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A Pacific Giant Salamander Survey and List of Herpetological Records in the Skagit River Watershed

by

A.C.M. Farr

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Abstract

A total of 62 creeks were surveyed extensively for Pacific Giant Salamanders in the Skagit River watershed; 15 creeks were surveyed intensively. No Pacific Giant Salamanders were found. Creeks having suitable characteristics for the salamander were relatively high in elevation. Available data suggest that cold winters limit the species distribution in British Columbia. Reliable records indicate that six amphibian and five reptilian species occur in the Skagit watershed. Earlier records of Rana aurora may be misidentifications of Rana pretiosa.

Objectives

The objectives of this study were to:

1. Determine the possible distribution of the Pacific Giant Salamander within the Skagit River Watershed. Specific objectives were to:
   1) determine the habitat potential of all watercourses for this species;
   2) survey all watercourses on a priority basis;
   3) determine the occurrence and distribution of this species.
2. Develop an updated species presence list of other amphibians and reptiles in the Skagit.

Methods

Extensive and intensive survey methods were used to determine the habitat potential for Pacific Giant Salamanders in the Skagit River watershed (Objective 1). Whenever possible, the extensive method was used first and consisted of driving all accessible roads in the watershed and determining which creeks appeared to provide suitable habitat for the species. Habitat criteria were derived from a previous survey of the Pacific Giant Salamander (Farr 1985) and included abundant cover, steep slope, and adequate water volume. Creeks which met these three criteria were given priority over other creeks as candidates for intensive surveys. Water volume was ranked as the most important of these characteristics. Dry creek beds, or creeks that appeared to have insufficient water volume to form pools large enough to contain Pacific Giant Salamanders, were rejected as candidates for intensive surveys. In areas with no road access selection of creeks for intensive surveys was based on slope, obtained from topographic maps, and the length of time required to hike to the creek.

Intensive surveys consisted of two individuals walking, crawling, or climbing up creeks, looking carefully in pools, and lifting up or probing underneath rocks, logs, and floating organic debris. This method was successfully used to locate 30 Pacific Giant Salamanders in 10 different small creeks in the Chilliwack River watershed in 1985. Habitat features recorded included stream gradient, water temperature, the percentages of

different types of available cover, general types and abundance of potential food items, observations of other amphibians or fish, and a list of streamside vegetation species. Prey abundance was crudely estimated by lifting approximately 10 rocks in riffle areas in each creek and catching the stream insects downstream in a finely-meshed strainer. Three broad categories of abundance were used: High (several insects caught each time), Moderate (usually at least one insect caught each time), and Low (no insects present underneath many of the rocks lifted). The distance surveyed varied from creek to creek due to differences in topography, vegetation penetrability, or time constraints. For example, if a large vertical waterfall was encountered and there did not appear to be a safe way to either climb it or circumnavigate it, an intensive survey was terminated. A total of fifteen creeks (Figures 1 to 5) were surveyed intensively between August 19 and September 16, 1986.

To complete objective 2, herpetological records for the Skagit River watershed were compiled from B.C. Provincial Museum records, literature, personal observations, and personal communication with naturalists.

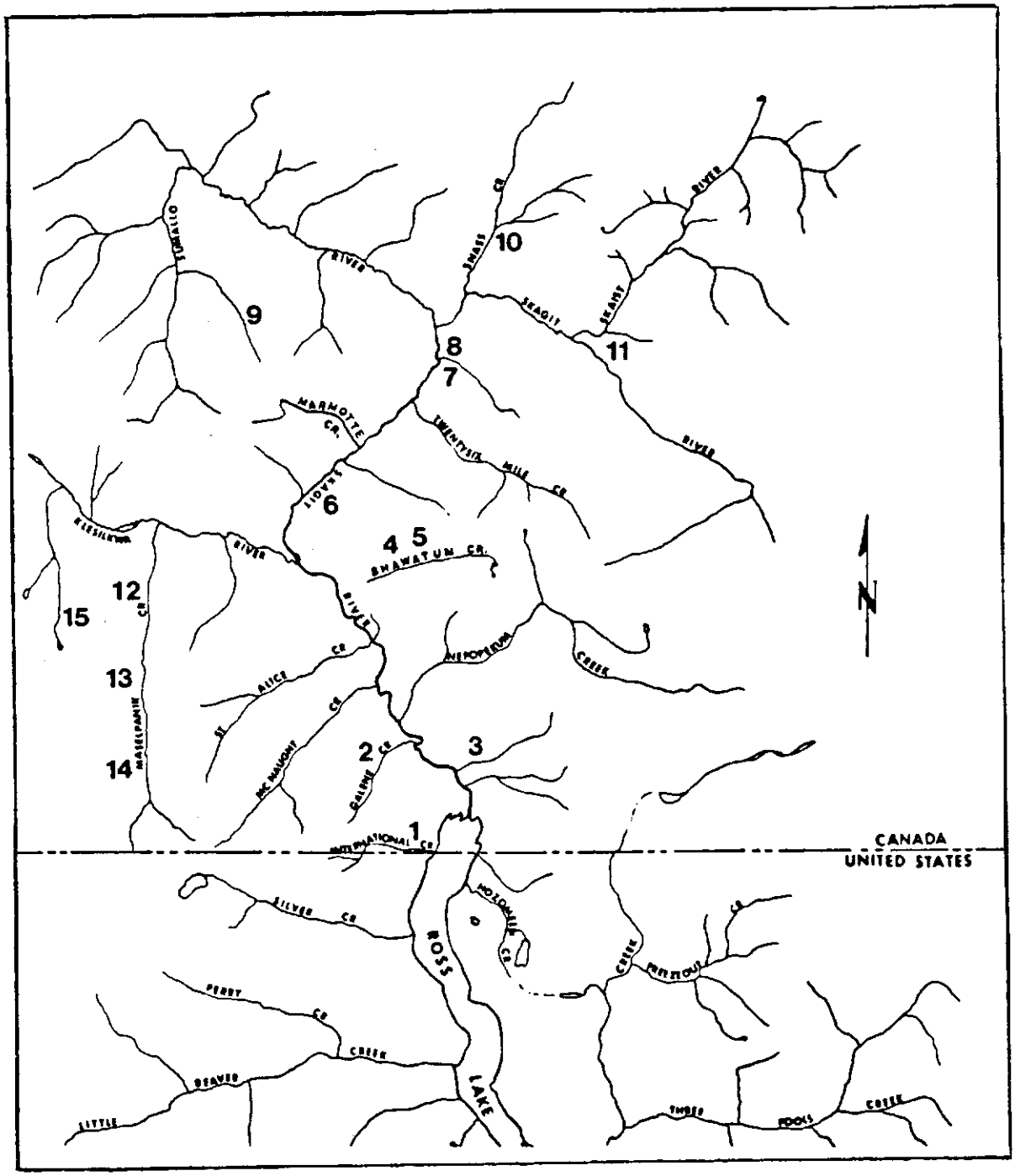

Figure 1. Map of the Skagit River system showing the locations of 15 creeks that were intensively surveyed. (Scale 1:287,500)

