

Appendix 7

Fish Data

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Fish Community Survey

Fish were sampled within the designated river sections to assess the status of the fauna communities. The Rushing Rivers Institute conducted fish collections in August 2008. A total of 178 grids were sampled for fish in eight sites upstream of Route 12 in Wekepeke Brook. Fish samples were not taken at mapping Site 1, due to the headwater characteristics of the segment, including a stream width that measured less than a standard grid size in some locations. The data was used to develop the existing fish community and as a validation of the habitat model outputs. A Target Fish Community was developed describing the native composition and proportions of the fish fauna that should be expected in the Wekepeke Brook under unimpaired conditions. Fish collections from other similar rivers were selected from rivers with the least evidence of impairment and of similar nature to the Wekepeke Brook to determine the Target Fish Community. Comparisons between the existing and expected fish communities of the Wekepeke Brook study area were then made.

Target Fish Species and Community Development

Target Fish Community (TFC) models have been utilized within instream flow related studies on multiple rivers in Southern New England since Bain and Meixler's initial development and application of the methodology on the Quinebaug River (2000). The purpose of this model is to define the expected structure of the native fish community as a baseline for comparison of species compositions within the existing fish community of a study stream. Successful applications of the approach to assess the status of native fish communities on the Quinebaug, Ipswich, Assabet, Charles, Housatonic, Pomperaug, Souhegan, and Eightmile Rivers (Armstrong *et al.*, 2001; Bain and Meixler, 2000; Lang *et al.*, 2001; Kearns *et al.*, 2005; Legros 2007a, Legros, 2007b; Meixler, 2005; Parasiewicz *et al.*, 2007b; Parker *et al.*, 2004) have proven the effectiveness of TFC models as fish community assessment tools. The increasing use and acceptance of this methodology and similar methods are indicative of the significance of using fish communities to assess the biological integrity of aquatic systems (Karr, 1981, Fausch *et al.*, 1990, Hughes, 1995, Halliwell *et al.*, 1999).

The development of a TFC is dependent upon the use of fish data from several ecologically healthy Reference Rivers that are physically and zoogeographically similar to a study river. While it is essential that the ecological condition of these rivers exceeds that of the study river, most still exhibit a certain degree of habitat degradation (**Tables 1 & 2**). Populations of some native fish species that were once common have declined or become extirpated from many of New England's rivers and streams as a result of centuries of anthropogenic impacts. In other words, neither "pristine rivers" nor "pristine fish assemblages" currently exist throughout much of New England. Consequently, many potential Reference Rivers within this region exhibit incomplete fish communities. Due to the absence or under-representation of some species within many Reference Rivers, TFC models are not always able to account for appropriate proportions of all species.

Table 1: Reference River Sites.

River	Agency	Site I.D.
Little Cohas Brook	NH DES	00M-50
Bassett Brook	MADFW	1688, 1804
Asnebumskit Brook	MADFW	1233, 1234, 1235, 1236, 1237, 1238, 1602
Oyster Brook	NH DES	2007-511, 615, 702, 703, 709, 713
Chelsey Brook	NH DES	2006-413, 914, 20070510

Table 2: Reference River Selection Criteria

Reference River Selection Criteria	
Characteristic	Class
Stream Order	2
Size Class	1
Elevation Class	1
Gradient Class	2
Chemical Class	2
Level III Ecoregion	5

In order to completely evaluate the existing fish community and guide future restoration efforts within the Watershed, it is important that TFC models developed for the watershed account for appropriate proportions of all fish species, which were historically present within the watershed. This includes species that are no longer present or are under-represented. The estimates of the proportions of these species developed in collaboration with local fish biologists are then incorporated into what we call Reference Fish Community (RFC) models.

A RFC was developed to assess the expected fish community of the Wekepeke Brook and identify indicator fish species for a MesoHABSIM model (Parasiewicz 2001 and 2007). Defining the RFC model was an interactive process that required direct input from two local fisheries experts John A. Magee and Neal Hagstrom. The New Hampshire Department of Environmental Protection and the Massachusetts Department of Fish and Wildlife provided Reference River fisheries data used to calculate the RFC model.

