Stream Depletion Method

A Method to set Environmental Flows for Groundwater Withdrawals

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RIDEM

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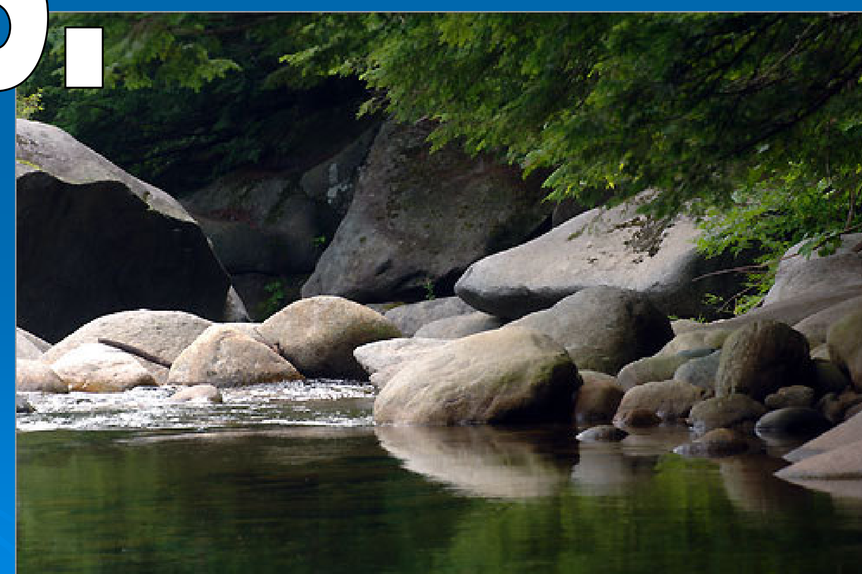
- EPA – Ralph Abele
- TNC – Mark Smith
- RI Coalition for Water Security
- USGS – Freeman and Marcinek

VS.



VS.

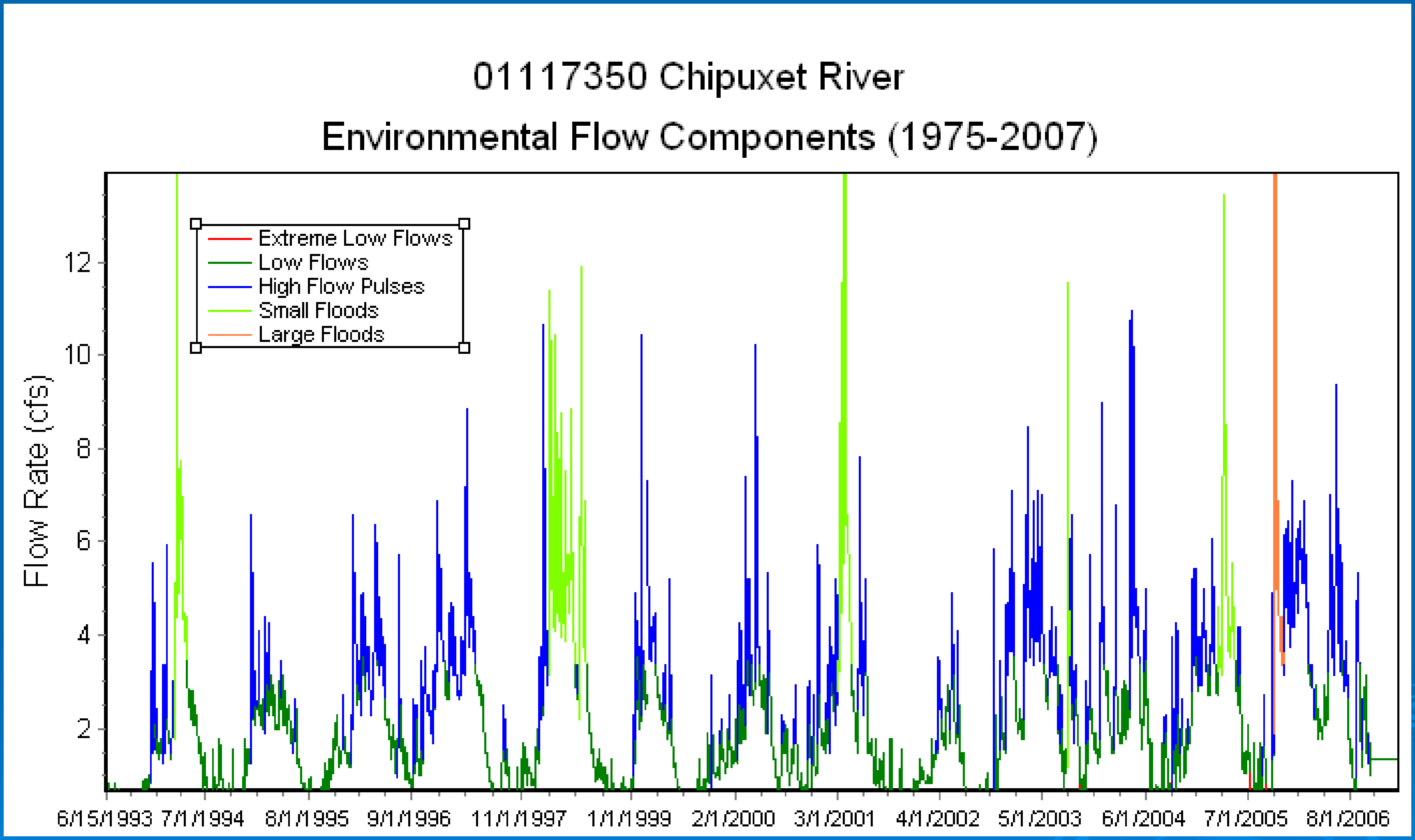
Sustainable Water Resources

Sustainability = Healthy Rivers

- Healthy Oceans
- Healthy Land Ecosystems
- Waste assimilation
- Recreation
- Manufacturing and businesses
- Sustainability for Future Generations

- **§ 46-15-1 Legislative declaration. –** The general assembly hereby finds and declares that:
- (2) In recent years it has become increasingly apparent that water supply management, protection, development, and use must be fully integrated into all statewide planning, and rivers and watershed planning and management processes, and that the allocation of the state's water resources to all users, purposes, and functions, including water to sustain our natural river and stream systems and natural biotic communities, must be equitably decided and implemented under a process which emphasizes efficiency of use and management, minimization of waste, protection of existing supplies, demand management, drought management, conservation, and all other techniques to ensure that our water resources serve the people of Rhode Island for the longest time, in the most efficient use, and in an environmentally sound manner;

Scituate Reservoir – SY 92MGD


01117350 Chipuxet River
Environmental Flow Components (1975-2007)
Extreme Low Flows
Low Flows
High Flow Pulses
Small Floods
Large Floods
Flow Rate (cfs)
12
10
8
6
4
2
6/15/1993
7/1/1994
8/1/1995
9/1/1996
11/1/1997
1/1/1999
2/1/2000
3/1/2001
4/1/2002
5/1/2003
6/1/2004
7/1/2005
8/1/2006