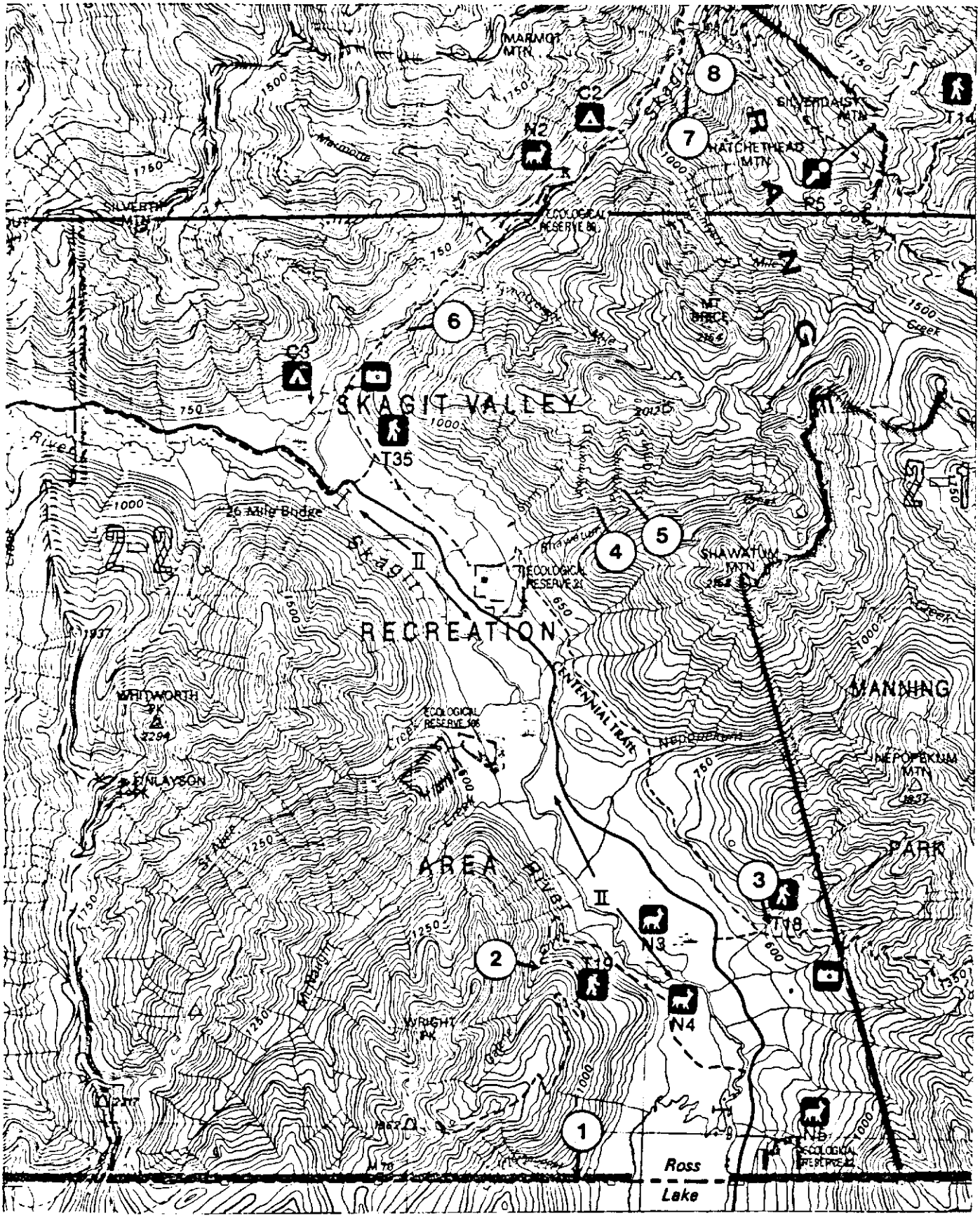

Figure 2. Map showing the exact locations of Creeks #1 to #8.

(Scale 1:100,000)

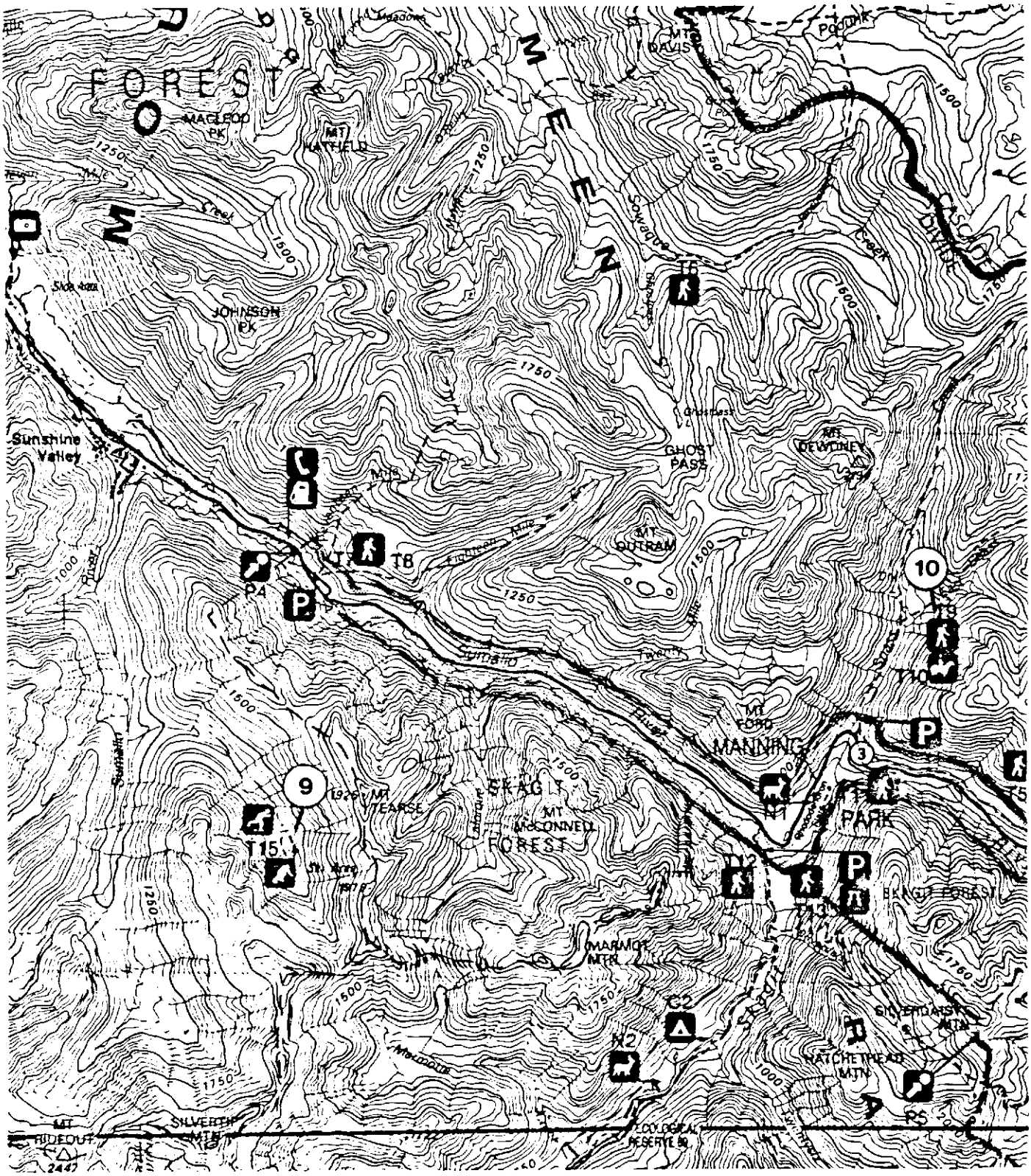

Figure 3. Map showing the exact locations of Creeks #9 and #10.
(Scale 1:100,000)

