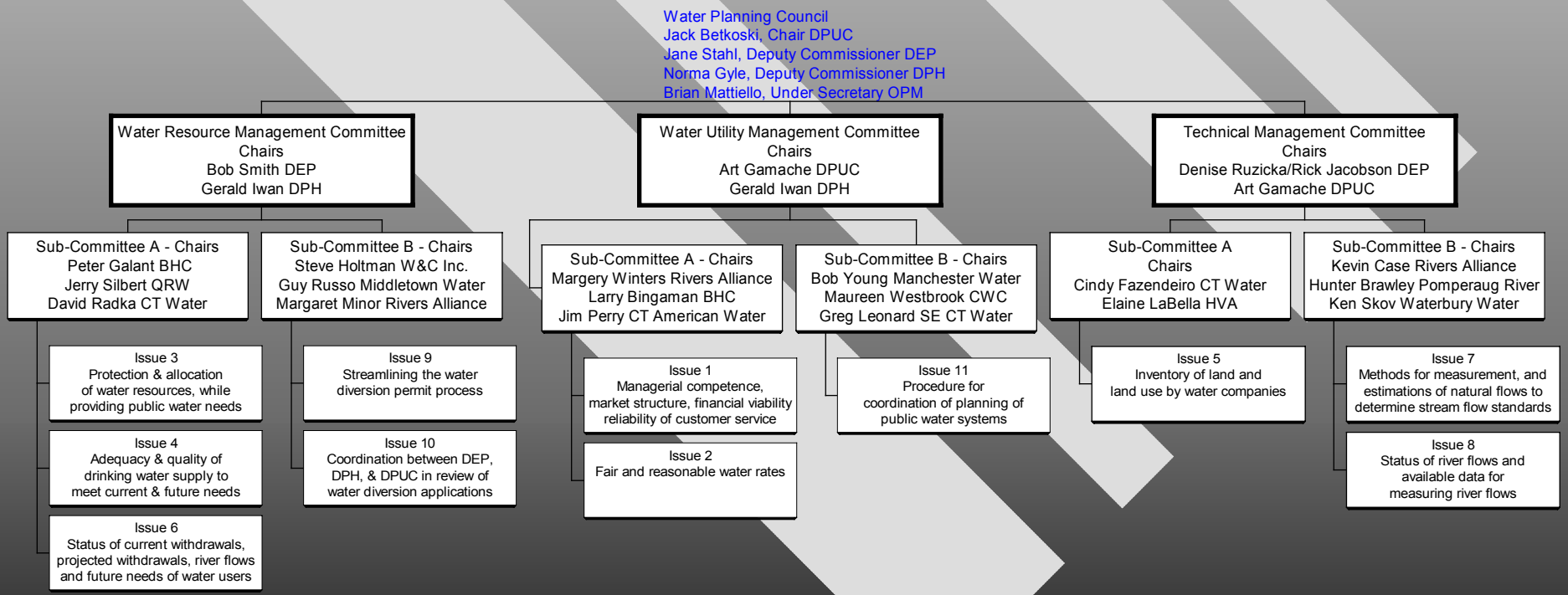
Connecticut Water Planning Council Flowchart



Connecticut Water Planning Council Issue 7

- Recommended methods for measurement and estimations of natural flows in Connecticut waterways in order to determine the standards for streamflows that will protect the ecology of the state's rivers and streams.

Issue 7 Technical Committee Member Organizations

- Co-chairs: Waterbury Bureau of Water/ Farmington River Watershed Association
- Government: USGS, EPA, DEP (3), CT DPH, Fisheries Advisory Council
- Conservation: TU, Pomperaug Watershed
- Water Companies: Aquarion (2),SCRWA, CT Water, Manchester Water and Sewer, RWA
- Consultants: KA, Leggette, Brashears, Milone & McBroom
- Academic: UMass-Dartmouth, UCONN/CT IWR

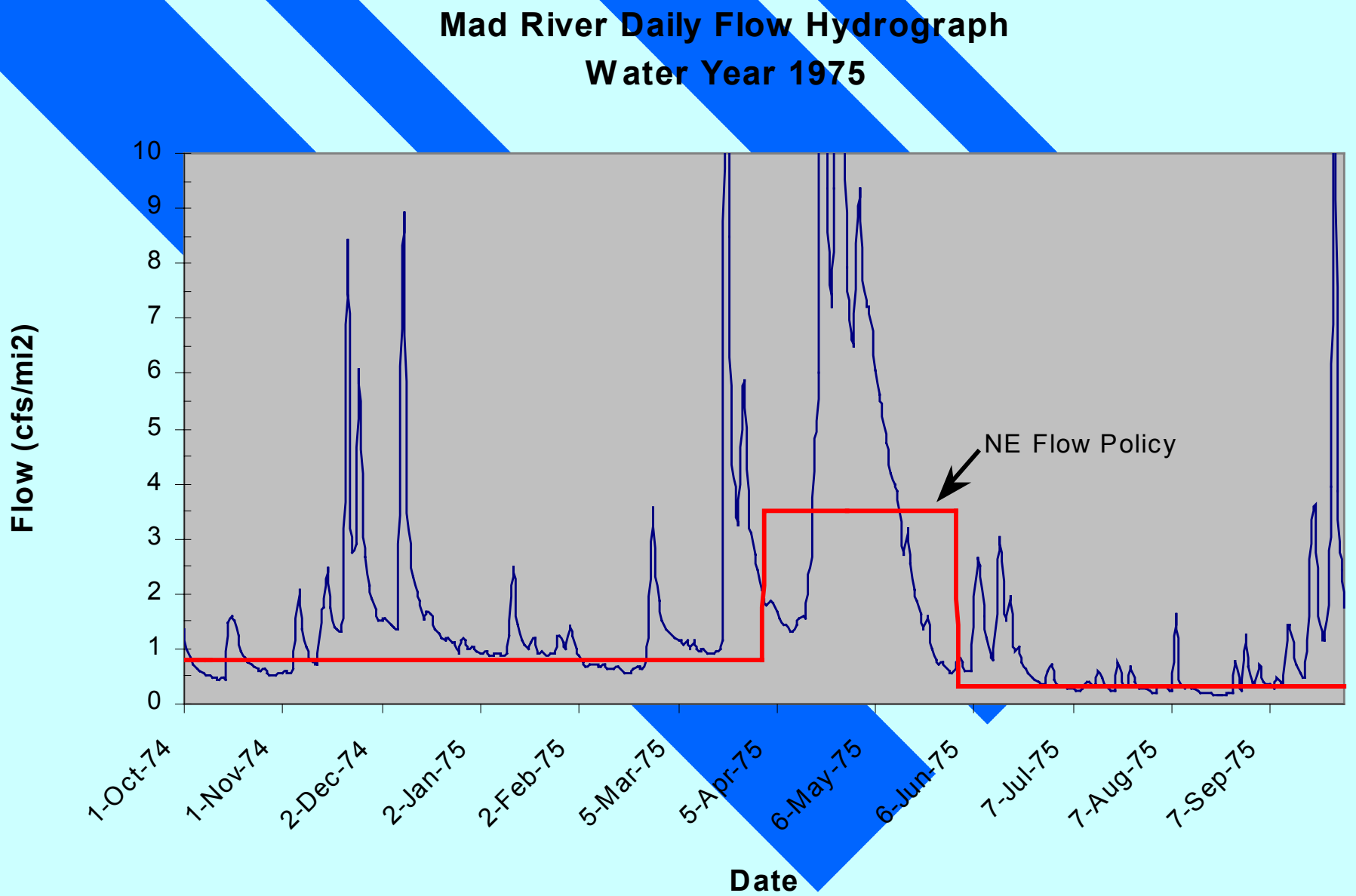
Issue 7 Consensus Statement

- Explore **interim** instream flow method for use over next five years
- Establish scientific framework to create and implement **long-term** instream flow protocols
- Establish process for ongoing review of methods
- Identify funding needs
- Identify implementation measures

