

Appendix 4

Site Groupings and UPGMA dendograms used for
model development

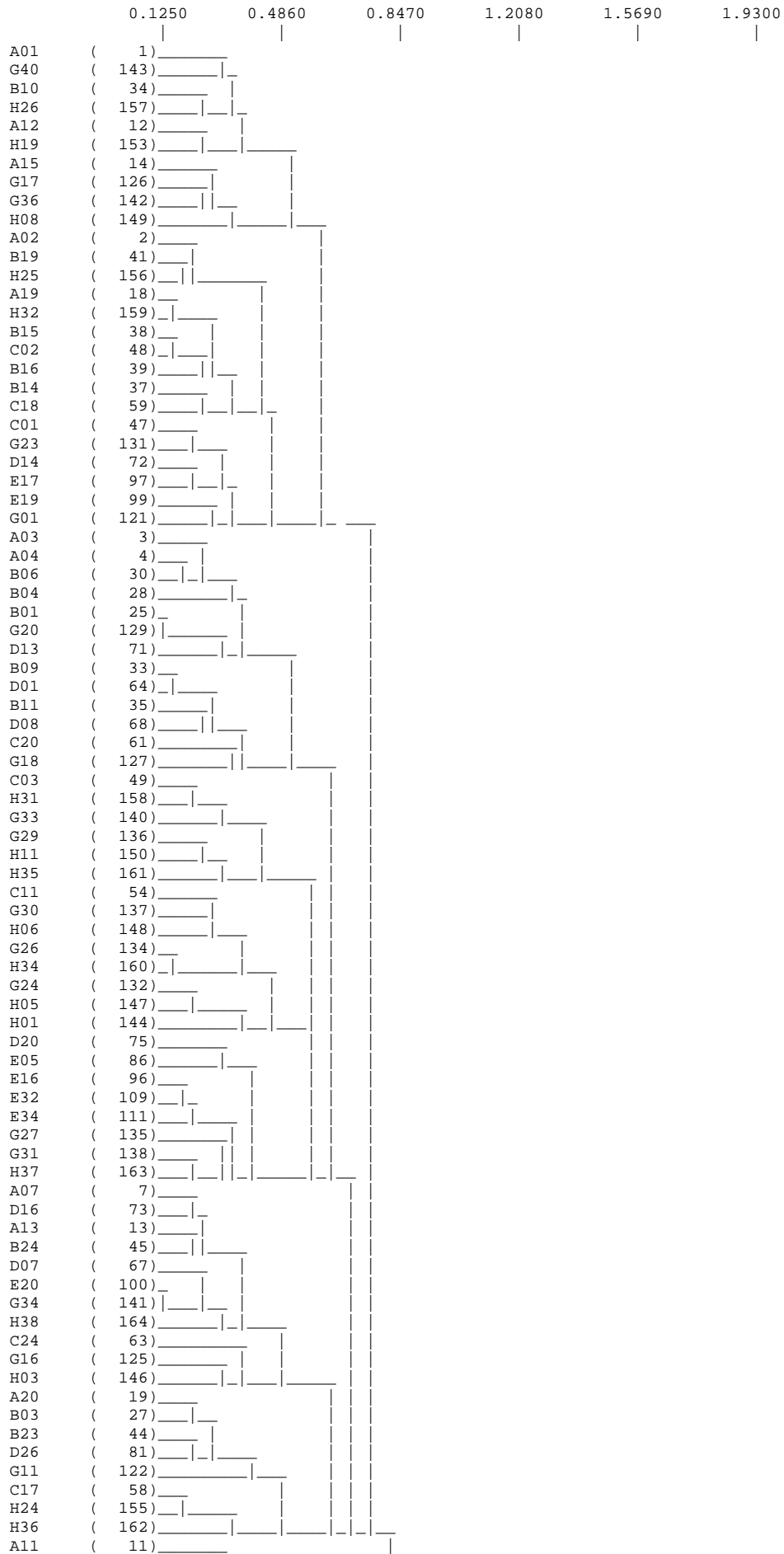
Site groupings for each of the six models developed under the MRHI program NS= Not Sampled, NU= Not Used in model development because site is an outlier or part of a small group, Low OE= sites Excluded from model development because of low OE values.