Watershed Based Standards for Water Withdrawals

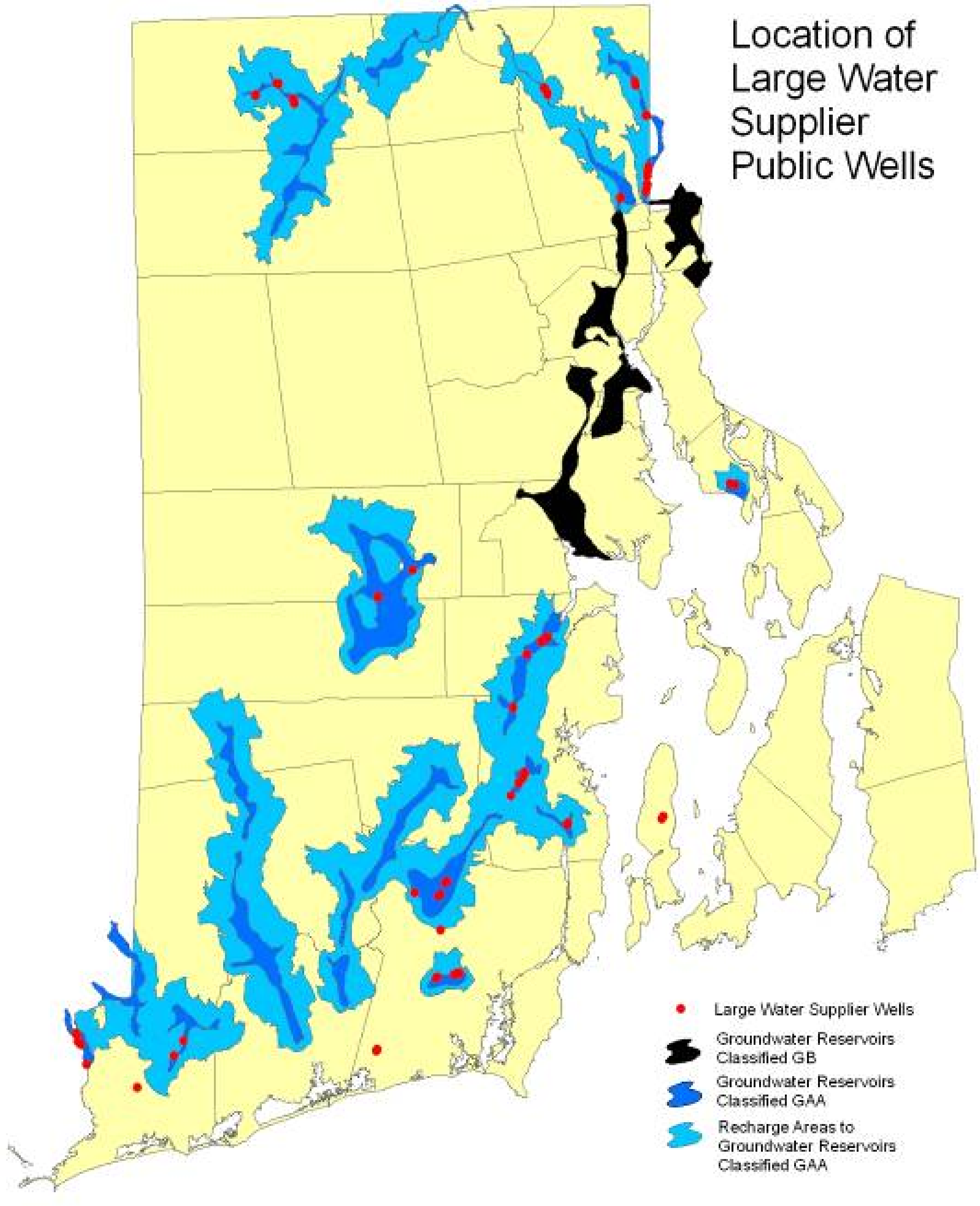
A Different Concept

From Allowable Releases

to

Allowable Withdrawals
(or allowable depletion)

Location of Large Water Supplier Public Wells

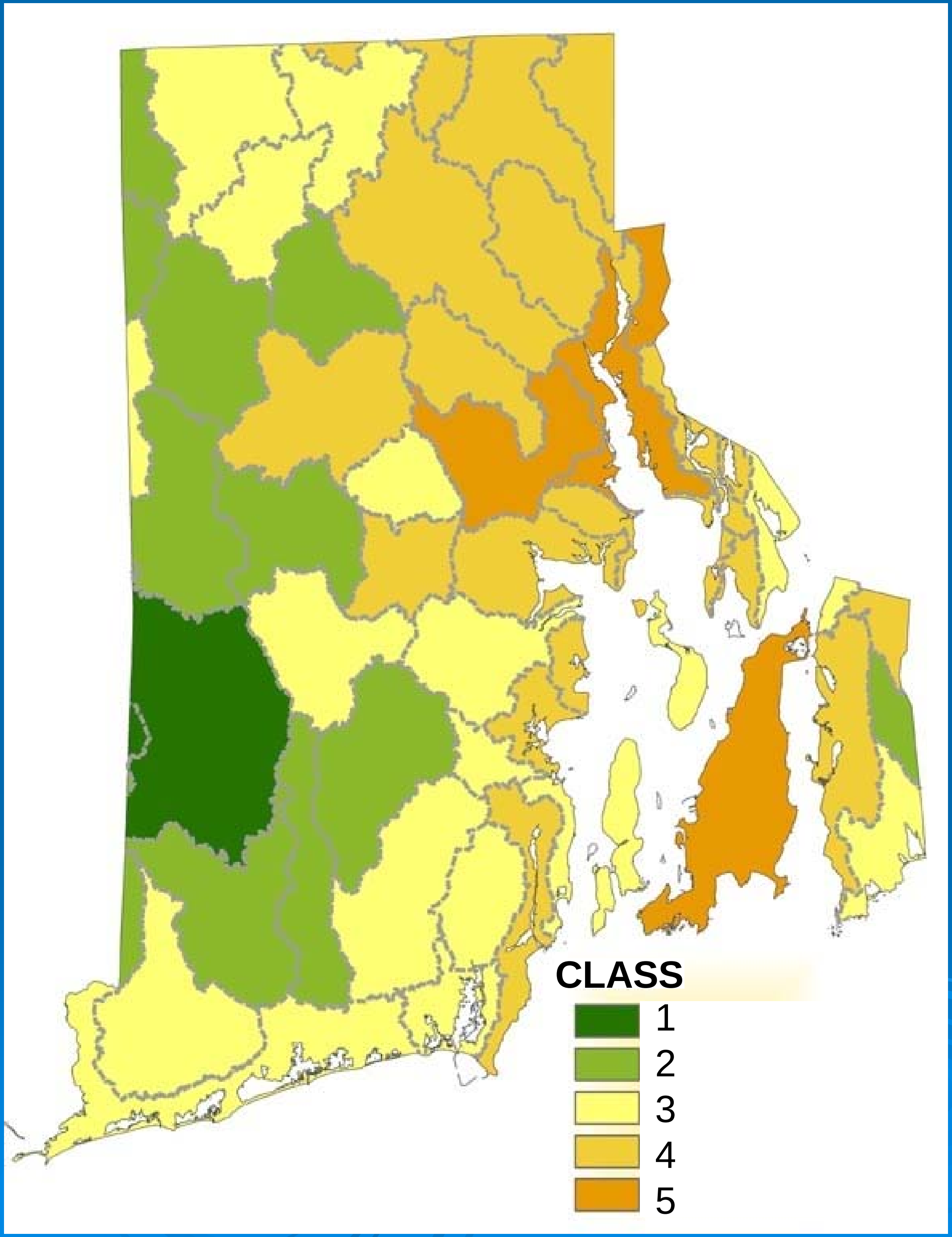


Stream Depletion Method

Step 1 – Classify all Watersheds

Step 2 – Link seasonal flow and ecological needs

Water Withdrawal Classification



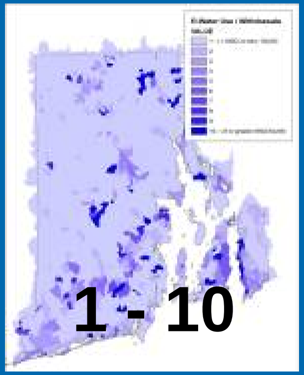
Classification Metrics

Each Watershed Unit is given a value for each metric listed below

Metrics Used to Assign Class
Diversions – Existing water withdrawals
Existing Impervious Cover - Existing Development
Future Impervious Cover - Urban Service Boundary
Existing Conservation Lands - (excluding water supply lands)
Future Conservation Plans – RIDEM, TNC, Land Conservancy, Audubon
Water Quality – Water Quality Standards
Water Supply Land
Farmland
Coldwater Fisheries

