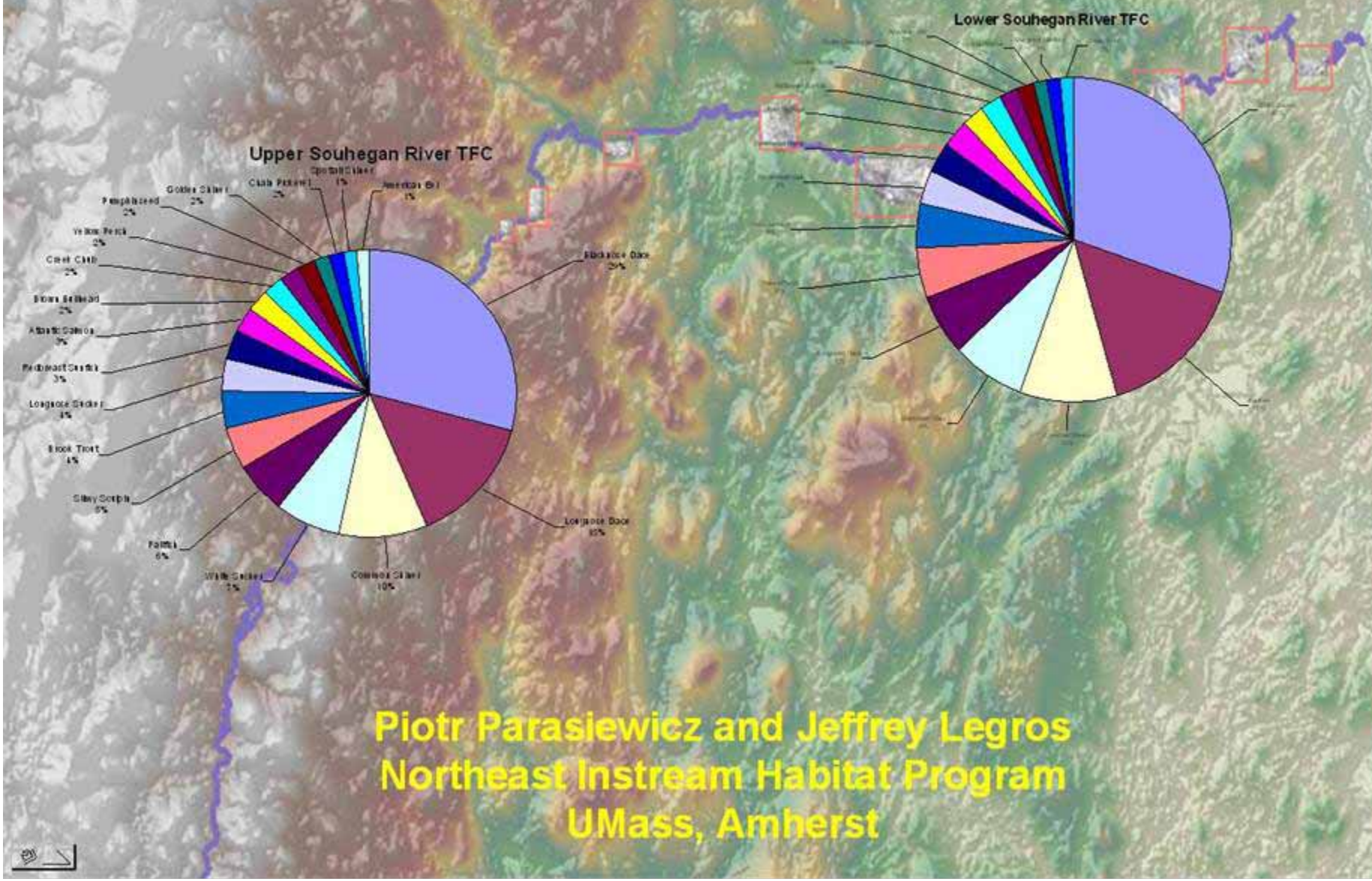
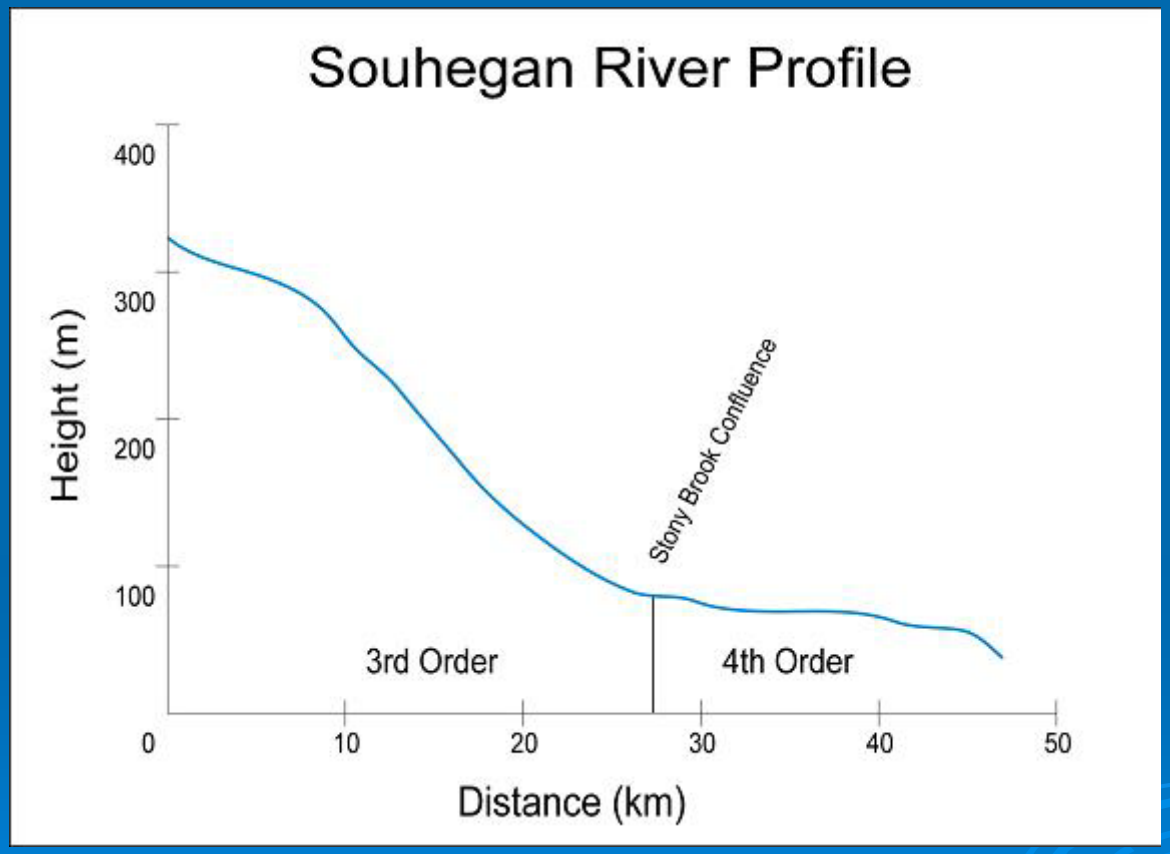
Target Fish Community Development for the Upper and Lower Souhegan River, New Hampshire

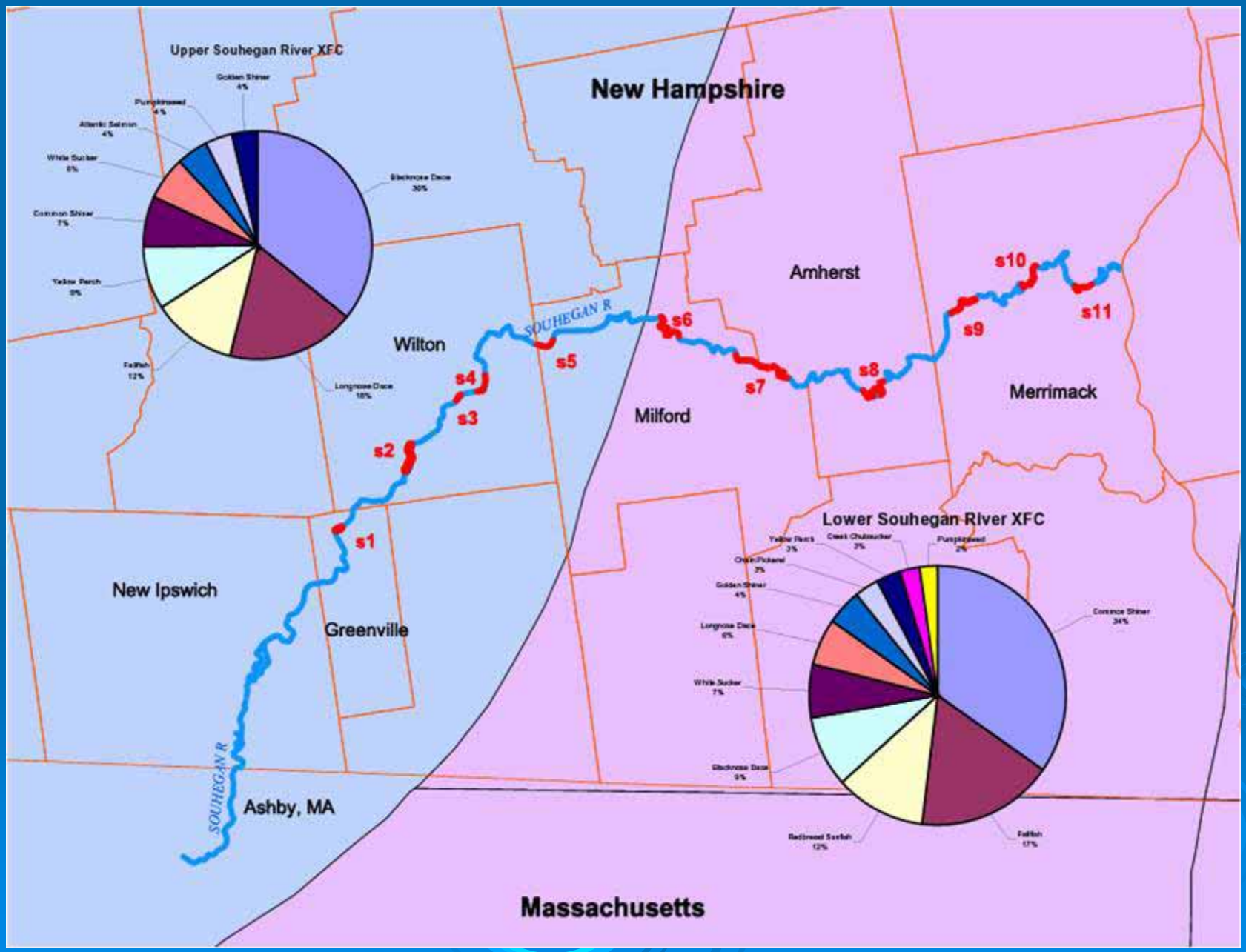


Piotr Parasiewicz and Jeffrey Legros
Northeast Instream Habitat Program
UMass, Amherst