Results

Existing Fish Community

This study found twelve fish species from six families occurring, currently, within the Brook. As no surveys of the Wekepeke Brook had been completed prior to 2008, these totals were based on the Rushing Rivers Institute collection records. These species were compiled into a table organized by taxonomic classes (**Table 3**). Native or introduced status, habitat use, pollution

tolerance, and thermal regime classifications were determined for each species. The assemblage contains a variety of species, both native and introduced, with a wide range of habitat use, pollution tolerance, and thermal regime classifications. Out of 1,725 fish, 84 were juveniles at an equivalent of 4.9% proportion of all fish sampled. The Biomass measured for coldwater species was equivalent to 1.82 g/m².

Table 3: Expected fish species of the Wekepeke Designated River.

Native (N) or introduced (I) statuses, fluvial specialist (FS), fluvial dependent (FD), or macrohabitat generalist (MG) habitat use classifications, intolerant (I), moderately tolerant (M), or tolerant (T) pollution tolerances, and cold, eurythermal, or warm water thermal regime tolerances are given for each species.

FAMILY	Genus	Species	Native or Introduced	Habitat Use Classification	Pollution Tolerance	Thermal Regime	Distribution match?
Common name							
Salmonidae							
Brook trout	<i>Salvelinus</i>	<i>fontinalis</i>	N	FS	I	Cold	Yes
Escocidae							
Chain pickerel	<i>Esox</i>	<i>niger</i>	N	MG	M	Warm	Yes
Cyprinidae							
Common shiner	<i>Notropis</i>	<i>cornutus</i>	N	FD	M	Eurythermal	Yes
Golden shiner	<i>Notemigonus</i>	<i>crysoleucas</i>	N	MG	T	Eurythermal	Yes
Blacknose dace	<i>Rhinichthys</i>	<i>atratus</i>	N	FS	T	Eurythermal	Yes
Longnose dace	<i>Rhinichthys</i>	<i>cataractae</i>	N	FS	M	Eurythermal	Yes
Catostomidae							
Common white sucker	<i>Catostomus</i>	<i>commersoni</i>	N	FD	T	Eurythermal	Yes
Ictaluridae							
Brown bullhead	<i>Ameiurus</i>	<i>nebulosus</i>	N	MG	T	Warm	Yes
Centrarchidae							
Pumpkinseed	<i>Lepomis</i>	<i>gibbosus</i>	N	MG	M	Warm	Yes
Percidae							
Yellow Perch	<i>Perca</i>	<i>flavescens</i>	N	MG	M	Eurythermal	Yes

Wekepeke Target Fish Community

Overall, Wekepeke Brook exhibited a fish community that was not similar to the Target Fish Community (TFC) (**Table 4**). A comparative evaluation of the two communities using the percent model affinity approach (Novak and Bode, 1992) yielded a 35% affinity index value. Major differences between the two communities were illustrated by an under-abundance or lack of several common regional species in the Wekepeke Brook. Additionally, major differences from expected TFC proportions were revealed by the dominance of fluvial specialist species and a bare presence of fluvial dependent and macrohabitat species within the existing fish community. In addition, there was a notable deviation between the expected and observed proportions of moderately pollutant tolerant (M) and Intolerant (I) species. Most of the M species comprising the TFC were underrepresented at the Wekepeke sites. The analysis suggests that the designated Wekepeke River may be affected by poor water quality conditions conducive to supporting warm-water, pollution tolerant species and limiting macrohabitat generalist species and cold-water species. Based on the overall dissimilarity of the existing fish community to the TFC, the biological integrity of the designated River appears to be impaired.

Table 4. Wekepeke Brook existing fish community data.

