THE FISH, AMPHIBIANS, REPTILES, AND MAMMALS OF SAINT-GAUDENS NATIONAL HISTORIC SITE: AN INVENTORY

Robert P. Cook
Natural Resources Management Specialist Trainee
North Atlantic Region
National Park Service
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INTRODUCTION

Saint-Gaudens National Historic Site (SAGA) consists of 150 acres located in Cornish, NH. Established in 1977 to preserve the home and studios of sculptor Augustus Saint-Gaudens, it is a mix of historic site and diverse natural habitats. Though established for historic purposes, there is considerable appreciation for, and activities based around, the site's natural resources.

Cronan (1981) conducted a natural resources inventory of the park in 1980, detailing plant communities, aquatic resources, geology, and to a lesser extent, wildlife. The present inventory builds on this earlier work and expands our knowledge of the fish, amphibians, reptiles, and mammals of SAGA. Its primary purpose was to determine which species occur here, and as feasible, assess their relative abundance and habitat associations. For these four groups it replaces Cronan (1981), though reliable records from that study have been incorporated into the updated species lists. That earlier work remains the best reference on other aspects of SAGA's natural resources.

This report is aimed at two audiences and may at times seem redundant or schizophrenic. Those interested in the general natural history of the park will be primarily interested in the annotated species accounts, habitat decsriptions, and species lists. More detailed descrition, discussion, and quantitative results make up the remainder of the report.

HABITAT DESCRIPTIONS

Habitat typing allows for describing the physical and vegetative make-up of the area, and permits analysis of animal - habitat associations. While conceptually useful, it should be borne in mind that the habitat types at SAGA are human interpretations rather than discrete natural units. Uniformity within a given type is generally lacking, and boundaries between types are not as clear cut as the map implies (Fig 1.) This is particularly true in the wetland and pond habitats where stream overflow and rainfall influence the depth, extent, and duration of standing water.

The following "types" describe both terrestrial and aquatic habitats. Most of the terrestrial types were first described by Cronan (1981) based on a quantitative analysis of forest composition, and the following are summarized from that work (Fig 1). The aquatic habitats are a qualitative asssessment, based on water flow, water permanence, substrate, and dominant plant growth form.

Following each habitat type name is an abbreviation. To save space and alllow for computerization of habitat information these will be used throughout. Latin names of all plant and animal species referred to are listed in Appendix A.

TERRESTRIAL HABITATS

Upland Hardwood Forest (UP HARD) - This intermediate-aged forest community is relatively open, contains a diverse assemblage of tree species dominated by red maple, white pine, red oak, and

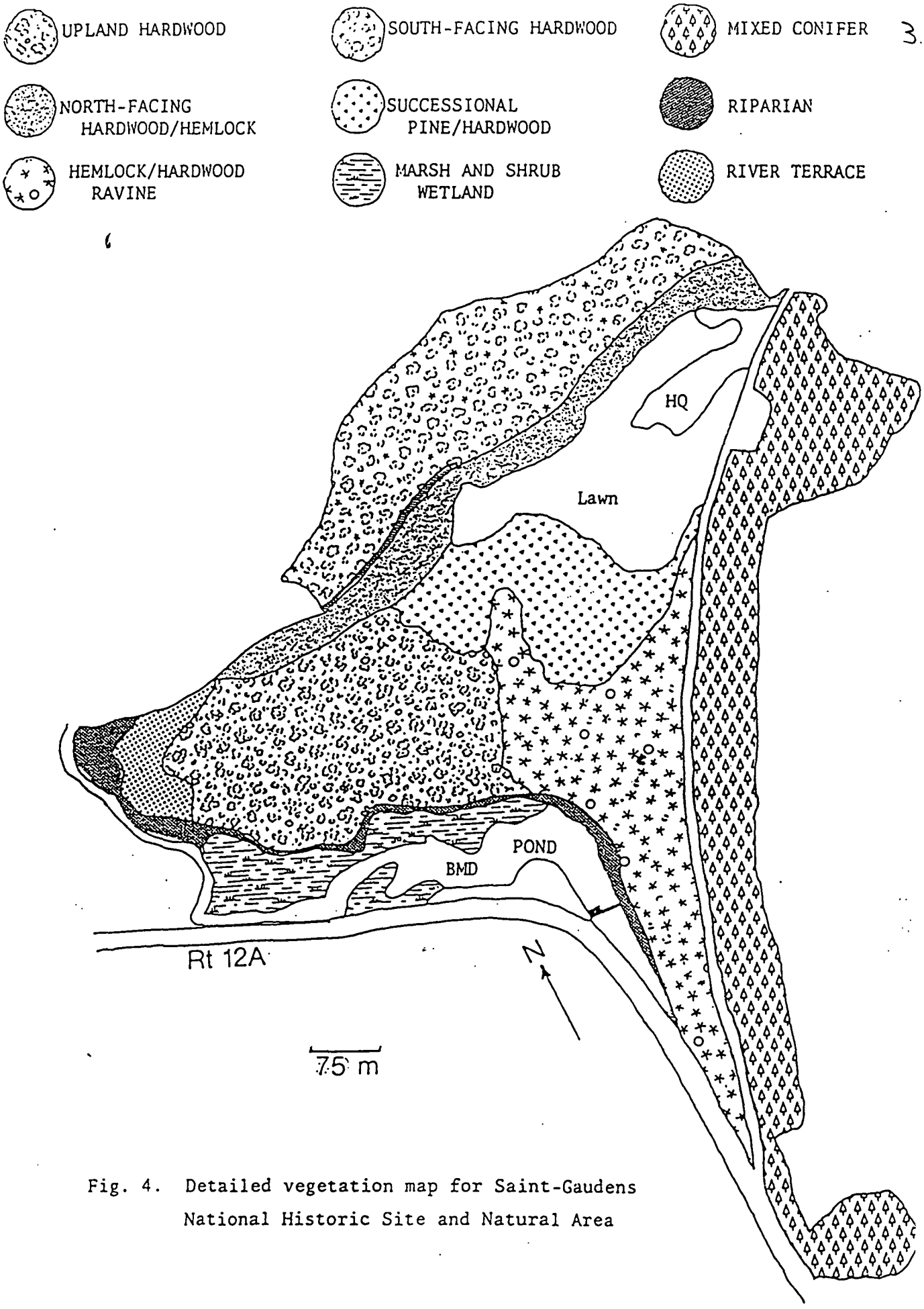

Fig. 4. Detailed vegetation map for Saint-Gaudens National Historic Site and Natural Area

paper birch. Subdominants include eastern hemlock, black birch, American beech, white ash, and sugar maple. Beneath the canopy is an understory of tree seedlings and shrubs, composed primarily of witch hazel, American beech, red maple, red oak, white ash, cherry, and white pine. Based on my observations, I would add that this habitat has a relatively thin duff layer and few downed logs.

For practical purposes some lumping of smaller habitat types was necessary. Lumping was based on similiarity of species composition and vegetative structure. UP HARD incorporates all of the River Terrace Community of Cronan (1981), plus that portion of the Riparian Forest that adjoins the combined River Terrace - Upland Hardwood communities (Fig 1). This lumping is consistent with the generalized vegetation map of Cronan (1981).

North-facing Hardwood Hemlock (NORTH HARD HEM) - This habitat occurs on the steep slope of the south side of Blow Me Up ravine. It is a mixed successional forest undergoing recovery from past disturbances. Though predominantly hardwood, the single-most important species is eastern hemlock, followed by black birch, red oak, mountain maple, white pine, and sugar maple. It contains a relatively high density of small diameter trees. The understory is a mixture of American beech, hemlock, white ash, sugar maple, striped maple, mountain maple, and viburnum.

South-facing Hardwood (SOUTH HARD) - Occurring on the hillslope north of Blow Me Up brook, this is a relatively open, medium age,

mixed hardwood stand dominated by hemlock, American beech, and red maple. Less important of the 17 different tree species found here are sugar maple, red oak, black birch, white ash, paper birch and American basswood. The understory is composed of seedlings of these dominant overstory species.

Hemlock-Hardwood Ravine Forest (HEM HARD) - This mature and stable community is dominated by large eastern hemlock, with sugar maple, black birch, red maple, yellow birch, white pine, and red oak as major sub-dominants. This habitat has the lowest stem density but second highest basal area, quantitative corroboration of the observation that it is composed of relatively few, but very large trees. The understory is dominated by seedlings of American beech, hemlock, red maple, white ash, and striped maple.

Lumped into this habitat is the adjacent, narrow strip of Riparian Forest.

Mixed Coniferous Forest (MIX CON) - This forest is dominated by white pine but also includes black birch, hemlock, white ash, paper birch, red oak, and sugar maple. Of all the forest types, this has the greatest basal area, which is distributed between two size classes. The smaller size class trees are hardwoods and hemlocks, whereas white pine dominates the larger class.

The understory includes red maple, hemlock, white ash, white pine, red-osier dogwood, and sugar maple.

Field (FIELD) - The field habitat is a recent addition to the SAGA landscape, resulting from the removal of trees in the Successional Pine/Hardwood Community and subsequent planting with

tall grass and wildflower species. Predominant species are sheep and other fescues, lance-leaved coreopsis, dame's rocket, and bachelor's button. This habitat is maintained through annual mowing in October.

Lawn (LAWN) - This type is a basic lawn with sections mowed on a frequency of from one to four weeks during the growing season.

Wetlands (WET) - The wetland habitat is diverse and heterogeneous, forming a transition zone that is part terrestrial and part aquatic. Fluctuations in water level due to rainfall and snowmelt are common, and the vegetation at any spot reflects the water depth and duration of inundation.

Three basic wetland types are interspersed throughout WET. The cattail-pond lily marsh is dominated by broadleaved cattail, blueflag iris, yellow pond lily, and pondweed. This occurs in the wettest spots, where water is present all or most of the year. A sedge marsh, dominated by tussock sedge is scattered in patches at slightly higher elevations. The "shrub marsh", more accurately termed a shrub swamp, consists of swamp alder, silky dogwood, honeysuckle, and red maple. It consists of short (<10 ft), very dense, small diameter shoots of the above species, and appears to be maintained in this state by beaver activity.

AQUATIC HABITATS

Overflow Ponds - These ponds occur in depressions along the floodplain of Blow Me Down Pond (Fig. 2) and form primarily from rainfall and spring high water in the pond backing up and overflowing. Due to this origin, they contain a mix of both BMD

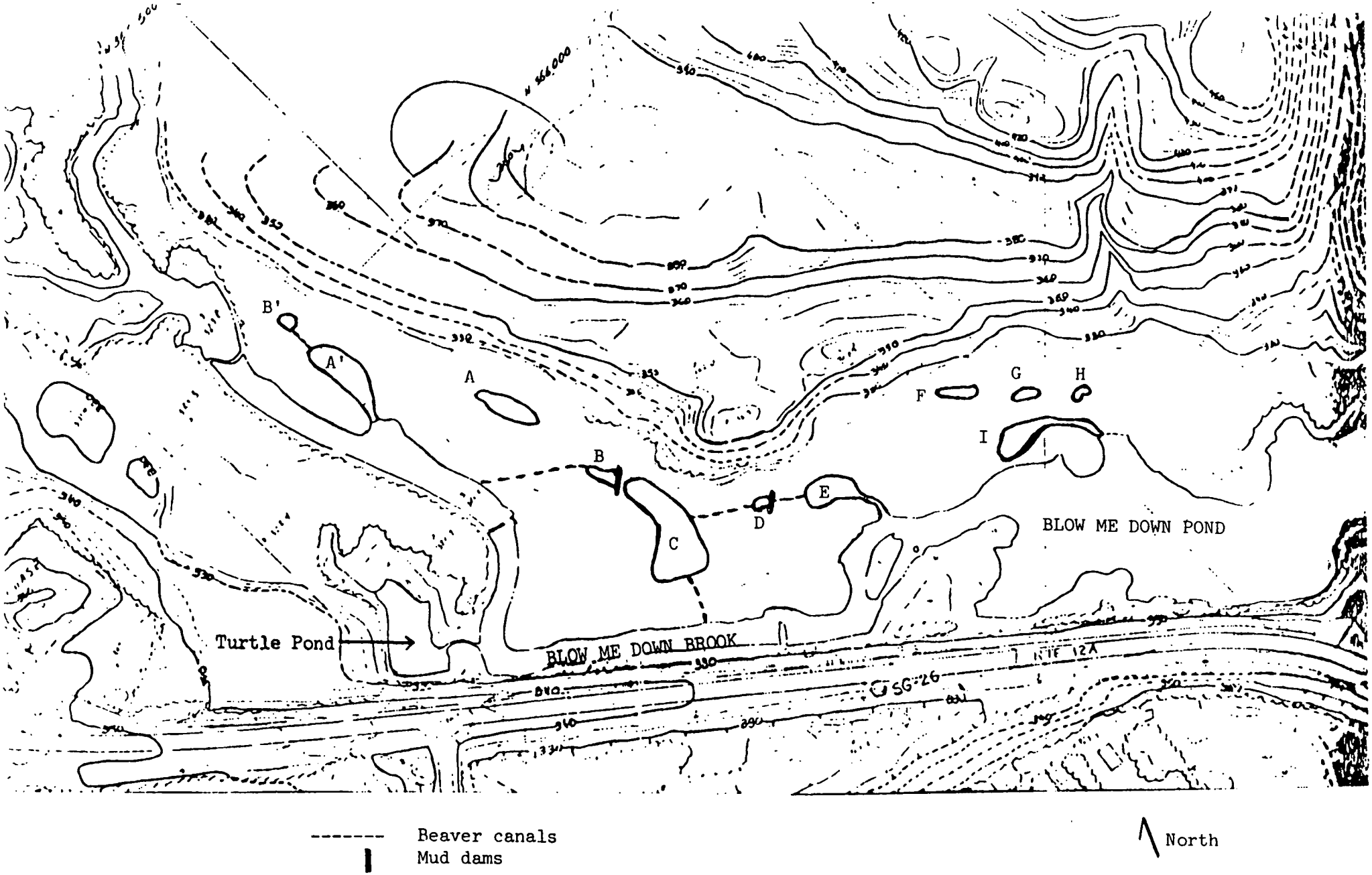

Figure 2. Location of overflow ponds along the Blow Me Down floodplain.

Pond animals and those that are considered temporary pond species.

These ponds vary in their depth, duration, and vegetation, and vegetatively may be split into two types. Marshy ponds (B,C,D,E,I,A',B', "Turtle Pond") are dominated by hebaceous plants (cattail, pond lily, sedge) and have deep mucky bottoms. These ponds are closer to BMD Pond both elevationally and in distance than the others. They contain water throughout most years, but contract and expand tremendously in response to rainy and dry periods. Shrubby types (A,F,G,H) are dominated by woody shrubs and have solid, leaf covered bottoms. They are higher in elevation, fluctuate greatly in size, and eventually dry up. (Pond A was present on 4/1/86 but had dried up by 4/17/86. Ponds F,G,H were distinct ponds from 4/17/86 through the summer, but had been one large, linear pond on 4/1/86. Pond F dried up and then reformed several times in the course of the summer).

Blow_Me_Down_Pond (BMD POND) - BMD POND is a shallow, but generally cool, oligotrophic pond formed by the damming of BMD BROOK. It averages 3.8 ft in depth (maximum 8 ft) and has soft bottom sediments that average 3.6 ft thick (7 ft maximum). It adjoins extensive sections of cattail,pond lily, and sedge marsh which provide a more warmwater habitat. Detailed morphological and chemical data are presented by Cronan (1981).

Blow_Me_Down_Brook (BMD BROOK) - BMD BROOK has been split into different sections based on geographical barriers, gradient, and substrate. Geographically the brook is divided by the dam, and

the lower section connects with the Connecticut River. Thus this section is accessible to river species, brook species, plus pond species washed over the dam. In terms of gradient and substrate, the brook is divided into low and medium gradient sections. Medium gradient is characteristically shallow (1-2 ft) with riffles, pools, and perceptible turbulance. Substrate tends to be small rocks and gravel. The low gradient sections are deeper (2-5 ft), show no obvious movement of water, and are sandy and muddy bottomed. Throughout all these sections, BMD BROOK is 20 - 30 ft. wide.

Blow_Me_Up_Brook (BMU) - BMU is a high gradient woodland stream. It is narrow (2-10 ft wide), shallow (< 1 ft. deep in riffle sections), and consists of a series of riffles and small pools (1-3 ft deep). The substrate consists of large rocks, gravel, and bedrock. It is a colder, clearer brook than BMD and receives little direct sunlight.

MATERIALS AND METHODS

GENERAL CONSIDERATIONS

Due to the large number of species potentially present, a variety of inventory techniques were employed. Certain species, life stages, or size classes are often only catchable or observable with specific types of equipment, or at specific times and places. An underlying bias in all the data collection was the attempt to determine the presence (or absence) of as many of the

potentially occurring species as possible. Placement of traps and nets was done to maximize capture.

