Potomac Basin Large River Environmental Flow Needs: Introductory webinar for expert workshop participants

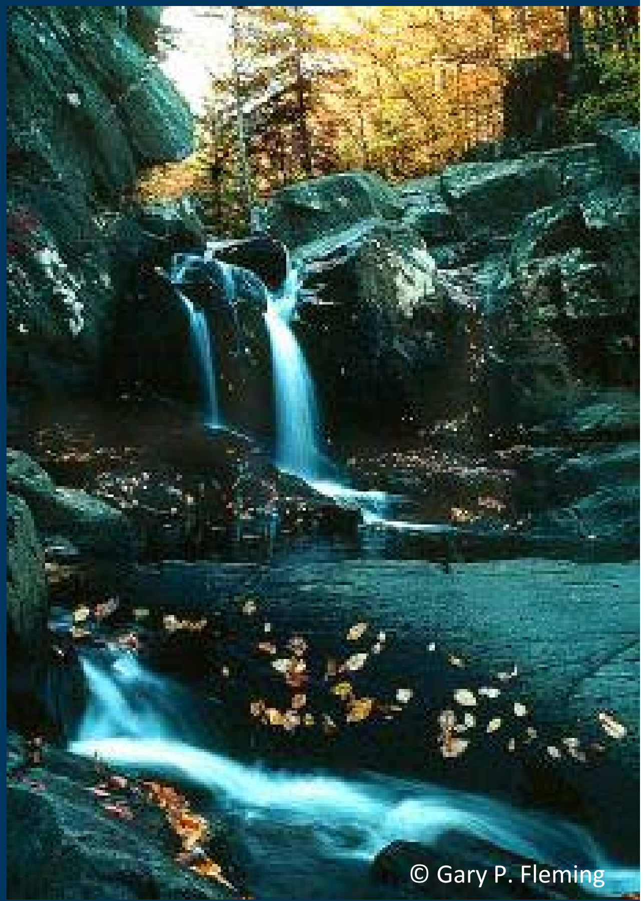
September 9, 2010

Welcome and webinar overview

- ~45 minutes of presentation

- Topics:
  1. Project introduction and background
  2. Project analytical approach
  3. Developing environmental flow needs
  4. Preparing for workshop
  5. Workshop logistics

- ~30 minutes of Q&A and group discussion
  - All welcome to join in
  - Q&A process to be explained



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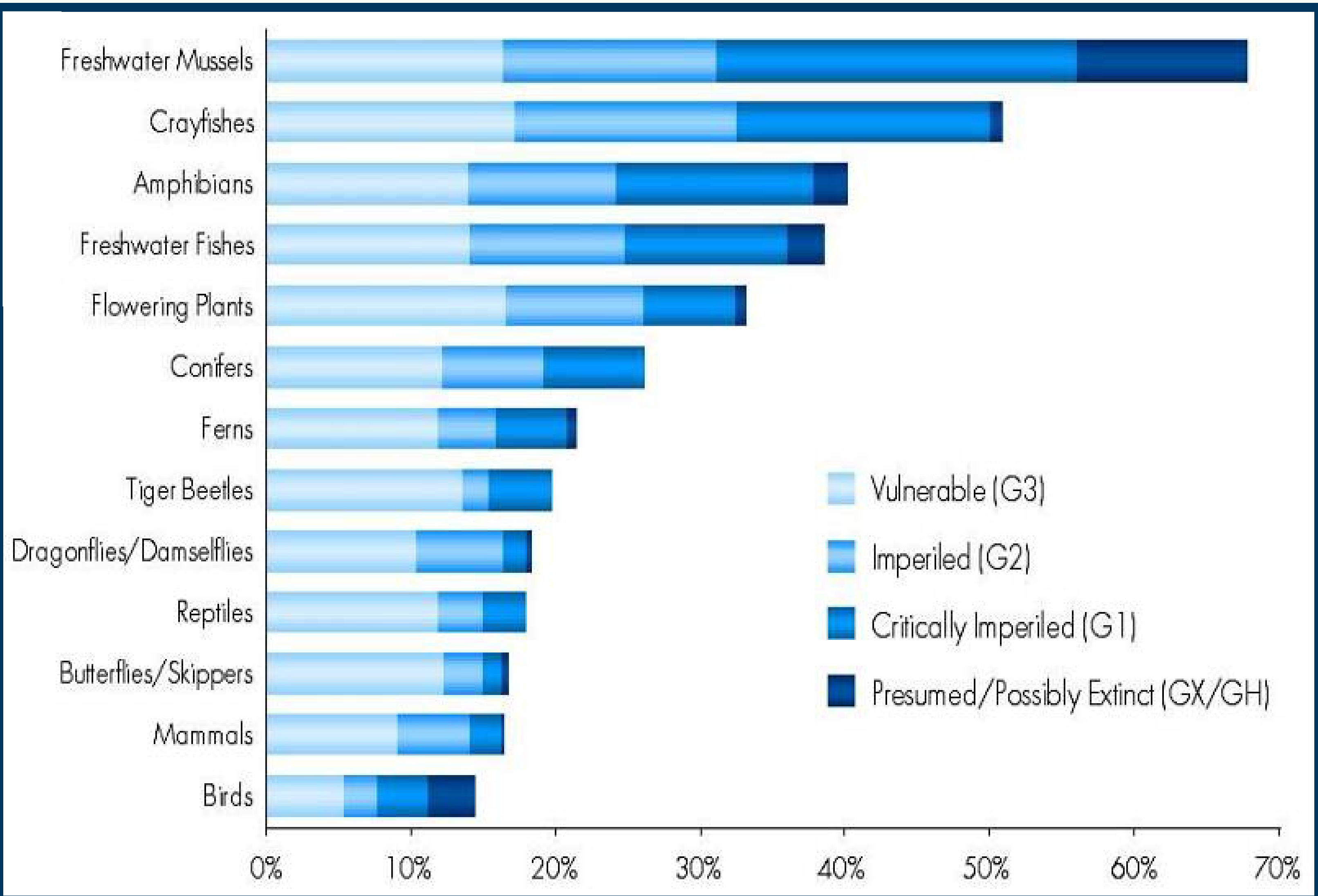
- Technical problems? Call Webex: 866-229-3239, 1

Why focus on freshwater ecosystems?
Proportion of U.S. species at risk

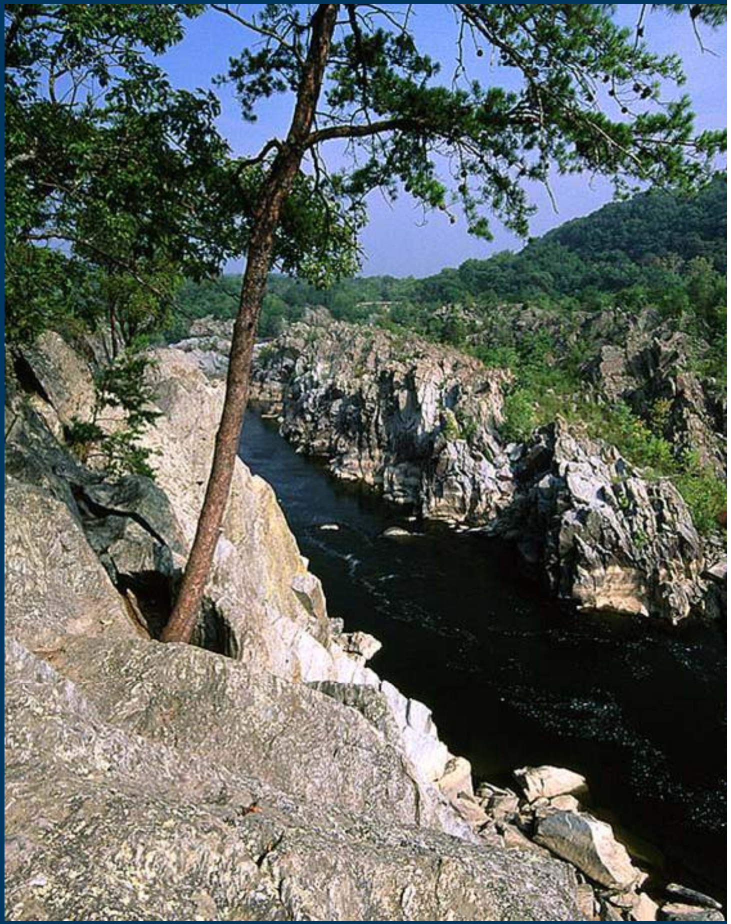


From "Rivers of Life: Critical Watersheds for Protecting Freshwater Biodiversity," 1998

Project purpose

To develop information and tools that enable the Potomac watershed jurisdictions and water managers to protect **environmental flows,**

defined as the seasonally variable flows of water that **sustain healthy river ecosystems** and the **goods and services** that **people** derive from them.

