

# **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

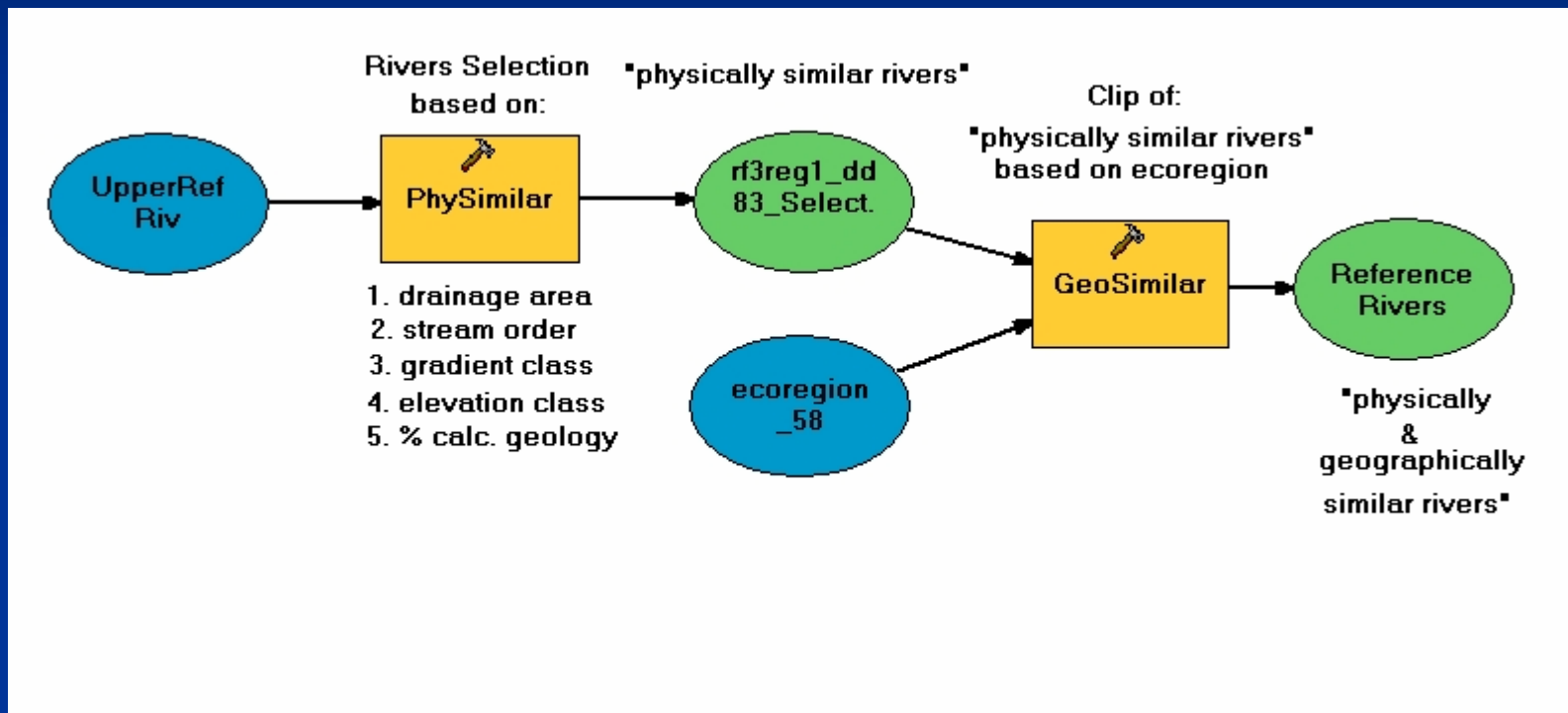
# Target Fish Community (TFC) Models

- 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