Common Name	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Existing Proportion
Blacknose Dace	202	124	280	371	88	256	144	85%
Brook trout	4	2	6	4	1	8	26	3%
Brown bullhead	5	1	1					<1%
Brown trout	1		2			2		<1%
Chain pickerel	1							<1%
Golden shiner	16	3		2	1		2	1%
Goldfish	1							<1%
Green sunfish	1							<1%
Largemouth bass	1	1	1	2				<1%
Longnose dace	6	1	5	14	20	26	16	5%
White sucker	2	2	10	27	2	13	20	4%
Pumpkinseed							1	<1%

Table 5: Definition of the Wekepeke Designated River TFC as calculated from the rankings of the reference river fish species native to the Lamprey watershed.

Fish Name	Expected		Observed		% Deviation	
	Mean Rank	Expected %	Mean Rank	Observed %		
Blacknose dace		2	20.00	1	85.00	325.00
Common white sucker		3	14.00	3	4.00	71.43
Common shiner		8	5.00	0	0.00	100.00
Longnose dace		6	7.00	2	5.00	28.57
Brook trout		1	41.00	4	3.00	92.68
Pumpkinseed		10	4.00	11	0.50	87.50
Yellow Perch		14	3.00	0	0.00	100.00
Chain pickerel		13	3.00	10	0.50	83.33
Brown bullhead		19	1.00	6	1.00	0.00
Golden shiner		18	2.00	5	1.00	50.00

Percent deviation was calculated for each species to document under-represented species, over-represented species, and species found in proportions similar to expected proportions (Table 5). A degree of deviation of 50% or greater was arbitrarily selected to indicate an apparent and substantial departure from expected (TFC) proportions. Species with observed proportions deviating by more than 50%, either less or greater than the expected (TFC) proportions, were considered under-represented or over-abundant, respectively.)

Those species present in the Wekepeke Brook falling within expected proportions include the Longnose Dace and Brown Bullhead species. The analysis showed numerous under-represented species; the Common White Sucker, Eastern Brook Trout, Pumpkinseed, Chain

pickerel, and Golden Shiner species. Two species within the TFC community were missing from the Wekepeke Brook, the Common Shiner and Yellow Perch. The only overly abundant species is the Blacknose Dace with a substantial deviation of 325%.

Figures 1 and 2 further demonstrate the differences in abundance for the Targeted Fish Community (TFC) and Existing Fish Community (EFC) for the same species in the Wekepeke.