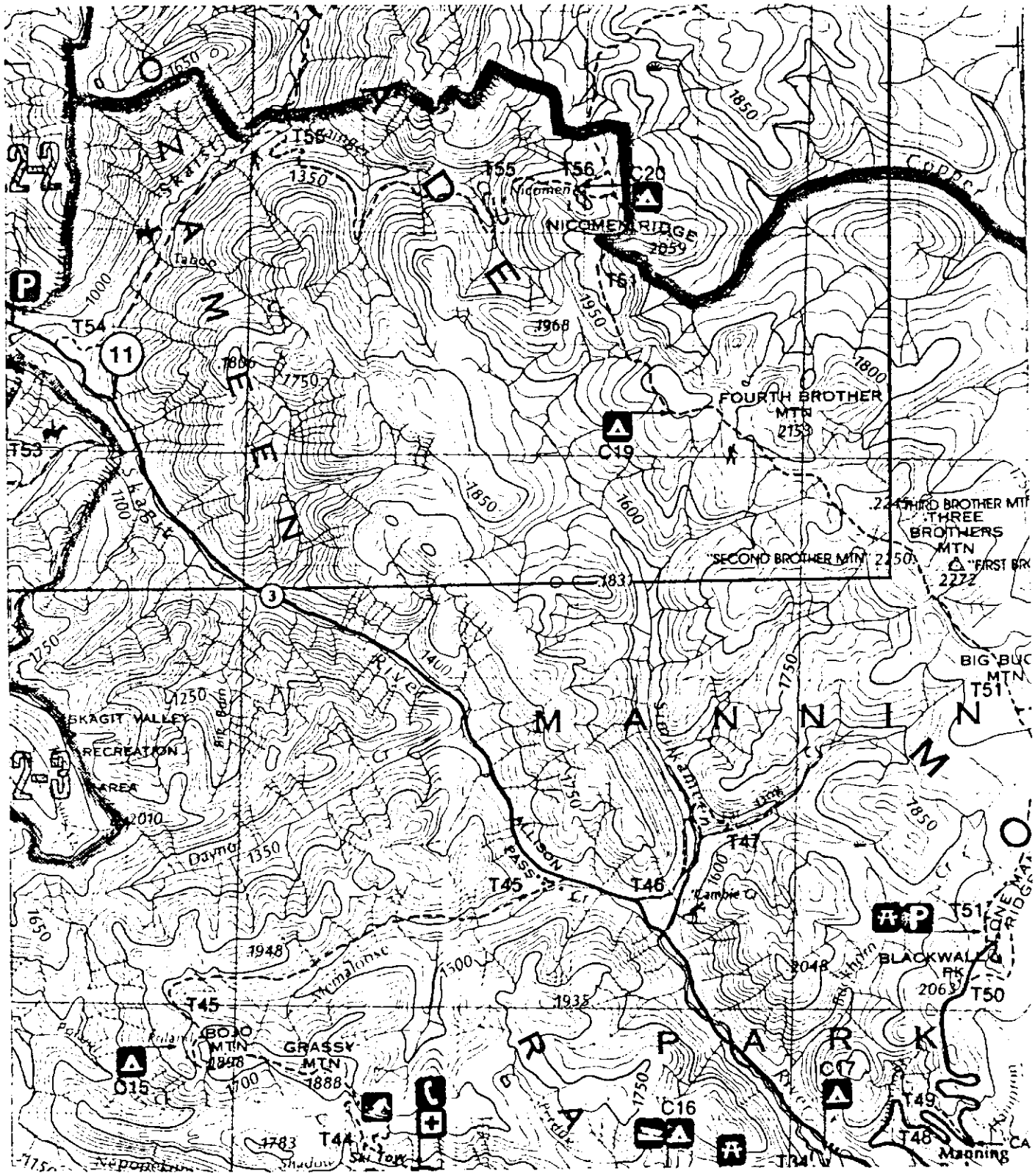

Figure 4. Map showing the exact location of Creek #11. (Scale 1:100,000)

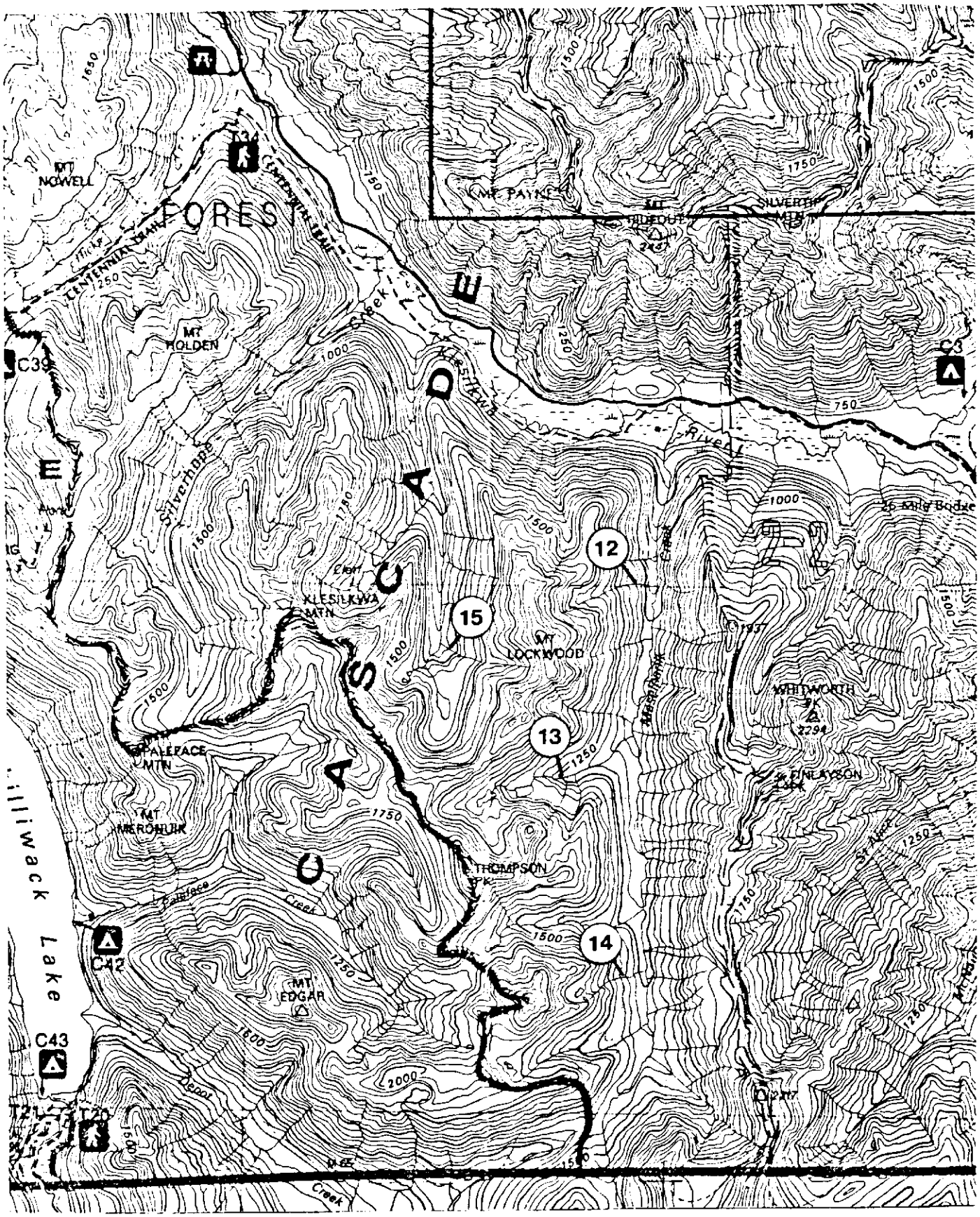

Figure 5. Map showing the exact locations of Creeks #12 to #15.
(Scale 1:100,000)

Results

1. Pacific Giant Salamander Survey

No Pacific Giant Salamanders were found. Extensive surveys in the Skagit River watershed encompassed 62 small creeks, of which 15 (24%) were dry, 21 (34%) were assessed as having inadequate water flow, 11 (18%) had sufficient water volume but were not surveyed, and 15 (24%) were surveyed intensively. Habitat characteristics of the 15 creeks surveyed intensively are summarized in Table 1.

Stream gradients of sections surveyed ranged from 4° to 30°. The two creeks with a slope of 4° (#7 and #10) each had trout along the entire section surveyed. Trout were also observed in the lower parts of two other creeks (#1 and #8) which had slopes of 8° and 7°. Stream temperatures ranged from 5° to 13° C. Only three creeks had a vegetation canopy of 50% or greater. The percentage of in-stream cover presented for each creek is the sum of crude estimates of percent cover provided by logs, rocks, and overhanging banks. Types and abundance of in-stream cover were extremely variable, but all creeks surveyed provided some potential cover. In all but one of the creeks surveyed, at least two of the three main stream insect staples (stoneflies, caddisflies, and mayflies) were found. None of these staples were found in Creek #4, the only creek ranked as "Low" in prey abundance. Tailed frogs (a total of 12 adults and 78 tadpoles) were found in 10 of the 15 creeks surveyed. The highest densities occurred in creeks #2, 3, and 15. The five creeks in which none

Table 1. Habitat characteristics of 15 creeks in the Skagit River watershed.

Creek	Slope (°)	Temp (°C)	Vegetation Canopy (%)	In-stream Cover (%)[a/]	Potential Prey Types[b/]					Prey Abundance[c/]	Trout Present[d/]
					S	C	M	U	TF		
1	8	11	23	40	X	X			X	M	L
2	15	12	7	36	X	X	X	X	X	H	
3	5	12	25	26	X	X			X	H	
4	20	9	8	85				X		L	
5	20	10	90	83	X	X		X		L-M	
6	15	7	10	26	X		X		X	M-H	
7	4	9	25	15	X	X	X	X		H	X
8	7	12	15	51	X	X	X		X	H	L
9	23	5	50	75	X	X	X		X	L-M	
10	4	10	15	16	X		X	X	X	H	X
11	14	10	90	50	X	X	X			H	
12	20	11	25	70	X		X			M	
13	8	13	15	32	X	X	X		X	M	
14	26	9	10	18	X	X	X	X	X	H	
15	30	10	15	25	X	X		X	X	H	

[a/] Estimate of % cover provided by logs, rocks, and overhanging banks.

[b/] Potential prey types that were present are marked with an X. S = Stonefly larvae, C = Caddisfly larvae, M = Mayfly larvae, U = Unidentified, TF = Tailed frog.

[c/] H = High, M = Moderate, L = Low.

[d/] X = Trout present along entire section surveyed, L = Trout present only in lower part of section surveyed.

were observed were creeks #4, 5, 7, 11, and 12 (Fig. 1 provides creek locations).

