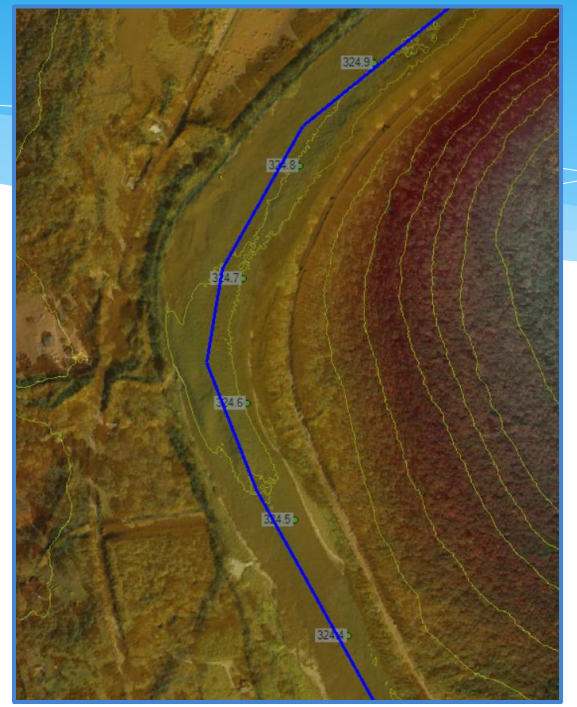
Delaware River Basin Commission

Status Update on modernization of Decision Support System (DSS) for Habitat Evaluations in the Upper Delaware



December 15, 2021

John Yagecic, PE

Manager, Water Quality Assessment DRBC

60 years 1961–2021

Delaware River Basin Commission

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Modernize DSS

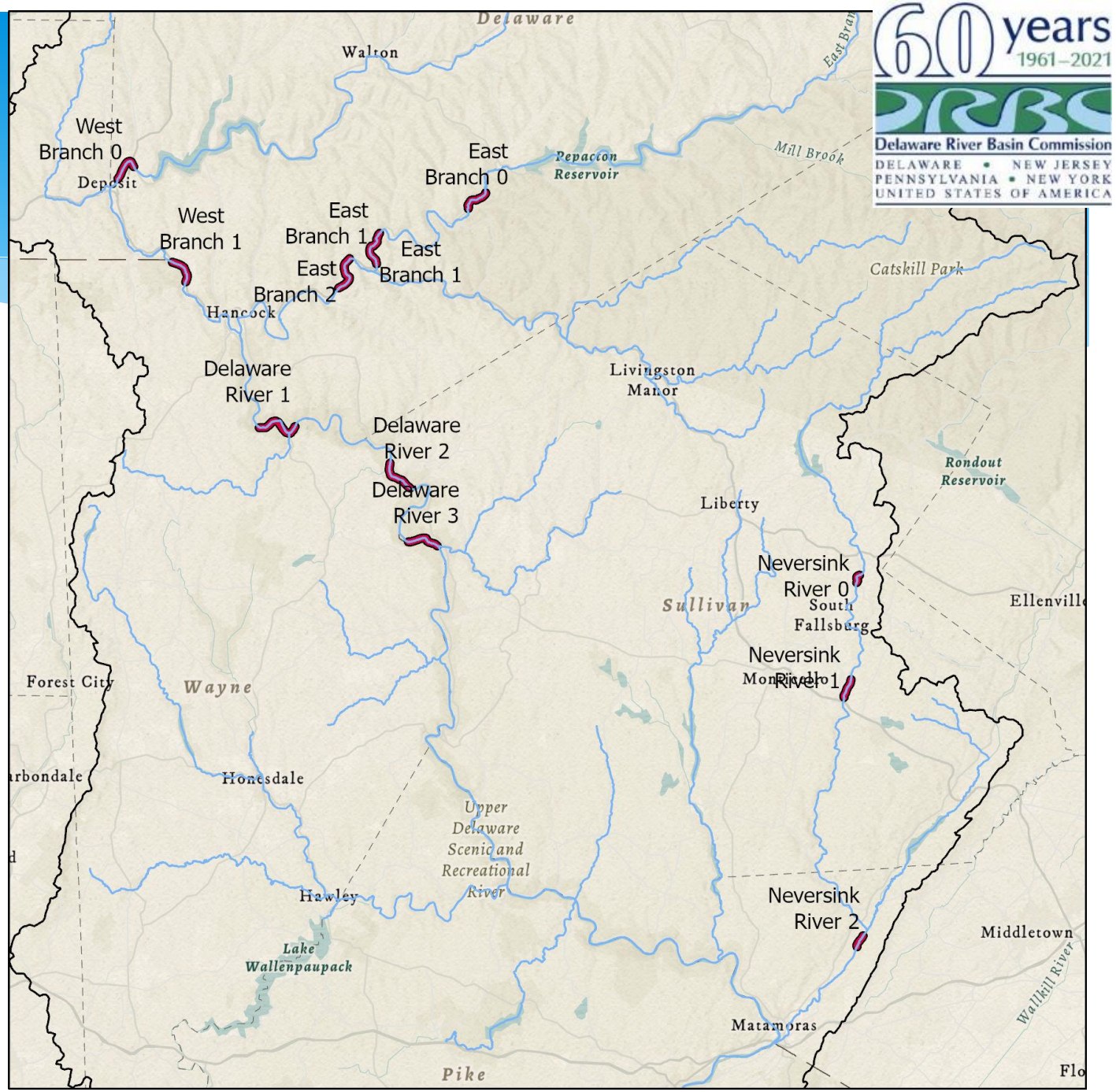
Original work by USGS:

Bovee, K.D., Waddle, T.J., Bartholow, J., and Burris, L. 2007. **A Decision Support Framework for Water Management in the Upper Delaware River: USGS** Open File Report 2007-1172

- 2007 Excel Spreadsheet based with VBA
- REF-DSS interactive
  - Software underpinning had become antiquated
  - Hard / impossible to run
  - Not expandable
  - Limited to comparing 1 base case to 1 alternative case
- **Goal to recode DSS into a modern modular platform for ease of use and expandability**

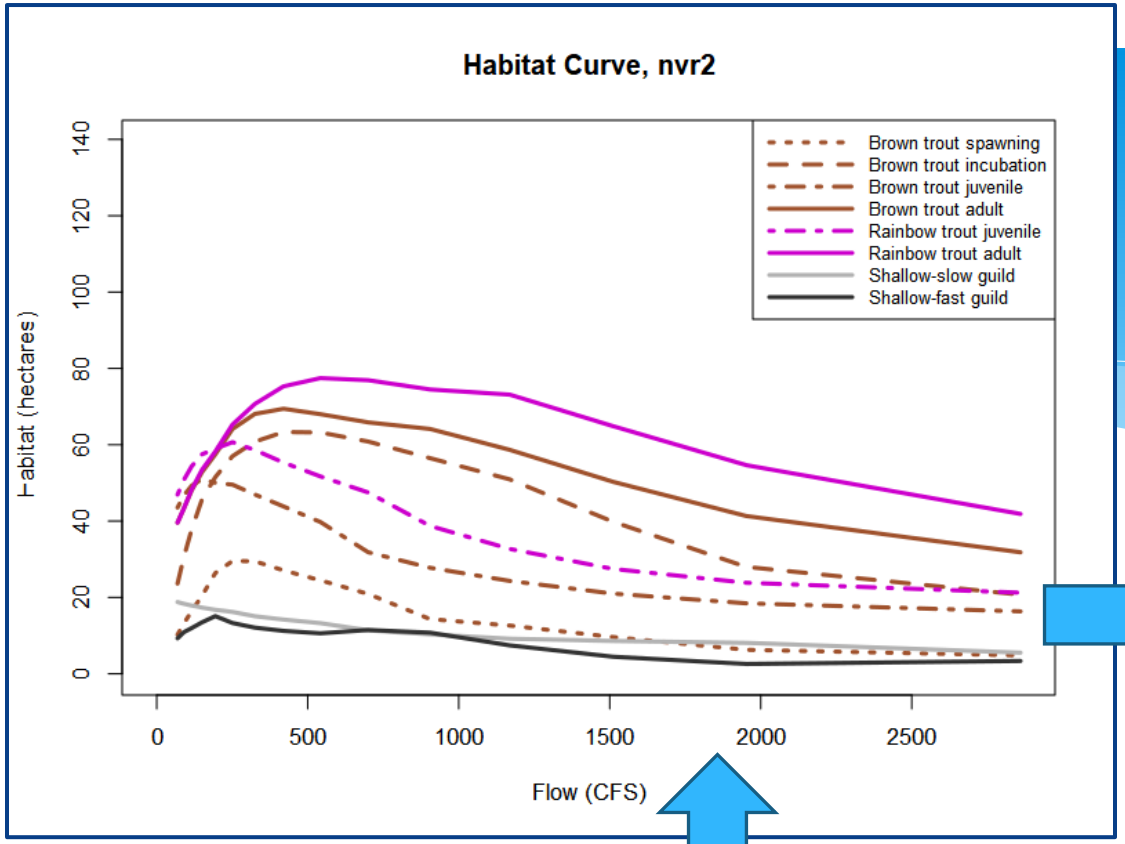
Habitat Study Reaches

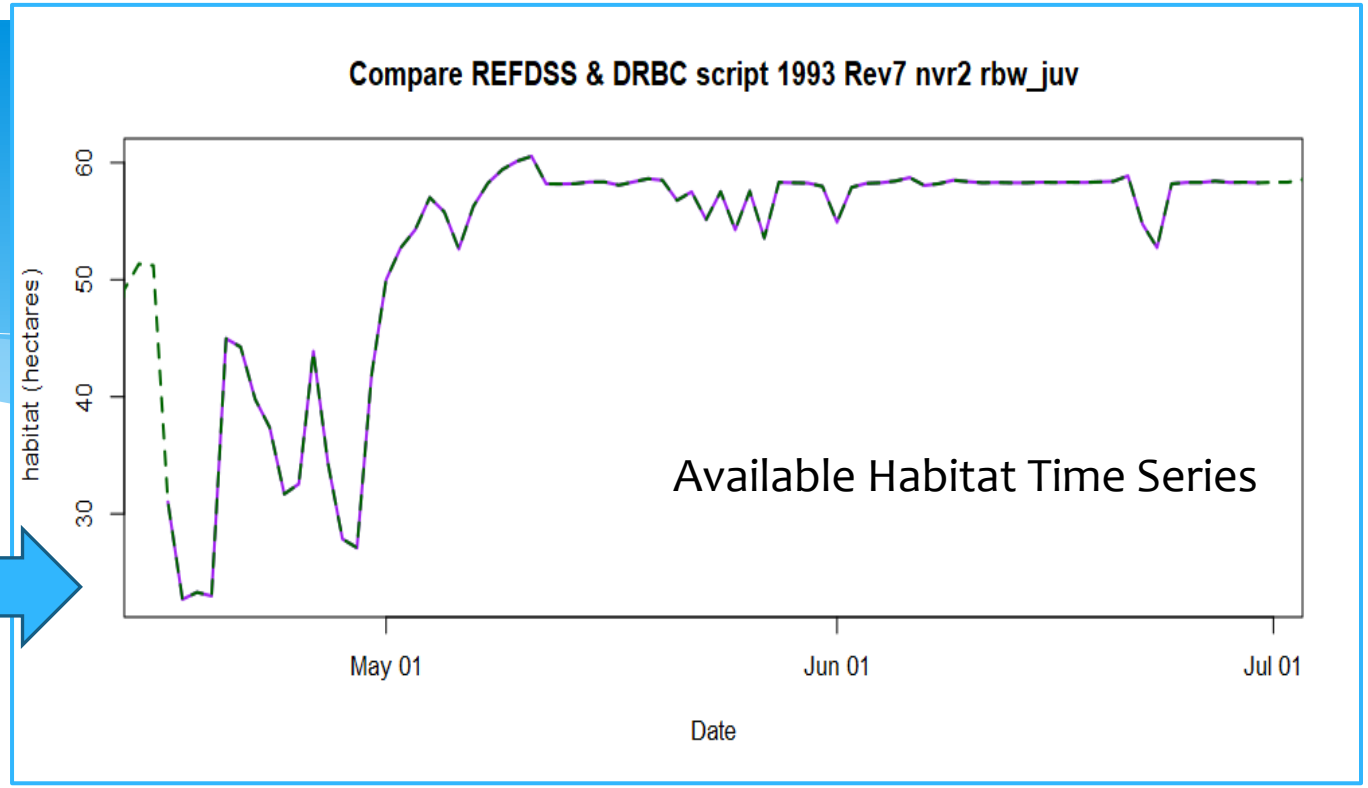
- In each of the study reaches, USGS available habitat at different flow values for several species and age class
  - Delaware (3 reaches)
  - East Branch (3 reaches)
  - West Branch (2 reaches)
  - Neversink (3 reaches)