Figure 1: Wekepeke Designated River TFC

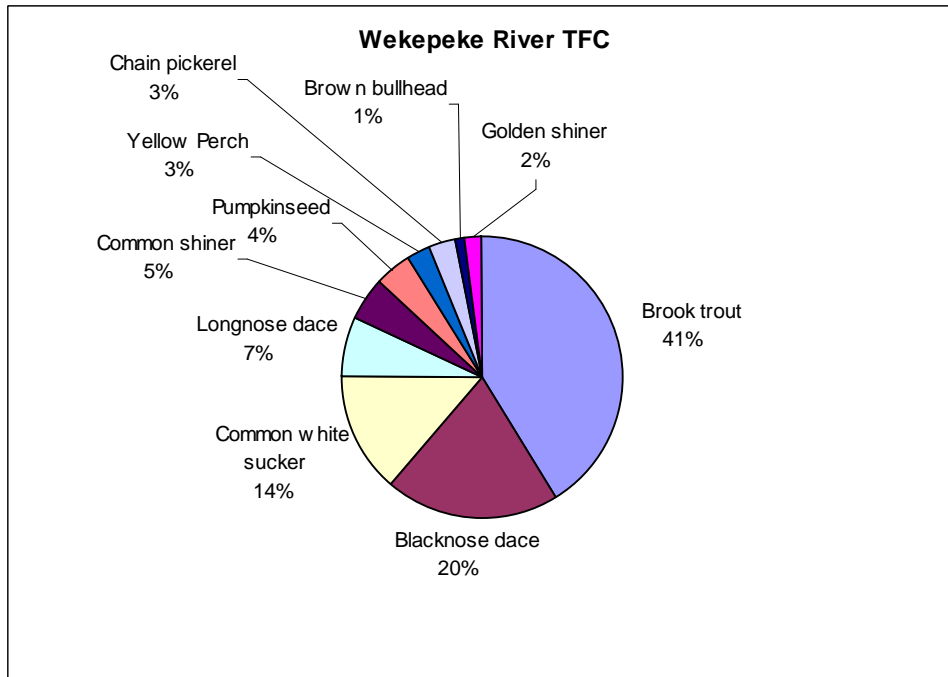


Figure 2: Wekepeke Existing Fish Community

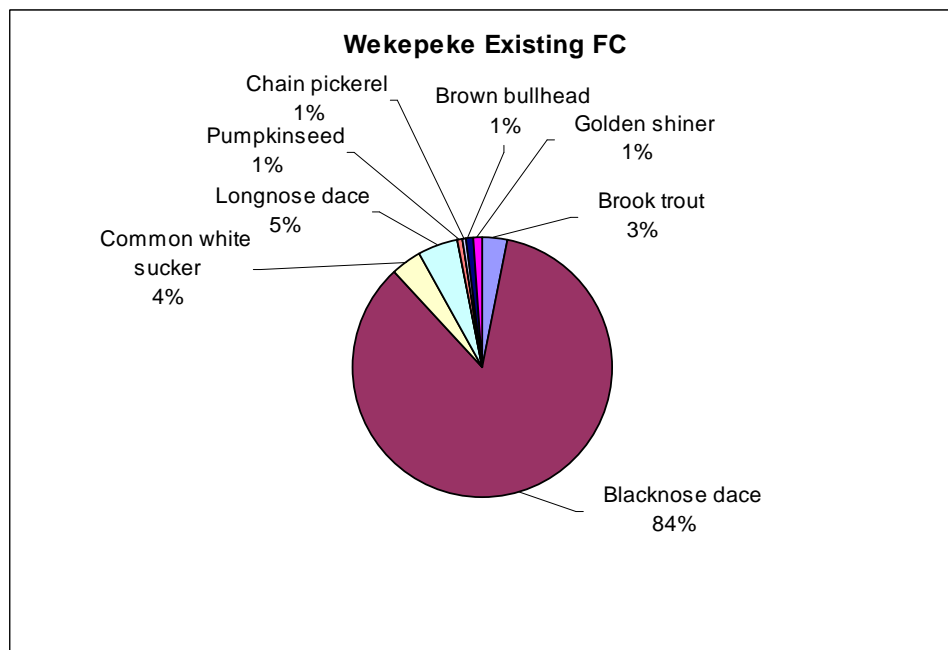


Table 6 and **Figures 3-8** represent the classification guilds of fish in the Wekepeke that are either expected or existing.

Table 6: Comparison of fish classification guilds for the Wekepeke River's TFC and EFC, indicating guild and community absolute differences, community affinity, and guild deviation percentages.

A	Habitat-Use Classification Guild	Expected Proportion	Existing Proportion	% Similarity	% Dev	Absolute Difference
	FS	20.00	85.00	67.50	76.47	65.00
	FD	19.00	4.00	92.50	375.00	15.00
	MG	61.00	11.00	75.00	454.55	50.00
	Total	100.00	100.00			130.00
	% affinity					35
B	Pollution Tolerance Classification Guild	Expected Proportion	Existing Proportion	% Similarity	% Dev	Absolute Difference
	I	41.00	3.00	81.00	1266.67	38.00
	M	22.00	6.00	92.00	266.67	16.00
	T	37.00	91.00	73.00	59.34	54.00
	Total	100.00	100.00			108.00
	% affinity					46.00
C	Thermal Regime Classification Guild	Expected Proportion	Existing Proportion	% Similarity	% Dev	Absolute Difference
	Cold	41.00	3.00	81.00	1266.67	38.00
	Eurythermal	51.00	95.00	78.00	46.32	44.00
	Warm	8.00	2.00	97.00	300.00	6.00
	Total	100	100			88.00
	% affinity					56

Figure 3: Wekepeke River TFC composition by habitat-use classification guilds.