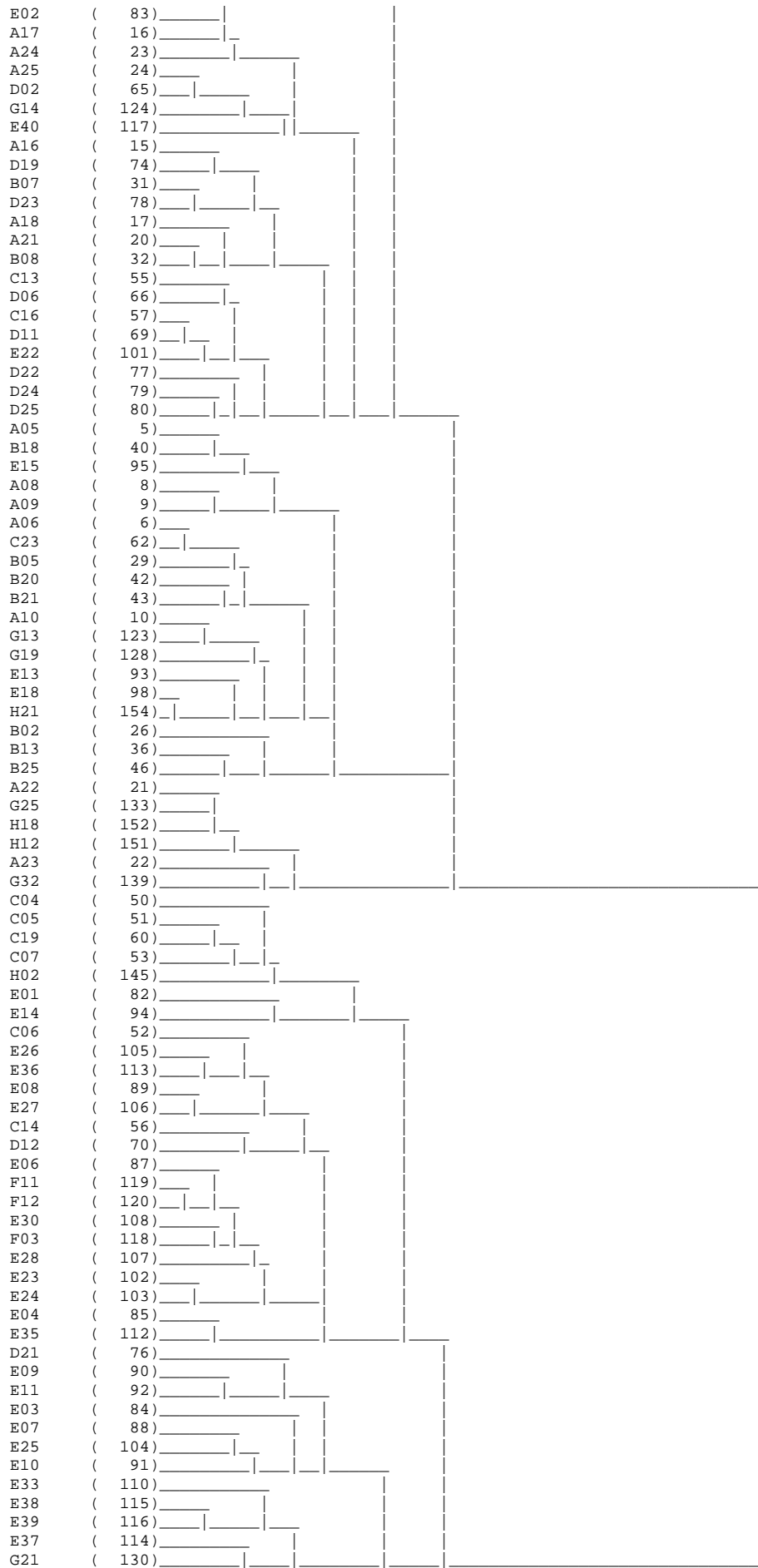
Autumn	Edge	Spring	Edge	Combined	Edge	Autumn	Riffle	Spring	Riffle	Combined	Riffle
A01	1	A01	1	A01	1	A01	1	A01	1	A01	1
A02	1	A02	1	A02	2	A02	5	A02	1	A02	1
A03	1	A03	4	A03	2	A03	5	A03	2	A03	1
A04	1	A04	4	A04	2	A04	5	A04	1	A04	1
A05	2	A05	2	A05	1	A05	2	A05	1	A05	2
A06	2	A06	3	A06	2	A06	5	A06	Low OE	A06	2
A07	1	A07	1	A07	2	A07	2	A07	Low OE	A07	1
A08	2	A08	4	A08	1	A08	1	A08	1	A08	4
A09	2	A09	4	A09	1	A09	1	A09	1	A09	1
A10	2	A10	1	A10	2	A10	5	A10	1	A10	1
A11	2	A11	1	A11	2	A11	5	A11	2	A11	2
A12	1	A12	4	A12	1	A12	5	A12	1	A12	2
A13	1	A13	2	A13	1	A13	1	A13	1	A13	1
A15	1	A15	4	A15	2	A15	2	A15	1	A15	2
A16	2	A16	3	A16	2	A16	NS	A16	NS	A16	NS
A17	2	A17	2	A17	1	A17	4	A17	3	A17	2
A18	2	A18	1	A18	2	A18	4	A18	4	A18	Low OE
A19	1	A19	4	A19	2	A19	5	A19	1	A19	2
A20	1	A20	4	A20	2	A20	5	A20	1	A20	2
A21	2	A21	4	A21	2	A21	Low OE	A21	1	A21	4
A22	2	A22	4	A22	2	A22	2	A22	1	A22	4
A23	Low OE	A23	1	A23	1	A23	4	A23	Low OE	A23	Low OE
A24	Low OE	A24	4	A24	2	A24	5	A24	2	A24	2
A25	2	A25	4	A25	2	A25	5	A25	2	A25	2
B01	1	B01	2	B01	2	B01	5	B01	1	B01	1
B02	Low OE	B02	2	B02	1	B02	5	B02	1	B02	1
B03	1	B03	4	B03	2	B03	5	B03	1	B03	1
