Target Fish Community (TFC) Model Development and Analysis

Evaluation of the existing fish community of the Lamprey River and identification of indicator fish species for the MesoHABSIM modeling process

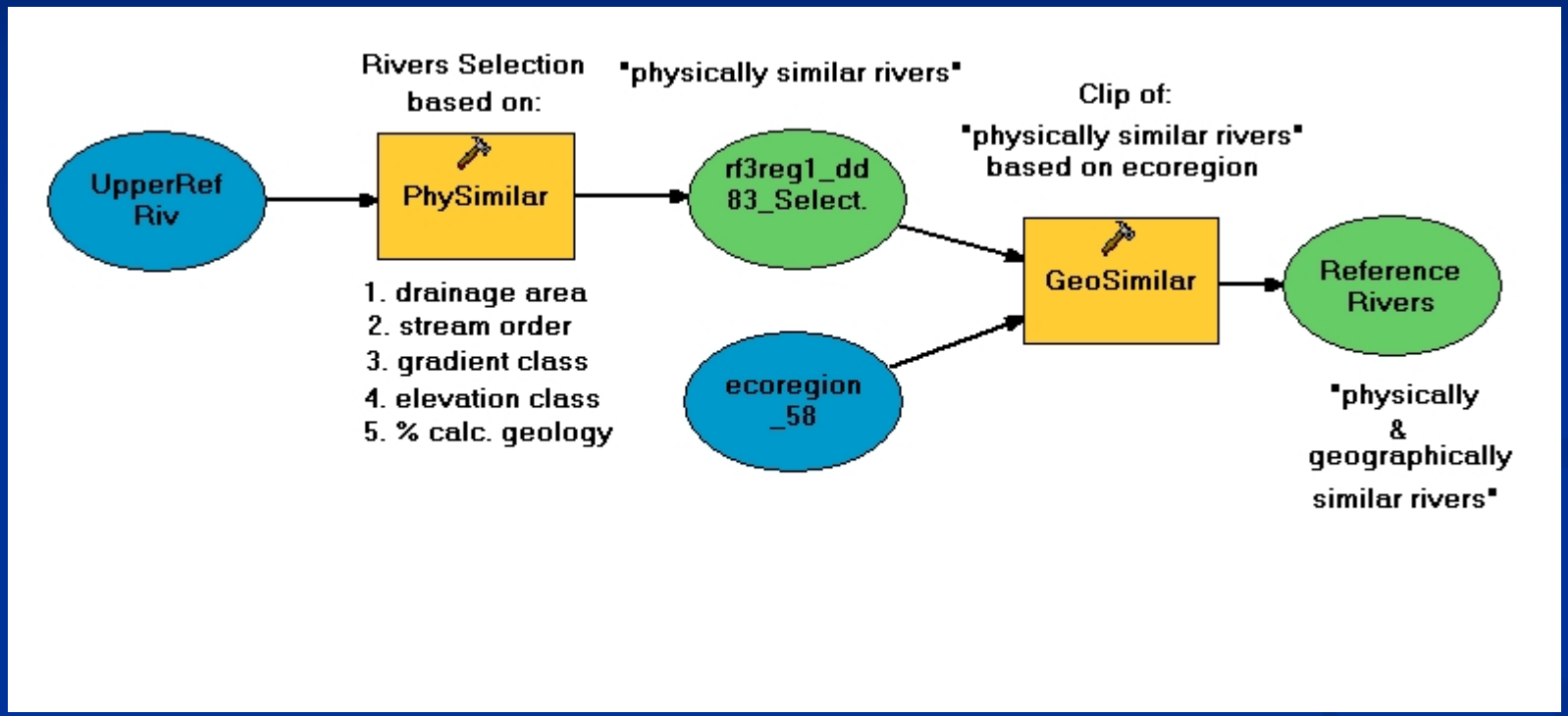
Target Fish Community (TFC) Models

- Bain and Meixler, 2000
- Uses fish data from un-impacted, quality streams similar to the study stream to develop a fish community model; excludes non-native fish.
- TFC is the fish community one could expect within the study river under un-impacted conditions.
- Comparison between the two communities to evaluate the ecological health of the study river.

TFC Development

- List of fish species existing, expected, or with potential to occur within the study river
- Selection of Reference Rivers
- Reference River Selection Model (RRSM); GIS
- Ecologically healthy or "quality rivers" (Kearns et al. 2005)
  - Few or no dams
  - No major water withdrawals or flow augmentations
  - Primarily forested and undeveloped watershed

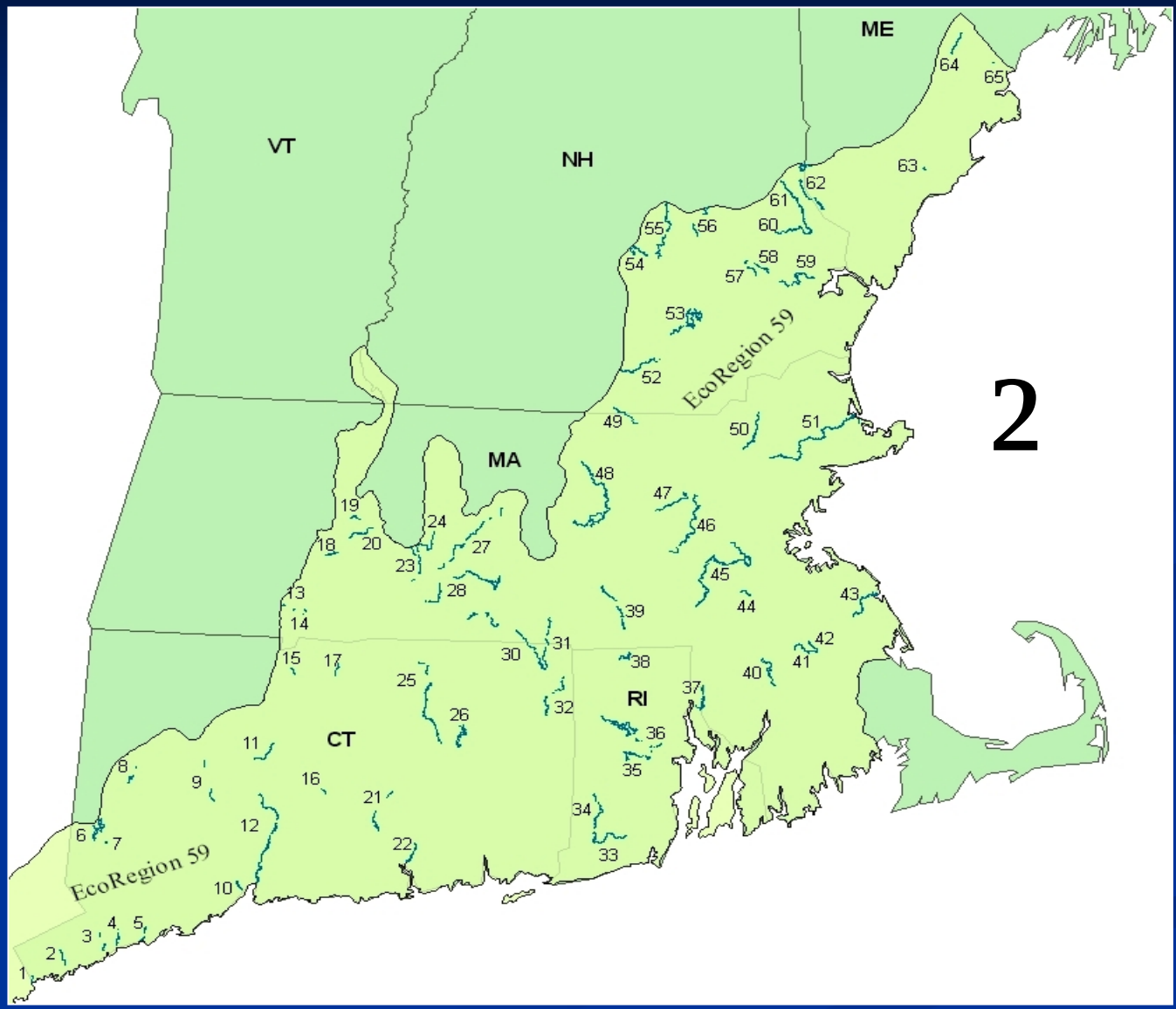
Reference River Selection Model Schematic