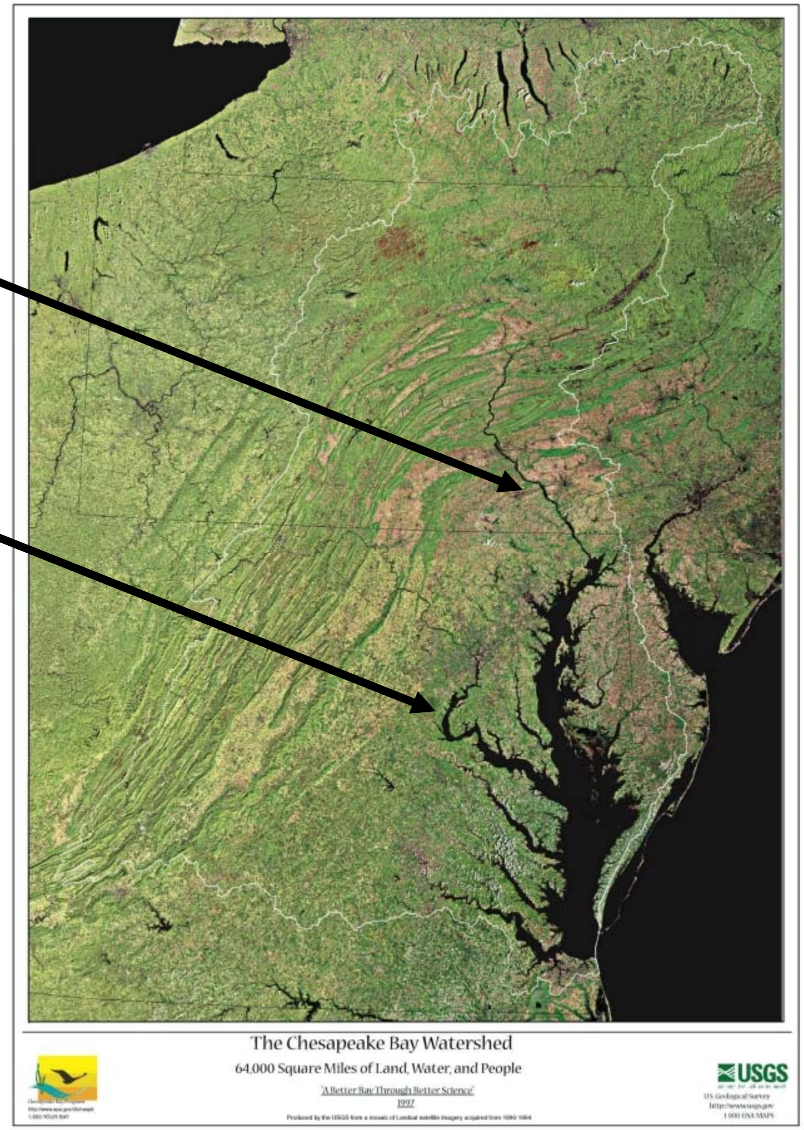


TNC interest in environmental flows to protect freshwater systems and Bay

Susquehanna River

Potomac River

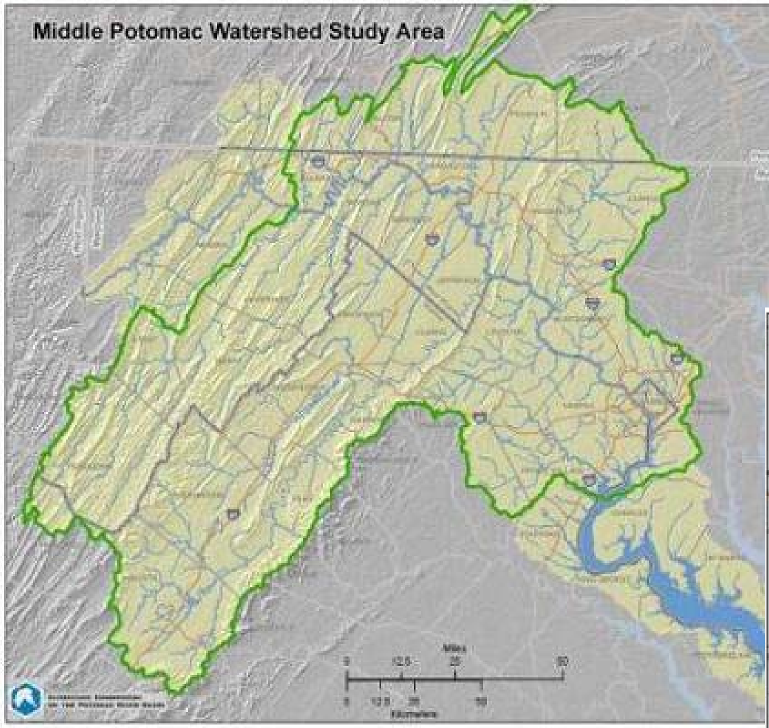
Environmental flow protection and restoration is a TNC conservation priority – in the Potomac, the Chesapeake Bay , nationwide and globally

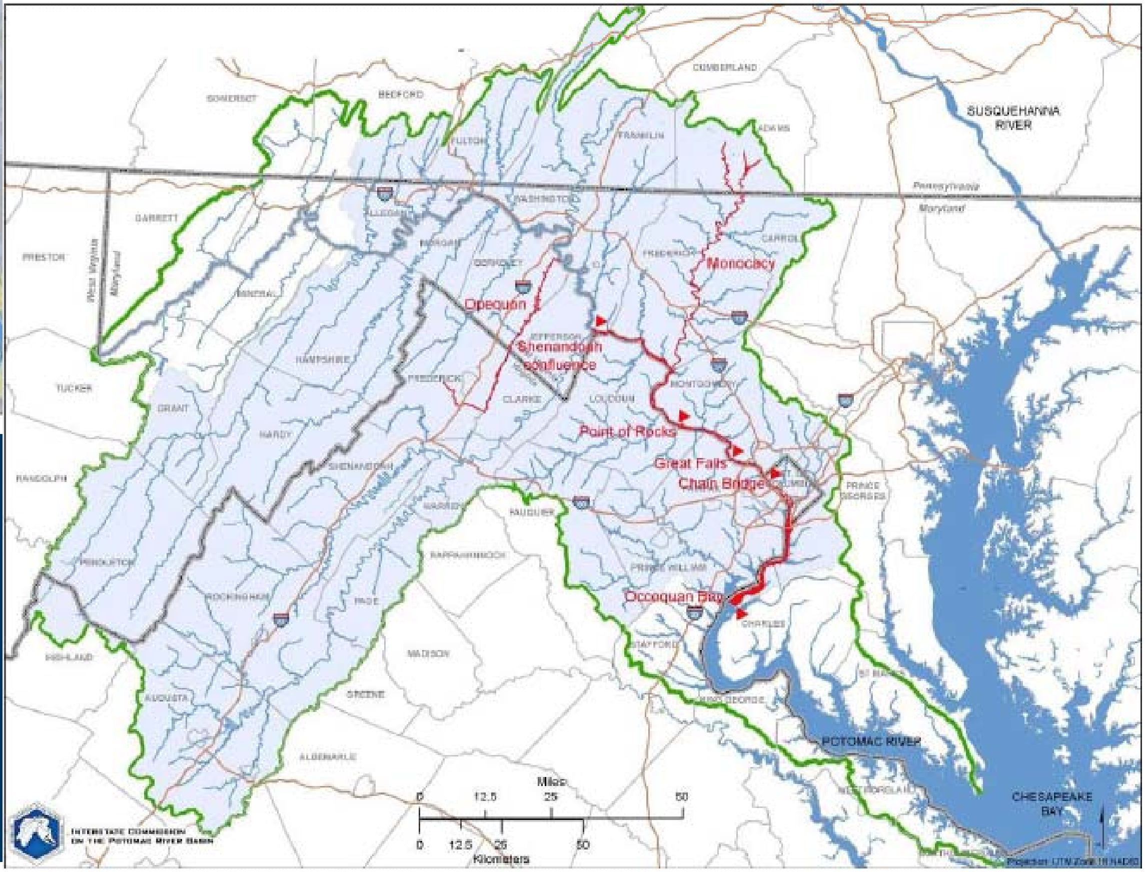


Why a concern with flows in the Potomac?

