 94). Some indications of possible additional sites in ID and OR (ORNHIC 2004u, p. 1).
Tall pebblesnail.	Shell about 4.5 by 3 mm; conical, white with green outer layer; black body except for white, flanged penis (Frest and Johannes 1999, p. 21).	Very cold water and cobbled substrate (Duncan 2005b, p. 9).	1 site at Harriman Spring, Klamath County, OR (Duncan 2005b, p. 9; USDA and USDI 2007, p. 92).

* mm = millimeter.

None of these eight aquatic mollusks are included in databases of recognized mollusk species, such as the Integrated Taxonomic Information System (ITIS) (2010), or Turgeon *et al.* (1998). All eight mollusks were first proposed as new species in an unpublished consultation report produced in 1993 (Frest and Johannes 1993, pp. 46, 49, 50, 59, 62, 67). These eight mollusks have been addressed in several subsequent documents (Frest and Johannes 1999, pp. 21–26, 29–30, 69–76, 85–90, 98–101; Furnish and Monthey 1999, Sections 2, 4, 5, entire; Frest and Johannes 2000, pp. 181, 264, 273, 274; ORNHIC 2004a, entire; ORNHIC 2004d, entire; ORNHIC 2004j, entire; ORNHIC 2004r, entire; ORNHIC 2004s, entire; ORNHIC 2004t, entire; ORNHIC 2004u, entire; ORNHIC 2004v, entire; Duncan 2005b, entire; Duncan 2005e, entire; USDA and USDI 2007, pp. 92–94, 250–252, 257–259, 268–269), but none of those documents provide peer-reviewed evidentiary support of the mollusks' taxonomic distinctness. Although the eight mollusks have been treated by the U.S. Forest Service (USFS) and Bureau of Land Management (BLM) as distinct entities under the SMP of the Northwest Forest Plan (see Factor D, below), that program is not specifically restricted to species or subspecies, as is the Act when applied to invertebrates (16 U.S.C. 1532 (16)).

The unpublished descriptions of these eight mollusks are all primarily based on shell characteristics, with occasional mention of certain characters of the animals themselves (such as color). Snail shell characteristics in general can vary due to environmental influences including elevation, calcium content of the surrounding water, and population density (Minton and Lydeard 2003, p. 76; Chak 2007, p. 3). The informal descriptions lack genetic data, data regarding microscopic anatomical features such as the radula (tongue), and photographs or drawings of anatomical features other than the shell. Such data are often highly distinctive, and are of key importance in formal descriptions (for example, Hershler *et al.* 2003, pp. 278–282; Hershler *et al.* 2007, pp. 407–419).

At the time the petition to list these aquatic mollusks was first submitted, only one of the petitioned mollusks (the nugget pebblesnail) had been formally described (CBD *et al.* 2008, p. 9). Since then, an additional five mollusks have been formally described and thereby established in the scientific community as valid species. These are the canary duskysnail, Goose Valley pebblesnail, Hat Creek pebblesnail, Potem Creek pebblesnail, and Shasta pebblesnail (Hershler *et al.* 2003, p. 278; Hershler *et al.* 2007, pp. 407, 409, 412, 415). For three of these recently described species (the canary duskysnail, Goose Valley pebblesnail, and Potem Creek pebblesnail), the formal descriptions

simply confirm the informal species designations under which they had been petitioned. However, the formal description of the Hat Creek pebblesnail combined into one species two of the petitioned mollusks that had previously been informally described as separate species (the umbilicate pebblesnail (*Fluminicola* n. sp. 19) and the Lost Creek pebblesnail (*Fluminicola* n. sp. 20). Similarly, the formal description of the Shasta pebblesnail combined four mollusks that had previously been informally described as separate species (Hershler *et al.* 2007, p. 419)). Three of those had been petitioned for listing (CBD *et al.* 2008, p. 9): the flat-top, Shasta Springs, and disjunct pebblesnails (identified as *Fluminicola* n. sp. 3, 4, and 5 in Frest and Johannes 1995b, pp. 43, 44; but as *Fluminicola* n. sp. 15, 16, and 17 in Frest and Johannes 1999, pp. 39, 43, 47 and in CBD *et al.* 2008, p. 9). The fourth, the Sacramento pebblesnail (*Fluminicola* n. sp. 1) (Frest and Johannes 1995b, p. 42) had not been petitioned for listing and was not protected by the SMP (USDA and USDI 2007, pp. 92–94). In describing the Shasta pebblesnail, the authors noted the ''[m]arked shell variation'' of the species (*Hershler et al.* 2007, p. 419).

The primary reason for combining multiple informally described mollusks in the formal descriptions of the Hat Creek and Shasta pebblesnails was that new genetic comparisons had shown those informally described mollusks were not genetically divergent or phylogenetically independent (Hershler *et al.* 2007, p. 383). Such genetic comparisons have not yet been published for the remaining undescribed mollusks. This suggests the remaining but undescribed mollusks may also be determined by future taxonomic analyses to represent populations of larger-ranging species or subspecies. New taxonomic analyses are currently being conducted for a large number of provisionally identified species in the *Fluminicola* genus (Johannes 2011, p. 1). Additionally, the establishment of the Shasta pebblesnail as a single species, despite the marked differences in shell morphology among its various populations, indicates that shell morphology is a relatively poor indicator of species status for at least some of these mollusks.

Accordingly, we conclude that the eight mollusks that have not been formally described (as listed in Table 1, above) cannot be considered to be listable entities under the Act at this time, and, therefore, we will not further evaluate the status of these entities. These include the Basalt juga, cinnamon juga, Columbia duskysnail, Fredenburg pebblesnail, Klamath Rim pebblesnail, knobby rams-horn, masked duskysnail, and tall pebblesnail. We, therefore, restrict the remainder of our listing status review to the six mollusks constituting listable entities under the Act. These are the canary duskysnail, the Goose Valley pebblesnail, the Hat Creek pebblesnail, the nugget pebblesnail, the Potem Creek pebblesnail, and the Shasta pebblesnail.

Generally Applicable Federal Regulatory Mechanisms

The Northwest Forest Plan

The Northwest Forest Plan (NWFP) is a set of amendments to the resource management plans for USFS and BLM lands within the range of the northern spotted owl (*Strix occidentalis caurina*) in western Washington, Oregon, and northwestern California (referred to below as NWFP lands) (USDA and USDI 1994a, pp. 11, 12). The NWFP was established to protect species commonly occurring in late-successional and old-growth forests, while also allowing for sustainable timber production (USDA and USDI 1994a, p. 3). The NWFP established several categories of land allocations and, with minor exceptions, restricted timber production to those areas designated as Matrix Lands (16 percent of the total) and to certain Adaptive Management Areas (6 percent of the total) (USDA and USDI 1994a, pp. 6, 7). The NWFP includes two subprograms designed to provide additional protections to specific resources on NWFP lands. The first subprogram is the Aquatic Conservation Strategy (ACS), which protects aquatic and riparian habitat. The second subprogram is the SMP, which protects numerous rare species associated with late-successional or old-growth forests that are not adequately protected by other provisions of the NWFP (USDA and USDI 1994a, pp. 9, 10; Olson *et al.* 2007, pp. 1, 2). The ACS and SMP are particularly applicable, in varying degrees, to the six listable aquatic mollusks considered here, and are discussed in more detail below.

The Aquatic Conservation Strategy

The ACS was established to protect and restore aquatic ecosystems on NWFP lands (USDA and USDI 1994b, p. B–11; Reeves *et al.* 2006, p. 320). The ACS includes four components: Riparian reserves, key watersheds, watershed analysis, and watershed restoration (USDA and USDI 1994a, pp. 9, 10). Of these, riparian reserves are the most significant conservation tool for the aquatic mollusks considered here. Riparian reserves include all aquatic habitat (perennial and seasonal streams, lakes, ponds, and wetlands) on NWFP lands. Riparian reserves are managed to maintain and restore water quality, aquatic ecosystem physical integrity, instream flows, habitat connectivity, and other natural features of the protected riparian and aquatic habitat (USDA and USDI 1994b, pp. B–11, B–13). Activities with the potential to negatively affect natural features, such as logging, road construction and maintenance, grazing, recreation, mineral management, and fire management are closely regulated within the reserves (USDA and USDI 1994a, p. 9; USDA and USDI 1994b, pp. C–31—C–38).

Riparian reserves incorporate buffers of 100 to 300 feet (ft) (30.5 to 91.4 meters (m)) around these aquatic features (except for wetlands of less than 1 acre (ac) (0.4 hectares (ha)), which have buffers that extend to the limit of the associated riparian vegetation). The six listable aquatic mollusks considered in this review all occupy springs (including those forming lakes or ponds) and perennial streams, sometimes fish-bearing and sometimes not (a stream is considered fish bearing if it supports any species of fish for any duration of time) (USDA and USDI 1994b, p. B–14). When any of these six mollusks are on NWFP lands in lakes, ponds, or fish-bearing streams, they are protected by buffers extending outward 300 ft (91.4 m) from the streambanks, to the limit of riparian vegetation or to a distance equal to the height of two site-potential trees, whichever is greater (USDA and USDI 1994a, p. 9). ''Site-potential tree height'' refers to the expected height attainable by a mature conifer growing in the area (Kier Associates 2011a, p. 2). Average site-potential tree height for much of the Pacific Northwest is about 170 ft (51.8 m). When present in non-fish-bearing streams on NWFP lands, the six mollusks are protected by buffers of 150 ft (45.7 m) or equal to the height of one site-potential tree, whichever is greater. These boundaries may be modified based on subsequent watershed analysis (USDA and USDI 1994a, p. 10; USDA and USDI 1994b, p. B–13)).

The second component of the ACS, key watersheds, establishes specific watersheds to be given the highest priority in watershed restoration efforts (USDA and USDI 1994b, p. B–19). None of the key watersheds identified under the ACS are in the known current range of, or upstream from, any of the six aquatic mollusks that qualify as listable entities (REO 2006, p. 5). Accordingly, the key watersheds provision of the ACS does not affect the conservation of those

six mollusks, except if new locations of those species are identified within key watersheds in the future.

The third component of the ACS, watershed analysis, is a systematic procedure to collect information on and characterize watersheds on NWFP lands (USDA and USDI 1994b, pp. B–20—B–31). Watershed analysis must be conducted in key watersheds and roadless areas prior to management activities, in riparian reserves prior to changing reserve widths, and in any watershed prior to restoration efforts. Watershed analysis is recommended for all watersheds, and has been conducted on an ongoing basis since its inclusion in the NWFP (USDA 2009, p. 1). Analyses have been conducted for portions of the upper Sacramento River and lower McCloud River watersheds, which support occupied sites of the Shasta pebblesnail and nugget pebblesnail, respectively.

The final component of the ACS, watershed restoration, focuses primarily on restoring watershed aquatic habitat through the prevention of road-related runoff, restoration of riparian vegetation, and restoration of instream habitat complexity (USDA and USDI 1994b, p. B–31). The Shasta-Trinity and Lassen National Forests are currently planning or implementing several such watershed restoration projects (USDA 2012a, pp. 4, 5; USDA 2012b, pp. 3, 5), although none of the currently active projects involve locations near sites occupied by the mollusks addressed in this status review at the present time.

The Survey and Manage Program

The SMP, like the ACS, was established under the NWFP and is particularly applicable, in varying degrees, to the six listable aquatic mollusks considered here. The six mollusks were protected under the SMP (when on Federal lands subject to the NWFP), but the SMP program was discontinued in 2007 (USDA and USDI 2007, pp. xii, xiii; CBD *et al.* 2008, p. 5). The SMP was subsequently reinstated in accordance with a court-approved settlement agreement in 2011 (*Conservation Northwest* v. *Sherman 2011,* C08–1067–JCC, p. 2), and is being implemented in accordance with the 2001 Record of Decision. All of the aquatic mollusks petitioned in 2008 (both formally described and otherwise) are protected where they occur on NWFP lands (*Conservation Northwest* v. *Sherman 2011,* C08–1067–JCC, Document 81–2, pp. 6, 7). Refinements to the SMP in 2001 established six species categories with differing mitigation requirements based on the species' conservation status and on the practicality of conducting predisturbance surveys (surveys conducted prior to habitat-disturbing projects) (Molina *et al.* 2006, p. 311, 312). Rare species for which predisturbance surveys are practical are in Category A. Thirteen of the 14 petitioned aquatic mollusks fall into this category, including all six of the listable mollusks (USDA and USDI 2007, pp. 92–94). The one exception among the petitioned aquatic mollusks is the knobby rams-horn (see Table 1, above), which is in Category E (rare, practicality of predisturbance surveys undetermined) (Molina *et al.* 2006, p. 312; USDA and USDI 2007, p. 94).

For Category A species, the SMP requires predisturbance, strategic surveys (conducted in areas not currently under consideration for habitat-disturbing projects), management of all known sites to support species persistence, and annual species reviews (Molina *et al.* 2006, p. 312; Olson *et al.* 2007, abstract). Numerous such surveys and several annual reviews have been completed (Molina *et al.* 2006, pp. 312–315; USDA and USDI 2001, entire; USDA and USDI 2002, entire; USDA and USDI 2003, entire). The process of continually collecting information through surveys, and of summarizing and updating the information in annual reviews, produces an adaptive management approach to guide conservation and mitigation measures for rare species associated with late-successional or old-growth forests (Olson *et al.* 2007, p. 2).

Summary of Procedures for Determining the Listing Status of Species

Review of Status Based on Five Factors

Section 4 of the Act (16 U.S.C. 1533) and implementing regulations (50 CFR part 424) set forth procedures for adding species to, removing species from, or reclassifying species on the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, a species may be determined to be endangered or threatened based on any of the following five factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

(E) Other natural or manmade factors affecting its continued existence.

In making these findings, we discuss information below pertaining to each species in relation to the five factors provided in section 4(a)(1) of the Act. In considering what factors might constitute threats to a species, we must look beyond the simple exposure of the species to a particular factor. Instead we must evaluate whether the species may respond to the factor in a way that causes actual impacts to the species. If there is exposure to a factor and the species responds negatively, the factor may be a threat and, during the status review, we attempt to determine how significant a threat it is. The threat is significant if it drives or contributes to the risk of extinction of the species such that the species warrants listing as endangered or threatened as those terms are defined by the Act. However, the identification of factors that could impact a species negatively may not be sufficient to compel a finding that the species warrants listing. The information must include evidence sufficient to suggest that the potential threat has the capacity (is of sufficient magnitude and extent) to affect the species' status such that it meets the definition of endangered or threatened under the Act.

Distinct Population Segments

After considering the five factors, we assess whether each species is endangered or threatened throughout all of its range. Generally, we next consider in our findings whether a DPS or any significant portion of the species' range meets the definition of endangered or is likely to become endangered in the foreseeable future (threatened). The inclusion of DPSs in the definition of species under paragraph 3(16) of the Act only applies to vertebrate fish or wildlife. Therefore, our Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act (DPS Policy) (61 FR 4722; February 7, 1996) is not applicable to mollusks and no population segments under review could qualify as a DPS under the Act. Although our DPS Policy is not applicable to mollusks, we do determine in our findings whether a mollusk species is endangered or threatened in a significant portion of its range.

Significant Portion of the Range

Under the Act and our implementing regulations, a species may warrant listing if it is endangered or threatened throughout all or a significant portion of its range. The Act defines ''endangered species'' as any species which is ''in danger of extinction throughout all or a significant portion of its range,'' and ''threatened species'' as any species which is ''likely to become an

endangered species within the foreseeable future throughout all or a significant portion of its range.'' The definition of ''species'' is also relevant to this discussion. The Act defines ''species'' as follows: ''The term 'species' includes any subspecies of fish or wildlife or plants, and any DPS of any species of vertebrate fish or wildlife which interbreeds when mature.'' The phrase ''significant portion of its range'' (SPR) is not defined by the statute, and we have never addressed in our regulations: (1) The consequences of a determination that a species is either endangered or likely to become so throughout a significant portion of its range, but not throughout all of its range; or (2) what qualifies a portion of a range as ''significant.''

Two recent district court decisions have addressed whether the SPR language allows the Service to list or protect less than all members of a defined ''species'': *Defenders of Wildlife* v. *Salazar,* 729 F. Supp. 2d 1207 (D. Mont. 2010), concerning the Service's delisting of the Northern Rocky Mountain gray wolf (74 FR 15123, April 2, 2009); and *WildEarth Guardians* v. *Salazar,* 2010 U.S. Dist. LEXIS 105253 (D. Ariz. September 30, 2010), concerning the Service's 2008 finding on a petition to list the Gunnison's prairie dog (73 FR 6660, February 5, 2008). The Service had asserted in both of these determinations that it had authority, in effect, to protect only some members of a ''species,'' as defined by the Act (i.e., species, subspecies, or DPS), under the Act. Both courts ruled that the determinations were arbitrary and capricious on the grounds that this approach violated the plain and unambiguous language of the Act. The courts concluded that reading the SPR language to allow protecting only a portion of a species' range is inconsistent with the Act's definition of ''species.'' The courts concluded that once a determination is made that a species (i.e., species, subspecies, or DPS) meets the definition of ''endangered species'' or ''threatened species,'' it must be placed on the list in its entirety and the Act's protections applied consistently to all members of that species (subject to modification of protections through special rules under sections 4(d) and 10(j) of the Act).

Consistent with that interpretation, and for the purposes of this finding, we interpret the phrase ''significant portion of its range'' in the Act's definitions of ''endangered species'' and ''threatened species'' to provide an independent basis for listing; thus there are two situations (or factual bases) under which a species would qualify for listing: a species may be endangered or threatened throughout all of its range; or a species may be endangered or threatened in only a significant portion of its range. If a species is in danger of extinction throughout a significant portion of its range, the species is an ''endangered species.'' The same analysis applies to ''threatened species.'' Based on this interpretation and supported by existing case law, the consequence of finding that a species is endangered or threatened in only a significant portion of its range is that the entire species shall be listed as endangered or threatened, respectively, and the Act's protections shall be applied across the species' entire range.