Techniques may be generally divided into two categories, quantitative and observational. The quantitative techniques (gill nets and trapping) provide numerical results which can be expressed as indices or frequencies, and can be analyzed statistically. The observational data consist of sight, sign, and sound records, and provide information on occurrence, activity periods, and habitat use of a species. These were often obtained incidental to trapping activities or are reliable sightings by SAGA staff. They give a general feel for abundance and habitat use. However, differences in observational effort in each habitat, particularly during all periods of time or weather preclude their use for any but qualitative conclusions. For a discussion of the rationale behind choice of inventory techniques, see workplan (Appendix C).

Initial identification of some fish species required collection of specimens for positive identification using keys (Scarola 1973, Werner 1980). With experience positive identification of live fish in the field became routine. Amphibians and reptiles presented little difficulty in identification, though Smith (1978) and Smith and Brodie (1982) were used to confirm identification. Mammals were generally identified in the field though certain groups (Sorex, Peromyscus, jumping mice) required the use of measurements and/or cranial characteristics for positive identification (Choate 1973, Godin 1977, Hamilton and

Whitaker 1979, Franq 1981). Specimens of Peromyscus required closest study, and identification was based on a combination of four characteristics; relative tail length, hairiness and "pencilling" of tail, shape of palatine foramina, and rostral breadth. Some individuals of P. maniculatus had tails less than body length, but were maniculatus in the other three attributes. Study skins at the University of New Hampshire Dept. of Zoology, Durham, were used for study and comparison.

Voucher specimens of some species were preserved. These will be catalogued into the SAGA collection and placed on five year renewable loan with the University of Massachusetts Museum of Zoology, Amherst, MA.

FISH

Fish were trapped using funnel traps of two different sizes and gill nets of three different mesh sizes. Small funnel traps (1/4" mesh, standard minnow traps) were placed in each of the nine habitats/locations shown in Table 3 for varying numbers of trap nights totalling 140. The level of trapping effort was generally proportionate to the size of a given area. Large funnel traps (1/2" mesh hardware cloth, 3ft x 1.5ft) were similiarly shown in the four habitats shown in Table 5, for a total of 130 trap nights. These larger traps were set to inventory turtles as well as fish, and this was a factor in their placement. All traps were baited with canned sardines in oil and checked daily.. At each check they were emptied, the catch enumerated, and rebaited.

All gill nets were 6ft x 30ft, and composed of either 1/2" x 1/2", 1" x 1", or 2" x 2" nylon monofilament. Nets of each size were placed at two locations in BMD pond, perpendicular to water flow. Due to the pond's shallowness, the nets intercepted the entire water column. Trial sets of three hours caught only a few individuals and nets were therefore set overnight. Fish mortality in overnight sets was about 20%, and after five net-nights of effort it became apparent that further effort was unlikely to detect additional species.

Additional fish records came from observations and hand netting.

AMPHIBIANS

Amphibian inventory consisted of observation and search. Breeding ponds were surveyed day and night throughout the spring and summer, noting the number of individuals observed or heard calling in each pond. Daytime counts of eggmasses were used to determine magnitude of some populations and relative importance of different ponds. Logs and rocks throughout all the terrestrial habitats were searched under and all findings recorded. A minimum of 50 log rolls/ habitat took place, but no record of total was kept. Similiarly, rocks and logs in and along BMU BROOK, and several unnamed brooks in the MIX CON and HEM HARD were searched under by hand. The entire length of BMU BROOK was surveyed using a D-net placed downstream of large flat rocks which were then flipped over to wash any animals hiding below into the net. Four hours were spent flipping about 200 rocks.

REPTILES

Turtle traps, "snake boards", and observation were used to inventory reptiles. Turtle traps (already described) were placed in BMD BROOK, BMD POND, and Turtle Pond in Sept. 1985 and May 1986, for a total of 130 trapnights.

"Snakeboards" (sections of plywood, planking, or black plastic sheeting averaging six square feet) were placed throughout the park, in areas of grass or damp, rank vegetation adjacent to pond or woodland habitats. Fourteen boards were in place in September 1985, and 16 during the 1986 field season. A total of 290 snakeboard visits were made on warm sunny days when snakes use such cover for the warm microenvironment it provides.

MAMMALS

Mammal inventory consisted of snap trapping, live trapping, and observations. Snap trapping consisted of trap lines of 50 Victor mouse traps placed for three consecutive nights in each of the habitats shown in Table 10. Traps were spaced roughly 15 feet apart, but specific placement was determined by the presence of runways, burrows, logs, and tree trunks. All of these were utilized to set traps for maximum likelihhod of capture, and traps were set perpendicular to the apparent path of travel. Due to logistics and equipment constraints, all habitats were not trapped simultaneously. The following are the trapping dates of each habitat;MIX CON 9/16 - 9/19/85, FIELD 9/17 - 9/20/86, WET, NORTH HARD HEM, SOUTH HARD 7/26 -7/29/86, HEM HARD,UP HARD 5/14 - 5/17/86 + 7/30 - 8/2/86.

In the HEM HARD and UP HARD habitats, trapping done in May was repeated in late July due to low capture rates in May. Since the species composition of the two trapping periods differed, it was decided that lumping the two periods together was preferable to ignoring one.

Live traps of two sizes (Tomahawk # 203 and 207) were set to capture mammals ranging in size from chipmunk to racoon. Habitats trapped are shown in Table 12, and twelve of each size trap were placed in each habitat for three consecutive nights. Due to limited numbers of traps, only two habitats were trapped simultaneously, but all were trapped between 5/22 and 5/31/86.

An additional effort using large snap traps was directed selectively in an attempt to detect weasels and flying squirrels. Traps were set at burrows (1" - 2" diameter), along logs, streams, and in ravines for weasels, and at the base of cavity trees for flying squirrels. A total of 229 trap nights were divided among the following habitats; MIX CON 16, WET 90, NORTH HARD HEM 75, HEM HARD 48.

All of the above traps were baited with a peanut butter-oatmeal mixture, checked, and reset every morning.

Trapping results were supplemented by sight and sign records.

RESULTS AND DISCUSSION

FISH

The fish of SAGA are a mix of cold and warmwater species.

BMD BROOK and POND is primarily a cold water environment driven by the cool waters of the brook. Shallows and marshes created by damming the brook provide warmwater habitats. The most abubdant species are coldwater ones, and the warmwater species appear to be limited in numbers or stunted. There are no high order predators ("game fish") here, despite the abundance of "forage" species.

A total of 17 fish species were recorded, and of these, the common shiner, creek chub, pumpkinseed, blacknose dace, and fallfish were most abundant (Table 1). Creek chub was the most ubiquitous species, occurring in all habitats but BMU BROOK (Table 2). BMD POND contained the greatest number of species (11), followed by the low gradient section of lower BMD BROOK with nine species. These latter points are probably the result of habitat diversity and geography. BMD POND contains warmwater habitats along its marshy periphery and cold, stream-fed sections in the channel carved by water flow. Both warm and coldwater species can occur. Lower BMD BROOK, as previously mentioned, is accessible to species from both the Connecticut River and upstream sources.

A comparison with previous surveys (Bailey and Oliver 1939, Cronan 1981) shows nine additional species recorded here (Table 1), and might suggest that major changes in the fish community have occurred. Though some of these differences do represent real change, it is difficult to reliably separate them from those due to greater sampling effort, more varied collection techniques,

Table 1. Fish species of SAGA. Comparison with previous work and summary of all fish captured by traps and gill nets in present study.

COMMON NAME	1939	1980	85/86	# inds	Rel Abund	Rank
Brook Trout	x	x	x	13	0.59	10
Chain Pickeral	-	x	-	-	-	-
Longnose Dace	x	x	-	-	-	-
Blacknose Dace	x	x	x	208	9.40	4
Redbelly Dace	-	-	x	71	3.21	7
Fallfish	x	x	x	125	5.65	6
Creek Chub	x	-	x	557	25.18	2
Bluntnose Minnow	-	-	x	2	0.09	15
Common Shiner	x	x	x	697	31.50	1
Golden Shiner	-	-	x	5	0.23	12
Longnose Sucker	-	-	x	29	1.31	8
Common Sucker	x	x	x	29	1.31	8
Brown Bullhead	-	-	x	126	5.70	5
Rock Bass	-	-	x	8	0.36	11
Redbreast Sunfish	x	-	x	1	0.05	17
Bluegill	-	-	x	5	0.23	12
Pumpkinseed	-	-	x	331	14.96	3
Yellow Perch	-	-	x	3	0.14	14
Tessellated Darter	-	x	x	2	0.09	15
TOTAL	8	8	17	2212	100%	

TABLE 2. Occurrence and distribution of fish species determined by all methods.

COMMON NAME	BMU	upper BMD		Turtle Pond	BMD Pond	lower BMD		overflow ponds		#habitats present
		Med	Low			Med	Low	Marshy	Woody	
Brook Trout	x									1
Blacknose Dace	x	x	x							3
Redbelly Dace		x	x	x			x	x		5
Fallfish				x	x		x			3
Creek Chub		x	x	x	x	x	x	x	x	8
Bluntnose Minnow						x	x			2
Common Shiner		x	x		x		x			4
Golden Shiner						x	x	x		3
Longnose Sucker					x					1
Common Sucker					x					1
Brown Bullhead				x	x	x				3
Rock Bass		x			x		x			3
Redbreast Sunfish					x					1
Bluegill					x					1
Pumpkinseed		x	x	x	x	x	x			6
Yellow Perch							x			1
Tessellated Darter		x	x		x					3
TOTAL # SPECIES	2	7	6	5	11	5	9	3	1	

and a greater number of sampling stations. For example, sampling below the dam added two new species not found elsewhere in this survey. Furtheremore, the 1939 data is from only two stations on BMD BROOK in Plainfield (Bailey and Oliver 1939). Records for stations elsewhere in Cornish show that golden shiner, rock bass, and tessellated darter occurred nearby. Thus it is equally likely that most of the species found at present have been here all along but went unrecorded.

Two absences in the present study seem to represent real changes. Longnose dace is a stream species, found in riffles and pools (Scarola 1973), and was expected to occur in the brooks. Its absence is inexplicable. Pickeral, characteristically found in quiet, shallow water were readily caught in gill nets in 1980 (DesMueles, pers. comm.). Their disappearance is probably due to the drawdown of BMD POND between 11/83 and 12/84 to repair the dam.

Results from each specific trapping technique show that different species were more readily taken with one technique than another, a fact hardly suprising (Tables 4,5,7). Comparison of data from different techniques is not possible, but within-technique comparisons are.

Minnow trap data are the most extensive, and account for 91% of all fish captured. Based on these data, the most abundant species are common shiner, creek chub, pumpkinseed, and blacknose dace (Table 3). An index of abundance (# inds/ trap-night) provides a standardized method of comparing the abundance of

TABLE 3. Summary, by habitat, of fish taken in small minnow traps.

COMMON NAME	BMU	upper BMD		Turtle Pond	BMD Pond	lower BMD		overflow ponds		Sum	Relative Abund
		Med	Low			Med	Low	Marshy	Woody		
Brook Trout	13									13	0.66
Blacknose Dace		71	136							207	10.33
Redbelly Dace		2	1	2			7	59		71	3.57
Fallfish				2	102		21			125	6.24
Creek Chub		22	100	182	156	7	37	30	1	535	26.68
Bluntnose Minnow						1	1			2	0.10
Common Shiner		345	274		35		12			666	33.21
Golden Shiner						1	3	1		5	0.26
Brown Bullhead				5	6	98				109	5.44
Rock Bass		1					5			6	0.31
Pumpkinseed		1	7	84	82	3	84			261	13.02
Yellow Perch							3			3	0.15
Tessellated Darter			1							1	0.05
TOTAL # INDS	13	442	519	277	381	110	173	90	1	2006	100%
TOTAL TRAP NIGHTS	18	8	12	8	32	16	24	15	7	140	
H'	0	0.299	0.472	0.357	0.579	0.182	0.662	0.301	0		

TABLE 4. Abundance (# inds/trap-night) of fish species taken in small minnow traps. Mean value is for all habitats combined.

COMMON NAME	BMU	upper BMD Med	upper BMD Low	Turtle Pond	BMD Pond	lower BMD Med	lower BMD Low	overflow ponds Marshy	overflow ponds Woody	Mean
Brook Trout	0.72									0.09
Blacknose Dace		9.25	11.33							1.48
Redbelly Dace		0.25	0.08	0.25			0.29	3.93		0.51
Fallfish				0.25	3.19		0.88			0.89
Creek Chub		2.75	8.33	22.75	4.88	0.44	1.54	2.00	0.14	3.82
Bluntnose Minnow						0.06	0.04			0.01
Common Shiner		43.13	22.83	1.09			0.50			4.76
Golden Shiner						0.06	0.13	0.07		0.04
Brown Bullhead				0.63	0.19	6.13				0.78
Rock Bass		0.13					0.21			0.04
Pumpkinseed		0.13	0.58	10.50	2.56	0.19	3.50			1.86
Yellow Perch							0.13			0.02
Tessellated Darter			0.08							0.01
SUM OF ALL SPECIES	0.72	55.25	43.25	34.63	11.91	6.88	7.21	6.00	0.14	14.33

TABLE 5. Abundance (#inds/trap-night) of fish taken in large funnel traps. Mean value is for all habitats combined.

COMMON NAME	upper BMD		Turtle Pond	BMD Pond	Mean
	med	low			
Brook Trout					
Blacknose Dace	0.08				0.01
Redbelly Dace					
Fallfish					
Creek Chub	0.33	0.20		0.16	0.16
Bluntnose Minnow					
Common Shiner	0.75	0.65		0.01	0.18
Golden Shiner					
Longnose Sucker					
Common Sucker				0.03	0.02
Brown Bullhead				0.01	0.01
Rock Bass				0.03	0.02
Redbreast Sunfish				0.01	0.01
Bluegill				0.01	0.01
Pumpkinseed		0.25	0.21	0.75	0.52
Yellow Perch					
Tessellated Darter				0.01	0.01
SUM OF ALL SPECIES	1.17	1.10	0.21	1.03	0.93

TABLE 6. Summary, by habitat, of fish taken in large funnel traps.

COMMON NAME	upper BMD med	upper BMD low	Turtle Pond	BMD Pond	Sum	Relative Abundance
Brook Trout						
Blacknose Dace	1				1	0.8%
Redbelly Dace						
Fallfish						
Creek Chub	4	4		13	21	17.4%
Bluntnose Minnow						
Common Shiner	9	13		1	23	19.0%
Golden Shiner						
Longnose Sucker						
Common Sucker				2	2	1.7%
Brown Bullhead				1	1	0.8%
Rock Bass				2	2	1.7%
Redbreast Sunfish				1	1	0.8%
Bluegill				1	1	0.8%
Pumpkinseed		5	4	59	68	56.2%
Yellow Perch						
Tessellated Darter				1	1	0.8%
TOTAL # INDS	14	22	4	81	121	100%
TOTAL TRAP NIGHTS	12	20	19	79	130	

TABLE 7. Summary of capture data and relative abundance of fish taken in gill nets. The 2" x 2" mesh gill net caught no fish in 5 net-nights.

	1/2" x 1/2" mesh			1" x 1" mesh		
COMMON NAME	# inds	Abundance*	Rel Abundance	# inds	Abundance*	Rel Abundance
Creek Chub	1	0.2	1.3%			
Common Shiner	31	6.2	39.7%			
Longnose Sucker	29	5.8	37.2%			
Common Sucker				27	5.4	84.4%
Brown Bullhead	11	2.2	14.1%	5	1.0	15.6%
Bluegill	4	0.8	5.1%			
Pumpkinseed	2	0.4	2.6%			
TOTAL	78	15.6	100%	32	6.4	100%

* - Abundance is expressed as the # inds/net-night, based on five net-nights of effort.

different species within a habtitat and/or differences in the abundance of a given species in different habitats. As expected, different species dominated different habitats, and the abundance of a particular species varied between habitats (Table 4). Habitat affinities will be discussed in the Species Accounts.

On a habitat basis, Upper BMD BROOK supported the most abundant fish populations (greatest # inds/ trap-night), followed by TURTLE POND and BMD POND (Table 4). The most diverse fish populations (based on the Shannon-Weiner diversity index H', Brower and Zar (1977)) were found in the low gradient section of Lower BMD BROOK, BMD POND, and the low gradient section of Upper BMD BROOK (Table 3). As previously mentioned, BMD POND is heterogeneous and not suprisingly supports a diversity of species. Both low gradient sections of BMD BROOK occur as transition zones between radidly flowing waters and those that are relatively still (Connecticut River, BMD POND) and typical of transition zones, they have relatively high species diversity.

Similiar though more limited data for large funnel traps and gill nets are shown in Tables 5,6,and 7.

AMPHIBIANS

The amphibians of SAGA are numerous and diverse. While those species found here are fairly common and widespread throughout New England, what is notewothy is this abundance and diversity on such a relatively small site.

The species found here possess a great variety of life history patterns. While all are ultimately tied to moisture

requirements, they range from the wholly terrestrial Redback salamander to the aquatic Bullfrog. Some are conspicuos and diurnal while others are nocturnal and burrowing. These patterns greatly influence the habitat associations and apparent abundance of the species. Because of this latter point, comparison of abundance must be made with caution.