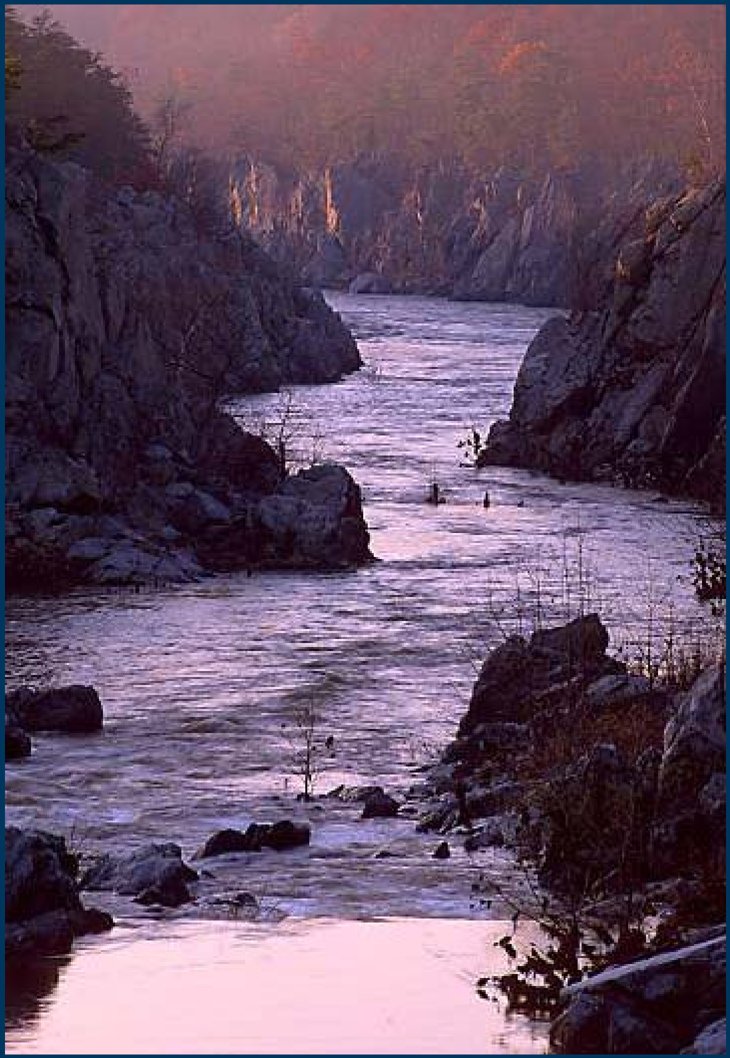
- Population growth – 10% increase per decade from 2000 to 2030
- Water demand – 20-30% increase in Metro DC water use over next 30 years
- Consumptive use for industry and agriculture
- Land use change/stormwater runoff
- Climate change

Large River Environmental Flow Needs project: part of a larger Corps project





Benefits of basin-scale project



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- Provides shared framework for incorporating ecological considerations into water and land use planning
- Helps support state-level water resource planning & management goals
- Offers proactive approach to identifying and managing sources of flow alteration
- Presents opportunity to move towards a more comprehensive, basin-wide approach to Potomac resource management
- Creates forum to discuss and develop shared goals for sustainable water management, outside context of water crisis

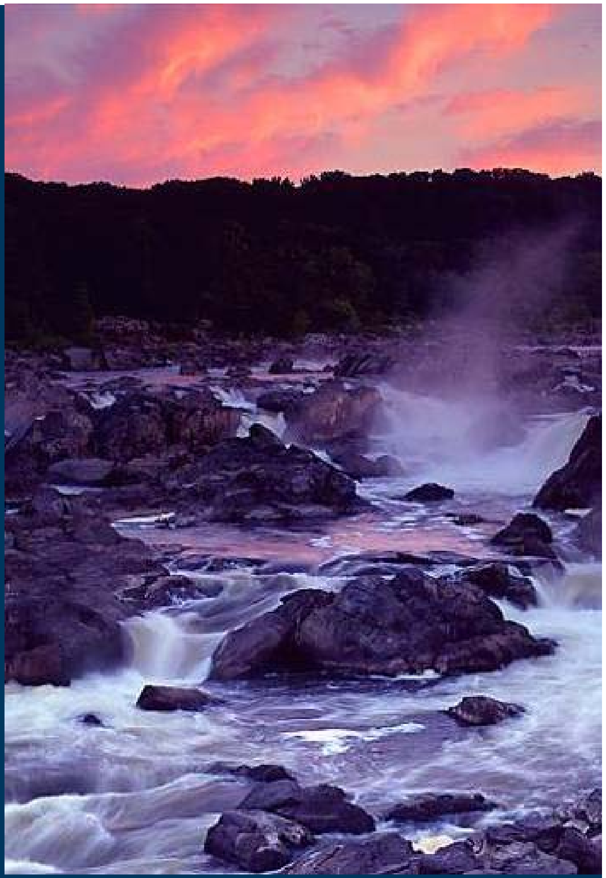
Large River Environmental Flow Needs: project origins and research team

Project sponsored by:

- The Nature Conservancy (TNC)
- Interstate Commission on the Potomac River Basin (ICPRB)
- National Park Service (NPS)
- U.S. Army Corps of Engineers (USACE)

Background report research team:

- Jim Cummins, Claire Buchanan, Carlton Haywood, Heidi Moltz, Adam Griggs (ICPRB);
- Than Hitt and Rita Villella (USGS);
- R. Chris Jones, Richard Kraus (GMU-PEREC)
- + Inputs from The Nature Conservancy



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Draft Background Report and Literature Review

Available online at www.potomacriver.org/sustainableflows

Potomac Basin Large River Environmental Flow Needs

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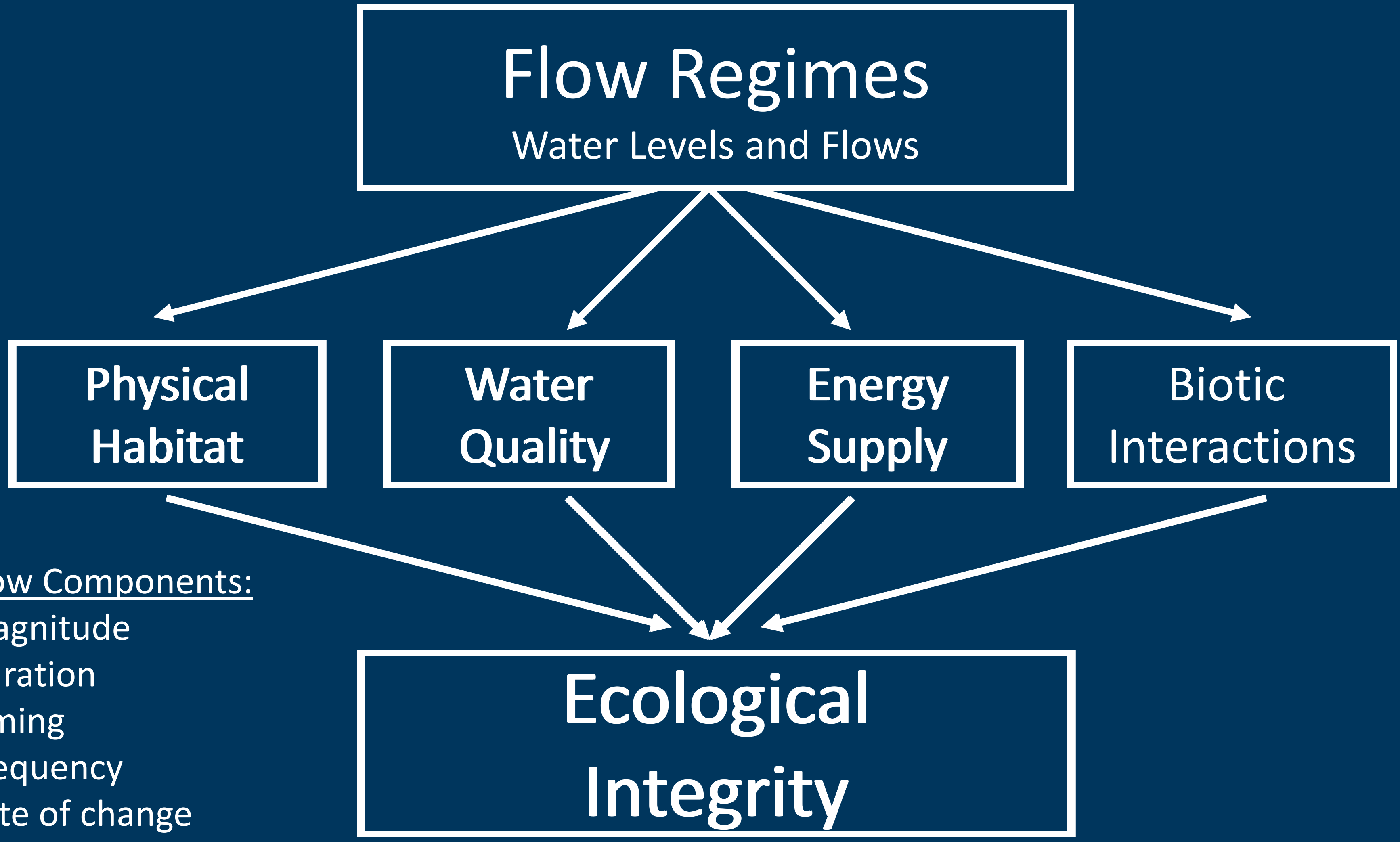
WITH FUNDING PROVIDED BY