B04	1	B04	4	B04	2	B04	5	B04	3	B04	3
B05	2	B05	2	B05	2	B05	1	B05	1	B05	1
B06	1	B06	2	B06	2	B06	5	B06	1	B06	2
B07	2	B07	4	B07	2	B07	5	B07	3	B07	2
B08	2	B08	2	B08	3	B08	1	B08	1	B08	3
B09	1	B09	2	B09	3	B09	5	B09	2	B09	2
B10	1	B10	2	B10	2	B10	5	B10	1	B10	1
B11	1	B11	2	B11	3	B11	5	B11	2	B11	3
B13	2	B13	4	B13	2	B13	5	B13	3	B13	1
B14	1	B14	4	B14	3	B14	5	B14	2	B14	3
B15	1	B15	4	B15	3	B15	5	B15	2	B15	2
B16	1	B16	4	B16	2	B16	5	B16	3	B16	2
B17	NU	B17	NU	B17	NU	B17	NU	B17	2	B17	NU
B18	2	B18	2	B18	3	B18	5	B18	2	B18	3
B19	1	B19	4	B19	2	B19	5	B19	3	B19	3
B20	2	B20	4	B20	2	B20	5	B20	2	B20	3
B21	2	B21	4	B21	3	B21	5	B21	2	B21	3
B23	1	B23	4	B23	2	B23	5	B23	2	B23	3
B24	1	B24	1	B24	1	B24	2	B24	Low OE	B24	4
B25	2	B25	Low OE	B25	1	B25	2	B25	1	B25	4
C01	1	C01	Low OE	C01	3	C01	5	C01	2	C01	2
C02	1	C02	3	C02	2	C02	5	C02	3	C02	3
C03	1	C03	4	C03	3	C03	5	C03	4	C03	1
C04	Low OE	C04	1	C04	1	C04	NS	C04	4	C04	NS
C05	3	C05	Low OE	C05	4	C05	NS	C05	3	C05	NS
C06	3	C06	4	C06	2	C06	5	C06	2	C06	3
C07	Low OE	C07	5	C07	4	C07	5	C07	2	C07	3
C11	1	C11	4	C11	3	C11	5	C11	2	C11	3
C13	2	C13	4	C13	3	C13	5	C13	2	C13	2
C14	3	C14	5	C14	4	C14	5	C14	1	C14	1
C16	2	C16	4	C16	3	C16	5	C16	2	C16	2
C17	1	C17	4	C17	2	C17	5	C17	Low OE	C17	3