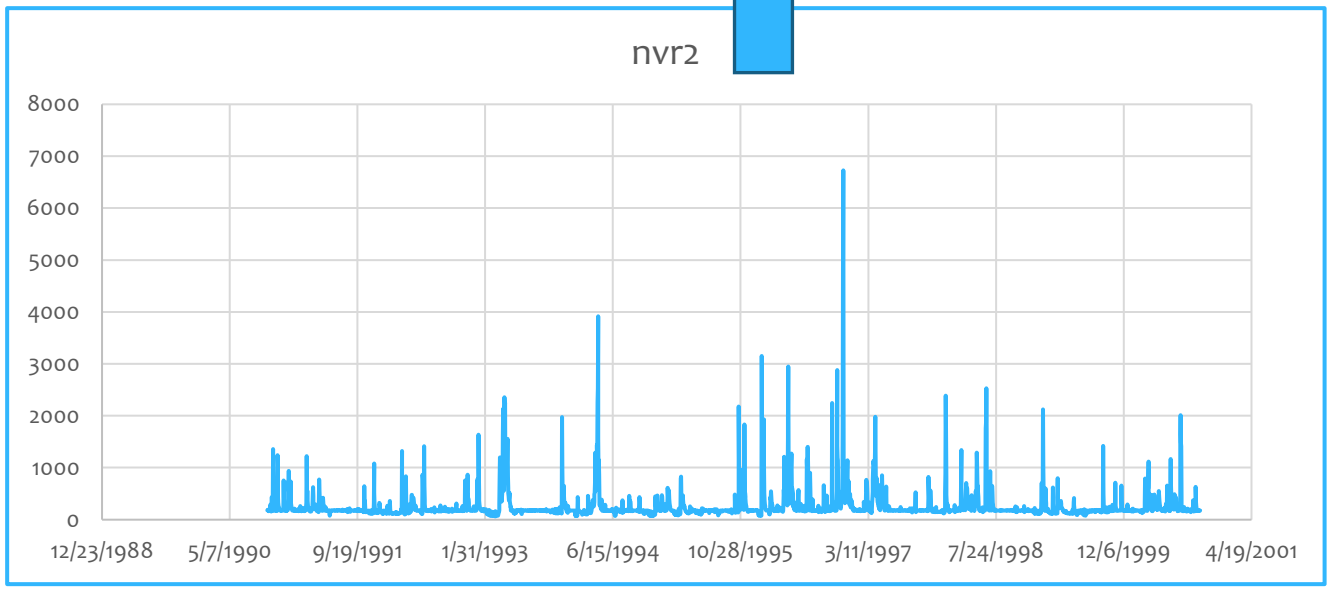


Species and Life Stage Groupings

Biota Category	Code	Reaches
Brown Trout, Spawning	Brn_spn	All
Brown Trout, Incubation	Brn_inc	
Brown Trout, Juvenile	Brn_juv	
Brown Trout, Adult	Brn_adlt	
Rainbow Trout, Juvenile	Rbw_juv	All
Rainbow Trout, Adult	Rbw_adlt	
American Shad, Spawning	Shd_spn	DEL1, DEL2, DEL3, EB2
American Shad, Juvenile	Shd_juv	
Other Fin Fish, Shallow Fast-Flowing Guild	Sfg	All
Other Fin Fish, Shallow Slow-Flowing Guild	Ssg	