The National Park Service

Revised August 24 2010

-- DRAFT -- report for workshop discussion

Flow: The master variable

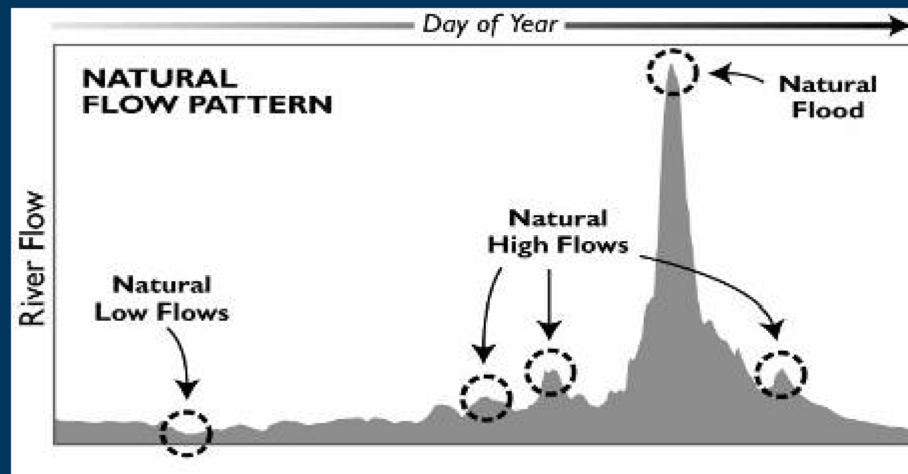


Flow Components:
Magnitude
Duration
Timing
Frequency
Rate of change
Inter-annual variability

From Poff et al. 1997

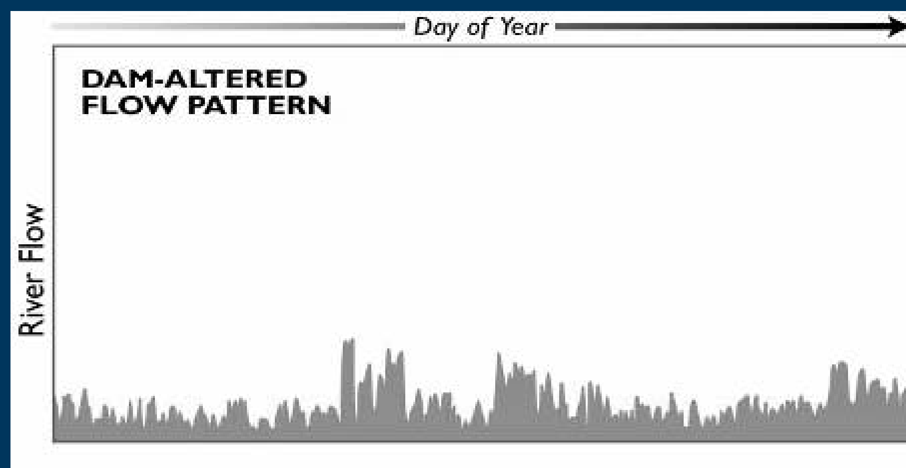
It’s not just a matter of water volume

=



= Better for species & ecological systems

=



= Bad for species & ecological systems

This is the same volume!

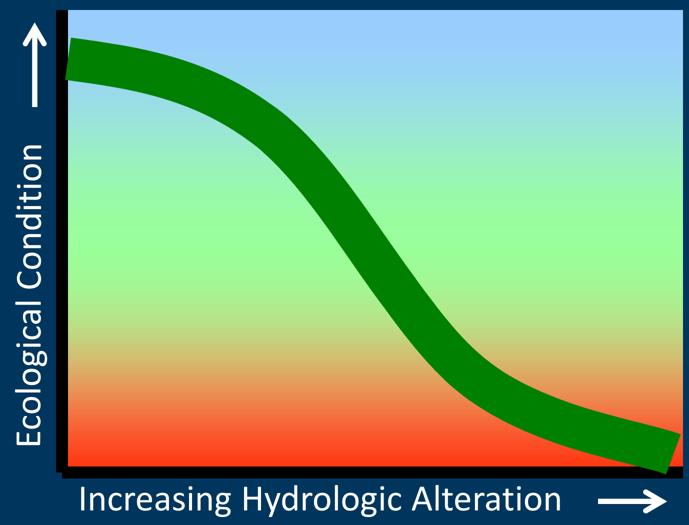
Developing environmental flow recommendations for the Potomac watershed

1. Determine large river environmental flow needs:

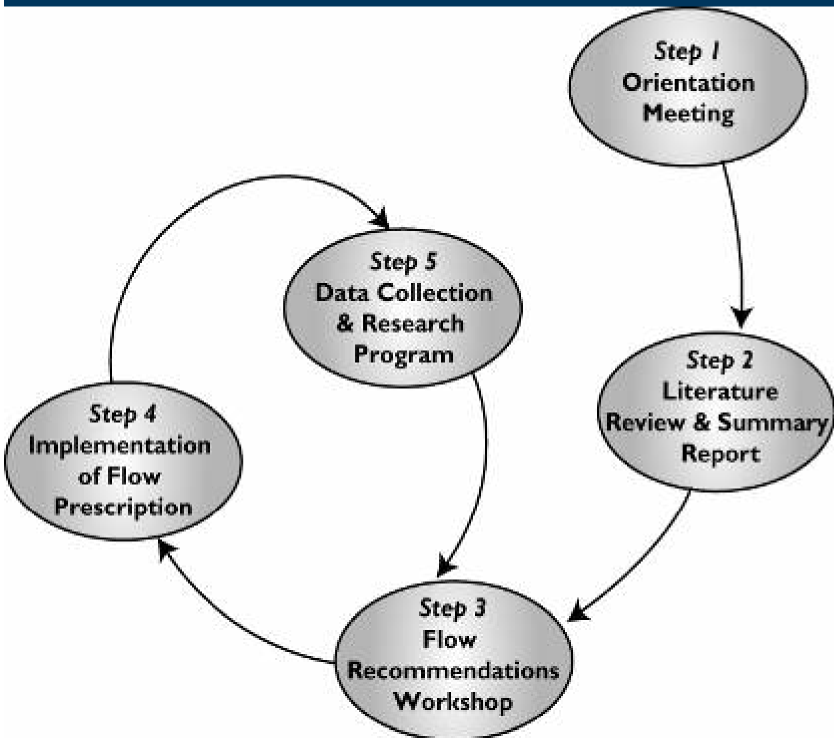
   - Use literature review, conceptual models, and expert input
   - Define ***full range* of hydrologic needs for species**
   - **Limitations on existing data and research**

2. Develop regional, quantitative flow-ecology relationships:

- Group streams into similar types
- Define flow alteration/ecological response relationships by group
- Use social/policy process to set flow recommendations
- May 2011 Expert workshop



Large River Environmental Flow Needs



Note: In the Potomac, we are only formally pursuing steps 1 - 3

Report on Potomac flow needs

Select indicator species

- diadromous and resident fish
- freshwater invertebrates
- floodplain vegetation
- estuarine communities

Define flow needs for species' life stages

- glochidia release
- seed dispersal and germination
- fish migration, spawning

Engage experts to review hypotheses, flow statistics, & draft flow recommendations

Discuss process to move towards quantifying recommended protective hydrologic ranges

Workshop goal and outcomes

Goal: Determine environmental flow needs for segments of the mainstem Potomac and selected large tributaries

Workshop process: Use expert input to refine initial draft flow-ecology hypotheses, statistics, and recommendations from the draft report during breakout group sessions

Expected outcome: A set of flow hypotheses and measurable flow statistics for the Potomac River and major tributaries that can be refined using an adaptive management approach

Environmental flow terms

Ecological Indicators – species sensitive to flow and grouped by taxa, life history strategies, and flow needs

Environmental Flow Components – types of flow events that represent the full spectrum of river flows and are required for ecological function: small and large floods, high flow pulses, mid-range flows, low flows, and drought flows