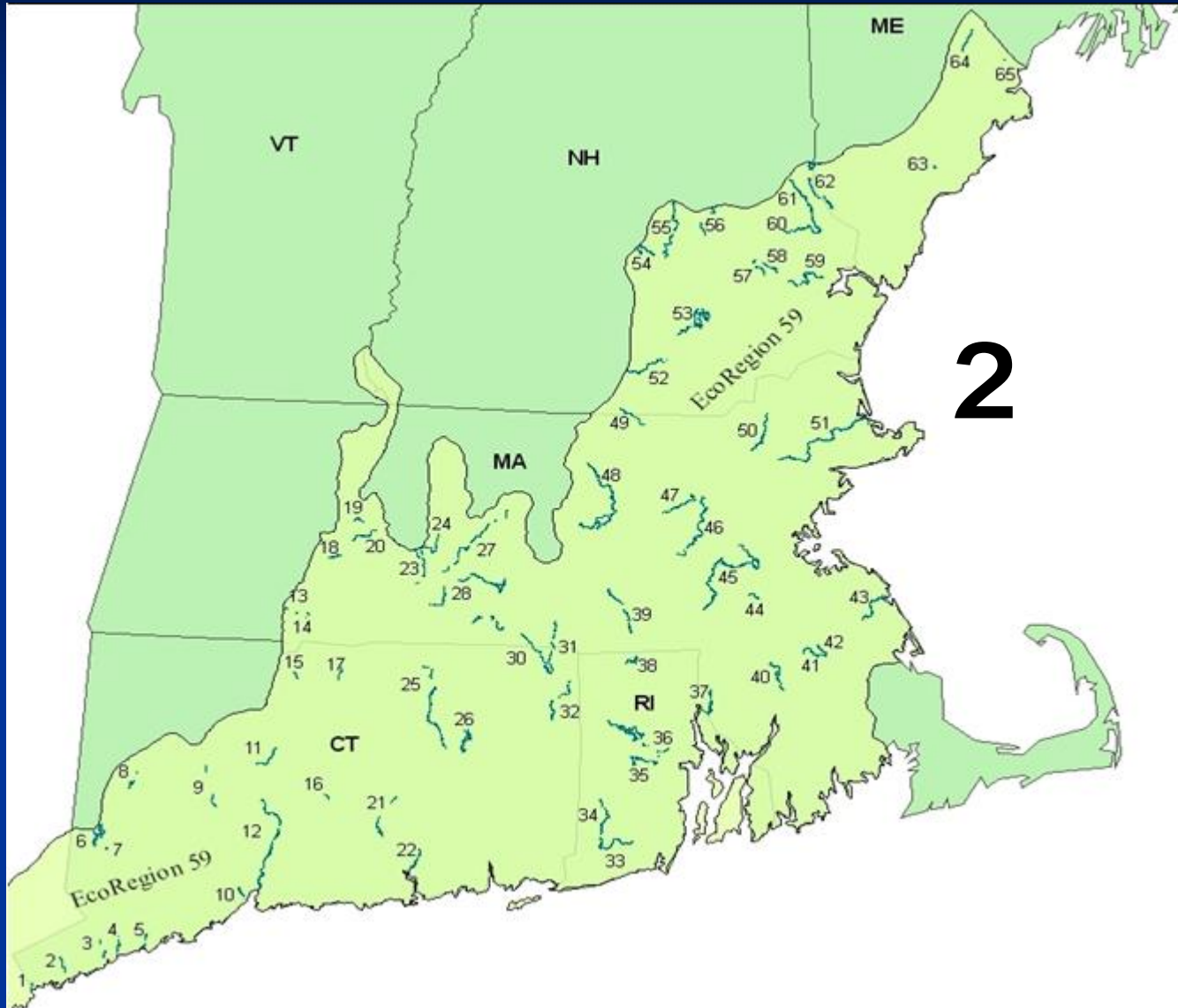
# Reference River Selection Model Schematic



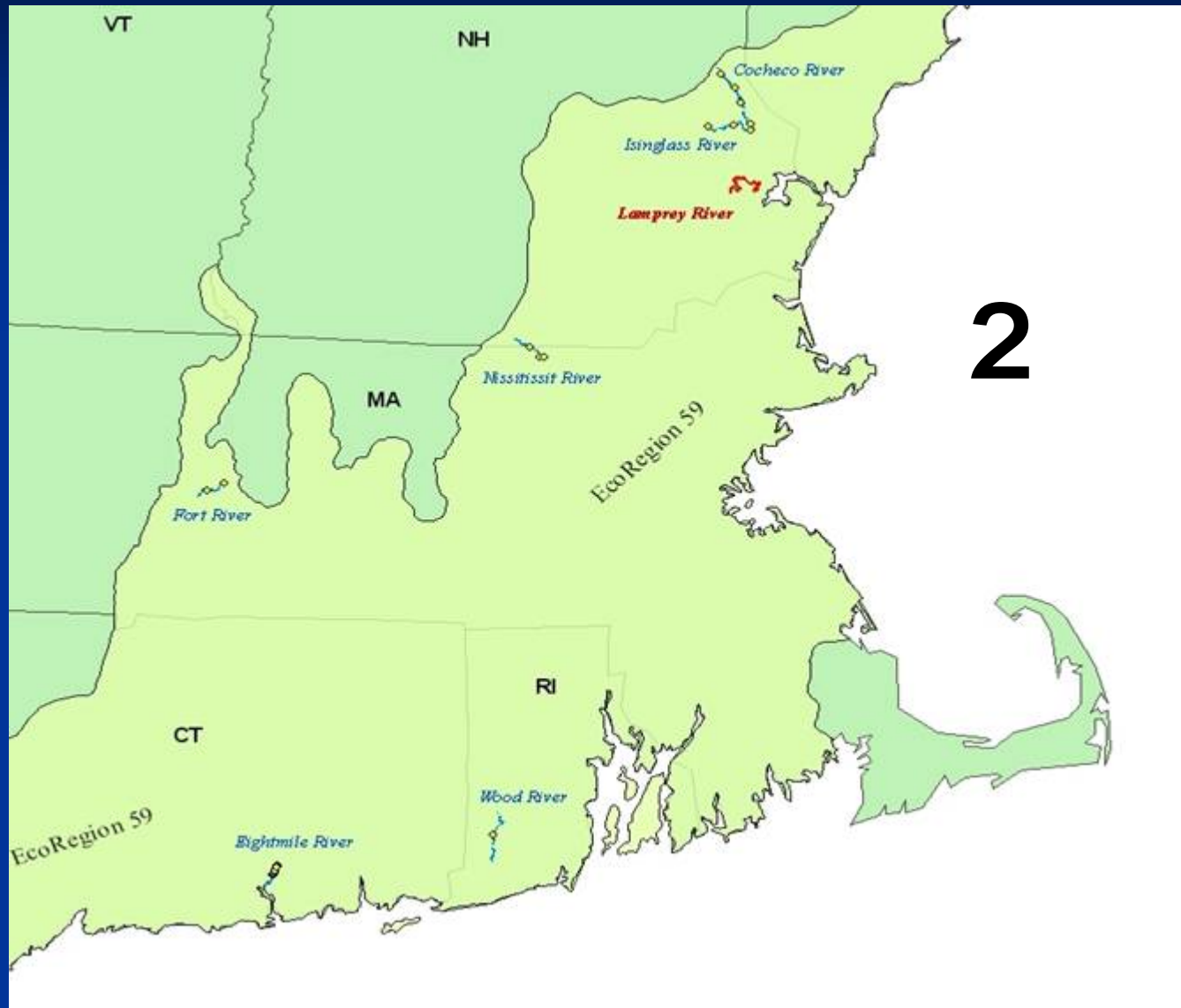
# Reference River Selection Criteria Parameters:

- 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)

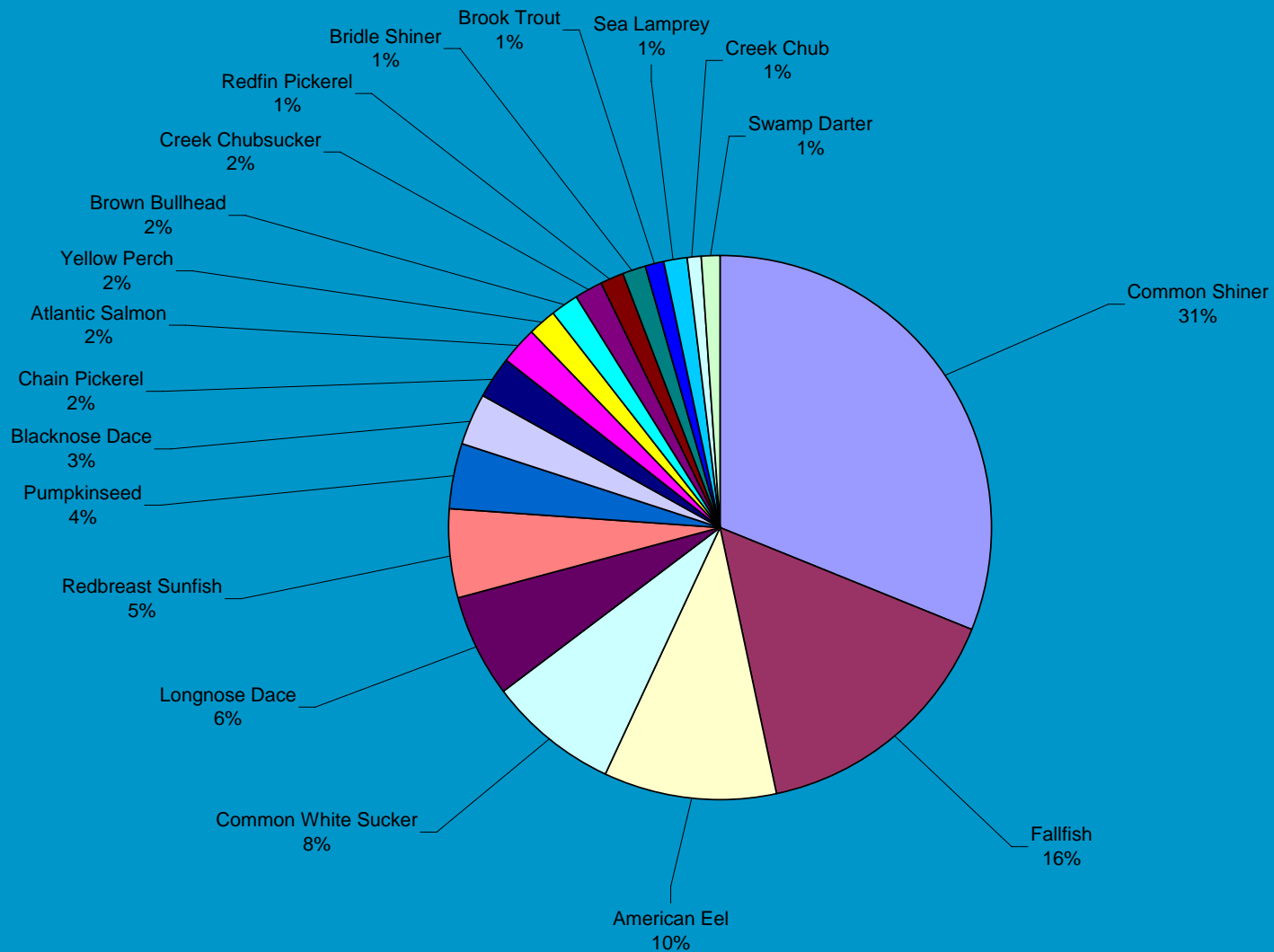
# Potential Lamprey Reference Rivers



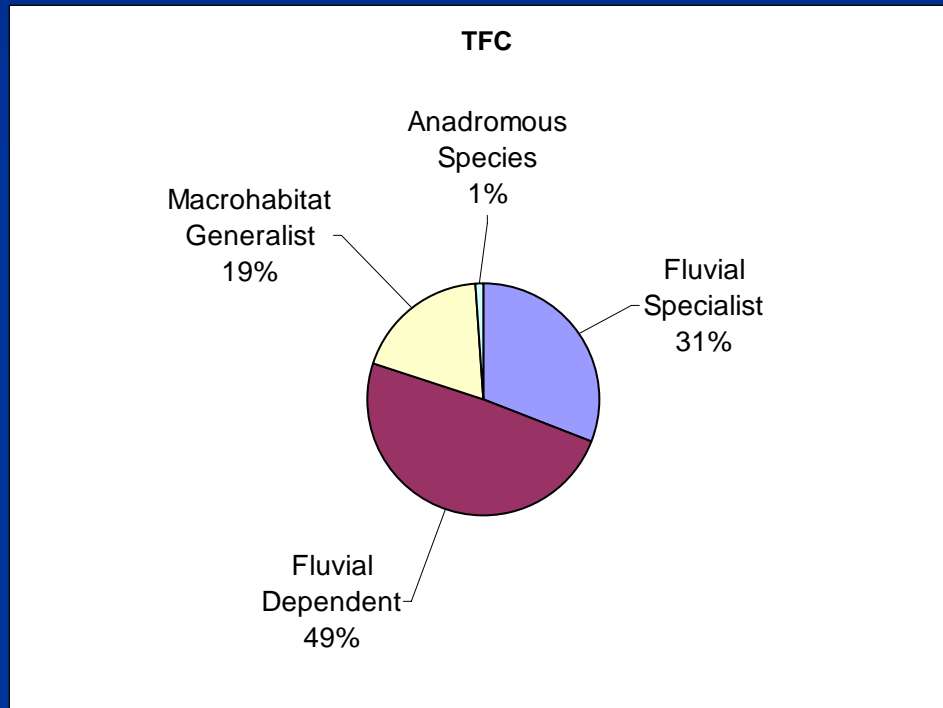