For each watershed unit add the Values for each of the nine metrics

Diversions



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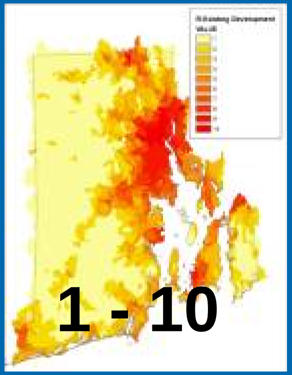
Existing Impervious



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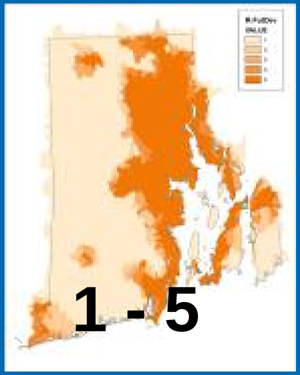
Future Impervious



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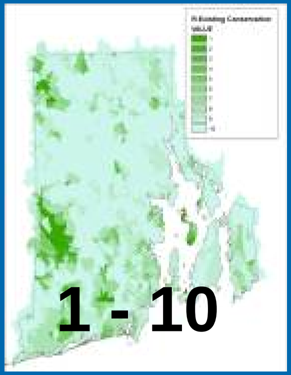
Existing Conservation



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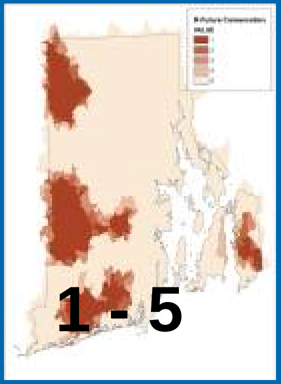
Future Conservation



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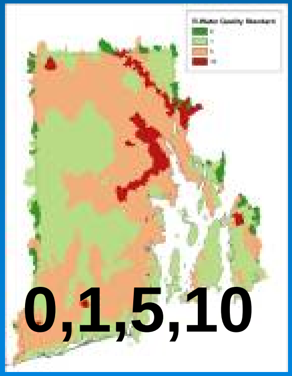
Water Quality



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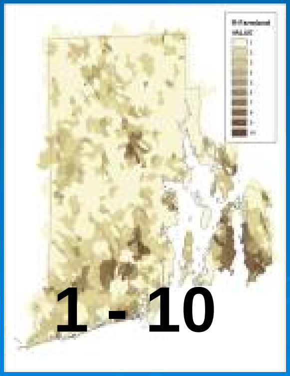
Farmland



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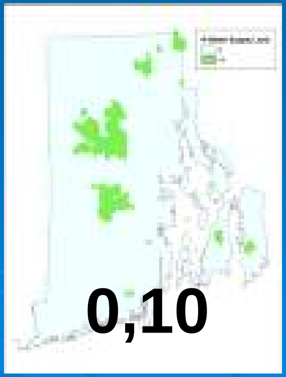
Water Supply Land



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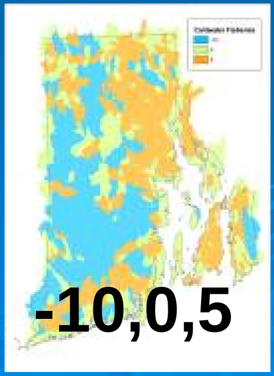
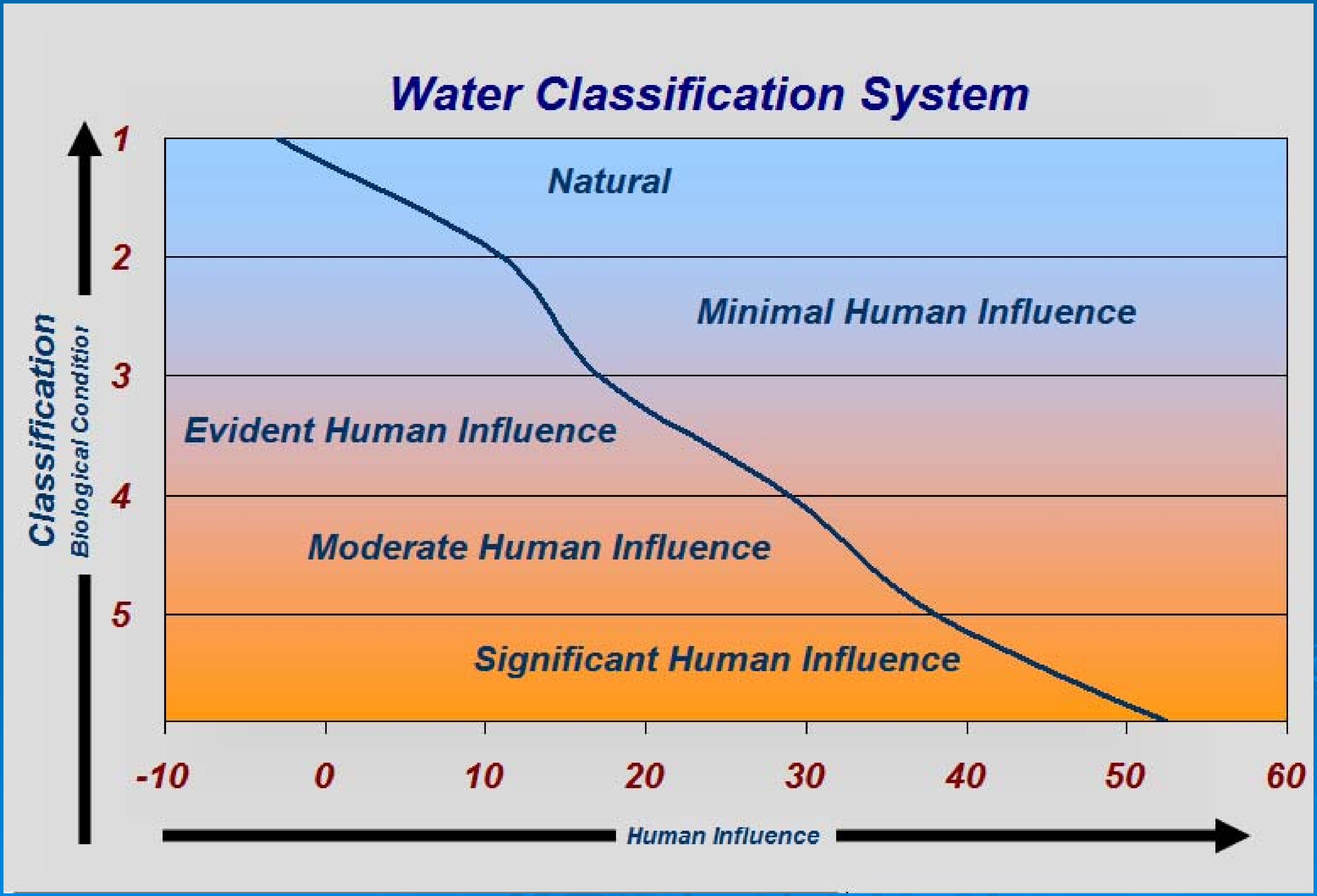
Coldwater Fisheries