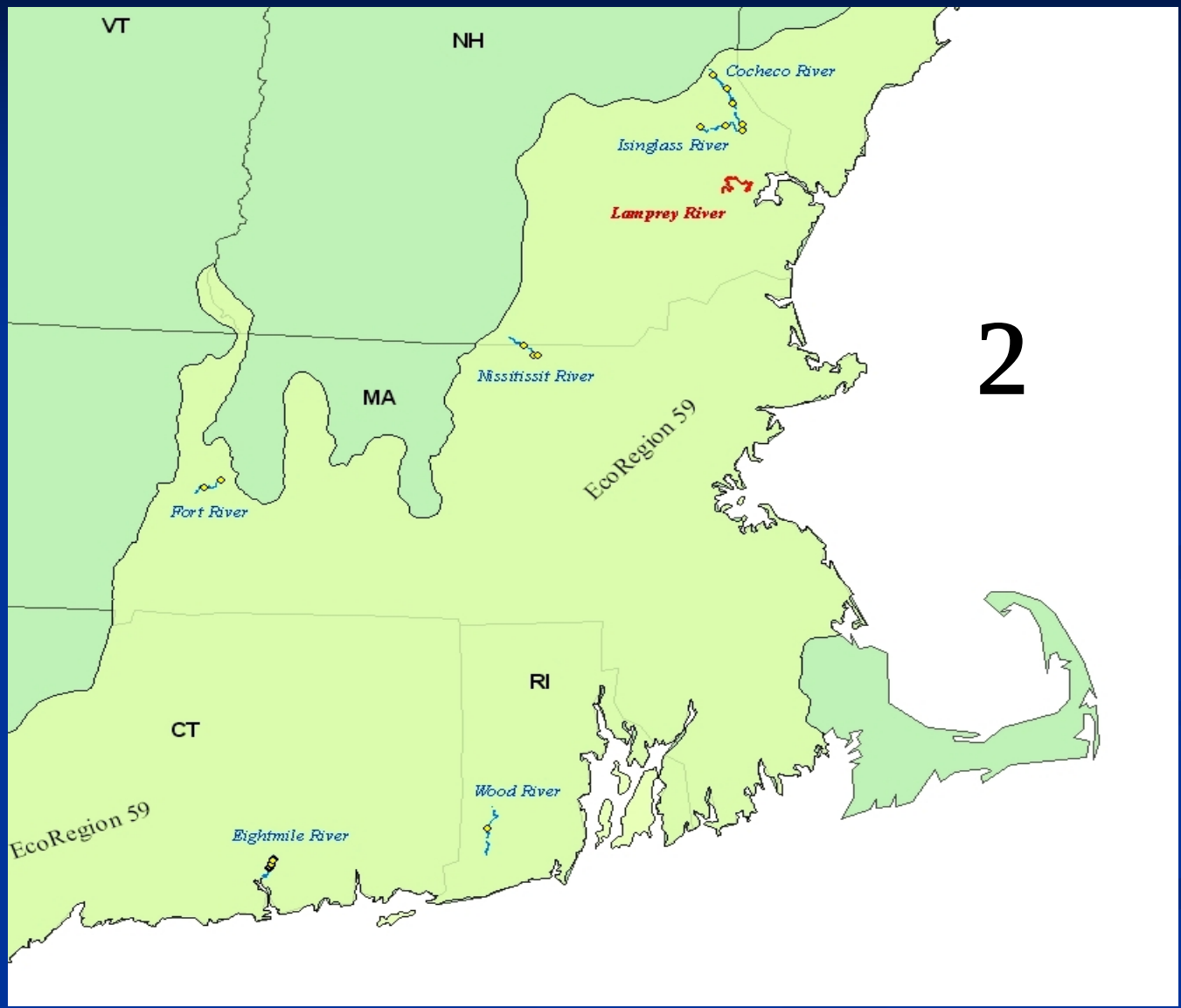
Reference River Selection Criteria Parameters:

- Stream order = 4
- Size class = 2 (watershed area: 30 – 200 sq. mi)
- Elevation class = 1 (elevation: 0 – 800 ft.)
- Gradient class = 1 (gradient: 0 – 0.5%)
- Chemical class = 1 (chem. composition: Acidic)
- Level III eco-region = 59 (Northeastern Coastal Zone)