Types of Instream Flow Assessment tools

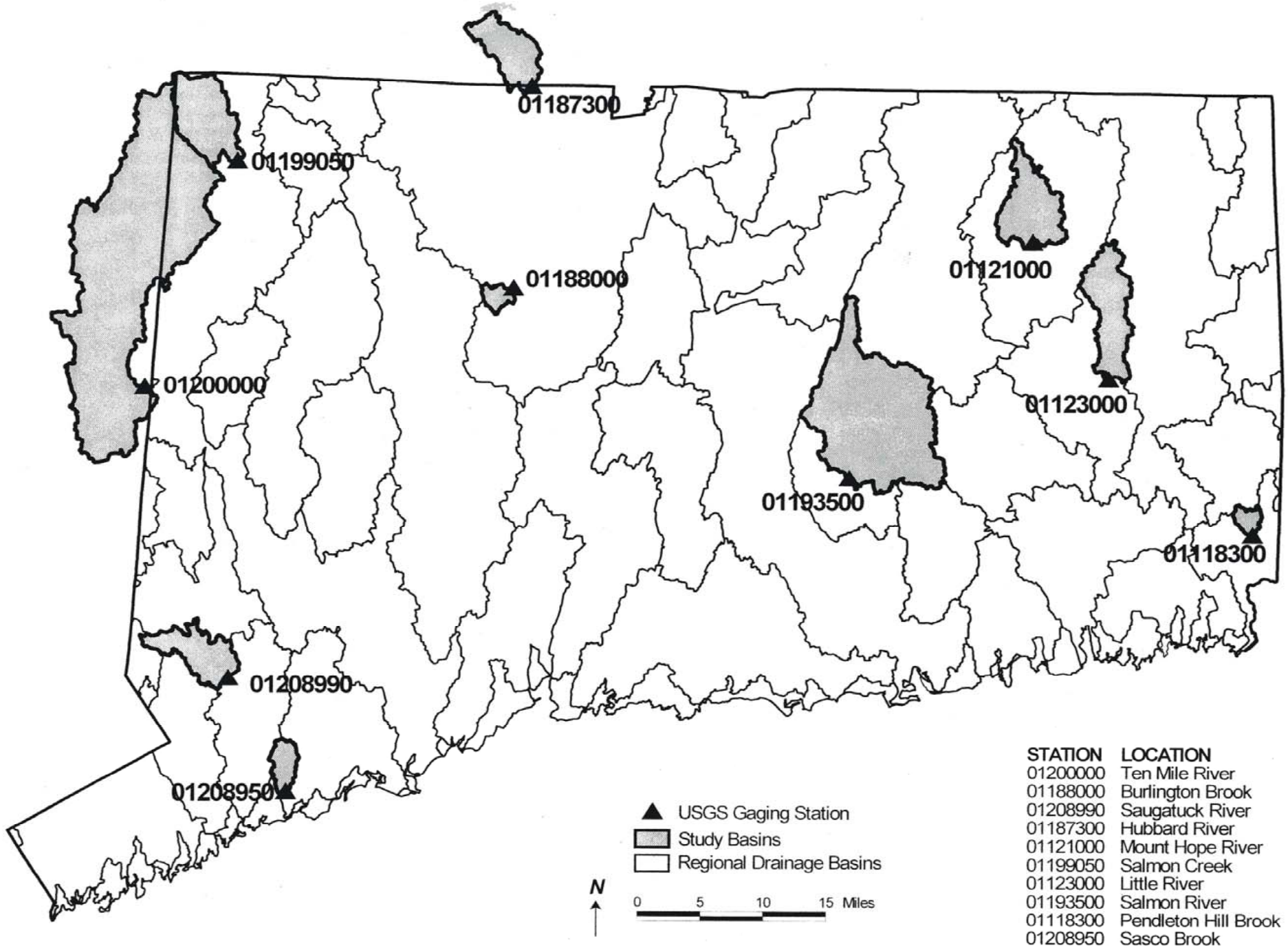
Tool	Description	Examples
Baseline	Establishes environmental or reference conditions	RVA IBI, IHA
Standard-setting	Sets limits or rules to define a flow regime	Tennant ABF, Wetted Perimeter R2-Cross
Incremental	Analyzes single or multiple variables to enable assessment of different flow management alternatives	IFIM, PHABSIM,MESOHABSIM RCHARC, SNTEMP Demonstration Flow Assessment
Monitoring / Diagnostic	Assesses conditions and how they change over time	IBI, HQI, IHA

(Instream Flow Council 2001)


Mad River Daily Flow Hydrograph
Water Year 1975
Flow (cfs/mi2)
10
9
8
7
6
5
4
3
2
1
0
NE Flow Policy
1-Oct-74
1-Nov-74
2-Dec-74
2-Jan-75
2-Feb-75
5-Mar-75
5-Apr-75
6-May-75
6-Jun-75
7-Jul-75
7-Aug-75
7-Sep-75
Date

Apse Connecticut Method

- Selected 10 Connecticut rivers which are wholly unregulated or slightly regulated
- At least 30 years of record
- Watershed areas between 4.1 and 203 square miles
- Calculate monthly numbers using FWS approach for Jul.-Sept. (median of monthly means)/ median of daily for Oct.-June)



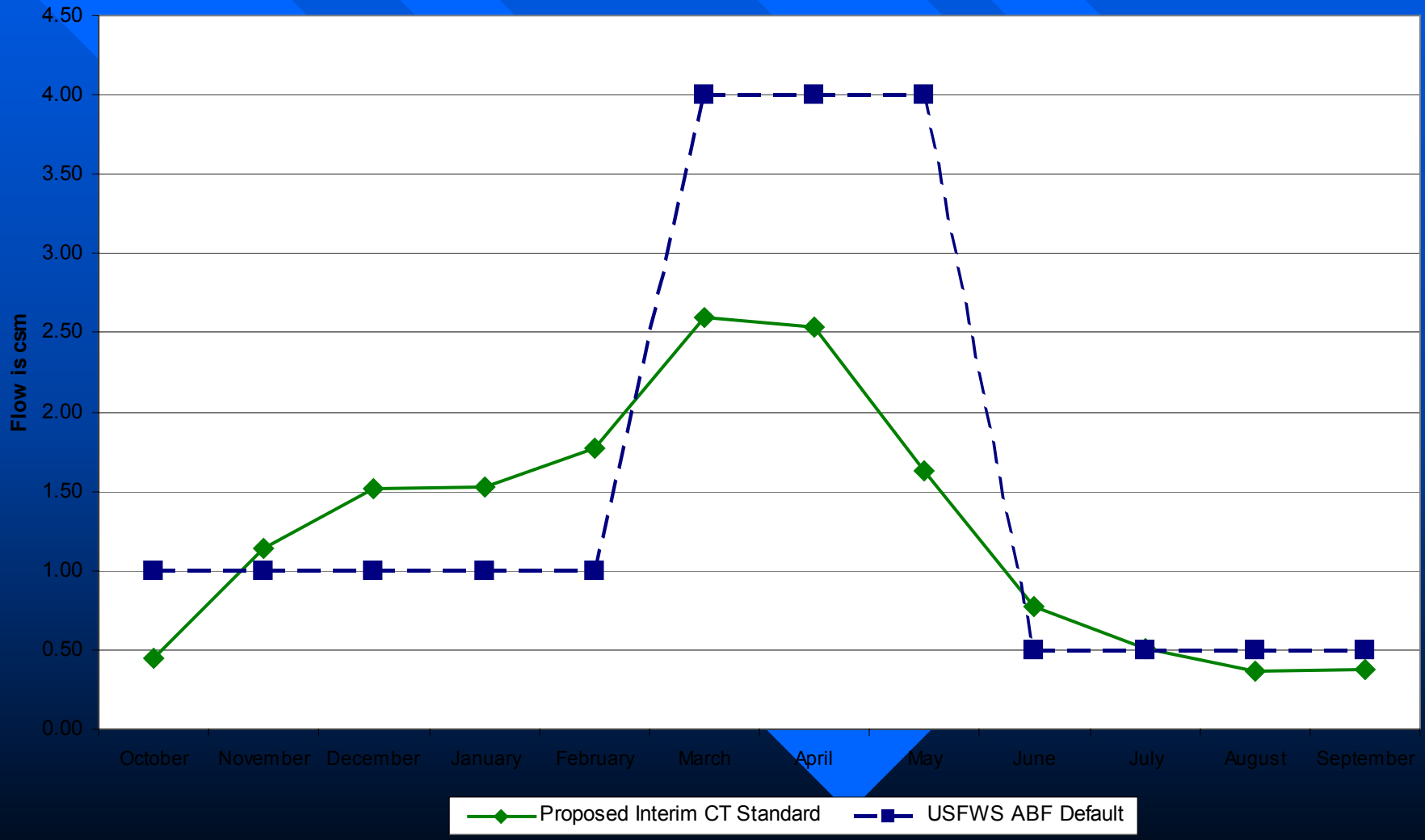
STATION	LOCATION
01200000	Ten Mile River
01188000	Burlington Brook
01208990	Saugatuck River
01187300	Hubbard River
01121000	Mount Hope River
01199050	Salmon Creek
01123000	Little River
01193500	Salmon River
01118300	Pendleton Hill Brook
01208950	Sasco Brook