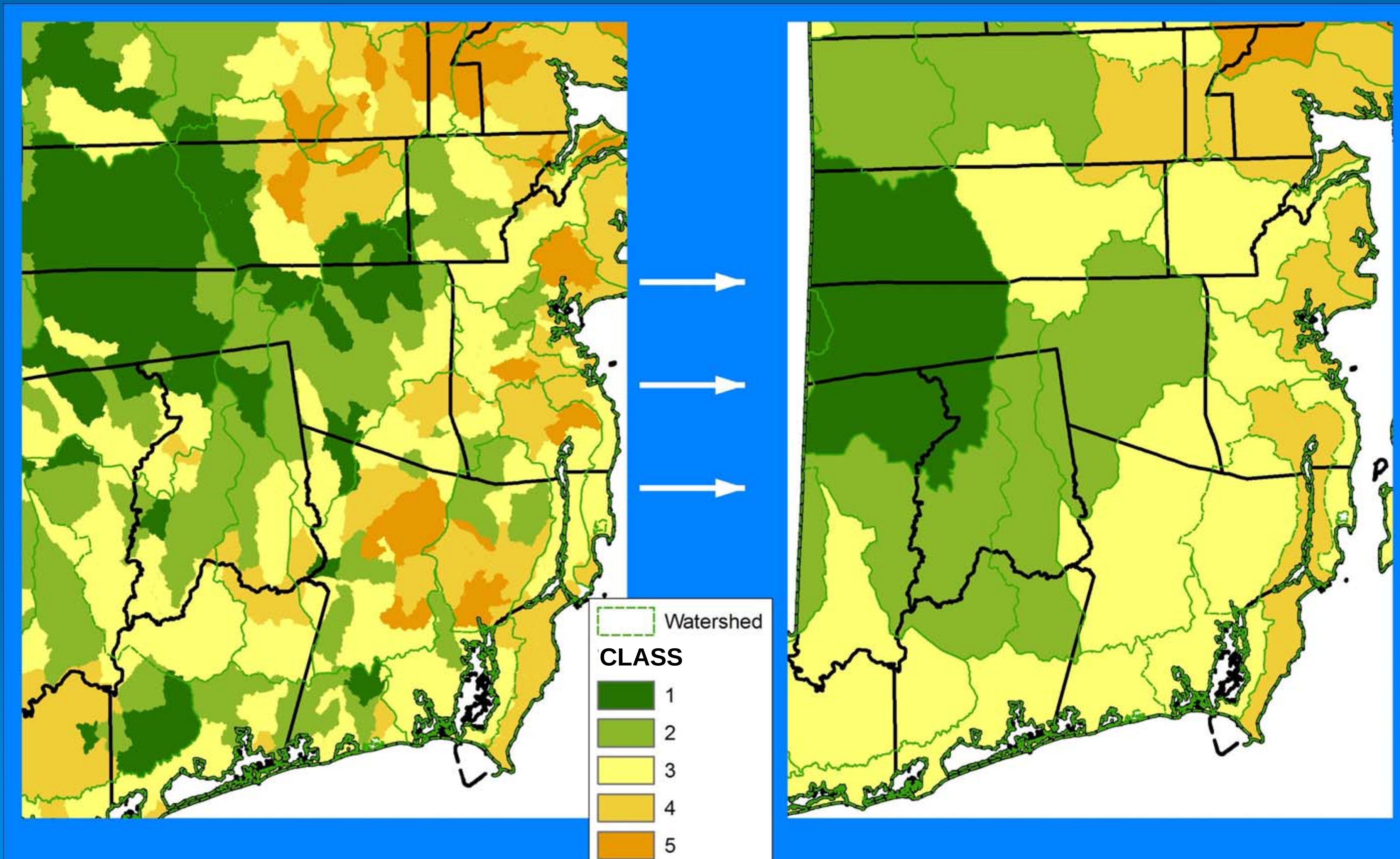
= Total Metric Score

Assign a Classification Based on Total Metric Score



From Catchment Classifications → HUC 12 Classifications

The score of each pixel in the HUC 12 was added together and then divided by number of pixels in the HUC 12. Then the HUC12's were divided by natural breaks.



Bioperiods

RIDEM Fish and Wildlife considered the following:

- Upstream migration (M) – returning from sea.
- Spawning (S)
- Rearing and growth (R) – defined here as a minimum sensitive time period after eggs have hatched.
- Outmigration (O) - heading out to sea.

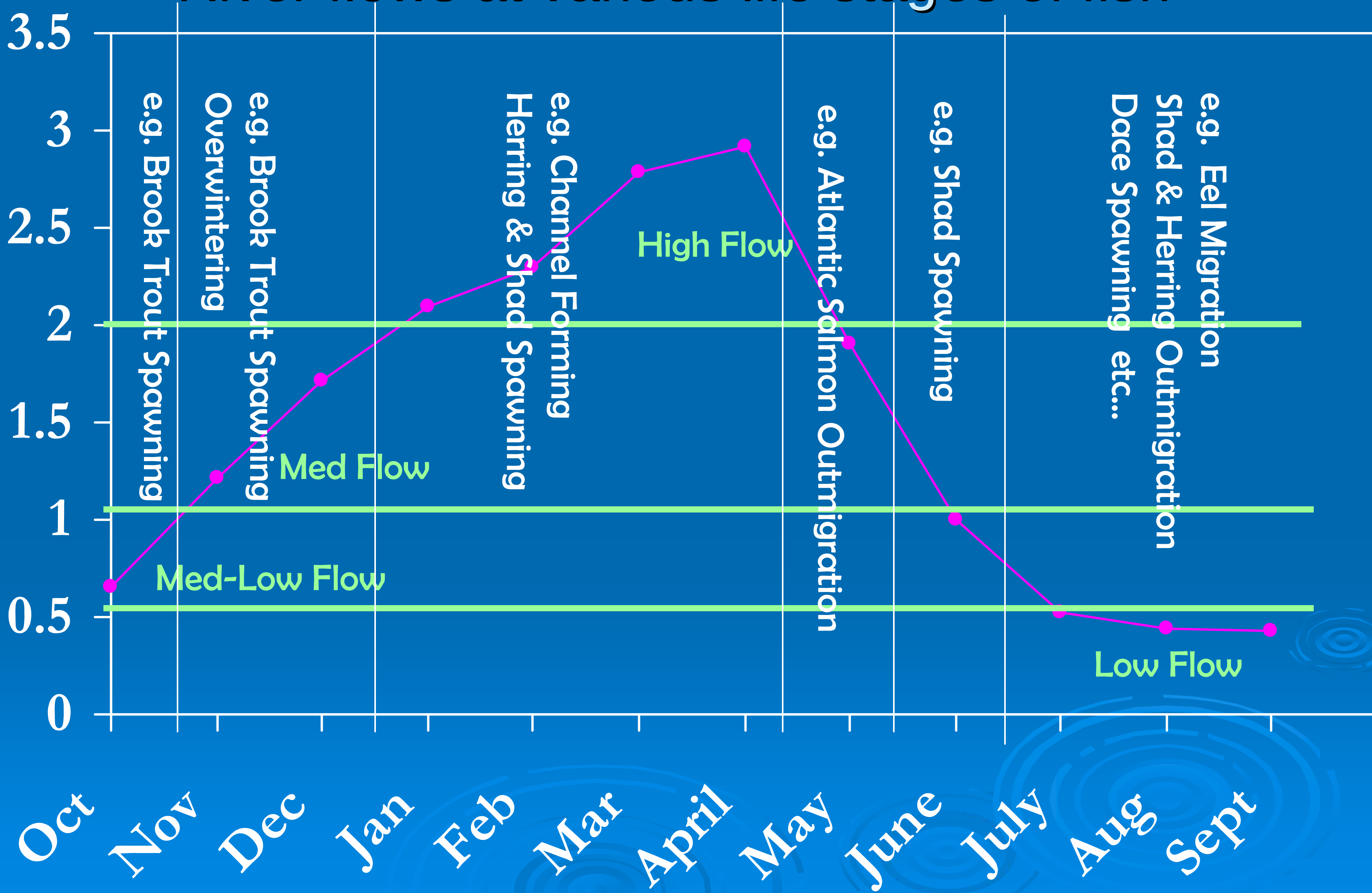
Life stages of River Fish

Species	O	N	D	J	F	M	A	M	J	J	A	S
Blacknose Dace								S	S	S	R	
Longnose Dace								S	S	S	R	
Fallfish							S	S	R			
Creek Chubsucker						S	S	S	R			
Atlantic Salmon						O	O	M	M	M		
Brook Trout	S	S										S
Tesselated Darter							S	S	R			
River Herring	O	O				SM	SM	SM	MO	RO	O	O
American Shad	O	O					SM	SM	SM	RO	O	O
Common Shiner								S	S	S	S	R
White Sucker							S	S	R			

