LONG-TOED SALAMANDER

TAXONOMY

Scientific name: *Ambystoma macrodactylum* (Baird, 1849)
Common name: Long-toed salamander
Family: Ambystomatidae
Taxonomic comments:
For phylogenetic analyses of North American *Ambystoma* see Kraus (1988), Shaffer et al. (1991), and Jones et al. (1993).

Five subspecies are currently recognized, one occurs in Alaska. It has been suggested that the mainland and island population in the vicinity of the Stikine River of coastal Alaska are phenotypically and taxonomically distinct (MacDonald 2003).

DESCRIPTION

Basic description: A salamander.

General description:
A delicate, smooth-skinned dusky or black salamander with an irregular yellow, tan, or light green dorsal stripe. White flecking on sides. Ventral surface is gray. Long toes and faint costal grooves (Hodge 1976). Adults measure up to 17 cm.

This species is easily distinguished from Alaska's other amphibians by its prominent dorsal stripe and long fourth toe.

Length (cm): 17

Reproduction:
Breeding season is longer and earlier (fall-early spring) in coastal lowlands, shorter and later (summer) in interior mountains. Clutch size is larger at lower elevations (Howard and Wallace 1985). Eggs laid in water, attached to vegetation or loose on bottom. Larvae metamorphose in first summer or overwinter (high elevations). In Alberta, sexually mature in 2+ years; maximum life span 10 years, usually 6 years or less (Russell et al. 1996).

Ecology:
Predators of larvae probably include fish, aquatic insects and garter snakes (*Thamnophis* spp.); garter snakes and bullfrogs (*Rana catesbeiana*) eat adults (Nussbaum et al. 1983).

Migration:
Migrates between breeding ponds and non-breeding habitat; usually migrates at night in conjunction with precipitation. Males reach ponds before females and stay longer.

Food:
Larvae feed on zooplankton, immature insects, snails, and occasionally other salamander larvae, including conspecifics. Adults eat terrestrial and aquatic invertebrates including: insects, insect larvae, spiders, slugs, earthworms, amphipods, etc.

Phenology:
May be active almost all winter in Pacific Northwest coastal ponds (Stebbins 1985).

Habitat:
Found in a wide variety of habitats, from semiarid sagebrush deserts to sub-alpine meadows, including dry woodlands, humid forests, and rocky shores of mountain lakes. Adults are subterranean except during the breeding season. A terrestrial habitat use survey near Hinton, Alberta determined that individuals were found primarily in well-drained areas with thick litter on the forest floor and close to relatively permanent water bodies (Graham 1997). Salamanders were also found in seral stages ranging from three-year-old clear-cuts to 180-year-old forests and occurred in active logging areas (Graham 1997). Breeds in temporary or permanent ponds, or in quiet water at the edge of lakes and streams. During the breeding season adults may be found under logs, rocks, and other debris near water. Eggs are attached to vegetation or loose on bottom.

STATUS

Global rank: G5 (2001-12-14)
Global rank reasons:
Global rank reasons not available.

State rank: S2? (1992-02-25, reviewed 2004-11-01)
State rank reasons:
Restricted distribution in Southeast Alaska. Possible island endemism, but genetics not available to validate. Relatively common throughout its range, but overall abundance and trends unknown. Major threats include destruction of wetland habitats, predation by introduced trout, and exposure to UV-B.

DISTRIBUTION AND ABUNDANCE

Range:
Global range:
Southeastern Alaska southward to Tuolumne County, California, east to Rocky Mountains (east to east-central British Columbia, west-central Alberta, western Montana, and central Idaho). Isolated populations in Santa Cruz and Monterey counties, California (Bury et al. 1980). Sea level to about 10,000 ft (Stebbins 1985).

State range:
Alaska distribution restricted to southeastern coastal forests adjacent to the Stikine and Taku River watersheds (Hodge 1976). Reported near the mouth of the Stikine River at Figure Eight Lake (Twin Lakes), Mallard Slough, Cheliped Bay, Andrew Slough, Farm Island and Sokolof Island. Also collected on the Alaska side of the Coast Range in the Taku River Valley (MacDonald 2003).

Abundance:

Global abundance:
Total adult population size is unknown but surely exceeds 10,000.

State abundance:
Relatively common throughout its range; the overall Alaska population size is unknown but considered relatively small. Waters (1992) surveyed the Stikine River Basin during summer 1991 and failed to observe this species.

Trends:

Global trend:
Unknown.

State trend:
Unknown. Data currently not available.

EXISTING PROTECTION

Global protection:
Would benefit from protection of habitat near breeding ponds (Bury et al. 1980). Prohibit introductions of non-native fishes in salamander habitat.