We conclude, for the purposes of this finding, that interpreting the significant portion of its range phrase as providing an independent basis for listing is the best interpretation of the Act because it is consistent with the purposes and the plain meaning of the key definitions of the Act; it does not conflict with established past agency practice (i.e., prior to the 2007 Solicitor's Opinion), as no consistent, long-term agency practice has been established; and it is consistent with the judicial opinions that have most closely examined this issue. Having concluded that the phrase ''significant portion of its range'' provides an independent basis for listing and protecting the entire species, we next turn to the meaning of ''significant'' to determine the threshold for when such an independent basis for listing exists.

Although there are potentially many ways to determine whether a portion of a species' range is ''significant,'' we conclude, for the purposes of this finding, that the significance of the portion of the range should be determined based on its biological contribution to the conservation of the species. For this reason, we describe the threshold for ''significant'' in terms of an increase in the risk of extinction for the species. We conclude that a biologically based definition of ''significant'' best conforms to the purposes of the Act, is consistent with judicial interpretations, and best ensures species' conservation. Thus, for the purposes of this finding, and as explained further below, a portion of the range of a species is ''significant'' if its contribution to the viability of the species is so important that without that portion, the species would be in danger of extinction.

We evaluate biological significance based on the principles of conservation biology using the concepts of redundancy, resiliency, and representation. *Resiliency* describes the characteristics of a species and its habitat that allow it to recover from periodic disturbance. *Redundancy* (having multiple populations distributed across the landscape) may be needed to provide a margin of safety for the species to withstand catastrophic events. *Representation* (the range of variation found in a species) ensures that the species' adaptive capabilities are conserved. Redundancy, resiliency, and representation are not independent of each other, and some characteristic of a species or area may contribute to all three. For example, distribution across a wide variety of habitat types is an indicator of representation, but it may also indicate a broad geographic distribution contributing to redundancy (decreasing the chance that any one event affects the entire species), and the likelihood that some habitat types are less susceptible to certain threats, contributing to resiliency (the ability of the species to recover from disturbance). None of these concepts is intended to be mutually exclusive, and a portion of a species' range may be determined to be ''significant'' due to its contributions under any one or more of these concepts.

For the purposes of this finding, we determine if a portion's biological contribution is so important that the portion qualifies as ''significant'' by asking whether *without that portion,* the representation, redundancy, or resiliency of the species would be so impaired that the species would have an increased vulnerability to threats to the point that the overall species would be in danger of extinction (i.e., would be ''endangered''). Conversely, we would not consider the portion of the range at issue to be ''significant'' if there is sufficient resiliency, redundancy, and representation elsewhere in the species' range that the species would not be in danger of extinction throughout its range if the population in that portion of the range in question became extirpated (extinct locally).

We recognize that this definition of ''significant'' (a portion of the range of a species is ''significant'' if its contribution to the viability of the species is so important that, without that portion, the species would be in danger of extinction) establishes a threshold that is relatively high. On the one hand, given that the consequences of finding a species to be endangered or threatened in a significant portion of its range would be listing the species throughout its entire range, it is important to use a threshold for ''significant'' that is robust. It would not be meaningful or appropriate to establish a very low threshold whereby

a portion of the range can be considered ''significant'' even if only a negligible increase in extinction risk would result from its loss. Because nearly any portion of a species' range can be said to contribute some increment to a species' viability, use of such a low threshold would require us to impose restrictions and expend conservation resources disproportionately to conservation benefit: listing would be rangewide, even if only a portion of the range of minor conservation importance to the species is imperiled. On the other hand, it would be inappropriate to establish a threshold for ''significant'' that is too high. This would be the case if the standard were, for example, that a portion of the range can be considered ''significant'' only if threats in that portion result in the entire species being currently endangered or threatened. Such a high bar would not give the significant portion of its range phrase independent meaning, as the Ninth Circuit held in *Defenders of Wildlife* v. *Norton,* 258 F.3d 1136 (9th Cir. 2001).

The definition of ''significant'' used in this finding carefully balances these concerns. By setting a relatively high threshold, we minimize the degree to which restrictions will be imposed or resources expended that do not contribute substantially to species conservation. But we have not set the threshold so high that the phrase ''in a significant portion of its range'' loses independent meaning. Specifically, we have not set the threshold as high as it was under the interpretation presented by the Service in the *Defenders* litigation. Under that interpretation, the portion of the range would have to be so important that current imperilment there would mean that the species would be *currently* imperiled everywhere. Under the definition of ''significant'' used in this finding, the portion of the range need not rise to such an exceptionally high level of biological significance. (We recognize that if the species is imperiled in a portion that rises to that level of biological significance, then we should conclude that the species is in fact imperiled throughout all of its range, and that we would not need to rely on the significant portion of its range language for such a listing.) Rather, under this interpretation we ask whether the species would be endangered everywhere without that portion, *i.e.,* if that portion were completely extirpated. In other words, the portion of the range need not be so important that even the species being in danger of extinction in that portion would be sufficient to cause the species in the remainder of the range to be endangered; rather, the *complete extirpation* (in a hypothetical future) of the species in that portion would be required to cause the species in the remainder of the range to be endangered.

The range of a species can theoretically be divided into portions in an infinite number of ways. However, there is no purpose to analyzing portions of the range that have no reasonable potential to be significant or to analyzing portions of the range in which there is no reasonable potential for the species to be endangered or threatened. To identify only those portions that warrant further consideration, we determine whether there is substantial information indicating that: (1) The portions may be ''significant,'' *and* (2) the species may be in danger of extinction there or likely to become so within the foreseeable future. Depending on the biology of the species, its range, and the threats it faces, it might be more efficient for us to address the significance question first or the status question first. Thus, if we determine that a portion of the range is not ''significant,'' we do not need to determine whether the species is endangered or threatened there; if we determine that the species is not endangered or threatened in a portion of its range, we do not need to determine if that portion is ''significant.'' In practice, a key part of the determination that a species is in danger of extinction in a significant portion of its range is whether the threats are geographically concentrated in some way. If the threats to the species are essentially uniform throughout its range, no portion is likely to warrant further consideration. Moreover, if any concentration of threats to the species occurs only in portions of the species' range that clearly would not meet the biologically based definition of ''significant,'' such portions will not warrant further consideration.

Evaluation of the Status of Each of the Six Mollusk Species That Are Listable Entities

For each of the six listable aquatic mollusk species considered, we provide a description of the species and its life history and habitat, an evaluation of listing factors, and our finding as to whether the petitioned action is warranted throughout its range. We then address whether the species may be considered endangered or threatened in any significant portion of its range.

Canary Duskysnail (Colligyrus convexus)

Species Information for the Canary Duskysnail

Taxonomy and Species Description

The canary duskysnail was formally named and described in 2003 (Hershler *et al.* 2003, p. 278). Prior to that it was referred to as ''*Lyogyrus* n. sp. 3'' (Frest and Johannes 1999, pp. 77–78; Hershler *et al.* 2003, p. 278; USDA and USDI 2007, pp. 93, 169), and also as ''*Lyogyrus* n. sp. 1'' (Frest and Johannes 1995b, p. 50). Although the canary duskysnail was considered to be in the Hydrobiidae family by earlier authors (Frest and Johannes 1995b, p. 50; Frest and Johannes 1999, p. 13), and was referred to as such in the listing petition (CBD *et al.* 2008, p. 9), it was placed in the family Amnicolidae when it was formally described (Hershler *et al.* 2003, p. 278). It is a small (1.4 to 1.9 millimeters (mm) 0.06 to 0.07 inches (in)), aquatic snail with a yellowish shell, sometimes with weakly striped markings on the whorls. It is distinguishable from the other two species in its genus by its smaller size, the highly convex whorls on the main part of its shell, and the waviness of the shell near the opening (Hershler *et al.* 2003, p. 278).

Distribution

The canary duskysnail is known from a total of 21 sites in Shasta County, California, including 9 along the lower Pit River (California Natural Diversity Database (CNDDB) 2012, pp. 1–5; Johannes 2012a, pp. 2–7; Pacific Gas and Electric Company (PGE) 2011, pp. 26, 37; Johannes 2012b, p. 11; PGE 2012, p. 27). Of those 21 sites, 7 are on Federal land covered by the NWFP, 1 is on an Indian Public Domain Allotment (PDA), 3 are in State parks, and 10 are on privately owned lands. Repeat site monitoring at eight of those sites (see Factor A, below) shows large shifts in population density and in presence or absence of canary duskysnails at any given site. Site locations fall into three broad areas: The lower Pit River and nearby Burney Creek (11 sites), Hat Creek (2 sites), and the upper Fall and Tule River area (8 sites).

Habitat and Biology

The canary duskysnail typically occurs in shallow water on the undersides of boulders and cobbles in pond springs and wetted areas near streambeds (the hyporheic zone) (Hershler *et al.* 2003, pp. 280, 284). It is most likely a grazer on perilithon, the community of small organisms such as

algae, protozoa, and bacteria growing underwater on stones (Frest and Johannes 1995b, p. 81; Furnish and Monthey 1999, Sect. 4, p. 9). It is most commonly found in areas lacking cover from aquatic plants, often in association with the Shasta crayfish (*Pacifastacus fortis*). It is found in, and is likely dependent on, water that is cold, clear, well-oxygenated, and unpolluted (Frest and Johannes 1995b, p. 3). It is often found in spring flows or in spring-influenced streams (Service 1998, p. 20; Frest and Johannes 1999, p. 78). The canary duskysnail is a short-lived species (1 to occasionally 2 years) that only reproduces once before dying (Frest and Johannes 1995b, p. 4; Furnish and Monthey 1999, Sect. 4, p. 7). Eggs are likely laid in the spring and hatch in 2 to 4 weeks (Furnish and Monthey 1999, Sect. 4, p. 7).

Five-Factor Evaluation of Threats for the Canary Duskysnail

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Impoundments

Nine of the 21 occupied sites are in or along the lower Pit River below Lake Britton (PGE 2011, pp. 26, 37; Johannes 2012b, p. 11; PGE 2012 p. 27). PGE maintains three dams in this area: Pit 3, 4, and 5 (PGE 2010, p. 5). Each dam sends water from its associated reservoir through tunnels to power-generating stations located just above the reservoirs of the next dam downstream. Flows in the natural river channel below each dam (referred to as the Pit 3, 4, and 5 reaches) have in the past consisted primarily of water from springs and minor tributaries emptying below each dam. In 2007, however, the Pit 3, 4, and 5 dams were issued a new operating license that required increased releases of surface water from the reservoirs into their associated reaches (PGE 2010, p. 2). These releases have the potential to negatively impact the canary duskysnail because reservoir surface water tends to be warmer than spring or creek water (Ellis 2012, p. 1). Because the dams initially lacked the infrastructure to release the required amounts of instream water, the required amounts were not achieved until 2011 (PGE 2012, p. 1). In accordance with a facilities modification plan, interim flow releases of approximately half the required amounts were authorized for 2008 through 2010 while the flow release structures of the dams were improved (PGE 2010, pp. 1, 2).

PGE was also required by the relicensing requirements to conduct mollusk surveys in 2009, in 2011–2015, in 2018, and every 4 years thereafter until the expiration of the license in 2043 (PGE 2012, p. 1). Following monitoring in 2009, PGE decided to monitor for mollusks in 2010 as well (PGE 2010, p. 54; PGE 2011, p. 1). Accordingly, we now have 3 years of survey data (2009–2011) for a total of 12 sites in the Pit River (four sites downstream of each dam) (PGE 2011, pp. 26, 37; PGE 2012, p. 27). The surveys found canary duskysnails at 8 of those 12 sites (as well as nugget pebblesnails at all 12 sites, as discussed below). A ninth site in the Pit River with canary duskysnails (as mentioned above) was not in a monitored location (Hershler *et al.* 2003, p. 280; CNDDB 2012, p. 2; Johannes 2012a, p. 2).

Four of the eight monitored occupied sites are in the Pit 3 reach, which is the farthest upstream (PGE 2011, pp. 26, 37; PGE 2012, p. 27). During 2009, that reach also showed the lowest average water discharge rates, lowest average water temperatures, and produced the highest average densities of canary duskysnails, thus tending to support the idea that canary duskysnails benefit from lower discharge rates from the dams (PGE 2010, p. 35; PGE 2011, pp. 26, 37; PGE 2012, p. 27). However, as average water discharge rates increased in the Pit 3 reach from 150 cubic ft per second (cfs) in 2009 to 350 cfs in 2011, and as average water temperatures increased as well from approximately 60 to about 63 degrees Fahrenheit (°F) (15.4 to 17.2 degrees Celsius (°C)), canary duskysnail densities rose from 20 to 53 snails per square meter (16.7 to 44.3 snails per square yard) at one location (their highest density in the study), and dropped from 50 to 0 snails per square meter (41.8 to 0 snails per square yard) at another location. The populations thus showed strong fluctuations, with widely differing responses to increasing flows. Similarly, in the Pit 5 reach, 37 snails per square meter (30.9 snails per square yard) were found in 2011 (the year of highest flows) at a location that had supported no snails in the 2 previous years. All other occupied locations had comparatively low population densities, and only one of those showed a clear drop in population density over the 3-year monitoring period (from 4 to 0 snails per square meter (3.3 to 0 snails per square yard)). Therefore, we conclude there are no clear trends in observed survey data attributable to changes in flow releases from dams.

The only other occupied site potentially affected by an impoundment is at Baum Lake (CNDDB 2012, p. 4; Johannes 2012a, pp. 4, 5), a PGE-owned reservoir on Hat Creek, just north of the town of Cassel (Service 1998, pp. 20, 43). Abundant canary duskysnails were found at the site in 2001, under cobbles near the outflow of Crystal Lake, a spring-fed water body that abuts and empties into Baum Lake (CNDDB 2012, p. 4; Johannes 2012a, pp. 4, 5). Although the best available information does not indicate the fate of that population, its presence in 2001 and the abundant number of individual snails found at that time suggest the impoundment of Baum Lake does not constitute a threat. Three other occupied sites (identified in the source material as locations 102, 412, and 514) are located on the margins of spring-fed natural lakes in water bodies draining into the Fall River (Johannes 2012a pp. 3, 6), so the species is capable of surviving in slow-moving lake waters fed by nearby springs.

Water Quality

The Pit River is considered a water-quality limited segment for 198 kilometers (km) (123 miles (mi)) upstream of Shasta Lake; including the locations of all nine canary duskysnail sites known from the Pit River (State Water Resources Control Board (SWRCB) 2010a, p. 164). Nutrients from cattle defecation and fertilizers applied in the course of agriculture enter the Pit River, where they promote algal growth that decreases oxygen levels and increases water temperature. However, as discussed above with respect to impoundments, the only population trend data available for the canary duskysnail does not show clearly decreasing populations, despite any temperature increases or oxygen decreases that may be attributable to water quality.

PGE will continue to monitor mollusk populations annually as discussed above (PGE 2012, p. 1), so if impacts from Pit water quality or from the releases themselves do develop, they should be detected. The operating license for the dams includes an adaptive management plan for responding to negative impacts detected by the monitoring program (PGE 2008, pp. 3–6). The Service serves on the Technical Review Group which recommends specific adaptive management responses (PGE 2008, p. 2), and so will remain informed of the effectiveness of those responses. Seven of the nine occupied locations on the Pit River are on Federal land (either Shasta-Trinity National Forest or Lassen National Forest) within the area covered by the NWFP. Activities on those lands with the potential to affect water quality (or to affect the populations directly) would have to meet the requirements of the SMP and the ACS, as discussed

above. For instance, logging or road construction in the vicinity of the Pit River or its tributaries (on Federal lands within the NWFP area) would be subject to buffers for riparian reserves established under the ACS as well as predisturbance surveys and mitigation as required by the SMP.

There are no locations occupied by canary duskysnails on the Pit River upstream of the Pit 3 dam at Lake Britton. However, there are two locations each on Burney Creek and Hat Creek, which both flow into Lake Britton. The remaining eight canary duskysnail locations are in the Fall River drainage, generally at the headwater springs (Service 2012a, p. 1). Neither Burney Creek nor Hat Creek is considered water-quality limited (SWRCB 2010a, entire; SWRCB 2010b, entire; SWRCB 2010c, entire). However, the Fall River is affected by sedimentation extending far enough upstream to reach the southernmost of the eight sites in the drainage occupied by canary duskysnails (SWRCB 2010a, p. 148; SWRCB 2011, p. 2). The sedimentation was caused by historical land management activities, and is not likely to constitute a threat to the other sites (Fall River Resource Conservation District (FRRCD) 2005, pp. 1–3; SWRCB 2010a, p. 148).

A final area with impaired water quality is Eastman Lake, at the headwaters of the Little Tule River, a tributary of the Fall River (SWRCB 2010a, p. 148; SWRCB 2011, p. 1). One canary duskysnail site (514) is located at the lake, while two others (102, 263) are just upstream of the inlet (Johannes 2012a, pp. 3, 4, 6). At an average pH of 8.64, the lake water is slightly more alkaline than the established water quality objective range of 6.5 to 8.5 (SWRCB 2010d, pp. 6, 7). The reason for the increased alkalinity is unknown, as is the optimal pH range for the canary duskysnail. However, acidic waters (pH 5 and below) can interfere with shell production, so freshwater snails are generally found in waters that are at least somewhat alkaline (Wyoming Game and Fish Department (WGFD) 2005, p. 548).