Ten Unregulated Gages

ABF Calculation in cfsm
(% duration flow)

	Tenmile River	Burlington Brook	Saugatuck River	Hubbard River	Mt Hope River	Salmon Creek	Little River	Salmon River	Pendleton Hill Brook	Sasco Brook	Mean	Median
October	0.35	0.83	0.50	0.61	0.61	0.67	0.65	0.60	0.68	0.72	0.62	0.63
	(46)	(38)	(47)	(40)	(37)	(50)	(43)	(38)	(40)	(30)	(41)	
November	0.94	1.82	1.53	1.76	1.39	1.40	1.49	1.31	1.58	1.30	1.45	1.45
	(43)	(32)	(38)	(34)	(37)	(40)	(38)	(40)	(42)	(40)	(42)	
December	1.50	1.95	2.41	2.18	1.83	1.50	1.91	1.85	2.33	2.07	1.95	1.93
	(41)	(32)	(40)	(30)	(40)	(45)	(42)	(40)	(44)	(38)	(39)	
January	1.39	1.90	2.18	1.65	2.24	1.70	2.43	2.35	2.85	2.08	2.08	2.21
	(45)	(31)	(38)	(31)	(31)	(32)	(31)	(33)	(33)	(36)	(34)	
February	1.70	1.99	2.65	1.65	2.38	1.61	2.57	2.40	3.16	2.19	2.23	2.29
	(38)	(34)	(34)	(34)	(36)	(40)	(33)	(37)	(34)	(38)	(36)	
March	2.96	3.85	3.23	3.25	3.55	2.72	3.47	3.62	3.79	3.04	3.35	3.36
	(38)	(30)	(40)	(40)	(34)	(40)	(32)	(34)	(38)	(34)	(36)	
April	2.79	3.53	3.04	4.17	3.01	3.08	3.16	3.24	3.55	3.02	3.26	3.12
	(47)	(33)	(37)	(38)	(37)	(38)	(34)	(36)	(36)	(28)	(36)	
May	1.62	2.27	1.85	2.43	2.15	1.96	2.12	2.14	2.36	1.82	2.07	2.13
	(43)	(34)	(42)	(30)	(32)	(36)	(36)	(38)	(40)	(38)	(37)	
June	0.81	1.17	0.80	0.91	0.78	0.98	0.99	0.93	1.09	0.66	0.91	0.92
	(45)	(37)	(45)	(34)	(45)	(44)	(41)	(43)	(43)	(47)	(42)	
July	0.53	0.74	0.49	0.38	0.43	0.68	0.59	0.45	0.51	0.34	0.51	0.50
	(38)	(34)	(34)	(33)	(32)	(36)	(34)	(38)	(35)	(37)	(35)	
August	0.31	0.55	0.39	0.24	0.31	0.43	0.44	0.34	0.28	0.39	0.37	0.37
	(40)	(39)	(34)	(34)	(34)	(49)	(37)	(36)	(42)	(30)	(38)	
September	0.28	0.59	0.31	0.27	0.25	0.55	0.44	0.36	0.32	0.38	0.38	0.34
	(40)	(34)	(36)	(38)	(45)	(40)	(34)	(36)	(36)	(30)	(37)	

Figure 6: Proposed Connecticut Interim Instream Flow Standard vs. USFWS New England Aquatic Base Flow Standard



	Median of the mean daily	Median of the mean monthly	Apse's Recommendati
July	0.33	0.51	0.51
August	0.23	0.37	0.37
September	0.22	0.38	0.38
October	0.45	0.62	0.45
November	1.14	1.45	1.14
December	1.52	1.95	1.52
January	1.53	2.08	1.53
February	1.77	2.23	1.77
March	2.60	3.35	2.60
April	2.54	3.26	2.54
May	1.63	2.07	1.63
June	0.77	0.90	0.77

CT Water Planning Council 2003 Recommendations to Legislature

- Endorse need for Interim and Long-Term Stream Flow Methods.
- Agreement by WPC that Apse approach is a reasonable reconnaissance-level approach.
- Although subcommittee did not agree on summer statistic, WPC chose median of daily flows
- DEP will set up working group to establish framework for using interim approach for regulating streamflows and to revise minimum streamflow regulations.
- DEP will continue to work with stakeholders to develop a long-term approach.

Recommended Interim Method

- If site is in one of ten unregulated "Apse" basins use basin-specific monthly statistics
- If site is located outside ten basins

  a. Use statewide monthly default criteria or

  b. Estimate monthly statistics using rainfall-runoff model or QPPQ transform

  c. Estimate statistics from a suitable alternative gauged watershed (unregulated/long term record)
- Alternatively, scientifically defensible site-specific studies to determine ecologically protective flows.

Technical Subcommittee consensus, scientific assumption

- ". In the absence of site – specific data that allow a better understanding of the relations between flow and biotic integrity, flows are sought that generally mimic the essential components of the natural flow regime under the assumption that ecological processes will then foster a desirable aquatic community"

Qualifications to committee recommendations

- Majority of committee recommends reconnaissance-level technique as reasonable **interim** method
- **Long-term method** needs to be developed which establishes flow/habitat relationships during all months
- Majority agreement to use Median daily flows October –June
- No agreement on flow statistics for July, August and September (ie, median daily or median monthly)

Management Recommendations

- Adaptive Management
- Water conservation as a "source" in lieu of new or proposed sources
- Mandatory water use restrictions to protect water supply and natural resources during low-flow periods
- Optimizing rate and timing of withdrawals
- Increased infiltration of stormwater
- Short-term pulsed flows as alternative to continuous releases
- Provision to include flushing flows

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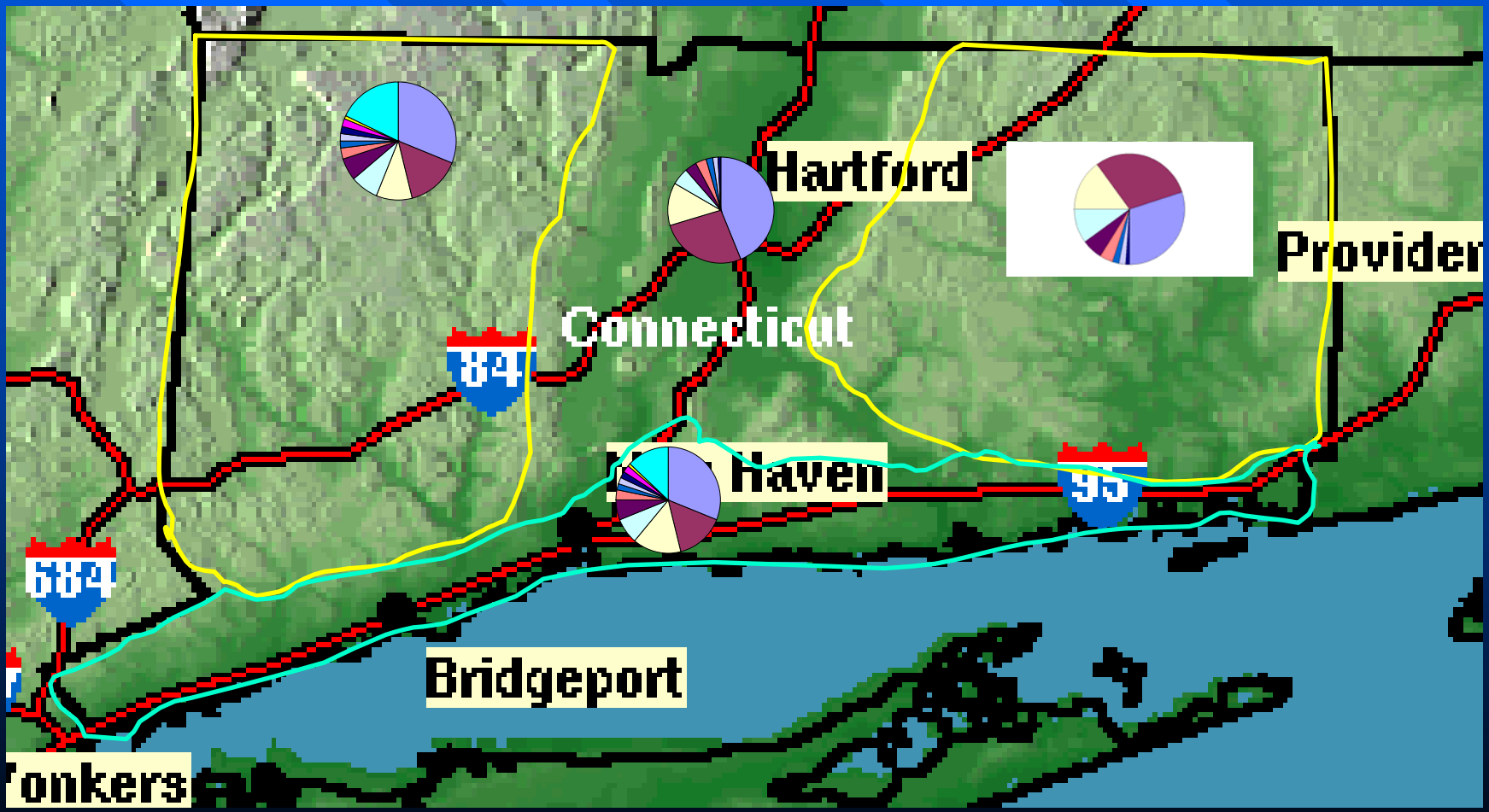
Proposed Long-Term Protocol