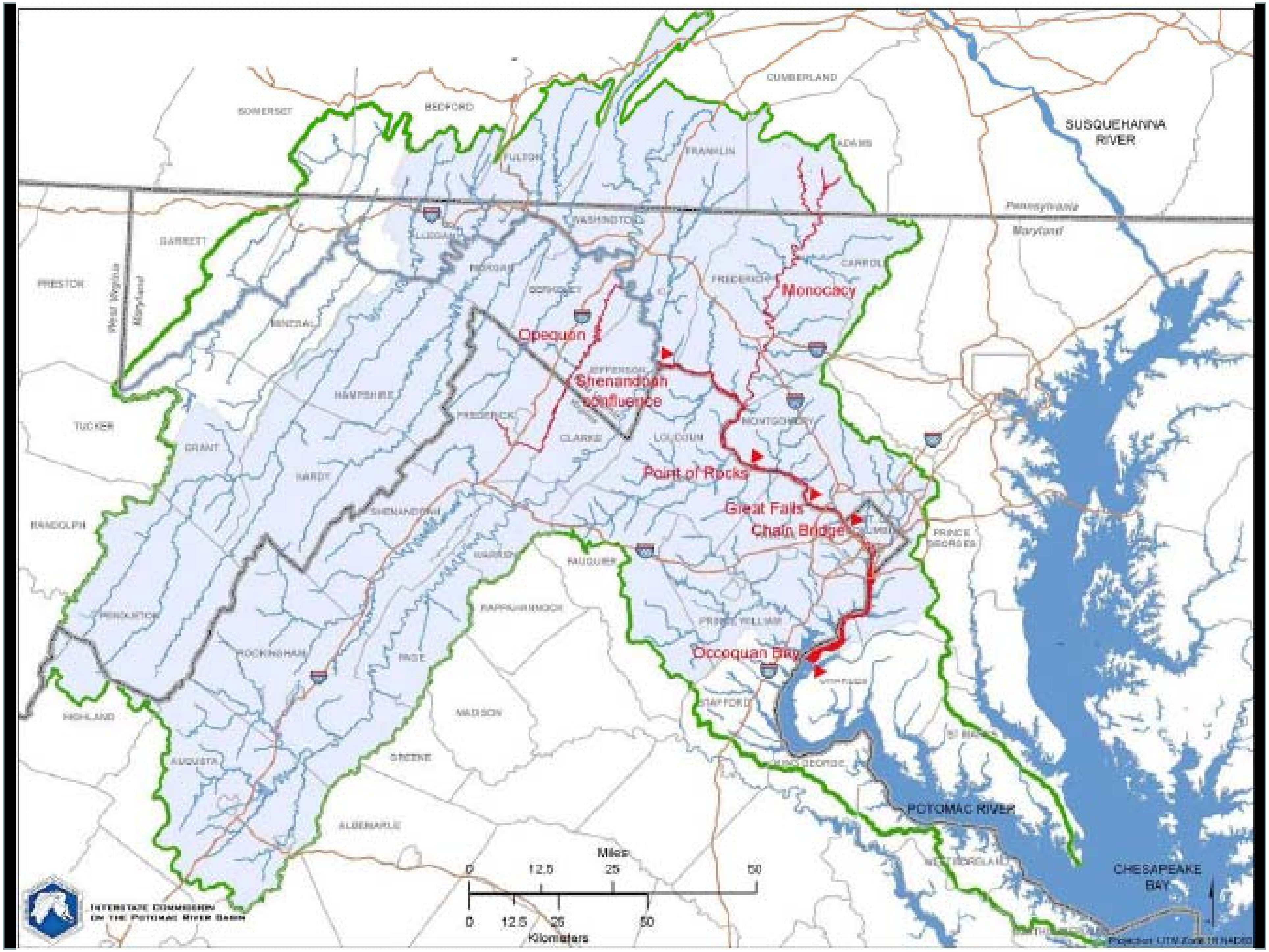
Environmental Flow Needs – the quality, quantity and timing of water flows required to maintain the components, functions, processes and resilience of aquatic ecosystems

Defining environmental flow needs

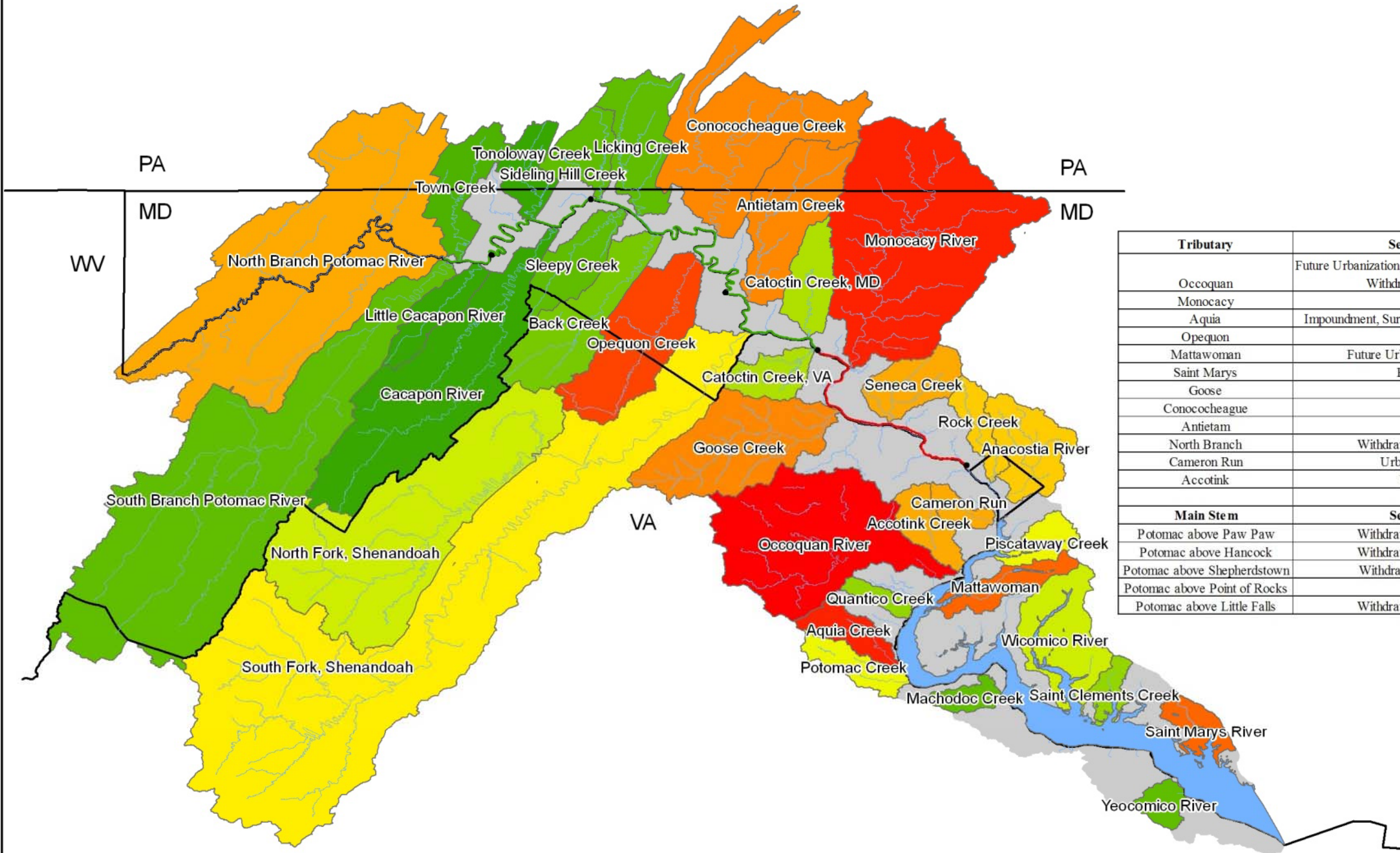
Flow hypothesis – a testable explanation for a suspected or observed relationship between river flow and the needs and tolerances of species and communities

Flow statistic – measurement of the magnitude, duration, frequency, timing, or rate of change of environmental flow components. Should be measureable, repeatable, and responsive to management.

Flow recommendation – recommended quantification of, or development of a range around, a flow statistic that is protective of one or more ecological indicator or function


SUSQUEHANNA
RIVER
Pennsylvania
Maryland
West Virginia
Maryland
CUMBERLAND
SOMERSET
BEDFORD
FULTON
FRANKLIN
ADAMS
GARRETT
PRESTON
WASHINGTON
MORGAN
FREDERICK
CARROLL
Monocacy
MINERAL
Opequon
JEFFERSON
Shenandoah
confluence
HAMPSHIRE
TUCKER
GRANT
FREDERICK
CLARKE
LOUDOUN
MONTGOMERY
HARDY
Point of Rocks
Great Falls
Chain Bridge
RANDOLPH
SHENANDOAH
WARREN
FAUQUIER
PRINCE
GEORGES
RAPPAHANNOCK
PENDLETON
PRINCE WILLIAM
Occoquan Bay
ROCKINGHAM
PAGE
STAFFORD
HIGHLAND
MADISON
GREENE
AUGUSTA
ALBEMARLE
POTOMAC RIVER
CHESAPEAKE
BAY
Miles
0
12.5
25
50
0
12.5
25
50
Kilometers
INTERSTATE COMMISSION
ON THE POTOMAC RIVER BASIN

Areas at greatest risk of hydrologic alteration



Tributary	Severe Risk Factors
Occoquan	Future Urbanization, Impoundments, Withdrawals, Surface Withdrawals, Consumptive Use
Monocacy	Agriculture
Aquia	Impoundment, Surface Withdrawals, Consumptive Use
Opequon	Karst
Mattawoman	Future Urbanization, Consumptive Use
Saint Marys	Future Urbanization
Goose	Agriculture
Conococheague	Agriculture
Antietam	Karst
North Branch	Withdrawals, Surface Withdrawals
Cameron Run	Urban, Forest, Impervious
Accotink	Urban, Impervious
Main Stem	**Severe Risk Factors**
Potomac above Paw Paw	Withdrawals, Surface Withdrawals
Potomac above Hancock	Withdrawals, Surface Withdrawals
Potomac above Shepherdstown	Withdrawals, Surface withdrawals
Potomac above Point of Rocks	Withdrawals
Potomac above Little Falls	Withdrawals, Surface Withdrawals

Subbasin Risk | Cumulative Mainstem Risk

Rivers 12 16 22 26 30 34 38 42 34 36 Smaller Tributaries Not Included in This Stage of Evaluation