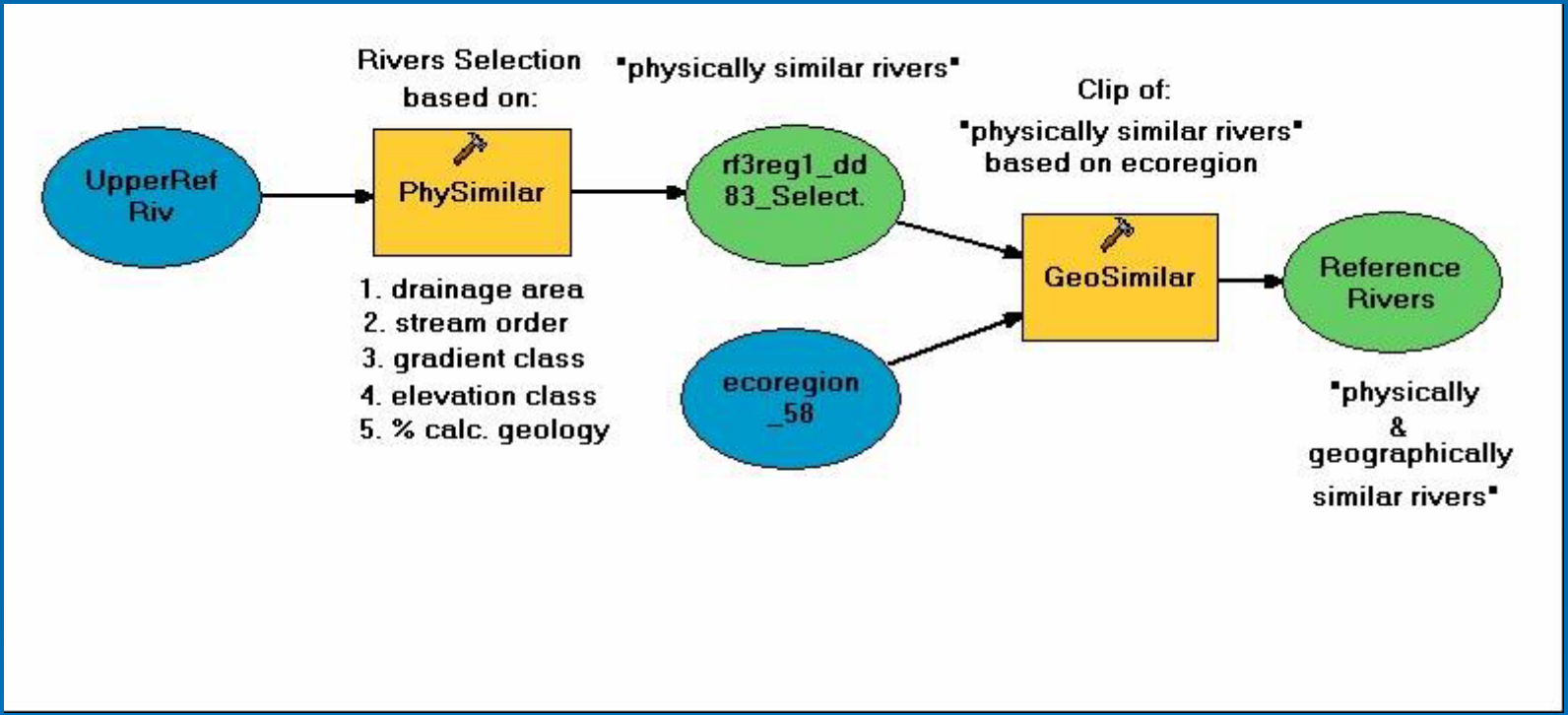
Graphic Illustrating gradient and stream order change between upper and lower Souhegan River



Souhegan River: ecoregions, sites and existing Fish Community



Schematic of Reference River Selection Model



Parameters used to select similar streams

Lower Souhegan River

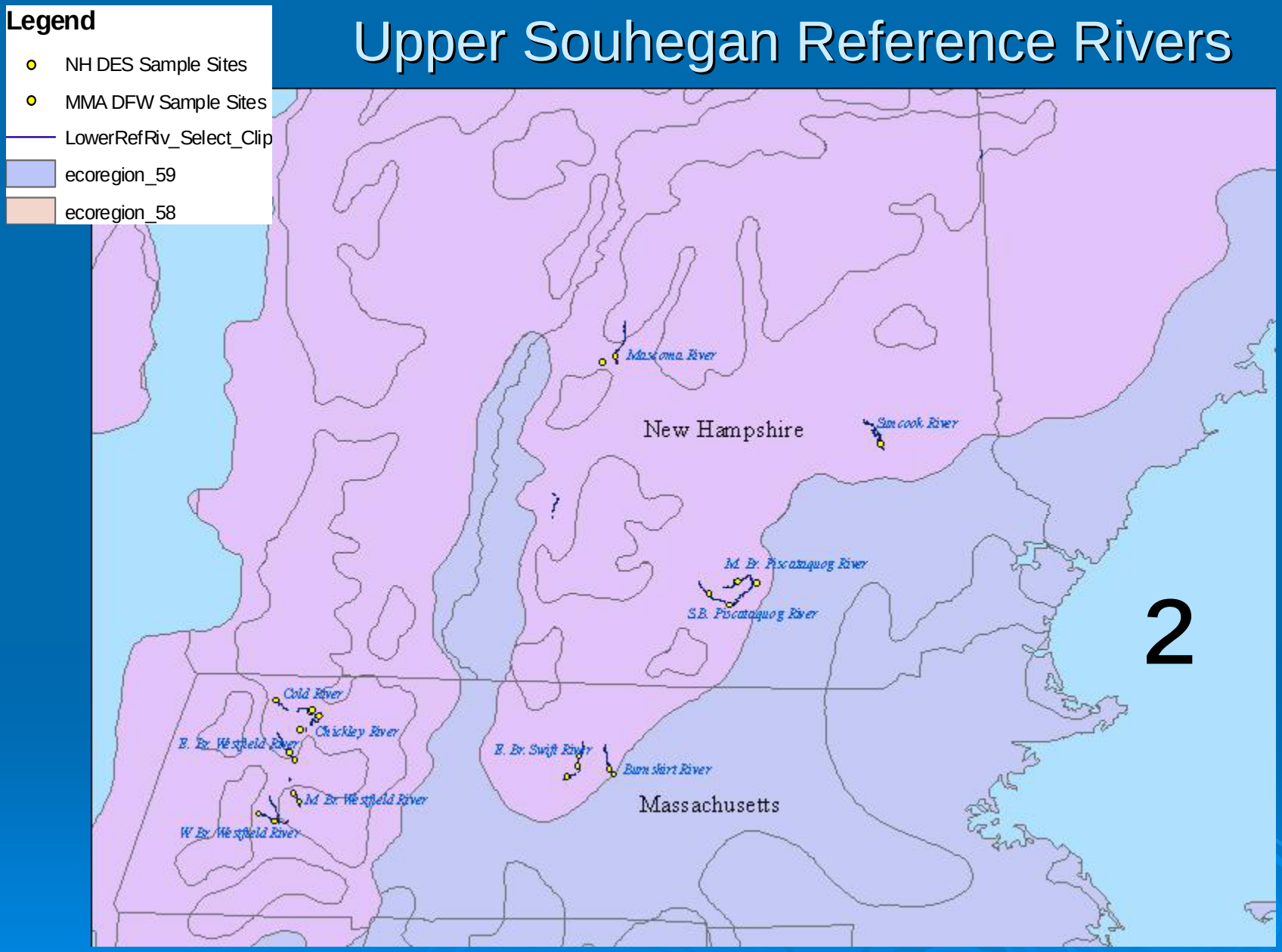
Physical Attribute	Selection Parameters
Drainage Area	80-171 sq. miles
Stream Order	4
Gradient Class*	1
Elevation Class**	1
% Calcareous Geology	0
Level III Ecoregion	59

Upper Souhegan River

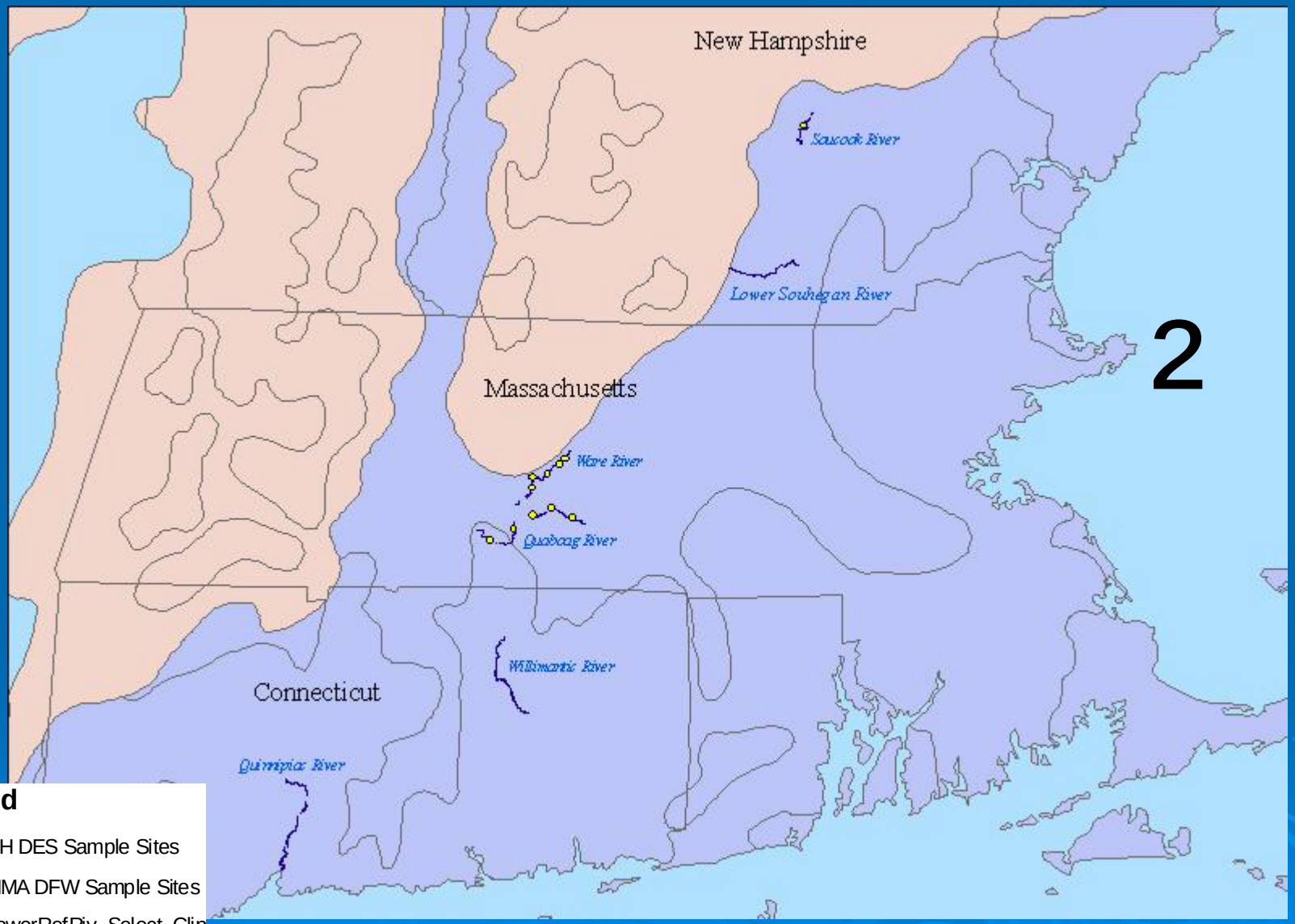
Physical Attribute	Selection Parameters
Drainage Area	7-80 sq. miles
Stream Order	2-3
Gradient Class	1-2
Elevation Class	1-2
% Calcareous Geology	0
Level III Ecoregion	58