The 13 amphibian species found here are listed in Table 8. Detailed information on a species is presented in the Species Accounts, and in the observational records (Appendix B).

The habitat listings are reasonably accurate in that they highlight the importance of the wetlands for most species, and show such affinities as that of the Redback salamander for woodlands and that of Two-lined and Dusky salamanders for small brooks. Such affinities are well known (DeGraaf and Rudis 1983) and in general the observed habitat use of all species here was typical. One exception though, is the Spotted salamander. They usually breed in small, temporary ponds and their use, for egg deposition, of ponds with fish is not well documented. Here, in addition to the temporary ponds, some egg masses were laid in the cattail marshes in the main body of BMD POND.

As mentioned above, the wetlands around BMD POND are important amphibian habitat. Aquatic species (eg. bullfrog, green frog, red-spotted newt) utilize BMD POND and, when present, the overflow ponds. This is a year round utilization, and breeding, feeding, and hibernation all take place in the ponds. Other species (eg. spotted and jefferson salamanders, spring peeper,

TABLE 8. Observed occurrence of amphibians and reptiles at SAGA.

	MIX CON	HEM HARD	SOUTH HARD	UP HARD	NORTH HARD/HEM	FIELD	LAWN	WET	BMU/ brook	BMD BROOK
Spotted Sal.					x			x		
Jefferson Sal.								x		
Red-spotted Newt	x		x	x	x	x	x	x		
Redback Sal.		x	x	x	x					
Two-lined Sal.					x				x	
Dusky Salamander					x				x	
American Toad	x	x	x	x	x	x	x	x		
Spring Peeper	x	x	x	x	x	x		x		
Gray Treefrog			x		x			x		
Wood Frog	x	x	x	x	x	x		x		
Pickeral Frog		x						x		
Green Frog		x					x	x	x	
Bullfrog								x		x
Snapping Turtle								x		x
Wood Turtle										x
Painted Turtle								x		
Garter Snake		x					x	x		
Milk Snake*										

* not recorded in this survey but reliably reported in 1980 (Cronan 1981)

gray treefrog, wood frog, American toad) feed and hibernate terrestrially but require the overflow ponds for courtship, egg laying, and development of eggs and larvae. The continued existence of these ponds is important for maintaining the amphibians at SAGA.

REPTILES

The reptiles of SAGA consist of three turtle species and two snakes (Table 8), all but one fairly common and widespread in New England. The wood turtle is uncommon to rare in New England (DeGraaf and Rudis 1983) and had been proposed for listing as a species of special concern in NH.

Turtle trapping in BMD POND and BROOK caught only three individuals (1 painted turtle, 2 snapping turtle) in 132 trap nights. Both species, however, are more numerous than these data suggest. Painted turtles were commonly seen basking in Turtle Pond, with a high count of 19 individuals on 4/19/86. Based on hand captures and traps a minimum of eight different snapping turtles were observed here. Individuals were differentiated by notches filed into the carapace, or by notation of scars, deformities, and size.

The aquatic painted and snapping turtles are fairly common here, though not abundant. This may be perfectly natural and normal since the abundance of painted turtles starts to diminish this far north in New England (Klemens, pers comm). Or it may be that pond dredging in 1984 has reduced the population.

During the dam restoration work in 1984 some turtles (presumably painted and numbers undetermined) were dredged out of hibernation in the pond bottom and died. While this undoubtedly reduced the painted turtle population, it is impossible to determine how great the impact was. However, sufficient numbers are present for the population to recover.

Snake boards were fairly unproductive, resulting in the capture of six garter snakes in 290 visits. These six, plus five observational records of garter snakes, constitute all the snakes observed at SAGA. Considering the effort spent searching under boards, plus all the time spent afield here, SAGA seems remarkably depauperate in both numbers and diversity of snakes. The habitats here, with an abundance of invertebrates, amphibians, fish, and small mammals certainly appear capable of supporting more snakes than encountered.

MAMMALS

SAGA supports a diverse mammal fauna (Table 9) and most species here are common and widespread both regionally and at SAGA. A few however, are noteworthy for their local or regional rarity. These include the masked shrew, star-nosed mole, meadow jumping mouse, fisher, and river otter.

Any discussion of an area's mammals must be done with the understanding that mammals are an extremely diverse group, and their habits vary greatly. While most of the smaller species have home ranges small enough to be contained within SAGA boundaries,

TABLE 9. Occurrence of mammals at SAGA based on trapping and observational records.

	MIX CON	HEM HARD	SOUTH HARD	UP HARD	NORTH HARD/HEM	FIELD	LAWN	WET
Masked Shrew						x		x
Smokey Shrew		x	x		x			
Short-tailed Shrew	x	x	x	x	x	x		x
Hairy-tailed Mole							x	
Star-nosed Mole								x
Big Brown Bat*								
Little Brown Bat**								
Eastern Chipmunk	x	x		x			x	x
Woodchuck							x	
Gray Squirrel	x		x	x	x			
Red Squirrel	x	x		x				
Beaver								x

* observed flying at dusk and roosting behind pictures in Atrium
** not observed in this survey but reliably reported by Cronan (1981)

TABLE 9. (continued)

	MIX CON	HEM HARD	SOUTH HARD	UP HARD	NORTH HARD/HEM	FIELD	LAWN	WET
Deer Mouse	x	x	x		x			
White-footed Mouse	x	x	x	x	x			x
Red-backed Mouse	x	x	x	x	x			
Meadow Vole						x		
Muskrat								x
Meadow Jumping Mouse								x
Woodland Jumping Mouse		x	x		x			x
Porcupine				x				
Racoon	x	x	x	x	x			x
Fisher	x							
Striped Skunk***								
River Otter								x
White-tailed Deer	x	x		x		x		x

*** observed dead on road near SAGA

larger species (eg. beaver, muskrat, porcupine, racoon, fisher, skunk, otter, deer) or migratory ones (bats) utilize SAGA for only a part of their daily, or yearly activity. Even for the smaller species, the populations extend beyond park boundaries.

Thus the habitats of SAGA and the mammals they support should be viewed in the context of surrounding habitats and landuse. The continued existence of some of the species found here is beyond direct NPS control and will be determined by external events.

A fair idea of habitat use by most species, compiled from all trapping and observational records is presented in Table 9. Certain widespread species, such as short-tailed shrew, white-footed mouse, deer mouse, and red-backed mouse have small individual home ranges and their wide occurrence here represents many individuals, each within its particular home range. Larger species, such as deer and racoon, have much larger home ranges that include most, if not all, of the "habitats" identified here. The habitat use records for these represent much fewer but wider ranging individuals. For some of the other large species, (eg. porcupine, fisher, skunk) the sightings are so few that Table 9 should be taken with the understanding that these species are really more wide ranging.

Certain species however, are found primarily in particular habitat(s). Aquatic species such as muskrat, beaver, and otter, though capable of overland travel, were only observed in the wetlands. Meadow voles were only found in FIELD, and the only

meadow jumping mouse was in WET, which contain an herbaceous meadow-like component. Both species of moles seem restricted, but this may be due to a sampling bias. Moles are not easily caught in snap traps, and all mole records are from chance observations (mostly by staff) of dead individuals. All hairy-tailed mole records are for LAWN probably because they are most observable there, and this is where SAGA staff spend most of their time.

Snap trapping of small mammals produced a total of 175 individuals of nine species in the seven habitats trapped (Tables 10 and 11). Overall, the short-tailed shrew was the most abundant species (38.8% relative abundance), and also the most widespread (all seven habitats). White-footed mice were nearly as widespread (occurring in six habitats) and ranked second in abundance (18.9% relative abundance). The meadow jumping mouse was least abundant, represented by a single individual trapped in WET.

While ranking third in overall abundance, the meadow vole attained the highest abundance within a single habitat. In the FIELD (the only habitat in which it was recored) meadow voles were trapped at a rate of 21.5 inds/100 trap nights (Table 10). Meadow voles are known for periodically reaching high densities (Godin 1977) and this may have been the case here. It was this great abundance of meadow voles that gave FIELD the highest total abundance of small mammals (22.82 inds/ 100 trap night). SOUTH HARD supported equal, though more diverse, numbers (22.67 inds/ 100 trap night). The habitat with fewest small mammals was UP HARD with 4.62 inds/100 trap night (Table 10).

TABLE 10. Relative abundance (# inds/100 trap-night), by habitat, of mammals taken in small snap traps.

	MIX CON	HEM HARD	SOUTH HARD	UP HARD	NORTH HARD/HEM	FIELD	WET	MEAN/All HABITATS
Masked Shrew						0.67	0.67	0.15
Smokey Shrew		0.33	1.33		0.67			0.30
Short-tailed Shrew	4.00	3.30	14.00	3.00	6.00	0.67	8.00	5.02
Deer Mouse	0.67	0.99	0.67		0.67			0.44
White-footed mouse	6.70	1.3	5.33	0.66	2.67		3.33	2.44
Red-backed Mouse	1.30	2.30	0.67	0.99	1.33			1.10
Meadow Vole						21.50		2.36
Meadow Jumping Mouse							0.67	0.07
Woodland Jumping Mouse		1.30	0.67		3.33		2.67	1.03
SUM OF ALL SPECIES	12.75	9.57	22.67	4.62	14.67	22.82	15.33	12.92
TOTAL # OF SPECIES	4	6	6	3	6	3	5	9

TABLE 11. Summary of small snap-trap data, showing # individuals trapped by habitat

	MIX CON	HEM HARD	SOUTH HARD	UP HARD	NORTH HARD/HEM	FIELD	WET	SUM	REL ABUND	RANK
Masked Shrew						1	1	2	1.1%	8
Smokey Shrew		1	2		1			4	2.3%	7
Short-tailed Shrew	6	10	21	9	9	1	12	68	38.8%	1
Deer Mouse	1	3	1		1			6	3.4%	6
White-footed mouse	10	4	8	2	4		5	33	18.9%	2
Red-backed Mouse	2	7	1	3	2			15	8.6%	4
Meadow Vole						32		32	18.3%	3
Meadow Jumping Mouse							1	1	0.6%	9
Woodland Jumping Mouse		4	1		5		4	14	8.0%	5
SUM OF ALL SPECIES	19	29	34	14	22	34	23	175		
# TRAP NIGHTS	149	303	150	303	150	149	150	1354		
H'	0.475	0.698	0.485	0.388	0.656	0.115	0.542	0.733		

Though it would require detailed analysis to prove, the low numbers of small mammals in the UF HARD are probably due to the lack of physical complexity within this habitat. Compared to the other woodland habitats it is flatter, has fewer rock outcrops, a thinner layer of litter, and few logs on the ground. It seems to provide less cover .

The HEM HARD, NORTH HARD/HEM, and SOUTH HARD each had six species. Based on the diversity index H' (Brower and Zar 1977), the most diverse small mammal populations were within the HEM HARD and NORTH HARD/HEM forests. The FIELD, so heavily dominated by meadow voles, had the lowest small mammal species diversity (Table 11).

Based on snap trap data, certain generalizations on habitat affinities can be made. Meadow vole, masked shrew, and meadow jumping mouse were found in habitats composed entirely or partially of herbaceous vegetation. Smokey shrew, deer mouse, white-footed mouse, red-backed mouse, and woodland jumping mouse are woodland species. The short-tailed shrew occurred in all habitats but was primarily a woodland species. Only one individual in 68 was trapped in the FIELD.

For the most part, these results agree with species profiles in Godin (1977) and Hamilton and Whitaker (1979). The masked shrew however, was rarer than these works lead you to expect, and was not found in woodlands.

Live trapping resulted in fewer captures and consequently less conclusive data (Table 12). So few squirrels were captured

that these records have simply been incorporated into the observational records. Both squirrel species were common, though not abundant, and it is difficult to say if the low capture rate is an accurate reflection of their numbers or if they avoided the traps.

The most noteworthy of the live captures was a fisher caught on 5/23/86 in the MIX CON. Fishers are noted as inhabitants of conoferous forests and have been increasing in southern NH (Godin 1977). Since fisher have a reported "normal" home range of 8-15 miles in diameter, it is safe to say that this individual ranges throughout the woodlands of SAGA, and that SAGA comprises only a small fraction of its home range.

A total of eight different racoons were trapped. Of these, two were captured twice, and one three times, for a total of 12 captures (Table 13). Racoons were captured in five of the six habitats live trapped (Table 12). Ironically, they were not trapped in the one habitat where there tracks were always present (WET). Based on these records, it is apparent that racoons, as a group and as individuals range throughout SAGA. For the four recaptures, the distance travelled ranged from 880 to 2300 feet. Home range in racoon has been shown to sometimes exceed three square miles, so none of these movements are unusual.

Seven of the eight racoons captured were males. Since females give birth to young in early May and are nursing young in late May , when trapping occurred, they presumably move around less and are not as prone to capture as males.

TABLE 12. Summary of live trap captures.

	MIX CON		HEM HARD		UP HARD		WET	SOUTH HARD		NORTH HARD/HEM		TOTAL	
SPECIES	#	RA*	#	RA*	#	RA*	#	#	RA*	#	RA*	#	RA*
Red Squirrel**	0	0	1	1.4	0	0	0	0	0	0	0	1	0.23
Gray Squirrel**	1	1.4	0	0	0	0	0	0	0	1	1.4	2	0.69
Racoon+	3	8.3	1	2.8	4	11.1	0	2	5.6	2	5.6	12	5.60
Fisher+	1	2.8	0	0	0	0	0	0	0	0	0	1	0.46

* RA = Relative Abundance based on the index #inds/100 trap nights

** these species were captured in both size live traps, thus RA is based on 72 trapnights/habitat

+ these species were only capturable in the larger live traps. RA is based on 36 trapnights/habitat

TABLE 13. Summary of racoon captures.

		INITIAL CAPTURE		FIRST RECAPTURE			SECOND RECAPTURE		
IND	SEX	DATE	HABITAT	DATE	HABITAT	DIST	DATE	HABITAT	DIST
1	M	5/23	HEM HARD	5/24	MIX CON	888'			
2	M	5/25	MIX CON						
3	M	5/25	MIX CON	5/27	UP HARD	2300'	5/30	SOUTH HARD	2038'
4	M	5/27	UP HARD						
5	M	5/27	UP HARD						
6	M	5/27	UP HARD						
7	F	5/30	SOUTH HARD	5/31	NORTH HARD HEM	1300'			
8	M	5/30	NORTH HARD HEM						

Additional attempts to detect other mammal species here were unsuccessful. No weasels or flying squirrels were taken in the large snap traps, and tapping on cavity trees also failed to produce flying squirrels. A small effort (6 net nights) was made to mist net bats in early August but was unsuccessful. Bats, presumably big brown bats, were seen every evening around 8:30 pm but were flying at heights well above the nets.

SPECIES ACCOUNTS

The pupose of this section is to provide SAGA-specific discussion of a species. Excellent general natural history information can be found in Oliver and Bailey (1939), Scarola (1973), DeGraaf and Rudis (1983), and Godin (1977). No attempt to recount all the details contained therein will be made and copies of these works are in the SAGA Natural Resources Library. In the interest of readability, citations will only be given for information not contained in the above references.

FISH

Brook Trout - Brook trout have been stocked in BMD BROOK since at least 1940 (Cronan 1981), and since 1977 aproximately 2000 have been released annually. The releases are spread among 26 sites upstream in Plainfield and in 1986, took place in April and May. Hatchery reared yearlings, 7-9 inches total length are released (Charles Thoits, pers comm). Despite this, no brook trout were found either in BMD BROOK or POND.

Past surveys have recorded brook trout in BMD BROOK, though Cronan (1981) noted there was little evidence of a sustained trout fishery. Brook trout are noted for their rigid temperature requirements, preferring streams of less than 68 degrees F. The only temperature data available, that of Cronan for spring 1980 show that water temperature and dissolved oxygen did not approach the limits of this specie's tolerance.

In BMU-BROOK, on the other hand, brook trout not only occur, but also reproduce. Individuals trapped in pools ranged in size from 2.5 - 4.6 inches, far smaller than the hatchery releases but in close agreement with size data for wild brook trout in New Hampshire. Their ability to sustain themselves in BMU suggest that BMD is, after all, unsuitable habitat for such possible reasons as water temperature, dissolved oxygen, silt loading, or substrate.

Brook trout were the dominant fish of BMU BROOK and ranked 10th in relative adundance.

Chain Pickeral - Pickeral are generally found in quiet, shallow waters with muddy bottoms, though they sometimes do occur in the same lakes as brook trout. Cronan (1981) includes a photo of this species in his SAGA Natural Resources Inventory, and DesMueles (pers comm) confirms its presence in BMD POND in 1980.

Its current absence, despite extensive and varied inventory effort, seems to be real, and probably the result of dam restoration work which resulted in the drawdown of BMD POND for over a year.

Longnose Dace - Considered to be widely distributed and generally abundant, this inhabitant of fast moving streams was recorded in BMD BROOK in 1939 and 1980, but does not appear to be present right now. Reasons for its apparent disappearance are unknown.