In British Columbia, protection occurs through the Wildlife Act, which includes all native amphibians (Graham and Powell 1999). In Alberta, long-toed salamanders are designated a sensitive species (Pearson 2003).

State protection:
In Alaska, amphibians are managed by Alaska Department of Fish and Game under statute 16.05.030, which legally includes amphibians in the definition of "fish". This statute makes it illegal for anyone to "hold, transport or release" any native amphibians without a valid permit. Occurs in Stikine-Leconte Wilderness Area of the Tongass National Forest.

CHALLENGES

Global challenges:
In the Cascades of northern Washington, larval abundance was related to both lake productivity and the presence of introduced trout (reduced larval abundance when trout present; Tyler et al. 1998). In Montana, introduced trout populations clearly excluded salamanders from lakes (Funk and Dunlap 1999).

In developed areas, the destruction of wetland habitats may be the greatest threat. Human disturbance such as road and trail construction, timber harvest, grazing, and fire management can result in fragmentation of terrestrial habitat and breeding ponds (Fukumoto 1995 in Graham and Powell 1999, Maxell 2000, Paton 2002). Larvae are sensitive to a combination of low pH and aluminum. In the Pacific Northwest, this species appears to be particularly sensitive to UV-B

exposure (Belden et al. 2000). Possible effects of exposure to UV-B include increased mortality and incidence of deformities, slowed growth and skin darkening (Belden and Blaustein 2002).

State challenges:
In developed areas, the destruction of wetland habitats may be the greatest concern. Human disturbance such as road and trail construction, timber harvest, grazing, and fire management can result in fragmentation of terrestrial habitat and breeding ponds (Fukumoto 1995 in Graham and Powell 1999, Maxell 2000, Grialou et al. 2000, Paton 2002). Larvae are sensitive to a combination of low pH and aluminum. In the Pacific Northwest, this species appears to be particularly sensitive to UV-B exposure (Belden et al. 2000). Possible effects of exposure to UV-B include increased mortality and incidence of deformities, slowed growth and skin darkening (Belden and Blaustein 2002). Trout introduction is of concern as they are known predators to larvae.

RESEARCH AND INVENTORY NEEDS

Global research needs:
See State research needs:

State research needs:
Establish programs to monitor population trends; identify threats and limiting factors. Genetic research needed to determine if island endemicity exists. Research is needed on the effects of roads and logging on population persistence.

Global inventory needs:
Since there can be significant year to year variation in amphibian breeding population size, long-term monitoring is necessary to determine population trends and size (Graham and Powell 1999, Paton 2002).

State inventory needs:
Additional inventory to precisely determine the species' range and population estimates for each area of occurrence are needed.

CONSERVATION AND MANAGEMENT NEEDS

Global conservation and management needs:
Fisheries management could improve the status of salamander populations by preventing introduction of fishes into salamander habitats where fishes are not native. Removal of non-native fishes from otherwise favorable salamander habitat is appropriate in many locations. Information on genetic variation on a large scale (subspecies) and population scale would be useful for management decision-making (Graham and Powell 1999). Montana researchers recommend using only herbicide and pesticide brands that rapidly decompose and not spraying within 300m of water bodies or wetlands (Joslin and Youmans 1999 in Paton 2002). Logging activities in areas with long-toed salamanders should be scheduled to occur during the winter to minimize soil compaction and litter layer disturbance (Graham 1997, Paton 2002).

State conservation and management needs:
Fisheries management could improve the status of salamander populations by not introducing fishes into salamander habitats where fishes are not native. Removal of non-native fishes from otherwise favorable salamander habitat is appropriate in many locations. Information on genetic variation and island endemism would provide useful data to aid in management decisions. Whenever possible, logging activities in areas with long-toed salamanders should be scheduled to occur during the winter to minimize soil compaction and litter layer disturbance (Graham 1997, Paton 2002).

LITERATURE CITED

Belden, L.K. and A.R. Blaustein. 2002. Population differences in sensitivity to UV-B radiation for larval long-toed salamanders. Ecology 83: 1586-1590.

Belden, L.K., E.L. Wildy and A.R. Blaustein. 2000. Growth, survival and behavior of larval long-toed salamanders (*Ambystoma macrodactylum*) exposed to ambient levels of UV-B radiation. Journal of Zoology 251:473-479.

Bury, R.B., C.K. Dodd, Jr., and G.M. Fellers. 1980. Conservation of the amphibia of the United States: a review. U.S. Fish and Wildlife Service, Washington, DC. Resource Publ. 134. 34 pp.