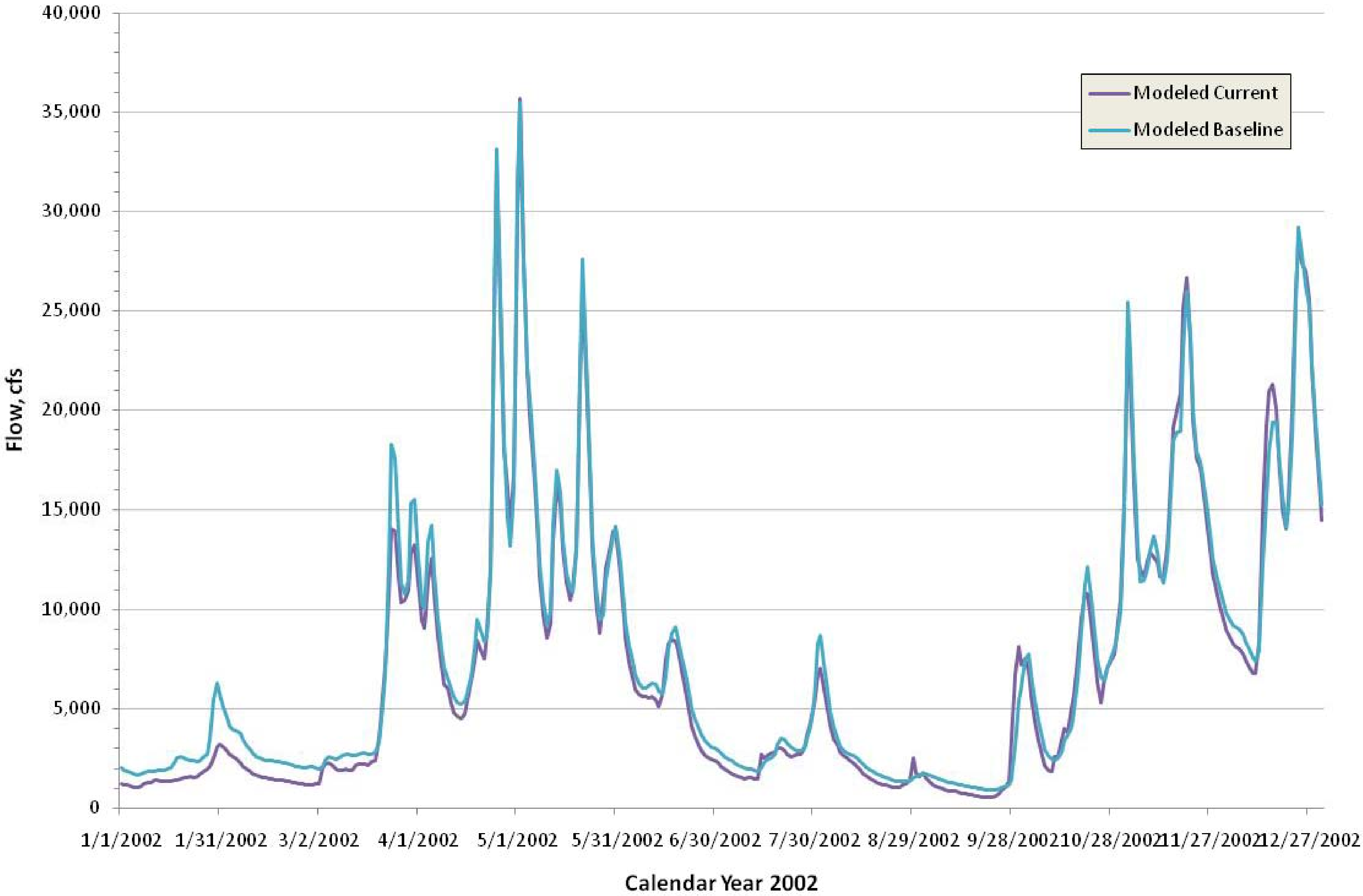
States 14 18 24 28 32 36 40 52 Mainstem Segment Boundaries for Index Development

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN

Data Sources: National Inventory of Dams; Chesapeake Bay Program 2000 Land Use and Predicted Future Land Use; Potomac Withdrawal Databases; EPA Region 3 Ecoregions; USGS AWUDS

Miles 0 5 10 20

Potomac River at Little Falls Simulation of 2002



Literature review process

Research Team: ICPRB, USGS Aquatic Ecology Branch, George Mason University (TNC in advisory role)

- Over 480 sources relevant to environmental flow requirements for the Potomac and its ecological components
- Organized into searchable online database

Content and synthesis:

1. Ecological indicator species and key life history stages
2. Group species with similar flow-sensitivities
3. Develop flow hypotheses and conceptual diagrams
4. Choose flow statistics and make recommendations for changes in statistics that are representative of flow needs

Ecological indicator taxa

- Fishes
- Mussels
- Riparian plant communities
- Freshwater estuarine system

Chosen based on targeted life history traits, sensitivity or adaptation to flow conditions

Fishes

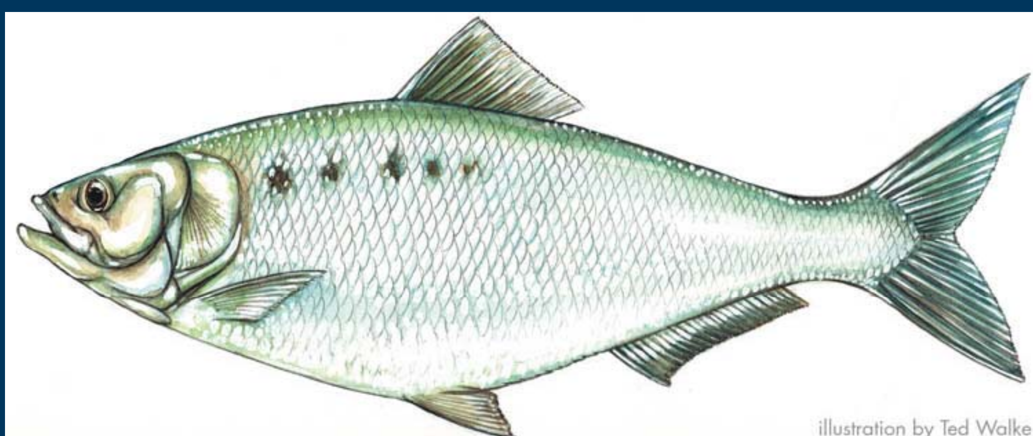
Functional groups and representatives:

A. Atlantic sturgeon – large bodied, flow-velocity generalists

B1. American shad – medium sized with moderate flow-velocity specialization, large home range size

B2. Smallmouth bass – medium sized with moderate flow-velocity specialization, small home range size

C. Fantail darter – small bodies, flow velocity generalists



American shad, *Alosa sapidissima*

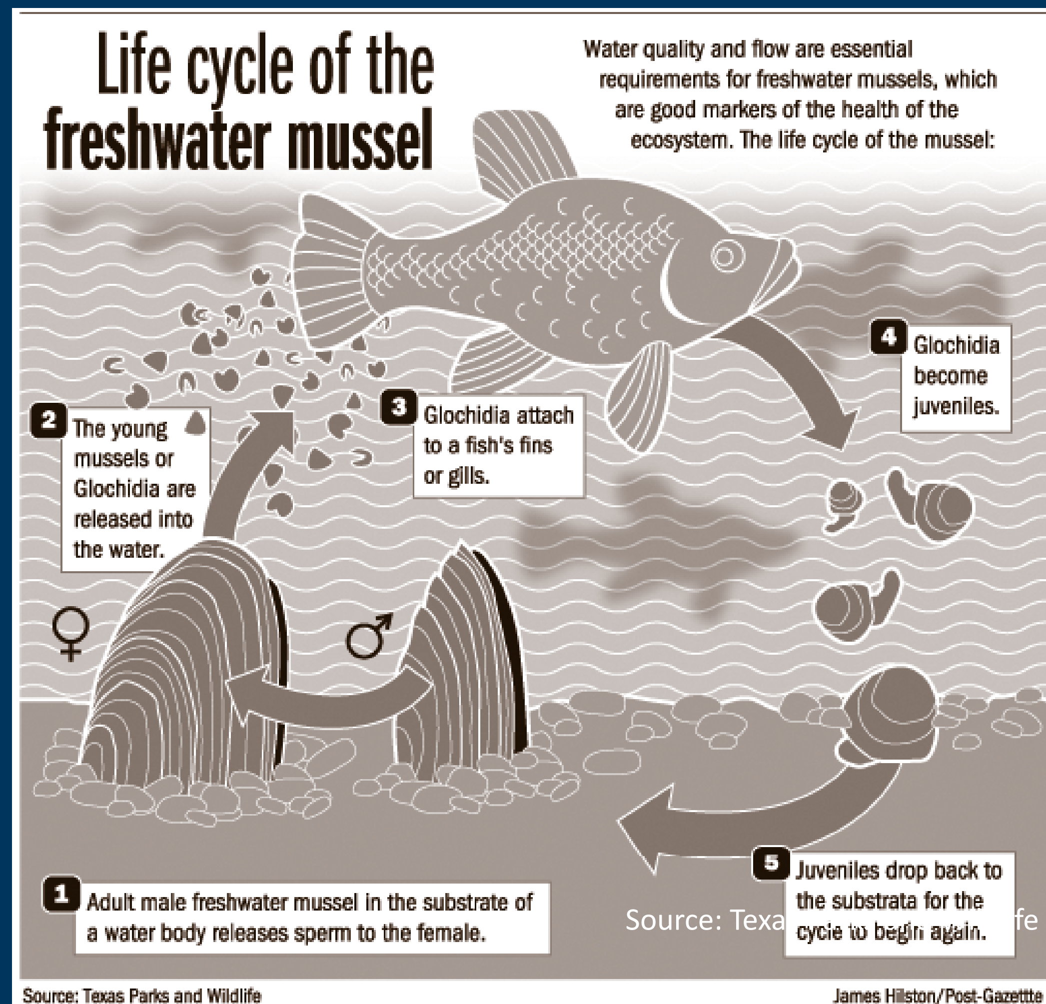
Vadas and Orth 2000, Frimpong and Angermeier 2009, Walsh et al 2007

illustration by Ted Walke, PFBC

Mussels

Targeted life history traits:

- Brood length
- Adult size
- Fish hosts
- Substrate
- Flow velocity



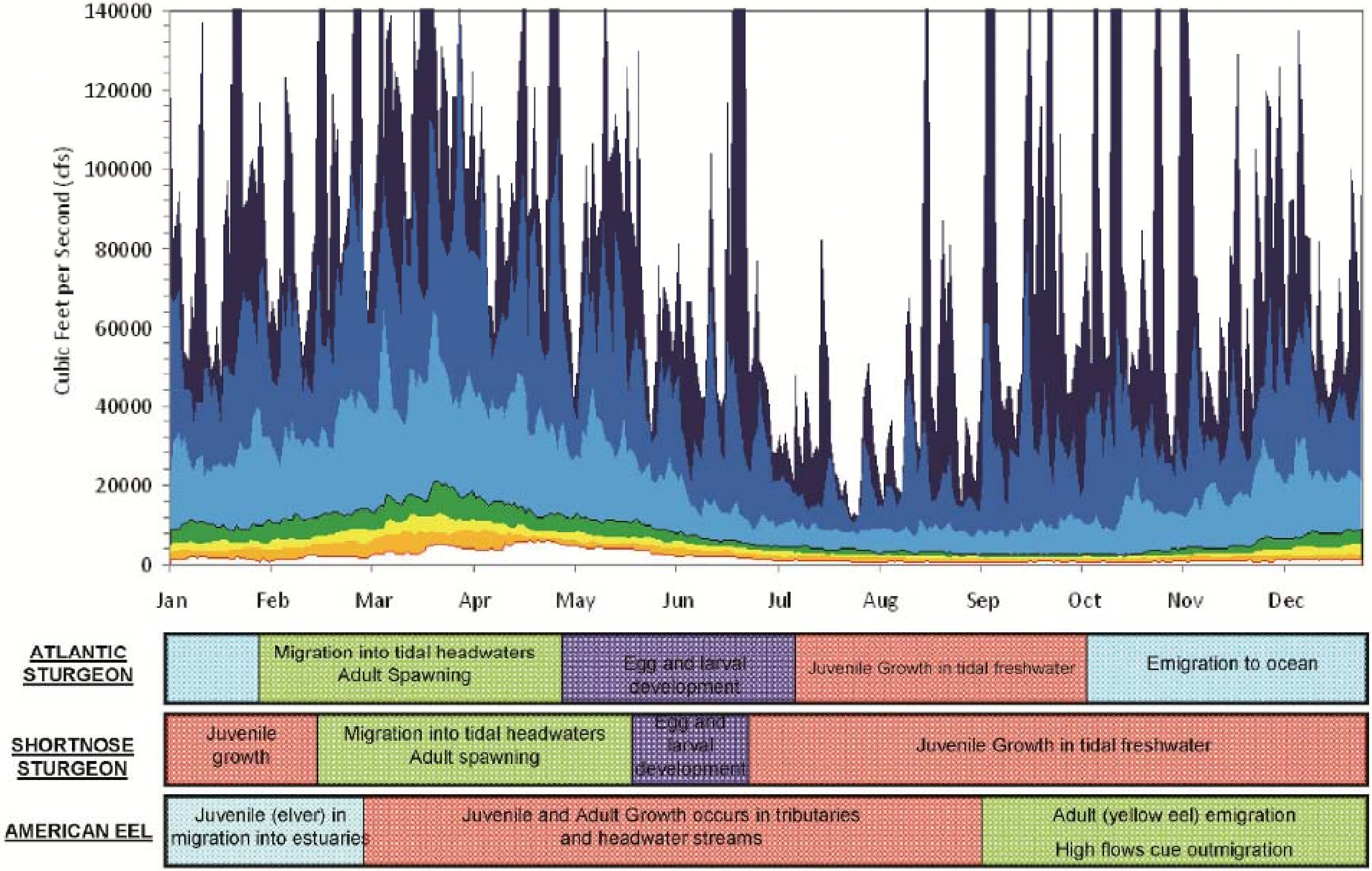
Aquatic and riparian vegetation

- Instream – inundated all year, some seasonal exposure at edges
- Bank and bar – mean water mark to 2-yr RI flood
- True flood plain – affected by floods with 2-10 yr RI
- Flood terrace – inundated by extreme floods > 10 yr RI

Freshwater estuarine system

1. Phytoplankton
2. SAV
3. Zooplankton
4. Benthic invertebrates
5. Fish

[redacted]



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Developing flow hypotheses

A testable explanation for a suspected or observed relationship between river flow and the needs and tolerances of the river's species and communities

Who	Species or group of species
What	Flow magnitude or event
When	Month or season
Where	Habitat type or unit
Why / how	Ecological response

Fish: flow hypotheses

During spring, American shad require high flows as one of several cues for upriver migrations of adults to non-tidal spawning grounds.

Loss of high spring flows may delay emigration and spawning.

Fish: flow hypotheses

During spring, American shad require high flows as one of several cues for upriver migrations of adults to non-tidal spawning grounds.

Loss of high spring flows may delay emigration and spawning.

Who What When Where Why/How

Choosing flow statistics ("what")

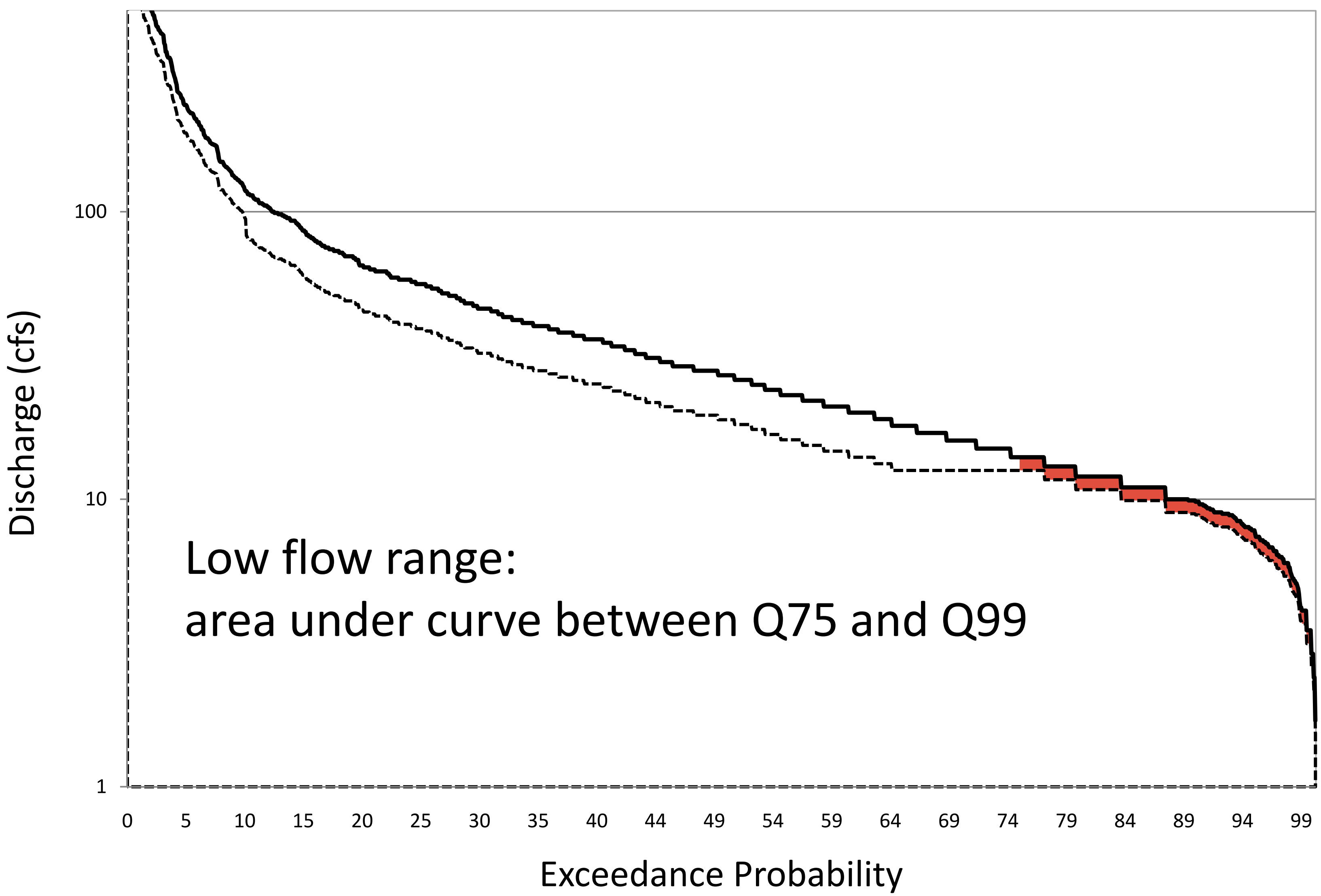
Measurements of the magnitude, duration, frequency, timing, or rate of change of environmental flow components - measureable, repeatable, and responsive to management