Blacknose Dace - Blacknose dace were found only in BMU BROOK and Upper BMD BROOK, where it attained its greatest abundance. In Upper BMD BROOK it was often seen in small pools with common shiners, the most abundant species in that habitat. It is considered a species of small, rapid streams, widespread throughout the state and abundant. Its habitat use and numbers here (fourth in relative frequency) are consistent with these generalizations.

Blacknose Dace were netted in BMU BROOK in the course of surveying for salamanders and were observed in breeding congregations in mid-May in pools in BMD BROOK

Redbelly Dace - Redbelly dace are fairly well distributed here, occurring in five habitats and ranking 7th in relative abundance. Its greatest abundance was in the marshy overflow ponds (particularly pond C), where it was the most abundant of all species. This coincides with the statement for this species "frequenting quiet backwaters where it often occurs in great numbers" (Scarola 1973).

Redbelly dace have a limited distribution in NH, almost exclusively north of the White Mountains. The only other locale is in nearby Claremont. The records from this survey expand its known distribution and suggest either a spread from Claremont or the possibility it escaped earlier surveys.

Fallfish - The fallfish is considered common, widespread, and adaptable, though more adundant in warm streams and lakes than its close relative the creek chub. It seems that these two species have partitioned habitats based on temperature, with some overlap in the midrange. Here at SAGA the fallfish was most abundant in BMD POND, though still less abundant than the creek chub. Overall, fallfish ranked sixth in relative abundance but were nowhere near as abundant as creek chub. This indicates that BMD POND is more a coldwater pond than warm. One question that comes to mind though, is whether creek chub have always dominated fallfish here, or whether the drawdown of the pond has caused a shift in their relationship.

Creek Chub - Creek chub was the most ubiquitous species and the second most abundant species, accounting for 1/4 of all captures. They were most abundant in Turtle Pond, though common to various degrees everywhere. Creek chub are considered a fish of small, gravelly brooks and streams, and its occurrence here is consistent with this. Its abundance in Turtle Pond is a bit deviant, though most of these individuals were small (1-2") and presumably young. The largest individuals (7") were in BMD BROOK and POND. Perhaps the warm, weedy habitat functions as a nursery, providing a more favorable habitat for growth and escape.

See Fallfish for discussion of relationship between creek chub and fallfish.

Bluntnose Minnow - The occurence of this species here is noteworthy as the first NH record (Thoits, pers comm). In New England

this species has been found in the Lake Champlain drainage (Werner 1980) but never in the Connecticut River drainage (Scott and Crossman 1973). The bluntnose minnow is an inhabitant of clear lakes, ponds, and slow flowing streams (Werner 1980). Its occurrene here only in Lower BMD BROOK is not unusual in regard to habitat, but does suggest a couple of things. This species may have entered from the Connecticut, and if so, probably occurs elsewhere in other tributaries. Further, and not suprisingly, the dam seems to limit its upstream spread.

Scott and Crossman (1973) note the common use of bluntnose minnows as bait in the U S, as does Werner (1980) in NY. However, it is not used by NH anglers (Thoits, pers comm) since it has not even been known to occur here. Its origins in NH probably do revert back to released bait but the details of it, and present distribution are unknown.

Positive identification of the two specimens of this species was made by Dr. C.L. Smith of the American Museum of Natural History in New York.

Common Shiner - "The common shiner is essentially a stream fish preferring moderately cool, flowing small and medium-sized streams with a gravel bottom and sparse vegetation; it also occurs frequently in lakes and rivers" (Scarola 1973). This fish is common and abundant throughout NH and its abundance and habitat utilization at SAGA are characteristic of the species. It dominated all other catches in Upper BMD Brook, where it attained the highest abundance of any species in this survey.

Overall, the common shiner accounted for nearly 1/3 of all fish caught in this survey.

On 5/14/86 and throughout mid-May, breeding congregations of 40-50 individuals were seen in many of the pools in the medium gradient section of Upper BMD BROOK. The red-finned, horny tubercled males were particularly conspicous. It was minnow traps set at this time that caught most individuals of this species.

Golden Shiner - The golden shiner inhabits quiet lakes, ponds, and sluggish streams, and based on the other species it associates with, is a warmwater species. It is uncommon here (ranking 12th in relative abundance) and of the five individuals caught, four were in quiet or sluggish sites. Four of the five also were from below the dam. It may be that the waters of SAGA tend to be too cold and thus limiting to this species.

Common Sucker - The common sucker is known for the wide range of habitats it occurs in. At SAGA it was only found in BMD POND and was almost exclusively caught by 1" x 1" gill nets. Considering its known range of habitat use I have some reservations about this distribution and wonder if it simply eluded detection in habitats not surveyed with gill nets.

The common sucker dominated the catch in the 1" gill nets and tied for eighth place in relative abundance.

Longnose Sucker - The longnose sucker is noted as being more of a coldwater species than the common and is usually found in cold, rapid flowing, gravel or rubble bottomed trout streams and colder lakes. Where it does occur with common sucker it generally lives

at greater depths, but here the two were found in essentially the same spot. BMD POND is not that deep, and is not thermally stratified (Cronan 1981), so it is neither possible nor necessary for these two species to separate out by depth. Apparently the temperatures of the pond (which, being a dammed up stream, are fairly cool in the main channel) are adequate for both species to co-occur.

Brown Bullhead - The widespread brown bullhead is found throughout NH, chiefly in small lakes, ponds and sluggish areas of streams. It is basically a warmwater species well known for its ability to tolerate low oxygen and high temperature. At SAGA the brown bullhead is common (fifth in relative abundance) and found primarily in BMD POND and lower BMD BROOK. The larger individuals (6-8") were found in the ponds and caught in gill nets. Its greatest abundance however, was in lower BMD BROOK. Here, in a large pool, underneath Rt 12-A over 30 individuals (2-4") were caught every day in one particular trap. Presumably these younger fish were washed over the dam and congregate in this semi-dark location in lieu of the deep pond bottoms that they normally prefer.

Rock Bass - Rock bass are uncommon at SAGA (11th in relative abundance) and seem to be most abundant in the low gradient section of lower BMD BROOK. It was introduced into NH and by 1939 was reported as abundant in, and restricted to, the Connecticut River and the mouths of its tributaries. This distribution still seems to hold some truth, as most of the captures were below the

dam in the stretch of brook that joins with the Connecticut. Some individuals however, have made it beyond the dam. Since the dam was first constructed in 1890, and the time of introduction of this species is unknown, it is impossible to know whether it reached these upstream sites before the dam, or during the dam's down times in 1938 (Cronan 1981) or 1984. Contrary to both early and modern reports, it is not abundant here.

Based on the temperature data of Cronan (1981) the mid-June water temperatures of BMD POND and BROOK (50 - 53 degrees F) are cooler than the spawning temperatures of 60 - 70 F reported for rock bass in NH, and reproduction here may be limited.

Redbreast Sunfish - Only a single individual was recorded here, taken in a large funnel trap on the shore of BMD POND, making this species 17 of 17 in relative abundance. It is considered a species of clear moderately flowing streams, which makes it seem well suited for SAGA waters. Perhaps its spawning requirement of water temperatures in the high 60's limit reproduction. It was also recorded in BMD BROOK in 1939 but was not common then either.

Bluegill - The bluegill is not native to NH and its presence in the Connecticut watershed is thought to be due to accidental introduction or immigration from Massachusetts. While concern over this species often stems from its capacity to overpopulate a water body, this doesn't appear to be a problem at SAGA. Only five individuals were recorded here, ranking 12th in relative abundance. All were in BMD POND and consisted of one adult (5.5")

and four young (2"). While there is no evidence of abundance, they are reproducing here.

Records for bluegill as of 1973 show it restricted to southeastern NH. These SAGA records extend its known range in NH at least 50 miles northwest and into the Connecticut River Watershed.

Pumpkinseed - Pumpkinseed were the second most widespread species (6 habitats) and third most abundant, accounting for 15% of all captures. They were absent only from BMU BROOK (too cold and fast?) and the overflow ponds. It is a fish of quiet or slow moving water and particularly abundant where good growth of aquatic vegetation is present. Its great abundance in Turtle Pond seems to bear this point out. None of the pumpkinseed here exceeded 3.5" total length, and most were smaller. Adults of 4" length are reported for stunted populations, and those individuals here may represent such a population.

Yellow Perch - The yellow perch is usually found in weedy sections of lakes or slow moving sections of large streams. All three individuals found here were in the low gradient section of Lower BMD BROOK, a slow moving section close to the Connecticut River. Individuals probably move back and forth between brook and river. It is uncommon, and ranked 14th in relative abundance.

Tessellated Darter - Tessellated darters live in a variety of habitats ranging from lakes, large rivers, and small streams. In NH it occurs only in the Connecticut Watershed. It was recorded here in past surveys (in 1939 it was not recorded in BMD but did

occur elsewhere in Cornish) and continues to be found in both BMD POND and BROOK.

Only two individuals were trapped (ranking 15th in relative abundance) but it may be more abundant than this. On 5/27/86, while walking the upper section of BMD BROOK, but not looking specifically for these or any other fish, four individuals were seen in 50 feet of stream. Two weeks prior, when this section of stream was trapped, none were seen. Perhaps they were still inactive during my trapping period?

AMPHIBIANS

Spotted Salamander - The spotted salamander is a terrestrial, burrowing species that is generally common and widespread, but difficult to observe outside of the breeding season when it congregates in temporary ponds and marshes. Here at SAGA it is common (as Ambystoma go) and was easily observed and captured in minnow traps in mid-April.

Breeding of this, and many other species, is stimulated by warm spring rains, and in 1986 the first individuals here (predominantly males) entered the overflow ponds between 4/2 and 4/17. Courtship was observed on the nights of 4/17 - 4/20, and by 4/20/86 a total of 42 egg masses were found as follows ; pond B-11, C-10, D-1, E-4, H-4, I-5, A'-5, B'-2. The mean number of eggs/mass was 72.9 +/- 24.6.

Heavy rains the night of 4/20/86 brought on another wave of migration to the ponds, and 21 individuals were trapped that night in ponds B and C. A second count of egg masses in pond B on

5/15/86 totalled 65 masses, demonstrating that most egglaying took place after 4/20/86. The fact that none of the masses on 5/15/86 were fresh means that the height of egg laying was soon after 4/20/86.

Assuming the proportionate increase in egg masses in pond B between 4/20 and 5/15 can be applied to all ponds, the total egg laying effort can be extrapolated to 248 masses. When multiplied by the mean # eggs/ mass (72.9) this totals 18,079 eggs laid. This total, when divided by the mean number of eggs/ female (161 in a Massachusetts population, Cook 1978) gives an estimated minimum of 112 females laying eggs at SAGA in 1986.

Hatching of most eggs had occurred by late May and well developed larvae, close to metamorphosis, were abundant in pond B on 8/17/86. The only terrestrial record was a recent metamorph found under a log along the Ravine Trail on 9/19/85. The spotted salamander certainly occurs in the other woodland habitats, but is difficult to find.

Jefferson Salamander - The jefferson salamander is similiar to the spotted in its general life history and habitat use, but may be a slightly earlier and faster developing species. It is much rarer than the spotted salamander, and had been proposed as a species of special concern in NH. Further complicating its regional status, and making it very interesting and important from an evolutionary standpoint is its role in a four species hybrid group consisting of two diploid species (one of which is

the jefferson) and two, almost exclusively all female, triploid species (see Smith 1978, DeGraaf and Rudis 1983)

The jefferson salamander appears to be rare at SAGA. No adults were observed and this species' occurrence here is based on the presence of three egg masses (30, 41, 23 eggs) found in pond B on 4/18/86. Further inventory in future years, directed more specifically at this species, would be useful to better document its status here.

Red-spotted Newt/Red Eft - The red-spotted newt and its terrestrial juvenile, the red eft, are abundant at SAGA. The red eft, because of its conspicuous color and diurnal activity, is one of the most frequently observed amphibians here.

Adult newts are aquatic and found in the still waters of the overflow ponds and marshy areas of BMD POND. Mating pairs were observed in mid-April in the overflow ponds day and night. The red eft was found in all terrestrial habitats except HEM HARD, where it probably also occurs.

Redback Salamander - The redback is a lungless, terrestrial species that completes its life cycle without entering any water body. It is primarily a woodland species and its distribution here at SAGA reflects that. It was most frequently found in the HEM HARD and UP HARD habitats, though part of that is due to sampling effort. However, not a single individual was found in the MIX CON, despite an extensive search that turned over 100+ logs.

Though Burton and Likens (1975) found this species to be the most abundant terrestrial vertebrate at the Hubbard Brook Experimental Forest in NH, it is not abundant here. A total of 34 individuals were recorded, 10 of which were a single hatchling group on 8/16/86. Compared to many other places where I have looked for redbacks, one has to work hard to find them at SAGA, and you don't find many.

All individuals found here were red-striped morphs.

Northern Two-lined Salamander - The two-lined salamander is common here, found in and along BMU BROOK and the smaller, unnamed brooks within the MIX CON and HEM HARD habitats. It is easily found by flipping rocks and logs next to these brooks, and by looking under flat rocks in shallow, quiet pools in the brook. Its occurrence and distribution is tied directly to the brooks, and only once was it found more than a couple of feet from water.

Northern Dusky Salamander - The dusky salamander seems to be more common than the two-lined and is also found in and along BMU and the other brooks. There does appear to be some partitioning of habitat though. Duskies tend to be found more frequently in slightly drier microhabitats. The streamside logs and rocks harbored mostly duskies, whereas the within-brook rocks had more even numbers of the two species. As with the two-lined, the dusky's occurrence is dependant on brooks and nearby seeps.

American Toad - The American toad is a common and widespread species at SAGA. It breeds in the overflow ponds in late May

(5/29/86 was the first night choruses were heard), and then disperses to all other terrestrial habitats for the rest of the year. Because it moves actively and in the open, it is a familiar and frequently observed species here.

Embryonic and larval development are rapid, and recently metamorphosed toadlets were seen on 7/12/85.

While the toads at SAGA are definitely American, some individuals show some characteristics of Fowler's toad (Bufo woodhousei fowleri). Three or more warts per dark spot and unspeckled bellies were observed, but the use of the "toad score" method (Lazell and Michener 1976) identified them as Americans.

Spring Peeper - The spring peeper is probably the most abundant and widespread amphibian at SAGA. It was found in all terrestrial habitats (except lawns) and during the breeding season occurs throughout both BMD and the overflow ponds.

Spring peepers are one of the first of the spring amphibians to become active. An estimated 100 were calling the night of 4/1/86, but at this early date they were very sensitive to disturbance and immediately stop calling. By mid-April the choruses were intense and much less sensitive to disturbance. Calling from the ponds at SAGA did not taper off until late May and occasional calling from terrestrial sites continues into the summer and autumn.

Development is rapid in spring peepers and young begin leaving the ponds and moving into terrestrial habitats in mid-July. However, there is considerable variation in dates of meta-

morphosis. Some individuals were as early as 7/11/85 while others observed on 8/17/86 in pond B were still tailed and aquatic.

Gray Treefrog - The gray treefrog is similiar in its basic life history to its more abundant relative the spring peeper but is much more arboreal. While it is certainly less numerous than spring peepers, its more limited breeding season, and lesser inclination to call at other times also make it seem rarer.

Gray treefrogs were first heard calling on 5/15/86 and by 5/23 through 5/29/86 breeding was in full swing. Calling males were heard throughout the wetlands and the periphery of BMD POND, with pond C and Turtle Pond especially important as breeding sites. The high count of calling males was 32 in pond C on 5/25/86.

Outside the breeding season gray treefrogs inhabit woodlands. Single individuals were heard calling in late July in the SOUTH HARD and NORTH HARD HEM and this species presumably occurs throughout the woodlands at SAGA.

Wood Frog - Closely rivalling the spring peeper in its abundance and widespread distribution at SAGA is the wood frog, In the breeding season it was found in all the overflow ponds, and at other times was seen in all the terrestrial habitats except LAWN.

Wood frogs are also an early breeder, and some were active on 4/1/86. Only a few individuals were present though, and calling was sporadic. The peak of breeding and egg laying was sometime between 4/2 and 4/17/86, a period during which I was absent. Egg laying was protracted over a couple of weeks. Fresh

laid masses were found through 4/18, while the earliest hatching observed was 4/19/86. Pond C contained the greatest number of egg masses (42 on 4/18/86) followed by pond G (14), H (10), and B (6).

Pickeral Frog - The pickeral frog is uncommon at SAGA and was only observed three times. It may breed in the overflow ponds but no calling males or mating pairs were observed. All three sightings were out of water and that of 9/17/85 was in the HEM HARD forest near the overflow parking lot.

Green Frog - The green frog is abundant along the shores of BMD POND and throughout the overflow ponds. It is predominantly aquatic as the bulk of observational records show. Actually these greatly underestimate its numbers and affinity for the wetlands. Anytime one walks through the wetlands or along pond edges there are green frogs leaping for cover and the water boils with tadpoles swimming away. To have recorded all of this would have been impractical.