Autumn	Edge	Spring	Edge	Combined	Edge	Autumn	Riffle	Spring	Riffle	Combined	Riffle

C18	1	C18	4	C18	3	C18	5	C18	2	C18	3
C19	3	C19	5	C19	4	C19	5	C19	2	C19	3
C20	1	C20	4	C20	4	C20	5	C20	2	C20	3
C23	2	C23	4	C23	2	C23	5	C23	2	C23	1
C24	1	C24	4	C24	1	C24	5	C24	1	C24	1
D01	1	D01	4	D01	3	D01	5	D01	2	D01	3
D02	2	D02	4	D02	2	D02	5	D02	2	D02	2
D06	2	D06	4	D06	3	D06	5	D06	1	D06	2
D07	1	D07	Low OE	D07	2	D07	5	D07	2	D07	2
D08	1	D08	4	D08	3	D08	5	D08	2	D08	3
D11	2	D11	4	D11	3	D11	5	D11	2	D11	3
D12	3	D12	5	D12	4	D12	5	D12	3	D12	1
D13	1	D13	4	D13	2	D13	5	D13	2	D13	1
D14	1	D14	4	D14	2	D14	5	D14	2	D14	3
D16	1	D16	4	D16	2	D16	5	D16	2	D16	2
D19	2	D19	Low OE	D19	3	D19	5	D19	2	D19	3
D20	1	D20	4	D20	3	D20	5	D20	3	D20	3
D21	Low OE	D21	5	D21	Low OE	D21	5	D21	NU	D21	Low OE
D22	2	D22	4	D22	3	D22	5	D22	1	D22	1
D23	2	D23	4	D23	3	D23	5	D23	2	D23	1
D24	2	D24	4	D24	2	D24	5	D24	3	D24	3
D25	2	D25	4	D25	3	D25	5	D25	2	D25	1
D26	1	D26	4	D26	2	D26	5	D26	2	D26	2
E01	3	E01	5	E01	4	E01	5	E01	3	E01	3
E02	Low OE	E02	4	E02	3	E02	NS	E02	3	E02	NS
E03	Low OE	E03	5	E03	4	E03	5	E03	4	E03	3
E04	3	E04	NS	E04	NS	E04	1	E04	Low OE	E04	3
E05	1	E05	NS	E05	NS	E05	NS	E05	NU	E05	NS