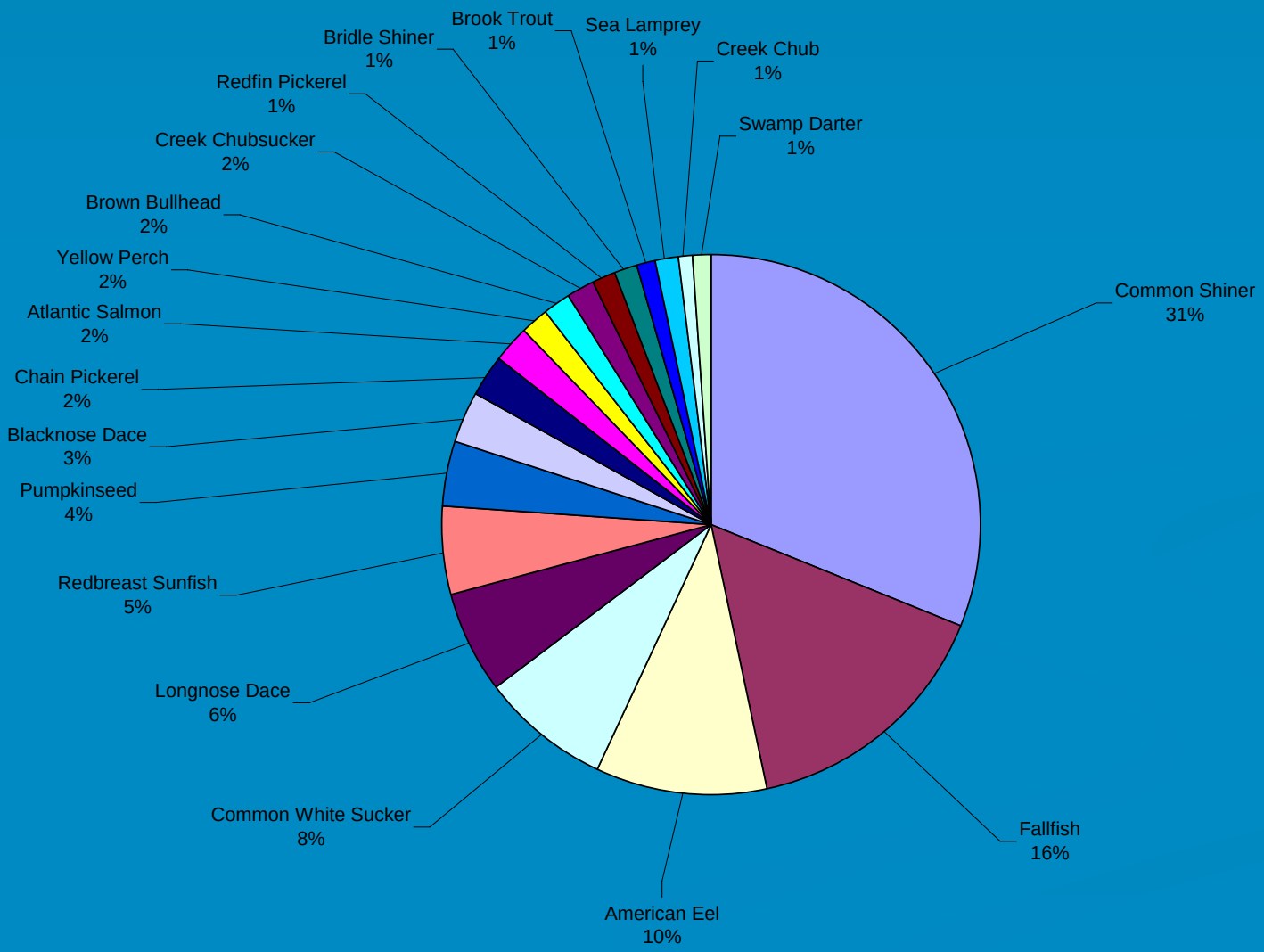
Potential Lamprey Reference Rivers



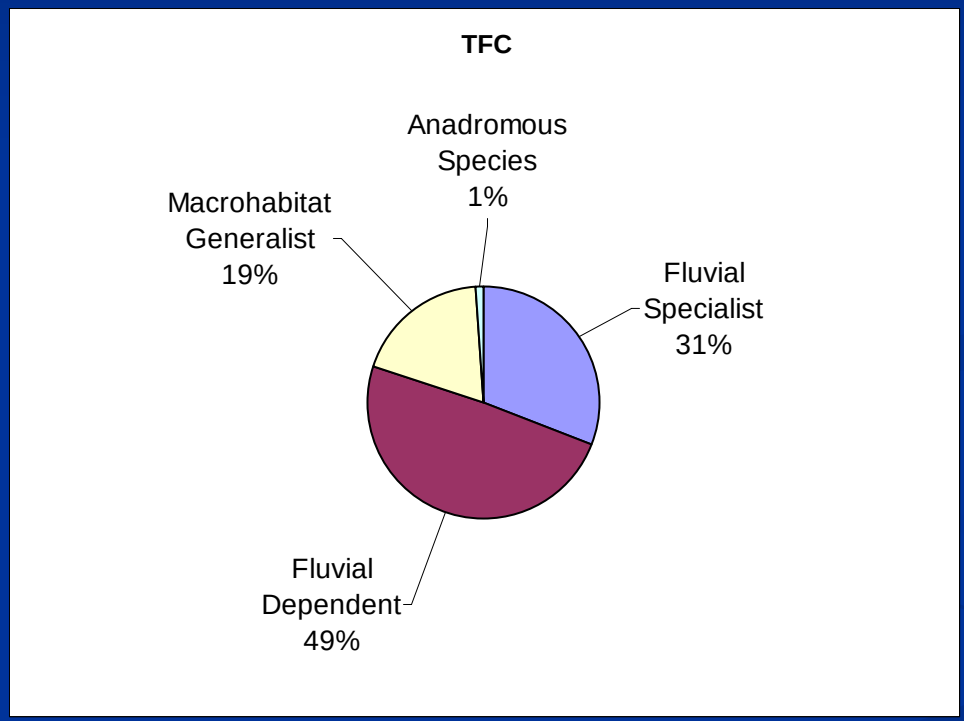
Selected Lamprey Reference Rivers



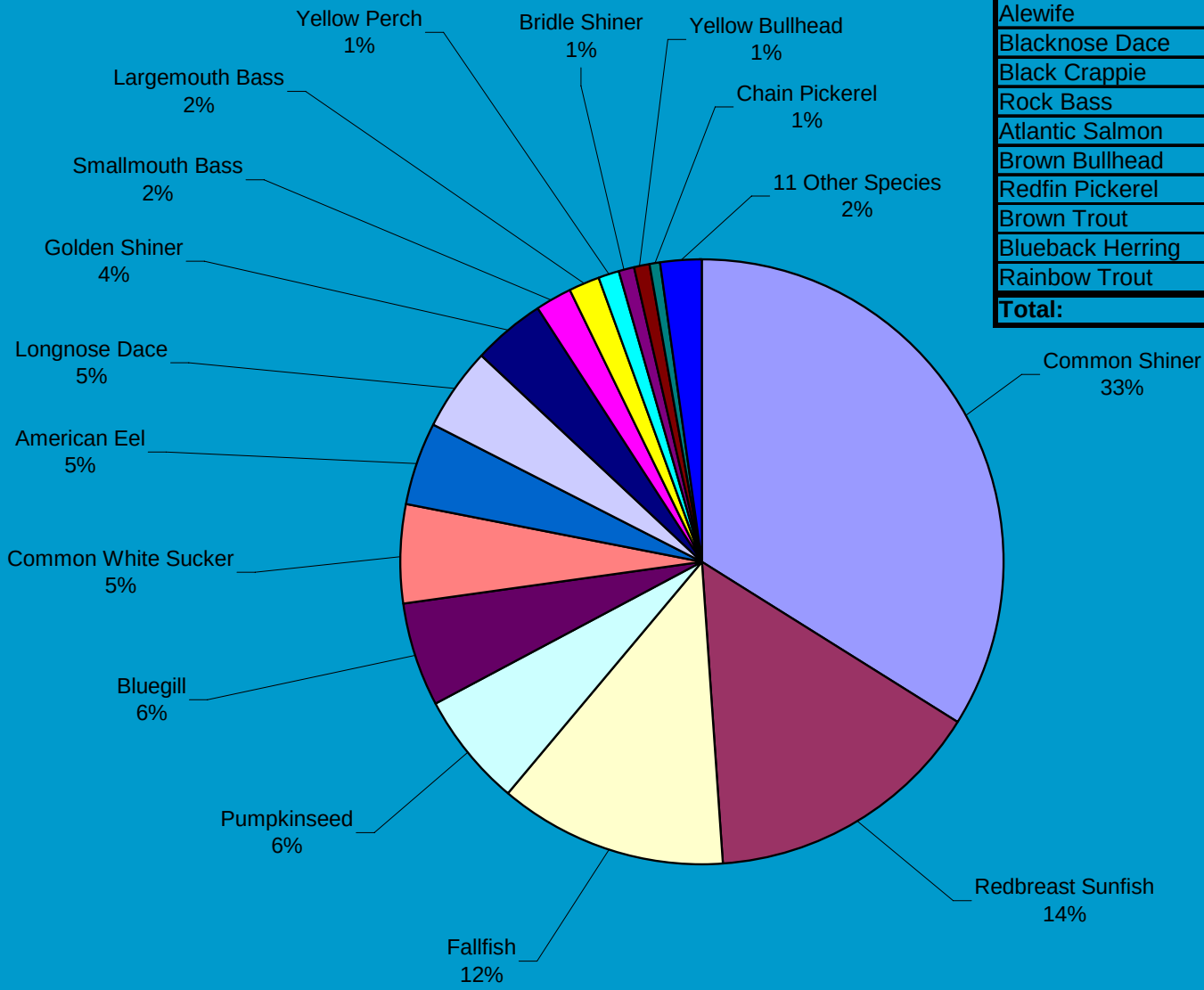
Lamprey River TFC



Lamprey River TFC Habitat Use Guild Compositions

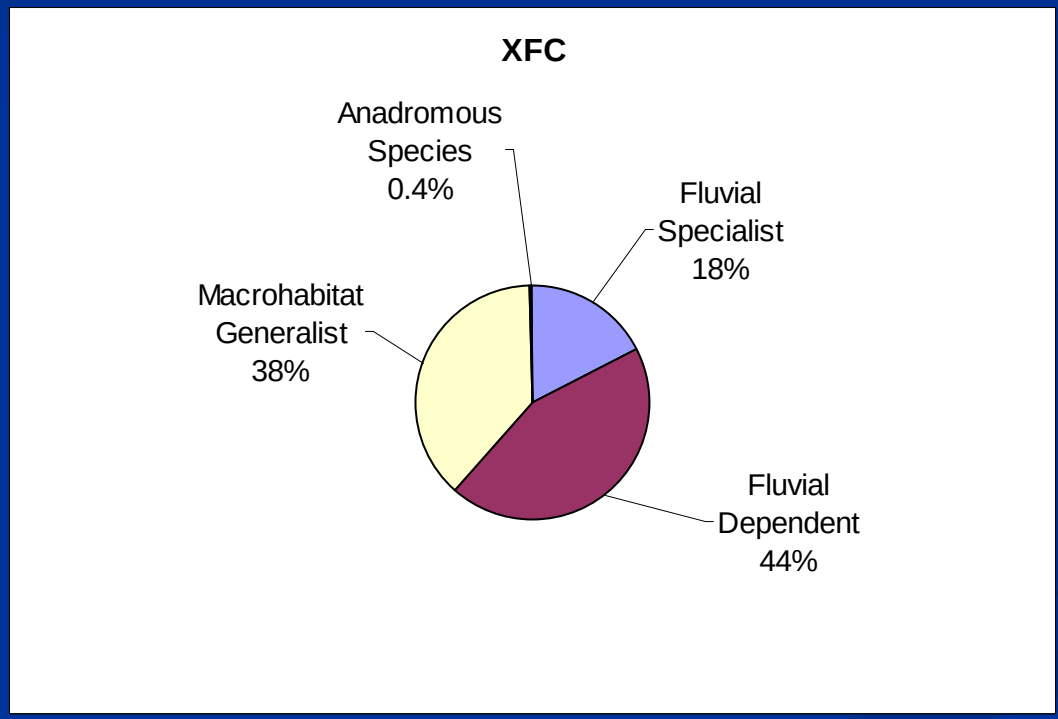


Lamprey River Existing Fish Community



List of Other Species (11)	Proportion
Creek Chubsucker	0.0035
Alewife	0.0033
Blacknose Dace	0.0030
Black Crappie	0.0029
Rock Bass	0.0029
Atlantic Salmon	0.0021
Brown Bullhead	0.0017
Redfin Pickerel	0.0010
Brown Trout	0.0005
Blueback Herring	0.0003
Rainbow Trout	0.0002
Total:	2%