# Selected Lamprey Reference Rivers



# Lamprey River TFC

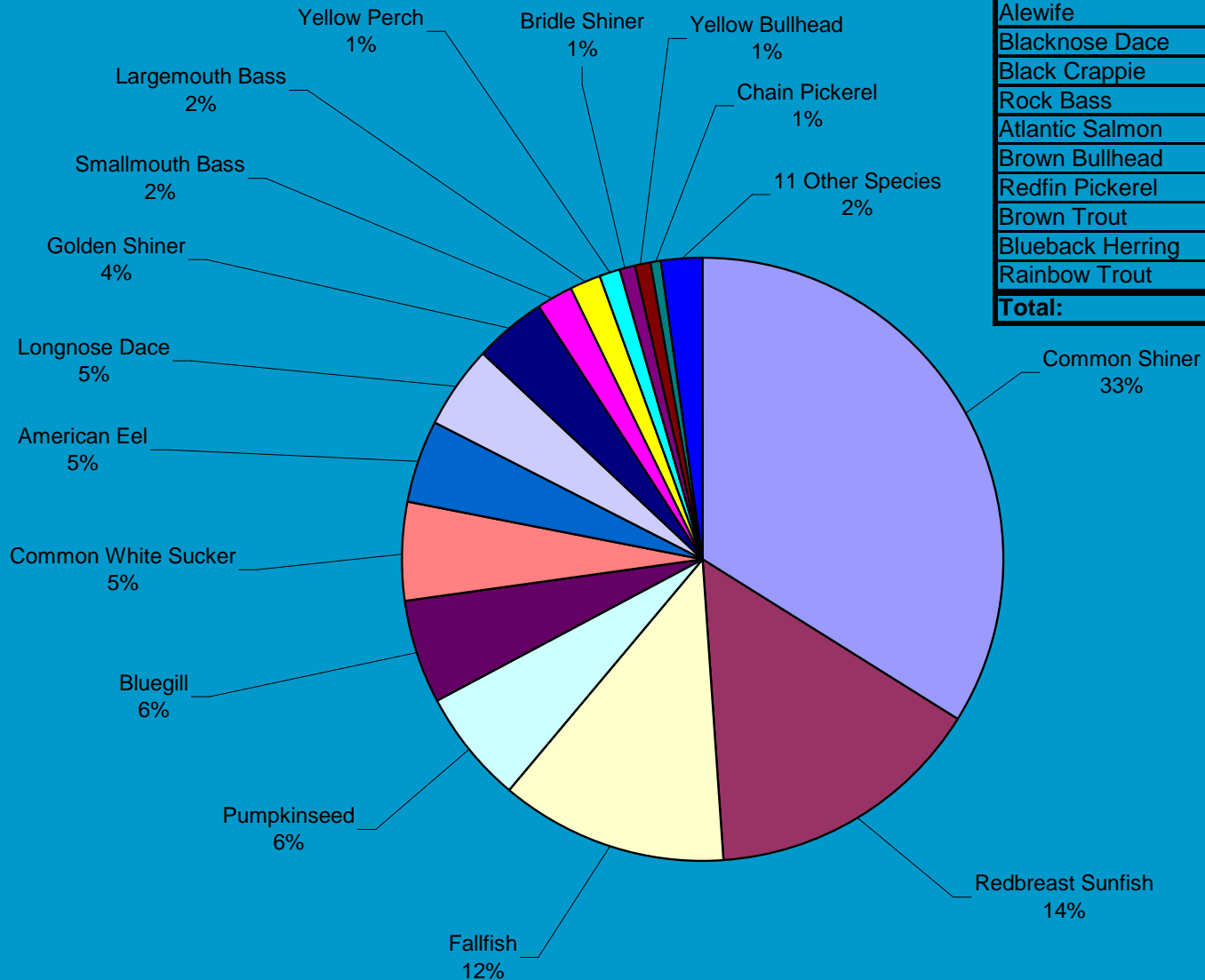


# Lamprey River TFC Habitat Use Guild Compositions

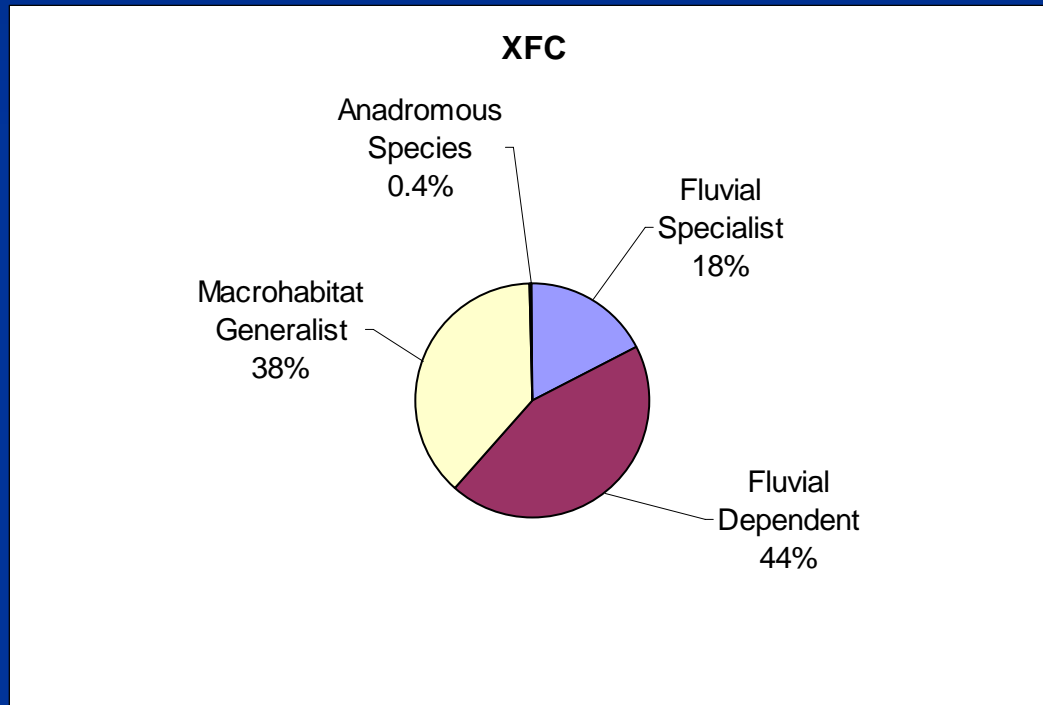


# Lamprey River Existing Fish