E06	3	E06	5	E06	4	E06	NS	E06	3	E06	NS
E07	Low OE	E07	5	E07	4	E07	NS	E07	4	E07	NS
E08	3	E08	5	E08	4	E08	5	E08	3	E08	1
E09	3	E09	5	E09	4	E09	NS	E09	NU	E09	NS
E10	Low OE	E10	5	E10	4	E10	NS	E10	NS	E10	NS
E11	3	E11	5	E11	4	E11	NS	E11	NS	E11	NS
E13	2	E13	5	E13	3	E13	1	E13	4	E13	1
E14	Low OE	E14	5	E14	4	E14	NS	E14	4	E14	NS
E15	2	E15	Low OE	E15	4	E15	NS	E15	3	E15	NS
E16	1	E16	2	E16	3	E16	5	E16	3	E16	3
E17	1	E17	5	E17	3	E17	NU	E17	3	E17	NU
E18	2	E18	5	E18	2	E18	5	E18	3	E18	3
E19	1	E19	5	E19	3	E19	5	E19	3	E19	3
E20	1	E20	2	E20	1	E20	5	E20	3	E20	2
E22	2	E22	4	E22	3	E22	5	E22	3	E22	3
E23	3	E23	5	E23	4	E23	NS	E23	NS	E23	NS
E24	3	E24	5	E24	4	E24	NS	E24	4	E24	NS
E25	3	E25	5	E25	Low OE	E25	NS	E25	3	E25	NS
E26	3	E26	Low OE	E26	4	E26	NS	E26	NS	E26	NS
E27	3	E27	5	E27	4	E27	NS	E27	3	E27	NS
E28	3	E28	5	E28	4	E28	NS	E28	NS	E28	NS
E29	NS	E29	5	E29	NS	E29	NS	E29	Low OE	E29	NS
E30	3	E30	5	E30	4	E30	NS	E30	3	E30	NS
E31	NS	E31	5	E31	NS	E31	NS	E31	NS	E31	NS
E32	1	E32	5	E32	4	E32	5	E32	3	E32	1
E33	3	E33	3	E33	3	E33	NS	E33	NS	E33	NS
E34	1	E34	2	E34	3	E34	5	E34	1	E34	4
E35	3	E35	5	E35	4	E35	NS	E35	4	E35	NS
E36	3	E36	5	E36	4	E36	5	E36	3	E36	1
E37	3	E37	3	E37	Low OE	E37	NS	E37	NS	E37	NS