Streamside vegetation species were extremely variable, but a few species were common. The most prevalent coniferous trees were Douglas-fir (Pseudotsuga menziesii), western redcedar (Thuja plicata), and western hemlock (Tsuga heterophylla), at least two of which were found growing near 13 of the 15 creeks. The other two creeks (#9 and #14) were in a mountain hemlock (Tsuga mertensiana)/Engelmann spruce (Picea englemannii) community. The most common deciduous trees or shrubs were Sitka alder (Alnus sinuata) and Devil's club (Oplopanax horridus), each of which occurred along 13 of the 15 creeks. The most common herb was lady fern (Athyrium filix-femina), which was found along 9 creeks. Creek #12 was in a clear cut and sections of Creeks #5, 9, 13, 14, and 15 were in or adjacent to clearcuts.

2. Updated species presence list of amphibians and reptiles in the Skagit.

Specimen and sight records of amphibians and reptiles in the Skagit River watershed are presented in Tables 2 and 3 and summarized in Table 4. Only sight records with dates and locations are included. Sources include personal communication, records of the B.C. Provincial Museum (BCPM), Carl et al. (1952), Slaney et al. (1973a), and Howie and Stirling (1981). The 6 species of amphibians which have been recorded are the long-toed salamander (Ambystoma macrodactylum), northwestern salamander (Ambystoma gracile), tailed frog (Ascaphus truei), Pacific tree

TABLE 2. Records of Amphibians in the Skagit River watershed.

Species	Number & Type[a]	Date	Location	BCPM Catalogue Number	Observer(s) or Source
Ambystoma macrodactylum	2 Ad.	May, 1971	Under logs near Ross Lake	---	Source: Slaney et al. 1973a
	1 Un.	April 16, 1972	Skagit Valley between 28 Mile Bridge and Ross Lake	---	M. Luz, M. Force, D. Peterson (Vancouver Natural History Society Field Trip)
	1 Ad.	Aug. 29, 1986	Near edge of Ross Lake (0.5 km south of Canada/U.S.A. border)	---	A. Farr, N. Minunzie
Ambystoma gracile	3 Ad.	April, 1971	Found under logs near Ross Lake	---	Source: Slaney et al. 1973a
Ascaphus truei	1 Ad. F.	June 5, 1947	Skyline trail, Skagit Valley	869	G.A. Hardy
	2 Un.	July 30, 1945	Skagit River 3 miles W of Allison Pass	---	G.C. Carl

[a]Un. = unclassified; Ad. = adult; Ad. F. = adult female; Im. = immature

[b]Whitworth Ranch was located about 3 miles N of the international border.

TABLE 2. -- continued --

Species	Number & Type[a]	Date	Location	BCPM Catalogue Number	Observer(s) or Source
	Un.	Aug. 13, 1945	Headwaters of Skagit River, Allison Pass, 4550' elevation, Manning Park	---	G.C. Carl
	Un.	May 30 - June 8, 1947 (?)	In a tributary to the Skagit near the old Whitworth Ranch[b]	---	G.C. Carl, G.A. Hardy, J.D. Yarwood
	12 Ad., 78 Im.	Aug. 19 - Sept. 16, 1986	In creeks #1, 2, 3, 6, 8, 9, 10, 13, 14, 15 (see Fig. 1-5 and Appendix II)	---	A. Farr, N. Minunzie, K. Fry
Bufo boreas	1 Ad.	June 1, 1947	Nepopekum (Muddy) Creek, Skagit Valley	---	G.C. Carl
	"Very abundant"	Summer, 1971	"in most areas of the Canadian Skagit Valley; ponds and channels in the Ross Lake drawdown are major breeding sites for this toad."	---	Source: Slaney et al. 1973a

TABLE 2. -- continued --

Species	Number & Type[a]	Date	Location	BCPM Catalogue Number	Observer(s) or Source
	"hundreds of Ad."	Aug. 30, 1986	Near footbridge crossing over Skagit River (2.3 km N of U.S. border) "crossing road and falling down the east bank into river."	---	R. Gurr et al. (Valley Outdoor Club Field Trip)
Hyla regilla	"present in numbers; half-grown tadpoles seen"	May 30 - June 8, 1947	Swamp below Whitworth ranch house in the Skagit Valley	---	G.C. Carl, G.A. Hardy, J.D. Yarwood
	"abundant"	Summer, 1971	"in all side channels and ponds on the valley bottom and lower slopes"	---	Source: Slaney et al. 1973a
	1 Ad.	April 16, 1972	Skagit Valley between 28 Mile bridge and Ross Lake	---	W.C. Weber et al. (Vancouver Natural History Society Field Trip)
	"numerous and in full chorus"	March 28, 1981	2.1 miles N of Silvertip campground	---	R. Howie, D. Stirling, J. Baldwin
Rana pretiosa	---	June 2, 1947	Skagit Valley (Whitworth ranch?)	871	J.D. Yarwood

TABLE 2. -- continued --

Species	Number & Type[a]	Date	Location	BCPM Catalogue Number	Observer(s) or Source
	1 Un.	June 3, 1947	Nepopekum (Muddy) Creek, Skagit Valley	---	G.C. Carl

TABLE 3. Records of Reptiles in the Skagit River watershed.

Species	Date	Location	BCPM Catalogue Number	Observer(s) or Source
Thamnophis elegans	June 7, 1947	Whitworth Ranch	1061	--
	Summer, 1971	"recorded throughout the valley although it appears most abundant in the Whitworth ranch area; there is 1 record from 3500 feet in elevation."	---	Source: Slaney et al. 1973a
Thamnophis sirtalis	June 1, 1947	Whitworth Ranch	936	--
	Summer, 1971	"recorded throughout the valley - appears to be the most abundant and widespread of the 3 species of garter snakes"	---	Source: Slaney et al. 1973a
Thamnophis ordinoides	Summer, 1971	"there are several records, all from a grassy slope on the edge of a birch-willow swamp at Whitworth Ranch"	---	Source: Slaney et al. 1973a
Gerrhonotus coeruleus	May 30 - June 8, 1947	Whitworth Ranch	---	Fletcher (fide G.C. Carl)

TABLE 3. -- continued --

Species	Date	Location	BCPM Catalogue Number	Observer(s) or Source
Charina bottae	May 30 - June 8, 1947	Skagit Valley near international border and at Mile 21	---	G.C. Carl
	July 13-21, 1949	Sumallo River Valley on Hope-Princeton Hwy. about Mile 20	---	G.C. Carl

TABLE 4. List of amphibian and reptile species which have been recorded[a] in the Skagit River watershed in B.C.

Amphibians	
Long-toed salamander	*Ambystoma macrodactylum*
Northwestern salamander	*Ambystoma gracile*
Tailed frog	*Ascaphus truei*
Western toad	*Bufo boreas*
Pacific tree frog	*Hyla regilla*
Spotted frog	*Rana pretiosa*
Reptiles	
Rubber boa	*Charina bottae*
Northern alligator lizard	*Gerrhonotus coeruleus*
Western garter snake	*Thamnophis elegans*
Common garter snake	*Thamnophis sirtalis*
Northwestern garter snake	*Thamnophis ordinoides*

[a]Only species for which either specimen records or sight records accompanied by dates and locations are included in this list. Slaney et al. (1973a) include the red-legged frog (*Rana aurora*) and western skink (*Eumeces skiltonianus*) in a list of species present in the Skagit, but data on locations were missing in at least two copies of their 1973 report. Their identification of *Rana* as *Rana aurora* is questioned (see Results 2).

frog (Hyla regilla), spotted frog (Rana pretiosa), and western toad (Bufo boreas). The 5 species of reptiles which have been recorded are rubber boa (Charina bottae), northern alligator lizard (Gerrhonotus coeruleus), western garter snake (Thamnophis elegans), common garter snake (Thamnophis sirtalis), and northwestern garter snake (Thamnophis ordinoides).

Robichaud et al. (1971) and Slaney et al. (1973a) included the red-legged frog (Rana aurora) and/or the western skink (Eumeces skiltonianus) in lists of species present in the Skagit, but data on locations were not given by Robichaud et al. and were missing in at least two copies of the Slaney et al. report. In their lists they did not include the spotted frog (Rana pretiosa), a species for which a Skagit specimen record exists in the B.C.P.M. Green and Campbell (1984) noted that the spotted frog, red-legged frog, and Cascades frog comprise a group of similar species; all are brown frogs that have some red, orange, or yellow on the belly, which may cause some confusion in telling them apart. On August 19, 1986, A. Farr and N. Minunzie observed hundreds of tadpoles and newly transformed froglets of the genus Rana that were in shallow water at the edge of Ross Lake. Due to their very small size (length 15 mm) and absence of the undersurface pigment that develops with age, it was difficult to make a positive identification of the species. The froglets did, however, have scattered black spots with light centres, which is one of the characteristics of the spotted frog.