Community

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
<b>Total:</b>	<b>2%</b>



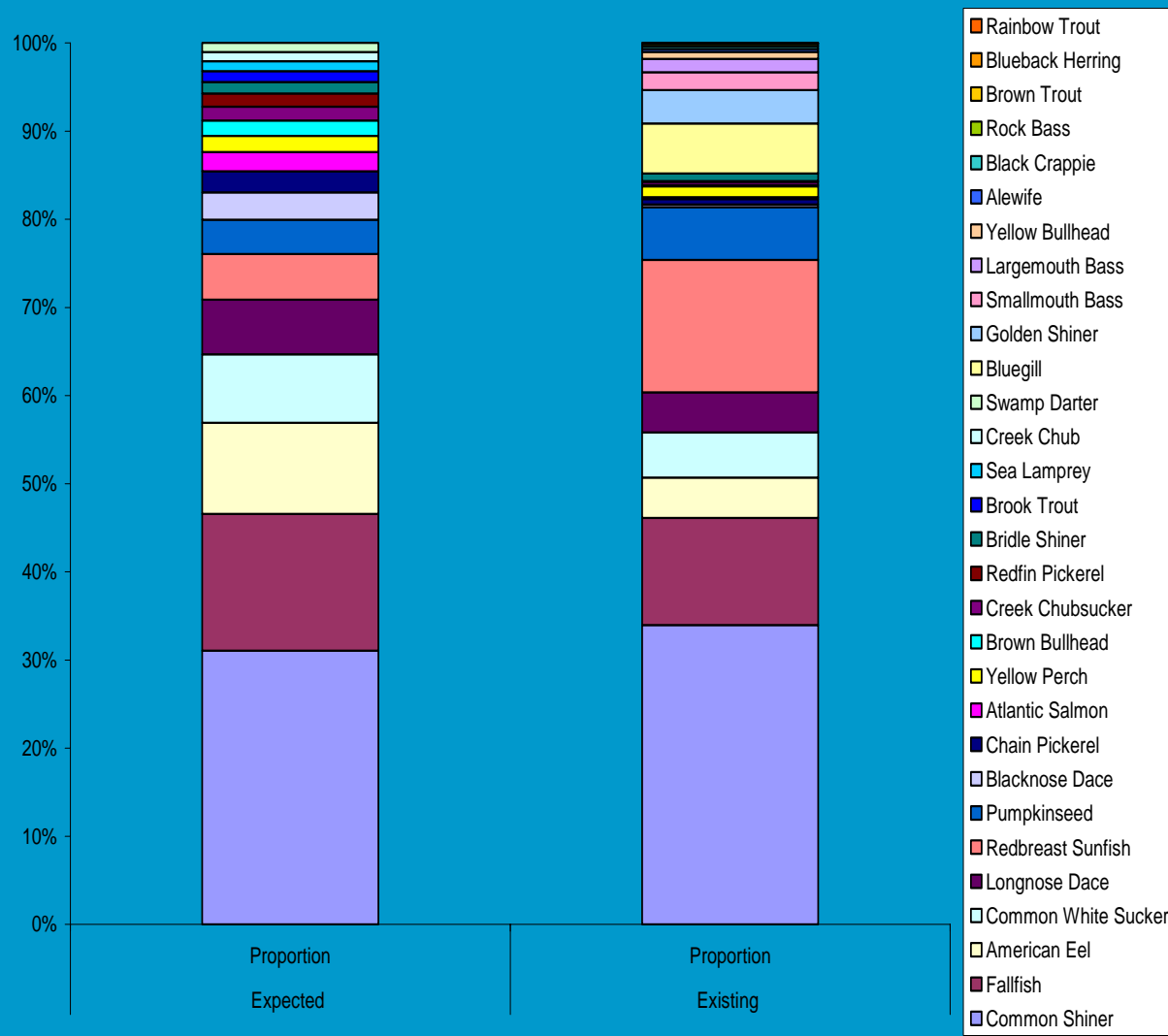
# Lamprey River Existing Fish Community Habitat Use Guilds Composition