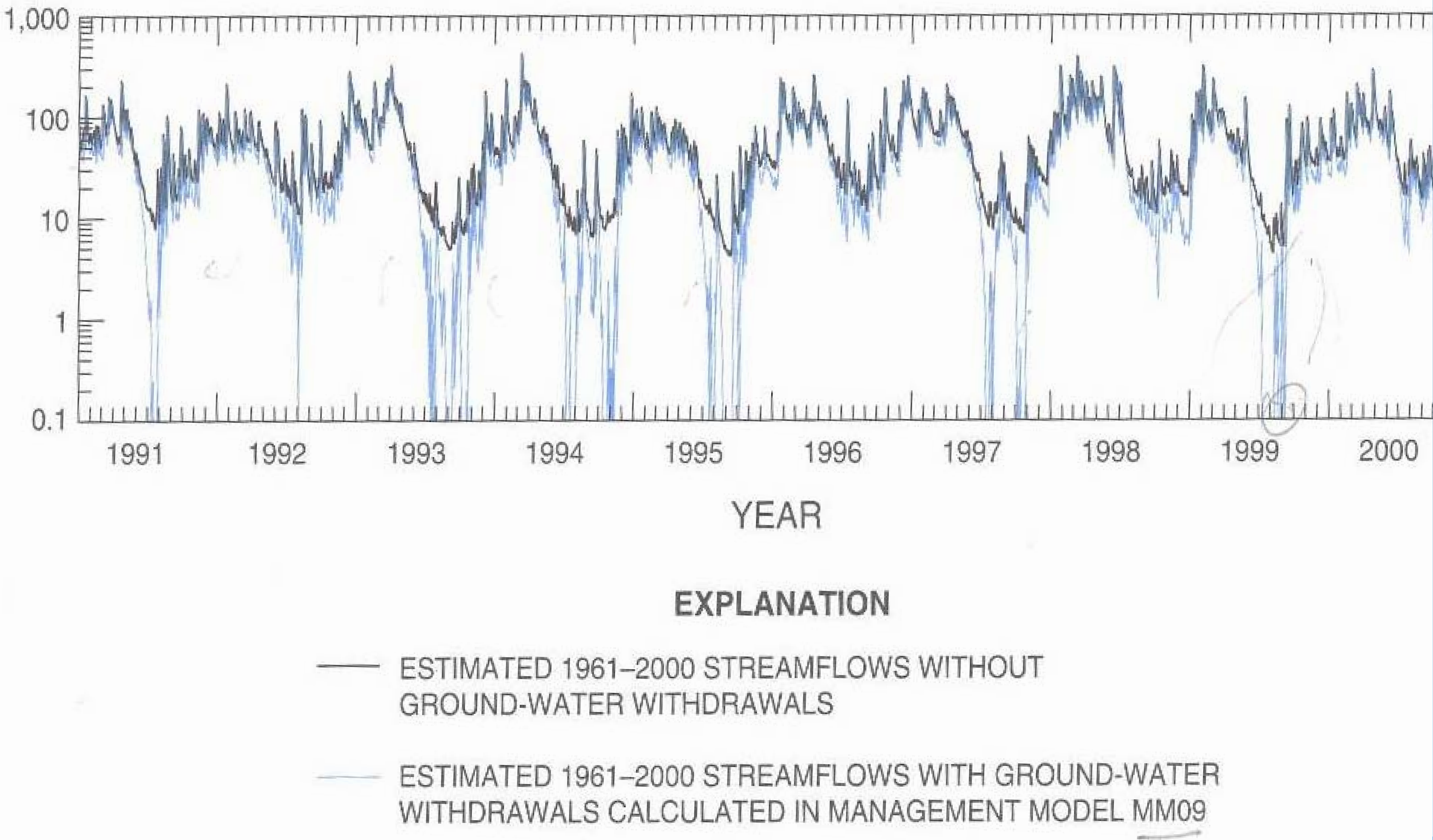
M = upstream migration, O = outmigration, R = rearing and growth, S = spawning

