TWO PATHOLOGIC POPULATIONS OF THE TIGER SALAMANDER (Ambystoma tigrinum) IN UTAH

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In 1980 a general survey of ponds and lakes in the Wasatch Mountains (directly east of Salt Lake City) and in the Uinta Mountains (east of the Wasatch Mountains) was conducted to determine 1) what lakes and ponds contained tiger salamanders, 2) what lakes and ponds contained the leech Nephelopsis obscura, a potential competitor of food and a potential predator of larval salamanders, and 3) what lakes and ponds contained the leech Batracobdella picta whose host is the tiger salamander in these mountain lakes. Twelve salamander ponds were observed in the study area. The elevation of the ponds was between 5280 and 10,000 feet. N. obscura thus far has only been found in the Uinta Mountains. Only two of ten lakes in the Wasatch Mountains contained B. picta and the salamanders in these two lakes often contained as many as 8 leeches.

The high elevation lakes can be characterized as semidrainage lakes and drainage lakes, neither type supporting trout (1). The life history pattern of the tiger salamander in these lakes follows the classification "two size classes of larvae with metamorphosis occurring in the second warm season" (2). Breeding occurs throughout July and August and in early September. Metamorphosis occurs when the larvae reach a snout-vent length between 50 and 60 mm. (Lower elevation lakes (5280 feet) contain the two size classes as well as a population which metamorphose the first summer (in August) at snout-vent length of about 40 mm).

Desolation Lake Pathologic Population

Lake Desolation (elevation 9240 feet) is a semidrainage lake with no outlet. There is very little vegetative matter in the lake. The size is oval with diameters of 600 and 1000 feet and with a depth of at least 10 feet. Sheep graze the region every summer. Two other semidrainage lakes are within 1 1/2 miles of Lake Desolation and contain normal populations of salamanders and the salamanders are infested with B. picta. A drainage lake is a mile away and contains a normal population of salamanders (without B. picta).

In early August 1980 all forms of salamanders (first year larvae, second year larvae, and metamorphosed breeding adults) were found dead or dying in Lake Desolation. The first year young (snout-vent length 30 mm, about 3-4 weeks old) were observed in a very lathargic state, swimming on their backs and had red throats. By this time no second year larvae were observed. Some breeding adults were observed, one was very lethargic and at the shore line and the other was actively swimming in the water.

In 1981 the U.S. Forest Service alerted me to the 'die-off" during the summer. By early September there were no salamanders in Lake Desolation. In one typical twenty foot length along the shore line, 100 dead and desicated young of the year were counted. Under two different logs, two and four dead breeding adults were found.

At the present time no causative factor (toxicity, bacterial, viral, protozoic, or metazoic) of the die-off is known. Water toxicity was examined by placing six first year larvae (from a different source) in two different aquarium. One aquarium contained water from Lake Desolation along with some macro-invertebrates and the 2nd aquarium contained water from a healthy pond along with some macro-invertebrates. Each aquarium contained four gallons of water. After three

months in the confines of the aquarium the Lake Desolation population and the control population were thriving. Two of the Lake Desolation salamanders metamorphosed and died early in the experiment.

Lake Solitude Pathologic Population

Lake Solitude (elevation 8880 feet) is a drainage pond formed behind a small earthen dam. A small creek flows into the pond and no water flows out of the pond, although seepage below the reservoir is observed. The pond is very shallow (less than two feet deep in early fall) and has a sandy bottom. The area is utilized actively by skiers in the winter and is a part of Salt Lake City's watershed.

On 23 August 1980 many first year larvae salamanders were observed (snout-vent length, 30 mm). September 28 two population sizes were readily observed, one with the snout-vent length of 38 mm and the second with the snout-vent length of 60 mm (the latter is probably second year young which were in hiding on 23 August). The larger larvae were is good health on 28 September, while the smaller larvae were dead, dying, and in apparent good health. The dying larvae and dead larvae appeared to have 'bread mold' on their entire body. When this 'bread mold' was wiped off, the skeleton was visible. Three normal appearing small larvae were taken to Salt Lake City for further observation (elevation 4300 feet). By the next morning all three larvae had the 'bread mold' (two were dead).

In 1981 another die-off occurred in Lake Solitude. This die-off affected the second year larvae (survivors of the bread-mold epidemic (snout-vent length of 44-61 mm). About 24 dead larvae were on the shore or floating in the water and only four larvae were observed in the pond upon walking throughout the waters. The larvae were lethargic, had swelled and redden anal openings and with extended abdomens. Two specimens were sent to Dr. John C. Harshbarger (Smithsonian Institution). Dr. Harshbarger reported that one specimen contained intestinal trematode infestation associated with bacterial enteritis and peritonitis. The second specimen had large nematodes (still being identified) in the visceral cavity. Liver and pancreas appeared to be healthy in both specimens.

Discussion

Frandsen and Grundmann (3) reported the presen of numerous parasites in the tiger salamander in Salt Lake County (including Lake Desolation). These parasites include protozoa (Chilomastix caulleryi, Hexamastix sp., Hexamita, Karotomorpha swezyi, Tritrichomonas augusta, Tritrichomonas batrachorum), cestodes (Ophiotaenia filaroides), and nematodes (Spironoura clongata). Grundmann did not recall any pathologic population in these investigations (personal communications, 1981). The trematodes and nematodes were associated with the Lake Solitude pathologic population and could have contributed to the die-off in 1981. This metazoan infestation would, likewise, have been exacerbated by the patholgic state of the first year larvae in 1980.

Reichenbach-Klinke and Elkan(4) have summarized the diseases of amphibians. Pathologic states in natural environments are referenced. One noted example is the die-off that Dusi observed when"a population of about three hundred American toads in a small pond during the breeding season" on one day and on "the next day all but a few of the toads were found dead" (4) (page 234-235). There was no reference to die-offs with salamander populations. The Lake Desolation die-off was complete much as the above toad population (which was ascribed to the "Red Leg" symptoms). The Lake Desolation die-off might have occurred over a period of two to four weeks in 1980. The toxicity study was

over a three month period. The red throats of the young larvae might imply a bacterialogic cause of the die-off (ulcerations and haemorrhages of the 'Red Leg" disease).

Salamanders are useful indicators of the health of the watershed and of the health of the ponds and lakes. The young can survive the anaerobic winter conditions that would normally kill trout and other fish. Are the pathologic populations a first indicator of a deteriorating environment? How is the disease maintained in a lake for two years if the die-off is complete? Can the pathogens (and leeches) be transmitted from lake to lake (over a mile via mountain ridges and drainages)? This year (1982) more effort will be made to identify the pathogens and to follow the development of the disease.

I would like to express thanks to Dr John Harshbarger for examining the two pathologic salamanders and to Dr Donald Klemm (Environmental Protection Agency, Cincinnati, Ohio) for identifying the leeches. I would appreciate more information of pathologic populations of salamanders in the natural environments.

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2) Sexton, O.J. and J.R. Bizer. 1978. The American Midland Naturalist 99: 101-118. Life history Patterns of Ambystoma tigrinum in Montane Colorado.
3). Frandsen, J.C. and A.W. Grundmann. 1951. J. Parasitology 46: 678. The Parasites of some Amphibians of Utah.
4) Reichenbach-Klinke, H. and E. Elkan. 1965. Diseases of Amphibians. Academic Press, London.