# Existing Fish Community Evaluation

- Percent Model Affinity (Novak and Bode 1992)
  - Percent similarity =  $100 - 0.5 (\text{sum } |t P - e P|)$
  - 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:

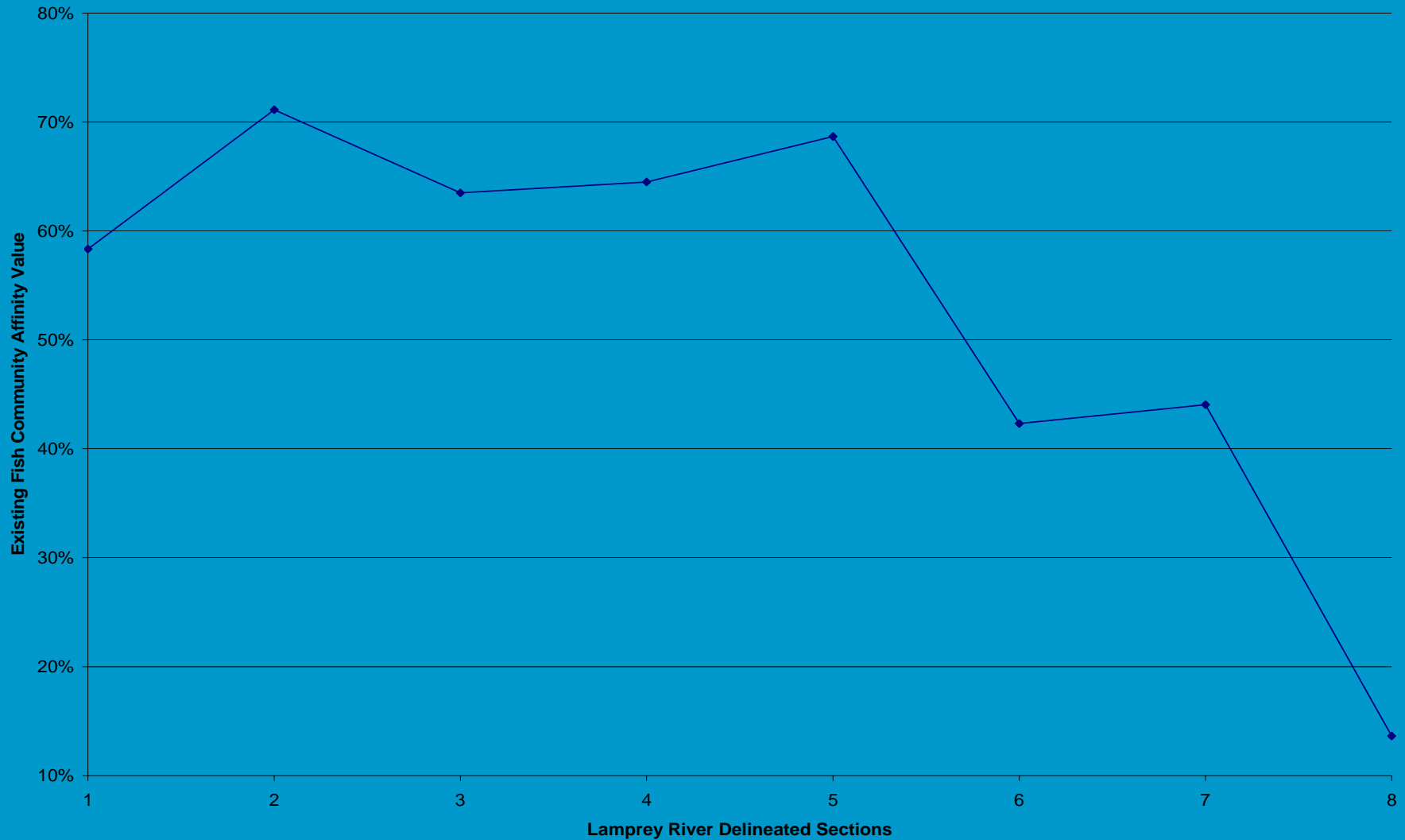
■ Upper Souhegan

■ 61%

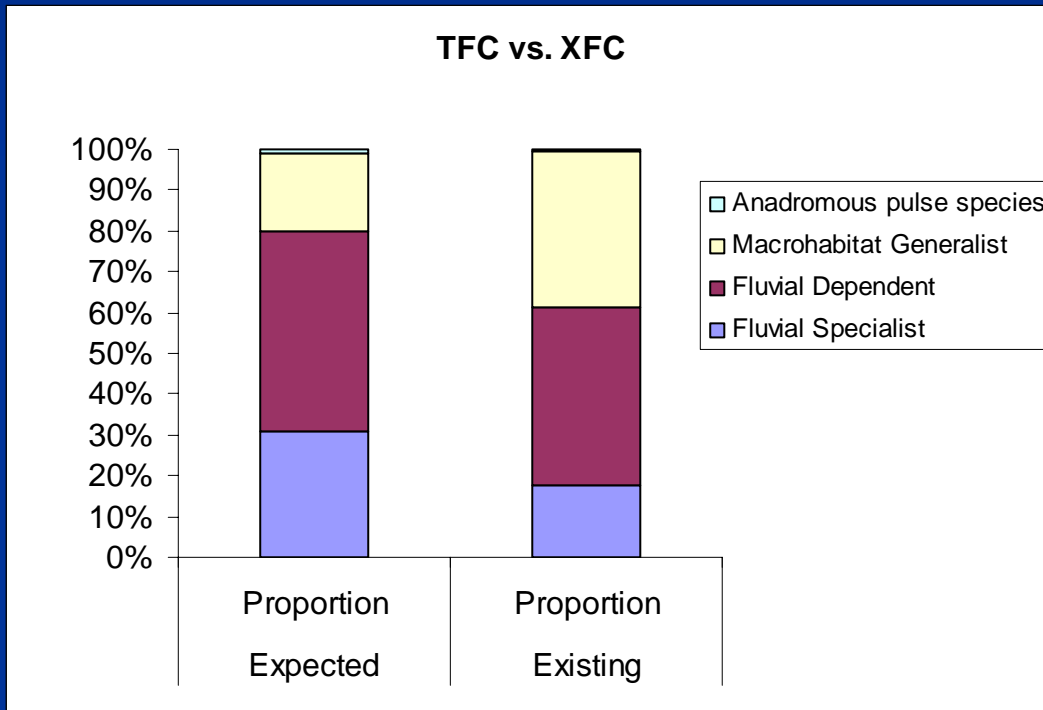