Other Habitat-Related Impacts

Grazing, spring diversions, road construction, and railroad construction have all been mentioned as possible threats to the canary duskysnail (Furnish and Monthey 1999, Sect. 4, p. 14; Service 2011, p. 61831). However, since the time of Furnish and Monthey's conclusions in 1999, the number of known locations has increased from 2 to 21, 10 of which are on protected State or Federal lands (Furnish and Monthey 1999, Sect. 4, pp. 10, 11; Johannes 2012a, pp. 2–7; Johannes 2012b, p. 11; PGE 2011, pp. 26, 37; PGE 2012 p. 27). The SMP (discussed above) has also been reinstated on Federal lands subject to the NWFP. Various habitat improvement measures have been carried out in the upper Fall River drainage, where the majority of occupied sites on private land are located (FRRCD 2005, pp. 1–3). Habitat improvements include exclusion fencing to keep cattle from streambanks, bank stabilization projects, and the replacement and upgrade of a railroad crossing that had collapsed twice in the past (producing extensive siltation on those occasions) (FRRCD 2005, p. 2; Ellis and Haley 2012, p. 1). Landowners also took steps to reduce the potential for serious wildfires and to prevent erosion of sediment from a nearby meadow (FRRCD 2005, p. 3). In Hat Creek, grazing has been eliminated in the general vicinity of the PGE dams since 2001 (Stewardship Council 2007, Vol. 2, p. PM–31). Grazing has also been eliminated from lands surrounding the two privately owned sites occupied by canary duskysnails in the lower Pit River. Forestry has been eliminated in areas near those sites conducted in accordance with a conservation plan developed and implemented by a nonprofit land-management corporation (see *Grazing and Logging* under Nugget Pebblesnail, below) (Stewardship Council, Vol. 2, pp. PM 38, 40, 41, 48, 50).

The Shasta crayfish is a federally endangered species that shares essentially the same native range and habitat requirements as the canary duskysnail (Service 2009, pp. 4–6). The two species often co-occur at the same locations (Hershler *et al.* 2003, p. 280). When we listed the Shasta crayfish in 1988, we identified grazing, pollution, and water use for residential development as threats to the species (Service 1988, p. 38463). In our 2009 review of the species' status, however, we determined those practices no longer constitute significant impacts to the species (Service 2009, p. 9).

Summary of Factor A

In summary, no clear population trends in response to habitat modifications are evident at any of the sites occupied by canary duskysnails, including the eight sites monitored by PGE. The release of additional Pit River waters from the dams under PGE's new licensing agreements does not appear to have resulted in adverse effects on downstream canary duskysnail populations. We also know of no occupied sites that have been permanently lost due to habitat modifications, although population fluctuations at some of the monitored sites included densities of zero during some years. No cause of the fluctuations at the monitored sites was evident. We therefore conclude, based on the best available scientific and commercial data, that the present or threatened destruction, modification or curtailment of its habitat or range does not constitute a significant threat to the species now or in the future.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Our review of the best available scientific and commercial information yielded nothing to indicate that overutilization for commercial, recreational, scientific, or educational purposes is occurring at this time or is likely to occur in the future. We therefore conclude such overutilization does not constitute a threat to the canary duskysnail.

Factor C. Disease or Predation

Disease

We reviewed the best available scientific and commercial information regarding this species and other similar species, and found no evidence to indicate that disease is impacting canary duskysnail populations.

Predation

There is the potential for increased predation on canary duskysnails due to the introduction of the signal crayfish (*Pacifastacus leniusculus*) into the mid-Pit River drainage in the late 1970s, and its subsequent expansion throughout the area during the 1990s and early 2000s (Ellis 1999, pp. 12, 57, 58; Service 2009, p. 10). The signal crayfish, which is native to Oregon, Washington, and more coastal portions of northwest California, is a faster growing, faster reproducing relative of the Shasta crayfish, with a greater tolerance for warmer water (Ellis 1999, pp. 2, 9, 12, 13; Service 2009, p. 9; PGE 2011c, p. 25). The signal crayfish now occurs in all the general locations occupied by the canary duskysnail (Service 2009, pp. 5, 10; PGE 2011b, pp. 4, 10, 23) and is a generalist feeder with a diet that very likely includes aquatic snails (Lorman and Magnuson 1978, p. 9; Ellis 1999, pp. 55, 56).

Experiments conducted with another species of crayfish in Wisconsin indicate that dense crayfish populations can significantly impact prey populations, including aquatic snails (Lorman and Magnuson 1978, p. 9). However, the best available scientific and commercial information does not

indicate how dense crayfish populations must generally be in order to impact populations of aquatic snails. The best available scientific and commercial information does not provide data on population density trends for crayfish and aquatic snails at the same locations. Although PGE conducted both crayfish and mollusk surveys at various locations in the Pit 4 reach, the surveyed sites did not overlap (PGE 2010, p. 7, PGE 2011b, p. 4). Crayfish were surveyed at foothill yellow-legged frog breeding sites, and one such site (Canyon Creek 45.8) appears to overlap a surveyed mollusk site referred to as Malinda Ridge by mollusk surveyors. However, Canyon Creek 45.8 was one of the frog breeding sites at which conditions did not allow crayfish surveys (due to risk of injuring frog eggs) (PGE 2011b, pp. 10, 21–23).

We do know that average densities of signal crayfish remained at 3 per square meter in the Pit 4 reach from 2008 through 2011 (PGE 2011b, p. 10, PGE 2012b, p. 9), despite increasingly large releases of warmer surface water from reservoirs during those years (PGE 2010, p. 35; PGE 2011, p. 24; PGE 2011b, p. iii; PGE 2012, p. 24) that might be expected to have benefitted signal crayfish (Service 2009, p. 9). Although average densities remained steady during the monitoring period, maximum densities of signal crayfish decreased from 14 to 7 per square meter (PGE 2011b. p. 10; PGE 2012b, p. 9). The sampled averages of 3 per square meter are very close to the average densities of 2.85 crayfish per square meter estimated for the native Shasta crayfish at Lava Creek (upper Fall River drainage) in 1990 (Ellis 1999, p. 58), and therefore suggest that they are close to the native crayfish densities with which the canary duskysnail evolved. The crayfish density surveys at Pit 4 reach also provide some evidence to suggest that signal crayfish densities are remaining stable in that area, despite warmer water temperatures from increased flows of reservoir surface water.

The evidence also does not support the possibility that, in areas occupied by canary duskysnails, populations of signal and Shasta crayfish might overlap to produce unusually high combined crayfish densities. The known range of the Shasta crayfish does not extend into Burney Creek or the lower Pit River (below Lake Britton) (Service 2009, pp. 3–5), so the 11 canary duskysnail sites in those areas are only subject to potential impacts from signal crayfish. Two general areas that support canary duskysnails are known to support both species of crayfish: The upper Fall River drainage and the area around Baum Lake on Hat Creek (Service 2009, p. 9; Johannes 2012a, pp. 2–7). Monitoring has shown that the occupied locations within these general areas may support relatively high numbers of Shasta crayfish, or of signal crayfish, but not of both (Service 2009, p. 9). As signal crayfish numbers increase at a given location, the numbers of Shasta crayfish drop dramatically (Ellis 1999, pp. 57, 58).

Hence, the available evidence does not support the contention that signal crayfish are present in the range of the canary duskysnail in sufficiently high densities to pose a predation risk to the canary duskysnail, either by themselves or in combination with the native Shasta crayfish. Furthermore, the information does not indicate any trend in the densities of the two crayfish that would lead us to a conclusion that the predation risk would increase in the future.

We therefore conclude, based on the best available scientific and commercial information, that neither disease nor predation constitutes a significant threat to the species now or in the future.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Under this factor, we examine whether existing regulatory mechanisms are inadequate to address the threats to the species discussed under the other factors. Section 4(b)(1)(A) of the Act requires the Service to take into account ''those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species * * *''. We interpret this language to require the Service to consider relevant Federal, State, and Tribal laws and regulations when developing our threat analyses. Regulatory mechanisms, if they exist, may preclude the need for listing if we determine that such mechanisms adequately address the threats to the species such that listing is not warranted. The analysis of threats to the canary duskysnail under the other factors included consideration of the ameliorative effects of regulatory mechanisms where applicable, such as those discussed under Factor A and under *Generally Applicable Federal Regulatory Mechanisms,* above.

Having evaluated the significance of the threat as mitigated by any such conservation efforts, we analyze under Factor D the extent to which existing regulatory mechanisms are inadequate to address the specific threats to the species. We found no significant threats to the canary duskysnail under the other factors, therefore, the analysis of any existing regulatory mechanisms' adequacy to address threats is not applicable. Consequently, after reviewing the best available commercial and scientific information, we conclude that the inadequacy of existing regulatory mechanisms is not a threat to the canary duskysnail now or in the future.

Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence

Competition With Invasive Species

New Zealand mudsnails (*Potamopyrgus antipodarum*) are 4 to 6 mm (0.12 to 0.24 in) aquatic snails that are extremely prolific and can reach densities of hundreds of thousands per square meter in waters outside their native New Zealand (National Biological Information Infrastructure (NBII) 2011, pp. 1, 2). They are carried to new areas on boots, fishing equipment, boats, or in the digestive systems of birds and fish, and are capable of colonizing locations with a wide variety of substrates, temperatures, and currents (NBII 2011, pp. 1–3). In the western United States, New Zealand mudsnail populations typically consist almost entirely of parthenogenic (asexually reproducing) females born with embryos already developing in their reproductive systems (NBII 2011, p. 4; Crosier and Molloy, undated, p. 1).

New Zealand mudsnails typically eat detritus (decaying organic matter), diatoms (a type of plankton), and periphyton (essentially the same as perilithon except on underwater surfaces of vascular plants rather than rock surfaces) (Frest and Johannes 1995b, p. 81; NBII 2011, p. 4). Although they reach their highest numbers in areas with numerous vascular water plants, they can also dominate areas that lack such plants (Hall *et al.* 2006, pp. 1122, 1126), indicating they eat perilithon as necessary. As discussed above, perilithon is likely the primary food source of the canary duskysnail (Furnish and Monthey 1999, Sect. 4, p. 9). One study found that New Zealand mudsnails reached higher numbers in areas with stable hydrological flows and relatively warm water temperatures (averaging 18 °C (64.4 °F) as compared to an average 6 °C (42.8 °F) in their native New Zealand) (Hall *et al.* 2006, p. 1128). As discussed below under *Changes in Precipitation and Water Availability Due to Climate Change,* the springs with which canary duskysnails are associated tend to be highly stable in flow (Service 1998, p. 46). Average summer water temperatures for 2009 through 2011 measured in the lower Pit River near sites occupied by canary

duskysnails ranged from 17.1 to 19.9 °C (62.8 to 67.8 °F) (PGE 2012, p. 24). Sites supporting canary duskysnails are thus not ideal for New Zealand mudsnails due to the lack of vascular plants, but they do provide favorable flow and temperature characteristics that could facilitate the growth and competitive ability of any New Zealand mudsnail populations that became established at those sites.

Because of their high reproductive rate, wide habitat tolerance, and few effective parasites or predators outside of their native waters, New Zealand mudsnails are capable of outcompeting most native aquatic snails for food and space (NBII 2011, pp. 1, 2). They are extremely difficult to eradicate once established (NBII 2011, pp. 3, 4).

In 2007, New Zealand mudsnails became established at the Bridge Bay Marina on Shasta Lake near Interstate 5 (United States Geological Survey (USGS) 2009a, pp. 1, 2; USGS 2009b, p. 1; McAlexander 2012a, p. 1). The aerial distance between that location and the nearest known site occupied by the canary duskysnail is about 48 km (30 mi). If the New Zealand mudsnail were to colonize multiple areas occupied by the canary duskysnail, it could become a serious threat to the species. However, the likelihood that such a scenario will occur is very uncertain. In 2011, six additional New Zealand mudsnail locations were found in the north-central California area, but population levels were low and all sites were on the Sacramento River (USGS 2009b, p. 1; USGS 2011, p. 40; McAlexander 2012a, p. 1). Five of those sites are downstream of the Bridge Bay Marina, while one is upstream at Castle Lake (USGS 2009b, p. 1; McAlexander 2012b, p. 1). No populations have so far been found in any tributary rivers or streams, such as the Pit River. The California Department of Fish and Game (CDFG) is following a national management and control plan (Aquatic Nuisance Species Task Force (ANSTF) 2007, entire) and has posted information and brochures about the New Zealand mudsnail on its Web site, including printable posters and wallet cards (CDFG undated, p. 1).

Although there is no recognized method for assessing the risk of New Zealand mudsnail establishment in a given area at a given time (ANSTF 2007, p. 17), we consider Lake Britton to be the location within the range of the canary duskysnail currently at greatest danger of infestation. Lake Britton supports a marina, boat launch, and fishery, borders a state park, and is easily accessed from State Highway 89 (Stewardship Council, Vol. 2, pp. PM–37–39). In contrast, vehicle access to the Pit 4 reservoir is more difficult, and boating is not currently allowed (Stewardship Council, Vol. 2. pp. PM–48, PM–49). Thus, if a boat inadvertently carrying New Zealand mudsnails were to be towed from the Bridge Bay Marina to some body of water in the range of the canary duskysnail, the most likely such location would be Lake Britton. However, virtually the entire extent of the canary duskysnail's range supports fisheries (Stewardship Council, Vol. 2. pp. PM–21, PM–31, PM–49), so it would be possible for New Zealand mudsnails to be carried on fishing waders from an infested fishing spot (presumably farther downstream on the Sacramento River, rather than at the Bridge Bay Marina itself) to almost anywhere in the range (NBII 2011, p. 3; Emery 2012, p. 1).

Once established at one location within the range of the canary duskysnail, the likelihood of infestation at other such locations would increase. However, to compete directly with canary duskysnails, the New Zealand mudsnail would have to establish itself at the canary duskysnail's occupied locations. The New Zealand mudsnail tends to have a spotty distribution, apparently governed to a large extent by where colonizing individuals are deposited by various vectors (USGS 2009b, p. 1; Emery 2012, p. 1). For the New Zealand mudsnail to be a threat to the canary duskysnail, first it would have to colonize somewhere within the range (probably Lake Britton), then it would have to establish so many additional colonies that a large percentage of canary duskysnail sites were overlapped. Then, it would have to outcompete the canary duskysnails at those sites and the canary duskysnails would have to be unable to establish themselves at different sites. All these stages are likely to require several years, if they happen at all. Currently the available information indicates there is no infestation at Lake Britton or at any locations occupied by the canary duskysnail. Accordingly, we do not consider competition from New Zealand mudsnails to be a threat to the canary duskysnail at this time.

Fire

A large high-severity fire could potentially impact canary duskysnails by removing ground cover (Robichaud undated, pp. 2, 4), thereby allowing silt to wash into occupied springs and streams. Silt can degrade water quality, cover the perilithon on which canary duskysnails feed, and could also smother canary duskysnail eggs (Furnish and Monthey 1999, Sect. 4, pp. 9, 14; Robichaud undated, p. 3). For the nine occupied sites in the Pit River below Lake Britton, siltation would be expected to collect in the Pit 3, 4, and 5 reservoirs, and to wash out of the river portions below each dam fairly quickly due to required flow releases established by the dam operating requirements (see Impoundments, above). The remaining 12 sites are spread out over 3 major areas, with 8 sites in the upper Fall River watershed, and 2 each in Burney Creek (in McArthur-Burney Falls State Park), and Hat Creek (near Cassel, CA). The closest distances between these locations range from 12 km (7.5 mi) (Burney Creek to Hat Creek) to 20 km (12.4 mi) (upper Fall River to Hat Creek). A fire would have to be extremely large and precisely positioned to encompass two such areas. Additionally, the occupied sites along the lower Pit River and in upper Fall River watershed are likely to benefit from fire prevention and fuel reduction activities conducted by the Shasta-Trinity National Forest (USDA 2012a, pp. 1–15, 17–19), the Lassen National Forest (USDA 2012b, pp. 1, 3–7, 9–12), and by landowners in the upper Fall River watershed (FRRCD 2005, p. 3).

Changes in Precipitation and Water Availability Due to Climate Change

Our analyses under the Endangered Species Act include consideration of ongoing and projected changes in climate. The terms ''climate'' and ''climate change'' are defined by the Intergovernmental Panel on Climate Change (IPCC). ''Climate'' refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term ''climate change'' thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (for example, habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

Climate change is not expected to significantly change total precipitation in northern California, but may affect seasonal water availability in some areas due to changes in snowpack melting times and the proportion of precipitation falling as rain rather than snow (Dettinger *et al.* 2004, pp. 43, 44). However, the water supplying springs occupied by the canary duskysnail in the middle Pit River drainage (including the upper Fall River area) and in Hat Creek are collected from wide areas in the Medicine Lake highlands and Lassen volcanic highlands, respectively (Service 1998, p. 18). Rain and snowmelt in those areas percolate through porous volcanic rocks to collect in large aquifers, thereby holding extra water from seasons when rain is plentiful and delivering it through springs during seasons when rain is not plentiful. Resulting spring flows are highly stable in volume, temperature, and clarity (Service 1998, p. 46). Accordingly, we do not expect changes in precipitation or water availability due to climate change to significantly affect the species.

Summary of Factor E

In summary, the canary duskysnail is protected from expected changes in precipitation or water availability due to climate change by the particular characteristics of its habitat. Although potential competition from the New Zealand mudsnail is cause for concern, no site currently occupied by canary duskysnail has been colonized and there is nothing to indicate the New Zealand mudsnail will colonize any of the multiple locations occupied by the canary duskysnail. There is also no direct evidence to show that any such occupied locations would be extirpated by such a colonization were it to occur. The two species are not known to have interacted in the past. We therefore conclude that, based on the best available scientific and commercial information, that other natural or manmade factors such as competition from the New Zealand mudsnail, changes in precipitation or water availability due to climate change, or fire do not constitute significant threats to the canary duskysnail now or in the future.

Finding for the Canary Duskysnail

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats faced by the canary duskysnail. We reviewed the petition, available published and unpublished scientific and commercial information, and information submitted to us during our status review. This finding reflects and incorporates that information. We also consulted with recognized authorities on this species, and we consulted with Federal and State resource agencies. Although only 21 occupied sites are known for the canary duskysnail, the best available scientific and commercial information does not clearly indicate that populations at any site are in decline, or that any sites are likely to be lost due to impoundments, water quality, other habitat-related impacts, overutilization, disease or predation, the inadequacy of existing regulatory mechanisms, competition with invasive species, or fire, now or in the foreseeable future. The best available scientific and commercial information at this time does not indicate that there is likely to be a change in any of these stressors in the future. Three years of data from an ongoing monitoring study found extreme fluctuations in population density numbers at certain sites, but did not indicate the fluctuations were in response to threats, or likely to lead to permanent local extirpation. New Zealand mudsnails could be a threat to canary duskysnails if they become established in their range, but we have no information to indicate whether that will happen in the foreseeable future or the extent of New Zealand mudsnail impact if they do become established in the range of the canary duskysnail.