Hydroperiods to Bioperiods

River flows at various life stages of fish



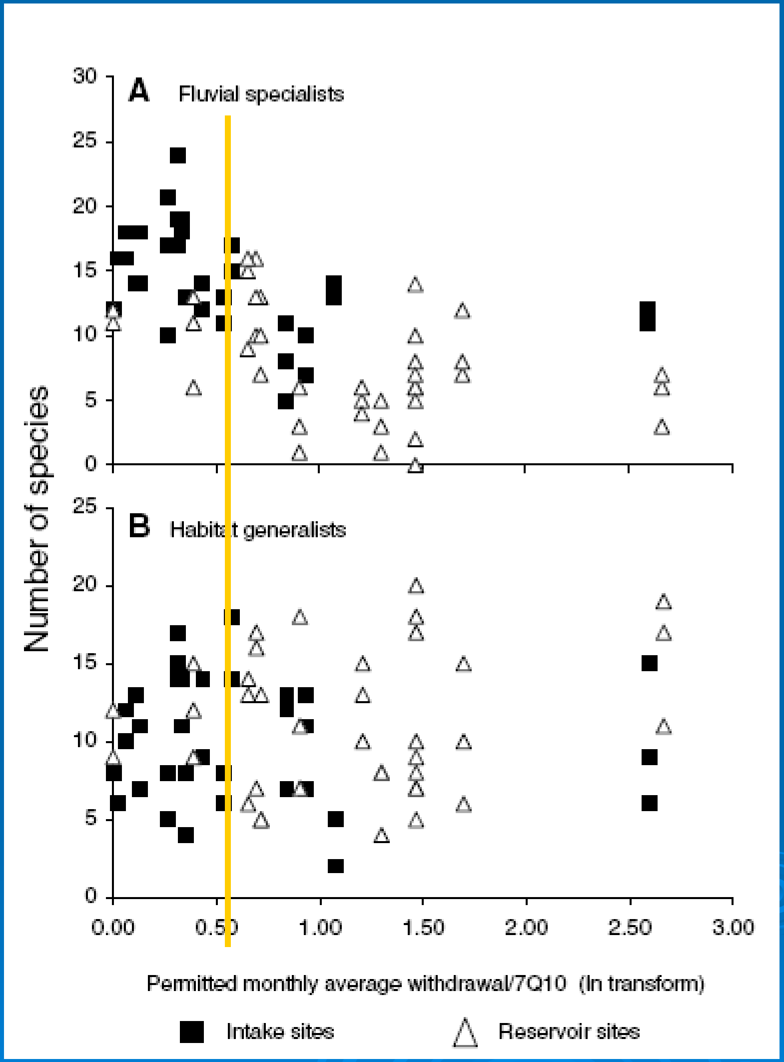
Effects of pumping at 2x the 7Q10



Scientific Basis for Allowable Reductions

USGS Scientists state

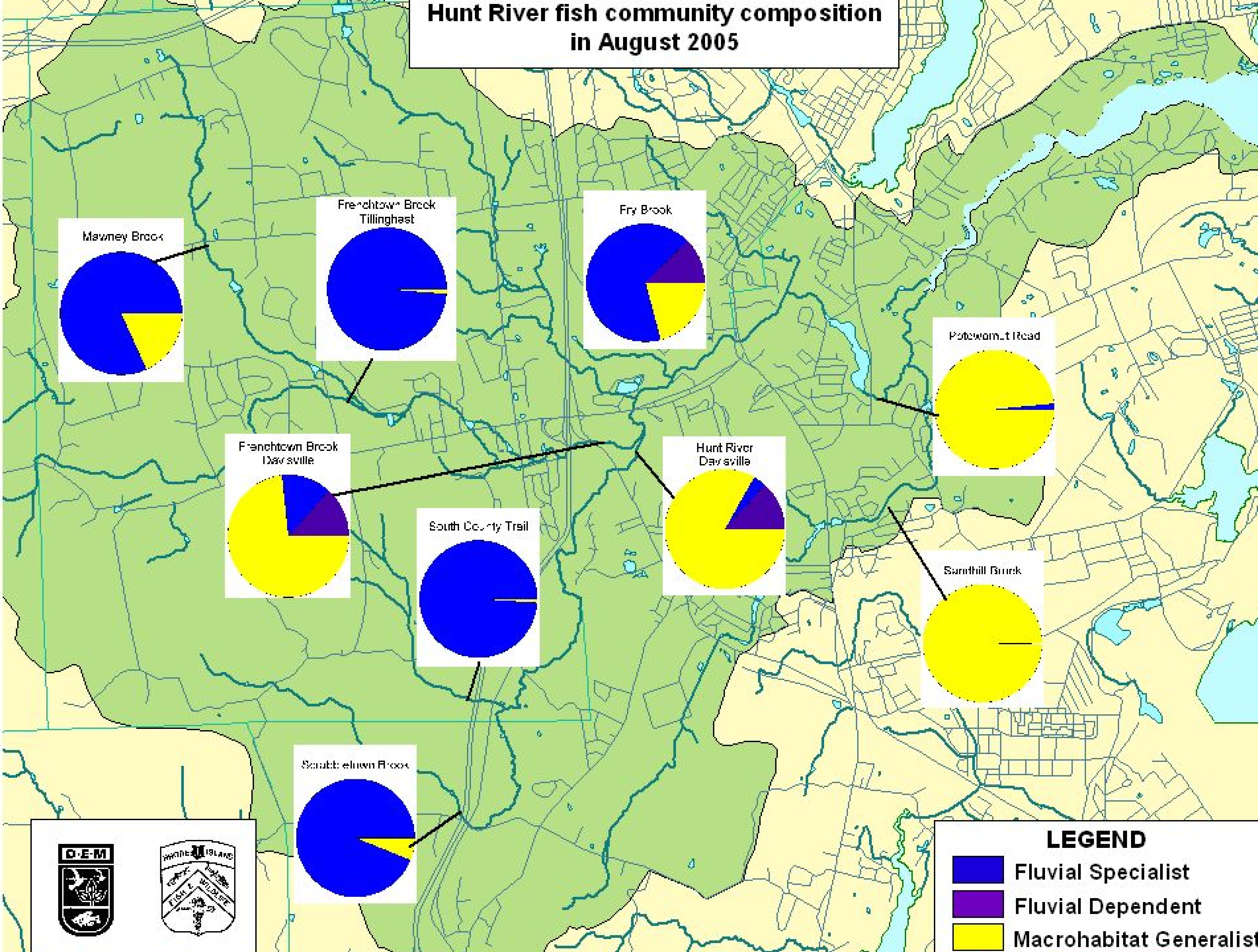
- **Significant losses of river fish due to withdrawal rates greater than 50% of the 7Q10**



Freeman, M. C. and P. A. Marcinek. 2006. Fish assemblage responses to water withdrawals and water supply reservoirs in Piedmont streams.
Environmental Management 38: 435-450.

Allowable Withdrawals for Each Class during Low Hydroperiod

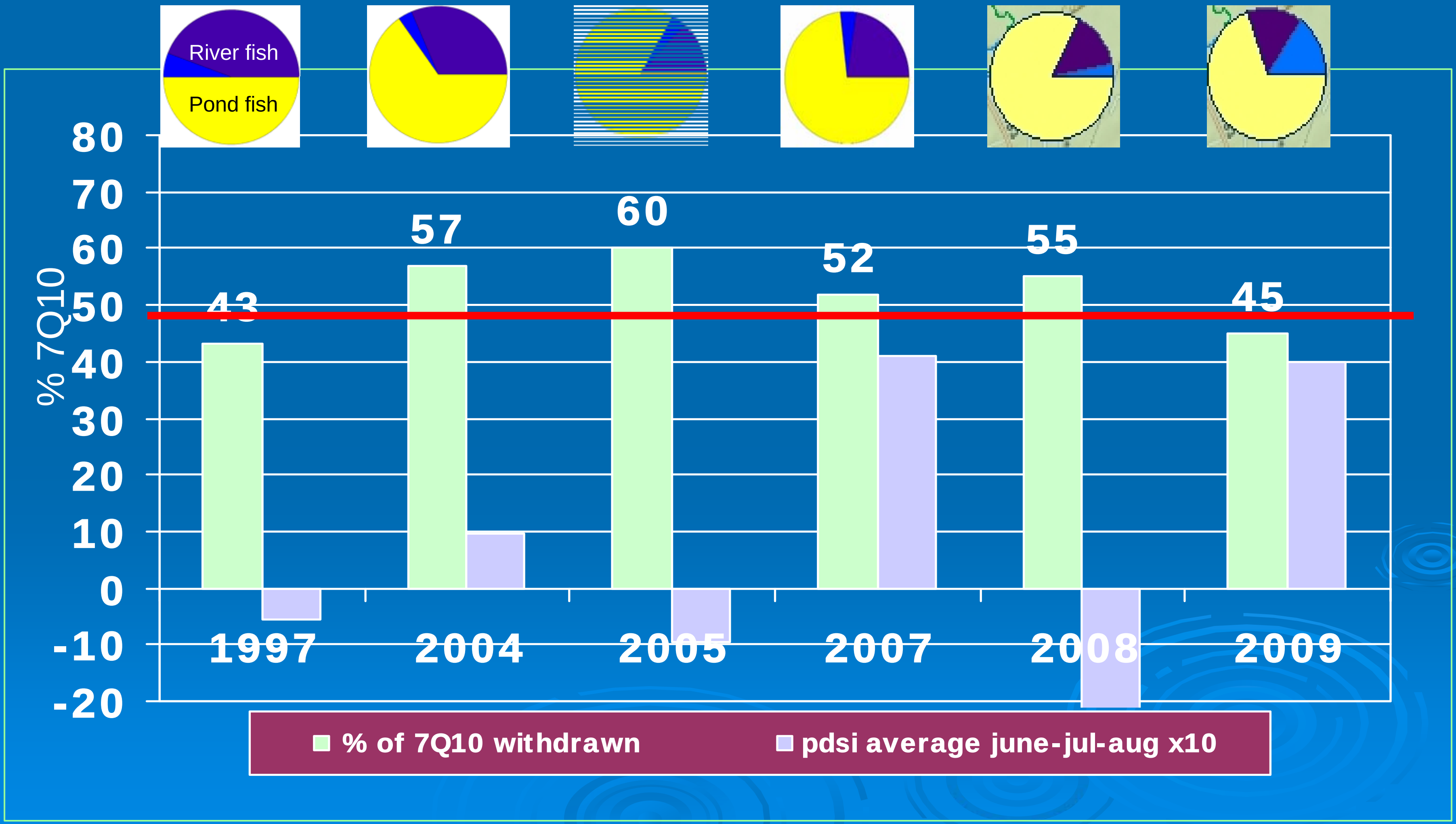
Class	% of 7Q10 Withdrawn	
1	10	Natural Streams
2	20	Minimal Human Influence
3	30	Evident Human Influence
4	40	Moderate Human Influence
5	50	Significant Human Influences