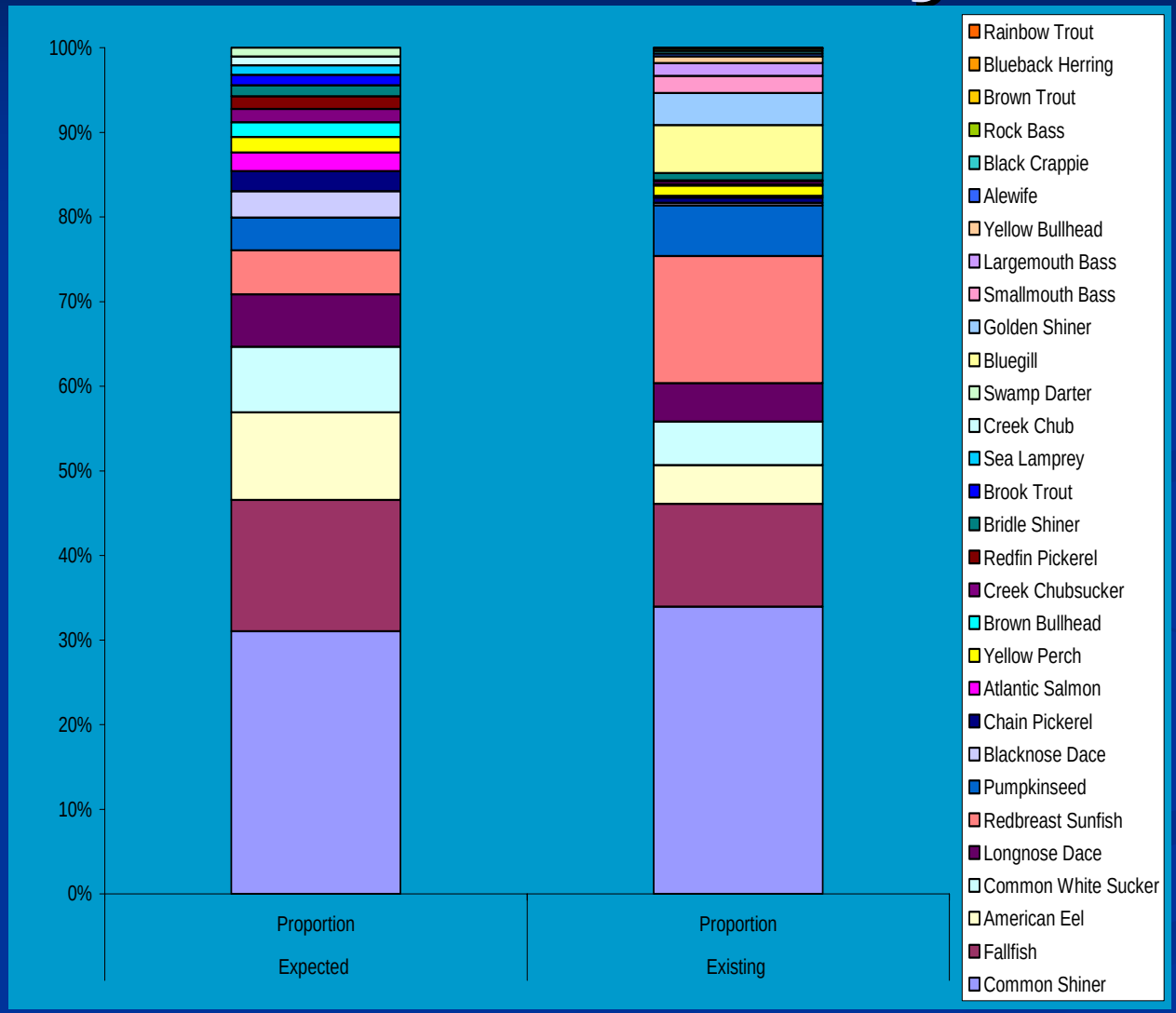
Lamprey River Existing Fish Community Habitat Use Guilds Composition



Existing Fish Community Evaluation

- Percent Model Affinity (Novak and Bode 1992)
  - Percent similarity = 100 – 0.5 (sum |t P – e P|)
  - Percent affinity by site
  - Comparisons between habitat use, pollution tolerance, and thermal regime classification guilds
  - Determination of overly abundant and under represented species