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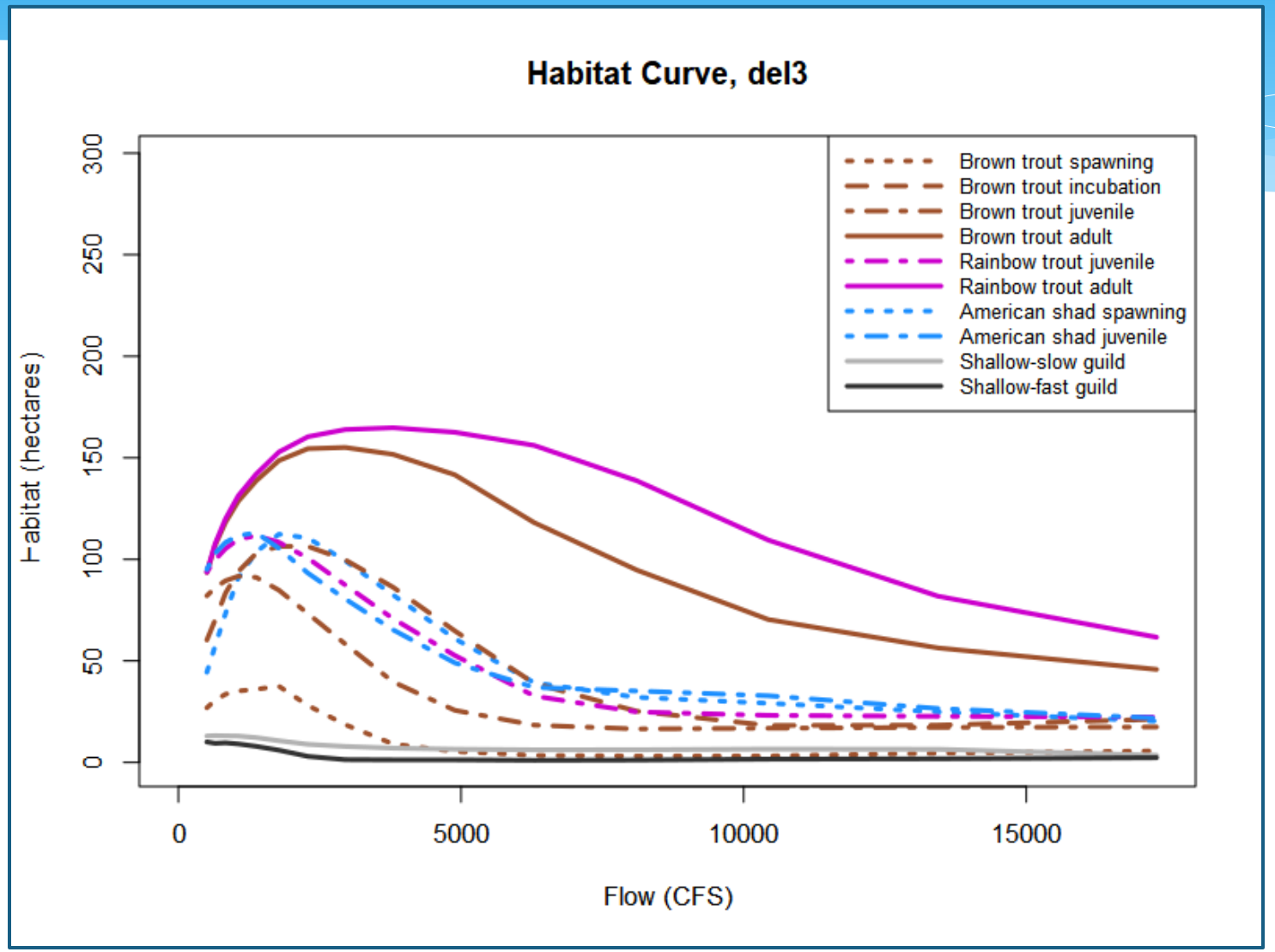
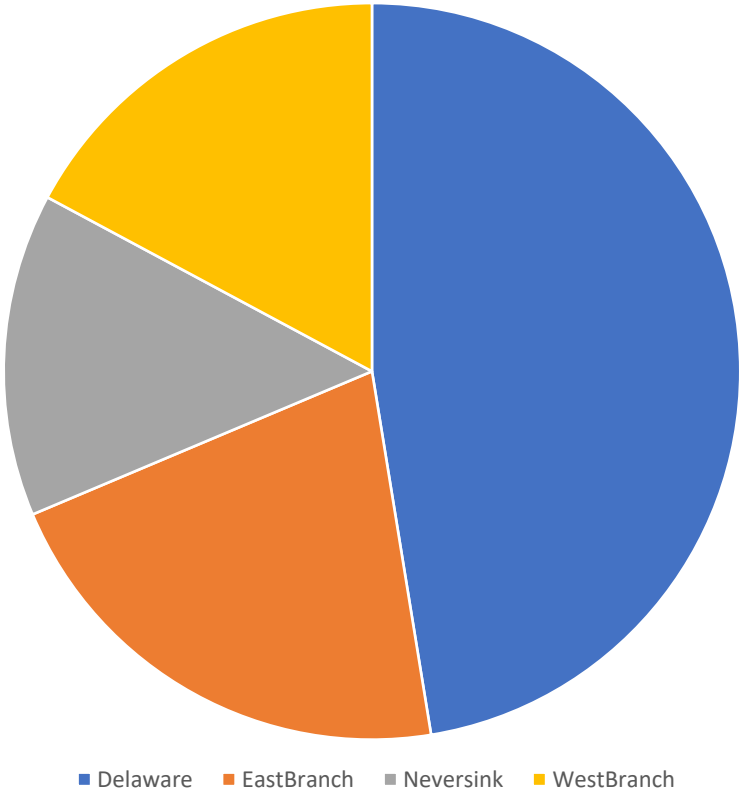
Example Habitat Curve – Reach del3