Hunt River fish community composition in August 2005
Mawney Brook
Frenchtown Brook Tillinghast
Fry Brook
Potowomut Road
Frenchtown Brook Davisville
Hunt River Davisville
South County Trail
Sandhill Brook
Scrabbletown Brook
D·E·M
RHODE ISLAND
LEGEND
Fluvial Specialist
Fluvial Dependent
Macrohabitat Generalist

Hunt River – Davisville

Annual Fish Community Analysis compared to upstream water withdrawals

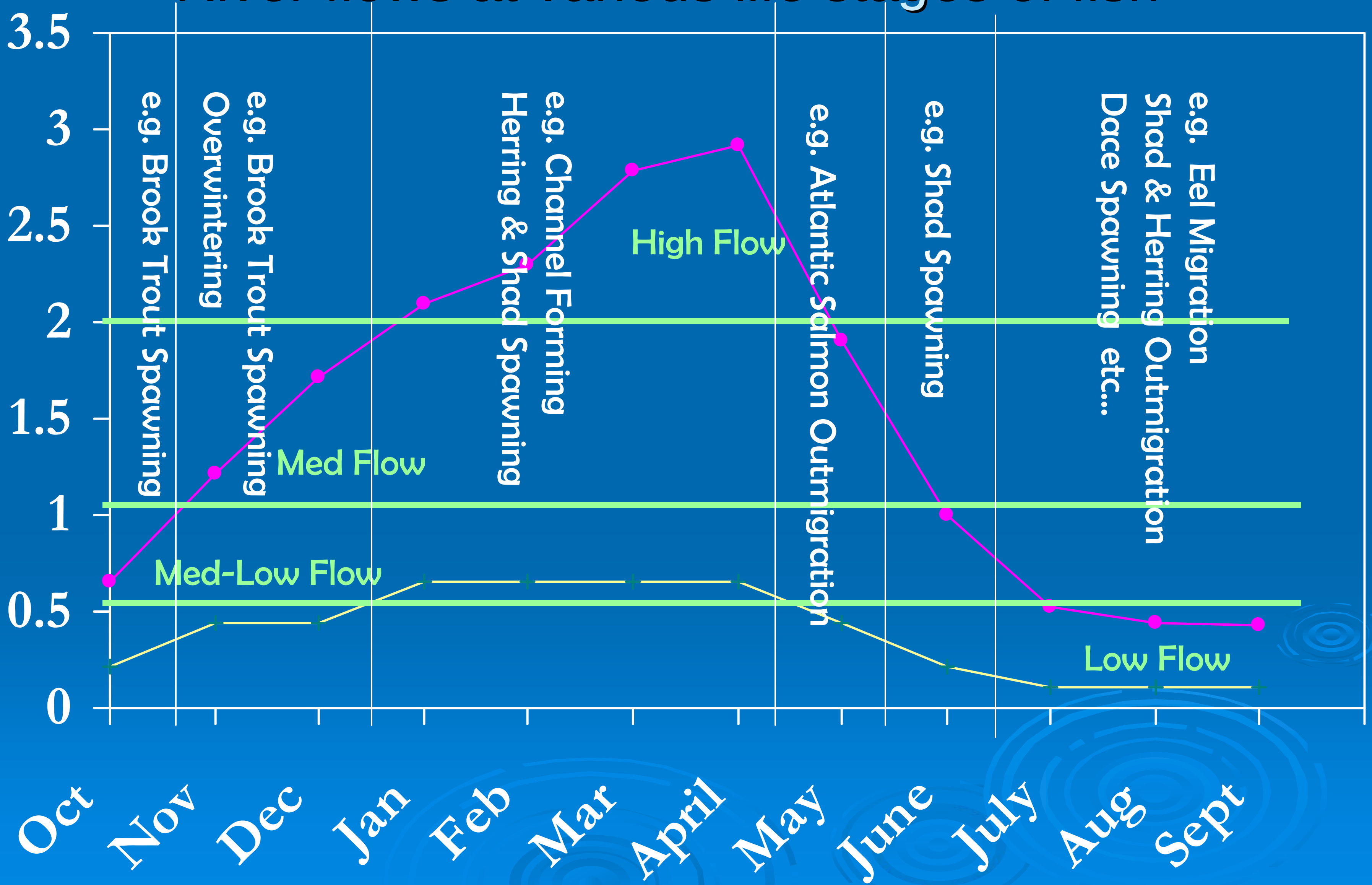


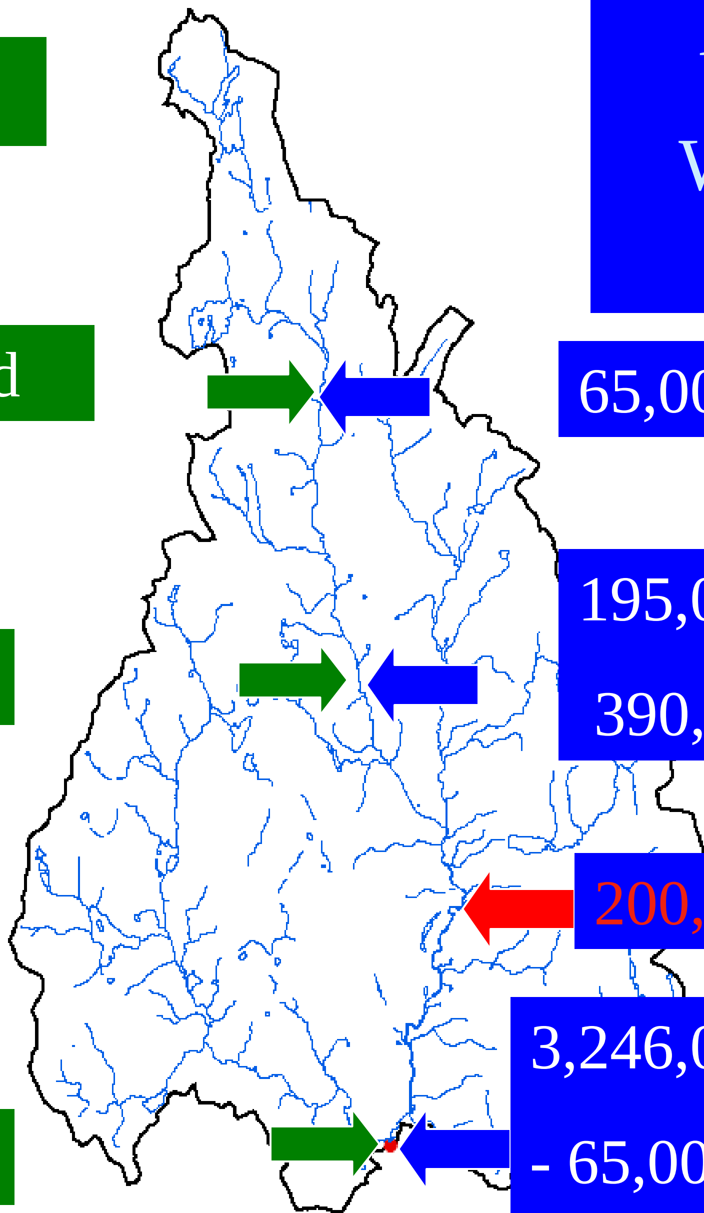
Allowable Depletion as a Percent of 7Q10

Month	BioPeriod	HydroPeriod	Class 1	Class 2	Class 3	Class 4	Class 5
Oct	Spawning & Outmig.	Medium-Low	20%	40%	60%	80%	100%
Nov	Overwinter	Mediuum	40%	80%	120%	160%	200%
Dec							
Jan	Overwinter &	High	60%	120%	180%	240%	300%
Feb	Channel Forming						
Mar	Anadromous	High	60%	120%	180%	240%	300%
April	Spawning						
May	Anad. Spawning	Medium	40%	80%	120%	160%	200%
June	Peak Resident Spawn.	Medium-Low	20%	40%	60%	80%	100%
July	Resident Spawning						
Aug	Rearing and Growth	Low	10%	20%	30%	40%	50%
Sept	Herring & Shad Out.						