Discussion

Data collected during fisheries operations in the Skagit River system in B.C. also suggest that the species Dicamptodon ensatus does not occur in this area. No Pacific Giant Salamanders were found during electroshocking operations in the Skagit in 1982 and 1983 (B. Griffith, pers. commun.) From August 26 to September 3, 1983, electroshocking occurred at a total of 19 sites, ranging in size from 25 m^2 to 120 m^2. Of the 19 sites, 11 were on the main stem of the Skagit River (from near Nepopekum Creek to Barrier Falls near Snass Creek), 2 sites were on Nepopekum Creek, 2 sites were on the Klesilkwa River, and 4 sites were on the Sumallo River. In 1982 electroshocking occurred at 4 sites on the main stem of the Skagit River above Barrier Falls (east of Snass Creek).

No amphibians were included in the list of food types consumed by trout in the Skagit, although anurans (frogs) were listed as an available but infrequent food type in the Skagit River (Slaney et al. 1973b). Food availability in the Skagit River was measured by collecting a total of 286 subsamples with a modified Surber sampler which collects fauna from one square foot of stream bottom. Samples were taken from riffle areas; pools and boulder areas were not sampled. The stomach analyses were conducted on 497 trout taken from Ross Lake, 228 of which were large trout (≥ 30 cm), and 432 trout taken from the Skagit River, at least 153 of which were large trout. The trout were collected in 1970 and 1971. In other areas in B.C., salamanders (i.e.,

Ambystoma gracile) have been found in the stomachs of rainbow trout (K. Kyatt, pers. commun.) and Dolly Varden char (B. Clark, pers. commun.). Rainbow trout, Dolly Varden char, and Eastern brook trout are the three major species of fish in the Skagit River (Adams et al. 1971).

Little information has been published on the distribution of the Pacific Giant Salamander in northern Washington. Slater (1955) listed one locality in Whatcom county (4.5 miles west of Camp Shukson) and one locality in Skagit county (Samish, which is near the coast). There are no records of the species in Okanogan county, which lies adjacent to the Canadian border east of Ross Lake. Nussbaum et al. (1983) compiled a map showing localities throughout the state (Figure 6). Only two localities are in Whatcom county, both of which are west of Chilliwack Lake in B.C. The two localities in Skagit county are even farther to the west.

A hypothetical list of amphibians and reptiles in North Cascades National Park,[1] provided by the U.S. National Parks Service, suggests that the Pacific Giant Salamander may occur on the west side of the park. The west side includes Mt. Shuksan, which is southwest of Chilliwack Lake.

To assess the habitat potential of the Skagit River system for Pacific Giant Salamanders, it is helpful to compare it with the adjacent Chilliwack River watershed, where the species has been found. The biogeoclimatic units of both watersheds have been mapped and described by Klinka et al. (1984). Almost all of the

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[1]Presented in Appendix I.

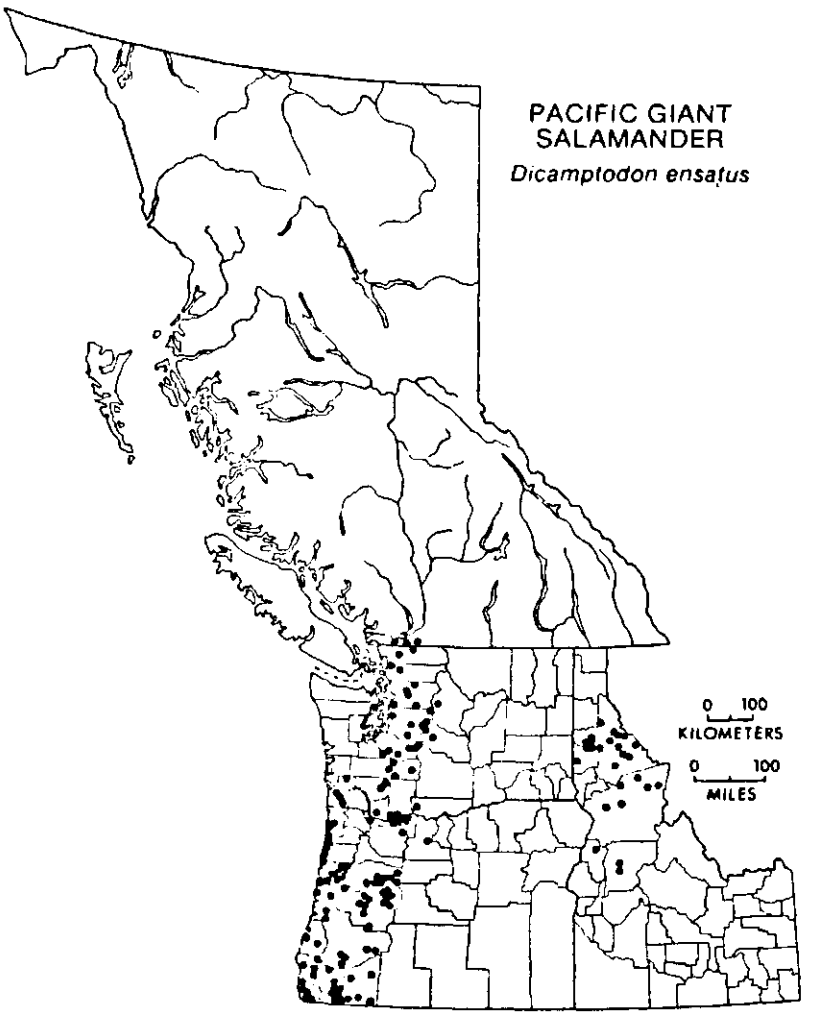

Figure 6. Map showing localities where Pacific Giant Salamanders have been found in B.C. and in Washington (from Nussbaum et al. 1983). The most eastern dot in B.C. is Chilliwack Lake. The county immediately to the south is Whatcom County, south of which is Skagit County.

sites where Pacific Giant Salamanders have been found in the Chilliwack River watershed are in or near the valley bottom within two biogeoclimatic zones, the drier maritime coastal western hemlock zone (Pacific Ranges subzone) and the drier submaritime coastal western hemlock zone (southern subzone). These two zones do not occur in the Skagit River system. The valley floor of the Skagit watershed, downstream from Twentyeight Mile Creek, is composed of the subcontinental Interior Douglas-fir zone, which does not occur in the Chilliwack River watershed. This zone has drier and warmer summers and cooler winters than those of the drier maritime and submaritime coastal western hemlock zones. At higher elevations, slopes of both the Chilliwack and Skagit Valleys are within the wetter coastal western hemlock zone (southern submaritime subzone). Pacific Giant Salamanders were found at two sites within this zone in the Chilliwack River watershed. The mountain hemlock zone (submaritime forested subzone) is also common to both watersheds.

In the Chilliwack River watershed, Pacific Giant Salamanders inhabit Chilliwack Lake, Chilliwack River, and small creeks. When characteristics of these three habitat types in the Chilliwack watershed are compared with those in the Skagit watershed, the Skagit appears to be a less favourable environment.

As the Canadian portion of Ross Lake is dry for several months of each year, it is an inhospitable environment for a species like D. ensatus which requires at least 2 years to mature. Even if the larvae or neotenic adults migrated to and

from this part of the reservoir each year, they might not find adequate food or cover there. Slaney et al. (1973b) concluded that macro-invertebrate production was severely restricted in the reservoir. A low standing crop of invertebrates in the draw down zone of a reservoir is generally attributed to absence of littoral vegetation and lengthy intervals of exposure (Fillion, 1976 in Slaney et al. 1973b). In Chilliwack Lake, Pacific Giant Salamanders were found in rocky "rip-rap" areas (B. Mitchell, pers. commun.). When the Canadian portion of Ross Lake is dry, it is apparent that this type of cover is virtually non-existent.

Both the Chilliwack River and the Skagit River appear to have abundant food (i.e., mayflies, stoneflies, caddisflies) and adequate rock or boulder cover for D. ensatus. Potential predators, however, such as large-sized Dolly Varden char and rainbow trout, may be more abundant in the Skagit River. Adams et al. (1971) compared the sizes of fish caught in the Skagit River with those caught in lower mainland lakes, including Chilliwack Lake. In Chilliwack Lake, 60% of the fish caught were under 10", 30% were 10-14", and 10% were over 14". In the Skagit River, 12% were under 10", 60% were 10-14", and 28% were over 14".

Small creeks may be critical breeding habitats for Pacific Giant Salamanders (Farr 1985). All of the small creeks intensively surveyed in the Skagit River watershed shared some of the characteristics of creeks where Pacific Giant Salamanders were found in the Chilliwack River watershed in 1985, such as adequate water flow and sufficient in-stream cover. Summer water

temperatures of the Skagit creeks were within the range of water temperatures recorded in spring and summer at salamander sites in Chilliwack creeks. All but three of the intensively surveyed creeks in the Skagit appeared to have adequate food.

