

Clutch Sizes and Nests of Tailed Frogs from the Olympic Peninsula, Washington

Abstract

In the summers 1995-1998, we sampled 168 streams (1,714 m of randomly selected 1-m bands) to determine distribution and abundance of stream amphibians in Olympic National Park, Washington. We found six nests (two in one stream) of the tailed frog, compared to only two nests with clutch sizes reported earlier for coastal regions. This represents only one nest per 286 m searched and one nest per 34 streams sampled. Tailed frogs occurred only in 94 (60%) of the streams and, for these waters, we found one nest per 171 m searched or one nest per 20 streams sampled. The numbers of eggs for four masses ($\bar{x} = 48.3$, range 40-55) were low but one single strand in a fifth nest had 96 eggs. One nest with 185 eggs likely represented communal egg deposition. Current evidence indicates a geographic trend with yearly clutches of relatively few eggs in coastal tailed frogs compared to biennial nesting with larger clutches for inland populations in the Rocky Mountains.

Introduction

Tailed frogs (*Ascaphus truei*) are endemic to the Pacific Northwest and the only species in the Ascaphidae, which may be a sister group to all other anurans (Ford and Cannatella 1993, Jamieson et al. 1993). They range from British Columbia to western Montana and southward to northern California, and occur from sea level to 2100 m. Tailed frogs frequent cool, fast-flowing streams that are permanent, and they have several adaptations for stream life (Bury 1988, Welsh 1990).

Female tailed frogs deposit eggs in mid-summer and attach strings of eggs to the undersides of rocky substrate. Tailed frog eggs are the largest of any North American frog and are slow to develop, averaging 6 wk to hatching (Brown 1975, 1989). Hatchlings may remain in the nest area for several months and may not emerge until spring. Most larvae metamorphose after 2-3 yr (Metter 1967), but may take up to 4 yr in high elevation, northern locales (Brown 1990) or only 1 yr in coastal areas from central Oregon to northern California (Wallace and Diller 1998, Bury and Adams 1999).

Most tailed frogs have small clutch sizes of only 45-60 eggs (Brown 1990). Metter (1967) counted ovarian eggs in 15 populations of tailed frogs and found considerable variation in egg numbers between populations ($x = 44.0-74.6$) but

no notable geographic pattern. However, there is some disparity in the literature on clutch sizes in coastal populations (Metter 1967, Adams 1993). Our objectives were to describe the clutch sizes of this species in the wild and to better define nesting areas in coastal habitats. We also compare results to other portions of its geographic range.

Materials and Methods

In the summers 1995-1998, we conducted surveys to determine distribution and abundance of stream amphibians in Olympic National Park (ONP) in northwestern Washington. Peaks rise to 2,865 m elevation and the terrain is steep. To gain access to ONP, we used the existing network of trails and a few roads that mostly were parallel to the main rivers or large tributaries. We hiked (or occasionally drove) along transects and recorded all streams with flowing water that intersected our path and then randomly selected one-third to one-half of these streams for intensive search.

We sampled 168 streams based on a new method (modified from Bury and Corn 1991, Adams and Bury in press): 10 belts (each 1-m long and variable in width to span the stream) were randomly selected along a 100-m section of water. We located surveys at least 30 m above trail and road crossings. We also revisited some streams, and the total length of waters searched was 1,714 m. Most sampling consisted of turning over moveable objects such as cobble and woody debris, and then

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immediately replacing objects at their original position. We caught amphibians that drifted downstream into dipnets or wire screens. We used a "light touch" that did not dislodge embedded cover objects to minimize disturbance in the National Park.

Results

We found six nests of the tailed frog in five streams in four ONP watersheds (Table 1). This represents one nest per 34 streams sampled (3% of the streams) and one nest per 286 m searched. We found adult tailed frogs present in only 94 (60%) of the selected streams and, for these waters, there was one nest per 20 streams (5% of streams) and one nest per 171 m of stream sampled.

We discovered three of the nests on the north side of ONP in 1996: two in small tributaries of the North Fork Soleduck River and one in a tributary of the Elwha River. The other three nests were found on the drier east side of the Park in summer 1998: one in the Skokomish drainage and two nests 7 m apart in a creek flowing into the Dosewallips River. All nests had eggs congealed into a mass, except for the Skokomish nest that had 96 newly deposited eggs still in a rosary-like string and attached at one end to the underside of a rock (the loose end flowed into the dipnet when the rock was turned). Numbers of eggs for four ONP masses were low ($\bar{x} = 48.3$, range 40–55), except for the Skokomish nest (96 eggs). We also found one nest with 182 eggs in a tributary of the North Fork Soleduck River (Table 1).

