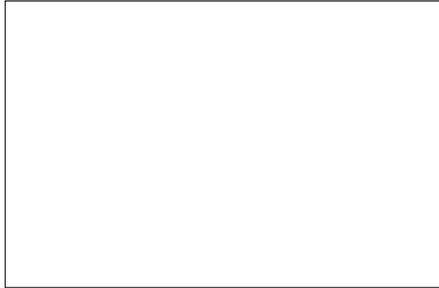




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IMPACTS OF TROUT STOCKING ON AMPHIBIAN POPULATIONS



Keywords: fish stocking, long-toed salamanders, Columbia spotted frogs, western toads, cutthroat trout, rainbow trout, golden trout

Background & Management Issues: Trout and other non-native sport fishes have been introduced into high-elevation lakes in western North America to provide recreational opportunities in the backcountry. Many of these lakes were historically fishless, and consequently, fish stocking has been implicated in the decline of native amphibian populations. Previous research has either examined spatial distributions of amphibian populations within individual water bodies decades after stocking occurred or focused on the effects on single species. Life history traits vary among amphibian species, however, and fish stocking may affect species differently. In addition, amphibian population structure may be affected at a broad scale when a portion of lakes and streams in a watershed are stocked. This habitat fragmentation may isolate amphibian populations and result in increased extinction rates.

Project Objectives:

To evaluate the effects of introduced trout on two species of amphibians with different life-history characteristics: long-toed salamanders, whose larvae overwinter two years before metamorphosing; and Columbia spotted frogs, whose larval stage is completed in one summer.

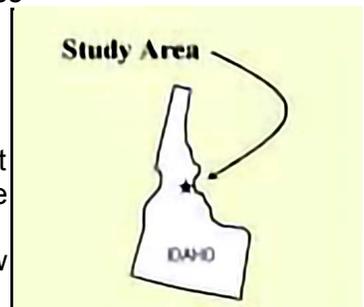
To examine the broad-scale effects of fish stocking on amphibian populations within drainage basins.

Project Description: Fish and amphibian surveys were conducted in the Bighorn Crags region of the Frank Church River of No Return Wilderness. Historical and state records, hook-and-line angling, gill netting, and visual observations were used to determine the presence of fish. Visual encounter surveys, where observers searched the perimeters of lakes, ponds, and entire flooded meadows for all life stages, were used to determine the distribution and abundance of amphibians. Snorkel surveys in 11 lakes were used to evaluate the accuracy of visual encounter surveys for salamanders, and mark-recapture population estimates from 39 lakes permitted evaluation of frog surveys. In addition, the physical, chemical, and biological characteristics of lakes and wetlands were recorded.

Results: Historical records indicated that Idaho Fish and Game stocked over 60,000 cutthroat and rainbow trout into 12 to 30 previously fishless lakes in 1937 and 1938 in the Bighorn Crags area. Beginning in the 1960s, fish were restocked every three to six years. In total, 37 lakes were stocked with 300,000 fry or fingerlings.

Cutthroat, rainbow, and golden trout and their hybrids were found in all 11 basins searched. Overall, fish occupied 43% of sites. Large, deep lakes (greater than 1 ha in surface area and more than 4 m deep) were occupied more than small, shallow wetlands. As a result, fish occupied 90% of the available surface area of water in the basins. More importantly, only two basins had more than one deep, fishless lake.

Densities of both long-toed salamanders and Columbia spotted frogs were lower in sites with fish than in those without fish. Indeed, fewer amphibians of all stages were found in stocked lakes than in lakes with similar characters but without fish. Moreover, densities of salamander larvae and adult and juvenile frogs in fishless sites decreased as the proportion of wetlands in the



Management Implications:

- ❖ Survival of salamander larvae and juvenile frogs may depend on deep lakes (>2 m), yet deep lakes are often stocked with fish.
- ❖ Negative effects of stocked lakes may extend across landscapes. Amphibians with extended larval periods may be forced to breed in shallower wetlands where the risk of extirpation due to desiccation, anoxia, and freezing are higher than in the deeper, more lentic environments. Likewise, amphibians that complete their life cycle in one summer may breed in shallow wetlands but may be forced to immigrate to deep lakes to overwinter. If those deep lakes are stocked with fish, the progeny may be completely eradicated.
- ❖ Information necessary to evaluate the effects of fish stocking in high-elevation lakes should include knowledge of:
 - ✓ the amphibian and fish species in the area – Information about distributions of many amphibian species is lacking, so surveys in wilderness areas should consider species potentially present. Different types of surveys conducted at various times of the year may be necessary to assess abundances and life stages.
 - ✓ the extent of area impacted – Surveys of entire watersheds provide the most unbiased information to determine production, habitat use, and potential interaction between fish and amphibians and allow the most accurate assessment of management actions. Stratified sampling in different watersheds will supply adequate information if all wetland types can be adequately represented. Integrating fish and amphibian surveys also may extend sampling ability.
 - ✓ the effect of management actions – Potential management actions include reducing the number of lakes that support fish by halting stocking and/or removing fish, providing fishless habitats for short periods by reducing stocking frequency/density or altering fertility (stocking sterile fish or limiting access to spawning habitat), reducing densities of predatory fish by stocking cutthroat

basin occupied by trout increased.

Publications / Products:

- ❖ Pilliod, David S.; Peterson, Charles R. 2000. Evaluating effects of fish stocking on amphibian populations in wilderness lakes. *In*: Cole, David N.; McCool, Stephen F.; Borrie, William T.; O'Loughlin, Jennifer, comps. Wilderness Science in a Time of Change Conference—Volume 5: Wilderness Ecosystems, Threats, and Management; 1999 May 23-27; Missoula, MT. Proceedings RMRS-P-15-VOL-5. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 328-335. Leopold Publication Number 406. [Read it here!](#)
- ❖ Pilliod, David S.; Peterson, Charles R. 2001. Local and landscape effects of introduced trout on amphibians in historically fishless watersheds. *Ecosystems*. 4(4): 322-333. Leopold Publication Number 446. [For ordering information...](#)

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