E38	3	E38	3	E38	3	E38	1	E38	3	E38	1
E39	3	E39	4	E39	2	E39	NS	E39	1	E39	NS
E40	Low OE	E40	5	E40	4	E40	NS	E40	NS	E40	NS
E41	NS	E41	5	E41	NS	E41	NS	E41	NS	E41	NS
F03	3	F03	5	F03	4	F03	5	F03	3	F03	3
F04	NS	F04	5	F04	NS	F04	NS	F04	NS	F04	NS
F05	NS	F05	5	F05	NS	F05	NS	F05	3	F05	NS
F07	NS	F07	3	F07	NS	F07	NS	F07	4	F07	NS
Autumn	Edge	Spring	Edge	Combined	Edge	Autumn	Rifle	Spring	Rifle	Combined	Rifle

F11	3	F11	4	F11	4	F11	NS	F11	3	F11	NS
F12	3	F12	5	F12	4	F12	NS	F12	3	F12	NS
F13	NS	F13	5	F13	NS	F13	NS	F13	NU	F13	NS
G01	1	G01	5	G01	3	G01	5	G01	1	G01	3
G06	NS	G06	NS	G06	NS	G06	NS	G06	Low OE	G06	NS
G11	1	G11	4	G11	3	G11	5	G11	1	G11	2
G12	NS	G12	NS	G12	NS	G12	3	G12	3	G12	2
G13	2	G13	5	G13	2	G13	5	G13	3	G13	2
G14	2	G14	4	G14	2	G14	5	G14	1	G14	2
G16	1	G16	4	G16	3	G16	5	G16	1	G16	2
G17	1	G17	4	G17	2	G17	5	G17	1	G17	2
G18	1	G18	3	G18	2	G18	5	G18	3	G18	3
G19	2	G19	5	G19	4	G19	4	G19	NS	G19	NS
G20	1	G20	5	G20	2	G20	5	G20	3	G20	3
G21	3	G21	5	G21	Low OE	G21	5	G21	3	G21	3
G23	1	G23	3	G23	2	G23	5	G23	3	G23	3
G24	1	G24	5	G24	3	G24	5	G24	3	G24	3
G25	2	G25	4	G25	1	G25	3	G25	NU	G25	Low OE
G26	1	G26	3	G26	2	G26	2	G26	3	G26	3
G27	1	G27	3	G27	3	G27	5	G27	3	G27	3