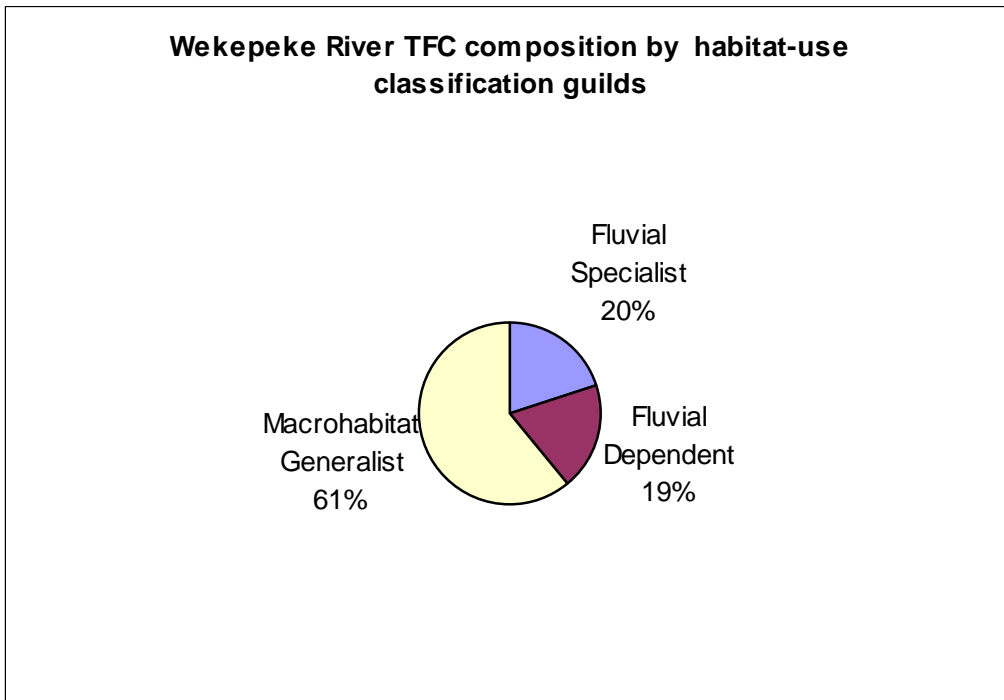


Figure 4: Wekepeke River Existing Fish composition by habitat-use classification guilds.