Differences between the two sets of creeks become apparent when other parameters are compared. The 10 small creeks where the species was found in the Chilliwack River watershed in 1985 were relatively low in elevation, had a vegetation canopy of 50 to 90%, and had a slope of 10° to 30°. At least 8 of the creeks appeared to be spring-fed. No small creeks having all of these characteristics were found in the Skagit River watershed.

Nussbaum (1976) stated that the Pacific Giant Salamander is most often found at altitudes ranging from sea level to about 960 m. The maximum altitude for a reliable sight record is 2160 m (Trinity Co., California); the highest elevations for specimen records are 1790 m in southern Oregon and 1880 m in northern California. Applying Hopkin's 'bioclimatic law,' that each degree of latitude is roughly equivalent to a 100 or 130 m change in elevation (e.g., Bunnell 1982), the upper elevational range of the species here would be about 900 or 1100 m.

Sites where Pacific Giant Salamanders were found in the Chilliwack River watershed ranged from about 31 m (Vedder Mt.) to about 715 m (above Chilliwack Lake). Only 3 creeks above 750 m, however, were surveyed in that watershed. Chilliwack Lake is about 620 m elevation. The southern part of the Skagit Valley in B.C. is about 550 m in elevation. On the east side of the Skagit

Valley, however, most of the creeks have a gradual slope up to at least 750 m elevation and on both sides of the valley the lower portions of many creeks (including Creeks #1, 2, and 3) were dry in late August. To find steep gradients and adequate water flow, it was thus necessary to survey creeks or sections of creeks at higher elevations. Nine of the intensive surveys occurred above 900 m in elevation (Creeks #2, 4, 5, 9, 11, 12, 13, 14, and 15). The lower reaches of virtually all of the small creeks in the Sumallo, Maselpanik, upper Klesilkwa, and upper Skagit Valleys are above 900 m in elevation.

In addition to elevation, a steep gradient, a dense vegetation canopy and/or a spring-fed source may be critical. A steep gradient effectively eliminates fish predators which would readily consume young salamander larvae (Petranka 1983). Shaded reaches of streams are warmer in winter and cooler in summer than exposed reaches; spring-fed streams are cooler in summer and warmer in winter than streams fed by run-off (Hynes 1970).

Creek #11 was the only small creek found which appeared to be spring-fed (little evidence of any fluctuation in water level) and was the only easily accessible creek which had both a steep slope and a dense vegetation canopy. If elevation is critical, however, this creek (with its mouth at about 900 m) may not be suitable habitat for Pacific Giant Salamanders.

The previous discussion has assumed implicitly that temperature plays a major role in determining habitat suitability for the Pacific Giant Salamander. Evidence supporting the

assumption that cold winters limit the species' range in B.C. includes:

1. The species is distributed from California to the extreme southern portion of B.C.
2. Comparing voluntary thermal minima of amphibian species found in the Skagit with that of the Pacific Giant Salamander (Table 5) reveals that the Pacific Giant Salamander may be less tolerant of cold temperatures. Although Brattstrom (1963) did not include data on three amphibian species that occur in the Skagit, the occurrence of the long-toed salamander and spotted frog in the northern interior of B.C. (Green and Campbell, 1984) indicates tolerance of cold temperatures.

It is possible that suitable habitat may exist in less accessible areas in the Skagit that were not surveyed. If so, it is very rare and localized. Based on existing evidence, the conclusion is that suitable habitat for Pacific Giant Salamanders probably does not exist in the Skagit River watershed in B.C.

TABLE 5. Voluntary thermal maxima and minima for some amphibian species.

Species	Min (°C)	Max (°C)	Mean (°C)
Found in the Skagit			
Long-toed salamander	-- no data -		
Tailed frog	4.4	14.0	10.0
Western toad	3.0	29.5	21.3
Pacific tree frog	3.0	24.0	16.2
Spotted frog	-- no data -		
Northwestern salamander	-- no data -		
Not found in the Skagit			
Pacific Giant Salamander	9.6	16.2	13.1
Rough-skinned newt	12.5	18.4	14.8

Compiled from Brattstrom (1963)

Acknowledgements

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Appendix I.

Hypothetical Listing of Amphibians and Reptiles in North Cascades National Park and Ross Lake and Lake Chelan National Recreation Areas

(provided by the U.S. National Park Service, Washington)

NORTH CASCADES NATIONAL PARK
ROSS LAKE AND LAKE CHELAN NATIONAL RECREATION AREAS

Amphibians and Reptiles
(Hypothetical Listing)

The following list is suspected but not confirmed. Please notify Park Rangers of corrections, additions and observations so that a complete and accurate checklist may be prepared.

AMPHIBIANS

Caudata

Long-toed Salamander	
Tiger Salamander	(Chelan Area)
Northwest Salamander	(West Side)
Rough-skinned Newt	(Common
Western Redbacked Salamander	(West Edge Only)
Pacific Giant Salamander	(West Side)
Eschscholtz's Salamander	(West Edge)

Salientia

Western Spadefoot Toad	(Doubtful, Southeast)
Western Toad	(Common Throughout)
Pacific Tree Frog	(Common Throughout)
Tailed Frog	
Spotted Frog	
Redlegged Frog	(West Side)

REPTILES

Turtles

Painted Turtle	(East Side - Seen at Stehekin 1969)

Lizards

Short-horned Lizard	(Chelan Area)
Sagebrush Lizard	(Chelan Area)
Western Fence Lizard	(Common)
Side-blotched Lizard	(Seen Near Stehekin)
Western Skink	
Northern Alligator Lizard	

Snakes

Rubber Boa	(Fairly Common)
Racer	(East Side Mostly)
Gopher Snake	(East Side Mostly)
Common Garter Snake	(Common)
Western Garter Snake	(Common)
Northwestern Garter Snake	(Mostly on West Side)
Western Rattlesnake	(East Side Especially Stehekin Area, Fairly Common)

(May 1979)

Appendix II.

Stream Survey Data Sheets

Stream Data

Date: Aug 19, 1986 Weather: clear and warm

Creek # : 1 Name: International Creek Area: Skagit

Location: West side of Ross Lake on the Canada/U.S.A. border.

Survey Starting Point: edge of Ross Lake

Meters surveyed (very approximate): 500

Stream Gradient: 8° Water Temperature: 11° C.

Streamside Vegetation

Tree: Douglas-fir, western redcedar, western yew, western hemlock, vine maple, Sitka alder, dogwood, black cottonwood

Shrub: Devil's club, Goat's beard, red elderberry, willows.

Herb: Lady fern, moss

Cover

Logs: 15 % Overhanging Vegetation: 23 %

Overhanging Bank: 0 Rocks or Boulders that provide cover: 25 %

Stream Fauna: stoneflies, caddisflies, leeches

Quantity: Stoneflies are quite abundant

Amphibians: tailed frogs: 2 tadpoles + 2 adults (one ♀ and one unclassified)

Fish: trout (5-15 cm in length) in lower part of creek

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: This creek was dry at the mouth (flowing underground) but had abundant water volume about 50 m. upstream from the mouth. Water occupied 33-66 % of the channel so there were no overhanging banks above the water. The upper part of the section we surveyed looked like suitable habitat for Pacific Giant Salamanders.

Stream Data

Date: Aug. 28, 1986 Weather: overcast and warm

Creek # : 2 Name: Galena Creek Area: Skagit

Location: a tributary on the west side of the Skagit River, north of Ross Lake.

Survey Starting Point: Galena Lake Trail at upper crossing of creek

Meters surveyed (very approximate): 150

Stream Gradient: 15° Water Temperature: 12° C.

Streamside Vegetation

Tree: Sitka alder, Douglas (?) maple (western redcedar and western hemlock well back from the creek)

Shrub: Devil's club, willow, salmonberry, goat's beard.

Herb: cow parsnip, Arnica, ladyfern, youth-on-age, fireweed, asters, grass, foam flower, bedstraw

Cover

Logs: 10 % Overhanging Vegetation: 7 %

Overhanging Bank: 0.5 % Rocks or Boulders that provide cover: 25 %

Stream Fauna: stoneflies, caddisflies, mayflies, unid.*1

Quantity: very abundant

Amphibians: Tailed frogs: 9 tadpoles + 2 small adults (unclassified)

Fish: 0

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: A bright, open stream with a fairly large volume of water which occupied about 33% of the channel. The section we surveyed had many deep pools with abundant rock cover, and flowed through lush deciduous slide vegetation. There were many bear trails and signs of bear feeding, such as nibbled parsnips. Survey was terminated at the base of a 5 m. high sloping slimy waterfall. We could have circumnavigated the waterfall by taking a steep, well-used bear trail through dense vegetation but we decided against it. Galena Creek was dry at the first trail crossing.