*Gradient Classes: 1 = 0-0.5%, 2 = 0.5-2%, 3 = 2-4%, 4 = 4-10%, 5 = >10%
**Elevation Classes: 1 = 0-800ft., 2 = 800-1700ft., 3 = 1700-2500ft., 4 = 2500ft.+

Upper Souhegan Reference Rivers



Lower Souhegan Reference Rivers

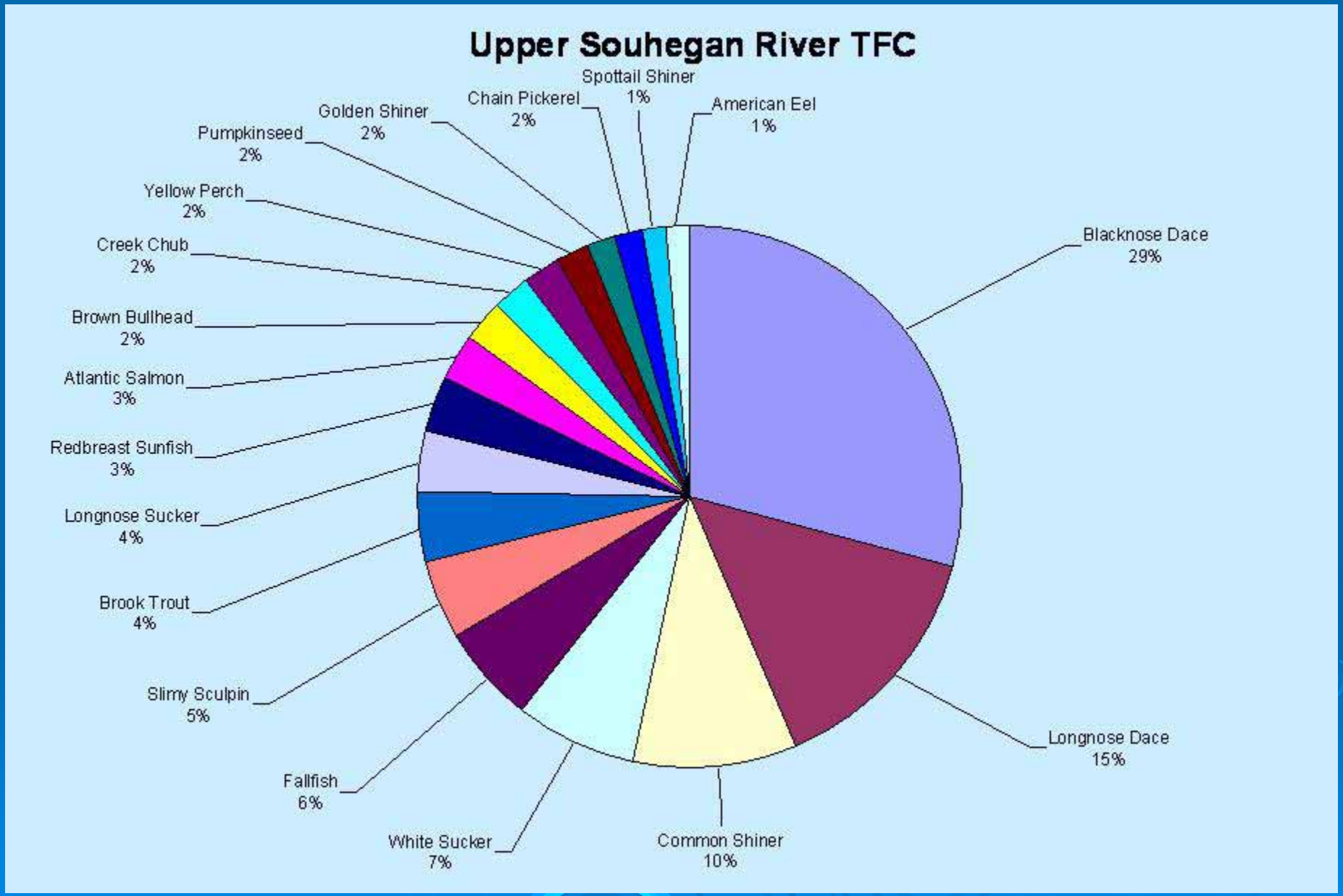


Legend

- NH DES Sample Sites
- MMA DFW Sample Sites
- LowerRefRiv_Select_Clip
- ecoregion_59
- ecoregion_58

Upper Souhegan TFC Data by Reference River

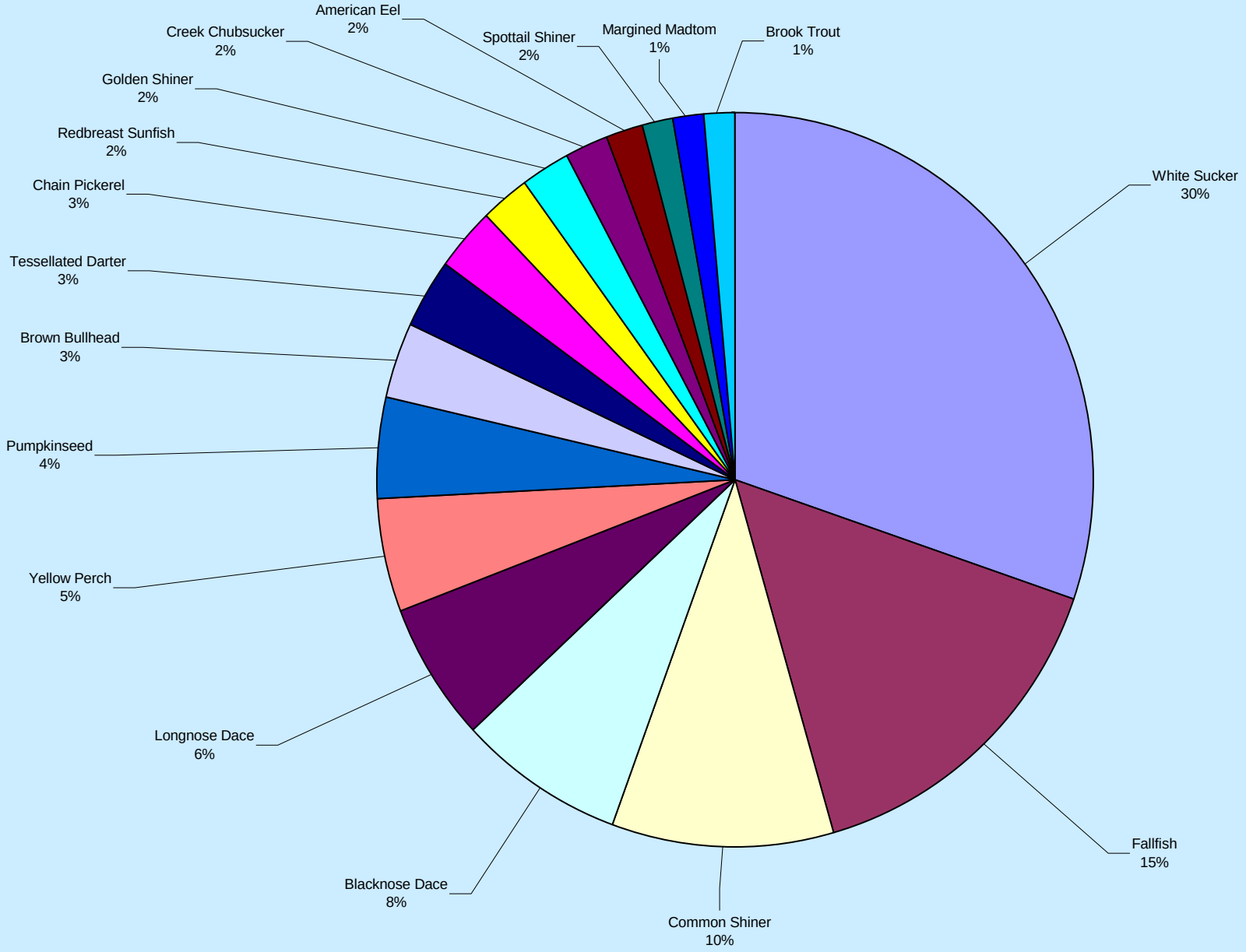
Common Name	Species Name	Burnshirt River	Chickley River	Cold River	Mascoma River	Piscataquog River, MB	Piscataquog River, S.B.	Suncook River	Swift River, E.B.	Westfield River, E.B.	Westfield River, MB.	Westfield River, WB.	Mean Rank	Expected Proportion
Blacknose Dace	*Rhinichthys atratulus*	4	54	159	24	89	138	4	85	111	105	95	1	29%
Longnose Dace	*Rhinichthys cataractae*	2	17	17	18	50	102	1	94	31	24	58	2	15%
Common Shiner	*Luxilus cornutus*	6		41	2	71	109	31		9	3	6	3	10%
White Sucker	*Catostomus commersoni*	39	4	15	18	7		3	70	22	30	27	4	7%
Fallfish	*Semotilus corporalis*	114			3	35	14	5	44			22	5	6%
Slimy Sculpin	*Cottus cognatus*		35	27						9	17	12	6	5%
Brook Trout	*Salvelinus fontinalis*		19	7					18	5	11	10	7	4%
Longnose Sucker	*Catostomus catostomus*		11	26		11	38						8	4%
Redbreast Sunfish	*Lepomis auritus*				2			10					9	3%
Atlantic Salmon	*Salmo salar*					23	42						10	3%
Brown Bullhead	*Ameirus nebulosus*	19		2		1			13			1	12	2%
Creek Chub	*Semotilus atromaculatus*			9	1			2			4		13	2%
Yellow Perch	*Perca flavescens*								33				14	2%
Pumpkinseed	*Lepomis gibbosus*					2	2		13	1		5	15	2%
Golden Shiner	*Notemigonus crysoleucas*			6		9	9						16	2%
Chain Pickerel	*Esox Niger*	10					1		3				17	2%
Spottail Shiner	*Notropis hudsonius*					2	3						21	1%
American Eel	*Anguilla rostrata*		1										22	1%
Totals:		194	141	309	68	300	458	56	373	188	194	236		1