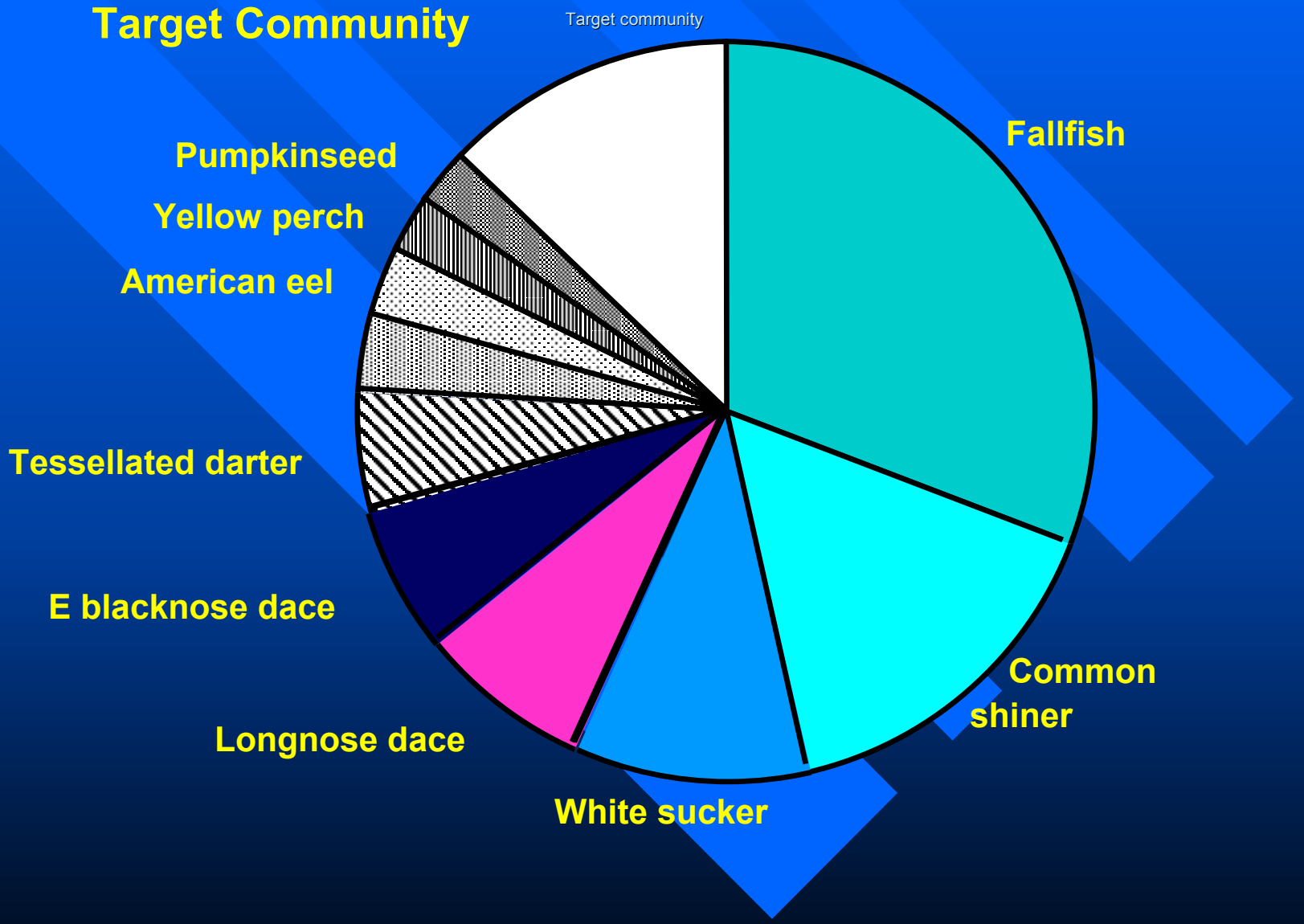
- 1. Target Fish Community Regions
- 2. Habitat Selection Criteria
- 3. Fish Habitat Regions
- 4. Habitat model
- 5. Habitographs
- 6. Application on individual cases
- 7. Impact simulator

Determine Target Community Regions

- using available fishing data
- stratified for stream order (small-big rivers)



Target Community



Bain & Meixler 2000

Target community spawning criteria

Fish Species	Date	Temperature	Mesohabitat	Depth	Velocity	Substrate	Other
White Sucker	Late Spring	57-68F	Shallow water, Isolated Pools and riffles	Shallow <50cm	Swift/Flowing 10-45	Gravel/rocky Akal, micro, meso	
Common Shiner	May 1-July 15	60-65 F:15.5-18.3C	Shallow riffles	13-44mm (under 5)	Slow <=20	Gravel/Sand Akal, psamal, micro	Likes to spawn over nests of other species
Fallfish	April 27-June 10	over 14.4C	Quiet pools	Shallow <50	Slow <=20	Gravel/small stones Akal, micro, meso	Eggs are covered by the parent with gravel
Longnose Dace	June and early July	11.7 C	Riffles, runs with gravel bottom	2-4inches (5-10cm) <15	Strong/Over 45 cm per second	Pebbles over 5cm Meso	Males guard territories, but no nest is built
Blacknose Dace	Late May-July	About 70F	Shallow riffles	4-8 inches <20	Fast water >45	Gravel Akal, micro	

preference

FALLFISH

Presence (76%)		Beta
	BOULDER	1.95
	SHADING	-1.07
	DEPTH 0-25 cm	-1.76
	VELOCITY 45-60 cm/s	1.06
	RUN	-0.57
High abundance (60%)		
	Overhanging vegetation	-0.97

COMMON SHINER

Presence (80%)		Beta
	BOULDER	1.71
	RIPRAP	1.40
	SHADING	-1.48
	DEPTH 50-75 cm	-1.23
High abundance (69%)		
	BOULDER	1.68
	SHADING	-1.01

WHITE SUCKER

Presence (95%)		Beta
	DEPTH 75-100 cm	5.01
	DEPTH 50-75 cm	2.19
	MESOLITHAL (small cobble)	1.62
	UNDERCUT BANK	1.66
High abundance (66%)		
	Depth 75-100	7.62

LONGNOSE DACE

Presence (92%)		Beta
	RIFFLE	2.05
	FAST RUN	2.45
	XYLAL (wood)	4.60
	RIPRAP	2.29
High abundance (73%)		
	VELOCITY 45-60 cm/s	3.35

BLACKNOSE DACE

Presence (94%)		Beta
	DEPTH 0-25cm	3.03
	BOULDER	2.57
	SHADING	-1.44
	SHALLOW MARGIN	1.65
	PELAL (mud)	3.09
	VELOCITY 45-60 cm/s	1.46
	Submerged vegetation	-1.44
High abundance (79%)		
	MICROLITHAL (small gravel)	-4.20