■ Lower Souhegan

■ 54%

# Lamprey River Affinity by Study Section

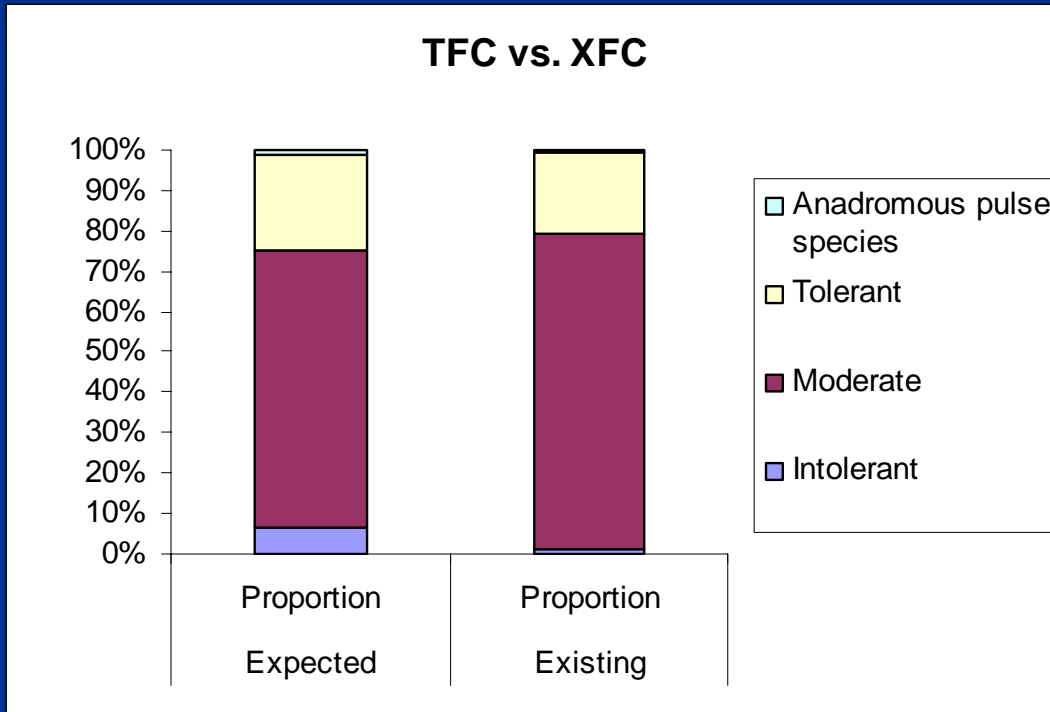


# Habitat Use Classification Comparison



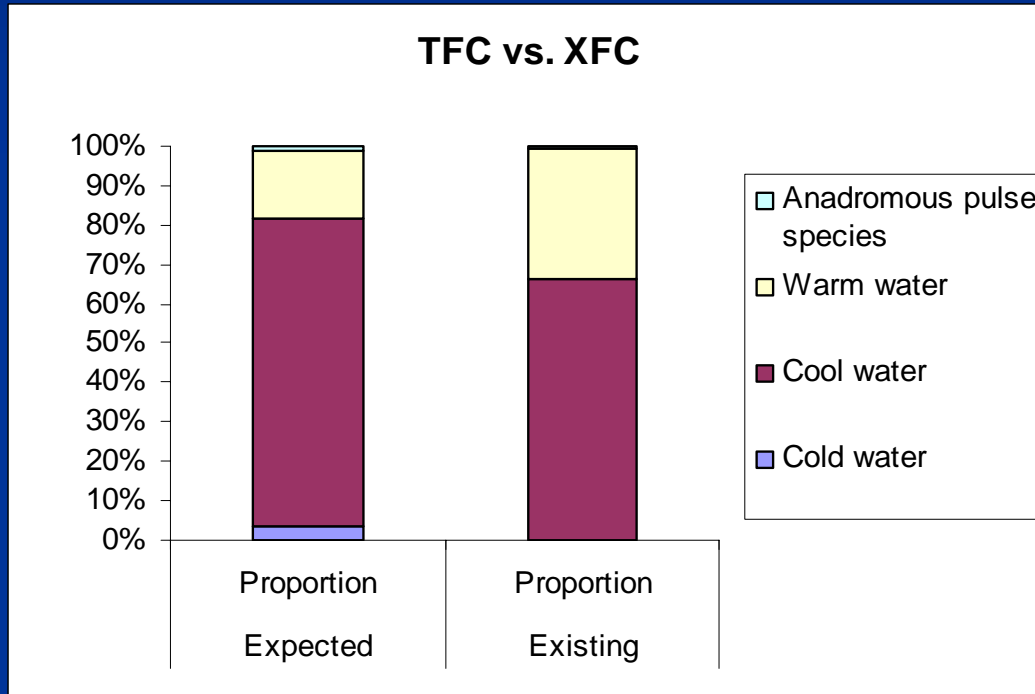
- 80% Affinity
- Over-abundance of Macrohabitat Generalists
  - TFC = 19%
  - XFC = 38%