Funk, W.C., and W.W. Dunlap. 1999. Colonization of high-elevation lakes by long-toed salmanders (*Ambystoma macrodactylum*) after the extinction of introduced trout populations. Canadian Journal of Zoology. 77:1759-1767.

Graham, K.L. 1997. Habitat use by long-toed salamanders (*Ambystoma macrodactylum*) at three different scales. M.S. Thesis. University of Guelph, Ottawa, Ontario. 71 pp.

Graham, K.L. and G.L. Powell. 1999. Status of the long-toed salamander (*Ambystoma macrodactylum*) in Alberta. Edmonton, AB. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 22.

Grialou, J.A., S.D. West, and R.N. Wilkins. 2000. The effects of forest clearcut harvesting and thinning on terrestrial salamanders. Journal of Wildlife Management. 64:105-113.

Hodge, R.P. 1976. Amphibians and reptiles in Alaska, the Yukon, and Northwest Territories. Alaska Northwest Publishing Company, Anchorage, AK. 89 pp.

Howard, J.H., and R.L. Wallace. 1985. Life history characteristics of populations of the long-toed salamander (*Ambystoma macrodactylum*) from different altitudes. Amer. Midl. Naturalist 113:361-373.

Jones, T.R., A.G. Kluge, and A.J. Wolf. 1993. When theories and methodologies clash: a phylogenetic reanalysis of the North American ambystomatid salamanders (Caudata: Ambystomatidae). Systematic Biology 42:92-102.

Kraus, F. 1988. An empirical evaluation of the use of the ontogeny polarization criterion in phylogenetic inference. Systematic Zoology 37:106-141.

MacDonald, S.O. 2003.The amphibians and reptiles of Alaska. A Field Handbook. Unpublished report to U.S. Fish and Wildlife Service, Juneau, AK.

Maxell, B.A. 2000. Management of Montana's amphibians: A review of factors that present a risk to population viability and accounts on the identification, distribution, taxonomy, habitat

use, natural history and the status and conservation of individual species. Missoula, MT. Region 1, USDA Forest Service.

Nussbaum, R.A., E.D. Brodie, Jr., and R.M. Storm. 1983. Amphibians and reptiles of the Pacific Northwest. Univ. Press of Idaho. 332 pp.

Paton, D. 2002. Columbia mountain amphibian surveys, 2001. Edmonton, AB. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 39.

Pearson, K. 2003. Distribution and habitat associations of the long-toed salamander (*Ambystoma macrodactylum*) in Oldman River drainage. Edmonton, AB. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 75.

Russell, A.P., G.L. Powell, and D.R. Hall. 1996. Growth and age of Alberta long-toed salamanders (*Ambystoma macrodactylum krausei*): a comparison of two methods of estimation. Canadian Journal of Zoology 74:397-412.

Shaffer, H.B., J.M. Clark, and F. Kraus. 1991. When molecules and morphology clash: a phylogenetic analysis of the North American ambystomatid salamanders (Caudata: Ambystomatidae). Systematic Zoology 40:284-303.

Stebbins, R.C. 1985. A field guide to western reptiles and amphibians. Second Edition. Houghton Mifflin Company, Boston, MA. xiv + 336 pp.

Tyler, T., W.J. Liss, L.M. Ganio, G.L. Larson, R. Hoffman, E. Deimling, and G. Lomnicky. 1998. Interaction between introduced trout and larval salamanders (*Ambystoma macrodactylum*) in high-elevation lakes. Conservation Biology 12:94-105.

Waters, D.L. 1992. Habitat associations, phenology, and biogeography of amphibians in the Stikine River basin and southeast Alaska. Unpubl. rep. of the 1991 pilot project. U.S. Dept. Interior, Fish and Wildlife Service, California Cooperative Fishery Research Unit, Humboldt State University, Arcata, CA. 61 pp.

Acknowledgements

State Conservation Status, Element Ecology & Life History Author(s): Gotthardt, T.A.
State Conservation Status, Element Ecology & Life History Edition Date: 22Mar2005
Reviewer(s): Stephen MacDonald, University of New Mexico; Blain Anderson, National Park Service, Anchorage, AK.

Life history and Global level information were obtained from the on-line database, NatureServe Explorer (www.natureserve.org/explorer). In many cases, life history and Global information were updated for this species account by Alaska Natural Heritage Program zoologist, Tracey Gotthardt. All Global level modifications will be sent to NatureServe to update the on-line version.
NatureServe Conservation Status Factors Edition Date: 28Dec2001
NatureServe Conservation Status Factors Author: Hammerson, G.
Global Element Ecology & Life History Edition Date: 19Sep1994
Global Element Ecology & Life History Author(s): Hammerson, G.