Establish of habitat selection criteria

- good quality rivers
- regionally valid set
- seasonal

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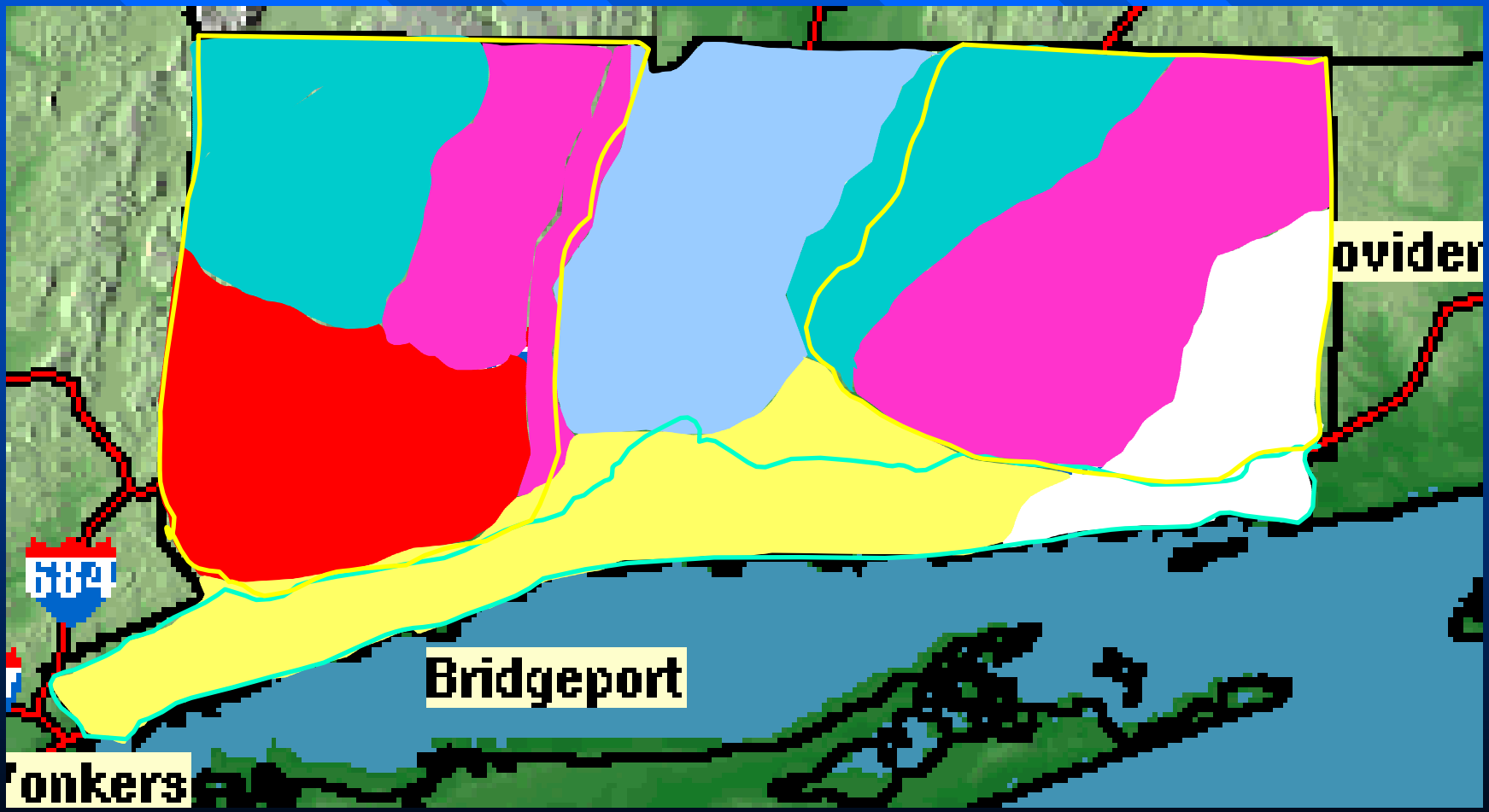
Delineate State into Hydro-Morphological Regions

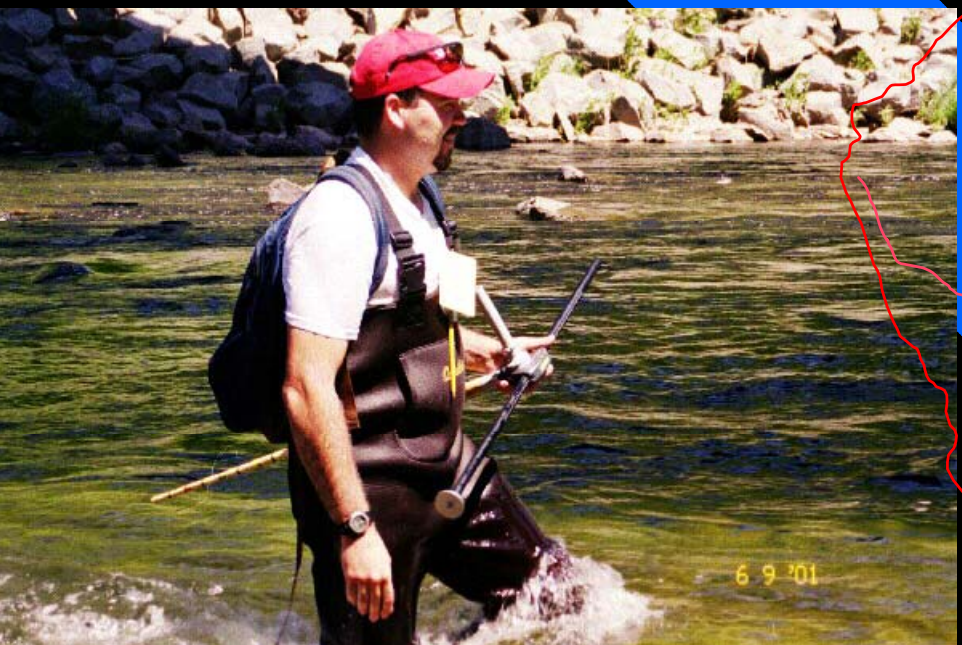
- supported by HUC
- geology etc.

