

1-Step or 2-Step Normalization and Deconstruction of Periphyton Data

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AQUATOX Modeling supporting information

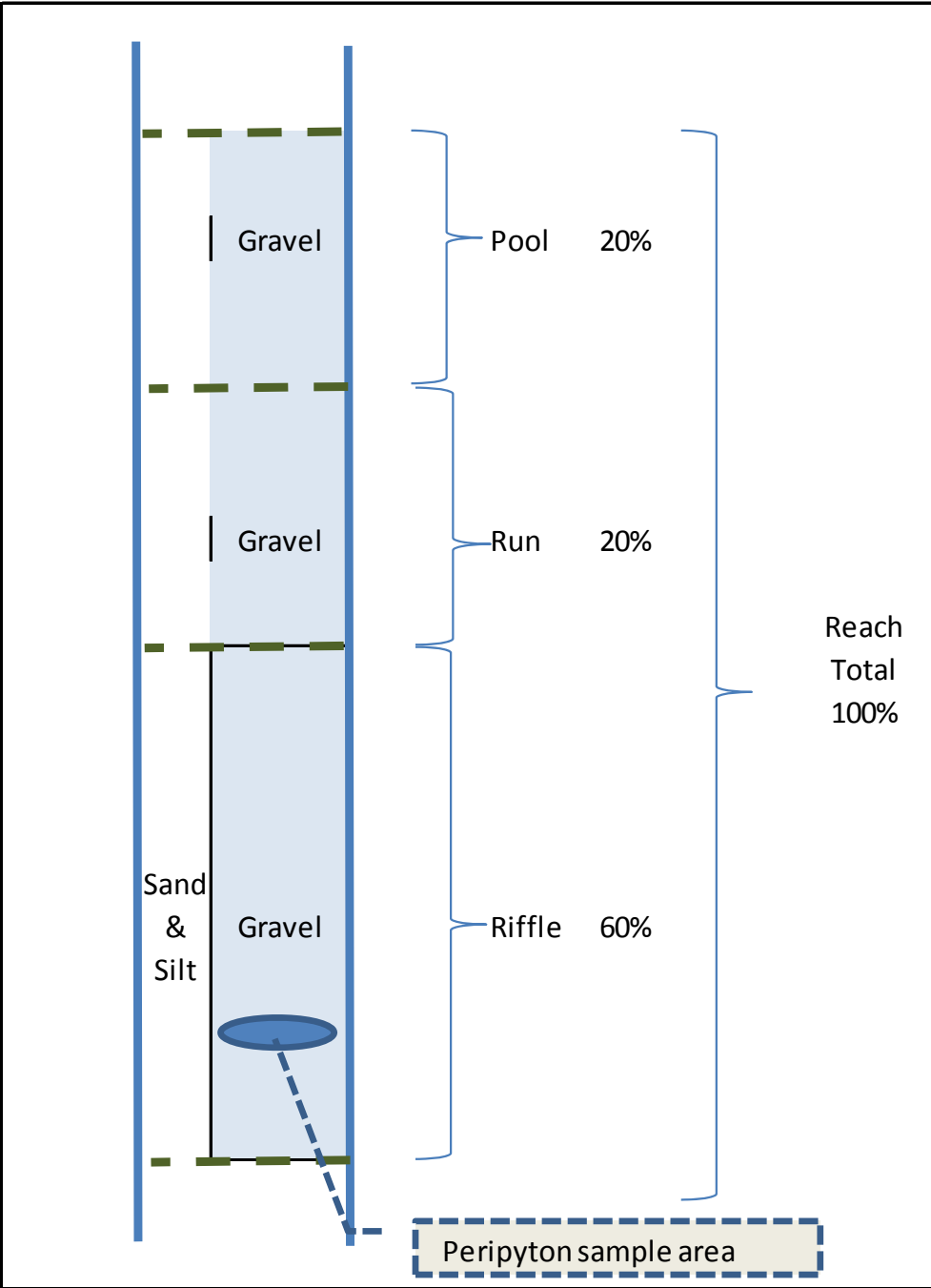
– prepared for review and discussion by Modeling Workgroup

Excerpt from supporting information provided to the AQUATOX Workgroup by Dick Park (May 7, 2013)

AQUATOX is an ecosystem model ...