Green frogs were not seen until mid-April (4/18/86) and calling did not begin until mid-May. The earliest calling record was 5/15/86 and this continued into August. The sightings away from ponds were of immature individuals and, except in one case, were along brooks. On rainy nights in July and August, young green frogs are all over the area's roads.

Bullfrog - Bullfrogs are common at SAGA though, being a higher level predator, are less numerous than green frogs. They are similiar to green frogs in their habits, though less likely to be

found away from the pond edge. Here at SAGA they are commonly seen in the overflow ponds and along the edge of BMD POND. One large adult was seen basking on the bank of BMD BROOK, and immatures can be found on roads on rainy summer nights.

Bullfrogs become active later in the spring than most amphibians. The earliest sighting was 5/15/86 and calling was not heard until 5/25/86. The peak of breeding appears to be in mid-July and calling continues at least until mid-August (8/15/86).

REPTILES

Snapping Turtle - The snapping turtle is common in BMD POND and in the overflow ponds, and its habitat use here is typical of the species. It was taken in funnel traps in BMD POND and on two occasions in late May, large individuals were seen basking at the water's surface.

Large snapping turtles were encountered in the overflow ponds in mid-April. Six individuals were seen, or in one case tripped over, between 4/17 and 4/20/86. By late May and through the summer they were not seen in these ponds. Their early spring use of the overflow ponds is probably due to these small, shallow ponds warming up faster than BMD POND.

Typical of the species, snapping turtles at SAGA respond to human presence by attempting to hide and escape. The only menacing behavior is in response to capture and handling.

Wood Turtle - The wood turtle is a semi-aquatic species which begins its yearly activity in and along streams, moves to adjacent field and woods in summer, and returns to the streams

to hibernate (Ernst and Barbour 1972). Here at SAGA the two records are both for individuals (adult males) along Upper BMD BROOK. One was walking on the stream bottom (4/20/86) and the other basking on the bank (5/23/86). In these situations (in the open and along a defined corridor) they are easier to observe than after they have dispersed into the terrestrial habitats.

As noted, wood turtles are now uncommon to rare in New England, and populations have declined. The wood turtles found at SAGA are not likely a self contained population, but rather individuals from a population along the length of BMD BROOK extending far beyond Park Service boundaries. Their continued existence here depends on maintaining the integrity and quality of BMD BROOK and adjacent lands.

Painted Turtle - The painted turtle is a widespread and common aquatic turtle in New England. At SAGA it is common, but not abundant, and occurs in BMD POND and the overflow ponds. The area of greatest concentration is "Turtle Pond" (Fig 2). Here it can be seen basking from April through September (and probably October). The highest count was 19 individuals on 4/19/86.

The painted turtle population at SAGA, and through most of New England (Klemens 1978), consists of individuals that are intergrades resulting from the hybridization of two sub-species. Eastern painted turtles (Chrysemys p. picta) and midland painted turtles (C. p. marginata) hybridized after the last glacial period, though there is uncertainty as to the time and place. The

two differ in, among other things, the alignment of scutes on their carapace (Conant 1975). Individuals with eastern-like and midland-like carapaces were seen here.

Some painted turtles apparently died after they were dredged out of hibernation during repairs to the dam in 1984. The numbers involved are unknown, as is the effect on the population since there is no baseline information. Regardless, sufficient numbers of painted turtles still exist at SAGA to maintain a population.

Monitoring of the painted turtle population could be easily done by counts of basking individuals. Since Turtle Pond is such a focal point for the species, counts made during April and May would give an index to their numbers.

Eastern Garter Snake - The garter snake was the only snake observed during this survey, usually basking in open, sunny spots or under a warm piece of cover in grassy settings. The garter snake is probably the commonest and most ubiquitous snake in New England, but it is not very common at SAGA. The preponderance of records in the LAWN is partially a sampling bias, and this species ranges throughout SAGA.

Eastern Milk Snake - The milk snake is also a common and wide-spread species. While it was not observed in the present survey, it is included here based on Cronan (1981) and the reports of SAGA employees who have seen it in the area.

Eastern Hognose Snake - Mistakenly listed in Cronan (1981), this species does not occur here. It was not recorded in the present,

nor in past surveys (DesMueles, pers. comm), and SAGA is beyond its more southern distribution.

MAMMALS

Masked Shrew - Hamilton and Whitaker (1979) state that the masked shrew occupies a very wide range of habitats, but that it is relatively scarce over much of its range. Here at SAGA it is also scarce. Only two individuals were trapped and it ranked 8 of 9 in relative abundance (1.1% of all small mammals trapped). It wasn't wide ranging here, and its occurrence appeared related to the presence of herbaceous vegetation. However, the limited number of captures make this a very tentative correlation.

Smokey Shrew - The smokey shrew is uncommon at SAGA and found in woodland habitats. A single individual was trapped in each of three habitats (HEM HARD, SOUTH HARD, and NORTH HARD HEM), making this species 7th in relative abundance (2.3% of small mammals trapped). The smokey shrew is widespread throughout New England and known to prefer cool moist woods, all of which agrees with the habitats it was found in here.

Short-tailed Shrew - The short-tailed shrew is the most abundant and widespread of small mammals at SAGA. It comprised 38.8% of all snap trap captures, and occurred in all habitats trapped. It was most abundant in SOUTH HARD (14.0 inds/100 trap night), and in most woodlands it was the most abundant small mammal. It was least abundant in the FIELD (0.67 inds/100 trap night). Its abundance and wide distribution at SAGA is typical of the species, with its low numbers in FIELD the possible exception.

Hairy-tailed Mole - The hairy-tailed mole is found through most of New England and inhabits woods and meadows with loose, well drained soils. Here at SAGA all three individuals were found dead on LAWN in the historic zone. Based on known habitat use of this species it probably ranges into the woodlands but moles are difficult to snap trap and the only records were chance encounters by staff. Since their time is almost exclusively spent in the historic zone, that is where all the records are from.

Star-nosed Mole - A single star-nosed mole was found dead in wooded wetlands adjacent to Turtle Pond. It is typically found in moist habitats and though seemingly uncommon, may simply be elusive.

Big Brown Bat - Big brown bats were recorded roosting behind pictures in the Atrium on 9/13/85 and 8/1/86. Staff commonly see bats (actually their guano) behind these pictures throughout the summer, and occasionally behind shutters at Aspet.

In late July, large bats (presumably of this species) were seen every evening around 8:30 pm flying above the fields and buildings of the historic zone. Up to five at a time were seen.

Big Brown Bats are widespread and fairly common in New England. Our knowledge of their numbers and habits at SAGA is limited.

Little Brown Bat - While no little brown bats were observed in this survey, attempts at bat inventory were limited and unsuccessful. This, and other bat species may well occur here, at least during migration. This species was reported here by Cronan

(1981) and since it is the commonest bat in New England, there is no reason to doubt this report.

Eastern Chipmunk - The familiar chipmunk is common at SAGA and easily the most conspicuous mammal. It burrows under and near building foundations and has learned to solicit food from staff and visitors. It is most numerous around the historic zone, but also occurs throughout most of the woodlands. These individuals are not so habituated to humans and are more difficult to observe.

Woodchuck - Woodchucks are generally found in pastures, meadows, and woodland edges, and are often abundant. They are uncommon at SAGA. In all my time here I observed only one woodchuck, on the evening of 7/12/85. It was on the LAWN, 30 feet from the NORTH HARD HEM and upon seeing me, it ran into the woods.

In the course of this survey I observed ten large burrows that looked like woodchuck. They were located in steeply sloped woodlands, close to open field. I can't be sure if they were, in fact, active woodchuck burrows.

Gray Squirrel - The gray squirrel is common at SAGA but not abundant. It stays within the woodlands and was not seen on or around the buildings. They are typical of hardwood and mixed forests, and their occurrence here is nothing unusual. Wild gray squirrels are wary, and since most records are for sigtings, they probably are an under-represented.

Red Squirrel - Red squirrels are also common at SAGA, occurring in woodlands. This species is known for its affinity to more

coniferous habitats than the gray squirrel. The limited number of sightings of these two species generally support this, but there is quite a bit of overlap between these two species here.

Beaver - Beaver have become a common sight in BMD POND after an apparent absence during the 1984 drawdown. Beaver were seen or heard (tail slapping) at all hours of the day, and were often seen swimming in mid-afternoon in front of groups of people.

An active lodge was located on the north side of BMD BROOK, right along Rt. 12-A and it seems that this one family group resided specifically at SAGA. No more than two, and usually only one individual were seen at any time.

The beaver here feed heavily on alders, silky dogwood, and birch and evidence of this can be seen throughout and adjacent to the wetlands.

Deer Mouse - Deer mouse are uncommon at SAGA, particularly compared to the closely related white-footed mouse. They ranked 6th of 9 in relative abundance and made up 3.4 % of all snap trap captures. They occurred only in woodland habitats, and were most abundant in the HEM HARD (0.99 inds/100 trap nights).

White-footed Mouse - The white-footed mouse is the second most abundant small mammal here (18.9% relative abundance) and occurred in all woodland habitats. Its abundance was greatest in MIX CON and SOUTH HARD, where it was trapped at rates of 6.70 and 5.33 inds/ 100 trap night respectively. It was least abundant in UP HARD.

At SAGA the white-footed and deer mouse occur together.

Choate (1973) reviewed the distribution and habitat preferences of these two species in New England and determined that geographically the deer mouse is a northerly species. The distributional boundary between the two species extends as a north-east/south-west line from northwest Connecticut across into southern Maine. Along this line is a sometimes wide zone of sympatry which includes the SAGA region.

Choate (1973) characterized habitat "preferences" as follows; "P. maniculatus <deer mouse> prefers habitats associated with coniferous forests (primarily red, white, and black spruce and balsam fir) or northen hardwoods (consisting mainly of beech, yellow birch, and sugar maple)". "P. leucopus <white-footed mouse> are distributed in slightly more arid habitats dominated primarily by white pine, hemlock, and oaks". He also mentions that the distribution of deer mouse is tied to that of boreal and sub-boreal mountain forests.

While there are certain anomalies in the trapping data for these two species here (such as the deer mouse being almost as abundant as the white-footed mouse in the HEM HARD despite the preference of white-footed for hemlock/white pine forest), the overall picture is that the woodlands at SAGA correspond more closely to the hemlock, white pine, and oaks preferred by white-footed mouse than to the sub-boreal forests of deer mouse.

Red-backed Mouse - The red-backed mouse is typically found in cool forests of hemlock, red spruce, and shaded mixed hardwoods.

Its occurrence here at SAGA in the five wholly wooded habitats is consistent with this, particularly in that it is most abundant in habitats with a large hemlock component. It was the forth most abundant small mammal here, with a relative abundance of 8.6%

Meadow Vole - The meadow vole, occurring only in FIELD at a rate of 21.5 inds / 100 trap nights was the near exclusive inhabitant of this habitat. No other species attained such a local abundance and it was this singular abundance that made the meadow vole third in overall abundance.

Its habitat use and abundance here are typical of the species. It is a prolific breeder and goes through cyclic build-ups and die offs. It can increase significantly in numbers in the course of a single year, and trapping done in mid-September probably sampled the population at its annual high point. Where it stood in its multi-year cycle is unknown.

Though trapped only in FIELD, this species must occur in the woodlands that directly border field. In October, when FIELD is mowed, the vole's primary habitat is eliminated and individuals are displaced into the woodland edges. Some probably live on this edge all along, ranging between habitats. Since trapping was not done along or through habitat edges, this effect was not documented here.

Muskrat - The muskrat is common in the wetlands here and usually seen swimming in BMD POND or BROOK. In mid-April muskrat were frequently seen swimming in BMD BROOK, right at the bend in the brook south of Turtle Pond. At this point there were at least two

below-water entrances to bank dens. In addition to bank dens, the muskrats at SAGA use the traditional cattail "muskrat house". Three seemingly active, and two inactive houses were set in the marshes and were visible from Rt 12-A.

Meadow Jumping Mouse - Meadow jumping mouse is the rarest of the small mammals trapped. Only a single individual was taken, in the WET habitat. It typically occurs in moist grassy and brushy fields and has a known affinity for moist areas. This individual was taken in a trap set at the interface between a stand of sedge and silky dogwood, about five feet from water.

Hamilton and Whitaker (1979) note that when both meadow and woodland jumping mice occur together, the meadow occupies open areas and the woodland occupies the woods. In the absence of the woodland jumping mouse, the meadow jumping mouse will inhabit woodlands. At SAGA the woodland jumping mouse not only occurs but dominates. This includes the WET, where the meadow jumping mouse occurs and, based on described habitat partitioning would be expected to outnumber the woodland jumping mouse. However, it does not.

Woodland Jumping Mouse - The woodland jumping mouse is common at SAGA in the NORTH HARD HEM, HEM HARD, and WET habitats. It ranked 5th with a relative abundance of 8%. Its predominance in woodland habitats is typical. Both woodland and meadow jumping mouse are widespread throughout New England, and partition habitats as discussed under meadow jumping mouse.

Porcupine - The porcupine is widespread in New England and has increased in numbers as woodlands increase. It is found in mixed hardwood-conifer woodlands such as those found at SAGA. It appears to be uncommon, but may simply be elusive. Two sightings by staff, on 6/27/86 (dead on road near BMD POND) and 7/3/86 in the UP HARD, plus recollections of porcupine gnawing on the Raving Studio are the only records.

Racoon - Racoon are common here and occur in all habitats. A total of eight individuals were trapped in late May, and this species dominated live trap captures. Individuals are known to have home ranges in excess of three square miles, so the individuals here, as shown in the recapture data (Table 13) can be expected to occur anywhere in SAGA.

This species is widespread and common throughout New England and there was nothing atypical noted in the numbers, habitat use, or habits of SAGA racoons.

Fisher - A single fisher was caught in a large live trap (Tomahawk #207) on 5/23/86 in the MIX CON. It is known to prefer dense forests of mixed hardwoods and conifers so its capture here is in character. Fisher are uncommon but apparently increasing in southern NH. They have a home range of from 8-15 miles in diameter, so SAGA provides only a small fraction of the habitat supporting this individual.

Striped Skunk - Skunk are common and widespread in New England, occurring in a great variety of habitats. None were recorded here

but two were seen dead on Rt 12-A north of the park. They more than likely range into SAGA.

River Otter - Three river otter were seen swimming in BMD POND at 4:30 pm on 7/27/86 and on 8/4/86 I met four people at BMD POND who were watching otters.

Otters are widespread but uncommon and occur in rivers, streams, and wetlands. No specific data on home range is available, but they are known as great travelers, and individuals moving 100 miles have been recorded. Thus these otters utilize habitats at SAGA in conjunction with other wetlands for miles around.

White-tailed Deer - The familiar, common, and widespread deer is common (as deer go) at SAGA. Individuals were seen in FIELD (where two were bedded down on 9/18/86), UP HARD, and WET, and their tracks, pellets, or trails were commonly observed elsewhere.

Deer have home ranges of 2-3 square miles and range in and out of SAGA in the course of daily activity.

EVALUATION OF RECENT HABITAT MANAGEMENT PROJECTS

N-1 BIRD HABITAT MANAGEMENT

In spring 1984, 3.5 acres of early succession woodlands were cleared of trees, stumps removed, and planted into field species (see Attachment 1 and description of FIELD habitat). Primary purpose was to restore the historic landscape, but an additional consideration was to provide habitat for field nesting birds.

Observations in summer 1985 and spring/summer 1986 did not detect the presence of any field nesting species. However, field feeding species such as chipping sparrow (Spizella passerina) and American goldfinch (Carduelis tristis) were frequently seen, as were eastern phoebe (Sayornis phoebe) and great crested flycatcher (Myriarchus crinitus). These latter are flycatchers and feed on insects taken on the wing. They perched in and around the fields, feeding on insects associated with the field.

While it may be too soon after clearing for any field nesting birds to have "colonized" these fields, a number of factors serve to make this less likely to ever occur.

The 3.5 acres are divided into three parcels, fingers projecting downslope into adjacent woodlands. These three fingers are roughly 0.5, 1.0, and 2.0 acres. The largest is bounded on both of its long sides by trails leading into the woodlands. Though these trails are not heavily used, there really is not much area within any of these fingers that is distant from human activity. This disturbance will inhibit bird nesting.

SAGA - N-1 - Bird Habitat Management Program/Historic Tree Line Restoration

Overgrowth of the historic tree line in the lower field/meadow of the Saint-Gaudens National Historic Site has occurred since 1907. Approximately twelve acres have grown up in hemlock, pine, birch, poplar, ash and hardwoods. The historic tree line has been established by aerial and topographical surveys and is included in the 1981 study by Dr. Chris Cronan. The trees are encroaching on the historic vista and have eliminated the nesting habitat for the meadow and field wildlife, particularly birds: bobolink, killdeer, meadowlark and savannah, vesper and grasshopper sparrows.

The twelve or so acres should be marked and cleared, returning the area to field and meadowlands by removal of tree stumps, grading and reseeding. The field would be maintained by annual haying in the late summer, much the same as it was in the historic period. The return of the tree line and vista is a Management objective following the recommendations of the approved Master Plan.