Stream Data

Date: Aug. 29, 1986 Weather: overcast and mild

Creek # : 3 Name: unnamed Area: Skagit

Location: A tributary on the east side of the Skagit River; flows down Nepopekum Mtn.

Survey Starting Point: where Centennial Trail crosses the creek

Meters surveyed (very approximate): 500

Stream Gradient: 5° Water Temperature: 12°C.

Streamside Vegetation

Tree: Douglas maple, western redcedar, Sitka alder, vine maple, black cottonwood, Douglas-fir, red alder, western hemlock

Shrub: thimbleberry, Devil's club, snowberry, currant

Herb: maidenhair fern, moss, foam flower, licorice fern, sword fern, ladyfern, grass, bedstraw, columbine, star flower

Cover

Logs: 8 % Overhanging Vegetation: 25 %

Overhanging Bank: 3 % Rocks or Boulders that provide cover: 15 %

Stream Fauna: stoneflies, leeches, caddisflies

Quantity: abundant

Amphibians: Tailed frogs: 31 tadpoles + 2 small adults (unclassified)

Fish: 0

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: A gentle cascading stream which was fairly open and easy to walk up. There was adequate water volume and many good-sized pools with rock cover. Water occupied about 66% of the channel. Possibly not steep enough for Pacific Giant Salamanders. Below the trail crossing the creek was dry.

Stream Data

Date: Aug 20, 1986 Weather: clear and warm

Creek # : 4 Name: Antimony Creek Area: Shawatum

Location: tributary of Shawatum Creek

Survey Starting Point: logging road on N side of Shawatum Cr.

Meters surveyed (very approximate): 100

Stream Gradient: 20° Water Temperature: 9° C.

Streamside Vegetation

Tree: Western redcedar, Douglas-fir, western hemlock, Sitka alder, vine maple, Douglas maple.

Shrub: Devil's club, salmonberry, red elderberry, Goat's beard.

Herb: wild lily-of-the-valley, twin-flower, lady fern, grasses, moss.

Cover

Logs: 70 % Overhanging Vegetation: 8 %

Overhanging Bank: 0 Rocks or Boulders that provide cover: 15 %

Stream Fauna: Unidentified #1 (looks like small green caterpillar)

Quantity: scarce

Amphibians: 0

Fish: 0

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: A steep creek with unstable (loose) rocks and large logs strewn lengthwise down the creek bed. Water occupied less than 50 % of the channel. Creek was braided in places, with several small channels and good-sized pools. Survey was terminated at a 4m. high sloping bedrock waterfall. This creek had good water flow, abundant cover and a good gradient, but appeared to be unstable and had virtually no food for Pacific Giant Salamanders.

Stream Data

Date: Aug 20, 1986 Weather: clear and hot

Creek # : 5 Name: Pyrrhotite Creek Area: Shawatum

Location: tributary of Shawatum Creek

Survey Starting Point: logging road on N side of Shawatum Cr.

Meters surveyed (very approximate): 150

Stream Gradient: 20° Water Temperature: 10 °C.

Streamside Vegetation

Tree: Sitka alder, western redcedar, Douglas-fir

Shrub: Devil's club, Goat's beard, Saskatoon berry, vine maple, willow, currant, salmonberry

Herb: lady fern, Arnica, moss

Cover

Logs: 80 % Overhanging Vegetation: 90 %

Overhanging Bank: 1 % Rocks or Boulders that provide cover: 2 %

Stream Fauna: stoneflies, caddisflies, Unid. #1

Quantity: probably adequate, but not really abundant

Amphibians: 0

Fish: 0

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: A difficult creek to search due to logs and dense vegetation. Above the logging road, on the E. side of the creek, is a clear cut which has also been burned. There were relatively few pools in the section we surveyed. We saw bear sign and one dead robin in the creek. Could be "possible" habitat for Pacific Giant Salamanders.

Stream Data

Date: Aug. 22, 1986 Weather: clear and warm

Creek # : 6 Name: unnamed Area: Skagit

Location: first creek on the S. side of the Skagit R., heading E along the Skagit River Trail. (Second creek to the W of Twentyeight Mile Cr.)

Survey Starting Point: Skagit River

Meters surveyed (very approximate): 400

Stream Gradient: 15° Water Temperature: 7° C.

Streamside Vegetation

Tree: western red cedar, Douglas-fir, vine maple, Sitka alder, dogwood.

Shrub: Devil's club, Goat's beard, currant

Herb: Lactuca, twisted stalk

Cover

Logs: 15 % Overhanging Vegetation: 10 %

Overhanging Bank: 1 % Rocks or Boulders that provide cover: 10 %

Stream Fauna: mayflies, stoneflies, leeches

Quantity: mayflies abundant, a few stoneflies, quite a few leeches

Amphibians: Tailed frog? (One small brown frog (~2.5cm long) leapt into a small turbulent pool and could not be found again.)

Fish: 0

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: A large, fairly open creek. Water volume was so great we could only search side channels and edges. Numerous small landslides have occurred alongside the creek, bringing logs and small loose rocks into the channel. There may be adequate food and cover for Pacific Giant Salamanders, but the creek may be too unstable. We saw a dipper in this creek.

Stream Data

Date: Aug. 26, 1986 Weather: clear and warm

Creek # : 7 Name: unnamed Area: Skagit

Location: Flows down Hatchethead Mtn. on the east side of the Skagit R.

Survey Starting Point: Skagit River Trail

Meters surveyed (very approximate): 150

Stream Gradient: 4° Water Temperature: 9° C.

Streamside Vegetation

Tree: western red cedar, western hemlock, Douglas-fir, black cottonwood, Sitka alder, Douglas maple, western yew

Shrub: currant, false box, red huckleberry, Devil's club

Herb: twisted stalk, moss

Cover

Logs: 5 % Overhanging Vegetation: 25 % (cedar)

Overhanging Bank: 0.2 % Rocks or Boulders that provide cover: 10 %

Stream Fauna: mayflies, stoneflies, caddisflies, unid. * 1

Quantity: abundant

Amphibians: 0

Fish: trout (very small up to 20 cm in length)

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: A broad open stream with a large volume of water, so we could only search edges and small pools. It flows through a coniferous forest and is very easy to walk up. Looks like good trout habitat.

Stream Data

Date: Aug. 26, 1986 Weather: clear and hot

Creek # : 8 Name: Silverdaisy Cr. Area: Skagit

Location: A tributary on the east side of Skagit R., close to the Manning Park boundary.

Survey Starting Point: Skagit River Trail

Meters surveyed (very approximate): 100

Stream Gradient: 7° Water Temperature: 12° C.

Streamside Vegetation

Tree: western redcedar, black cottonwood, western hemlock, Douglas-fir, Sitka alder

Shrub: red osier dogwood, Devil's club, salmonberry, willow, currant, thimbleberry, Goat's beard

Herb: ladyfern, fireweed, moss

Cover

Logs: 30 % Overhanging Vegetation: 15 %

Overhanging Bank: 1 % Rocks or Boulders that provide cover: 20 %

Stream Fauna: Stoneflies, mayflies, caddisflies, leeches

Quantity: abundant

Amphibians: Tailed frog: 1 tadpole

Fish: Trout: one ≈15 cm long

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: The lower part of the section we surveyed was a disturbed, somewhat scoured, rocky channel with log jams. Water volume was adequate and further up there were good-sized pools with lots of available cover. Parts of the creek were well canopied by deciduous trees and shrubs. Water occupied about one third of the channel, which was about 5 m. in width. We hiked up to the old cabin and mine shaft at the base of a 10 m. high sloping steep bedrock waterfall. It looked like the creek continued above through steep bedrock walls so we did not try and climb around the waterfall.

Stream Data

Date: Sept. 16, 1986 Weather: Overcast with showers and sunny breaks

Creek # : 9 Name: unnamed Area: Sumallo

Location: flows down Mt. Tearse, on the east side of the east fork of the Sumallo River, in the ski area.

Survey Starting Point: top of chairlift

Meters surveyed (very approximate): 200

Stream Gradient: 23° Water Temperature: 5° C.

Streamside Vegetation

Tree: Sitka alder, Engelmann spruce, mountain hemlock, willow, western white pine

Shrub: blue huckleberry, false azalea

Herb: lady fern, oak fern, twisted stalk, moss

Cover

Logs: 65 % Overhanging Vegetation: 50 %

Overhanging Bank: 5 % Rocks or Boulders that provide cover: 5 %

Stream Fauna: caddisflies, stoneflies, mayflies, leeches.