- required to maintain mass balance, accounting for all changes in concentrations of nutrients, algae, invertebrates, and fish. Its application cannot be restricted to only one part of a reach such as a riffle. [Park and Clough \(2012\)](#)
- ...requires that it **represent average conditions for an entire reach.**
- ...**deconstruct the simulation results** by saving the output to Excel and reversing the calculations used in normalizing the data.

AQUATOX
Model
VS
Gravel and
Periphyton
data
collection



Normalization and Deconstruction of Periphyton Data

- A 1-step procedure is appropriate ...if Pebble Count AND Periphyton data are collected to represent a reach (pool, run, riffle)
- A 2-step procedure would be more appropriate ...if Pebble Count AND/OR Periphyton data collection are for riffles only.

1-Step Example (Dupuis 2013)

Pebble Count		Eckert Rd	Glenwood	Middleton	Ft Boise WMA
Mean % size class		11/18/1997	2/27/1995	11/24/1997	1/26/1998
Mean % very large boulders	4096-2048 mm	0.00	0.00	0.98	0.00
Mean % large boulders	2047-1024 mm	0.00	0.00	0.00	0.00
Mean % medium boulders	1023-512 mm	0.00	0.00	0.00	0.00
Mean % small boulders	511-256 mm	1.68	0.62	0.00	0.00
Mean % large cobbles	255-128 mm	36.44	14.27	2.00	0.69
Mean % small cobbles	127-64 mm	29.10	33.91	14.43	7.59
Mean % very coarse gravel	63-32 mm	8.88	20.25	17.54	19.07
Mean % coarse gravel	31-16 mm	3.34	4.11	9.13	16.96
Mean % medium gravel	15-8 mm	1.45	5.83	5.36	8.70
Mean % fine gravel	7.9-4 mm	0.27	0.00	2.08	0.79
Mean % very fine gravel	3.9-2 mm	0.00	0.00	5.48	0.00
Mean % sand	1.9-0.062 mm	18.84	21.03	38.40	29.80
Mean % silt	<.062	0.00	0.00	4.61	16.41
% substrate greater than sand and silt		81	79	57	54
chl a (mg/m2) measured in Oct. 2005 in riffles		94	158	93	162
chl a (mg/m2) for reach (normalized by pebble count)		76	125	53	87
deconstructed chl a (mg/m2) for riffles		94	158	93	162

Spreadsheet with multiple transects of Boise River...

USGS, 1997.

Site		Eckert Rd	Eckert Rd	Eckert Rd	Eckert Rd	Eckert Rd	Eckert Rd	Average
Date		11/18/1997	11/18/1997	11/18/1997	11/18/1997	11/18/1997	11/18/1997	
Transect		1	2	3	4	5	6	
very large boulders	4096-2048 mm							
large boulders	2047-1024 mm							
medium boulders	1023-512 mm							
small boulders	511-256 mm		1	2		1	3	
large cobbles	255-128 mm	26	71	25		25	52	
small cobbles	127-64 mm	35	91	11		19	32	
very coarse gravel	63-32 mm	13	26	1		9	9	
coarse gravel	31-16 mm	2	8	1		3	6	
medium gravel	15-8 mm		1			5		
fine gravel	7.9-4 mm					1		
very fine gravel	3.9-2 mm							
sand	1.9-0.062 mm	56	12	12		11	9	
silt	<.062							
Notes		deep run	riffle	run/pool	run/pool-too deep	riffle	riffle	
Total		132	210	52	0	74	111	
% very large boulders	4096-2048 mm	0	0	0		0	0	0
% large boulders	2047-1024 mm	0	0	0		0	0	0
% medium boulders	1023-512 mm	0	0	0		0	0	0
% small boulders	511-256 mm	0	0.476190476	3.8461538		1.3513514	2.7027027	1.675279675
% large cobbles	255-128 mm	19.69697	33.80952381	48.076923		33.783784	46.8468468	36.44280944
% small cobbles	127-64 mm	26.515152	43.33333333	21.153846		25.675676	28.8288288	29.1013671
% very coarse gravel	63-32 mm	9.8484848	12.38095238	1.9230769		12.162162	8.10810811	8.884556885
% coarse gravel	31-16 mm	1.5151515	3.80952381	1.9230769		4.0540541	5.40540541	3.341442341
% medium gravel	15-8 mm	0	0.476190476	0		6.7567568	0	1.446589447
% fine gravel	7.9-4 mm	0	0	0		1.3513514	0	0.27027027
% very fine gravel	3.9-2 mm	0	0	0		0	0	0
% sand	1.9-0.062 mm	42.424242	5.714285714	23.076923		14.864865	8.10810811	18.83768484
% silt	<.062	0	0	0		0	0	0
SUMMARY								
		Eckert Rd	Glenwood	Middleton	Ft Boise WMA			
		11/18/1997	2/27/1995	11/24/1997	1/26/1998			
Mean % very large boulders	4096-2048 mm	0.00	0.00	0.98	0.00			
Mean % large boulders	2047-1024 mm	0.00	0.00	0.00	0.00			
Mean % medium boulders	1023-512 mm	0.00	0.00	0.00	0.00			
Mean % small boulders	511-256 mm	1.68	0.62	0.00	0.00			
Mean % large cobbles	255-128 mm	36.44	14.27	2.00	0.69			
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Mean % medium gravel	15-8 mm	1.45	5.83	5.36	8.70			
Mean % fine gravel	7.9-4 mm	0.27	0.00	2.08	0.79			
Mean % very fine gravel	3.9-2 mm	0.00	0.00	5.48	0.00			
Mean % sand	1.9-0.062 mm	18.84	21.03	38.40	29.80			
Mean % silt	<.062	0.00	0.00	4.61	16.41			