Hydroperiods to Bioperiods

River flows at various life stages of fish





Flow

Allowable

Withdrawal

(Low Flow)

7Q10 = 650,000 gpd

65,000 gpd (Class 1)

7Q10 = 1.95 MGD

195,000 gpd (Class 1)

390,000 gpd (Class 2)

200,000 gpd

7Q10 = 6.5 MGD

3,246,000 gpd

- 65,000 -391,000 +

200,000 =

2,991,000 gpd

Determining Allowable Withdrawal

(as % of 7Q10)

- Allowable withdrawals are based on a percent of low flow
- Larger streams will have more allowable withdrawal than smaller streams
- The higher the Class the more allowable withdrawals
- The higher the seasonal flow the more available water

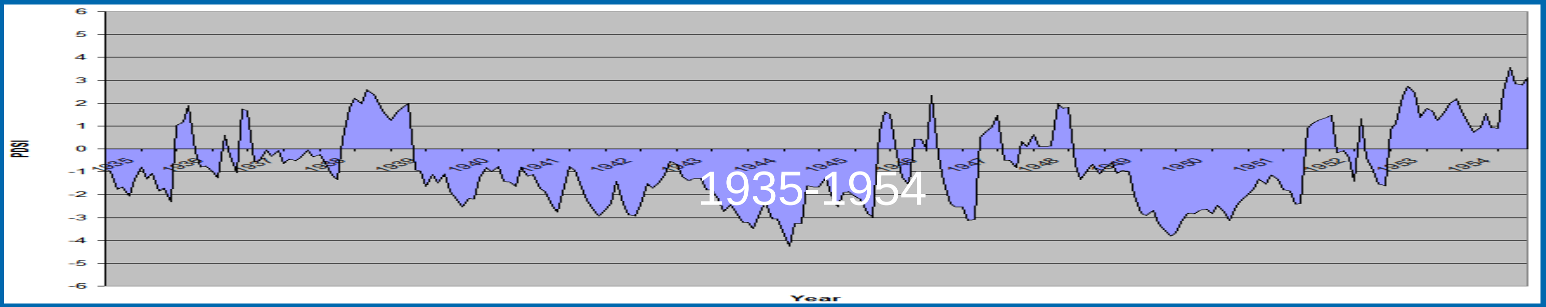
We don't inherit the land from our parents, we borrow it from our children

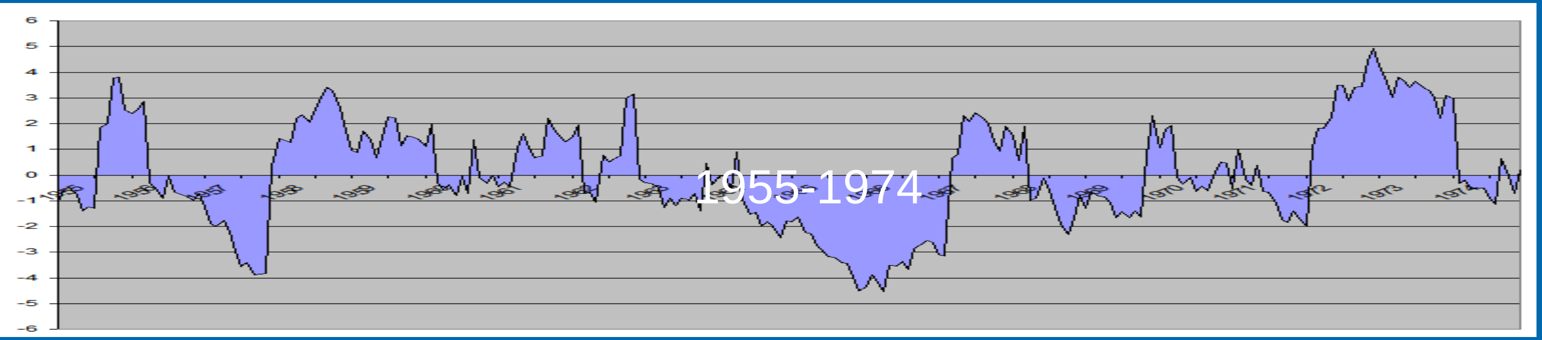
~Ancient Indian Proverb

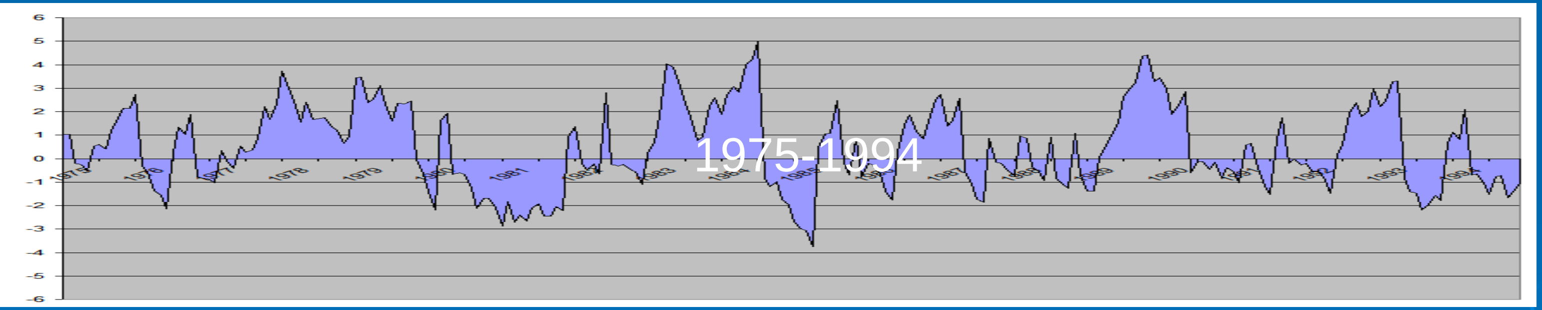
Fry Brook – August 2007

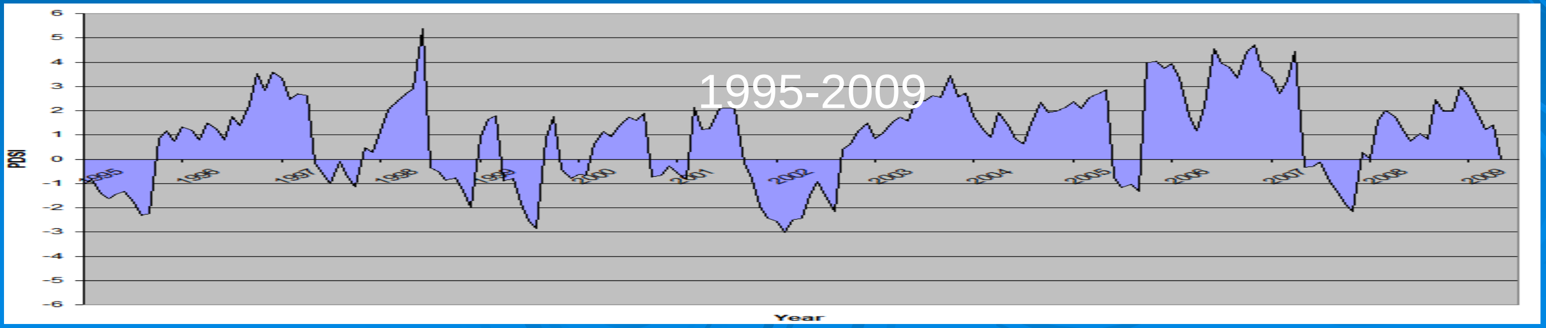

Brook

Potowomet Dam, Summer 2007


1935-1954
PDSI
Year
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6


1955-1974
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6


1975-1994
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6


1995-2009
PDSI
Year
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6