# 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

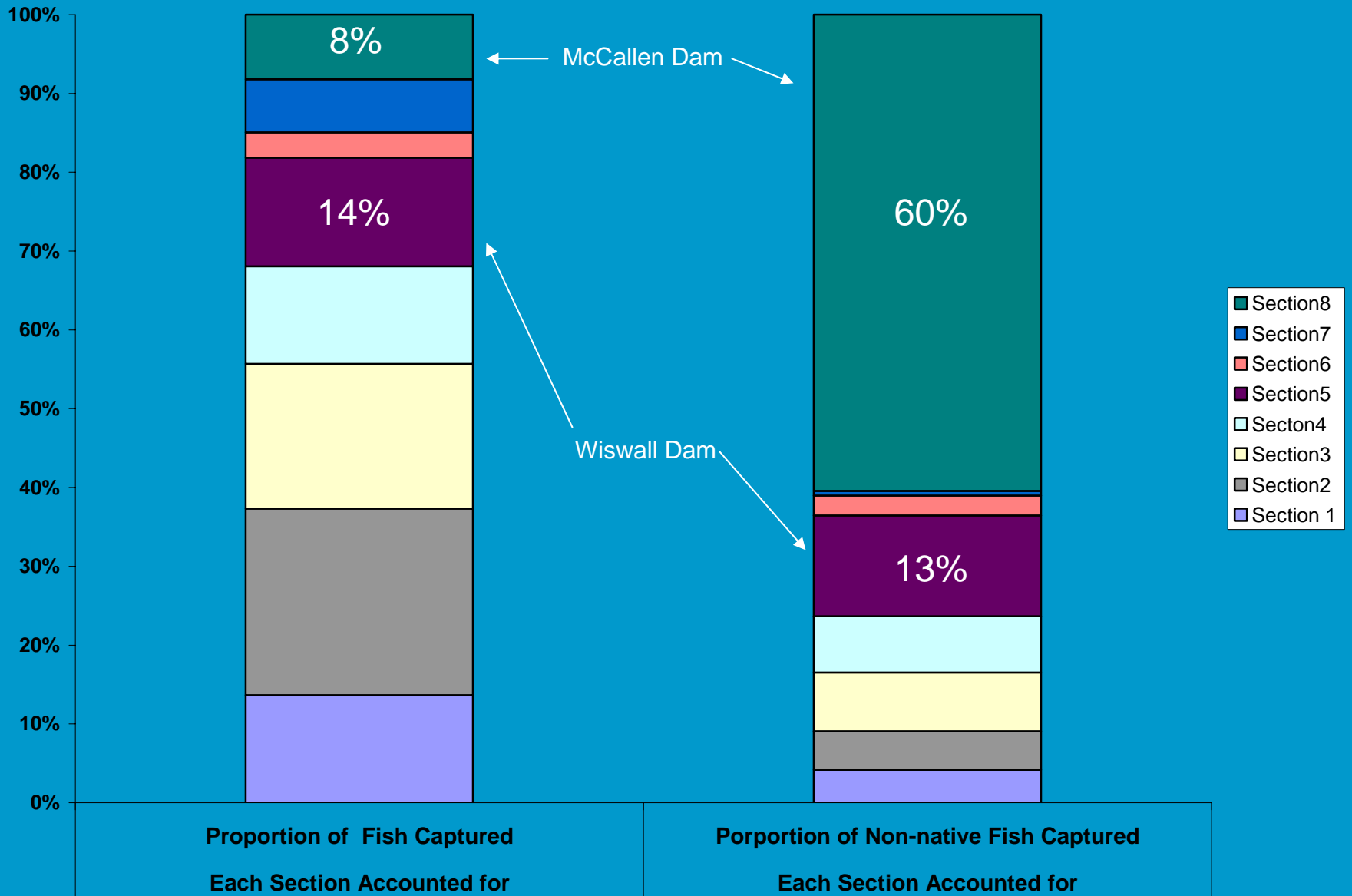
# Lamprey River Species Comparison Table

Species	Proportion of Target Fish Community	Proportion of Existing Fish Community	Percent Deviation	Native or Introduced	Habitat use Classification	Pollution Tolerance	Thermal Regime
<b><i>Underrepresented fish species</i></b>							
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
<b><i>Fish species recorded as expected</i></b>							
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
<b><i>Overly abundant fish species</i></b>							
Redbreast Sunfish	5%	15%	190%	N	MG	M	Warm
Pumpkinseed	4%	6%	54%	N	MG	M	Warm
<b><i>Missing fish species</i></b>							
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
<b><i>Introduced species present within the existing fish community (considered overly abundant)</i></b>							
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
<b><i>Native fish species currently or historically present within the Lamprey River missing from the Target Fish Community</i></b>							
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



# Questions?