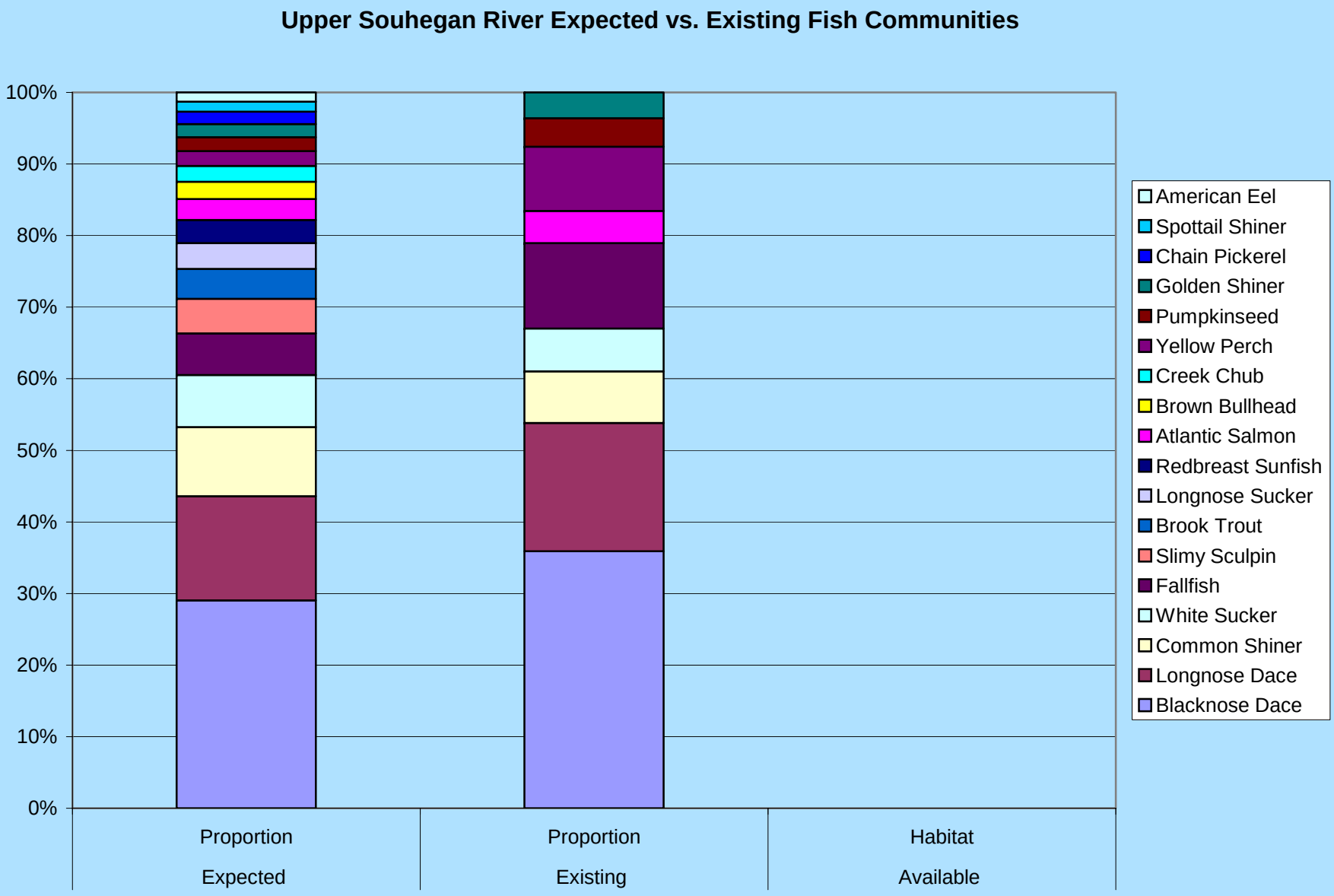

Upper Souhegan River TFC
Spottail Shiner 1%
Chain Pickerel 2%
American Eel 1%
Golden Shiner 2%
Pumpkinseed 2%
Yellow Perch 2%
Creek Chub 2%
Brown Bullhead 2%
Atlantic Salmon 3%
Redbreast Sunfish 3%
Longnose Sucker 4%
Brook Trout 4%
Slimy Sculpin 5%
Fallfish 6%
White Sucker 7%
Common Shiner 10%
Longnose Dace 15%
Blacknose Dace 29%

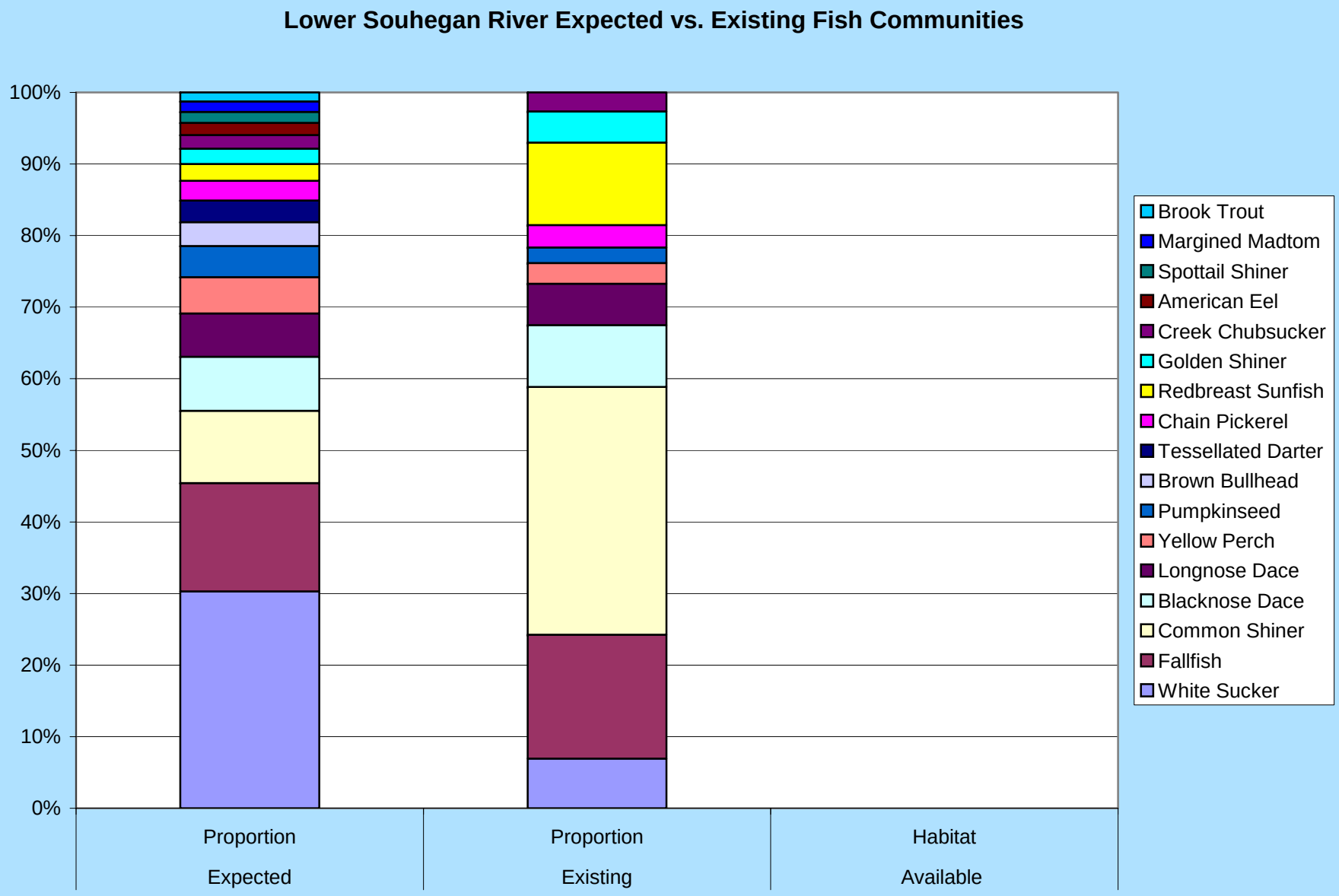
Lower Souhegan TFC Data by Reference River

Common Name	Species Name	Quaboag River	Quinnipiac River	Soucook River	Ware River	Willimantic River	Mean Rank	Expected Proportion
White Sucker	*Catostomus commersoni*	69	625	2	283	1092	1	30%
Fallfish	*Semotilus corporalis*	14	95	1	227	3194	2	15%
Common Shiner	*Luxilus cornutus*			100	32	1440	3	10%
Blacknose Dace	*Rhinichthys atratulus*	14		117	5	557	4	8%
Longnose Dace	*Rhinichthys cataractae*	69	225	53	70		5	6%
Yellow Perch	*Perca flavescens*	193	30		203	193	6	5%
Pumpkinseed	*Lepomis gibbosus*	208	10		96	50	7	4%
Brown Bullhead	*Ameirus nobulosus*	138		2	14	2	9	3%
Tessellated Darter	*Etheostoma olmstedi*		135	2		104	10	3%
Chain Pickerel	*Esox Niger*	128			9	7	11	3%
Redbreast Sunfish	*Lepomis auritus*	82				150	13	2%
Golden Shiner	*Notemigonus crysoleucas*	104			1	22	14	2%
Creek Chubsucker	*Erimyzon oblongus*	91			9		16	2%
American Eel	*Anguilla rostrata*		75	2		21	18	2%
Spottail Shiner	*Notropis hudsonius*			6		16	20	2%
Margined Madtom	*Noturus insignis*	26					21	1%
Brook Trout	*Salvelinus fontinalis*		5	1			24	1%
Totals:		1136	1200	286	949	6848		1