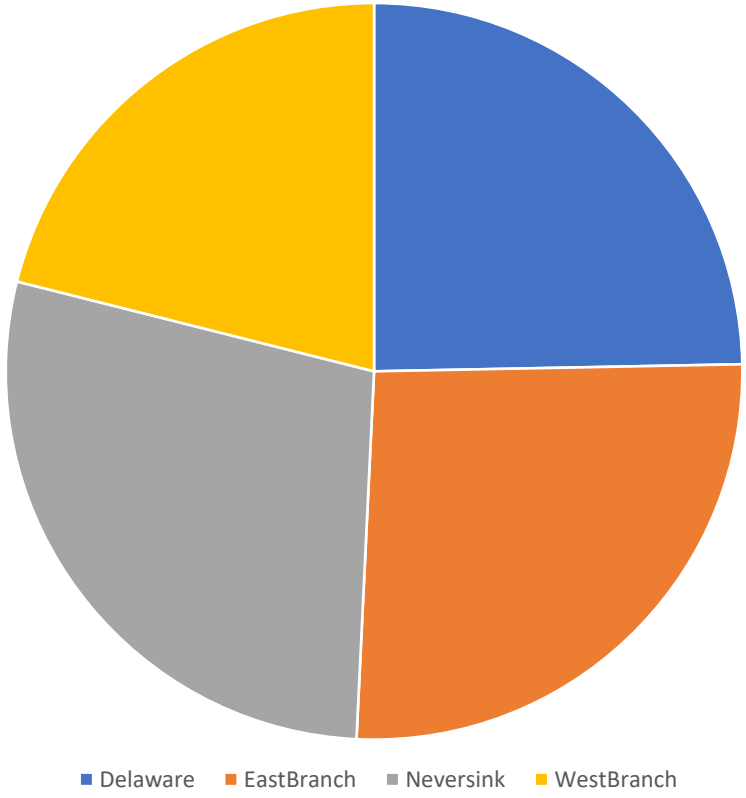
System-wide Habitat

DRAFT - Likely to change

Rainbow Adult, FFMP2017 (median values)



SSG, FFMP2017 (median values)



Seasonal Habitat Ranges

	brn_spn	brn_inc	brn_juv	brn_adlt	rbw_juv	rbw_adlt	shd_spn	shd_juv	sfg	ssg
Jan										
Feb										
Mar										
April		15-Apr								
			16-Apr		16-Apr		16-Apr			
May									year round	year round
Jun			30-Jun		30-Jun		30-Jun			
Jul				1-Jul		1-Jul		1-Jul		
Aug										
Sep				30-Sep		30-Sep		30-Sep		
Oct	1-Oct									
Nov	30-Nov									
Dec		1-Dec								

Steps So Far

1. **Benchmarking REF-DSS**
   - Coding a new version of DSS based on our understanding
   - Applying legacy flow time series to habitat curves, ensure 100% match
   - REV1, REV7, FFMP
   - Complicated by multiple versions of habitat curves within REF-DSS, linear interpolation decisions
   - Successful completion in Spring 2021

2. **Develop & Run Modernized DSS**
   - Process current versions of REV1, FFMP2008, FFMP2011, FFMP2017
   - 1/1/1990 through 12/30/2000 (other options available)
   - Post-processing, synthesis, and interpretation tools & metrics

Progression of Benchmarking

Row Label	brn_adlt	brn_inc	brn_juv	brn_spn	rbw_adlt	rbw_juv	sfg_	shd_juv	shd_spn	ssg_
FFMP										
del1	0.98	0.23	1	0.05	0.97	1	1	0.96	1	0.94
del2	0.78	0.92	1	0.08	0.38	1	0.99	0.86	1	0.87
del3	0.93	0.57	1	0.01	0.83	1	0.88	0.92	0.99	0.97
eb0	1	0.63	1	1	1	1	1			0.94
eb1	1	0.12	1	0.92	0.99	1	1			0.99
eb2	1	0.75	1	0.89	0.77	1	1	1	1	0.99
nvr0	1	0.07	1	0.98	0.99	1	1			0.99
nvr1	1	0.06	1	0.96	1	1	1			1
nvr2	1	0.06	1	0.99	0.79	1	1	1	1	0.98
wb0	1	0.61	1	0.92	0.99	1	1			0.99
wb1	1	0.17	1	0.93	0.97	1	1			1
Rev1										
del1	0.97	0.19	1		0.96	1	1	0.94	1	0.94
del2	0.83	0.9	1	0.13	0.32	1	1	0.88	1	0.89
del3	0.95	0.55	1	0.02	0.8	1	0.88	0.94	0.99	0.96
eb0	1	0.75	1	0.88	0.99	1	1			0.91
eb1	0.98	0.03	1	0.93	0.95	1	1			0.96
eb2	1	0.72	1	0.88	0.75	1	1	1	1	0.99
nvr0	1	0.49	1	0.98	0.99	1	1			0.99
nvr1	1	0.17	0.99	0.96	1	0.98	1			1
nvr2	0.96	0	1	0.97	0.87	1	0.98	0.87	1	0.89
wb0	1	0.7	1	0.94	0.99	1	1			0.98
wb1	1	0.17	1	0.95	0.98	1	1			0.99
Rev7										
del1	1	0.25	1	0.12	0.98	1	1	1	1	0.95
del2	0.98	0.92	1	0.13	0.2	1	1	0.99	1	0.93
del3	0.99	0.58	1	0.01	0.78	1	0.9	0.99	1	0.97
eb0	1	0.77	1	0.99	0.99	1	1			0.93
eb1	1	0.04	1	0.93	0.91	1	1			0.97
eb2	1	0.76	1	0.85	0.65	1	1	1	1	0.99
nvr0	1	0.46	1	0.98	0.99	1	1			0.99
nvr1	1	0.05	0.99	0.96	1	0.99	1			1
nvr2	1	0.03	1	0.98	0.66	1	1	1	1	0.99
wb0	1	0.61	1	0.92	0.98	1	1			0.98
wb1	1	0.14	1	0.94	0.97	1	1			1