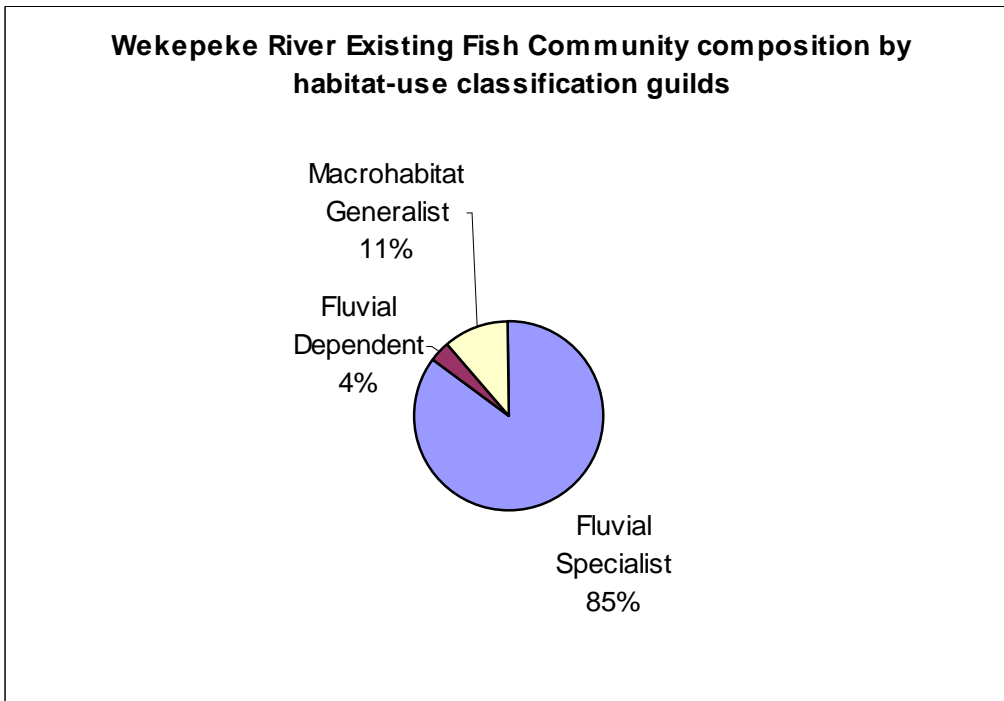


Figure 5: Wekepeke River TFC composition by tolerance classification guilds.

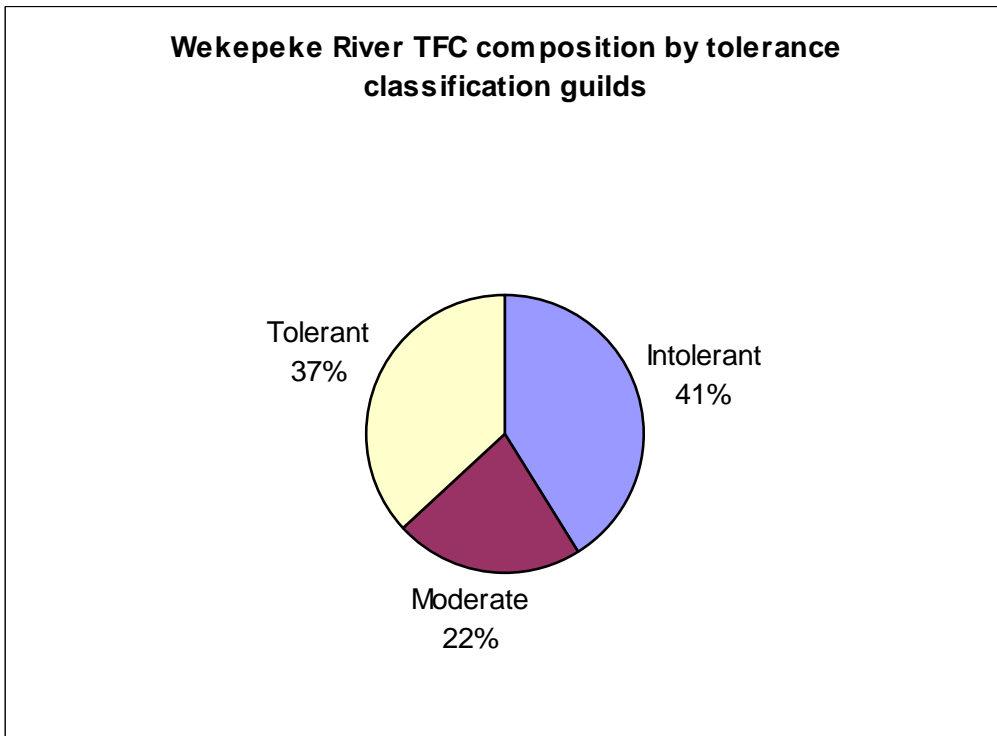


Figure 6: Wekepeke River Existing Fish Community composition by tolerance classification guilds.