Lower Souhegan River TFC



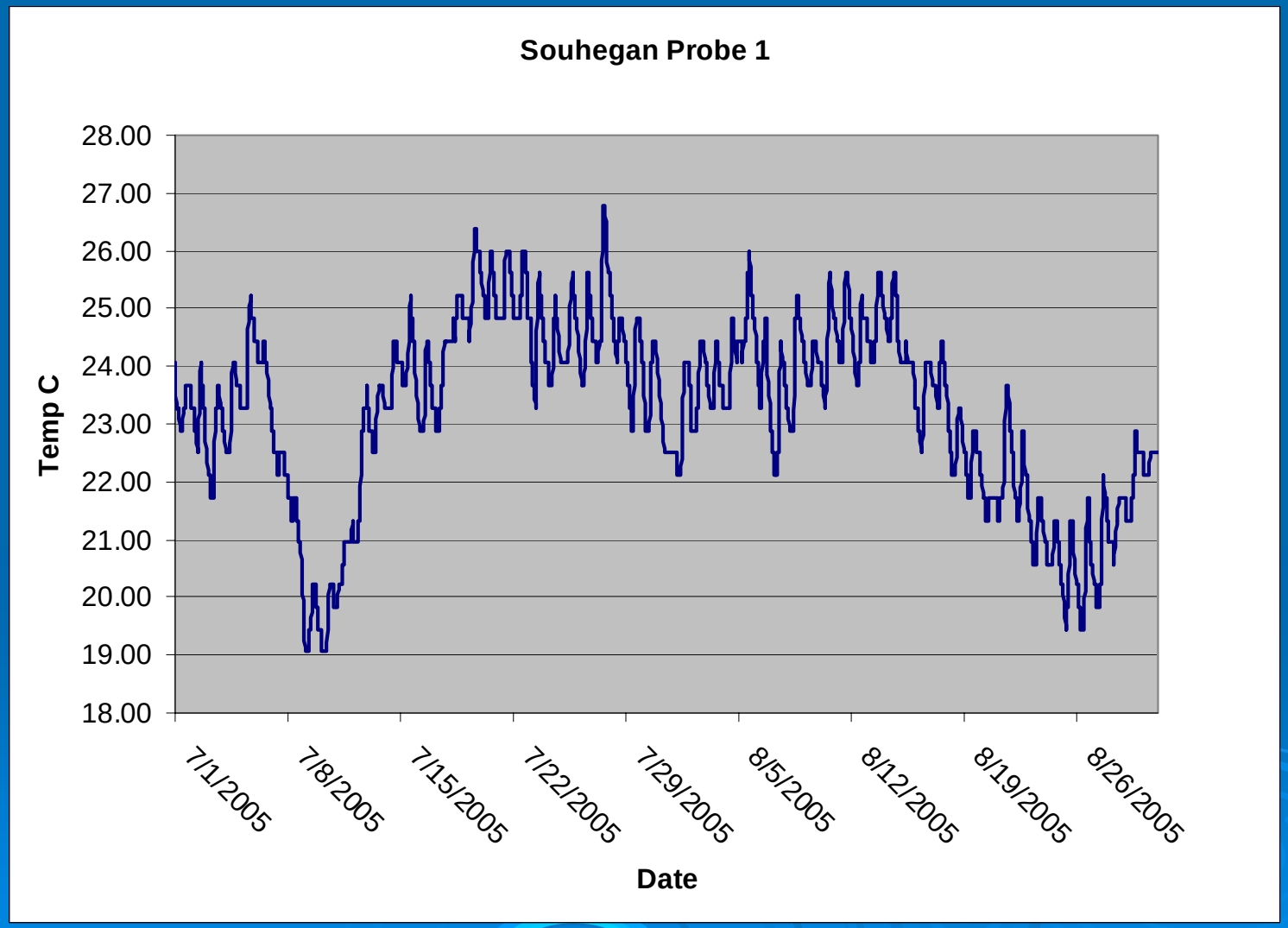

Upper Souhegan River Expected vs. Existing Fish Communities
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Proportion Expected
Proportion Existing
Habitat Available
American Eel
Spottail Shiner
Chain Pickerel
Golden Shiner
Pumpkinseed
Yellow Perch
Creek Chub
Brown Bullhead
Atlantic Salmon
Redbreast Sunfish
Longnose Sucker
Brook Trout
Slimy Sculpin
Fallfish
White Sucker
Common Shiner
Longnose Dace
Blacknose Dace


Lower Souhegan River Expected vs. Existing Fish Communities
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Proportion Expected
Proportion Existing
Habitat Available
Brook Trout
Margined Madtom
Spottail Shiner
American Eel
Creek Chubsucker
Golden Shiner
Redbreast Sunfish
Chain Pickerel
Tessellated Darter
Brown Bullhead
Pumpkinseed
Yellow Perch
Longnose Dace
Blacknose Dace
Common Shiner
Fallfish
White Sucker

Preliminary conclusions from XFC/TFC comparison

- Lower number of species
- Low species density (~ 0.8 fpm)
- Cold water species missing
- Proportions of fluvial vs. ponds species similar

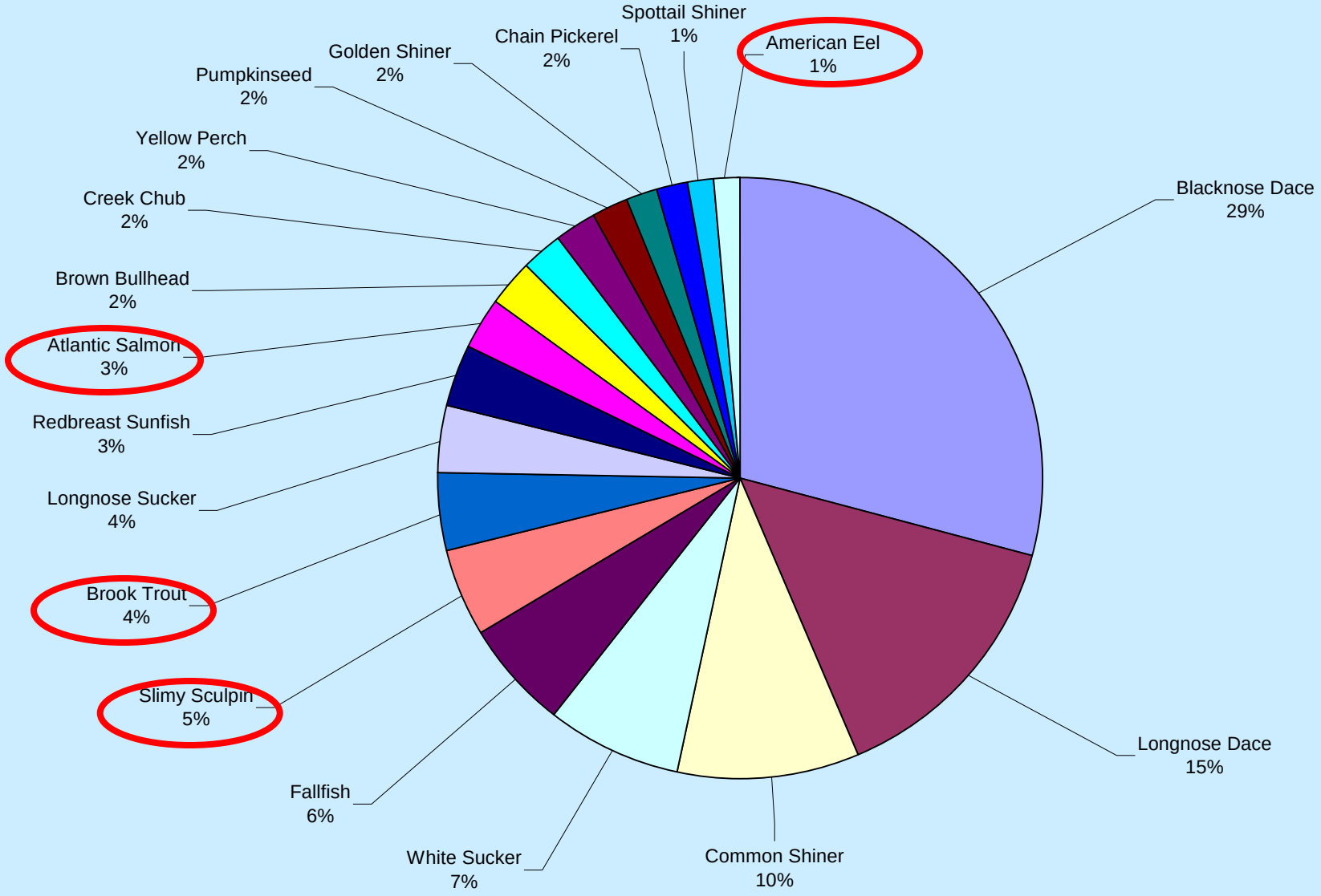
Temperature



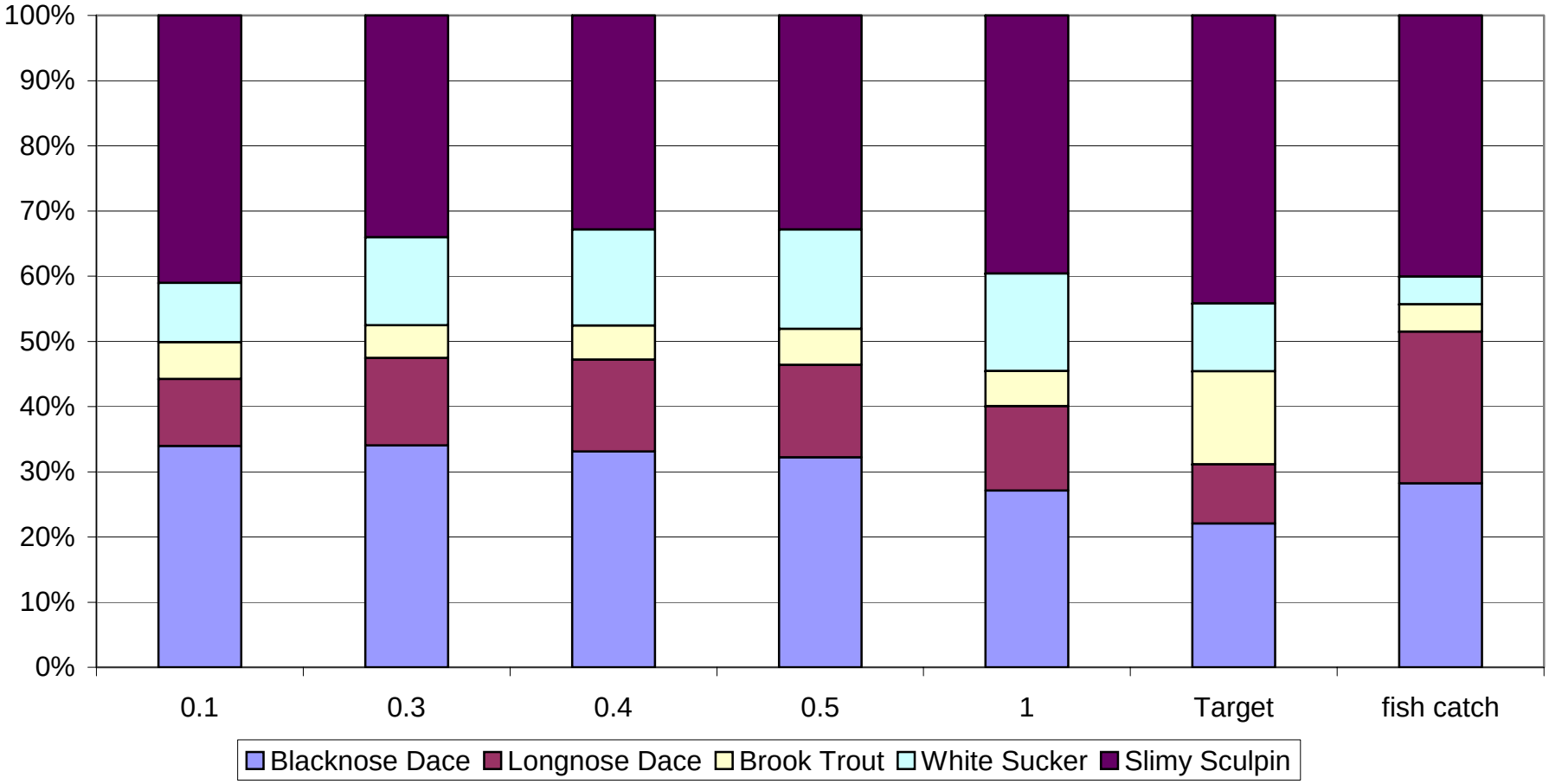
Next steps

- Final approval of TFC
- Establishing RFC by:
  - Ranking missing/underrepresented species
    - Atlantic Salmon
    - American Eel
    - Lamprey (?)
    - Brook trout
    - Slimy sculpin
    - American shad (?)
    - Blueback herring (?)
- Establish fish/habitat ratio
- Finalize habitat models
  - Identify habitat deficits
  - Identify measures