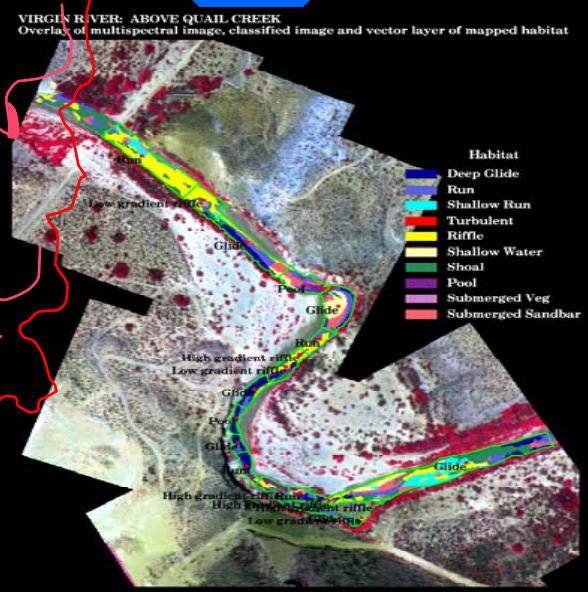
Overlay with TCR

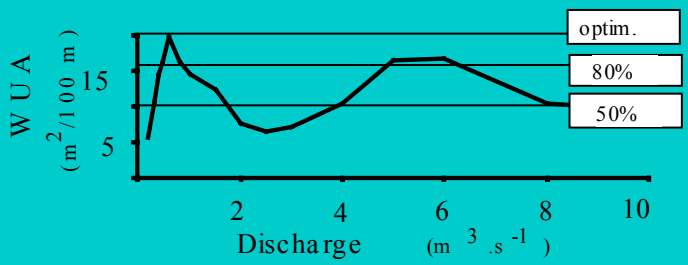


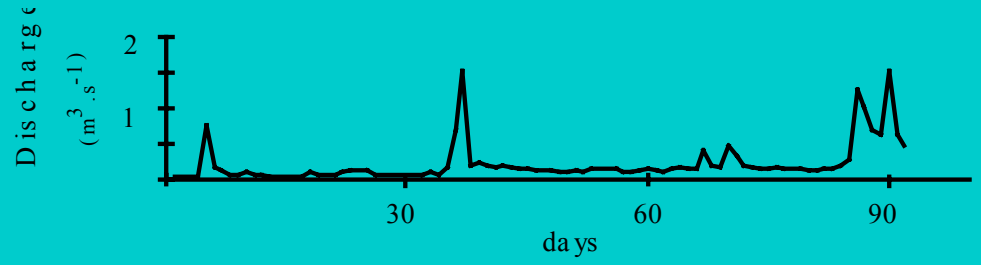
Representative watersheds

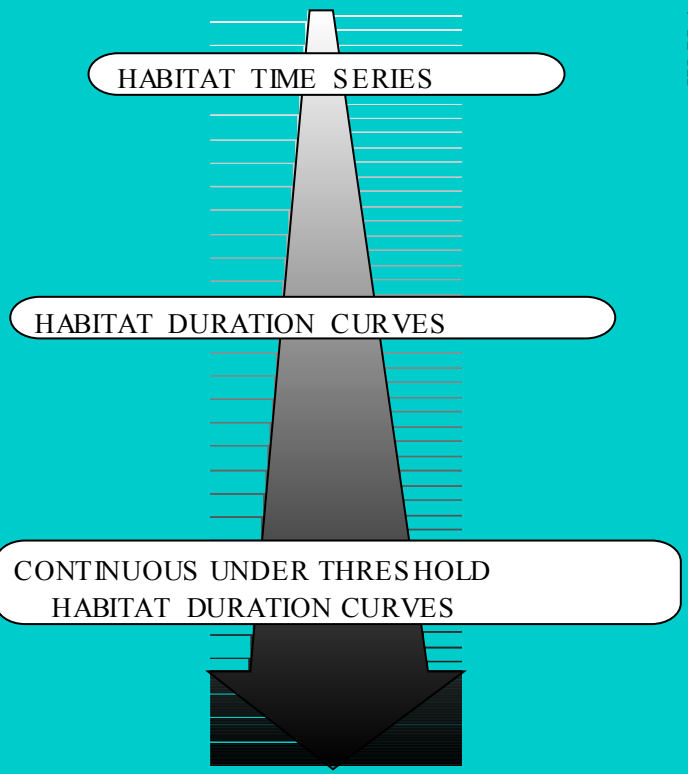
- habitat census
- representative sites
- mapping low flows

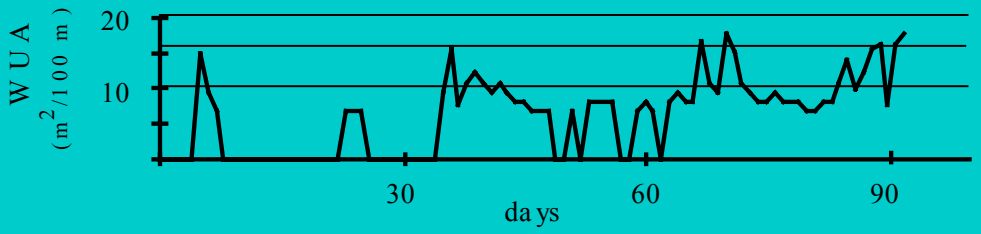


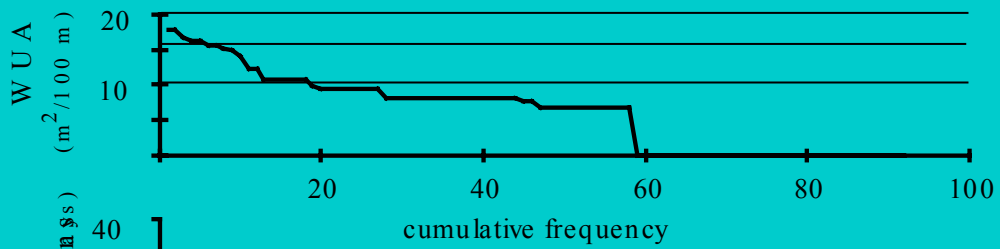


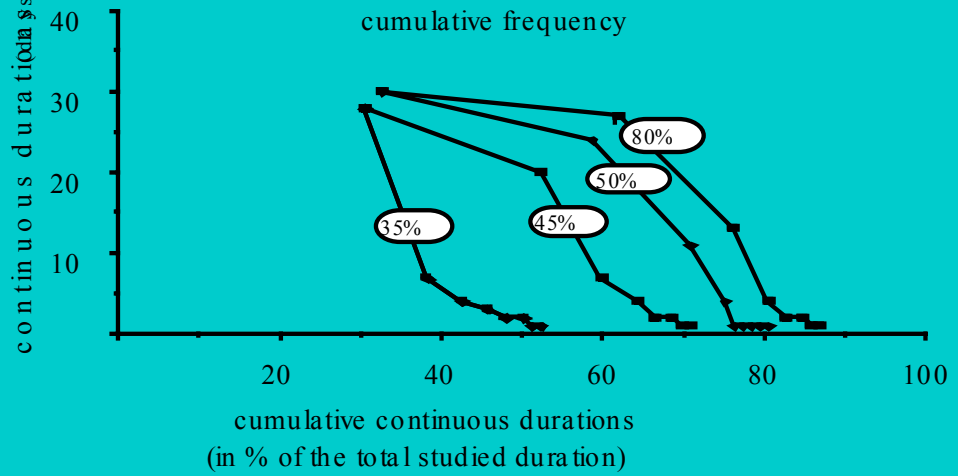

WUA
(m2/100 m)
15
5
optim.
80%
50%
2
4
6
8
10
Discharge (m3.s-1)