Alternative action would be: (1) to do nothing. The twelve acre area would continue to grow up, obliterating the historic vista of Mt. Ascutney and the Green Mountains of Vermont; one of the most important visual resources of the park, and the factor in Saint-Gaudens' establishing his home here. Habitats for field and meadow birds would not be available, reducing the diversity of species, a unique characteristic of the area.

Recommended action is: (2) to determine the historic line of the forest for 1907. Begin a tree clearing project to eliminate growth that has occurred since Saint-Gaudens' residency. identify any trees that may be growing in the area, that would have been extant in the 1907 period. Clear the growth that has occurred since the historic period, remove stumps and reseed the field grass and native wildflowers. The meadow of approximately twelve acres would be maintained by cutting on an annual basis, preferably in August to perpetuate the nesting of meadow and field birds.

Addendum - February 1984

A complete analysis of the site indicated an area of 3.5 acres.

Contract CX1600-3-0061 was awarded September 6, 1983 and the work is to be accomplished beginning on May 15, 1984 and ending June, 1984.

ATTACHMENT 1

The fields are maintained by annual mowing in October. When birds return to nest in April and May the field has yet to regrow and provides habitat not much different than a coarse lawn. This does not provide adequate nesting cover, particularly in conjunction with the disturbance factor.

If promotion of field nesting birds is really desired, a numbers of changes are suggested. Some of these may be viewed as in conflict with other values and will require a decision on the part of management. None of the suggested changes are irreversible, so they can be tried out, evaluated, modified, or discarded as experience dictates.

Increasing the amount of field habitat is one important step. Most of the lawn below Aspet is mowed monthly, and that adjacent to the buildings is mowed weekly. The area of monthly mowed lawn could be greatly decreased and allowed to grow into the taller field habitat. The lower, more distant sections, such as that between the Temple and the overflow parking area, are the best place to start. Not only would this increase the amount of field habitat, it would reduce the amount and cost of mowing operations.

Re-route access to the Return Trail so that it connects in a straight North/South line to the BMD Pond Trail by crossing the lower end of the field (where it is narrow). This will eliminate disturbance along the southern egde of this, the largest of the fingers.

Changes in mowing practice may also be necessary. A number of options come to mind and the choice will require further investigation and trials. Perhaps mowing in late August (after any nesting birds have fledged young) will allow enough regrowth before winter to provide adequate cover in spring. Another possibility might be to adopt a mowing frequency of two years, with half mowed in any given year. This would still maintain the FIELD as such, plus ensure that some cover existed in spring. It would also preserve some of the aesthetic appeal that the late summer wildflowers in these fields provide.

My recommendation would be to adopt the two year mowing frequency and allow as much of the monthly mowed sections to grow up as possible. Start big. It can always be mowed back if really necessary. Bird use should be monitored in May and June to determine if nesting is taking place. Four sessions, of one hour duration, done by an experienced birder, would be sufficient.

N-2 HABITAT MANAGEMENT PROGRAM BLOW ME DOWN POND

In conjunction with repairs to the dam in 1984, 9000 cubic yards of silt above the dam were dredged (Attachment 2). Impacts of this work appear to be two, one of which is more properly related to the drawdown of the pond for a year rather than to dredging.

As noted before, dredging resulted in the death of an undetermined number of painted turtles. The overall impact on the population is unknown, but there are still sufficient numbers of painted turtles left to maintain the population.

SAGA - N-2 - Habitat Management Program Blow-Me-Down Pond

Blow-Me-Down Pond once occupied an approximate 40 acre area. During the past fifty years extensive silting (natural erosion into the pond, trapped by the dam) and resultant natural vegetative encroachment has reduced the open water to a 15 acre pond. Unabated filling of the area will result in the loss of this important wildlife habitat and aesthetic resource. A Flora and Fauna research project completed in 1981 for the National Park Service by Dr. Chris Cronan recommends removal of the woody vegetative encroachments and excessive silt overburden in the pond and contiguous areas. Utilizing the opportunity to restore the Blow-Me-Down dam which created the pond will allow work to be accomplished on the dam, as well as the necessary work to excavate the silting at the back of the dam and the pond basin. The work would be done in the late summer and early fall to minimize impact on the wildlife. Construction of a needed boardwalk and observation tower along the edge of the pond and stream will protect these delicate wildlife breeding areas and provide needed access for the visitor.

Alternative actions would include: (1) doing nothing. Continued encroachment of the vegetation and silting will result in a loss of the pond. With no emergency work done on the dam, the structure will continue to deteriorate and result in loss of the dam as well as what remains of the pond, returning it to a meandering stream. A significant habitat will have been lost as well as a degradation of the aesthetic appeal of the area.

Recommended action: (2) temporarily drain the pond, excavate the overburden of silt in the pond basin and at the base of the dam; repair the dam; remove encroachment of woody vegetation and restore the 40 acre open water area. Work would be accomplished in the late summer and early fall to minimize the impact on wildlife habitats.

Addendum - February 1984

As a result of remedial work done on the Blow-Me-Down Dam under contract CX1600-3-0064, a separate line item in the contract funded by the Jobs Act Program allowed for dredging of approximately 9000 cubic yards of silt from the stream bed in the pond basin.

Further dredging will be necessary to remove heavy woody vegetative encroachments and excessive silt overburden in the pond basin.

ATTACHMENT 2

Monitoring of painted turtles in April and May, using multiple counts of individuals basking in Turtle Pond will provide an index of painted turtle numbers.

Breaching the dam, and the long drawdown period appears to have eliminated pickeral from BMD POND, and possibily reduced the numbers of other warmwater species. As with the painted turtles, there is little pre-project information to compare with. Those species possibly reduced, but still present (bluegill, redbreast sunfish) will likely recover.

Pickeral will only recover through recolonization or restocking. Whether they will recolonize in the near future is uncertain, since we don't know if the pickeral there in 1980 were naturally occurring or released. Recolonization from the Connecticut River is blocked by the dam and I am uncertain if there are any upstream populations that might colonize through BMD BROOK. If recolonization is not possible, restocking might be considered. Any thoughts of restocking should be thoroughly studied and personnel of NH Fish and Game consulted with.

Any further dredging must be critically evaluated and planned carefully. Dredging directly above the dam, and in the main channel of the pond will decelerate its filling in, but removal of marshy and woody vegetation along the pond's margin is probably not necessary nor desirable. These wetland habitats are what make the pond so attractive to and productive of wildlife.

There seems to exist an equilibrium between the channel of the brook/pond and the wetlands, maintained by water flow. Much more long-term information, such as aerial photos of the entire system, taken every 5-10 years over a 20+ year period are needed to document changes that may be occurring here. Cronan (1981) includes an aerial photo of BMD POND taken in 1979. Acquisition of copies of this, and any other aerial photos taken by other land management agencies for other purposes (eg. soil surveys, land use and planning, crop inventory), both in past and future years, could provide the information at nominal cost to the NPS.

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PERSONAL COMMUNICATIONS

Mark DesMueles
The Nature Conservancy
7 Main St
Montpelier, VT 05602

Michael Klemens
Dept. of Herpetology
American Museum of Naural History
Central Park West and 79 St.
New York, NY

C. Lavett Smith
Dept. of Ichthyology
American Museum of Natural History
Central Park West and 79 St.
New York, NY

Charles Thoits
New Hampshire Division of Fish and Game
34 Bridge St.
Concord, NH 03301

APPENDIX A. Latin names of species referrred to in text.

PLANTS

Alder, swamp	*Alnus serrulata*
Ash, white	*Fraxinus americana*
Bachelor's Button	*Centaura cyanus*
Basswood, American	*Tilia americana*
Beech, American	*Fagus grandifolia*
Birch, Black	*Betula lenta*
Birch, Paper	*Betula papyrifera*
Birch, Yellow	*Betula alleghaniensis*
Cattail, Broad-leaved	*Typha latifolia*
Coreopsis, Lance-leaved	*Coreopsis lanceolata*
Dame's Rocket	*Hesperis matronalis*
Dogwood, Red-osier	*Cornus stolonifera*
Dogwood, Silky	*Cornus ammomum*
Fescue sp.	*Festuca sp.*
Fescue, sheep	*Festuca ovina*
Hemlock, Eastern	*Tsuga canadensis*
Honeysuckle	*Lonicera sp.*
Iris, Blueflag	*Iris versicolor*
Maple, Mountain	*Acer spicatum*
Maple, Red	*Acer rubrum*
Maple, Striped	*Acer pennsylvanicum*
Maple, Sugar	*Acer saccharum*
Oak, Red	*Quercus rubrum*
Pine, White	*Pinus strobus*
Pondweed	*Potamogeton sp.*
Pond-lily, Yellow	*Nuphar variegatum*
Sedge, Tussock	*Carex stricta*
Virburnum	*Virburnum sp.*
Witch Hazel	*Hamamellis virginiana*

APPENDIX A.

FISH

Brook Trout	*Salvelinus fontinalis*
Chain Pickeral	*Esox niger*
Creek Chub	*Semotilus atromaculatus*
Fallfish	*Semotilus corporalis*
Bluntnose Minnow	*Pimephales notatus*
Common Shiner	*Notropis cornutus*
Golden Shiner	*Notemigonus crysoleucas*
Longnose Dace	*Rhinichthys cataractae*
Blacknose Dace	*Rhinichthys atratulus*
Redbelly Dace	*Phoxinus eos*
White Sucker	*Catostomus commersoni*
Longnose Sucker	*Catostomus catostomus*
Brown Bullhead	*Ictalurus nebulosus*
Rock Bass	*Ambloplites rupestris*
Bluegill	*Lepomis macrochirus*
Pumpkinseed	*Lepomis gibbosus*
Redbreast Sunfish	*Lepomis auritus*
Yellow Perch	*Perca flavescens*
Tessellated Darter	*Etheostoma olmstedi*

AMPHIBIANS

Spotted Salamander	*Ambystoma maculatum*
Jefferson Salamander	*Ambystoma jeffersonianum*
Red-spotted Newt	*Notophthalmus viridescens*
Redback Salamander	*Plethodon cinereus*
Northern Two-lined Salamander	*Eurycea bislineata*
Northern Dusky Salamander	*Desmognathus fuscus*
Eastern American Toad	*Bufo americanus*
Northern Spring Peeper	*Hyla crucifer*
Gray Treefrog	*Hyla versicolor*
Wood Frog	*Rana sylvatica*
Pickeral Frog	*Rana palustris*
Green Frog	*Rana clamitans*
Bullfrog	*Rana catesbiana*

REPTILES

Snapping Turtle	*Chelydra serpentina*
Wood Turtle	*Clemmys insculpta*
Painted Turtle	*Chrysemys picta*
Eastern Garter Snake	*Thamnophis sirtalis*
Eastern Milk Snake	*Lampropeltis triangulum*
Eastern Hognose Snake	*Heterodon platyrhinos*

APPENDIX A

MAMMALS

Masked Shrew	*Sorex cinereus*
Smokey Shrew	*Sorex fumeus*
Short-tailed Shrew	*Blarina brevicauda*
Hairy-tailed Mole	*Parascalops breweri*
Star-nosed Mole	*Condylura cristata*
Big Brown Bat	*Eptesicus fuscus*
Little Brown Bat	*Myotis lucifugus*
Eastern Chipmunk	*Tamias striatus*
Woodchuck	*Marmota monax*
Gray Squirrel	*Sciurus carolinensis*
Red Squirrel	*Tamiasciurus hudsonicus*
Flying Squirrel	*Glaucomys* sp.
Beaver	*Castor canadensis*
Deer Mouse	*Peromyscus maniculatus*
White-footed Mouse	*Peromyscus leucopus*
Gapper's Red-backed Mouse	*Clethrionomys gapperi*
Meadow Vole	*Microtus pennsylvanicum*
Muskrat	*Ondatra zibethica*
Meadow Jumping Mouse	*Zapus hudsonicus*
Woodland Jumping Mouse	*Napeozapus insignis*
Porcupine	*Erethizon dorsatum*
Racoon	*Procyon lotor*
Fisher	*Martes pennanti*
Weasel	*Mustela* sp.
Striped Skunk	*Mephitis mephitis*
River Otter	*Lutra canadensis*
White-tailed Deer	*Odocoileus virginianus*

APPENDIX B. OBSERVATIONAL RECORDS

The following observational records are listed by latin name of species and arranged in ascending taxonomic order. They are derived from SAGAWILD, a D-dase III file of wildlife observations made during this inventory. A floppy disk copy of this database is being submitted to SAGA for future use and updating

```
. list for species = "Rhinichthys atratulus"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
117	Rhinichthys atratulus	09/13/85	13:30	1	BMU Brook	pool	Memo
118	Rhinichthys atratulus	05/14/86	11:00	20	BMD Brook	pool	Memo
265	Rhinichthys atratulus	08/04/86	12:30	2	BMU Brook	under rocks	Memo

```
. list for species += "Notropis cornutus"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
119	Notropis cornutus	05/14/86	11:00	40	BMD Brook	pool	Memo

```
. list for species = "Etheostoma olmstedi"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
183	Etheostoma olmstedi	05/27/86	16:30	4	BMD Brook	among rocks, bottom	Memo

```
. list for species = "Ambyst( a maculatum"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
58	Ambystoma maculatum	09/19/85	17:30	1	north hard hem	under log	Memo
80	Ambystoma maculatum	04/17/86	22:00	3	wetland	pond B	Memo
84	Ambystoma maculatum	04/18/86	14:00	42	wetland	egg masses	Memo
90	Ambystoma maculatum	04/18/86	10:00	9	wetland	ponds B, G	Memo
99	Ambystoma maculatum	04/19/86	10:00	3	wetland	pond B	Memo
105	Ambystoma maculatum	04/20/86	10:30	1	wetland	pond b	Memo
108	Ambystoma maculatum	04/20/86	20:30	5	wetland	ponds A', B'	Memo
110	Ambystoma maculatum	04/21/86	09:30	21	wetland	ponds B, C	Memo
125	Ambystoma maculatum	05/15/86	13:00	65	wetland	eggmasses, pond B	Memo
212	Ambystoma maculatum	07/26/86	11:00	50	wetland	pond B	Memo

```
. list fior species = "Ambyst ma jeffersonianum"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
86	Ambystoma jefferson: num	04/18/86	14:00	3	wetland	pond C, eggmasses	Memo

```
. list for species = "Noto-phthalmus viridesacens"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
25	Notophthalmus viridescens	07/15/85	07:40	1	lawn	walking in grass	Memo
45	Notophthalmus viridescens	09/16/85	12:45	1	wetland	under board at edge	Memo
75	Notophthalmus viridescens	04/01/86	19:00	10	wetland	overflow ponds	Memo
78	Notophthalmus viridescens	04/17/86	16:00	6	wetland	marshy pond C	Memo
81	Notophthalmus viridescens	04/17/86	22:00	2	wetland	pond C	Memo
87	Notophthalmus viridescens	04/18/86	14:00	46	wetland	ponds B,C,D,E	Memo
96	Notophthalmus viridescens	04/19/86	11:30	2	wetland	"turtle pond"	Memo
100	Notophthalmus viridescens	04/19/86	10:00	9	wetland	ponds B,C	Memo
106	Notophthalmus viridescens	04/20/86	10:30	12	wetland	ponds B, C, H	Memo
109	Notophthalmus viridescens	04/20/86	20:30	2	wetland	pond A'	Memo
142	Notophthalmus viridescens	05/22/86	17:50	1	field	on surface,eft	Memo
143	Notophthalmus viridescens	05/22/86	17:45	1	up hard	on surface, eft	Memo
146	Notophthalmus viridescens	05/23/86	10:00	1	mix con	on surface, eft	Memo
149	Notophthalmus viridescens	05/23/86	11:50	2	up hard	on surface, eft	Memo
152	Notophthalmus viridescens	05/25/86	12:30	1	up hard	surface, eft	Memo
193	Notophthalmus viridescens	05/30/86	09:30	1	north hard hem	surface, eft	Memo
217	Notophthalmus viridescens	07/27/86	09:30	2	north hard hem	surface , eft	Memo
224	Notophthalmus viridescens	07/28/86	18:15	1	up hard	surface, eft	Memo
225	Notophthalmus viridescens	07/28/86	10:00	1	north hard hem	surface, eft	Memo
227	Notophthalmus viridescens	07/28/86	08:00	1	up hard	surface, eft	Memo
229	Notophthalmus viridescens	07/29/86	09:10	1	south hard	surface, eft	Memo
230	Notophthalmus viridescens	07/29/86	07:00	1	up hard	surface, eft	Memo
235	Notophthalmus viridescens	07/30/86	07:45	1	north hard hem	surface, eft	Memo
237	Notophthalmus viridescens	07/30/86	09:00	20	up hard	surface, efts	Memo

```
. list for species = "Plethodon cinereus"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
2	Plethodon cinereus	07/10/85	15:00	1	up hard	under log	Memo
6	Plethodon cinereus	07/11/85	16:43	1	hem hard	under bark shingles	Memo
16	Plethodon cinereus	07/12/85	19:30	2	hem hard	under logs	Memo
24	Plethodon cinereus	07/14/85	10:10	3	up hard	all under same log	Memo
28	Plethodon cinereus	07/16/85	10:00	1	up hard	under log	Memo
35	Plethodon cinereus	09/13/85	13:45	1	up hard	under log in forest	Memo
38	Plethodon cinereus	09/14/85	11:35	1	hem hard	under plywood	Memo
55	Plethodon cinereus	09/18/85	12:30	1	hem hard	under log	Memo
56	Plethodon cinereus	09/18/85	13:00	1	hem hard	under slate	Memo
71	Plethodon cinereus	04/01/86	16:20	1	hem hard	under log	Memo
115	Plethodon cinereus	05/14/86	14:30	1	up hard	under log	Memo
121	Plethodon cinereus	05/15/86	08:00	1	up hard	underlog	Memo
126	Plethodon cinereus	05/15/86	15:00	5	hem hard	under rocks	Memo
148	Plethodon cinereus	05/23/86	13:00	1	hem hard	under log	Memo
173	Plethodon cinereus	05/26/86	13:30	1	hem hard	under log	Memo
176	Plethodon cinereus	05/27/86	15:25	1	hem hard	under log	Memo
246	Plethodon cinereus	08/16/86	15:00	10	north hard hem	in rotting log	Memo
247	Plethodon cinereus	08/16/86	15:45	1	south hard	under log	Memo