	brn_adlt	brn_inc	brn_juv	brn_spn	rbw_adlt	rbw_juv	sfg_	shd_juv	shd_spn	ssg_
FFMP										
del1	0.98	1	1	1	0.98	1	1	0.96	1	0.99
del2	0.78	1	1	0.97	0.8	1	0.99	0.86	1	0.9
del3	0.93	1	1	0.99	0.94	1	0.99	0.91	1	0.98
eb0	1	1	1	0.64	1	1	1			1
eb1	1	1	1	0.11	1	1	1			1
eb2	1	1	1	0.12	1	1	1	1	1	1
nvr0	1	1	1	0.75	1	1	1			1
nvr1	1	1	1	0.45	1	1	1			1
nvr2	1	1	1	0.84	1	1	1	1	1	1
wb0	1	1	1	0.91	1	1	1			1
wb1	1	1	1	0.53	1	1	1			1
Rev1										
del1	0.97	1	1		0.97	1	1	0.94	1	0.99
del2	0.83	1	1	0.98	0.84	1	1	0.88	1	0.94
del3	0.95	1	1	1	0.96	1	1	0.94	1	0.99
eb0	1	1	1	0.64	1	1	1			0.87
eb1	0.98	1	1	0.26	0.98	1	1			0.99
eb2	1	1	1	0.14	1	1	1	1	1	1
nvr0	1	1	1	0.84	1	1	1			1
nvr1	1	1	1	0.49	1	1	1			1
nvr2	0.96	1	1	0.86	0.97	1	0.98	0.88	1	0.93
wb0	1	1	1	0.94	1	1	1			1
wb1	1	1	1	0.66	1	1	1			1
Rev7										
del1	1	1	1	1	1	1	1	1	1	1
del2	0.98	1	1	0.98	0.98	1	1	0.99	1	0.99
del3	0.99	1	1	1	0.99	1	1	0.99	1	1
eb0	1	1	1	0.85	1	1	1			0.99
eb1	1	1	1	0.02	1	1	1			1
eb2	1	1	1	0.07	1	1	1	1	1	1
nvr0	1	1	1	0.85	1	1	1			1
nvr1	1	1	1	0.15	1	1	1			1
nvr2	1	1	1	0.64	1	1	1	1	1	1
wb0	1	1	1	0.95	1	1	1			1
wb1	1	1	1	0.64	1	1	1			1

	brn_adlt	brn_inc	brn_juv	brn_spn	rbw_adlt	rbw_juv	sfg_	shd_juv	shd_spn	ssg_
FFMP										
del1	1	1	1	1	1	1	1	1	1	1
del2	1	1	1	1	1	1	1	1	1	1
del3	1	1	1	1	1	1	1	1	1	1
eb0	1	1	1	1	1	1	1			1
eb1	1	1	1	1	1	1	1			1
eb2	1	1	1	1	1	1	1	1	1	1
nvr0	1	1	1	1	1	1	1			1
nvr1	1	1	1	1	1	1	1			1
nvr2	1	1	1	1	1	1	1			1
wb0	1	1	1	1	1	1	1			1
wb1	1	1	1	1	1	1	1			1
Rev1										
del1	1	1	1	1	1	1	1	1	1	1
del2	1	1	1	1	1	1	1	1	1	1
del3	1	1	1	1	1	1	1	1	1	1
eb0	1	1	1	1	1	1	1			1
eb1	1	1	1	1	1	1	1			1
eb2	1	1	1	1	1	1	1	1	1	1
nvr0	1	1	1	1	1	1	1			1
nvr1	1	1	1	1	1	1	1			1
nvr2	1	1	1	1	1	1	1			1
wb0	1	1	1	1	1	1	1			1
wb1	1	1	1	1	1	1	1			1
Rev7										
del1	1	1	1	1	1	1	1	1	1	1
del2	1	1	1	1	1	1	1	1	1	1
del3	1	1	1	1	1	1	1	1	1	1
eb0	1	1	1	1	1	1	1			1
eb1	1	1	1	1	1	1	1			1
eb2	1	1	1	1	1	1	1	1	1	1
nvr0	1	1	1	1	1	1	1			1
nvr1	1	1	1	1	1	1	1			1
nvr2	1	1	1	1	1	1	1			1
wb0	1	1	1	1	1	1	1			1
wb1	1	1	1	1	1	1	1			1

Modernized DSS Raw Output

- See CSV file
- 10 year flow period (3,650 days) X 11 reaches X 10 species and life groupings X 4 flow management scenarios
- 1,542,916 discrete habitat output values

- **Need metrics to collapse all that output to compare the flow management scenarios**