Lamprey River TFC – Existing Fish Community Comparison

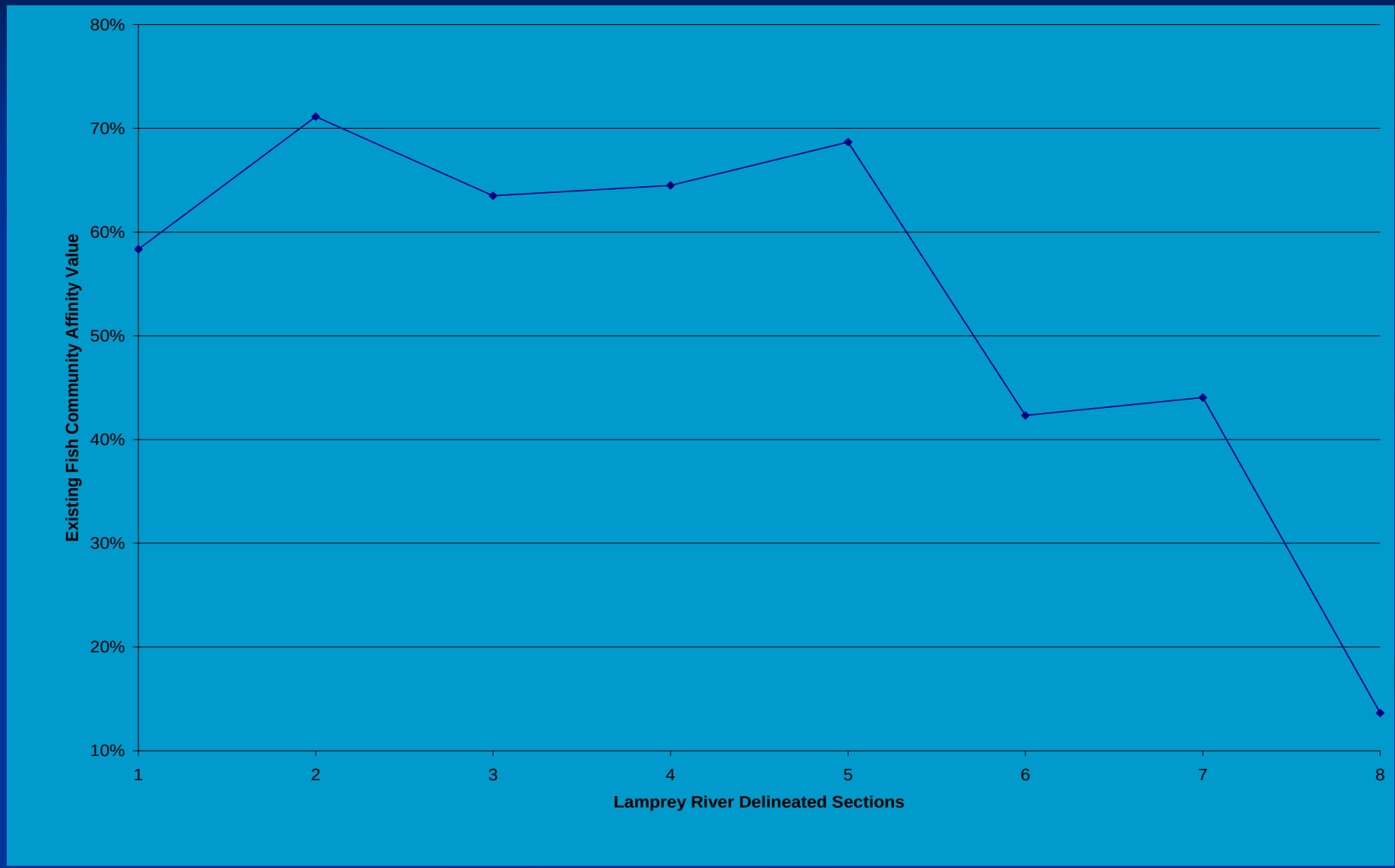


- **70% Affinity**

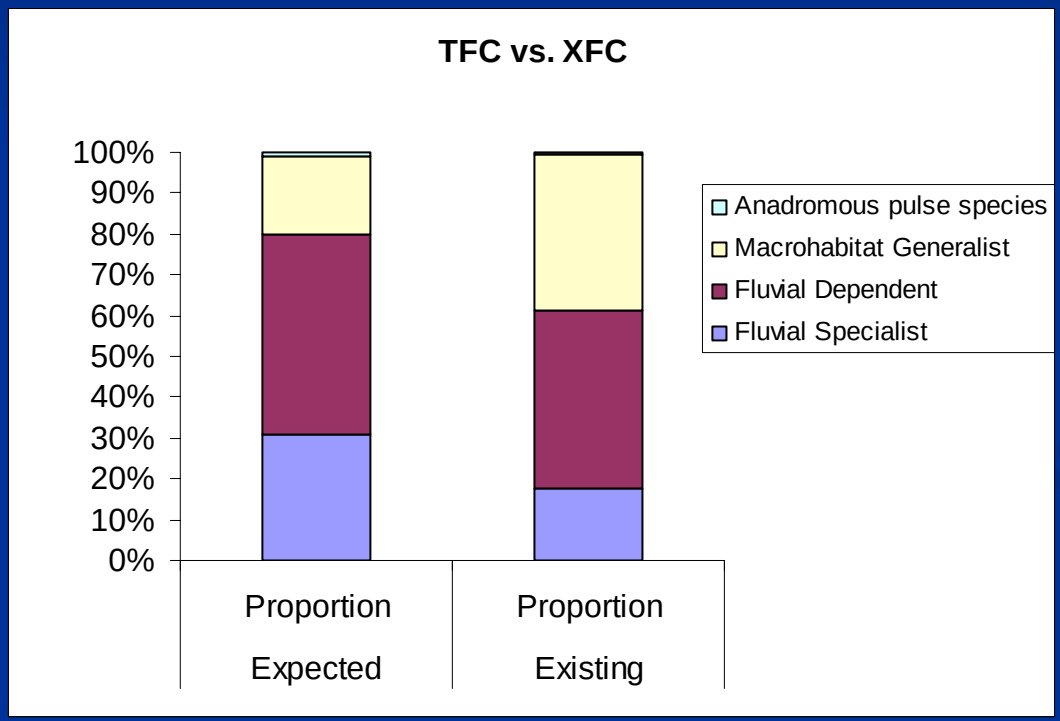
Comparisons:

- Upper Souhegan
  - 61%
- Lower Souhegan
  - 54%

Lamprey River Affinity by Study Section

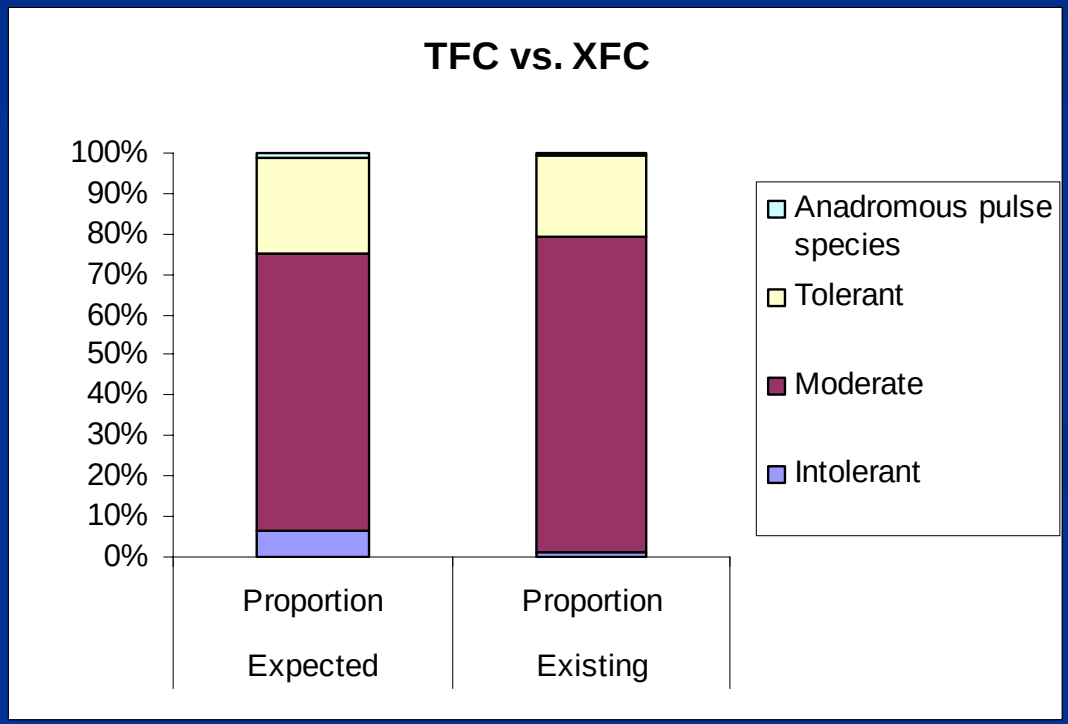


Habitat Use Classification Comparison



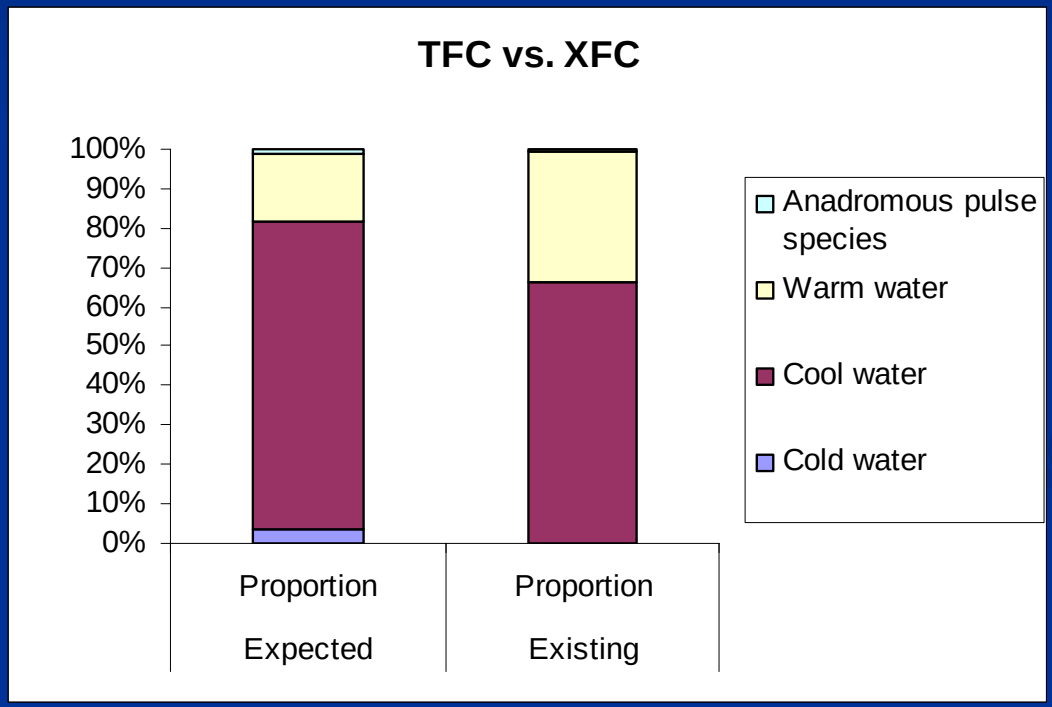
- 80% Affinity
- Over-abundance of Macrohabitat Generalists
  - TFC = 19%
  - XFC = 38%

Pollution Tolerance Classification Comparison



- 91% Affinity
- Pollution Intolerant species under-represented
  - TFC = 6%
  - XFC = 1%

Thermal Regime Classification Comparison



- 84% Affinity
- Warm-water species over-abundant
  - TFC = 17%
  - XFC = 33%
- Cold-water species under-represented
  - TFC = 3%
  - XFC = 0.2%

Species Comparison

- Under-represented species
- Species existing in expected proportions
- Overly-abundant species
- Missing species
- Introduced/non-native species
- Existing native species un-represented in the TFC