Based on our review of the best available scientific and commercial information pertaining to the five factors, we find that the threats as described above, either alone or in combination are not of sufficient imminence, intensity, or magnitude to indicate that the canary duskysnail is in danger of extinction (endangered) or likely to become endangered within the foreseeable future (threatened), throughout all of its range.

Significant Portion of the Range

Having determined that the canary duskysnail is not endangered or threatened throughout all of its range, we must next consider whether there are any significant portions of the range where the canary duskysnail is in danger of extinction or is likely to become endangered in the foreseeable future. See *Significant Portion of the Range* under Summary of Procedures for Determining the Listing Status of Species.

We evaluated the current range of the canary duskysnail to determine if there is any apparent geographic concentration of potential threats for the species. The canary duskysnail is highly restricted in its range and the threats occur throughout its range. We considered the potential threats due to impoundments, water quality, other habitat-related impacts, overutilization, disease or predation, the inadequacy of existing regulatory mechanisms, competition with invasive species, and fire. We found no concentration of threats that suggests that the canary duskysnail may be in danger of extinction in a portion of its range. We found no portions of its range where potential threats are significantly concentrated or substantially greater than in other portions of its range. Therefore, we find that factors affecting the species are essentially uniform throughout its range, indicating no portion of the range of the species warrants further consideration of possible endangered or threatened status under the Act.

We find that the canary duskysnail is not in danger of extinction now, nor is likely to become endangered within the foreseeable future, throughout all or a significant portion of its range. Therefore, listing the canary duskysnail as endangered or threatened under the Act is not warranted at this time.

Goose Valley Pebblesnail (Fluminicola anserinus)

Species Information for the Goose Valley Pebblesnail

Taxonomy and Species Description

The Goose Valley pebblesnail was formally named and described in 2007 (Hershler *et al.* 2007, p. 409). Prior to 2007, it was referred to as the globular pebblesnail, ''*Fluminicola* n. sp. 18'' (Frest and Johannes 1993, p. 52; Frest and Johannes 1999, pp. 51–52; Furnish and Monthey 1999, Sect. 2, p. 6; CBD *et al.* 2008, p. 49). It was assigned a different provisional scientific name (''*Fluminicola* n. sp. 6'') by Frest and Johannes (1995b, p. 44), although it remained the ''globular pebblesnail'' as referred to in that source. Although pebblesnails in general (*Fluminicola* genus) had previously been considered part of the Hydrobiidae family (Hershler *et al.* 2003, p. 275), they have since been reassigned to the Lithoglyphidae family (Hershler *et al.* 2007, p. 371).

The Goose Valley pebblesnail is a small aquatic snail, roughly 2 to 3.5 mm (0.08 to 0.14 in) tall, with about 3.25 to 3.75 major whorls (Hershler *et al.* 2007, pp. 372, 410–412). Its head is dark brown, while the periostracum (outer layer) is tan or light green. It is similar in appearance to the Potem Creek pebblesnail (described below), but has a larger shell aperture with a more reinforced periphery (among other

differences) (Furnish *et al.* 1997, p. 48; Hershler *et al.* 2007, pp. 409, 410).

Distribution

The Goose Valley pebblesnail is known from a total of 13 locations, 2 in the upper Sacramento River drainage in Siskiyou County, California (Frest and Johannes 1995b, pp. T12, A6, B24), and 11 (after accounting for overlap from different sources) in the lower Pit River drainage, Shasta County, California (Frest and Johannes 1995b, pp. T13, A7; Hershler *et al.* 2007, pp. 376, 409, 410; Haley 2012a, p. 3). Further review has indicated that the Siskiyou County sites must be considered unconfirmed (Johannes 2012c, pp. 1–4).

The type locality for the Goose Valley pebblesnail is a spring on the west side of Goose Valley, about 10 km (6.3 mi) east of the crossing of Highways 89 and 299, and about 6.5 km (4 mi) from the Pit River (Hershler *et al.* 2007, p. 409). All other occupied sites in the drainage are in the valley formed by the Pit River itself. Nine sites are in springs along the Pit 4 reach (below Pit 4 dam) on Shasta-Trinity National Forest land in the NWFP area (Hershler *et al.* 2007, pp. 376, 409, 410; Haley 2012a, p. 3). The 11th site is upstream, in a spring on private land near Lake Britton (Hershler *et al.* 2007, pp. 376, 409, 410). The unconfirmed sites in the upper Sacramento River drainage are located in springs somewhat east of the river and north of Mossbrae Falls Frest and Johannes 1995b, pp. T12, A6, B24). Those sites also support Shasta pebblesnails (discussed below).

Habitat and Biology

The Goose Valley pebblesnail occurs in springs and spring-fed habitats, generally on the sides and undersides of stones in shaded areas with few water plants (Frest and Johannes 1999, p. 52; Spring Rivers 2001, p. 22). It is likely to be a perilithon grazer (Furnish *et al.* 1997, p. 31; Frest and Johannes 1999, p. 52). We have no specific information regarding the reproduction of this species, but members of the *Fluminicola* genus typically live a single year and breed only once (Furnish and Monthey 1999, Sect. 2, p. 5; ORNHIC 2004, p. 2). They generally lay eggs in the spring, which hatch in 2 to 4 weeks. They are not known to disperse widely, and are highly sensitive to water pollution, decreases in dissolved oxygen, elevated temperatures, and sedimentation (Furnish and Monthey 1999, Sect. 2, pp. 5, 7; Hershler *et al.* 2007, p. 372).

Five-Factor Evaluation of Threats to the Goose Valley Pebblesnail

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Impoundments

Although 9 of the 11 known occupied sites are downstream of the Pit 4 dam, the sites consist of springs or spring-fed creeks near the Pit River and thus physically removed from any warmer high-water flows released by the dams (Hershler *et al.* 2007, pp. 376, 409, 410; Haley 2012a, p. 3). A tenth occupied site is near Lake Britton, at 878 m (2,880 ft) elevation (Hershler *et al.* 2007, p. 409). The lake surface is lower than 841 m (2,759 ft) when full, and we are not aware of any plans to raise the level of the lake. The final occupied location, at Goose Valley, is not influenced by dams. Therefore, we conclude the habitat of the Goose Valley pebblesnail is not currently at risk of modification due to impoundments nor do we expect it to be so in the future.

Agriculture

The type locality is a spring on the edge of Goose Valley, the floor of which is completely converted to agriculture. The site is within 50 m (164 ft) of converted land, but it is separated by Goose Valley Road, and is on sloped and forested terrain. The limits of the converted land have not changed since at least 2001, and the occupied site is on land zoned as unclassified, whereas the valley floor is zoned as exclusive agriculture and agricultural preserve (Shasta County 2003, p. 1; Shasta County 2012, p. 1). The best available scientific and commercial information does not indicate that the quality of the site has been damaged by its proximity to converted agricultural lands over the past decade, nor is there any indication that the location of the spring itself is likely to be converted to agriculture. None of the other occupied locations are near agricultural lands.

Diversions and Grazing

In our 90-day finding, we indicated that diversions of spring water for agricultural and other uses, and grazing in and around occupied locations, were potential threats. However, these conclusions were largely based on generalized information for the mid and lower Pit River area (Hershler *et al.* 2003, p. 277) and the upper Sacramento River (ORNHIC 2004e, p. 2), where we now know no occupied locations exist (see Distribution, above). Nine of the 11 known sites in the Pit River drainage are within the NWFP area on the Shasta-Trinity National Forest and, as such, are protected by the SMP and ACS (see *Generally Applicable Federal Regulatory Mechanisms,* above). Proposed diversions or grazing practices at those locations would have to take into account the buffer requirements established by the ACS riparian reserves, as well as the survey and mitigation requirements of the SMP. We are not aware of evidence suggesting any such practices are occurring on Shasta-Trinity National Forest land.

In summary, although the type locality is close to agricultural land, most occupied locations are near flows influenced by dams, and diversions and grazing occur within the larger geographic area occupied by the species, a review of the best available scientific and commercial information does not indicate that any of these factors are negatively impacting any populations of Goose Valley pebblesnails. We therefore conclude that the present or threatened destruction, modification or curtailment of its habitat or range does not constitute a significant threat to the species now or in the future.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Our review of the best available scientific and commercial information yielded nothing to indicate that overutilization for commercial, recreational, scientific, or educational purposes is occurring at this time or is likely to occur in the future. We therefore conclude such overutilization does not constitute a threat to the Goose Valley pebblesnail.

Factor C. Disease or Predation

Disease

We reviewed the best available scientific and commercial information regarding this species and other similar species, and found no evidence to indicate that disease is impacting Goose Valley pebblesnail populations.

Predation

There is a potential for increased predation on Goose Valley pebblesnails due to the establishment of the signal crayfish in the mid and lower Pit River drainage (Ellis 1999, pp. 12, 57, 58; Service 2009, p. 10). As discussed above with regard to the canary duskysnail, signal crayfish predation can significantly impact mollusk populations when the crayfish are at high densities (Lorman and Magnuson 1978, p. 9). The known Goose Valley pebblesnail sites do not overlap the current range of the Shasta crayfish, so only the signal crayfish poses a potential predation impact. The only

information we have regarding crayfish densities applies to the Pit 4 reach and does not indicate that crayfish densities at that location are either particularly high (as compared to populations of native crayfish at other locations) or increasing (Ellis 1999, p. 58; PGE 2011b, pp. iii, 10; PGE 2012b, p. 9). Hence, the available evidence does not support the contention that signal crayfish are present in the range of the Goose Valley pebblesnail in sufficiently high densities to pose a predation risk to the Goose Valley pebblesnail. Furthermore, the information does not indicate any trend in the densities of the signal crayfish that would lead us to a conclusion that the predation risk would increase in the future.

We therefore conclude, based on the best available scientific and commercial information, that neither disease nor predation constitutes a significant threat to the species now or in the future.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Under this factor, we examine whether existing regulatory mechanisms are inadequate to address the threats to the species discussed under the other factors. Section 4(b)(1)(A) of the Act requires the Service to take into account ''those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species * * *''. We interpret this language to require the Service to consider relevant Federal, State, and Tribal laws and regulations when developing our threat analyses. Regulatory mechanisms, if they exist, may preclude the need for listing if we determine that such mechanisms adequately address the threats to the species such that listing is not warranted. The analysis of threats to the Goose Valley pebblesnail under the other factors included consideration of the ameliorative effects of regulatory mechanisms where applicable, such as those discussed under Factor A and under *Generally Applicable Federal Regulatory Mechanisms,* above.

Having evaluated the significance of the threat as mitigated by any such conservation efforts, we analyze under Factor D the extent to which existing regulatory mechanisms are inadequate to address the specific threats to the species. We found no significant threats to the Goose Valley pebblesnail under the other factors, therefore, the analysis of any existing regulatory mechanisms' adequacy to address threats is not applicable. Consequently, after reviewing the best available commercial and scientific information, we conclude that the inadequacy of existing regulatory mechanisms is not a threat to the Goose Valley pebblesnail now or in the future.

Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence

Competition With Invasive Species

An invasion by the New Zealand mudsnail into the lower Pit River drainage could constitute a serious threat to the Goose Valley pebblesnail due to competition for food and space (see canary duskysnail, above). However, we found no information to indicate New Zealand mudsnails are currently in the lower Pit River, nor did we find specific information to indicate the likelihood of an invasion by New Zealand mudsnails in the near future. Additionally, the occupied spring at Goose Valley would be less likely to be colonized by the New Zealand mudsnail because it drains into Goose Valley, where it is used for agriculture, rather than into the Pit River, which is visited by boaters and fishermen who may inadvertently transport the mudsnail from previously visited sites.

Changes in Precipitation and Water Availability Due to Climate Change

See our discussion of climate change in general in the *Changes in Precipitation and Water Availability Due to Climate Change* section under ''Factor A'' in *Five-Factor Evaluation of Threats for the Canary Duskysnail.* Climate change is not expected to significantly change total precipitation in northern California, but may affect seasonal water availability in some areas due to changes in snowpack melting times and the proportion of precipitation falling as rain rather than snow (Dettinger *et al.* 2004, pp. 43, 44). However, the water supplying springs occupied by the Goose Valley pebblesnail in the middle Pit River drainage is collected from wide areas in the Medicine Lake highlands (Service 1998, p. 18). Rain and snowmelt in those areas percolate through porous volcanic rocks to collect in large aquifers, thereby holding extra water from seasons when rain is plentiful and delivering it through springs during seasons when it is not. Resulting spring flows are highly stable in volume, temperature, and clarity (Service 1998, p. 46). Similarly, the size of the aquifer that supplies the water for the Goose Valley spring is estimated at approximately 18 square km (7 square mi) (CDWR 2003, p. 1). All occupied locations of the Goose Valley pebblesnail are in springs or small spring-fed streams, rather than in the main current of the Pit River, and so are likely to be protected from temperature and flow variations by the springs' stable flows. Accordingly, we do not expect changes in precipitation or water availability due to climate change to significantly affect the species.

Fire

Fire could potentially affect Goose Valley pebblesnails by increased siltation due to the accumulation of ash or subsequent erosional deposition of soil in their springs or streams. However, most siltation should clear relatively quickly from the four occupied locations in the lower Pit River drainage, because the flow rates for those locations are high (Haley 2012b, p. 1). Biologists working on mollusk surveys in the lower Pit River both before and after the Shasta-Trinity Unit (SHU) Lightning Complex Fire of early August 2009 (PGE 2010, p. 13) did not consider the impacts to nearby springs and streams to be serious or lasting (Ellis and Haley 2012, p. 1). A search of fire data archived by the California Department of Forestry and Fire Protection (CAL FIRE) and extending back to 2003, indicates that the SHU Lightning Complex Fire, at 17,623 ac (7,132 ha) (CAL FIRE 2009, p. 1) was the largest in Shasta County on record (Service 2012, p. 1). Future Shasta County fires are therefore likely to be smaller than the SHU Lightning Complex Fire, and to have smaller impacts (such as less siltation from the accumulation of ash). Since the SHU Lightning Complex fire did not produce serious impacts to Goose Valley pebblesnail habitats, smaller fires would not be expected to either.

Summary of Factor E

In summary, the Goose Valley pebblesnail is protected from likely impacts of climate change and fire by the particular characteristics of its habitat. Although potential competition from the New Zealand mudsnail is cause for concern, no site currently occupied by Goose Valley pebblesnail has been colonized, and there is nothing to indicate the New Zealand mudsnail will colonize multiple locations occupied by the Goose Valley pebblesnail. There is also no direct evidence to show that any such occupied locations would be extirpated by such a colonization, were it to occur. The two species are not known to have interacted in the past. We therefore conclude, based on the best available scientific and commercial information, that other natural or manmade factors such as competition from the New Zealand mudsnail, changes in

precipitation or water availability due to climate change, or fire do not constitute significant threats to the Goose Valley pebblesnail now or in the future.

Finding for the Goose Valley Pebblesnail

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats faced by the Goose Valley pebblesnail. We reviewed the petition, available published and unpublished scientific and commercial information, and information submitted to us during our status review. This finding reflects and incorporates that information. We also consulted with recognized authorities on this species and Federal and State resource agencies. Although only 11 occupied sites are known for the Goose Valley pebblesnail, a review of the best available information does not indicate that populations at any site are in decline, or that any sites are likely to be lost due to impoundments, agriculture, diversions and grazing, overutilization, disease or predation, the inadequacy of existing regulatory mechanisms, competition with invasive species, changes in precipitation and water availability due to climate change, or fire, now or in the foreseeable future. The best available scientific and commercial information at this time does not indicate that there is likely to be a change in any of these stressors in the future.

Based on our review of the best available scientific and commercial information pertaining to the five factors, we find that the threats as described above, either alone or in combination, are not of sufficient imminence, intensity, or magnitude to indicate that the Goose Valley pebblesnail is in danger of extinction (endangered) or likely to become endangered within the foreseeable future (threatened), throughout all of its range.

Significant Portion of the Range

Having determined that the Goose Valley pebblesnail is not endangered or threatened throughout all of its range, we must next consider whether there are any significant portions of the range where the Goose Valley pebblesnail is in danger of extinction or is likely to become endangered in the foreseeable future. See *Significant Portion of the Range* under Summary of Procedures for Determining the Listing Status of Species.

We evaluated the current range of the Goose Valley pebblesnail to determine if there is any apparent geographic concentration of potential threats for the species. The Goose Valley pebblesnail is highly restricted in its range and the threats occur throughout its range. We considered the potential threats due to impoundments, agriculture, diversions and grazing, overutilization, disease or predation, the inadequacy of existing regulatory mechanisms, competition with invasive species, changes in precipitation and water availability due to climate change, and fire. We found no concentration of threats that suggests that the Goose Valley pebblesnail may be in danger of extinction in a portion of its range. We found no portions of its range where potential threats are significantly concentrated or substantially greater than in other portions of its range. Therefore, we find that factors affecting the species are essentially uniform throughout its range, indicating no portion of the range of the species warrants further consideration of possible endangered or threatened status under the Act.

We find that the Goose Valley pebblesnail is not in danger of extinction now, nor is likely to become endangered within the foreseeable future, throughout all or a significant portion of its range. Therefore, listing the Goose Valley pebblesnail as endangered or threatened under the Act is not warranted at this time.