- Individual statistics
- Ranges of a flow duration curve

Statistics suggested by flow hypotheses

Flow Component	Flow statistic
High flows	Bankfull (2-yr RI) and large floods (10-yr RI)
	Magnitude of annual Q10 flow
	Frequency of high flow events, fall and winter
Seasonal flows	Magnitude of monthly Q10
	Magnitude of monthly Q50
	Magnitude of monthly Q90
Low flows	Magnitude of annual Q90
	7Q10 (7 day, 10 year) flow
	Duration of low flow events, summer and fall
	Low flow range (flow duration curve)

Flow Duration Curve



Developing flow recommendations from hypotheses (quantify "what")

Recommended quantification of, or development of a range around, a flow statistic that is protective of one or more ecological indicator or function

Who	Species or group of species
What	Flow statistic and recommended value or range
When	Month or season
Where	River, group of rivers, or river reach
Why/How	Ecological response

Example flow recommendations: Susquehanna River

Table 5.1 Flow recommendations for the Susquehanna River ecosystem.

Season	Flow Component	Flow Statistic	Flow Recommendations	
			Headwater streams < 50 sq mi	**Streams and small rivers (50 – 200 sq mi)**
Annual and Interannual Events	High Flows	Large flood	Maintain magnitude and frequency of annual Q0.05 (20-yr flood)	Same for all streams
		Small flood	Maintain magnitude and frequency of annual Q0.2 (5-yr flood)	Same for all streams
		Bankfull	Maintain magnitude and frequency of annual Q0.5 (Approx. 1 to 2-yr flood)	Same for all streams
All Months	High flows	Monthly Q10	<10% change to magnitude of monthly Q10	Same for all streams
	Seasonal flows	Monthly Median	Between 45th and 55th percentiles	Same for all streams
		Monthly Range	≤ 20% change to area under curve between Q10 and Q75	Same for all streams
	Low flows	Monthly Low Flow Range	No change to area under curve between Q75 and Q99	≤ 10% change to area under curve between Q75

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Maintain baseline conditions for individual flow statistics

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Ranges around individual statistics

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Area under a flow duration curve

Preparing for the workshop: review background report

In particular, focus on the following:

- Executive summary
- Summaries at the beginning of each chapter
- Flow hypotheses at the end of chapters 2 and 3
- Chapter 4 – synthesizes the flow needs of all ecological indicators and provides draft flow recommendations
- Tables 12-16
- Appendix A for explanation of some flow statistics and environmental flow components

Tables 12-13: flow needs of ecological indicators (pp 79-88)

Biota	Flow Component: High Flow Events	Flow Component: Mid-Range Flows	Flow Component: Low Flows	Reference
Group A fish (large-bodied, long-lived, late maturation, migratory, flow-velocity generalist) e.g., American eel	Sep-Feb – provides one of several cues for out-migration of adult eel (silver eels) (Flow Statistics 15-# events Winter, 16-# events Spring)	Dec-Apr - one of several cues for upriver migrations of juvenile eel (elvers) (Flow Statistic 9-# events Fall)	Sept-Feb - Out-migration delayed if prolonged. (Flow Statistics 7-duration events Fall, and 8-duration events Summer)	• High flows trigger adult eel out-m (Smogor et al. 1995). • Migrating eels may delay migrati velocities are too low or too high (2009).
Group B1 fish (Alosid, medium-sized, migratory, moderate flow-velocity specialization, e.g., blueback herring, alewife, American shad	Mar-Jun – provides one of several cues for upriver migrations of adults to nontidal spawning grounds Mar-Aug - high flow pulses not too numerous or too strong to cause loss of larvae and young-of-year class August-November- High flow are one emigration trigger. (Flow Statistics 13-2 yr R.I. event, 15- # events Winter, 16-# events Spring, and 18- # events Fall)	Mar-Jun – provide adults with access to natal spawning streams (Flow Statistics 9- Monthly Q_{90} flow, 10- Monthly Q_{50} flow, and 11- Monthly Q_{10} flow)		•High flows in summer limit recrui (Jenkins and Burkholder 1994) • Cues for emigration include high et al 2009).

Table 14: Flow statistics (pp 89)

Flow category	Flow Statistics		
	Magnitude (cfs)	Frequency (#)	Duration (days)
Low flows (flow < Q_{90})	1. Annual 1 day min. flow 2. Annual Q_{90} flow 3. ${}_{7}Q_{10}$ (7 day, 10 year) flow	Median # of low flow events 4. Spring (Apr - Jun) 5. Summer (Jul - Sep) 6. Fall (Oct - Dec)	Median duration of low flow events 7. Summer (Jul - Sep) 8. Fall (Oct - Dec)
Mid-range flows (Q_{90} < flow < Q_{10})	9. Monthly Q_{90} flow 10. Monthly Q_{50} flow 11. Monthly Q_{10} flow		
High flows (> annual Q_{10}), Small Floods (>= 2 yr R.I. and < 10 yr R.I. event), and Large Floods (>= 10 yr R.I. event)	12. Annual Q_{10} flow 13. 2 yr Recurrence Interval (R.I.) event (approx. bank full) 14. 10 yr R.I. event (Large flood)	Median # of high flow events 15. Winter (Jan-Mar) 16. Spring (Apr - Jun) 17. Summer (Jul - Sep) 18. Fall (Oct - Dec)	Median duration of high flow events 19. Spring (Apr - Jun) 20. Summer (Jul - Sep)

Preparing for the workshop: questions for your consideration

- Do the flow hypotheses adequately represent the flow needs of the ecological indicators?
- Do the recommended flow statistics adequately represent the flow needs for each hypothesis?
- Are current conditions appropriate to use as a baseline for flow recommendations?
- Please come prepared to discuss these questions and provide expert opinion to determine environmental flow needs and monitoring priorities

Specific workshop tasks

- Review flow-ecology hypotheses and draft flow recommendations from summary report
- Determine adequacy of current conditions to meet ecological needs
- Review proposed environmental flow statistics that reflect flow needs
- Identify best approaches to characterizing change
- Identify and prioritize longer-term research and monitoring
- Discuss potential applications and approaches to protecting natural flows in the Potomac mainstem and selected large tributaries

Workshop logistics

- Meetings at National Conservation Training Center (NCTC)
- All registrants to date will have lodging at NCTC
- Starts 10 am on Day 1, Wed. Sept. 22 – please arrive by 9:30am
- Ends 4pm on Day 2, Thurs. Sept. 23

NCTC is located along the Potomac River in Shepherdstown, WV

Note: registration closes 9/13
Lodging space at NCTC running out

Brief overview of agenda

Interactive Workshop:

- Plenary sessions
- Breakout sessions
- Wed. evening dinner and after-dinner reception at NCTC
- Thurs. lunchtime speaker: Brian Richter, TNC's Director of Freshwater Conservation
- Revised agenda, registration confirmation to come

Reminder: Important note to government employees

Must send TNC letter of permission for TNC to cover your workshop costs by 9/13/10

Contact Stephanie Flack if you have any questions

Discussion / Question and Answer Session

Process

- All phones muted, except recognized speaker
- Raise "hand" to make comment or ask question
- When recognized, speaker's phone un-muted
- Lower "hand" when finished speaking
- We will also answer any questions raised using the "chat" function during the presentation

For more information on workshop or background report

Project leads from TNC and ICPRB:

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Julie Zimmerman, The Nature Conservancy, jzimmerman@tnc.org, 301-897-8570 x220

Jim Cummins, Interstate Commission on the Potomac River Basin, jcummins@icprb.org, 301-274-8106

Carlton Haywood, Interstate Commission on the Potomac River Basin, chaywood@icprb.org, 301-274-8105

For more information, visit potomacriver.org/sustainableflows