Pebble Count Data

- Pebble count data were collected on multiple transects by USGS in 1997, with varying habitat types (See Attachment A – “Notes”).
- This indicates that gravel sampling (i.e., characterization) covered a “Reach” of river that included pools, run and riffle habitat.
- **This supports a 1-Step procedure...** if similar levels of periphyton are anticipated in each habitat type

Etheridge email on periphyton data collection... Etheridge, A. 2013.

Quantitative epilithic periphyton samples were collected and processed using protocols developed by the USGS NAWQA Program (Porter and others, 1993).

- Epilithic periphyton **samples were collected from 10 cobbles per riffle** (5 cobbles from each of 2 adjacent benthic macroinvertebrate collection subsites).
- **This suggest a “2-step procedure”** ...unless similar levels of periphyton are expected in runs and pools...

Model Setup (K Harris, 2013)

Stream Parameters	Eckert	Glenwood	Middleton	Parma	Units
Channel Slope	0.002036	0.002	0.002	0.002	<i>m/m</i>
Maximum Channel Depth Before Flooding	1.5	5	1.5	1.5	<i>m</i>
Sediment Depth	0.1	0.1	0.1	0.1	<i>m</i>
Manning's Coefficient					
Estimate based on stream type	natural stream	natural stream	natural stream		
or use value below				0.05	<i>s/m^{1/3}</i>
River Habitats Represented					
Percent Riffle	80	80	43	55	%
Percent Pool	0	0	0	0	%
Percent Run	20	20	57	45	%

2-Step Example: Normalization

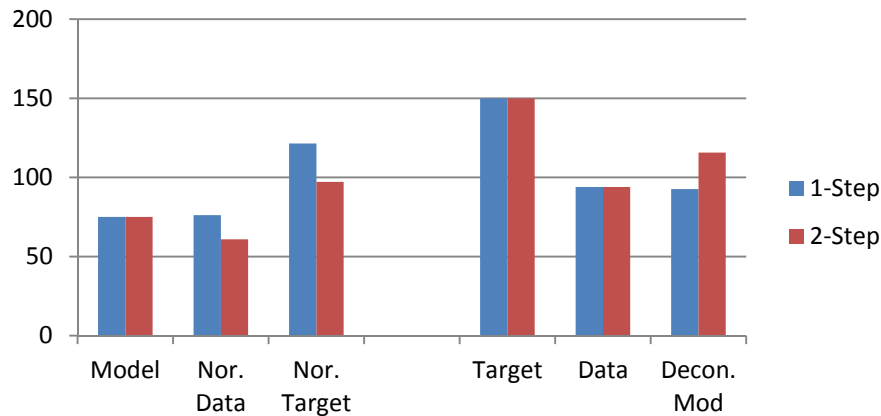
	Example		
	A	B	C
Measured Data			
Measured Periphyton on Gravel (avg)	94	158	140
Percent Greater than Sand/Silt	81%	81%	70%
Percent Riffle/Reach	80%	80%	55%
Data Normalization (to use "in" model)			
Step 1 - Reach Normalization			
% Gravel/Reach	81%	81%	70%
Periphyton in Riffle	76	128	98
Setp 2 - Gravel/Riffle Normalization			
% Riffle	80%	80%	55%
Periphyton in Reach	61	102	54