Discharge
(m3.s-1)
2
1
30
60
90
days

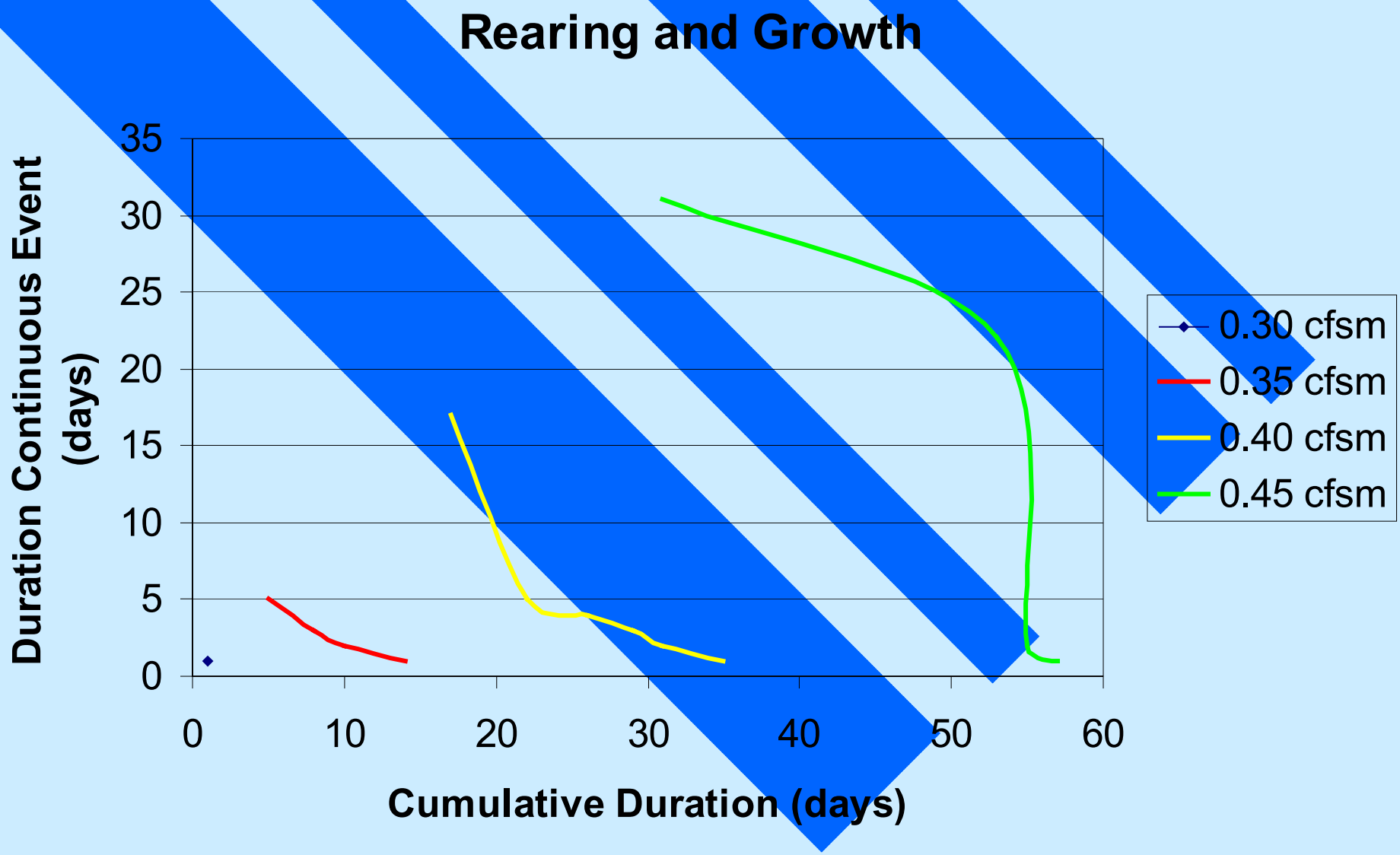

HABITAT TIME SERIES
HABITAT DURATION CURVES
CONTINUOUS UNDER THRESHOLD
HABITAT DURATION CURVES


WUA
(m2/100 m)
20
10
30
60
90
days

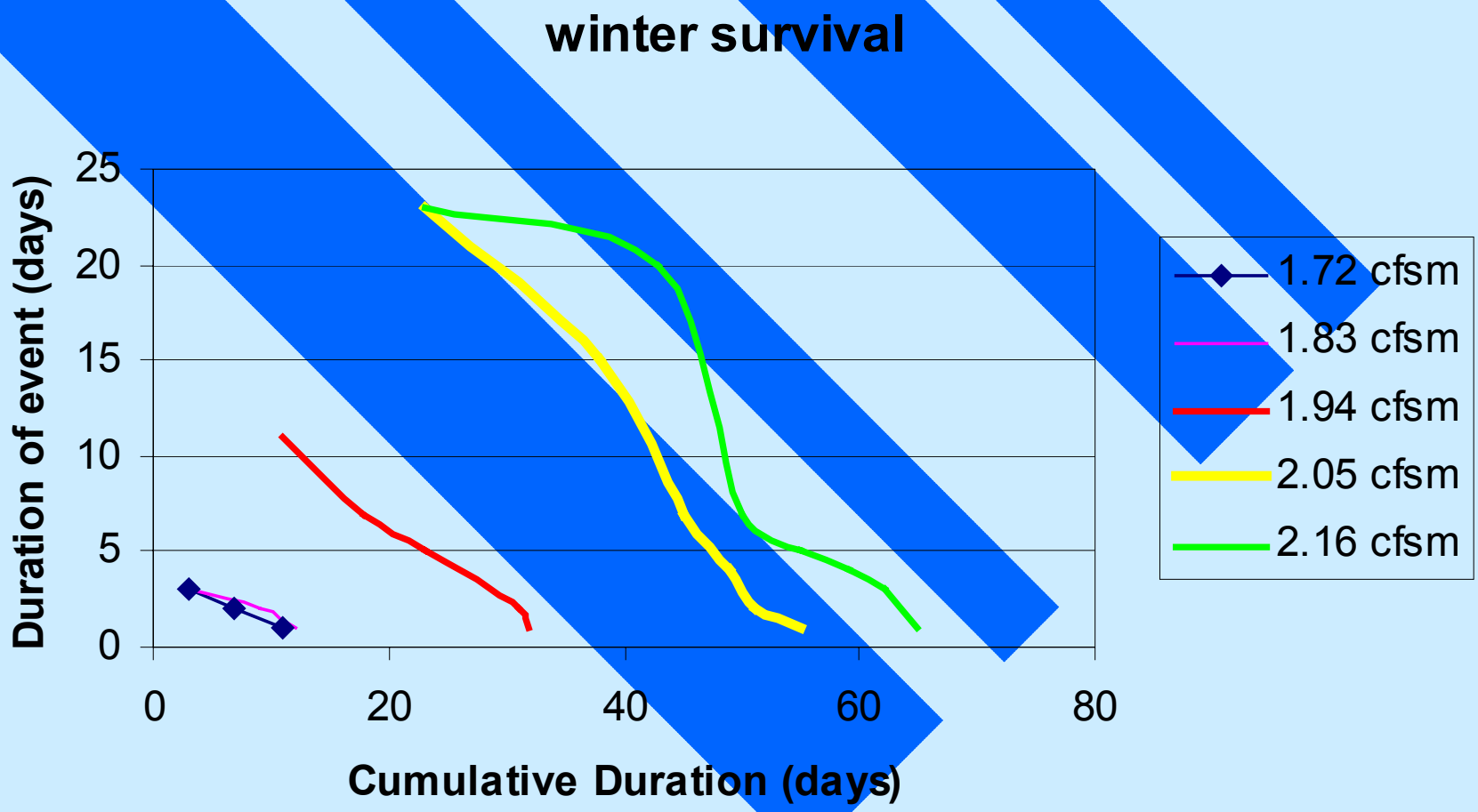

WUA
(m2/100 m)
20
10
20
40
60
80
100
cumulative frequency

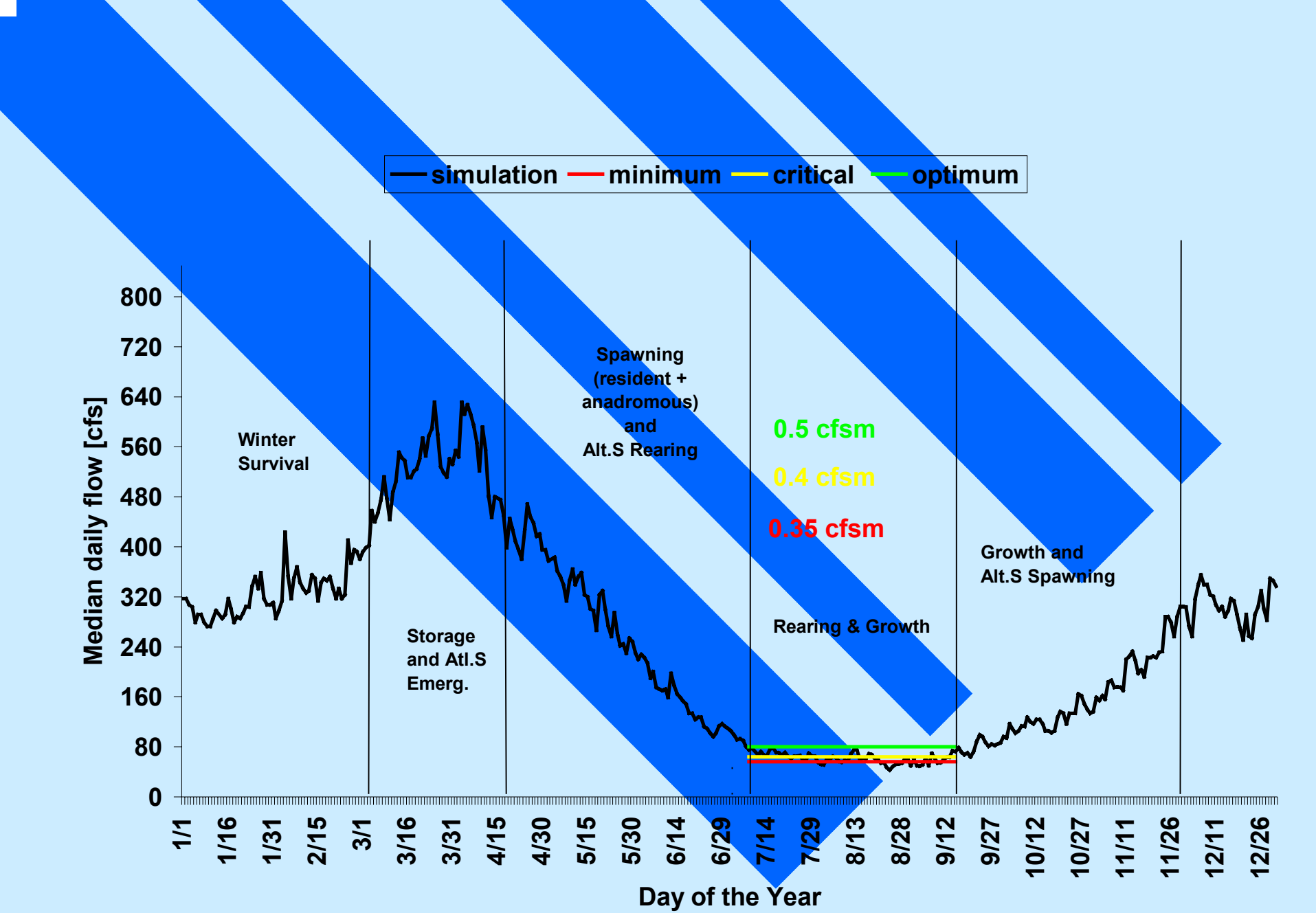

continuous durations (days)
40
30
20
10
80%
50%
45%
35%
20
40
60
80
100
cumulative continuous durations
(in % of the total studied duration)