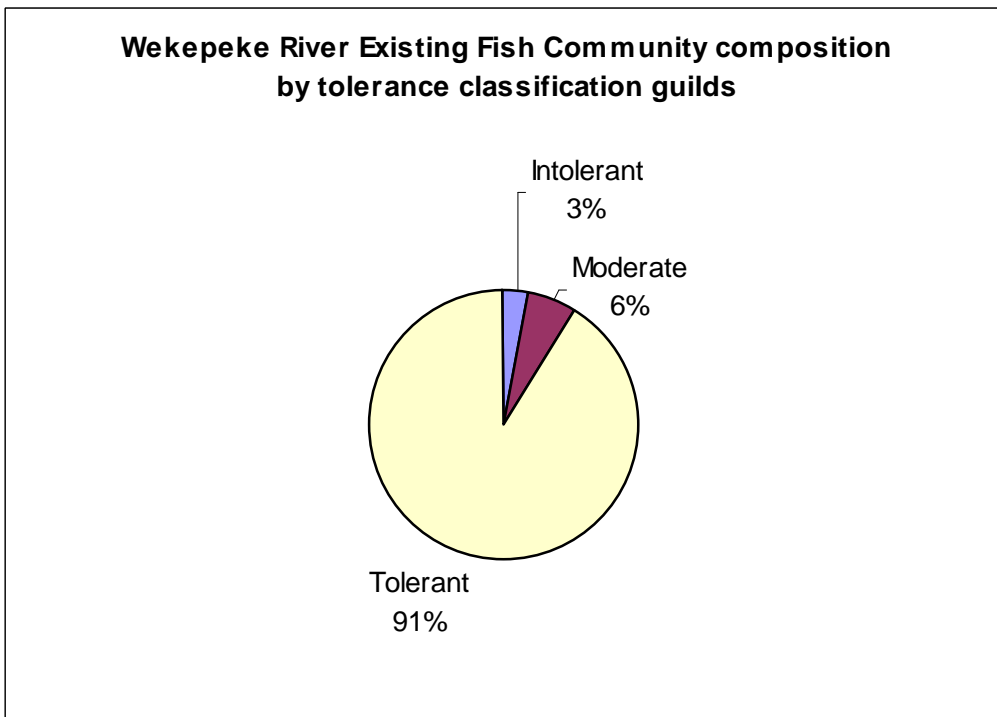


Figure 7: Wekepeke River TFC composition by thermal regime classification guilds.

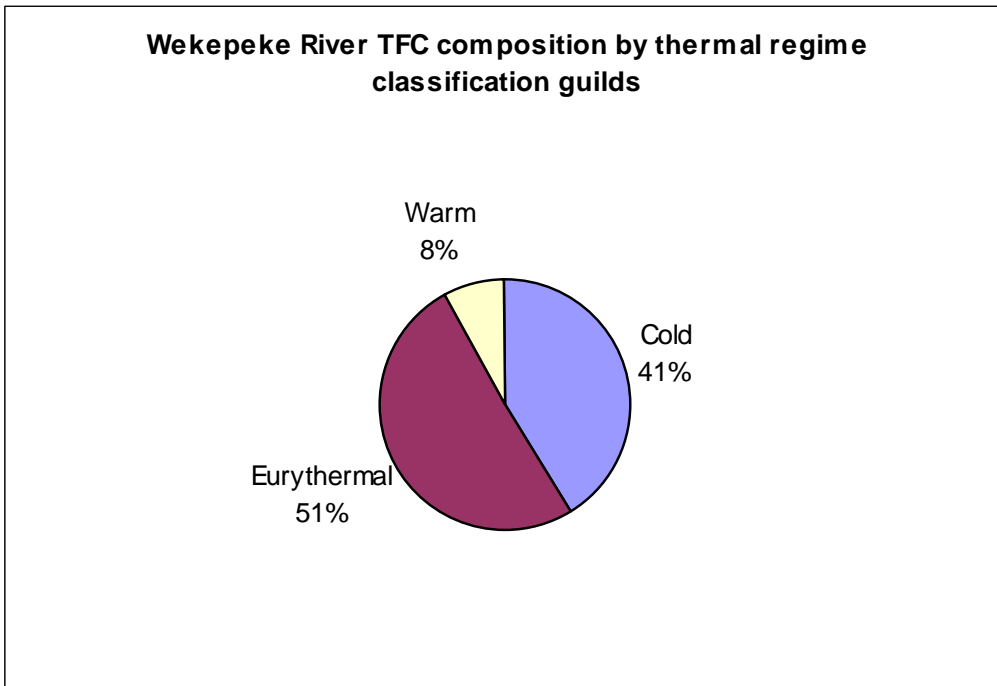


Figure 8: Wekepeke River Existing Fish Community composition by thermal regime classification guilds.