Upper Souhegan River TFC



Stony Clove Creek , NY



Habitat used by Brook trout

- Riffle
  - Woody debris
  - Boulders
  - Shading
  - Depth < 50 cm
  - Velocity < 40 cm/s
  - Shallow margins
- Run
  - Shading
  - Woody debris
  - Boulders
  - Depth < 50 cm
  - Velocity < 75 cm/s
  - Shallow margin
- Pool
  - Lots of woody debris
  - Shading
  - Velocity < 60 cm/s

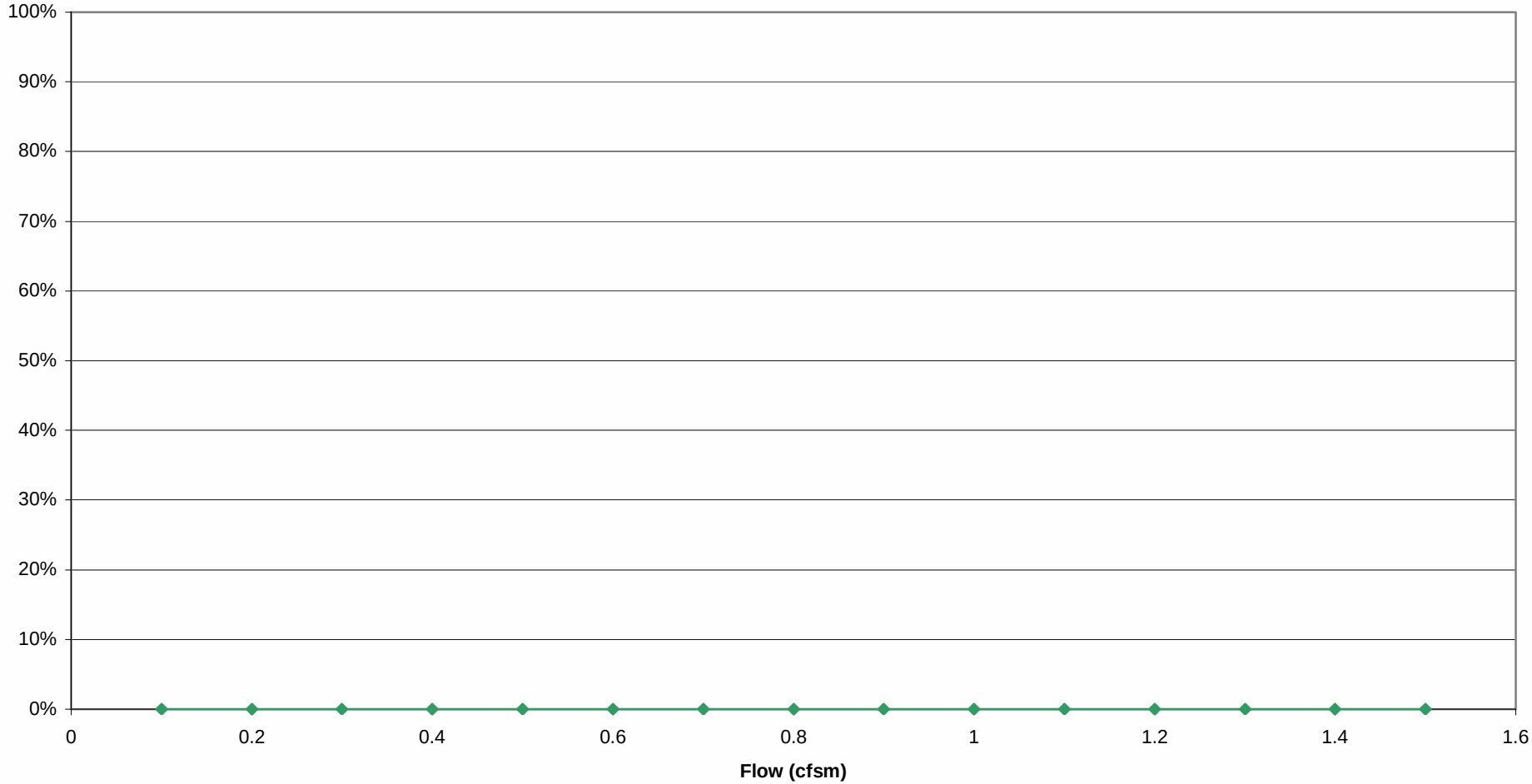
- Glide
  - Shallow margins
  - Woody debris
  - Shading
  - Depth < 50 cm
  - Velocity < 45 cm/s

Habitat deficits of Brook trout in MU 30

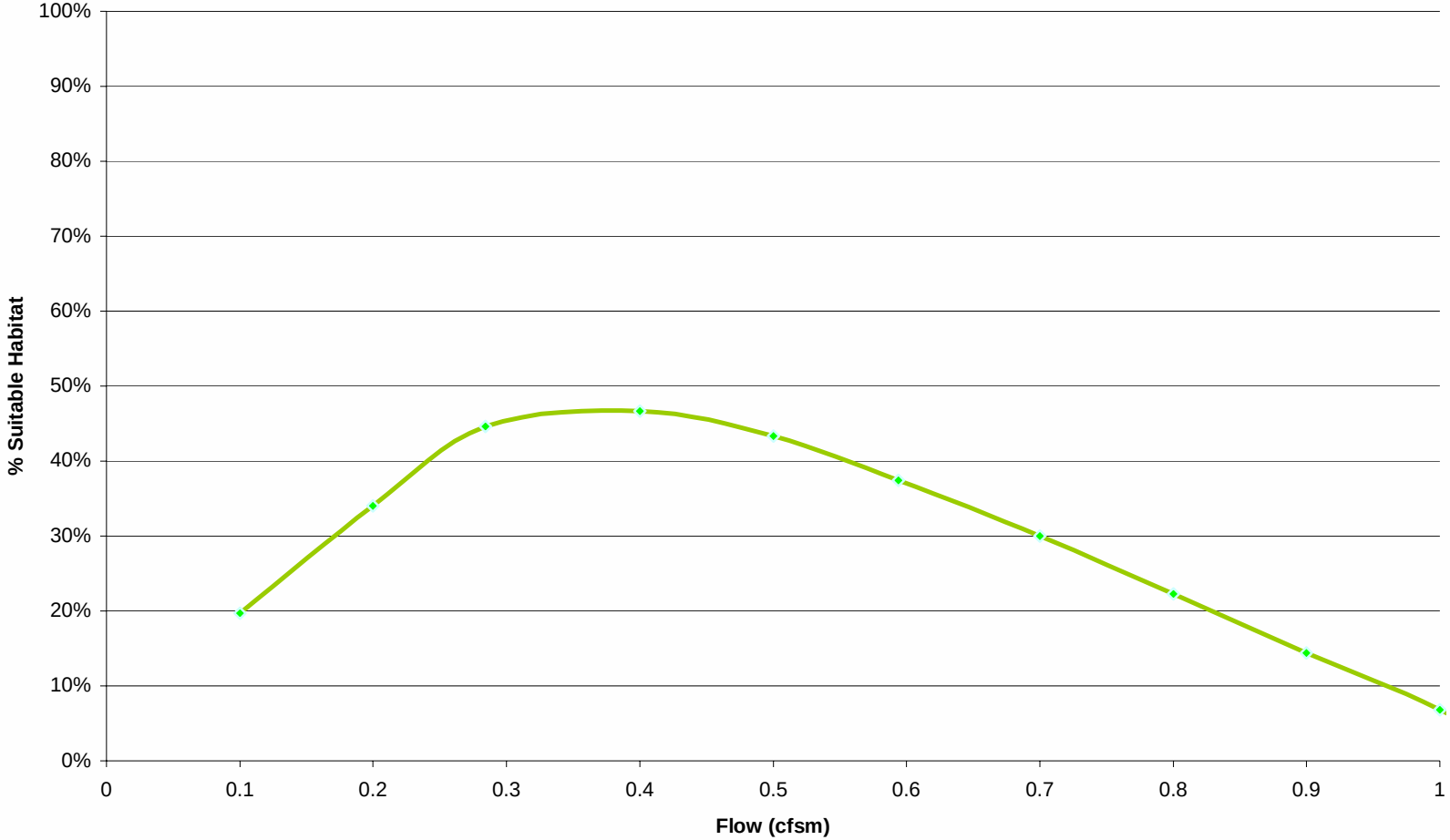
Add woody debris
Add boulders
Add shading

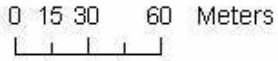
- Riffle
  - Woody debris
  - Boulders
  - Shading
  - Too fast
- Run
  - Shading
  - Woody debris
  - Boulders
  - Deeper
  - Too fast
- Pool
  - Woody debris
  - Shading
  - Too shallow
  - Too fast

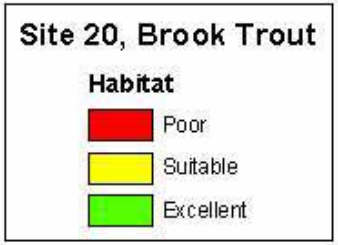
- Glide
  - Shallow margins
  - Woody debris
  - Shading
  - Too slow


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
Flow (cfsm)