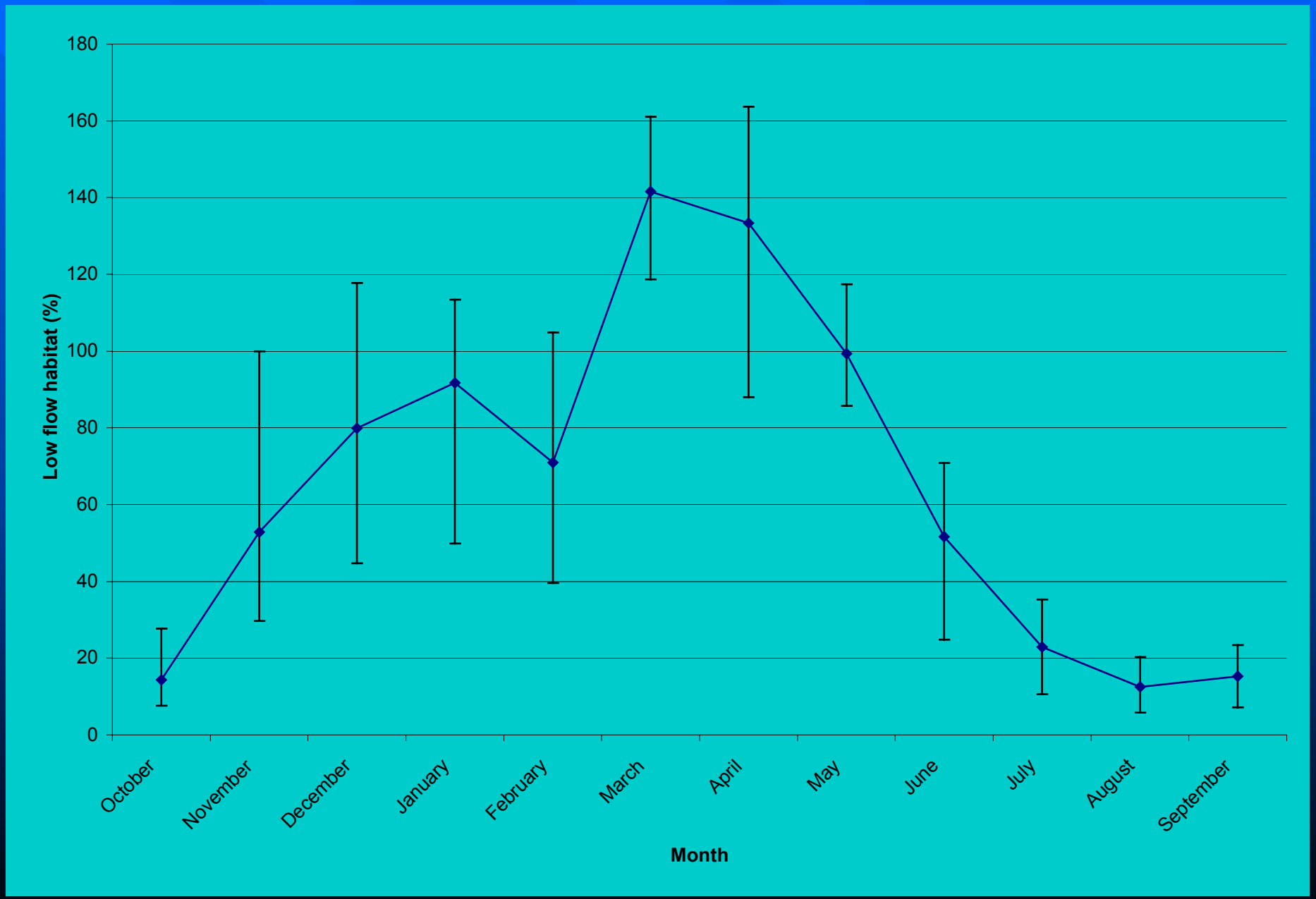
Hydrological criteria setting CUT-curves

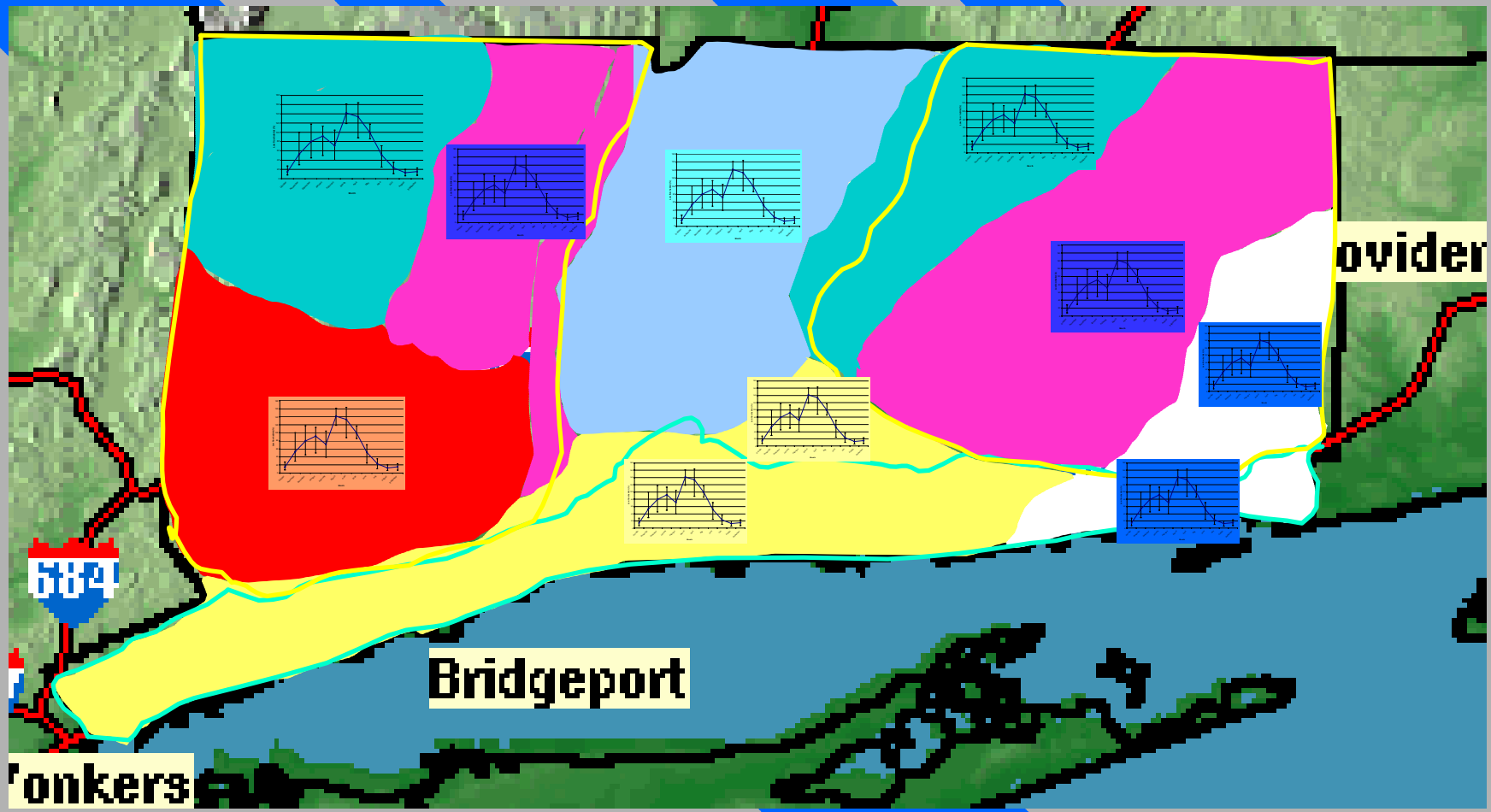


Hydrological criteria setting
CUT- curves




simulation
minimum
critical
optimum
Median daily flow [cfs]
800
720
640
560
480
400
320
240
160
80
0
Winter Survival
Storage and Atl.S Emerg.
Spawning (resident + anadromous) and Alt.S Rearing
Rearing & Growth
Growth and Alt.S Spawning
0.5 cfsm
0.4 cfsm
0.35 cfsm
1/1
1/16
1/31
2/15
3/1
3/16
3/31
4/15
4/30
5/15
5/30
6/14
6/29
7/14
7/29
8/13
8/28
9/12
9/27
10/12
10/27
11/11
11/26
12/11
12/26
Day of the Year


180
160
140
120
100
80
60
40
20
0
Low flow habitat (%)
October
November
December
January
February
March
April
May
June
July
August
September
Month


ovider
Bridgeport
onkers