2-Step Example: Deconstruction

	Example		
	A	B	C
Deconstructing Model Results			
Ex. Modeled Value (Avg for Reach)	75	130	110
1-Step Deconstructed Periphyton	93	160	157
2-Step Deconstructed Periphyton	116	201	286
Target	150	150	150
1-Step Normalized Target	122	122	105
2-Step Normalized Target	97	97	58

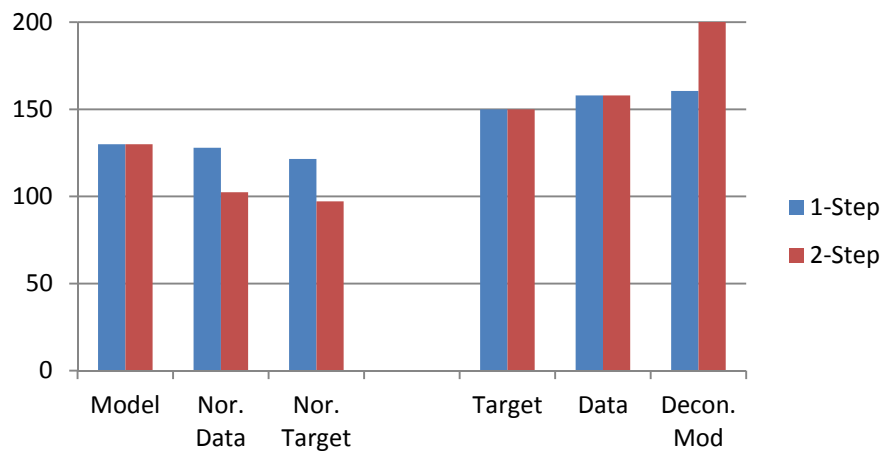
Comparisons of 1 and 2-Step

Example A - Eckart

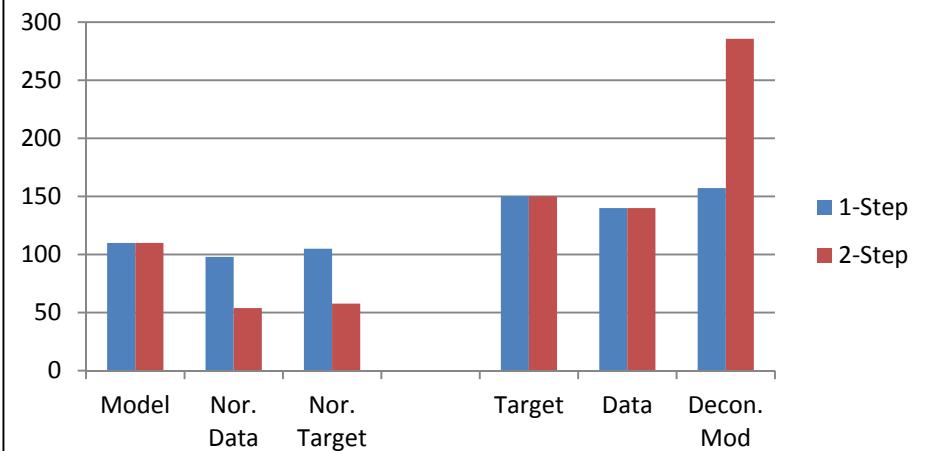


	Example		
	A	B	C
Measured Data			
Measured Periphyton on Gravel (avg)	94	158	140
Percent Greater than Sand/Silt	81%	81%	70%
Percent Riffle/Reach	80%	80%	55%
Ex. Modeled Value (Avg for Reach)	75	130	110