0
25
50
100
Meters
N
Site 20, Brook Trout
Habitat
Poor
Suitable
Excellent

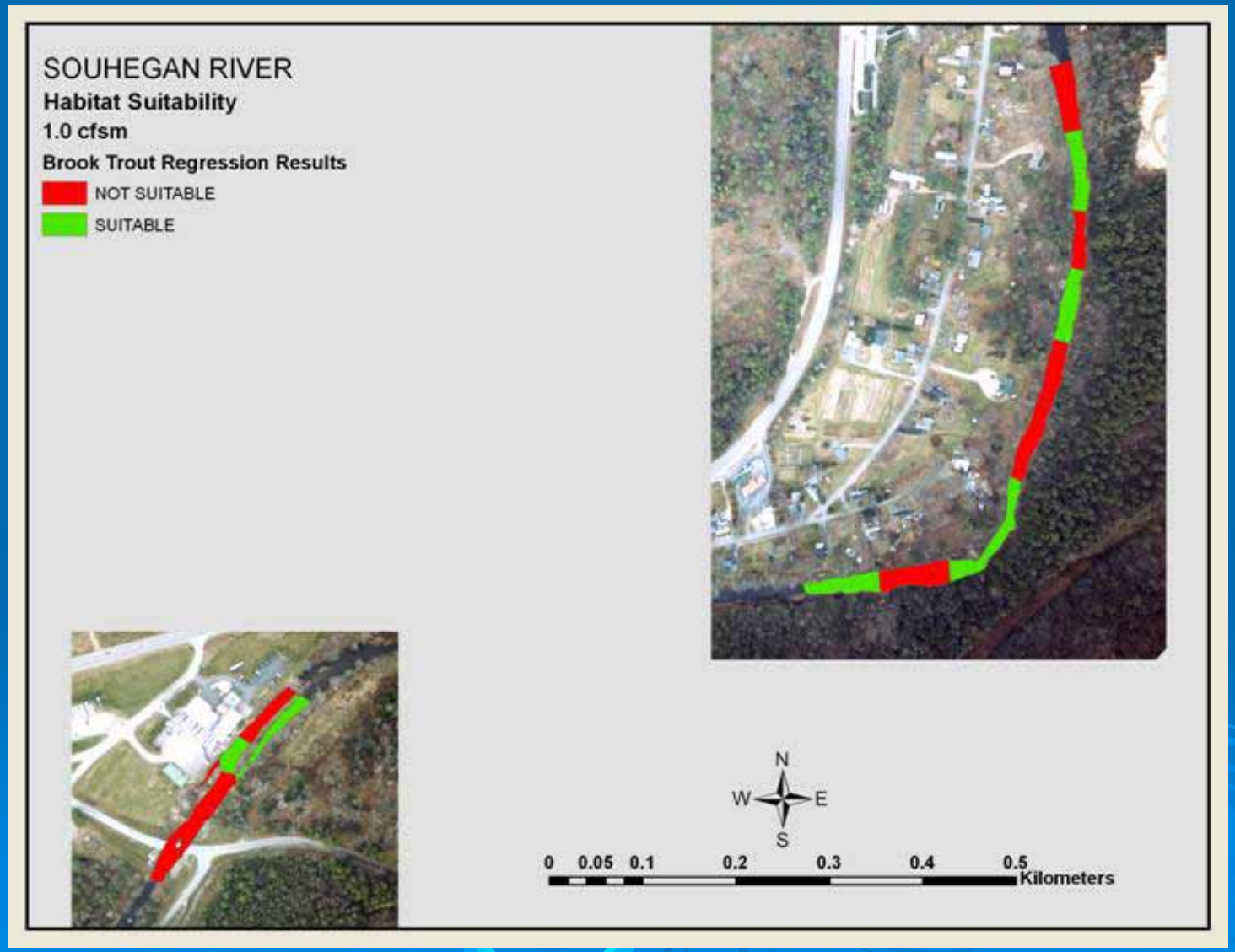




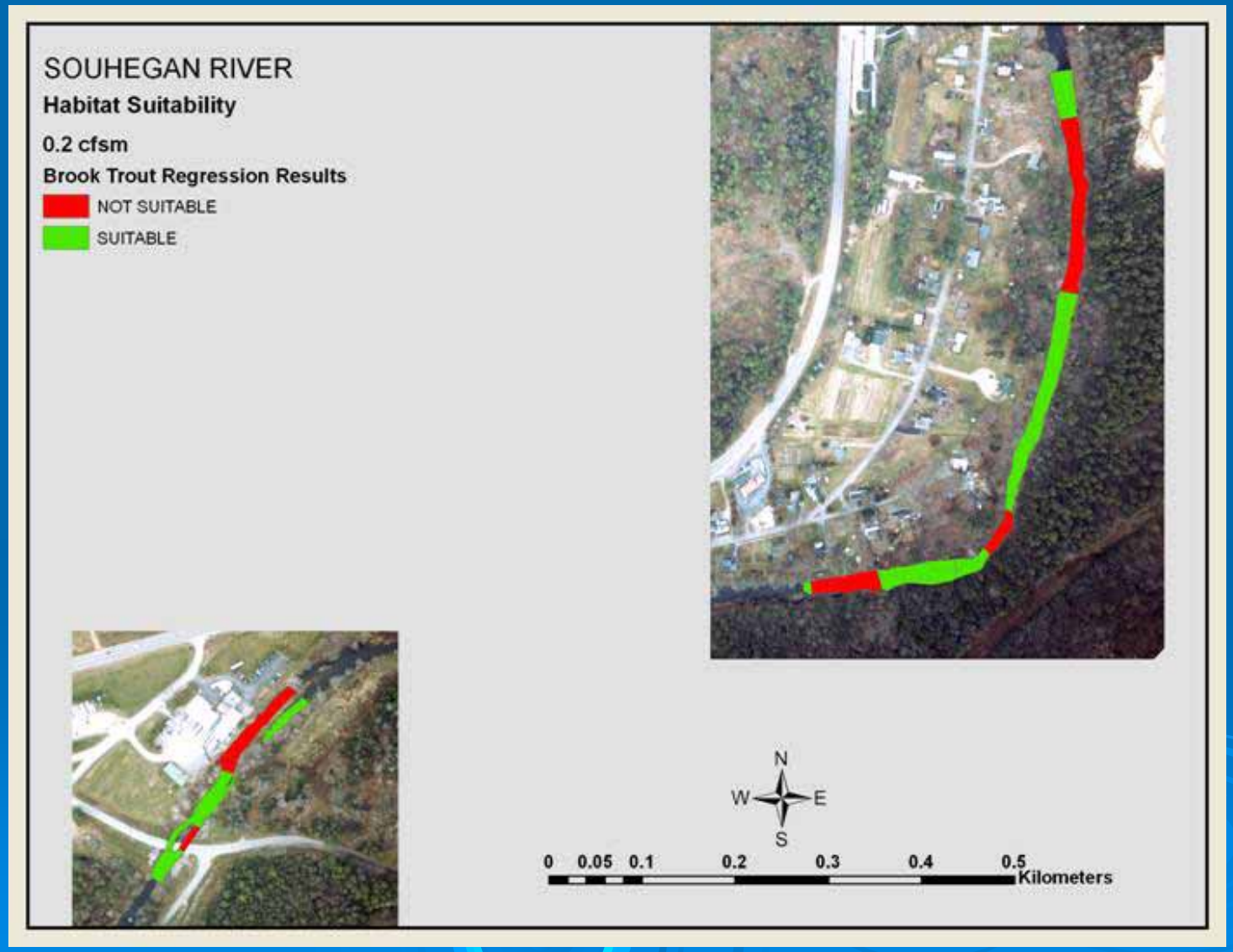


Relative weighted usable area for brook trout at Site 20, depicting poor, usable and excellent habitat after modification.