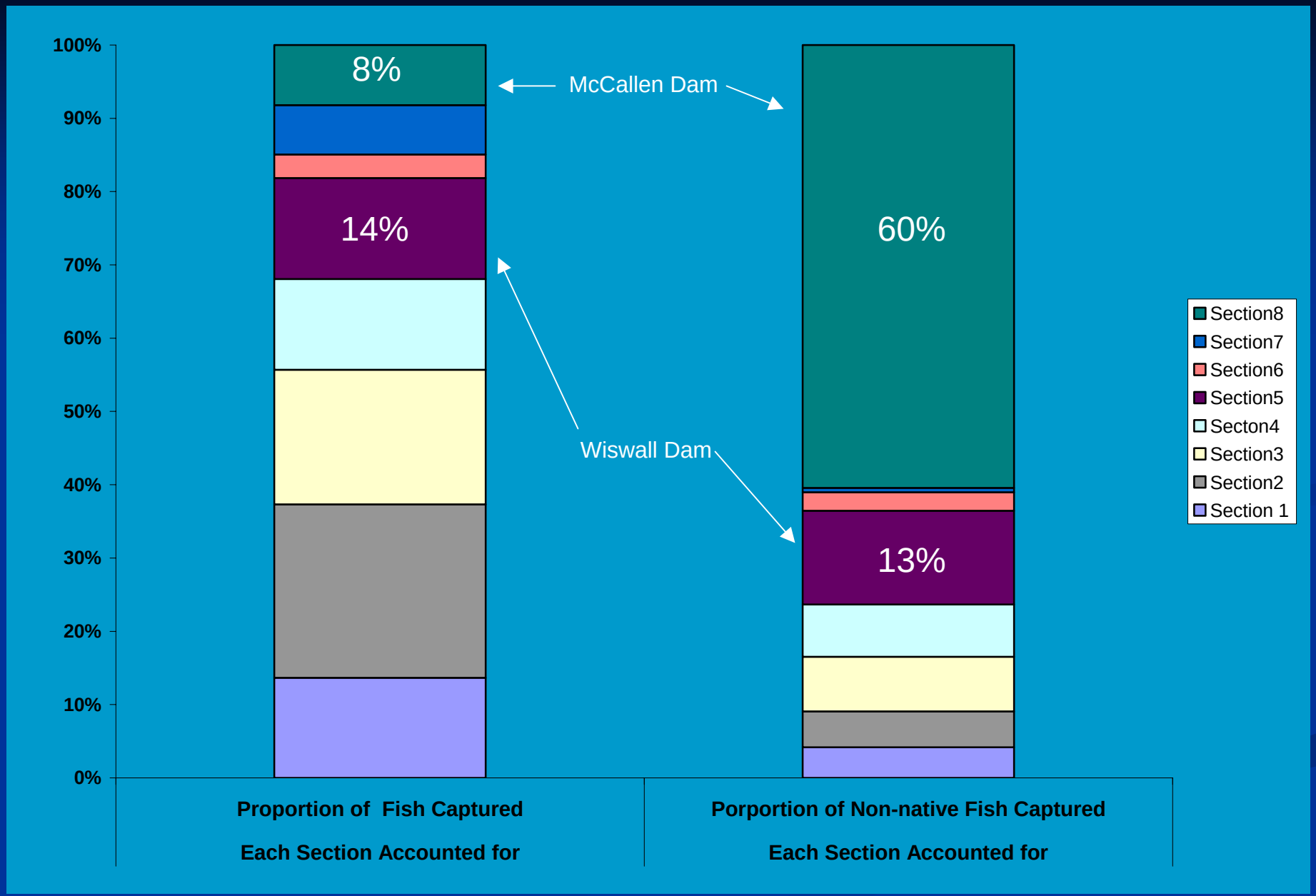
Lamprey River Species Comparison Table

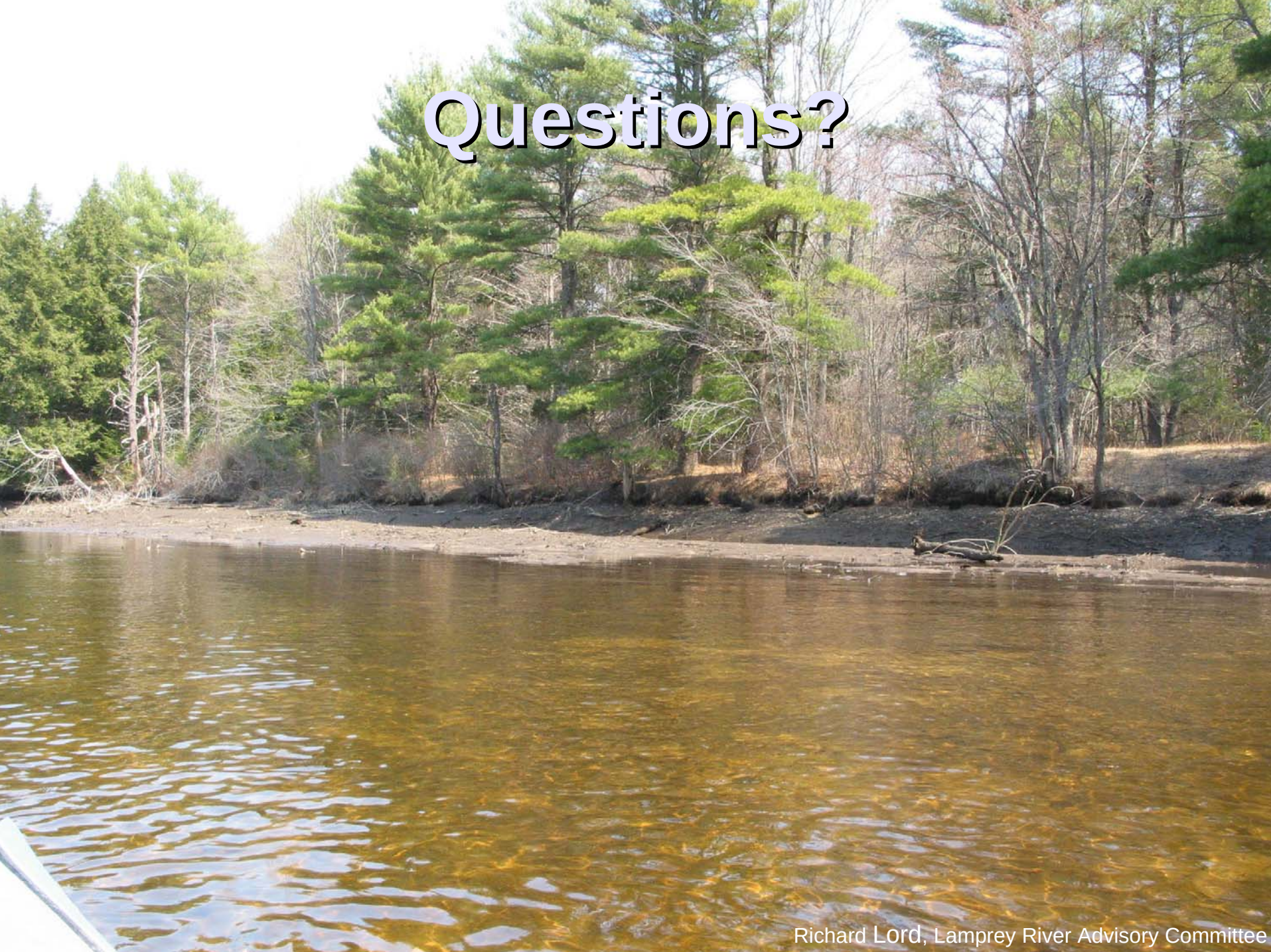
Species	Proportion of Target Fish Community	Proportion of Existing Fish Community	Percent Deviation	Native or Introduced	Habitat use Classification	Pollution Tolerance	Thermal Regime
Underrepresented fish species							
American Eel	10%	5%	56%	N	FD	T	Cool
Blacknose Dace	3%	0.3%	90%	N	FS	T	Cool
Chain Pickerel	2%	1%	75%	N	MG	M	Warm
Atlantic Salmon	2%	0.2%	91%	N	FS	I	Cold
Brown Bullhead	2%	0.2%	90%	N	MG	T	Warm
Creek Chubsucker	2%	0.3%	78%	N	FS	I	Cool
Redfin Pickerel	1%	0.1%	94%	N	MG	M	Warm
Fish species recorded as expected							
Common Shiner	31%	34%	9%	N	FD	M	Cool
Fallfish	16%	12%	22%	N	FS	M	Cool
Common White Sucker	8%	5%	34%	N	FD	T	Cool
Longnose Dace	6%	5%	27%	N	FS	M	Cool
Yellow Perch	2%	1%	33%	N	MG	M	Cool
Bridle Shiner	1%	1%	34%	N	MG	I	Warm
Overly abundant fish species							
Redbreast Sunfish	5%	15%	190%	N	MG	M	Warm
Pumpkinseed	4%	6%	54%	N	MG	M	Warm
Missing fish species							
Brook Trout	1%	-	100%	N	FS	I	Cold
Sea Lamprey*	1%	-	100%	N	N/A	N/A	N/A
Creek Chub	1%	-	100%	N	FS	T	Cool
Swamp Darter	1%	-	100%	N	MG	M	Warm
Introduced species present within the existing fish community (considered overly abundant)							
Bluegill	-	6%	N/A	I	MG	T	Warm
Smallmouth Bass	-	2%	N/A	I	MG	M	Warm
Largemouth Bass	-	2%	N/A	I	MG	M	Warm
Yellow Bullhead	-	1%	N/A	I	MG	T	Warm
Black Crappie	-	0.3%	N/A	I	MG	M	Warm
Rock Bass	-	0.3%	N/A	I	MG	M	Warm
Brown Trout	-	0.05%	N/A	I	FD	I	Cool
Rainbow Trout	-	0.02%	N/A	I	FD	I	Cold
Native fish species currently or historically present within the Lamprey River missing from the Target Fish Community							
Golden Shiner	-	4%	N/A	N	MG	T	Cool
Alewife*	-	0.3%	N/A	N	N/A	N/A	N/A
Blueback Herring*	-	0.03%	N/A	N	N/A	N/A	N/A

*Anadromous non-resident species

Conclusions

- The TFC provides a reference to compare the existing fish community of the Lamprey to the expected community of an un-impacted stream.
- The Lamprey River existing fish community exhibited a high affinity to the TFC model.
- Major deviations from target conditions included:
  - Under-representations of pollution intolerant, and cold-water species, and …
  - Over-abundances of Warm-water, and Macrohabitat Generalist species.
- Artificially impounded areas contained fish community structures that deviated drastically from TFC conditions and accounted for the majority of non-native fish species collected within the Lamprey River.


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
8%
14%
60%
13%
McCallen Dam
Wiswall Dam
Section8
Section7
Section6
Section5
Secton4
Section3
Section2
Section 1
Proportion of Fish Captured
Each Section Accounted for
Porportion of Non-native Fish Captured
Each Section Accounted for


Questions?
Richard Lord, Lamprey River Advisory Committee