```
. list fior species = "Eurycea bislineata"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
33	Eurycea bislineata	09/13/85	14:00	17	BMU Brook	loose flat rocks	Memo
48	Eurycea bislineata	09/17/85	11:30	1	brook, mix con	under rock	Memo
57	Eurycea bislineata	09/18/85	13:00	1	hem hard	under slate	Memo
62	Eurycea bislineata	09/19/85	17:00	3	BMU Brook	under rocks	Memo
66	Eurycea bislineata	04/01/86	12:30	3	BMU Brook	under rocks	Memo
127	Eurycea bislineata	05/15/86	15:00	1	brook,hem hard	under rock	Memo
232	Eurycea bislineata	07/29/86	11:00	1	north hard hem	surface	Memo
267	Eurycea bislineata	08/15/86	15:20	4	BMU Brook	under rocks	Memo

```
. list for species = "Desmognathus fuscus"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
34	Desmognathus fuscus	09/13/85	14:15	1	north hard hem	under rock in seep	Memo
47	Desmognathus fuscus	09/17/85	11:30	2	brook, mix con	under rock	Memo
50	Desmognathus fuscus	09/17/85	15:45	5	brook,hem hard	under rock	Memo
63	Desmognathus fuscus	09/19/85	17:00	3	BMU Brook	under rocks	Memo
123	Desmognathus fuscus	05/15/86	15:50	2	brook,hem hard	under rocks	Memo
128	Desmognathus fuscus	05/15/86	15:00	6	brook,hem hard	under rocks	Memo
266	Desmognathus fuscus	08/15/86	15:15	5	BMU Brook	under rocks, logs	Memo

```
. list for species = "Bufo Amamericanus"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
1	Bufo americanus	07/10/85	15:00	1	up hard	forest floor	Memo
8	Bufo americanus	07/11/85	16:50	1	hem hard	under log	Memo
9	Bufo americanus	07/11/85	17:00	1	field	grass clump	Memo
12	Bufo americanus	07/12/85	09:40	1	wetland	on ground,pond edge	Memo
19	Bufo americanus	07/14/85	10:00	1	up hard	forest floor	Memo
27	Bufo americanus	07/15/85	17:00	1	hem hard	forest floor	Memo
29	Bufo americanus	07/16/85	09:20	1	lawn	in garden	Memo
61	Bufo americanus	09/19/85	16:45	1	north hard hem	hopping on surface	Memo
120	Bufo americanus	05/15/86	11:00	1	wetland	on surface	Memo
141	Bufo americanus	05/22/86	12:15	1	mix con		Memo
160	Bufo americanus	05/25/86	16:00	1	wetland	calling	Memo
167	Bufo americanus	05/26/86	14:20	1	wetland	grass clump	Memo
180	Bufo americanus	05/27/86	15:50	1	wetland	grassy clump	Memo
187	Bufo americanus	05/29/86	09:00	1	wetland		Memo
188	Bufo americanus	05/29/86	20:45	4	wetland	Turtle pond, calling	Memo
194	Bufo americanus	05/30/86	08:30	2	north hard hem	surface	Memo
197	Bufo americanus	05/30/86	10:00	1	south hard	surface	Memo
200	Bufo americanus	05/30/86	14:00	1	wetland	surface	Memo
221	Bufo americanus	07/27/86	08:30	1	wetland	collected	Memo
231	Bufo americanus	07/29/86	20:30	1	lawn	surface	Memo

```
. list for species ="Hyla crucifer"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
3	Hyla crucifer	07/11/85	17:40	1	up hard	forest floor	Memo
7	Hyla crucifer	07/11/85	16:55	1	hem hard	forest floor	Memo
20	Hyla crucifer	07/14/85	10:00	4	up hard	forest floor	Memo
36	Hyla crucifer	09/14/85	11:20	1	north hard hem		Memo
41	Hyla crucifer	09/16/85	12:00	1	up hard		Memo
42	Hyla crucifer	09/16/85	19:00	1	hem hard		Memo
43	Hyla crucifer	09/16/85	19:15	1	mix con		Memo
49	Hyla crucifer	09/17/85	15:20	1	field	grass clump	Memo
52	Hyla crucifer	09/17/85	16:00	1	up hard	forest floor	Memo
53	Hyla crucifer	09/18/85	15:00	1	field	in grass	Memo
59	Hyla crucifer	09/19/85	17:00	3	north hard hem		Memo
65	Hyla crucifer	09/19/85	12:00	4	wetland		Memo
67	Hyla crucifer	04/01/86	15:30	1	south hard	calling from forest	Memo
68	Hyla crucifer	04/01/86	15:10	1	north hard hem	calling from forest	Memo
69	Hyla crucifer	04/01/86	15:40	1	wetland	calling	Memo
72	Hyla crucifer	04/01/86	19:00	100	wetland	guestimate, calling	Memo
77	Hyla crucifer	04/17/86	15:00	900	wetland	guestimate, calling	Memo
129	Hyla crucifer	05/15/86	22:00	500	wetland	guestimate, calling	Memo
144	Hyla crucifer	05/22/86	17:50	200	wetland	pond C, calling	Memo
164	Hyla crucifer	05/25/86	22:00	300	wetland	guestimate,calling	Memo
190	Hyla crucifer	05/29/86	20:45	0	wetland	no count,calling	Memo
191	Hyla crucifer	05/30/86	08:30	1	north hard hem	surface	Memo
196	Hyla crucifer	05/30/86	10:00	1	south hard	surface	Memo
213	Hyla crucifer	07/26/86	11:15	10	wetland	pond B	Memo
258	Hyla crucifer	09/18/86	08:46	1	mix con	surface	Memo

```
. list for species ="Hyla versicolor"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
132	Hyla versicolor	05/15/86	17:00	1	wetland	calling from tree	Memo
136	Hyla versicolor	05/17/86	12:30	2	wetland	calling from veg.	Memo
145	Hyla versicolor	05/22/86	21:15	17	wetland	pond C	Memo
155	Hyla versicolor	05/25/86	20:45	2	pond in Atrium	calling males	Memo
163	Hyla versicolor	05/25/86	21:00	32	wetland	pond C,Turtle Pond	Memo
175	Hyla versicolor	05/27/86	20:45	2	pond in Atrium		Memo
178	Hyla versicolor	05/27/86	16:00	1	wetland	tree near mill	Memo
185	Hyla versicolor	05/29/86	21:00	2	pond in Atrium	calling	Memo
189	Hyla versicolor	05/29/86	20:45	0	wetland	calling, no count	Memo
216	Hyla versicolor	07/27/86	11:30	1	south hard	calling from tree	Memo
226	Hyla versicolor	07/28/86	09:00	1	north hard hem	calling from tree	Memo

```
. list for species = "Rana sylvatica"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
10	Rana sylvatica	07/11/85	16:00	1	field	grass clump	Memo
21	Rana sylvatica	07/14/85	19:45	2	north hard hem	forest floor	Memo
22	Rana sylvatica	07/14/85	19:00	1	mix con	under board at edge	Memo
23	Rana sylvatica	07/14/85	11:30	1	field	in grass	Memo
73	Rana sylvatica	04/01/86	17:00	3	wetland	pond C	Memo
74	Rana sylvatica	04/01/86	20:45	2	up hard	puddle	Memo
85	Rana sylvatica	04/18/86	14:00	72	wetland	egg masses	Memo
98	Rana sylvatica	04/19/86	10:00	1	wetland	pond C,eggs hatch	Memo
107	Rana sylvatica	04/20/86	10:30	1	wetland	pond H	Memo
192	Rana sylvatica	05/30/86	08:30	1	north hard hem	surface	Memo
195	Rana sylvatica	05/30/86	10:00	1	south hard	surface	Memo
210	Rana sylvatica	07/26/86	14:00	1	south hard	surface	Memo
218	Rana sylvatica	07/27/86	09:15	1	north hard hem	surface	Memo
233	Rana sylvatica	07/29/86	07:55	1	north hard hem	surface	Memo
240	Rana sylvatica	07/31/86	08:15	1	north hard hem	surface	Memo
243	Rana sylvatica	08/02/86	09:00	1	hem hard	surface	Memo
244	Rana sylvatica	08/04/86	14:30	1	mix con	surface	Memo

```
. list for species = "Rana palustris"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
51	Rana palustris	09/17/85	14:00	1	hem hard	forest floor	Memo
135	Rana palustris	05/17/86	12:45	1	wetland	bank of BMD Brook	Memo
199	Rana palustris	05/30/86	14:00	1	wetland	surface	Memo

```
. list for species = "Rana clamitans"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
4	Rana clamitans	07/11/85	21:30	10	wetland	pond edge	Memo
14	Rana clamitans	07/12/85	09:40	1	wetland	within vegetation	Memo
18	Rana clamitans	07/12/85	21:30	20	wetland	pond edges	Memo
44	Rana clamitans	09/16/85	12:00	1	wetland	mudflat	Memo
54	Rana clamitans	09/18/85	12:00	1	hem hard	in stream	Memo
60	Rana clamitans	09/19/85	17:15	1	BMU Brook		Memo
64	Rana clamitans	09/19/85	12:00	6	wetland	water lily marsh	Memo
89	Rana clamitans	04/18/86	15:00	4	wetland	ponds C,E,I	Memo
133	Rana clamitans	05/15/86	21:00	1	wetland	pond c	Memo
161	Rana clamitans	05/25/86	10:00	1	wetland	calling	Memo
170	Rana clamitans	05/26/86	10:00	6	wetland	pond c	Memo
179	Rana clamitans	05/27/86	12:10	1	wetland	brook below dam	Memo
215	Rana clamitans	07/26/86	11:15	28	wetland	pond B,estimated #	Memo
239	Rana clamitans	07/31/86	17:00	1	lawn	by Aspet	Memo
257	Rana clamitans	08/16/86	15:30	1	BMU Brook		Memo

```
. list for species = "Rana catesbiana"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
5	Rana catesbiana	07/11/85	21:30	4	wetland	pond edge	Memo
17	Rana catesbiana	07/12/85	21:30	3	wetland	pond edge	Memo
134	Rana catesbiana	05/15/86	13:00	1	wetland	pond I	Memo
162	Rana catesbiana	05/25/86	15:00	1	wetland	calling	Memo
214	Rana catesbiana	07/26/86	11:15	2	wetland	pond B	Memo
259	Rana catesbiana	08/15/86	21:00	1	wetland	pond B	Memo
268	Rana catesbiana	05/28/86	14:00	1	BMD Brook	basking on bank	Memo

```
. list for species = \"Chelydra serpentina"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
30	Chelydra serpentina	07/16/85	10:15	1	BMD pond		Memo
79	Chelydra serpentina	04/17/86	15:30	1	wetland	pond C	Memo
82	Chelydra serpentina	04/18/86	14:00	1	wetland	pond I	Memo
83	Chelydra serpentina	04/17/86	14:30	1	wetland	pond C	Memo
97	Chelydra serpentina	04/19/86	11:30	2	wetland	"turtle pond"	Memo
250	Chelydra serpentina	05/26/86	14:00	1	BMD Pond	basking at surface	Memo
251	Chelydra serpentina	05/30/86	11:00	1	BMD Pond	basking at surface	Memo
252	Chelydra serpentina	05/29/86	13:00	1	BMD Pond	in trap, marked	Memo
269	Chelydra serpentina	05/28/86	13:20	1	BMD Brook	dead on bank	Memo

```
. list fvoor species = "Clemmys insculpta"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
101	Clemmys insculpta	04/20/86	16:00	1	BMD Brook	stream bed	Memo
150	Clemmys insculpta	05/23/86	14:15	1	BMD Brook	basking on bank	Memo

```
. list for species = "Chrysemys picta"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
95	Chrysemys picta	04/19/86	11:00	19	wetland	"turtle pond"	Memo
114	Chrysemys picta	05/14/86	09:30	7	wetland	"turtle pond"	Memo
137	Chrysemys picta	05/17/86	11:45	1	wetland	pond C	Memo
253	Chrysemys picta	05/25/86	13:30	1	BMD Pond	weedy shallows	Memo
255	Chrysemys picta	09/13/86	14:00	1	wetland	turtle pond, trap	Memo

```
. list for species = "Thamnophis sirtalis"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
37	Thamnophis sirtalis	09/14/85	11:30	1	lawn	near hem/hard ravine	Memo
70	Thamnophis sirtalis	04/01/86	16:00	1	hem hard	basking in sun	Memo
122	Thamnophis sirtalis	05/15/86	15:45	1	hem hard	under board	Memo
154	Thamnophis sirtalis	05/25/86	08:15	2	lawn	plastic sheet	Memo
165	Thamnophis sirtalis	05/26/86	10:30	1	lawn	plastic sheet	Memo
172	Thamnophis sirtalis	05/26/86	14:00	1	wetland	surface, grassy	Memo
198	Thamnophis sirtalis	05/30/86	10:55	1	lawn	under plastic sheet	Memo
203	Thamnophis sirtalis	06/30/86	13:00	1	lawn		Memo
204	Thamnophis sirtalis	07/08/86	14:00	1	lawn		Memo
249	Thamnophis sirtalis	08/02/86	16:00	1	wetland	under board	Memo
270	Thamnophis sirtalis	08/16/86	15:00	1	Lawn	visitor hysterical!q	Memo

```
. list for species = "Parascalops breweri"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
46	Parascalops breweri	09/17/85	11:45	1	lawn	found dead	Memo
207	Parascalops breweri	06/13/86	12:00	1	lawn	collected, dead	Memo
248	Parascalops breweri	08/14/86	15:00	1	lawn	found dead	Memo

```
. list for species = "Condylura cristata"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
208	Condylura cristata	05/25/86	17:15	1	wetland	see memo.	Memo

```
. list for species = "Eptesicus fuscus"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
241	Eptesicus fuscus	08/01/86	12:30	1	Atrium	behind picture	Memo
242	Eptesicus fuscus	09/13/85	11:00	1	Atrium	behind picture	Memo

```
. list for species = "Tamias  striatus"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
130	Tamias striatus	05/15/86	19:30		lawn	under foundations	Memo
138	Tamias striatus	05/22/86	14:00	1	lawn		Memo
139	Tamias striatus	05/22/86	14:15	1	hem hard		Memo
140	Tamias striatus	05/22/86	15:00	1	up hard		Memo
153	Tamias striatus	05/25/86	13:00	1	up hard		Memo
156	Tamias striatus	05/25/86	13:00	1	lawn	burrow by admin bldg	Memo
158	Tamias striatus	05/25/85	08:45	1	hem hard		Memo
159	Tamias striatus	05/25/86	15:30	1	hem hard		Memo
177	Tamias striatus	05/27/86	14:00	2	up hard		Memo
186	Tamias striatus	05/29/86	18:50	1	up hard		Memo
254	Tamias striatus	05/23/86	09:00	1	hem hard		Memo
256	Tamias striatus	05/27/86	09:30	1	wetland		Memo
260	Tamias striatus	05/24/86	10:30	1	wetland		Memo
261	Tamias striatus	05/16/86	09:00	1	mix con		Memo

```
. list for species = "Marmota monax"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
15	Marmota monax	07/12/85	19:15	1	lawn		Memo