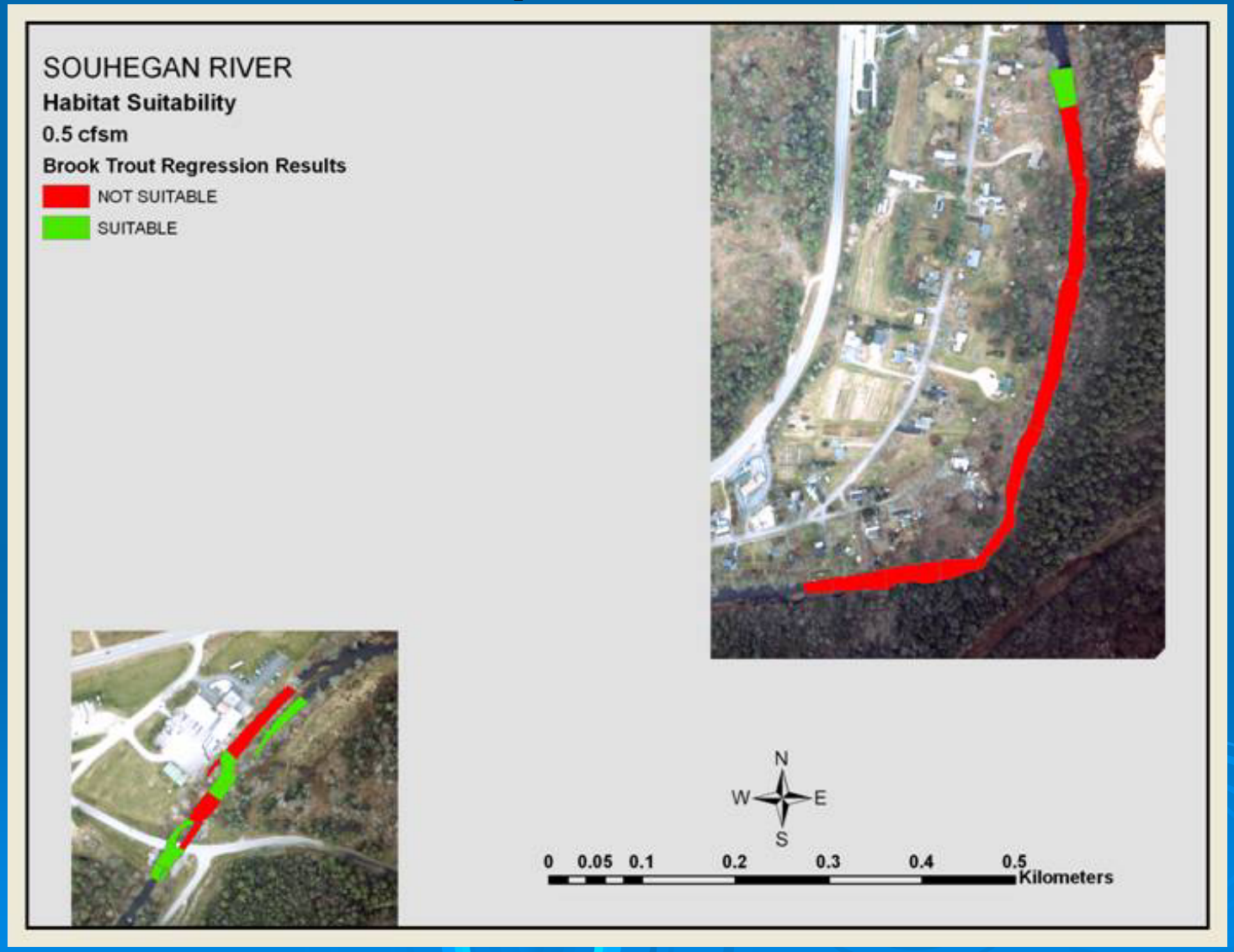
Habitat map for brook trout



Habitat map for brook trout



Habitat map for brook trout



Species selected for habitat modeling

Fallfish

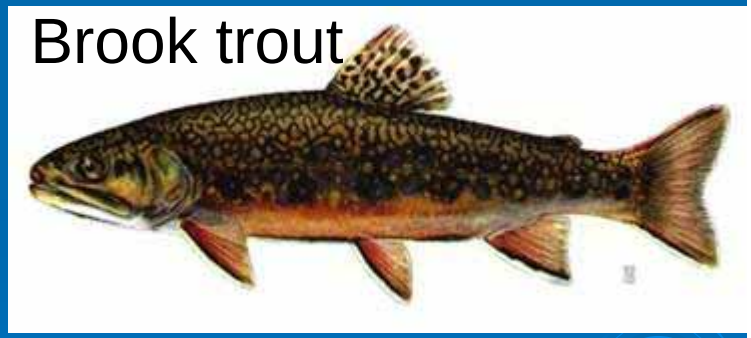
Longnose dace

American Eel

Common shiner

Blacknose dace

Brook trout

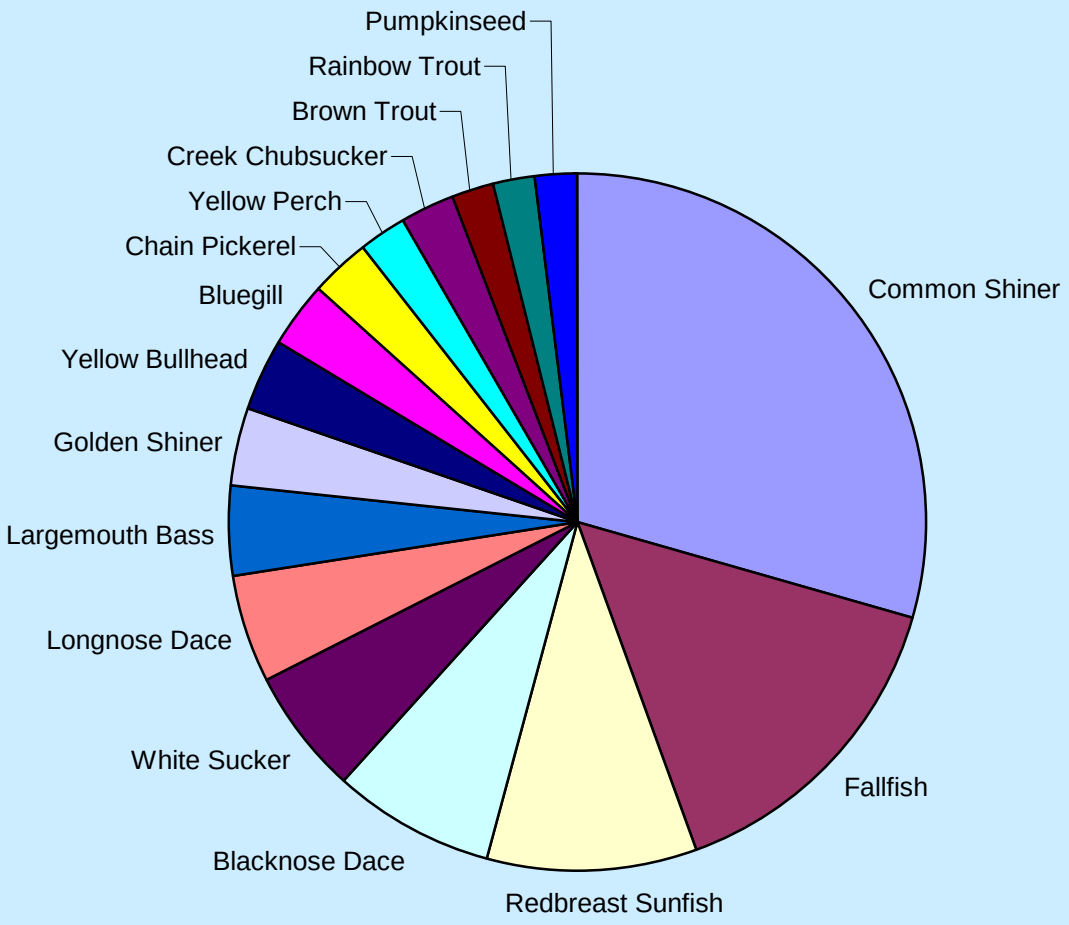


White sucker

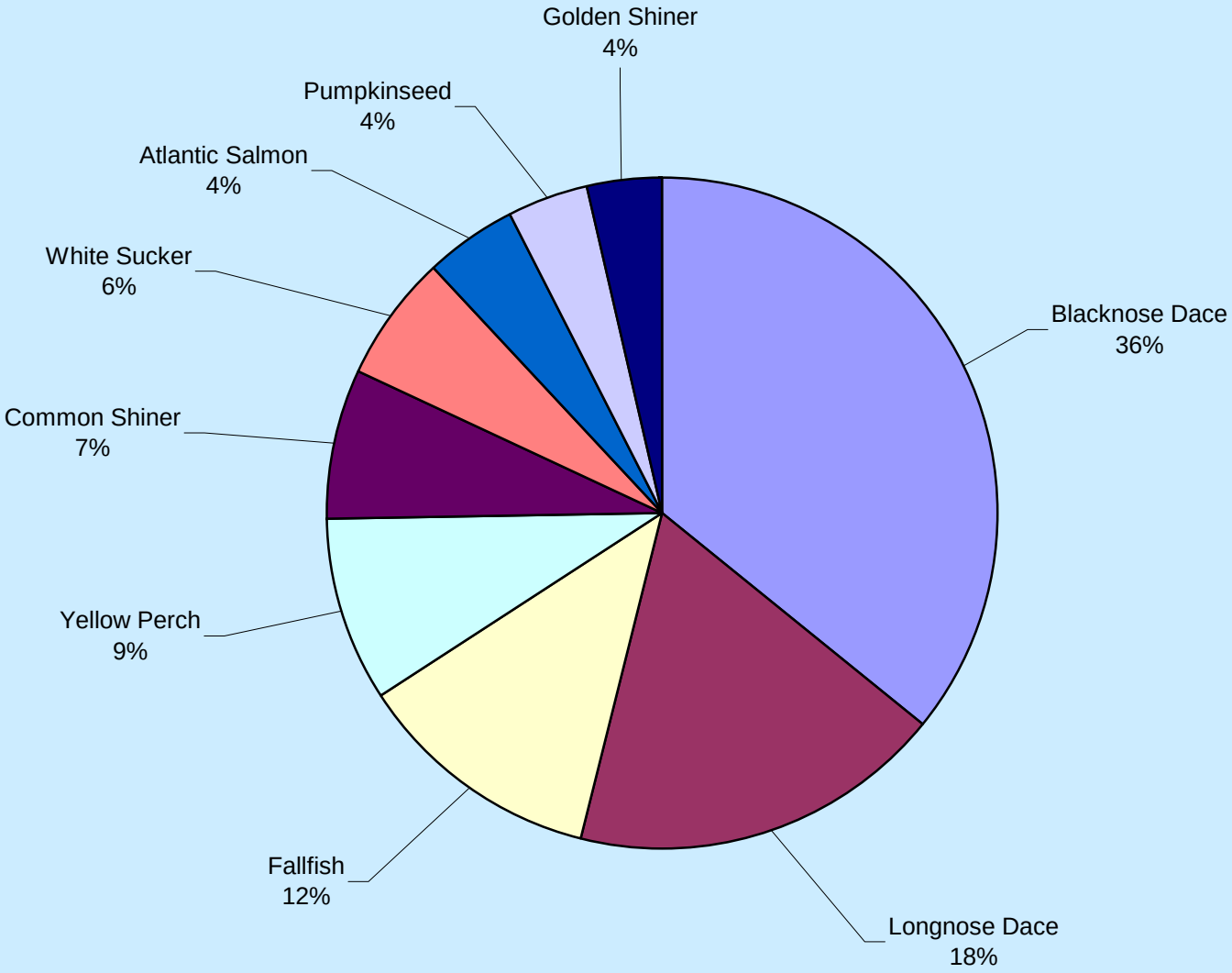
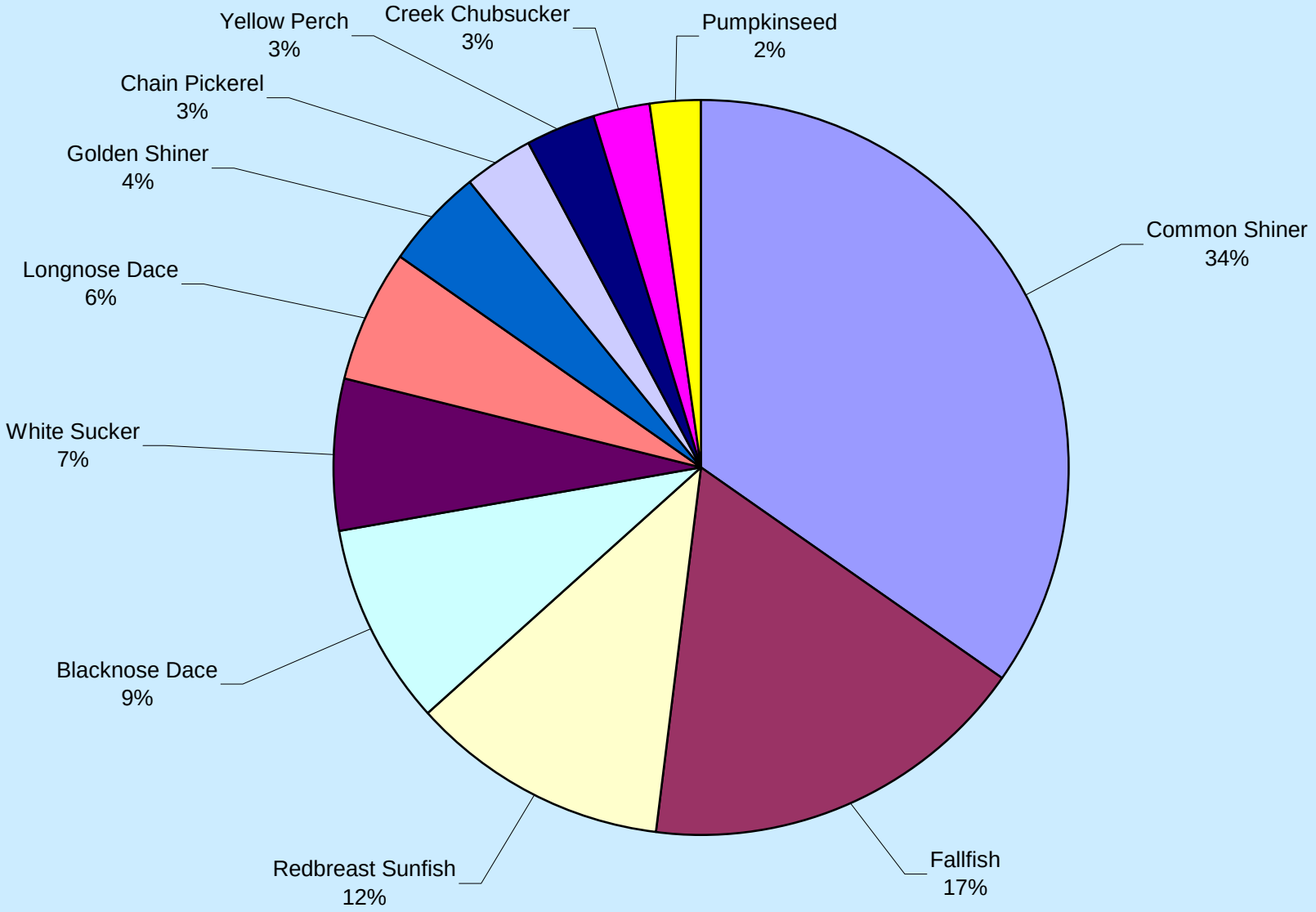
Slimy sculpin

Atlantic salmon

Lower Souhegan Existing Proportions (including non-native species)



Upper Souhegan River XFC



Lower Souhegan River XFC