Metric 1 – Habitat Area Days

DRAFT - Likely to change

Concept

- Day 1 – 10 Hectares Habitat
- Day 2 – 10 Hectares Habitat
- Day 3 – 5 Hectares Habitat

- Period total: 25 Habitat Area Days
- Generically, more is better

BioCode	FFMP2008	FFMP2011	FFMP2017	REV1
brn_spn	108,979	123,318	121,130	102,317
brn_inc	795,392	831,984	817,786	742,348
brn_juv	455,739	457,838	456,970	431,863
brn_adlt	876,129	901,083	905,224	825,560
rbw_juv	565,050	565,937	567,293	536,547
rbw_adlt	897,825	923,298	927,401	845,583
shd_spn	269,786	271,033	269,816	260,236
shd_juv	434,715	432,442	432,336	431,503
ssg	502,374	496,010	496,758	508,906
sfg	321,401	319,716	316,323	264,545

Metric 2 – Days below 50% of Maximum Habitat

DRAFT - Likely to change

Raw Days

BioCode	FFMP2008	FFMP2011	FFMP2017	REV1
brn_adlt	0	0	0	0
brn_inc	65	47	48	96
brn_juv	94	83	95	94
brn_spn	137	93	98	178
rbw_adlt	0	0	0	0
rbw_juv	40	37	35	46
sfg	928	966	1003	1677
shd_juv	23	24	24	21
shd_spn	156	145	154	156
ssg	187	182	186	240

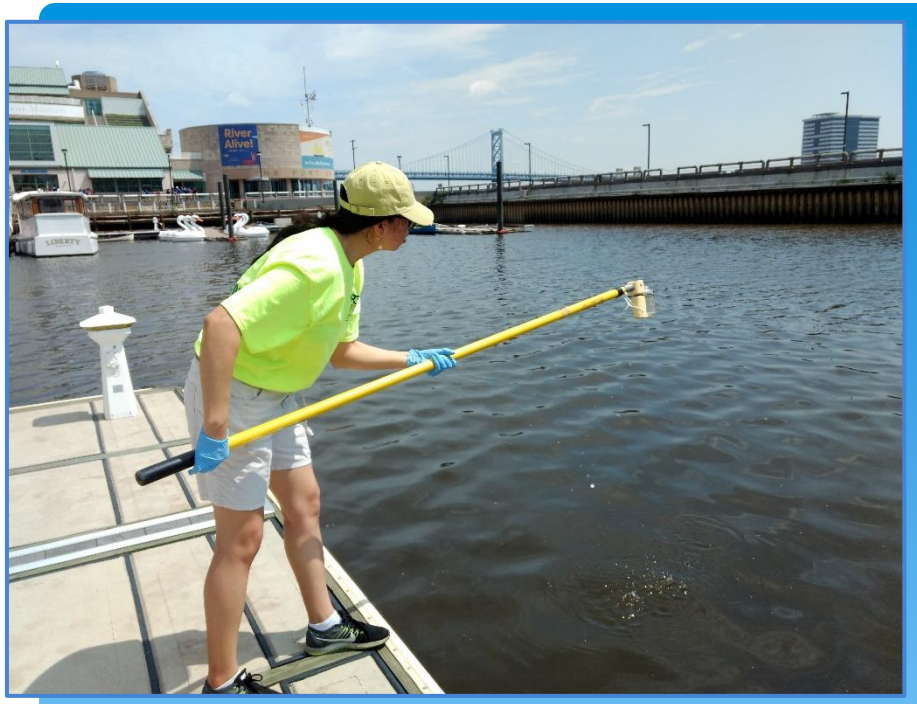
Percent of total Species Days

BioCode	FFMP2008	FFMP2011	FFMP2017	REV1
brn_adlt	0.0%	0.0%	0.0%	0.0%
brn_inc	4.4%	3.2%	3.2%	6.5%
brn_juv	11.2%	9.9%	11.4%	11.2%
brn_spn	20.4%	13.9%	14.6%	26.5%
rbw_adlt	0.0%	0.0%	0.0%	0.0%
rbw_juv	4.8%	4.4%	4.2%	5.5%
sfg	23.2%	24.1%	25.0%	41.9%
shd_juv	2.3%	2.4%	2.4%	2.1%
shd_spn	18.7%	17.3%	18.4%	18.7%
ssg	4.7%	4.5%	4.6%	6.0%

Shiny App
Jake Bransky

Next Steps

1. Evaluate the impact of alternative method for choosing the reservoir release table
2. Evaluate the new rapid flow change protocols(?)
3. Add a 2nd web-based application for generating user-specified DSS plots
4. GIS-based narrative engagement tool for understanding the DSS
5. Continued coordination with SEF and other stakeholders
6. Project complete by end of March 2022



Questions & Discussion

Contacts

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