```
. list for species =  "Sciurus carolinensis"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
171	Sciurus carolinensis	05/26/86	14:00	1	up hard	scolding from tree	Memo
184	Sciurus carolinensis	05/28/86	18:15	1	up hard		Memo
211	Sciurus carolinensis	07/26/86	14:15	1	south hard		Memo
238	Sciurus carolinensis	07/30/86	07:50	1	up hard		Memo
245	Sciurus carolinensis	08/04/86	15:15	0	mix con		Memo
262	Sciurus carolinensis	05/25/86	09:50	1	mix con		Memo
264	Sciurus carolinensis	05/29/86	10:20	1	north hard hem		Memo

```
. list for species =  "Tamiasciurus hudsionicus"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
131	Tamiasciurus hudsonicus	05/15/86	20:15	1	up hard	pine tree	Memo
157	Tamiasciurus hudsonicus	05/25/86	08:15	1	mix con		Memo
166	Tamiasciurus hudsonicus	05/26/86	10:30	1	mix con	scolding from tree	Memo
209	Tamiasciurus hudsonicus	07/25/86	16:00	1	mix con		Memo
219	Tamiasciurus hudsonicus	07/27/86	09:00	1	up hard		Memo
263	Tamiasciurus hudsonicus	05/28/86	08:00	1	hem hard		Memo

```
. list for species = "Ondatra zibethica"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
11	Ondatra zibethica	07/12/85	09:00	2	wetland	cattails	Memo
26	Ondatra zibethica	07/15/85	17:30	3	wetland	lily pond	Memo
92	Ondatra zibethica	04/19/86	14:00	2	BMD Brook		Memo
93	Ondatra zibethica	04/19/86	18:00	1	BMD Pond		Memo
102	Ondatra zibethica	04/20/86	15:30	1	wetland	"turtle pond"	Memo
116	Ondatra zibethica	05/14/86	10:00	1	BMD Brook		Memo
169	Ondatra zibethica	05/26/86	10:00	1	BMD Brook		Memo

```
. list for species = "Castor canadensis"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
13	Castor canadensis	07/12/85	09:30	1	BMD Pond		Memo
32	Castor canadensis	09/12/85	18:30	1	BMD Pond		Memo
40	Castor canadensis	09/14/85	13:50	0	wetland		Memo
103	Castor canadensis	04/20/86	14:00	2	BMD Pond		Memo
124	Castor canadensis	05/15/86	16:00	1	BMD Pond		Memo
174	Castor canadensis	05/26/86	14:15	1	BMD Pond		Memo
181	Castor canadensis	05/27/86	16:00	1	BMD Pond		Memo
182	Castor canadensis	05/27/86	20:30	1	BMD Pond		Memo
222	Castor canadensis	07/27/86	18:00	1	BMD Pond		Memo

```
. list for species =          Erethizon dorsatum"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
202	Erethizon dorsatum	07/03/86	11:00	1	up hard		Memo
205	Erethizon dorsatum	06/27/86	08:00	1	road	DOR near BMD Pond	Memo

```
. list for species = "Procyon lotor"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
31	Procyon lotor	09/12/85	18:45	1	wetland	crossing beaver dam	Memo
168	Procyon lotor	05/26/86	13:45	0	wetland	tracks along stream	Memo

```
. list for species = "Mephitis mephitis"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
94	Mephitis mephitis	04/19/86	19:00	2	road		Memo

```
. list for species = "Lutra canadensis"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
220	Lutra canadensis	07/27/86	16:30	3	BMD Pond		Memo

```
. list for species = "Odocoileus virginianus"
```

Record#	SPECIES	DATE	TIME	NUMBER	HABITAT	COMMENTS	DETAILS
91	Odocoileus virginianus	04/18/86	10:00	0	up hard	pellets	Memo
104	Odocoileus virginianus	04/20/86	16:00	3	wetland		Memo
111	Odocoileus virginianus	05/14/86	12:00	0	hem hard	pellets	Memo
112	Odocoileus virginianus	05/14/86	13:00	0	up hard	pellets	Memo
113	Odocoileus virginianus	05/20/86	13:30	0	wetland	pellets	Memo
147	Odocoileus virginianus	05/23/86	09:50	0	mix con	pellets	Memo
151	Odocoileus virginianus	09/18/85	12:00	2	field		Memo
201	Odocoileus virginianus	07/23/86	10:00	2	up hard	doe & fawn	Memo
228	Odocoileus virginianus	07/28/86	07:45	0	wetland	tracks throughout	Memo
234	Odocoileus virginianus	07/29/86	07:40	2	up hard		Memo

APPENDIX C

VERTEBRATE FAUNA INVENTORY OF SAINT-GAUDENS NATIONAL HISTORIC SITE

WORKPLAN

Robert P. Cook
Natural Resources Management Specialist Trainee
North Atlantic Region
October 1, 1986

TABLE OF CONTENTS

INTRODUCTION

Saint-Gaudens National Historic Site consists of 150 acres located in Cornish New Hampshire. Established in 1977 to preserve the properties of sculptor Augustus Saint-Gaudens, it is a mix of historic site and diverse natural habitats. Though established primarily for historic purposes, there is considerable appreciation for, and activities based around, the site's natural resources, particularly wildlife.

Cronan (1981) conducted a natural resources inventory of this site in 1980, covering vegetation, aquatic resources, geology, and fauna. Comprehensiveness of this work varies, and an examination of the faunal sections show some are based on anecdotal observations or meager sampling. One familiar with the region's fauna is left with the impression that many additional species are probably part of the park's fauna. This impression is furthered upon reviewing the relevant monographs on such taxonomic classes as fish (Bailey and Oliver 1939, Carpenter and Siegler 1947, Scarola 1973, Werner 1980), amphibians and reptiles (Oliver and Bailey 1939, Conant 1975, Smith 1978, Smith and Brodie 1982, DeGraaf and Rudis 1983), and mammals (Carpenter and Siegler 1955, Burt and Grossenheider 1964, Godin 1977, Hamilton and Whitaker 1979). While not expecting all New Hampshire-occurring members of these classes to occur at SAGA (Saint-Gaudens NHS), it appears certain that with further effort and a diversity of inventory techniques, a more complete knowledge of its fauna will be obtained. The primary purpose of this inventory therefore, will be to determine which species of non-avian vertebrates occur at SAGA and, as feasible, assess their relative abundance and habitat relationships.

MATERIALS AND METHODS

General- Considering the large number of species potentially present, and the diversity of habitats, life modes, and activity patterns, there is no single method or time of year adequate to assess all species. Specialized techniques for each class, and often for a particular species, will be necessary.

Before proceeding to specifics, further generalization is necessary and should be borne in mind throughout. Since the primary objective is to determine which species are present, all methodology will be biased towards "finding" or capturing the target species rather than following systematic or random sampling techniques. The information generated by these techniques will mostly be of a qualitative nature (eg. relative abundance) or expressed as an index (catch/unit effort). Finally, many of the techniques to be employed do not necessarily provide the most unbiased and statistically oriented data. Constraints of time, money, and personnel prevent the application of state of the art methodology to all the faunal groups expected. What emerges then is a plan that, based on personal experience, literature, and personal communications, balances these con-

straints to provide the most information on the non-avian fauna of SAGA possible.

Fish- Fish occur throughout the open waters and marshes of Blow-Me-Down Pond, Blow-Me-Down Brook, and Blow-Me-Up Brook. In order to account for the different habitats within these aquatic systems, as well as behavioral and size differences in the fish present, a number of passive capture techniques will be employed. These have been found to be fairly simple, easy to operate, and yield fairly precise data on relative abundance (Hubert 1983).

Ten standard minnow traps (Gee's minnow trap) baited with stale bread and sardines will be placed in the pond and pools within the brook for a minimum of five days (50 trap nights) in May 1986 and checked/rebaited daily. Additional sites may be added as time and experience allow. Similiarly, 10 larger funnel traps (3ft. long x 1.5 ft. dia.) will be set along the shoreline of the pond and Blow-Me-Down Brook for a week in September 1985 and June 1986 (140 trap nights). Though set primarily for aquatic turtles, these traps also sample medium to large fish. Finally, two 6 ft. x 30 yd. sampling gill nets, each consisting of equal sections of 0.5", 1", and 2" square mesh, will be set in the deeper, open waters of the pond. A minimum of five days will be spent gill netting in May 1986. As Hubert (1983) mentions, use of gill nets can result in the death of those fish caught. Personal experience in the nearby Connecticut River has shown that gill nets set overnight did not cause mortality. However, in gill netting on the pond, nets will be checked at two hour intervals until experience there dictates a safe and effective duration of set.

Amphibians- Amphibian inventory will rely mostly on search, observation and vocalizations. In July/September 1985 and April/May 1986, the brooks, ravines, and woodlands will be actively searched. Search will consist of rolling or overturning logs, rocks, or other potential cover. All animals observed and their location will be recorded on a topo map blow-up. Since many species are most active on rainy spring nights when they congregate for breeding (eg. Ambystoma sp.), night searches in April/May 1986 will concentrate on permanent and vernal water bodies. Where possible, counts of breeding aggregations will be made and vocalizations used to confirm species identification of certain anurans present (ie. Bufo sp.) Additional information on amphibians is expected from road kills following rainy nights and through the capture of aquatic species in funnel traps set primarily for fish and turtles.

Reptiles- The reptiles occurring at SAGA are either snakes or turtles, and since no terrestrial turtles are expected in this area, turtle inventory will consist of aquatic funnel traps. Each trap is 3 ft. long x 1.5 ft. diameter, and constructed of 0.5"

mesh, galvanized hardware cloth. Ten traps will be set along the shoreline of Blow-Me-Down Pond and Brook, generally in quiet waters or near aquatic vegetation (U.S. Bureau of Sport Fisheries 1962) and baited with sardines packed in oil (Klemens 1978). Trapping will occur for one week in September 1985 and another in June 1986 (total 140 trap nights). Captures will be marked for individual recognition by scute marking (Woodbury 1956) and released at point of capture.

Although snakes can be captured and inventoried with drift fences and funnel traps (Fitch 1951,1963) this approach is too involved and visually obtrusive. Instead, active search, road kills, and the use of "snake boards" (pieces of plywood set out in grass or forbs along a woody edge) will be used. Twelve boards will be placed throughout the site and each will be checked a minimum of 30 times during the course of this project. Appropriate rocks and other cover will also be checked. Snakes captured will be scale clipped for individual recognition and count purposes (Blanchard and Finster 1933).

Mammals- Of all the taxa to be inventoried, the mammals of SAGA possess the greatest species richness and consequently the greatest range in body size, home range, and "habits". Different techniques such as direct observation, presence of sign, and trapping will be used to determine their occurrence and habitat affinities. Large and/or readily observed forms will be de-emphasised due to the great effort and/or lesser value of data on these species(eg. white-tailed deer are known to occur here and their sign are readily observed. The effort required to capture and mark deer would not be justified, particularly when it would mean diverting efforts to inventory the smaller, more secretive species). Thus most effort will be placed on the live and snap trapping of small and medium-sized species.

Small mammal trapping can be a complex proposition and much has been written in this regard. Stickel (1948) states that the large area live-trap quadrat method gives reliable data on the actual number of animals in an area, but is too time consuming for sampling a number of habitats in a given season. Live-trap grids in conjunction with pitfalls set along an aluminum fence was used by Briese and Smith (1974) to study home range and migration patterns, finding that pitfalls caught more species than live traps. Williams and Braun (1983) compared trapping methods, catching the greatest number of individuals with pitfalls, snap-traps, and live-traps respectively. However this relationship was not manifested for all species, demonstrating that different techniques work best for different species.

Another important consideration in selection of trapping technique is objective; the present one being to determine occurrence, relative abundance, and habitat affinities. Hahn and Michael (1980) used snap-traps to determine presence and abund-

ance of small mammals, as did Connors (1953,1971) to determine habitat preferences.

Geir and Best (1980) state that populations of several small mammal species (some which may occur at SAGA) could not be estimated from live-trap data due to their low susceptibility to or complete avoidance of live-traps. This may well explain why Nothnagle and DesMueles(1980), using live-traps, did not record the presence of any Insectivora or Microtus at SAGA, despite their probable occurrence (Hamilton and Whitaker 1979). The results of Briese and Smith (1974) also suggest that live-traps are not effective at capturing moles and shrews. Thus, for reasons of economy, ease of setting, and effectiveness, snap traps will be used for small mammal inventory. Pitfalls were ruled out due to the labor intensiveness of their placement (particularly in an area with steep,rocky terrain) and the undesirability of having holes throughout the site.

Small mammal trapping will take place in seven different habitats described by Cronan and DesMueles(1981) or since created. In selecting these sites every efforet was made, for comparison purposes, to trap in the same or similiar habitats as trapped by Nothnagle and DesMueles(1981). However, recent habitat changes and some discrepencies in habitat nomenclature between Cronan and DesMueles(1981) and Nothnagle and DesMueles(1981) make it impossible to achieve complete correspondence between my trapping sites and those of Nothnagle and DesMueles(1981). Habitats to be snap-trapped are as follows;

A - Mixed Conifer
B - Tall Grass Meadow, formerly Successional Pine/Hardwood until cleared in 1984 and planted to meadow.
C - Hemlock/Hardwood Ravine
D - Riparian plus Marsh and Shrub Wetland
E - South Facing Hardwood
F - Upland Hardwood
G - North-facing Hardwood/Hemlock.

Within each habitat a line of 50 snap-traps will be set, generally in the center and on the habitat's long axis. Traps will be spaced approximately five meters apart, but specific placement of traps will be subjective. After pacing the five meter distance, runways, tunnels, holes, logs, etc. will be taken advantage of to place the trap where it appears most likely to capture something. This method will result in the greatest number of captures and increase the likelihood of recording all those species present (Paul Connors, pers. comm.) Each trap line will be run for three consecutive nights in May 1986 (total 150 trap nights/habitat). All seven lines cannot be run simultaneously but will be staggered in the course of one week. Traps will be baited with a mix of peanut butter and oatmeal (Knudsen 1966).

Medium-sized mammals will be trapped using two sizes of live-traps (Tomahawk #203 and #207). Twelve traps of each size will be set in each habitat for three consecutive nights (total 36 trap nights/habitat/trap size). Traps will be spaced approximately every 50 meters and will be set where prospects of capture seem best. Due to the cost of traps and time required to set, all habitats cannot be trapped simultaneously. Instead they will be done two at a time over the course of a nine day period in May 1986. Bait will be the peanut butter-oatmeal mixture plus sardines or bloody meat to attract carnivores such as weasels (Knudsen 1966). Color dyes will be used as short term markers(Day et. al.1980) to determine the number of individuals captured and possibly document movement between habitats.

Voucher Specimens- This inventory will be conducted under permit from the New Hampshire Fish and Game Department and may preserve up to two specimens of each species as voucher specimens. Preservation techniques for the different taxa are presented in Knudsen(1966), Pisani(1973), and Wobeser et. al.(1980). Some discretion, however, must be exercised and factors such as specimen size, ease or difficulty of species identification, rarity or endangered status of species, existence of museum records for species, etc. must be weighed.

Identification of specimens will be accomplished through the keys provided in the monographs cited in the introduction and, where doubt exists, staff and materials at the University of New Hampshire or the American Museum of Natural History will be referred to. All voucher specimens will be catalogued using NPS Form 10-254B (Museum Catalog Record-NH) and catalog numbers assigned from the SAGA museum catalog. Specimens will ultimately be placed in the collection of a major museum in order to provide the most usefulness to the scientific community.

TIME TABLE

Work described in this time table will be done by one individual and number of work days to accomplish primary tasks are estimated. Due to weather factors and other exigencies (FY 86 training courses) scheduling of activities can be no more specific than month.

Time period	#work days	Primary Activity
July 85	10	planning, procurement, logistics begin amphibian survey
Sept 85	14	library work, planning, procurement, amphibian & snake survey, turtle & fish trapping
Nov 85	5	procurement, library work, examine reference collections

April 86	7	breeding amphibian surveys
May 86	14	mammal trapping, snake survey, gill netting
June 86	14	fish survey (minnow traps, large funnel traps), turtle trapping, snake survey, specimen ID.
July 86	5	specimen cataloging, results analysis
August 86	14	results analysis, prepare report

BUDGET

		FY85		FY86
Salary and Benefits (GS7/1) (provided by WASO)	24 days	1820.00	59 days	4473.97

Administrative Overhead — provided by NARO and SAGA

all other expenses charged against acct. 1662-0001-189

	FY85	FY86
Travel and per diem	406.95	1000.00
Photographic services	14.00	150.00
Reference literature	63.57	125.00
Capital Equipment		
rowboat and accessories		500.00
dissecting microscope		400.00
portable freezer		500.00
Non-capital equipment and supplies		
waders	63.25	
mammal live traps	1385.20	
aquatic hand nets	53.40	
large funnel traps	121.47	
minnow traps	60.00	
gill nets	159.82	
snap traps	149.59	
miscellaneous tools	108.22	60.00
preservative chemicals	49.02	115.00
jars/dissecting equipment	112.19	70.00
baits	79.98	

flashlights	95.00	40.00
rain suit	45.98	
Total	2967.64	3000.00

PROJECTED PRODUCT

Finished product will be a report on the non-avian fauna of SAGA consisting of a general discussion of the land and vegetation, and annotated accounts of all species found there. Information on relative abundance, habitat affinities, and other site specific observations will be included. Detailed description of methods and quantitative data will be presented in appendices. With this format, the information generated will be useful for staff interpretive purposes as well as providing technical baseline information.

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