Quantity: adequate (?) - not really abundant

Amphibians: Tailed frogs : 8 tadpoles

Fish: 0

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: This creek had adequate water flow and moderate sized pools. There were no really large pools. Much of the creek was subterranean - flowing underneath a canopy of logs. The slope adjacent to the lower part of the section we surveyed has been logged and burned to create a ski slope. There is a good vegetative canopy over the creek, and the gradient and amount of log cover are very suitable for Pacific Giant Salamanders, but available food may be insufficient and the creek is cold due to the high elevation.

Stream Data

Date: Aug 25, 1986 Weather: clear and hot

Creek # : 10 Name: Snass Cr. and East Snass Cr. Area: Skagit

Location: a tributary on the N. side of the upper Skagit R.; the mouth of the creek is within Manning Park.

Survey Starting Point: Highway # 3

Meters surveyed (very approximate): 200

Stream Gradient: 4° Water Temperature: 10° C.

Streamside Vegetation

Tree: western red cedar, Douglas-fir, Douglas maple, alder, western hemlock

Shrub: Devil's club, currant, red elderberry

Herb: Queen's cup, twisted stalk, lady fern, foam flower

Cover

Logs: 10% Overhanging Vegetation: 15 %

Overhanging Bank: 0.5 % Rocks or Boulders that provide cover: 5%

Stream Fauna: mayflies, stoneflies, Unid. # 1

Quantity: very abundant

Amphibians: Tailed frogs: 4 tadpoles

Fish: trout - one ~10 cm and one ~20 cm long in a deep pool.

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: A rather open creek with a gentle gradient and frequent small cascades. A large volume of water although it occupied only ~50% of the channel. Log jams fairly frequent and some very deep pools. Abundant food but possibly not enough cover for Pacific Giant Salamanders. Snass Creek went underground above the trail crossing. We surveyed ~150 m. of East Snass Cr.

Stream Data

Date: Aug 26, 1986 Weather: clear and hot

Creek # : 11 Name: unnamed Area: Skagit

Location: 8.3 Km E. of Snass Creek along Hwy # 3 ; a tributary of the Skagit River on the north side of the highway

Survey Starting Point: Highway

Meters surveyed (very approximate): 100

Stream Gradient: 14° Water Temperature: 10° C.

Streamside Vegetation

Tree: Willow, Sitka alder, Douglas-fir

Shrub: Devil's club, red elderberry

Herb: lady fern, youth-on-age, stinging nettle, grass

Cover

Logs: 15 % Overhanging Vegetation: 90 %

Overhanging Bank: 25 % Rocks or Boulders that provide cover: 10 %

Stream Fauna: Stoneflies, mayflies, caddisflies

Quantity: abundant

Amphibians: 0

Fish: 0

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: A very difficult creek to search, due to nearly impenetrable thickets of Devil's club. Also, parts of the creek are subterranean, and there is enough log debris in the larger pools that salamanders could easily avoid detection. There is little evidence of any fluctuation in water level, which suggests that this is a spring-fed creek. Adequate water volume, abundant food and cover, fairly steep gradient, absence of trout, and a stable creek bed suggest that this creek would be ideal habitat for Pacific Giant Salamanders. A potential problem is the culvert at the highway, which is about 3 m. (vertical distance) above the creek, and which may prevent access up the creek from the Skagit River.

Stream Data

Date: Aug. 21, 1986 Weather: clear and hot

Creek # : 12 Name: unnamed Area: Maselpanik

Location: on the W side of Maselpanik Cr., ~4.3 Km from where the logging road joins the main Skagit road.

Survey Starting Point: logging road

Meters surveyed (very approximate): 150

Stream Gradient: 20° Water Temperature: 11° C.

Streamside Vegetation

Tree: 3 to 7 m high balsam firs and western hemlocks, tiny western red cedars, Sitka alder, willows

Shrub: Devil's club, wild raspberry, salmonberry

Herb: Arnica, grasses.

Cover

Logs: 50 % Overhanging Vegetation: 25 %

Overhanging Bank: 10 % Rocks or Boulders that provide cover: 10 %

Stream Fauna: Stoneflies, mayflies

Quantity: quite abundant

Amphibians: 0

Fish: 0

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: This is a braided creek that flows through a clearcut. The rocks in the creek bed are loose and unstable, but there is adequate food and cover for Pacific Giant Salamanders.

Stream Data

Date: Aug 21, 1986 Weather: clear and hot

Creek # : 13 Name: unnamed Area: Maselpanik

Location: on the W. side of Maselpanik Cr, ~7.6 km from where the logging road joins the main Skagit rd. This creek comes from 2 lakes.

Survey Starting Point: logging road

Meters surveyed (very approximate): 250

Stream Gradient: 8° Water Temperature: 13° C.

Streamside Vegetation

Tree: western hemlock, balsam fir, Douglas-fir, Sitka alder

Shrub: Devil's club, salmonberry, false azalea, blue huckleberry

Herb: moss

Cover

Logs: 7% Overhanging Vegetation: 15 %

Overhanging Bank: 10 % Rocks or Boulders that provide cover: 15 %

Stream Fauna: stoneflies, mayflies, caddisflies, leeches

Quantity: fairly abundant, especially mayflies.

Amphibians: Tailed frogs: 4 tadpoles and 2 adults (one ♂ and one unclass.)

Fish: 0

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: A gentle cascading stream with lots of water. Many pools were very large and too deep and turbulent to search, so we searched edges, backwater pools, side channels. Biting insects in the air were very bad. Found one solitary beige egg (~0.5 cm diameter) with a dark central spot, attached to a rock by pedicel.

Stream Data

Date: Aug. 21, 1986 Weather: clear and warm

Creek # : 14 Name: unnamed Area: Maselpanik

Location: On the W side of Maselpanik Cr., ~12 km from where the logging road joins the main Skagit road. This creek comes from a lake.

Survey Starting Point: upper logging road

Meters surveyed (very approximate): 250

Stream Gradient: 26° Water Temperature: 9° C.

Streamside Vegetation

Tree: Douglas-fir, balsam fir, mountain hemlock, Engelmann spruce

Shrub: false azalea, blue huckleberry

Herb: twisted stalk, Arnica, yellow monkey flower (in clearcut), princes' pine, 1-sided wintergreen.

Cover

Logs: 5 % Overhanging Vegetation: 10 %

Overhanging Bank: 3 % Rocks or Boulders that provide cover: 10%

Stream Fauna: stoneflies, mayflies, caddisflies, leeches, Unid. #1

Quantity: abundant

Amphibians: Tailed frogs: 2 tadpoles and 1 adult ♂

Fish: 0

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: The lower part of the section we surveyed is in a clearcut, but we found many insects and one tadpole there. The clearcut is in the fireweed stage, with tree seedlings about 0.5 m high. Further upstream, in unlogged forest, there are numerous bedrock waterfalls, most of which we had to skirt around, through the bush. Am fairly confident if Pacific Giant Salamanders were here we would have found one, as there is not much cover for them. We found a group of ≥100 beige-coloured eggs, ~0.5 cm in diameter, with many dark spots in each egg, at the foot of a waterfall on the upper surfaces and sides of several rocks.

Stream Data

Date: Aug 27, 1986 Weather: clear and hot

Creek # : 15 Name: unnamed Area: Klesilkwa

Location: end of logging road along E. side of Klesilkwa valley ~6.5 Km from where logging road joins main Skagit road.

Survey Starting Point: ~30m above logging road (in timber above clearcut)

Meters surveyed (very approximate): 300

Stream Gradient: 30° Water Temperature: 10°c.

Streamside Vegetation

Tree: western hemlock, western redcedar, balsam fir

Shrub: blue huckleberry, false azalea, goat's beard, Devil's club

Herb: Foam flower, oak fern, fairy bells(?), moss

Cover

Logs: 15 % Overhanging Vegetation: 15 %

Overhanging Bank: 0 Rocks or Boulders that provide cover: 10 %

Stream Fauna: stoneflies, caddisflies, unid #1

Quantity: caddisflies are abundant

Amphibians: Tailed frogs: 17 tadpoles and 2 adult ♂'s.

Fish: 0

Number of Pacific Giant Salamanders: Caught: 0 Seen: 0

Comments: A fairly open creek with moss-covered boulders. It was easy to climb up and pools were easy to search. There was abundant algae on the rocks for tadpoles to feed on. The creek is steep and a number of trees have fallen into the channel. Water volume was adequate for salamanders and occupied about 33% of the channel. There was probably adequate cover for salamanders, especially in the larger pools. In the clear cut above the logging road this creek was completely buried by log debris.