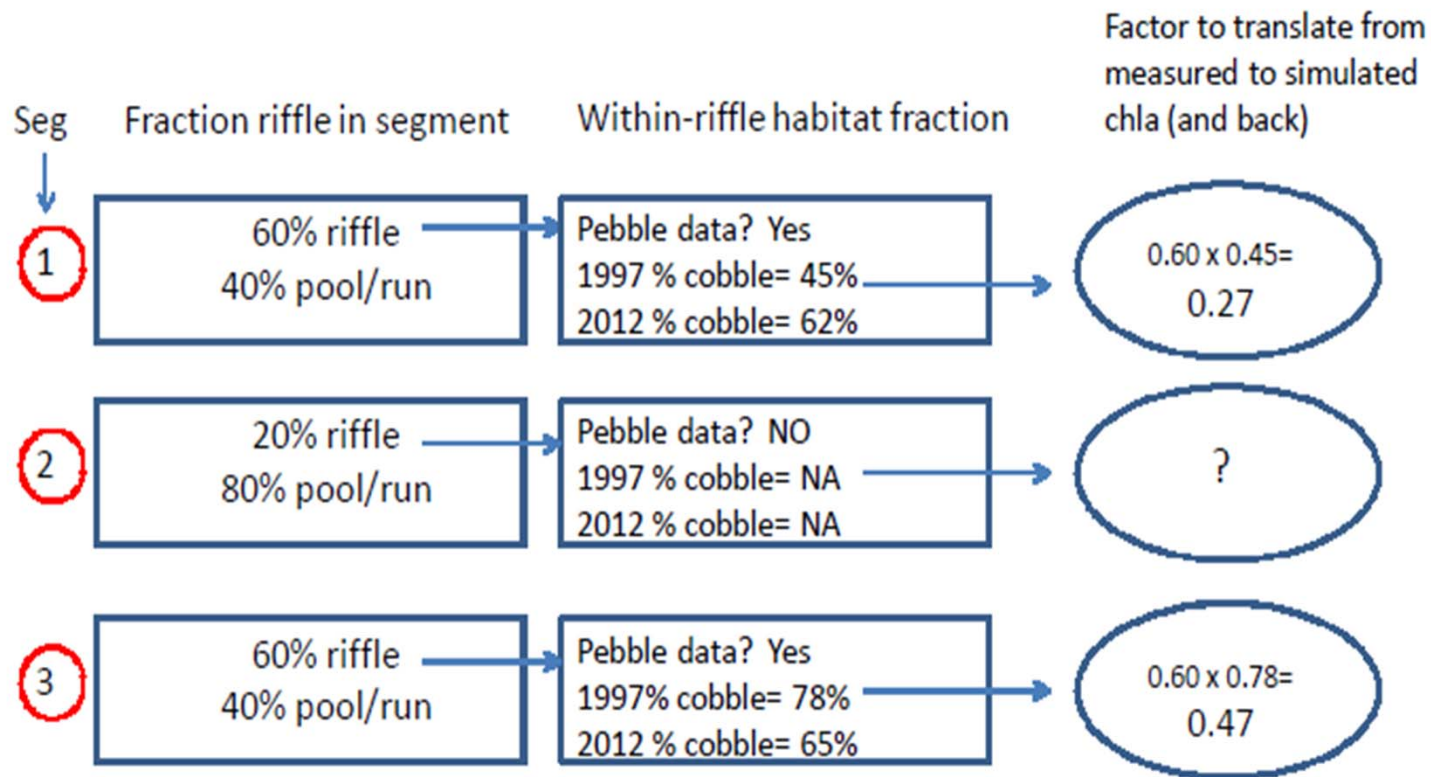
Example B - Glenwood



Example C - Parma (revised)



Mockup by Cope (2013)



References

- USGS. 1997. Spreadsheet with multiple transects of Boise River...
- Etheridge, A. 2013. Email communication on periphyton data collection...
- Park and Clough. 2012. AQUATOX Model documentation...
- Park, R. 2013. Supporting Information provided to the AQUATOX Workgroup by (May 7, 2013)
- Tom Dupuis 4/29/2013. Modeling supporting information...
- K Harris. 2013. Email with Tables of Parameters for “4 segment Model”
- Cope, B. 2013. “Mockup” example