Discussion

Only about a dozen nests of this species have been found in the wild, including five nests from coastal or Coast Range areas. Two of the nests reported

for the Olympic Peninsula, Washington, lacked counts of egg numbers (Gaige 1920). Adams (1993) found two nests (one with countable eggs) and he reported counts from another nest from coastal Oregon. Thus, there were only two natural nests with clutch sizes known for coastal areas prior to our surveys.

Current evidence indicates a possible geographic trend in clutch sizes. The five ONP nests we found had relatively few eggs ($x = 57.8$, range 40–96). The nest we found with 96 eggs is a record high for a coastal female. On the east side of the Olympic Peninsula, Washington, Gaige (1920) found 35 and 49 eggs inside two females whereas Noble and Putnam (1931) induced ovulation in five females and the counts were low ($\bar{x} = 36.6$). Metter (1967) dissected seven females from Mary's Peak in the Oregon Coast Range and the clutch sizes were moderately low ($\bar{x} = 49.3$, range 39–61). Adams (1993) reported counts for two of three nests from coastal Oregon streams: 38 eggs, and 60 (27 well-developed eggs plus 33 small hatchlings in one nest). These 21 records for coastal populations have relatively few eggs ($\bar{x} = 47.2$ eggs per clutch).

Inland populations from the Cascade Mountains appear to have about 10 more eggs per clutch than the records from coastal areas. Metter (1967) dissected 49 gravid females and mean number of eggs in populations varied little from 56.0 (range 41–85) to 57.9 (range 44–98). Brown (1975) induced ovulation in 22 females and they yielded a mean of 58.8 eggs (range 37–82).

Farther inland, populations from eastern Washington to western Montana in the Rocky Mountains have higher counts. Franz (1970) reported nests of 64 and 86 eggs from the wild in western Montana. Metter (1964) dissected 20 ripe females

TABLE 1. Location and habitat data for tailed frog nests from Olympic National Park, Washington. Abbreviations for major watersheds: NFS = North Fork Soleduck; ELW = Elwha; SKO = Skokomish; DOS = Dosewallips. Rock size was longest length, width, and depth.

Watershed	NFS	NFS	ELW	SKO	DOS	DOS
Date found	31 Jul 96	6 Aug 96	15 Aug 96	8 Jul 98	4 Aug 98	4 Aug 98
Number of eggs	55	182	52	96	40	46
Rock size (cm)	19×15×8.5	100×50×20	55×45	15×14×5	11×9×4.5	35×19×14
Environment	Riffle	Pool	Pool	Riffle	Pool	Pool
Water (°C)	11.0	8.5	11.0	10.0	7.0	7.0
Elevation (m)	648	640	579	1122	610	610
Gradient (%)	8	25	16	17	21	21

from eastern Washington and northern Idaho, and they had high counts ($x = 68$ eggs, range 50-85). Metter (1967) dissected 58 animals from seven inland sites and values were again high ($x = \sim 63.5$ eggs, range 33-97). Female tailed frogs in the Rocky Mountains appear to have about 18 more eggs per clutch than those from coastal sites.

Metter (1964) suggested that tailed frogs oviposit every year in coastal areas and every other year inland. If true, tailed frogs would likely have yearly clutches of smaller numbers in coastal populations compared to biennial nesting with larger clutches for inland areas. Numbers of eggs from dissection of females or induced ovulation likely is more accurate than counts in the wild because tailed frogs nest in cascading streams where fast currents could wash eggs away. Giant salamanders (genus *Dicamptodon*) prey on larval tailed frogs (Metter 1963), and may also eat tailed frog eggs. On the other hand, it is not known if females deposit all of their eggs at one time, so that counts of eggs from wild nests remain important data.

Two instances of communal nesting are now known in tailed frogs. Brown (1975) found 123 eggs and 20 females under one rock near Mount Baker, Washington. We found one nest containing 182 eggs. In ONP, we found four nests in pools of streams and the other two were in riffles. Nests were under cobble or large rocks, but these varied widely (Table 1). Most of the nests were not under the largest rock or boulder we moved in streams.

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Olympic National Park, one of the largest undisturbed areas in the Pacific Northwest, lacks negative influence of disturbances such as timber harvest (see Corn and Bury 1989, Diller and Wallace 1999, Wahbe and Bunnell 2001) or siltation from road construction (Welsh and Ollivier 1998). Still, we rarely encountered tailed frog nests even with many surveys in pristine habitats. Nests of tailed frogs are likely scarce in the wild due to several factors, including: (1) females placing eggs under large rocks and boulders; (2) occasional communal nesting (i.e., concentration of eggs in a few sites that may easily escape detection); and (3) lack of extensive searches. Deeper excavation of substrate of stream bottoms may be required to reveal more nests in the wild. Further research is needed to better define the clutch sizes and nesting requirements of tailed frogs.

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