G28	NS	G28	NS	G28	NS	G28	2	G28	1	G28	4
G29	1	G29	3	G29	2	G29	5	G29	3	G29	3
G30	1	G30	3	G30	3	G30	5	G30	3	G30	3
G31	1	G31	4	G31	2	G31	5	G31	3	G31	3
G32	Low OE	G32	2	G32	2	G32	5	G32	1	G32	3
G33	1	G33	3	G33	2	G33	5	G33	3	G33	3
G34	1	G34	1	G34	2	G34	5	G34	2	G34	3
G36	1	G36	4	G36	2	G36	5	G36	3	G36	3
G38	NS	G38	4	G38	NS	G38	2	G38	1	G38	4
G40	1	G40	3	G40	3	G40	5	G40	4	G40	3
G41	NS	G41	NS	G41	NS	G41	1	G41	NU	G41	1
G42	NS	G42	4	G42	NS	G42	2	G42	1	G42	4
G43	NS	G43	3	G43	NS	G43	5	G43	3	G43	3
H01	1	H01	3	H01	3	H01	5	H01	3	H01	3
H02	3	H02	2	H02	3	H02	5	H02	3	H02	3
H03	1	H03	5	H03	3	H03	NS	H03	1	H03	NS
H05	1	H05	4	H05	2	H05	5	H05	3	H05	3
H06	1	H06	4	H06	3	H06	5	H06	2	H06	3
H07	NS	H07	NS	H07	NS	H07	5	H07	1	H07	1
H08	1	H08	4	H08	2	H08	5	H08	1	H08	3
H10	NS	H10	NS	H10	NS	H10	2	H10	2	H10	4
H11	1	H11	3	H11	2	H11	2	H11	1	H11	3
H12	2	H12	4	H12	2	H12	2	H12	1	H12	4
H13	NS	H13	4	H13	NS	H13	5	H13	3	H13	2
H14	NS	H14	NS	H14	NS	H14	Low OE	H14	1	H14	4
H15	NS	H15	NS	H15	NS	H15	2	H15	1	H15	4
H18	Low OE	H18	3	H18	2	H18	2	H18	1	H18	4
H19	1	H19	1	H19	2	H19	5	H19	1	H19	2
H20	NS	H20	NS	H20	NS	H20	2	H20	1	H20	4
H21	2	H21	2	H21	1	H21	1	H21	3	H21	3
H24	1	H24	4	H24	2	H24	5	H24	1	H24	2