Hat Creek Pebblesnail (Fluminicola umbilicatus)

Species Information for the Hat Creek Pebblesnail

Taxonomy and Species Description

The Hat Creek pebblesnail is an aquatic snail that was formally named and described in 2007 (Hershler *et al.* 2007, p. 407). This species combines two taxa previously considered likely species but never formally described, the umbilicate pebblesnail (*Fluminicola* n. sp. 19) (Frest and Johannes 1999, p. 55) and the Lost Creek pebblesnail (*Fluminicola* n. sp. 20) (Frest and Johannes 1999, pp. 55, 59). The shell of the Hat Creek pebblesnail is subglobose (rounded top) to ovate conic (egg shaped top), and ranges from 2.1 to 5.4 mm (0.08 to 0.2 in) tall, with 3.25 to 4.5 major whorls (Hershler *et al.* 2007, p. 409). The periostracum can be tan, brown, or light green. The head is dark brown to almost black. Adult Hat Creek pebblesnails are somewhat unusual among *Fluminicola* species in having a visible open space near the opening of the shell, called an umbilicus, around which the whorls wrap (Frest and Johannes 1999, pp. 55, 58).

Distribution

The Hat Creek pebblesnail is known from five locations in the upper Hat Creek watershed, Shasta County, close to the intersection of State Highways 44 and 89. The locations fall into two groups, one of which centers on Hat Creek itself and the other on nearby Lost Creek. Lost Creek disappears into a lava tube, and is presumed to connect to Hat Creek (ORNHIC 2004f, p. 1). The groups are roughly 13 km (8 mi) apart, and the furthest distance of occupied locations within each group is roughly 1 km (0.6 mi). One occupied location in each group is on Lassen National Forest land, while the others are on private inholdings within the general boundaries of the National Forest.

Habitat and Biology

The Hat Creek pebblesnail appears limited to cold water springs and spring runs (Frest and Johannes 1999, pp. 56, 60). It occurs on sand-gravel substrates, and on water plants such as watercress (genus *Nasturtium,* formerly *Rorippa*) and brooklime (*Veronica sp.*). It grazes on perilithon and periphyton. We have no specific information regarding the reproduction of this species, but members of the *Fluminicola* genus typically live a single year and breed only once (Furnish and Monthey 1999, Sect. 4, p. 7 and Sect. 6, p. 4; ORNHIC 2004f, p. 2). They generally lay eggs in the spring, which hatch in 2 to 4 weeks. They are not known to disperse widely, and are highly sensitive to water pollution, decreases in dissolved oxygen, elevated temperatures, and sedimentation (Furnish and Monthey 1999, Sect. 4, pp. 7, 8).

Five-Factor Evaluation of Threats to the Hat Creek Pebblesnail

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Timber Production

Lassen National Forest plans to reduce fuel loads by removing small conifers upstream of the two southernmost sites occupied by Hat Creek pebblesnails (Burton 2012, p. 1). Such operations, if not carefully conducted, could potentially remove shading foliage and collapse riverbanks, thereby causing siltation and increased water temperatures that could impact Hat Creek pebblesnails downstream. However, the operations will take place in Riparian Conservation Areas (RCAs, discussed below), and are subject to protective regulations likely to prevent serious habitat impacts. In keeping with these regulations, the fuel reduction projects will proceed with a minimum

of disturbance, and conifers will be cut by hand to avoid unnecessary use of heavy machinery near the stream (Burton 2012, p. 1).

Timber Production—Protective Regulatory Mechanisms

The Sierra Nevada Forest Plan Amendment (SNFPA)—The SNFPA is a set of amendments to the resource management plans of national forests in the Sierra Nevada and Modoc Plateau areas of California (USDA 2004, p. 15). The SNFPA applies to those portions of the Lassen National Forest not covered by the NWFP, including the two areas within the National Forest occupied by Hat Creek pebblesnails. The SNFPA includes a sub-program called the Aquatic Management Strategy (AMS), which establishes RCAs around perennial streams and other hydrological or topographic depressions, such as ponds and springs (USDA 2004, pp. 32, 42). Activities within the RCAs require site-specific analyses to ensure the activity conforms to several riparian conservation objectives (USDA 2004, p. 33). Those objectives include maintaining or restoring geomorphic and biological characteristics of special aquatic features and ensuring that activities enhance or maintain physical and biological characteristics associated with aquatic and riparian-dependent species. Although they also include provisions for improving habitat, such improvements are subject to funding and may take time to address situations in which habitat has already been impacted, such as recreational vehicle impacts upstream of the occupied sites on Hat Creek.

Grazing

The two occupied sites on Hat Creek are not near grazed areas, but two of the three occupied sites on Lost Creek are on private land in a location that is subject to grazing (Burton 2012, p. 1). The third Lost Creek site is on ungrazed land in the Lassen National Forest, about 0.64 km (0.4 mi) downstream from the grazed area. Cattle grazing in and around streams can trample banks and riparian vegetation, resulting in wider, shallower, muddier, and less shaded waters (Meehan and Platts 1978, pp. 275–276; Stephenson and Street 1978, p. 152; Kauffman and Krueger 1984, p. 432). If such impacts were to occur in the vicinity of the sites occupied by Hat Creek pebblesnails, they could threaten the snail populations, which (as discussed under Habitat and Biology, above) are highly sensitive to water pollution, decreases in dissolved oxygen, elevated temperatures, and sedimentation. However, the stream in the area of the occupied sites is protected from cattle by a combination of fencing, brush, and rocks (Suarez 2012, p. 1). Cattle are typically driven across the stream twice per year, but the substrate at the crossing site is primarily rock, so the stream bed suffers little trampling damage.

Impoundments

The two occupied sites on Hat Creek are not near impoundments, but the three occupied sites on Lost Creek are downstream of one small impoundment and upstream from another, with approximately 2.5 km (1.5 mi) of perennial stream between the two reservoirs (Burton 2012, p. 1). There is some potential for increases in water temperatures in the Lost Creek occupied sites due to releases from the upper reservoir. However, the small upstream reservoir exposes relatively little still surface water to the sun as compared to the much larger Pit 3, 4, and 5 reservoirs, and so is less likely to produce significantly higher downstream temperatures (see Impoundments, under Canary Duskysnail, above). Both the upstream reservoir and the water below it in Lost Creek support coldwater fish such as rainbow trout (Burton 2012, p. 1).

The downstream reservoir is over 200 m (650 ft) from the nearest occupied location. The downstream dam includes an overflow outlet, so the reservoir is unlikely to back up during high flows and inundate sites occupied by Hat Creek pebblesnails.

Recreation

An area about 4.8 km (3 mi) long along Hat Creek, upstream of the occupied sites, has been heavily impacted by off-highway vehicle (OHV) use in and around the creek (Burton 2012, p. 1). Impacts at the OHV site include crushed riparian vegetation and collapsed stream banks, resulting in increased siltation and potentially higher temperatures. However, the nearest site occupied by the Hat Creek pebblesnail is a spring off the side of Hat Creek (Hershler *et al.* 2007, p. 407), while the other occupied site in the area is farther downstream in Hat Creek, approximately 2 km (1.2 mi) from the edge of the recreational area and 2.6 km (1.6 mi) from the area of primary impact. Because of distance to the second site, and spring flows from the first, sediment and increased temperatures produced by upstream recreational use would be unlikely to significantly affect either occupied site. There is no evidence of OHV impacts at the spring.

Accordingly, although timber management, grazing, impoundments, and OHV use all occur in the general vicinity of occupied sites, the best available evidence indicates they are not impacting occupied habitat. We therefore conclude, based on the best available scientific and commercial information, that the present or threatened destruction, modification or curtailment of its habitat or range does not constitute a significant threat to the species now or in the future.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Our review of the best available scientific and commercial information yielded nothing to indicate that overutilization for commercial, recreational, scientific, or educational purposes is occurring at this time, or is likely to occur in the future. We therefore conclude such overutilization does not constitute a threat to the Hat Creek pebblesnail.

Factor C. Disease or Predation

Disease

We reviewed the best available scientific and commercial information regarding this species and other similar species, and found no evidence to indicate that disease is impacting Hat Creek pebblesnail populations.

Predation

Predation by the introduced signal crayfish could threaten Hat Creek pebblesnail populations if the signal crayfish were present in sufficiently high densities (see canary duskysnail, above). However, we have no direct evidence that either signal or Shasta crayfish are present in the upper portions of Hat Creek or Lost Creek. The closest area for which we have signal crayfish density information is the middle Pit River, where densities were roughly equal to native crayfish densities as measured in the upper Fall River (Ellis 1999, p. 58; PGE 2011b, pp. iii, 10; PGE 2012b, p. 9). Hence, the available evidence does not support the contention that signal crayfish are present in Hat or Lost Creeks in sufficiently high densities to pose a predation risk to the Hat Creek pebblesnail. Furthermore, the information does not indicate any trend in the densities of either crayfish that would lead us to a conclusion that the predation risk would increase in the future.

We therefore conclude, based on the best available scientific and commercial

information, that neither disease nor predation constitutes a significant threat to the species now or in the future.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Under this factor, we examine whether existing regulatory mechanisms are inadequate to address the threats to the species discussed under the other factors. Section 4(b)(1)(A) of the Act requires the Service to take into account ''those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species...''. We interpret this language to require the Service to consider relevant Federal, State, and Tribal laws and regulations when developing our threat analyses. Regulatory mechanisms, if they exist, may preclude the need for listing if we determine that such mechanisms adequately address the threats to the species such that listing is not warranted. The analysis of threats to the Hat Creek pebblesnail under the other factors included consideration of the ameliorative effects of regulatory mechanisms where applicable, such as those discussed under Factor A and under *Generally Applicable Federal Regulatory Mechanisms,* above.

Having evaluated the significance of the threat as mitigated by any such conservation efforts, we analyze under Factor D the extent to which existing regulatory mechanisms are inadequate to address the specific threats to the species. We found no significant threats to the Hat Creek pebblesnail under the other factors, therefore, the analysis of any existing regulatory mechanisms' adequacy to address threats is not applicable. Consequently, after reviewing the best available commercial and scientific information, we conclude that the inadequacy of existing regulatory mechanisms is not a threat to the Hat Creek pebblesnail now or in the future.

Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence

Competition With Invasive Species

New Zealand mudsnails are not currently known to occur within the range of the Hat Creek pebblesnail (Lost Creek and upper Hat Creek). If New Zealand mudsnails were to become established in those areas, they would likely compete with Hat Creek pebblesnails for food and space (see canary duskysnail, above). Typically, New Zealand mudsnails establish themselves in new areas after being transported on boating or angling equipment (ANTSF 2005, p. 1). Upper Hat Creek and Lost Creek are popular fishing destinations, but lack boating facilities, so the likelihood of New Zealand mudsnail infestation in these areas may be somewhat lower than for areas in the canary duskysnail's range that support both fishing and boating, such as Lake Britton.

Changes in Precipitation and Water Availability Due to Climate Change

See our discussion of climate change in general in the *Changes in Precipitation and Water Availability Due to Climate Change* section under ''Factor A'' in *Five-Factor Evaluation of Threats for the Canary Duskysnail.* Climate change is not expected to significantly change total precipitation in northern California, but may affect seasonal water availability in some areas due to changes in snowpack melting times and the proportion of precipitation falling as rain rather than snow (Dettinger *et al.* 2004, pp. 43, 44). However, the water supplying springs emptying into Lost Creek and upper Hat Creek are collected from wide areas in the Lassen volcanic highlands (Service 1998, p. 18). Rain and snowmelt in those areas percolate through porous volcanic rocks to collect in large aquifers, thereby holding extra water from seasons when rain is plentiful and delivering it through springs during seasons when it is not. Resulting spring flows are highly stable in volume, temperature and clarity (Service 1998, p. 46). Accordingly, we do not expect changes in precipitation or water availability due to climate change to significantly affect the species.

Catastrophic Events—Highway Spill

Spills from tank trucks carrying chemicals, such as pesticides or gasoline, on State Highway 44 near the two occupied sites on Hat Creek could potentially impact the Hat Creek pebblesnails at those sites. Chemical spills can eliminate pebblesnail populations (see discussion of Chemical Spills under Nugget Pebblesnail (Fluminicola seminalis), below). However, the more upstream of the two occupied sites is in a spring near the creek (Hershler *et al.* 2007, p. 407), and the highway pulls away from the creek upstream of that location, so a tanker spill would have to occur directly above that site in order to significantly impact the pebblesnail population there. The highway runs close to the creek from that point to the second occupied site, a distance of about 1.2 km (0.75 mi), so a spill somewhere along that stretch might impact the second site. We are not aware of any previous spills within that region, however, and we consider the likelihood of a major chemical spill within that relatively small area to be low.

Summary of Factor E

We find that neither highway spills, competition with the New Zealand mudsnail, nor changes in precipitation or water availability due to climate change are a threat to the Hat Creek pebblesnail. Although a chemical spill off the highway could potentially impact up to two locations, the likelihood of such an event is extremely low. No site occupied by the Hat Creek pebblesnail has been colonized by the New Zealand mudsnail and the lack of boating opportunities makes invasion by the mudsnail less likely. The springs supplying Hat and Lost Creeks are resistant to the fluctuations in temperature and water availability associated with predicted climate changes. We therefore conclude that, based on the best available scientific and commercial information, that other natural or manmade factors as described above, do not constitute significant threats to the Hat Creek pebblesnail now or in the future.

Finding for the Hat Creek Pebblesnail

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats faced by the Hat Creek pebblesnail. We reviewed the petition, available published and unpublished scientific and commercial information, and information submitted to us during our status review. This finding reflects and incorporates that information. We also consulted with recognized authorities on this species and Federal and State resource agencies. Although only five occupied sites are known for the Hat Creek pebblesnail, a review of the best available data does not indicate that populations at any site are in decline, or that any sites are likely to be lost due to timber production and management, grazing, impoundments, recreation, overutilization, disease or predation, the inadequacy of existing regulatory mechanisms, competition with invasive species, changes in precipitation and water availability due to climate change, or catastrophic events such as highways spills, now or in the foreseeable future. The best available scientific and commercial information at this time does not indicate that there is likely to be a change in any of these stressors in the future.

Based on our review of the best available scientific and commercial information pertaining to the five factors, we find that the threats as

described above, either alone or in combination are not of sufficient imminence, intensity, or magnitude to indicate that the Hat Creek pebblesnail is in danger of extinction (endangered) or likely to become endangered within the foreseeable future (threatened), throughout all of its range.

Significant Portion of the Range

Having determined that the Hat Creek pebblesnail is not endangered or threatened throughout all of its range, we must next consider whether there are any significant portions of the range where the Hat Creek pebblesnail is in danger of extinction or is likely to become endangered in the foreseeable future. See *Significant Portion of the Range* under Summary of Procedures for Determining the Listing Status of Species.

We evaluated the current range of the Hat Creek pebblesnail to determine if there is any apparent geographic concentration of potential threats for the species. The Hat Creek pebblesnail is highly restricted in its range and the threats occur throughout its range. We considered the potential threats due to timber production and management, grazing, impoundments, recreation, overutilization, disease or predation, the inadequacy of existing regulatory mechanisms, competition with invasive species, changes in precipitation and water availability due to climate change, and catastrophic events such as highways spills. We found no concentration of threats that suggests that the Hat Creek pebblesnail may be in danger of extinction in a portion of its range. We found no portions of its range where potential threats are significantly concentrated or substantially greater than in other portions of its range. Therefore, we find that factors affecting the species are essentially uniform throughout its range, indicating no portion of the range of the species warrants further consideration of possible endangered or threatened status under the Act.

We find that the Hat Creek pebblesnail is not in danger of extinction now, nor is likely to become endangered within the foreseeable future, throughout all or a significant portion of its range. Therefore, listing the Hat Creek pebblesnail as endangered or threatened under the Act is not warranted at this time.

Nugget Pebblesnail (Fluminicola seminalis)

Species Information for the Nugget Pebblesnail

Taxonomy and Species Description

The nugget pebblesnail was first described as *Palludina seminalis* in 1842 (Hershler and Frest 1996, p. 15). After undergoing several name changes, it was redescribed as *Fluminicola seminalis* in 1996 (Hershler and Frest 1996, p. 15). It has a globose to broadly conical shell with 4 to 4.5 whorls (Frest and Johannes 1995b, p. 49; Hershler and Frest 1996, p. 16). The shell can be tan, brown, or light green, and has a large opening. Its distinguishing features, as compared to other pebblesnails, include (among other features) its relatively large size (about 6 to 8 mm (0.24 to 0.31 in), thick periostracum, and thin parietal lip (on the side of the opening toward the inside of the whorls) (Hershler *et al.* 2007, p. 405). The snail itself is black with a pale gray head (Hershler and Frest 1996, p. 16). Although pebblesnails in general (*Fluminicola* genus) had previously been considered part of the Hydrobiidae family (Hershler *et al.* 2003, p. 275), they have since been reassigned to the Lithoglyphidae family (Hershler *et al.* 2007, p. 371).

Distribution

The nugget pebblesnail is known from approximately 44 occupied sites in Shasta, Lassen, and Tehama Counties. The sites can be grouped into five general areas: The mid and lower Pit River and nearby tributaries including Hat Creek; the upper Fall River drainage; Ash Creek (a tributary of the upper Pit River in Lassen County); the McCloud River near Lake Shasta; and Battle Creek, along the Shasta-Tehama County boundary. The majority of known sites (37 of 44) are in the mid and lower Pit River and upper Fall River areas. The local abundance of this snail at occupied sites can be high (Frest and Johannes 1995b, p. 50).

The nugget pebblesnail was formerly widespread in the upper Sacramento River above Lake Shasta, but was apparently extirpated from the entire region in 1991 due to the Cantara Spill, in which a railcar containing the herbicide metam sodium derailed and spilled its contents into the river (Frest and Johannes 1995b, pp. 13, 50; Hershler and Frest 1996, p. 16; ORNHIC 2004k, p. 1).

Habitat and Biology

The nugget pebblesnail prefers gravel-boulder substrate and clear, cold, flowing water, but has been found on soft substrate in a few very large spring pools (Frest and Johannes 1995b, p. 50). It is a riparian associate, apparently grazes on perilithon and periphyton, and possibly on fine particles of detritus as well (Frest and Johannes 1993, p. 54; Furnish *et al.* 1997, p. 31). We have no specific information regarding the reproduction of this species, but members of the *Fluminicola* genus typically live a single year and breed only once (Furnish and Monthey 1999, Sect. 3, p. 4; ORNHIC 2004f, p. 2). They generally lay eggs in the spring, which hatch in 2 to 4 weeks. They are not known to disperse widely, and are sensitive to water pollution, decreases in dissolved oxygen, elevated temperatures, and sedimentation (Furnish and Monthey 1999, Sect. 3, pp. 5, 8).

Five-Factor Evaluation of Threats to the Nugget Pebblesnail

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Impoundments

Thirteen of the 44 occupied sites are in or along the lower Pit River below Lake Britton (Hershler *et al.* 2007, p. 405; Haley 2012a, p. 3; PGE 2011, pp. 26, 37; PGE 2012 p. 27). Twelve of those 13 sites were monitored by PGE from 2009 through 2011, in accordance with the 2007 relicensing requirements for the Pit 3, 4, and 5 dams (see canary duskysnail, above). Flow releases from the dams for 2009 and 2010 were at interim levels (higher than in previous years but lower than the final levels required by the relicensing agreements (PGE 2010, pp. 1, 2). Flow releases had reached their final required levels in 2011 and are expected to remain at those levels thereafter.

Increased flows from dams may negatively impact nugget pebblesnails by raising water temperatures (see canary duskysnail, above) (Ellis 2012, p. 1). As average flows increased from 2009 to 2011, average temperatures did in fact go up, and average density of nugget pebblesnails decreased at the four locations monitored in the Pit 3 reach (PGE 2010, p. 35; PGE 2011, pp. 24, 26, 37; PGE 2012, pp. 24, 27). Average densities of nugget pebblesnails likewise decreased each year over the 3-year period at each of four sites in the Pit 5 reach. However, average water temperatures in the Pit 5 reach were highest in 2009 at one of those locations, highest in 2010 at another location, and remained essentially unchanged at a third location. This may be due to variations in air temperature

across the 3 years (PGE 2010, p. 35; PGE 2011, p. 24; PGE 2012, p. 24). In the Pit 4 reach, there was a varied response, with July surveys showing an overall average increase in nugget pebblesnail density from 2009 to 2011, and August surveys showing a (smaller) overall decrease. Thus, increased water temperatures and increased flows were closely correlated with decreased population densities in the Pit 3 reach, but not in the Pit 4 or 5 reaches.

Despite any decreases, nugget pebblesnails remained common throughout the three survey years, and no sites were extirpated (PGE 2011, pp. 26 37; PGE 2012, p. 27). Average densities in 2009 ranged from 240 to 4,970 snails per square meter, while in 2011 they ranged from 10 to 5,058 snails per square meter. The nugget pebblesnail was also the most common aquatic snail in each of the three areas surveyed in 2009 (PGE 2010, p. 41), whereas, in the following 2 years it was the most common in the Pit 3 and Pit 4 reaches, but the second-most common in the Pit 5 reach (PGE 2011, p. 29; PGE 2012, p. 28). Accordingly, while the current data from PGE surveys indicate that increased flow releases may have impacted the nugget pebblesnail in at least some of their lower Pit River sites, high densities of nugget pebblesnails persist in all three reaches despite these impacts. We therefore do not consider the existing data to indicate that increased flows are likely to threaten the continued existence of the nugget pebblesnail in the area. PGE will continue to monitor mollusk populations, so any significant declines in nugget pebblesnail populations should be detected promptly (PGE 2012, p. 1).

Four sites in the lower Hat Creek watershed also are potentially affected by dams. Two of these are in Baum Lake near the outflow of Crystal Lake, and close to the Baum Lake location of canary duskysnails (discussed above) (Hershler *et al.* 2007, p. 405). Another occupied site is at Crystal Lake, a spring-fed lake that flows into Baum Lake at its eastern end (PGE 2006, fig 1, p. 46; Hershler *et al.* 2007, p. 405). A fourth site is upstream of Baum Lake, just below the PGE dam (Hat Creek 1) that forms Cassel Pond. Licensing requirements, established by the Federal Energy Regulatory Commission (FERC) when the two dams were relicensed in 2002 establish minimum flows of 8 cfs in Hat Creek below the Hat Creek 1 dam (White 2008, pp. 1, 2) and also require PGE to maintain the surface of Baum Lake at a constant height (FERC 2011, p. 1). Accordingly, the occupied sites in Baum Lake are likely to be kept at a constant depth, and the occupied site below the Hat Creek 1 dam is unlikely to be left without water. The nugget pebblesnails at those locations are therefore unlikely to lose the cold, well-oxygenated flows they require.

Two occupied sites are in the McCloud River near Lake Shasta (Hershler *et al.* 2007, p. 405; Haley 2012a, p. 3). One could potentially be inundated by the lake if a proposal to raise the height of Shasta dam up to 18.5 ft (5.6 m) is carried out (U.S. Bureau of Reclamation (USBR) 2007, p. ES 6; USBR 2011, pp. 1–6). Inundation resulting from the higher reservoir level made possible by raising the dam height would likely remove necessary flows and would extirpate the site. The best available scientific and commercial information does not indicate the likelihood of the proposal being implemented (USBR 2011, pp. 182–184), nor the likelihood of relocating the nugget pebblesnails or otherwise mitigating the project's impact.

Water Quality

The Pit River is considered a water-quality limited segment for 198 km (123 mi) upstream of Shasta Lake, due to added nutrients from agriculture and grazing that encourage algal growth (see canary duskysnail above) (SWRCB 2010a, p. 164). Sixteen sites occupied by the nugget pebblesnail are within that area, including the 12 sites considered above with regard to impoundments, and an additional 4 sites upstream of the Pit 3, 4 and 5 reaches. Although we lack information regarding the impacts (if any) of the impaired water quality on the snails, snail populations at 12 of the 16 occupied sites are subject to annual monitoring (see *Impoundments*). At this point, after only 3 years of monitoring and 1 year at the full flow releases established by the operating license, the data do not indicate that water quality is a threat to nugget pebblesnail populations in the lower Pit River.

Sediment levels in the upper Fall River and high pH in Eastman Lake (see canary duskysnail, above) may affect nugget pebblesnails at three occupied sites in those locations. Three additional occupied sites in upper Ash Creek (Lassen County) may also be subject to alkalinity levels slightly above the established water quality limit of 8.5 pH (SWRCB 2010a, p. 137; SWRCB 2010b, p. 1). Three water quality samples from the area showed pH levels of 8.62, 8.53, and 8.58 (SWRCB 2010b, p. 8).

The three occupied sites in upper Ash Creek discussed above may also be subject to levels of *Escherichia coli* (*E. coli*) bacteria (an indicator of sewage contamination) exceeding water quality standards (SWRCB 2010 (Ash Cr), pp. 5, 6). A single sample taken from upper Ash Creek in 2005 showed an *E. coli* density greater than three times the water quality standard for non-contact recreation, and greater than 5.5 times the standard for water contact recreation (SWRCB 2010 (Ash Cr), pp. 6, 7). The source of contamination was not established (SWRCB 2010(Ash Cr), p. 5), although feces from grazing cattle is a possibility (see below). Although nugget pebblesnails are considered sensitive to water pollution (Furnish and Monthey 1999, Sect. 3, pp. 5, 8), their response to *E. coli* contamination is not known. No population trend data are available for nugget pebblesnails in Ash Creek, therefore, it is difficult to infer any direct response to *E. coli* levels at this location.

Grazing and Logging

In the middle and lower Pit River area (including lower Hat Creek), 7 occupied sites are on National Forest lands in the NWFP area, 14 are on PGE lands, and 1 is in MacArthur-Burney State Park (Stewardship Council 2007, Vol. 2, pp. PM–20, PM–30, PM–38, PM–58). The sites on NWFP lands benefit from the SMP and ACS, (see *Generally Applicable Federal Regulatory Mechanisms,* above) and so are unlikely to be threatened by grazing or logging taking place on those lands. Such activities would be subject under the SMP to predisturbance surveys and management of known sites to support species persistence (Molina *et al.* 2006, p. 312; Olson *et al.* 2007, abstract). Under the ACS they would also be subject to close regulation within riparian reserve buffer areas so as to maintain water quality and aquatic ecosystem integrity (USDA and USDI 1994a, p. 9; USDA and USDI 1994b, pp. C–31–C–38). The site at the State Park is also unlikely to be threatened by grazing or logging, as the Park is committed to maintaining its scenic features in a natural condition (California Department of Parks and Recreation (CDPR) 1997, p. 46), and to take measures to monitor and maintain natural water quality, channel flow, and sediment transport rates (CDPR 1997, p. 47). Although the State is considering closing several State Parks in order to save money, neither MacArthur-Burney State Park, nor Ahjumawi Lava Springs State Park (discussed below) are among those being considered for closure (CDPR 2012, p. 2).

Lands owned by PGE are also subject to conservation management. Due to bankruptcy proceedings in 2004 (Stewardship Council 2007, Vol. 1, pp. ES–1, ES–2), PGE accepted a settlement

agreement with the California Public Utilities Commission (PUC) that requires PGE to protect the lands associated with its dams, either by establishing conservation easements or by donating the land to qualified conservation managers. A nonprofit corporation was established that published a land conservation plan in 2007 (Stewardship Council 2007, Vol. 1, p. ES–1). As the plan indicates, grazing has been eliminated to protect water quality in the areas of the Pit 3, 4, and 5 dams and associated reaches since the late 1980s (Stewardship Council, Vol. 2, p. PM–47). Grazing was eliminated in the general vicinity of the PGE dams on Hat Creek in 2001 (Stewardship Council 2007, Vol. 2, p. PM–31). Current timber management activities on the PGE Hat Creek and Fall River lands are restricted to mitigating for watershed and forest health issues (Stewardship Council 2007, Vol. 2, pp. PM–3, PM–31). A single timber management unit of 2,499 ac (1,011 ha) exists in the vicinity of Lake Britton and the Pit 3 reach and is managed for multiple uses (Stewardship Council, Vol. 2, p. PM–40). In the Pit 4 reach, six timber management units totaling 2,123 ac (859 ha) are currently managed for sustainable production, with the most recent harvest in 2005 and 2006 (Stewardship Council, Vol. 2, p. PM–50).

Timber harvest on private lands is governed by the state Nejedly-Z'berg Forest Practice Act (FPA). The FPA requires timber harvesters to submit a publicly reviewable Timber Harvest Plan (THP) to the California Department of Forest and Fire Protection (CAL FIRE) (Kier Associates 2011b, p. 2) and to maintain buffers around fish-bearing streams of at least 75 ft (23 m) within which at least 50 percent of overstory and understory vegetation and 75 percent of total original vegetation must remain uncut (CAL FIRE 2012, pp. 68–72).

In the upper Fall River drainage, eight occupied sites are on private land, one is on an Indian PDA, and three are in the Ahjumawi Lava Springs State Park. Various habitat improvement measures have been carried out by private landowners in the area, including the erection of exclusion fencing, bank stabilization projects, and the replacement and upgrade of a railroad crossing that had collapsed twice in the past (see canary duskysnail, above) (FRRCD 2005, pp. 1–3; Ellis and Haley 2012, p. 1). Landowners also took steps to reduce the potential for serious wildfires and to prevent erosion of sediment from a nearby meadow (FRRCD 2005, p. 3).

A general plan is not yet completed for Ahjumawi Lava Springs State Park, but the California State Park System maintains a resource management program with the general goal of protecting, restoring, and maintaining the natural resources within the Parks (CDPR 2012, p. 2).

There are three occupied sites in upper Ash Creek in Lassen County; two occupied sites are in the Modoc National Forest and the other is on private land. The sites in the National Forest are in the Ash Creek management unit of the Round Valley grazing allotment, where grazing is not currently permitted (Raymond 2012, p. 1). Grazing does occur on private lands farther upstream from the National Forest, however (Raymond 2012, p. 1), so it may occur in the vicinity of the occupied site on private land. Grazing in and around streams on private land is not closely regulated, and can lead to trampled vegetation, fecal matter in the water, and a muddier and warmer stream (Meehan and Platts 1978, p. 276; Stephenson and Street 1978, p. 152; Kauffman and Krueger 1984, p. 432), all of which would negatively impact the nugget pebblesnail. We do not have information regarding the extent of grazing on private lands in the area, nor of the extent to which protective management actions may have been taken.

The Modoc National Forest also expects to offer a timber sale this year in the vicinity of Ash Creek, possibly leading to timber removal in the spring of 2013 (Raymond and Bryan 2012, p. 1). Timber removal would be subject to restrictions established by the SNFPA (see Hat Creek pebblesnail, above).

Summary of Factor A

In summary, flow rates from the Pit 3, 4, and 5 dams, as well as impaired water quality, may be affecting occupied locations in the lower Pit River, but the nugget pebblesnail remains extremely common in the area, and ongoing monitoring will alert us if species persistence in the area becomes threatened. Potential water quality issues may also apply to three sites in the upper Fall River drainage and to three sites at Ash Creek, but the available data do not show that resident nugget pebblesnail populations are, or are likely to be, impacted by these issues. Available data also do not suggest that any occupied sites are threatened by grazing or logging, and most occupied locations along the Pit River also receive high levels of regulatory protection from grazing and logging. Seven of those sites are protected by the SMP and ACS, fourteen are protected by conservation provisions established for PGE lands under a settlement agreement, and one is protected by State Park regulations. In the upper Fall River drainage several habitat improvement projects have been completed by landowners, while in the Ash Creek drainage two occupied sites are on un-grazed Federal land protected by the SNFPA, and one is on grazed private land. We conclude, based on the best available scientific and commercial information, that the present or threatened destruction, modification or curtailment of its habitat or range does not constitute a significant threat to the species now or in the future.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Our review of the best available scientific and commercial information yielded nothing to indicate that overutilization for commercial, recreational, scientific, or educational purposes is occurring at this time or is likely to occur in the future. We therefore conclude such overutilization does not constitute a threat to the nugget pebblesnail.

Factor C. Disease or Predation

Disease

We reviewed the best available scientific and commercial information regarding this species and other similar species, and found no evidence to indicate that disease is impacting nugget pebblesnail populations.

Predation

The nugget pebblesnail occurs in the same general areas as the canary duskysnail, and may also be subject to predation by the introduced signal crayfish. Predation by dense crayfish populations can significantly impact aquatic snails (Lorman and Magnuson 1978, p. 9). However, our only data regarding signal crayfish densities indicate those densities appear to be holding stable at levels equivalent to those of the native Shasta crayfish, alongside which the nugget pebblesnail has evolved (see Canary Duskysnail, above) (Ellis 1999, p. 58; PGE 2011b, pp. iii, 10; PGE 2012b, p. 9). We do not expect occupied areas within the current range of both crayfish species to be subject to high combined crayfish densities, because past monitoring has shown a strong tendency for one or the other crayfish species to be common in an area, but not both (Ellis 1999, pp. 57, 58; Service 2009, p. 9) (see Canary Duskysnail, above). Hence, the available evidence does not support the contention that signal crayfish are

present in the range of the nugget pebblesnail in sufficiently high densities to pose a predation risk to the nugget pebblesnail. Furthermore, the information does not indicate any trend in the densities of the signal crayfish that would lead us to a conclusion that the predation risk would increase in the future.

We therefore conclude, based on the best available scientific and commercial information, that neither disease nor predation constitutes a significant threat to the species now or in the future.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Under this factor, we examine whether existing regulatory mechanisms are inadequate to address the threats to the species discussed under the other factors. Section 4(b)(1)(A) of the Act requires the Service to take into account ''those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species * * *''. We interpret this language to require the Service to consider relevant Federal, State, and Tribal laws and regulations when developing our threat analyses. Regulatory mechanisms, if they exist, may preclude the need for listing if we determine that such mechanisms adequately address the threats to the species such that listing is not warranted. The analysis of threats to the nugget pebblesnail under the other Factors included consideration of the ameliorative effects of regulatory mechanisms where applicable, such as those discussed under Factor A and under *Generally Applicable Federal Regulatory Mechanisms,* above.

Having evaluated the significance of the threat as mitigated by any such conservation efforts, we analyze under Factor D the extent to which existing regulatory mechanisms are inadequate to address the specific threats to the species. We found no significant threats to the nugget pebblesnail under the other factors, therefore, the analysis of any existing regulatory mechanisms' adequacy to address threats is not applicable. Consequently, after reviewing the best available commercial and scientific information, we conclude that the inadequacy of existing regulatory mechanisms is not a threat to the nugget pebblesnail now or in the future.

Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence

Competition With Invasive Species

The New Zealand mudsnail has the potential to outcompete and thereby threaten the nugget pebblesnail if it can establish itself at a significant number of locations that the nugget pebblesnail currently occupies (see canary duskysnail, above). However, the level of threat is somewhat reduced by the nugget pebblesnail's greater range as compared to the canary duskysnail. We consider Lake Britton to be at greatest danger of infestation within that range, due to its ease of access, marina, boat launch, fishery, and nearby state park (Stewardship Council, Vol. 2, pp. PM–37–39). As discussed above in relation to the canary duskysnail, once the first infestation point is established, new infestation points could be expected to establish themselves from that base. At that point, if it occurs, we could ascertain whether the New Zealand mudsnail was spreading in a manner likely to threaten the nugget pebblesnail in a significant portion of its range. At the current time, no infestations of New Zealand mudsnail are known within the nugget pebblesnail's range. Accordingly, we do not consider competition from New Zealand mudsnails to be a threat to the canary duskysnail at this time.

Changes in Precipitation and Water Availability Due to Climate Change

See our discussion of climate change in general in the *Changes in Precipitation and Water Availability Due to Climate Change* section under ''Factor A'' in *Five-Factor Evaluation of Threats for the Canary Duskysnail.* Climate change is not expected to significantly change total precipitation in northern California, but may affect seasonal water availability in some areas due to changes in snowpack melting times and in the proportion of precipitation falling as rain rather than snow (Dettinger *et al.* 2004, pp. 43, 44). However, the springs that support sites occupied by the nugget pebblesnail in the middle and lower Pit River and upper Fall River drainages are supplied by large aquifers of porous lava that collect and store water from wide areas, thereby holding extra water from seasons when rain is plentiful and delivering it through springs during seasons when it is not (see canary duskysnail, above). Resulting spring flows are highly stable in volume, temperature, and clarity (Service 1998, p. 46) We lack information regarding aquifer sizes and collection ranges for the six occupied sites that are not in the middle and lower Pit River or upper Fall River drainages, but given the general volcanic geology of the entire area (U.S. National Park Service (USNPS) 2005, p. 1), we consider it most likely that these sites also will maintain relatively constant flow rates and water temperatures despite climate change.

Catastrophic Events—Chemical Spills

The nugget pebblesnail was apparently extirpated from the upper Sacramento River due to a catastrophic spill of herbicide (the Cantara Spill) from a derailed rail car in 1991 (see Distribution, above) (Frest and Johannes 1995b, pp. 13, 50; Hershler and Frest 1996, p. 16; ORNHIC 2004k, p. 1). A rail line owned by the McCloud River Railroad crosses the Pit River just upstream of Lake Britton, but freight service on the line was discontinued in 2006 (Trainweb undated, p. 1). A rail line owned by the Burlington Northern and Santa Fe (BNSF) railroad crosses the Pit River much farther upstream in Lassen County, south of the town of Nubieber, and runs close to the Pit River for almost 4 km (2.5 mi) after the crossing. However, the point where the rail line leaves the vicinity of the Pit River is approximately 50 km (31 mi) upstream of the closest known occupied site on the Pit River. Although the Cantara spill's effects may have reached such a distance (Frest and Johannes 1995b, p. 73), in this case a spill from the BNSF line would have to travel 50 km (31 mi) to affect one occupied nugget pebblesnail site, then approximately 6.7 km (4.2 mi) to affect two more, then approximately 23 km (14 mi) farther (including approximately 11 km (6.8 mi) through Lake Britton) to the next occupied site. If a very large spill were to occur, the most sites it could affect would be the three Pit River sites upstream of Lake Britton. That would still leave 41 known occupied sites, and so would not pose a threat to the species.

Summary of Factor E

In summary, the nugget pebblesnail is protected from likely impacts of changes in precipitation or water availability due to climate change by the particular characteristics of its habitat. Although potential competition from the New Zealand mudsnail is cause for concern, no site currently occupied by nugget pebblesnail has been colonized and the best available information does not indicate it will colonize areas occupied by the nugget pebblesnail, or that it will threaten the nugget pebblesnail with extinction if it does so. We conclude that, based on the best available

scientific and commercial information, that other natural or manmade factors such as competition from the New Zealand mudsnail, changes in precipitation or water availability due to climate change, and chemical spills are not a threat to the nugget pebblesnail now or in the future.

Finding for the Nugget Pebblesnail

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats faced by the nugget pebblesnail. We reviewed the petition, available published and unpublished scientific and commercial information, and information submitted to us during the public comment period following our 90-day petition finding. This finding reflects and incorporates information we received during the public comment period. We also consulted with recognized authorities on this species and Federal and State resource agencies. The nugget pebblesnail occupies 44 sites, and a review of the best available information does not indicate that populations at any site are likely to be extirpated due to impoundments, water quality, grazing and logging, overutilization, disease or predation, the inadequacy of existing regulatory mechanisms, competition with invasive species, changes in precipitation and water availability due to climate change, or catastrophic events such as chemical spills, now or in the foreseeable future. The best available scientific and commercial information at this time does not indicate that there is likely to be a change in any of these stressors in the future.

Based on our review of the best available scientific and commercial information pertaining to the five factors, we find that the threats as described above either alone or in combination, are not of sufficient imminence, intensity, or magnitude to indicate that the nugget pebblesnail is in danger of extinction (endangered) or likely to become endangered within the foreseeable future (threatened), throughout all of its range.

Significant Portion of the Range

Having determined that the nugget pebblesnail is not endangered or threatened throughout all of its range, we must next consider whether there are any significant portions of the range where the nugget pebblesnail is in danger of extinction or is likely to become endangered in the foreseeable future. See *Significant Portion of the Range* under Summary of Procedures for Determining the Listing Status of Species.

We evaluated the current range of the nugget pebblesnail to determine if there is any apparent geographic concentration of potential threats for the species. The nugget pebblesnail is highly restricted in its range and the threats occur throughout its range. We considered the potential threats due to impoundments, water quality, grazing and logging, overutilization, disease or predation, the inadequacy of existing regulatory mechanisms, competition with invasive species, changes in precipitation and water availability due to climate change, and catastrophic events such as chemical spills. We found no concentration of threats that suggests that the nugget pebblesnail may be in danger of extinction in a portion of its range. We found no portions of its range where potential threats are significantly concentrated or substantially greater than in other portions of its range. Therefore, we find that factors affecting the species are essentially uniform throughout its range, indicating no portion of the range of the species warrants further consideration of possible endangered or threatened status under the Act.

We find that the nugget pebblesnail is not in danger of extinction now, nor is likely to become endangered within the foreseeable future, throughout all or a significant portion of its range. Therefore, listing the nugget pebblesnail as endangered or threatened under the Act is not warranted at this time.

Potem Creek Pebblesnail (Fluminicola Potemicus)

Species Information for the Potem Creek Pebblesnail

Taxonomy and Species Description

The Potem Creek pebblesnail was formally named and described in 2007 (Hershler *et al.* 2007, pp. 412–415). Prior to 2007, it was referred to as the ''Potem pebblesnail (*Fluminicola* n. sp. 14)'' (Frest and Johannes 1999, pp. 35–38). It was also referred to as the ''Potem pebblesnail (*Fluminicola* n. sp. 2)'' by Frest and Johannes (1995b, pp. 42, 43) (Hershler *et al.* 2007, p. 414). Although pebblesnails in general (*Fluminicola* genus) had previously been considered part of the Hydrobiidae family (Hershler *et al.* 2003, p. 275), they have since been reassigned to the Lithoglyphidae family (Hershler *et al.* 2007, p. 371).

The shell of the Potem Creek pebblesnail is about 2.5 to 3.3 mm (0.1 to 0.13 in) tall, with 3 to 3.75 whorls. Its periostracum is tan or light green, and the head of the snail itself is pale brown or gray (Hershler *et al.* 2007, p. 412).

Distribution

Only one occupied site (the type location) for the Potem Creek pebblesnail is mentioned in the formal description of the species (Hershler *et al.* 2007, p. 412). However, that description indicates the species was previously referred to as *Fluminicola* n. sp. 2 (Hershler *et al.* 2007, p. 412). *Fluminicola* n. sp. 2 (common name Potem pebblesnail) has been identified at 11 locations (Frest and Johannes 1995b, pp. T10–T13, T17, T22, T23), including the 1 site mentioned by Hershler *et al.* (2007, p. 412) and 7 sites in the upper Sacramento River drainage. Subsequent communications indicate that the snails from the upper Sacramento River sites were likely Shasta pebblesnails (*Fluminicola multifarius*) rather than Potem pebblesnails (Hershler 2012, pp. 2–5; Johannes 2012c, pp. 2, 3). However, this has not been confirmed by reexamination of all the specimens involved (Hershler 2012, p. 2; Johannes 2012c, p. 1). As discussed below, Shasta pebblesnails are unusually variable in form (Hershler *et al.* 2007, p. 419). Prior to genetic tests establishing the species identity of the Shasta and Potem Creek pebblesnails (Hershler *et al.* 2007, pp. 380–382), the particular morphological characteristics separating one from the other may not have been clear. The seven Potem pebblesnail sites in the upper Sacramento River, and the three Potem pebblesnail sites in the Pit River drainage (other than the Potem Creek pebblesnail type location) identified by Frest and Johannes in 1995 (Frest and Johannes 1995b, pp. T13, T17), are, therefore, considered unconfirmed.

We have also received information regarding three additional sites in the lower Pit River drainage with snails tentatively identified (based on shell alone) as Potem Creek pebblesnails (Haley 2012, pp. 1, 3). Therefore, we are aware of 1 confirmed site (the type location) and 13 unconfirmed sites. Seven of the unconfirmed sites are in the upper Sacramento River drainage, while all of the other sites are in the lower Pit River drainage. One of the unconfirmed sites in the Pit River drainage is on Shasta-Trinity National Forest land within the NWFP area. All other sites are on private land. The type location is on a small private inholding within the perimeter of the Shasta-Trinity National Forest.

Habitat and Biology

The Potem Creek pebblesnail occurs on muddy or silty substrates in small, cold springs and spring runs (Frest and Johannes 1995b, p. A7 (site 36); Frest

and Johannes 1999, p. 36). It appears to graze on partly decayed deciduous leaves (Frest and Johannes 1999, p. 36). We have no specific information regarding reproduction for this species, but members of the *Fluminicola* genus typically live a single year and breed only once (Furnish and Monthey 1999, Sect. 2, p. 5; ORNHIC 2004, p. 2). They generally lay eggs in the spring, which hatch in 2 to 4 weeks. They are not known to disperse widely, and are highly sensitive to water pollution, decreases in dissolved oxygen, elevated temperatures, and sedimentation (Furnish and Monthey 1999, Sect. 2, pp. 5, 7; Hershler *et al.* 2007, p. 372).

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Impoundments

All of the Potem Creek pebblesnail occupied sites (confirmed and unconfirmed) are in small spring ponds or creeks (Frest and Johannes 1995b, pp. 42, A3, A4, A6–A8, A14, A22, T10–T13, T17, T22, T23; Hershler *et al.* 2007, p. 412; Haley 2012, p. 3) and are thus relatively unlikely to be affected by flow releases from major dams. The three unconfirmed locations found by Haley (2012, p. 3) are very close to the edges of the Pit 6 and Pit 7 reservoirs, but we are not aware of any plans to raise the surface levels of those lakes (which could impede flows and raise temperatures). The surface level of Shasta Lake may be raised up to 18.5 ft (5.6 m) if a proposal by USBR to enlarge Shasta Dam is implemented (see nugget pebblesnail, above), but the closest occupied location of the Potem Creek pebblesnail (the type location) is over 350 ft (107 m) above the current elevation of the lake surface, and would therefore remain unaffected. We conclude that, based on the best available scientific and commercial information, that the present or threatened destruction, modification or curtailment of its habitat or range does not constitute a significant threat to the species.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Our review of the best available scientific and commercial information yielded nothing to indicate that overutilization for commercial, recreational, scientific, or educational purposes is occurring at this time or is likely to occur in the future. We therefore conclude such overutilization does not constitute a threat to the Potem Creek pebblesnail.

Factor C. Disease or Predation

Disease

We reviewed the best available scientific and commercial information regarding this species and other similar species, and found no evidence to indicate that disease is impacting Potem Creek pebblesnail populations.

Predation

The Potem Creek pebblesnail occurs in the same general areas as the canary duskysnail, and may also be subject to predation by the introduced signal crayfish. Predation by dense crayfish populations can significantly impact aquatic snails (Lorman and Magnuson 1978, p. 9). However, our only data regarding signal crayfish density indicates those densities appear to be holding stable at levels equivalent to those of the native Shasta crayfish, alongside which the Potem Creek pebblesnail has evolved (see canary duskysnail, above) (Ellis 1999, p. 58; PGE 2011b, pp. iii, 10; PGE 2012b, p. 9). None of the confirmed or unconfirmed Potem Creek pebblesnail sites overlap the current range of the Shasta crayfish, so only the signal crayfish poses a potential predation impact. Hence, the available evidence does not support the contention that signal crayfish are present in the range of the Potem Creek pebblesnail in sufficiently high densities to pose a predation risk to the Potem Creek pebblesnail. Furthermore, the information does not indicate any trend in the densities of the signal crayfish that would lead us to a conclusion that the predation risk would increase in the future.

We therefore conclude, based on the best available scientific and commercial information, that neither disease nor predation constitutes a significant threat to the species now or in the future.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Under this factor, we examine whether existing regulatory mechanisms are inadequate to address the threats to the species discussed under the other factors. Section 4(b)(1)(A) of the Act requires the Service to take into account ''those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species * * * ''. We interpret this language to require the Service to consider relevant Federal, State, and Tribal laws and regulations when developing our threat analyses. Regulatory mechanisms, if they exist, may preclude the need for listing if we determine that such mechanisms adequately address the threats to the species such that listing is not warranted.

Having evaluated the significance of the threat as mitigated by any such conservation efforts, we analyze under Factor D the extent to which existing regulatory mechanisms are inadequate to address the specific threats to the species. We found no significant threats to the Potem Creek pebblesnail under the other factors, therefore, the analysis of any existing regulatory mechanisms' adequacy to address threats is not applicable. Consequently, after reviewing the best available commercial and scientific information, we conclude that the inadequacy of existing regulatory mechanisms is not a threat to the Potem Creek pebblesnail now or in the future.

Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence

Competition with Invasive Species

The New Zealand mudsnail is a potential threat to the Potem Creek pebblesnail (see canary duskysnail, above). The level of threat is significantly reduced in the three occupied locations (including the type location) that are far from the Pit River. Because New Zealand mudsnails are transported on boats and fishing equipment (NBII 2011, pp. 1–3), they are less likely to become established in smaller creeks where boating is not possible and fishing by non-locals is less common. The seven unconfirmed sites in the upper Sacramento River are at greater potential risk because New Zealand mudsnails have been reported at Castle Lake, which is about 5.6 km (3.5 mi) from Siskiyou Lake (McAlexander 2012a, p. 1; McAlexander 2012b, p. 1). If the New Zealand mudsnail established itself in Siskiyou Lake, it might then easily wash down the Sacramento River, potentially establishing anywhere along the route, which might include any of the seven unconfirmed occupied sites. Since the Sacramento River occupied sites are unconfirmed, however, and since the available data does not indicate New Zealand mudsnails will establish themselves at Lake Siskiyou or points downstream, we do not consider the New Zealand mudsnail a threat to the continued existence of the Potem Creek pebblesnail.

Changes in Precipitation and Water Availability Due to Climate Change

See our discussion of climate change in general in the *Changes in Precipitation and Water Availability Due to Climate Change* section under

''Factor A'' in *Five-Factor Evaluation of Threats for the Canary Duskysnail.* Climate change is not expected to significantly change total precipitation in northern California, but may affect seasonal water availability in some areas due to changes in snowpack melting times and in the proportion of precipitation falling as rain rather than snow (Dettinger *et al.* 2004, pp. 43, 44). However, the springs supporting sites occupied by the Potem Creek pebblesnail in the middle and lower Pit River are supplied by large aquifers of porous lava that collect and store water from wide areas (see canary duskysnail, above). The aquifers are therefore able to provide water to the springs at highly constant flow rates and temperatures, despite fluctuations in precipitation. We lack information regarding aquifer sizes and collection ranges for the seven unconfirmed sites in the upper Sacramento River drainage, but based on the best available scientific and commercial information and given the general volcanic geology of the entire area (USNPS 2005, p. 1), we consider it most likely that these sites also will maintain relatively constant flow rates and water temperatures despite climate change.

Catastrophic Events—Fire

Siltation caused by fires would be likely to be cleared relatively quickly by springs in the lower Pit River area (see Goose Valley pebblesnail, above). We do not know the flow rate of the spring at the type location of the Potem Creek pebblesnail, however, so fire remains a concern at that site. However, for a fire at the location to threaten the species, it would have to be serious enough to produce extensive siltation; the flow of the spring would have to be insufficient to flush that siltation; the seven unconfirmed occupied sites in the upper Sacramento River drainage would have to be unoccupied; and the six unconfirmed occupied locations in the Pit River drainage, (located at distances of 6 to 20 km (3.7 to 12.4 mi) from the type location) would have to be unoccupied or similarly affected by the fire. We consider such a combination of circumstances unlikely. Additionally, the Potem Creek pebblesnail occurs on muddy or silty substrates (see Habitat and Biology, above), and so is likely to be less strongly affected by siltation than other pebblesnail species.

Summary of Factor E

In summary, the Potem Creek pebblesnail is protected from expected changes in precipitation or water availability due to climate change by the particular characteristics of its habitat. Although potential competition from the New Zealand mudsnail is cause for concern, no site currently occupied by the Potem Creek pebblesnail has been colonized and there is nothing to indicate the New Zealand mudsnail will colonize any of the locations occupied by the Potem Creek pebblesnail. There is also no direct evidence to show that any such occupied locations would be extirpated by such a colonization were it to occur. The two species are not known to have interacted in the past. We consider catastrophic events such as fire to be unlikely, and the Potem Creek pebblesnail is likely to be less strongly affected by siltation than other pebblesnail species. We therefore conclude that, based on the best available scientific and commercial information, that other natural or manmade factors such as competition from the New Zealand mudsnail, changes in precipitation or water availability due to climate change, or fire do not constitute significant threats to the Potem Creek pebblesnail now or in the future.

Finding for the Potem Creek Pebblesnail

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats faced by the Potem Creek pebblesnail. We reviewed the petition, available published and unpublished scientific and commercial information, and information submitted to us during our status review. This finding reflects and incorporates that information. We also consulted with recognized authorities on this species, and we consulted with Federal and State resource agencies. Although only 1 confirmed and 13 unconfirmed occupied sites are known for the Potem Creek pebblesnail, review of the best available information did not indicate that populations at any site are likely to be extirpated due to impoundments, overutilization, disease or predation, the inadequacy of existing regulatory mechanisms, competition with invasive species, changes in precipitation and water availability due to climate change, or catastrophic events such as fire, now or in the foreseeable future. The best available scientific and commercial information at this time does not indicate that there is likely to be a change in any of these stressors in the future.

Based on our review of the best available scientific and commercial information pertaining to the five factors, we find that the threats as described above either alone or in combination are not of sufficient imminence, intensity, or magnitude to indicate that the Potem Creek pebblesnail is in danger of extinction (endangered) or likely to become endangered within the foreseeable future (threatened), throughout all of its range.

Significant Portion of the Range

Having determined that the Potem Creek pebblesnail is not endangered or threatened throughout all of its range, we must next consider whether there are any significant portions of the range where the Potem Creek pebblesnail is in danger of extinction or is likely to become endangered in the foreseeable future. See *Significant Portion of the Range* under Summary of Procedures for Determining the Listing Status of Species.

We evaluated the current range of the Potem Creek pebblesnail to determine if there is any apparent geographic concentration of potential threats for the species. The Potem Creek pebblesnail is highly restricted in its range and the threats occur throughout its range. We considered the potential threats due to impoundments, overutilization, disease or predation, the inadequacy of existing regulatory mechanisms, competition with invasive species, changes in precipitation and water availability due to climate change, and catastrophic events such as fire. We found no concentration of threats that suggests that the Potem Creek pebblesnail may be in danger of extinction in a portion of its range. We found no portions of its range where potential threats are significantly concentrated or substantially greater than in other portions of its range. Therefore, we find that factors affecting the species are essentially uniform throughout its range, indicating no portion of the range of the species warrants further consideration of possible endangered or threatened status under the Act.

We find that the Potem Creek pebblesnail is not in danger of extinction now, nor is likely to become endangered within the foreseeable future, throughout all or a significant portion of its range. Therefore, listing the Potem Creek pebblesnail as endangered or threatened under the Act is not warranted at this time.

Shasta Pebblesnail *(Fluminicola multifarius)*

Species Information for the Shasta Pebblesnail

Taxonomy and Species Description

The Shasta pebblesnail is an aquatic snail that was formally named and described in 2007 (Hershler *et al.* 2007, pp. 415–419). This species combines

four taxa previously considered likely species, but never formally described: The Sacramento pebblesnail (*Fluminicola* n. sp. 1) (Frest and Johannes 1995b, pp. 42, D14) and three species discussed in Frest and Johannes 1999 (pp. 39–50), the flat top pebblesnail (*Fluminicola* n. sp. 15), the Shasta Springs pebblesnail (*Fluminicola* n. sp. 16), and the disjunct pebblesnail (*Fluminicola* n. sp. 17). The latter three were included under the SMP (USDA and USDI 2007, pp. 169, 252). Although pebblesnails in general (*Fluminicola* genus) had previously been considered part of the Hydrobiidae family (Hershler *et al.* 2003, p. 275), they have since been reassigned to the Lithoglyphidae family (Hershler *et al.* 2007, p. 371).

The shell of the Shasta pebblesnail is 2.3 to 4.6 mm (0.09 to 0.18 in) tall, with a tan, brown, or light green periostracum and 3.25 to 4.5 whorls (Hershler *et al.* 2007, pp. 417–419). The Shasta pebblesnail has a high range of shell variation, with shapes ranging from subglobose to narrowly conic, and lower whorls that are sometimes loosened from the coiling axis and sometimes not (Hershler *et al.* 2007, p. 419). This range of morphological characteristics is the source of the Shasta pebblesnail's specific name *multifarius,* meaning ''in various manners.''

Distribution

Twenty occupied locations of the Shasta pebblesnail are known, 19 of which are in Siskiyou County, California, and the other along the Sacramento River in Shasta County, California (Hershler *et al.* 2007, pp. 415–417). All but two sites are in springs or spring runs, the exceptions being two sites in the Sacramento River itself, which may be associated with nearby springs. Five sites are at Mount Shasta City Park, 11 are along the Sacramento River between Lake Siskiyou and the southern end of Dunsmuir, and 3 are east of the town of McCloud in waters that drain into the McCloud River. There is one occupied site on Shasta-Trinity National Forest land, within the NWFP area, and two others in the Cantara/Ney Springs State Wildlife Area. The rest (except for the five mentioned above at Mount Shasta City Park) are on private property.

Habitat and Biology

The Shasta pebblesnail occurs in cold perennially flowing waters on substrates ranging from sand to cobbles (Frest and Johannes 1995b, p. 42; Frest and Johannes 1999, pp. 40, 44, 48). It is often associated with watercress, and it feeds on perilithon and may eat periphyton as well (Frest and Johannes 1995b, pp. 42, 43; Frest and Johannes 1999, p. 40; Furnish and Monthey 1999, Sect. 2, p. 2). We have no specific information regarding reproduction for this species, but members of the *Fluminicola* genus typically live a single year and breed only once (Furnish and Monthey 1999, Sect. 2, p. 5; ORNHIC 2004, p. 2). They generally lay eggs in the spring, which hatch in 2 to 4 weeks. They are not known to disperse widely, and are highly sensitive to water pollution, decreases in dissolved oxygen, elevated temperatures, and sedimentation (Furnish and Monthey 1999, Sect. 2, pp. 5, 7; Hershler *et al.* 2007, p. 372).

Five-Factor Evaluation of Threats for the Shasta Pebblesnail

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Impoundments

One occupied site (identified as USNM 1020758) is located in the main stem of the Sacramento River, about 3 km (1.9 mi) downstream of Box Canyon Dam, which impounds Lake Siskiyou (Hershler *et al.* 2007, p. 415). Due to low generating capacity, the dam was exempted in 1982 from licensing requirements under the Federal Power Act (Siskiyou County and CDFG 1983a, p. 2). However, the exemption requires Siskiyou County to comply with requirements established by CDFG for flow releases from the lake. Those requirements include minimum flow volumes (40 cfs), minimum dissolved oxygen concentrations (7.0 milligrams per liter (mg/l)), and procedures to minimize water temperatures during summer months (by releasing water from the lowest possible depth in the lake) (Siskiyou County and CDFG 1983a, pp. 2, 3). All of these requirements benefit Shasta pebblesnails in downstream locations, because the upebblesnails require cold, well-oxygenated flowing water (see Habitat and Biology, above). We have obtained monitoring information from 2003, 2004, and 2006 indicating these requirements were consistently met in those years (Webb 2005, pp. 2–13, 18–29; FERC 2006, p. 2). The maximum recorded temperature during 2003 and 2004 was 59.2 °F (15.1 °C) (in October 2003), which is colder than all but one of the average water temperatures measured in 2009 through 2011 in the Pit 3, 4, and 5 reaches (see Canary duskysnail, above) (PGE 2010, p. 35; PGE 2011, p. 24; PGE 2012, p. 24). Minimum flow requirements were not met for a few brief periods of 15 minutes or less in 2002, 2005, and 2009 (Webb 2005, p. 14; FERC 2006, pp. 3, 4; FERC 2009, p. 1), but we do not expect these to have significantly impacted the Shasta pebblesnails in the main stem location. Additional water is also supplied to that location by Ney Creek, which joins the Sacramento River about 0.8 km (0.5 mi) upstream of the occupied site. Two additional occupied sites are within a mile downstream (Hershler *et al.* 2007, p. 417), but these are in springs and so less likely to be impacted by flow releases from the dam.

Grazing and Logging

Of the 20 occupied sites, 5 are in a small city park unlikely to be used for grazing or logging, 2 are on property used as a spiritual retreat by the St. Germain Foundation, 2 are in the Cantara/Ney Springs Wildlife Area, and 1 is in the Shasta-Trinity National Forest within the NWFP boundary and outside of any grazing allotments (Hershler *et al.* 2007, p. 417). An eleventh occupied site (in Shasta County) is in a spring on a thin strip of land between the Union Pacific railroad tracks and Interstate 5, and thus unlikely to be grazed or logged. This leaves nine sites for which we lack data regarding potential grazing impacts. Comparisons of mapped Shasta pebblesnail sites (Hershler *et al.* 2007, pp. 404, 405; Service 2012, p. 1) with locations of planned timber harvests (THP Tracking Center 2012, p. 1) show no THPs have been filed since 2009 for lands covering any of the 20 occupied sites.

To summarize: (1) Only a few locations occur near impoundments, and those impoundments are managed to minimize potential impacts; (2) the locations of 11 of 20 sites makes them unlikely to be grazed or logged; (3) the remaining 9 sites are not scheduled to be logged in the near future, but we lack information regarding grazing at those sites. We conclude that, based on the best available scientific and commercial information, that the present or threatened destruction, modification or curtailment of its habitat or range does not constitute a significant threat to the species.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Our review of the best available scientific and commercial information yielded nothing to indicate that overutilization for commercial, recreational, scientific, or educational purposes is occurring at this time or is likely to occur in the future. We therefore conclude such overutilization

does not constitute a threat to the Shasta pebblesnail.

Factor C. Disease or Predation

Disease

We reviewed the best available scientific and commercial information regarding this species and other similar species, and found no evidence to indicate that disease is impacting Shasta pebblesnail populations.

Predation

It is likely the introduced signal crayfish has established itself in the upper Sacramento River, as well as the Pit River. Predation by dense crayfish populations can significantly impact aquatic snails (Lorman and Magnuson 1978, p. 9). However, our only data regarding signal crayfish densities indicates those densities appear to be holding stable at levels equivalent to those of the native Shasta crayfish, alongside which the Shasta pebblesnail has evolved (see canary duskysnail, above) (Ellis 1999, p. 58; PGE 2011b, pp. iii, 10; PGE 2012b, p. 9). The known Shasta pebblesnail sites do not overlap the current range of the Shasta crayfish, so only the signal crayfish poses a potential predation impact. Hence, the available evidence does not support the contention that signal crayfish are present in the range of the Shasta pebblesnail in sufficiently high densities to pose a predation risk to the Shasta pebblesnail. Furthermore, the information does not indicate any trend in the densities of the two crayfish that would lead us to a conclusion that the predation risk would increase in the future.

We therefore conclude, based on the best available scientific and commercial information, that neither disease nor predation constitutes a significant threat to the species now or in the future.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Under this factor, we examine whether existing regulatory mechanisms are inadequate to address the threats to the species discussed under the other factors. Section 4(b)(1)(A) of the Act requires the Service to take into account ''those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species * * *''. We interpret this language to require the Service to consider relevant Federal, State, and Tribal laws and regulations when developing our threat analyses. Regulatory mechanisms, if they exist, may preclude the need for listing if we determine that such mechanisms adequately address the threats to the species such that listing is not warranted.

Having evaluated the significance of the threat as mitigated by any such conservation efforts, we analyze under Factor D the extent to which existing regulatory mechanisms are inadequate to address the specific threats to the species. We found no significant threats to the Shasta pebblesnail under the other factors; therefore, the analysis of any existing regulatory mechanisms' adequacy to address threats is not applicable. Consequently, after reviewing the best available commercial and scientific information, we conclude that the inadequacy of existing regulatory mechanisms is not a threat to the Shasta pebblesnail now or in the future.

Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence

Competition With Invasive Species

The New Zealand mudsnail (see canary duskysnail, above) has been reported at Castle Lake, which is about 5.6 km (3.5 mi) from Siskiyou Lake (see Potem Creek pebblesnail, above) (McAlexander 2012a, p. 1; McAlexander 2012b, p. 1). If the New Zealand mudsnail were to establish itself in Siskiyou Lake, it could potentially wash down the Sacramento River, establishing anywhere along the route and thereby potentially competing directly with the Shasta pebblesnail at 11 of its 20 known occupied sites, including 2 sites in the river itself and 9 sites in springs that are close to the river and hydrologically connected to it (Hershler *et al.* 2007, pp. 415, 417). If that were to happen, it could pose a threat to the species. However, the available information does not indicate that such a scenario is likely. We consider the risk of infestation to be much lower in springs adjoining the river since the New Zealand mudsnails could not simply be washed to such locations by the current. Nine of the eleven Shasta pebblesnail sites in the upper Sacramento River area are in adjoining springs. Additionally, CDFG is following a national control plan (ANSTF 2007, entire) and has posted information and downloadable posters and wallet cards to its Web site (see canary duskysnail, above) (CDFG undated, p. 1). Accordingly, we do not consider competition from the New Zealand mudsnail a threat to the species.

Changes in Precipitation and Water Availability Due to Climate Change

See our discussion of climate change in general in the *Changes in Precipitation and Water Availability Due to Climate Change* section under ''Factor A'' in *Five-Factor Evaluation of Threats for the Canary Duskysnail.* Climate change is not expected to significantly change total precipitation in northern California, but may affect seasonal water availability in some areas due to changes in snowpack melting times and in the proportion of precipitation falling as rain rather than snow (Dettinger *et al.* 2004, pp. 43, 44). However, the water supplying many springs in Shasta and Siskiyou Counties is collected from wide areas and percolates through porous volcanic rocks to collect in large aquifers, thereby holding extra water from seasons when rain is plentiful and delivering it through springs during seasons when it is not (Service 1998, p. 18). Resulting spring flows are generally highly stable in volume, temperature and clarity (Service 1998, p. 46). We lack information regarding aquifer sizes and collection ranges for the specific springs supporting sites occupied by the Shasta pebblesnail, but given the general volcanic geology of the entire area (USNPS 2005, p. 1), we consider it most likely that these sites will maintain relatively constant flow rates and water temperatures despite climate change. Accordingly, we do not expect changes in precipitation or water availability due to climate change to significantly affect the species.

Catastrophic Events—Chemical Spills

In 1991, a Southern Pacific railroad car carrying the herbicide metam sodium spilled its contents into the upper Sacramento River near Dunsmuir (Frest and Johannes 1995b, p. 13). The spill eliminated numerous mollusks from the main stem, but did not eliminate Shasta pebblesnails from their remaining known occupied sites along the river, presumably because most of those sites are in springs to the side of the main stem (Frest and Johannes 1995b, p. 73; Hershler *et al.* 2007, pp. 415–417). The flow from those springs would have prevented the chemical from traveling from the river into the springs themselves. The one occupied site in the main stem of the river near Dunsmuir is about 500 m (1,640 ft) upstream of the spill site (Frest and Johannes 1995b, p. F4). Since the time of the spill, the railroad company involved (Southern Pacific) has been acquired by the Union Pacific, which has taken several steps to prevent a

recurrence of the accident. These steps include regrading the section of track, replacing the wooden ties with concrete ties, lowering the maximum length of trains operating in the area, reducing the maximum speed, upgrading locomotives, and requiring locomotives to be spread more evenly throughout each train (Darling 2011, p. 4). If such a spill were to recur, most Shasta pebblesnail populations would again be protected by their location in springs and spring runs outside the main stem flow.

Summary of Factor E

In summary, the Shasta pebblesnail is protected from expected changes in precipitation or water availability due to climate change by the particular characteristics of its habitat. Although potential competition from the New Zealand mudsnail is cause for concern, no site currently occupied by the Shasta pebblesnail has been colonized and there is nothing to indicate the New Zealand mudsnail will colonize any of the locations occupied by the Shasta pebblesnail. There is also no direct evidence to show that any such occupied locations would be extirpated by such a colonization were it to occur. The two species are not known to have interacted in the past. If a chemical spill were to occur, most Shasta pebblesnail populations would be protected by their location in springs and spring runs outside the main stem flow. We therefore conclude that, based on the best available scientific and commercial information, that other natural or manmade factors such as competition from the New Zealand mudsnail, changes in precipitation or water availability due to climate change, or chemical spills do not constitute significant threats to the Shasta pebblesnail now or in the future.

Finding for the Shasta Pebblesnail

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats faced by the Shasta pebblesnail. We reviewed the petition, available published and unpublished scientific and commercial information, and information submitted to us during our status review. This finding reflects and incorporates that information. We also consulted with recognized authorities on this species and Federal and State resource agencies. Although only 20 occupied sites are known for the Shasta pebblesnail, a review of the best available information does not indicate that populations at any site are likely to be extirpated due to impoundments, grazing and logging, overutilization, disease or predation, the inadequacy of existing regulatory mechanisms, competition with invasive species, changes in precipitation and water availability due to climate change, or catastrophic events such as chemical spills, now or in the foreseeable future. The best available scientific and commercial information at this time does not indicate that there is likely to be a change in any of these stressors in the future.

Based on our review of the best available scientific and commercial information pertaining to the five factors, we find that the threats as described above either alone or in combination are not of sufficient imminence, intensity, or magnitude to indicate that the Shasta pebblesnail is in danger of extinction (endangered) or likely to become endangered within the foreseeable future (threatened), throughout all of its range.

Significant Portion of the Range

Having determined that the Shasta pebblesnail is not endangered or threatened throughout all of its range, we must next consider whether there are any significant portions of the range where the Shasta pebblesnail is in danger of extinction or is likely to become endangered in the foreseeable future. See *Significant Portion of the Range* under Summary of Procedures for Determining the Listing Status of Species.

We evaluated the current range of the Shasta pebblesnail to determine if there is any apparent geographic concentration of potential threats for the species. The Shasta pebblesnail is highly restricted in its range and the threats occur throughout its range. We considered the potential threats due to impoundments, grazing and logging, overutilization, disease or predation, the inadequacy of existing regulatory mechanisms, competition with invasive species, changes in precipitation and water availability due to climate change, and catastrophic events such as chemical spills. We found no concentration of threats that suggests that the Shasta pebblesnail may be in danger of extinction in a portion of its range. We found no portions of its range where potential threats are significantly concentrated or substantially greater than in other portions of its range. Therefore, we find that factors affecting the species are essentially uniform throughout its range, indicating no portion of the range of the species warrants further consideration of possible endangered or threatened status under the Act.

We find that the Shasta pebblesnail is not in danger of extinction now, nor is likely to become endangered within the foreseeable future, throughout all or a significant portion of its range. Therefore, listing the Shasta pebblesnail as endangered or threatened under the Act is not warranted at this time.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* and upon a request to the Sacramento Fish and Wildlife Office (see **ADDRESSES** section).

Authors

The primary authors of this notice are the staff members of the Sacramento Fish and Wildlife Office.

Authority

The authority for this action is section 4 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Dated: September 5, 2012.

Rowan W. Gould,

Acting Director, Fish and Wildlife Service.

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