H25	1	H25	4	H25	2	H25	5	H25	1	H25	2
H26	1	H26	4	H26	1	H26	4	H26	Low OE	H26	Low OE
H27	NS	H27	NS	H27	NS	H27	2	H27	1	H27	4
H28	NS	H28	NS	H28	NS	H28	2	H28	1	H28	4
H31	1	H31	4	H31	3	H31	5	H31	3	H31	3
H32	1	H32	3	H32	2	H32	5	H32	3	H32	2
H33	NS	H33	4	H33	NS	H33	2	H33	1	H33	4
H34	1	H34	3	H34	3	H34	5	H34	3	H34	3
H35	1	H35	1	H35	2	H35	5	H35	1	H35	3
H36	1	H36	4	H36	2	H36	5	H36	3	H36	3
H37	1	H37	4	H37	2	H37	5	H37	1	H37	2
H38	1	H38	4	H38	2	H38	5	H38	4	H38	3

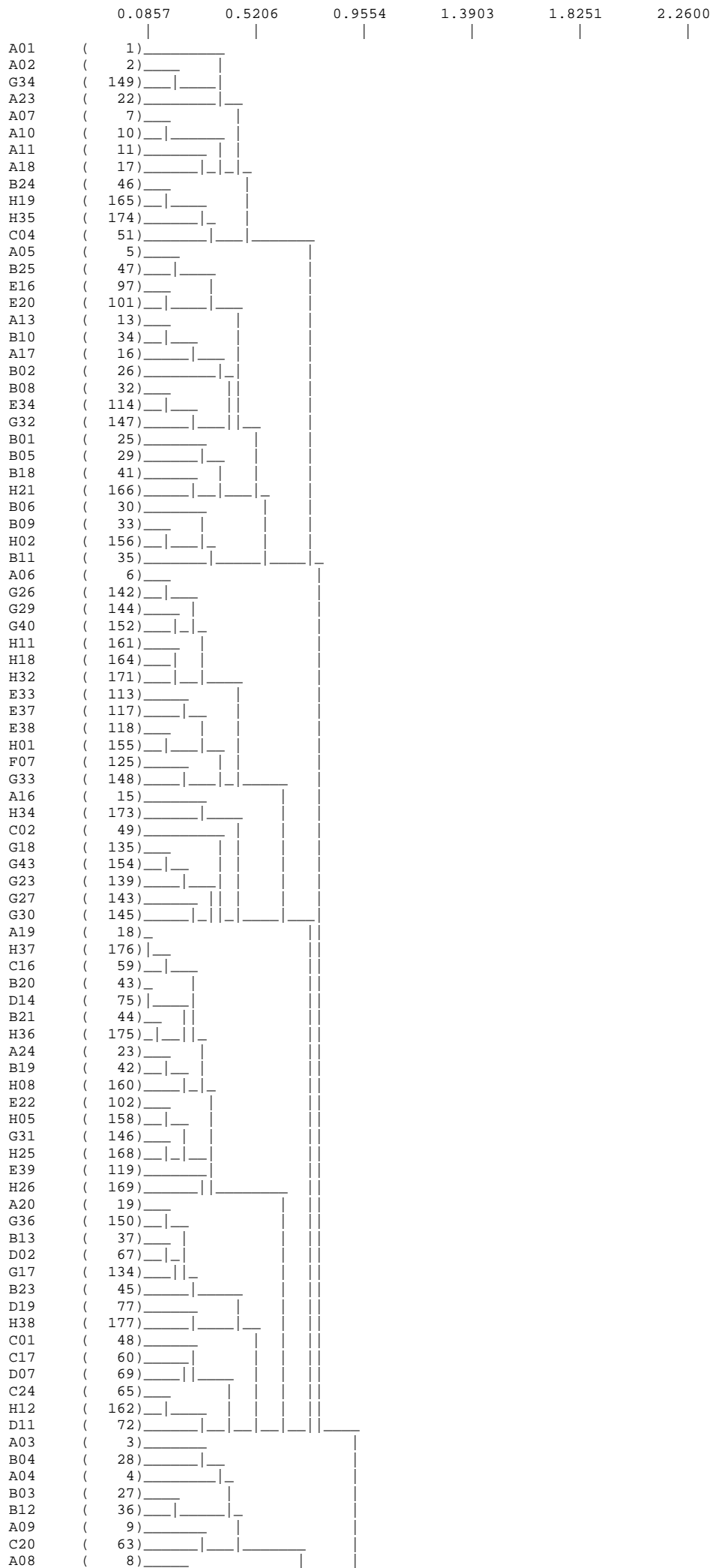
Autumn Edgewater dendrogram with impacted sites and outliers removed Beta= -0.2

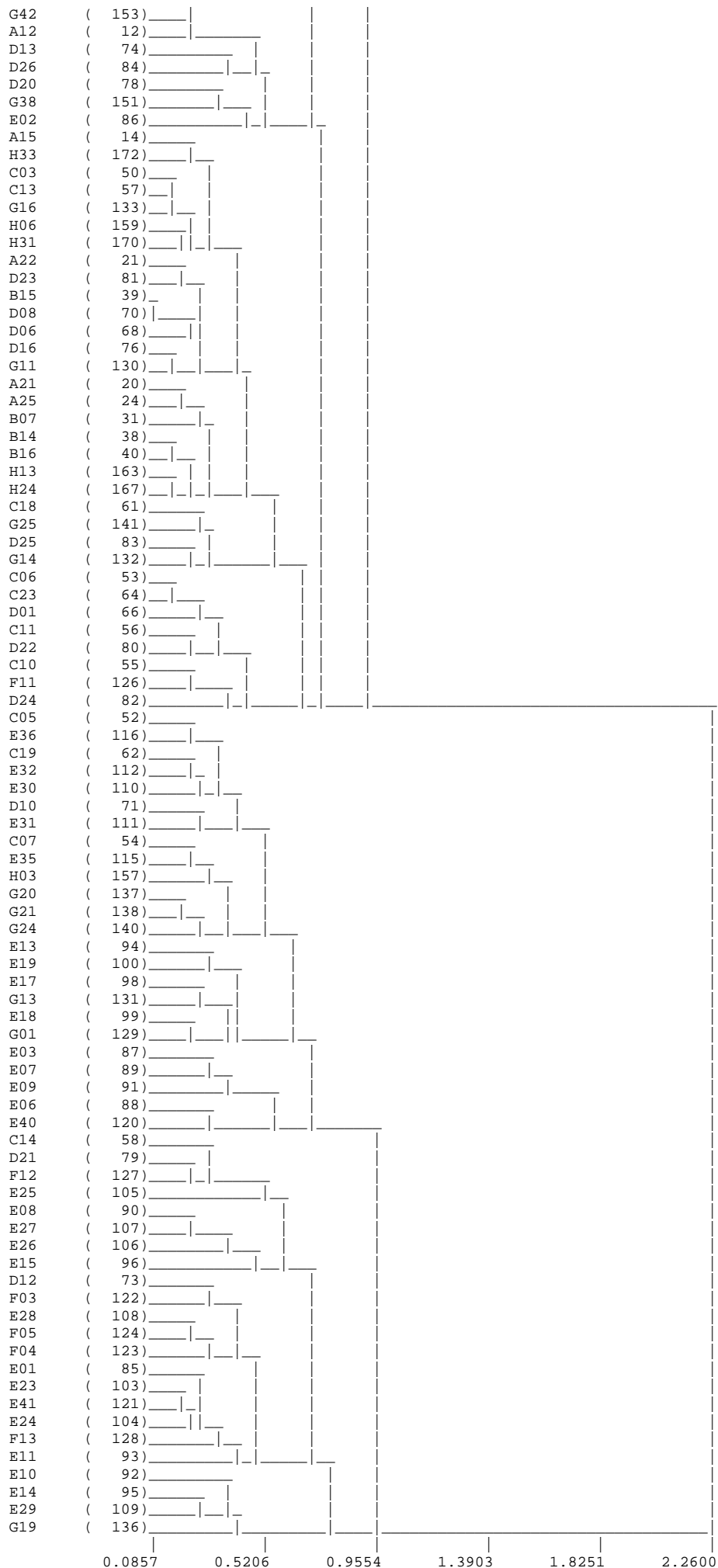




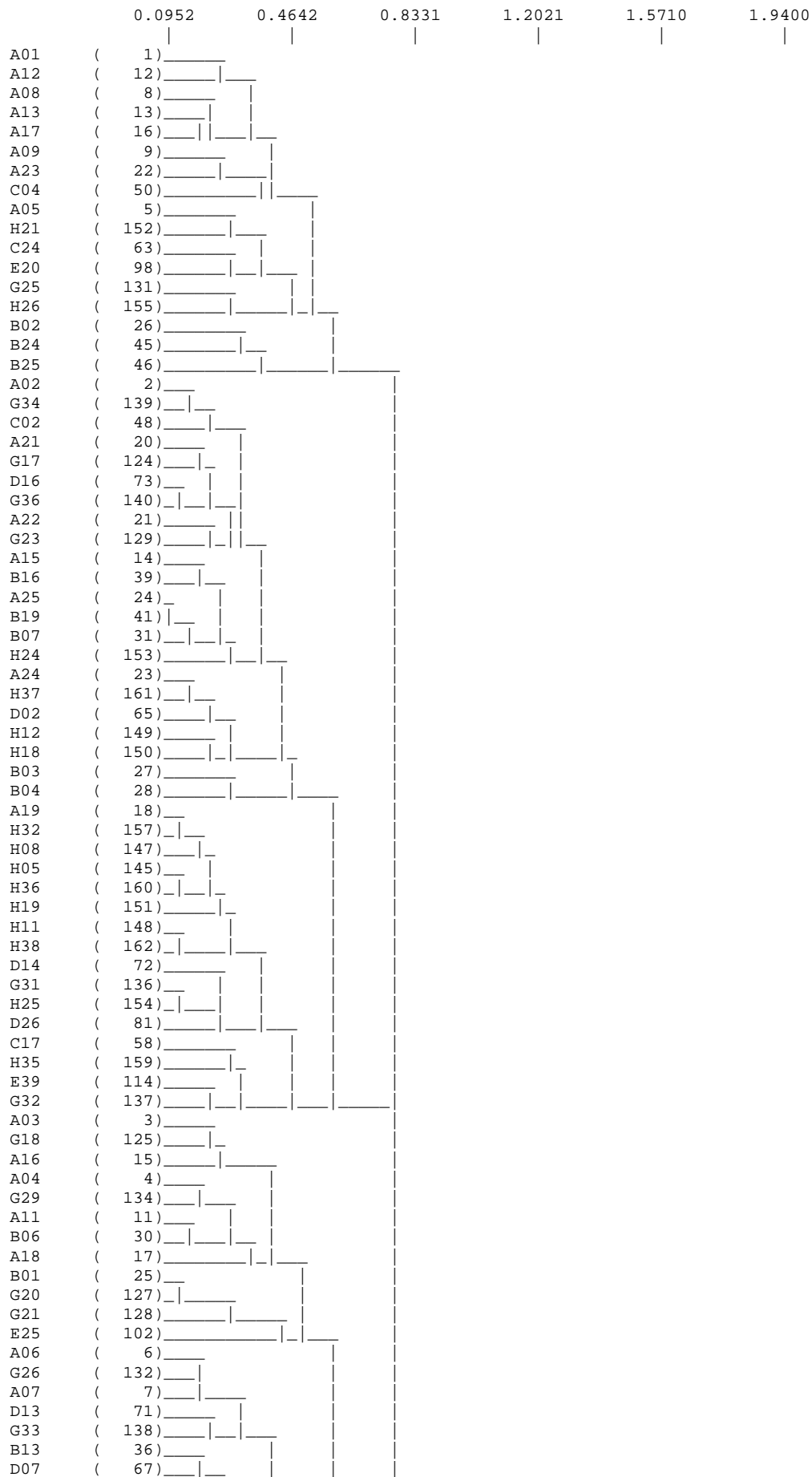
0.1250 0.4860 0.8470 1.2080 1.5690 1.93

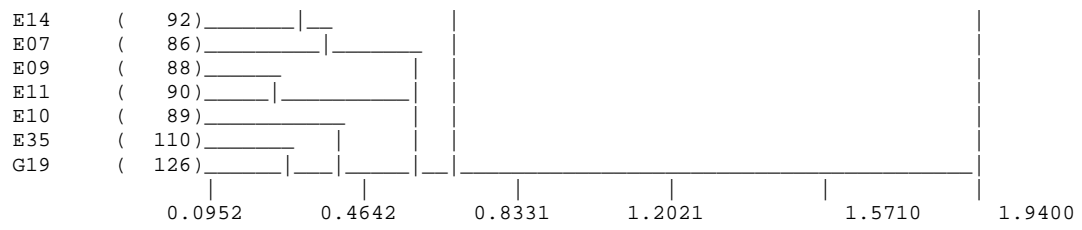
Spring Edgewater dendrogram with impacted sites and outliers removed Beta= -0.2



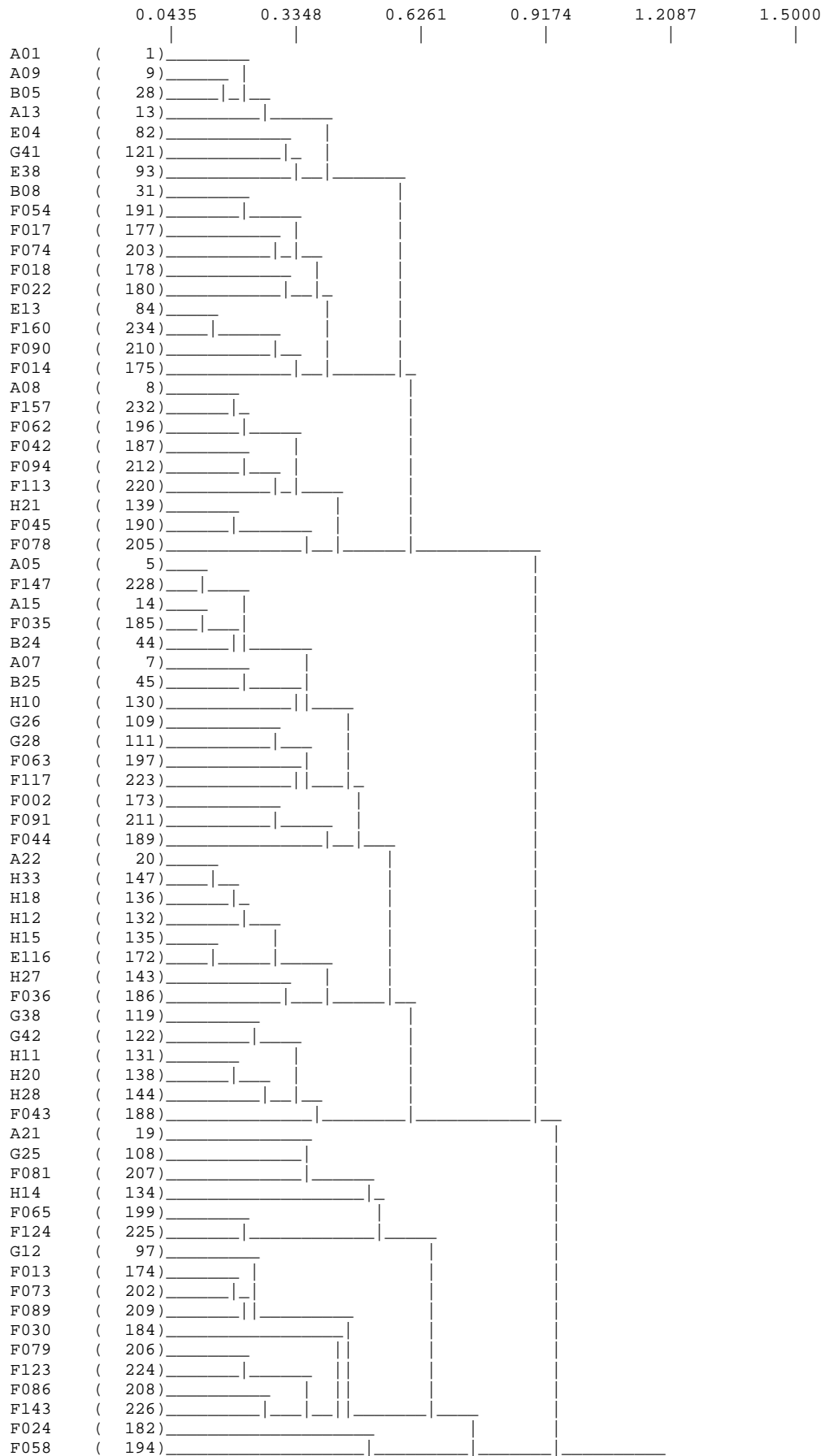


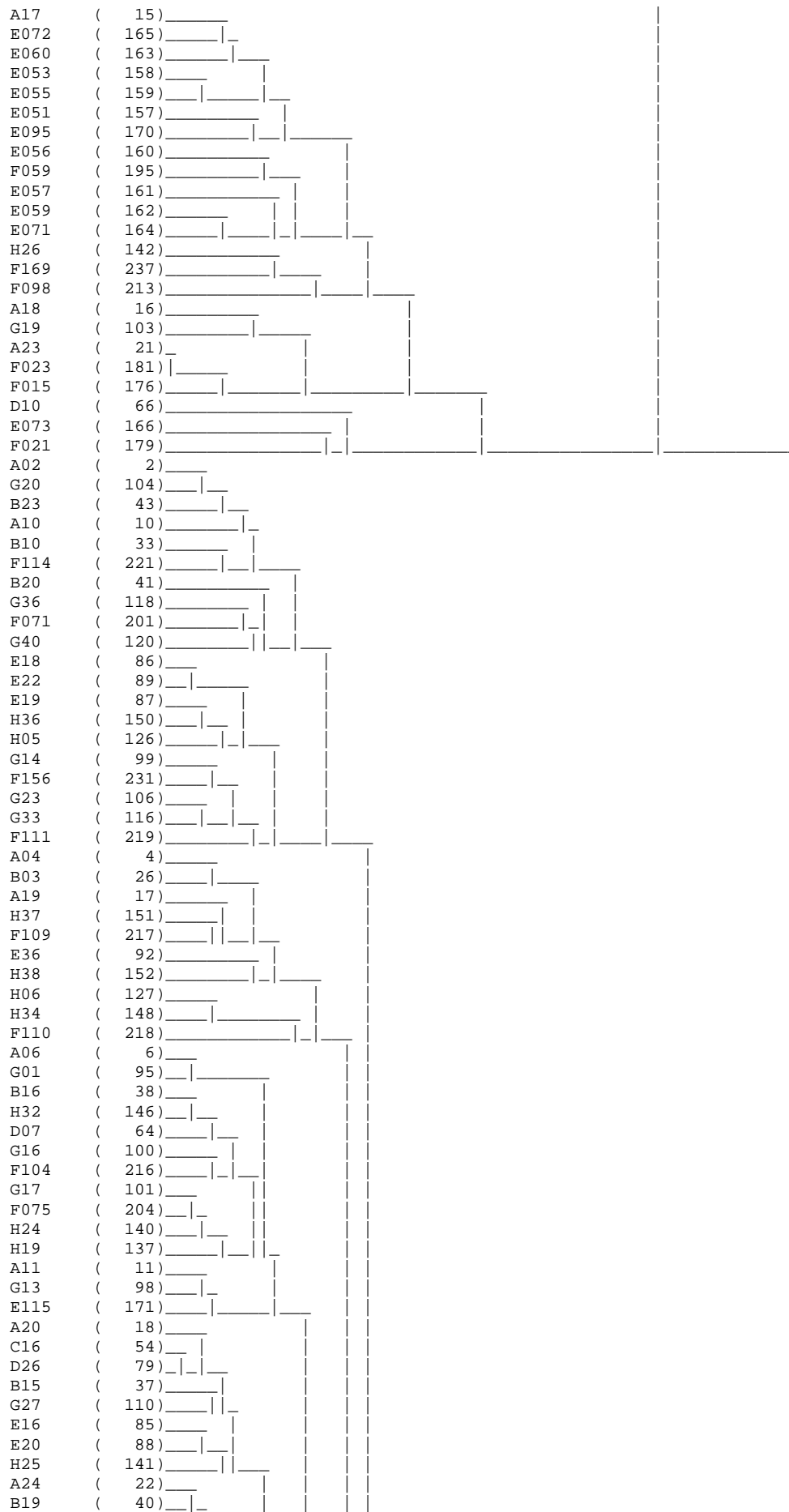
Combined Seasons Edgewater dendrogram with impacted sites and outliers removed. Beta = -0.2. Sites B12, C25, D10, E04, E05, E29, E31, E41, F04, F05, F07, F13, G38, G42, G43, H13, H33 have been removed because they were sampled in only one season.

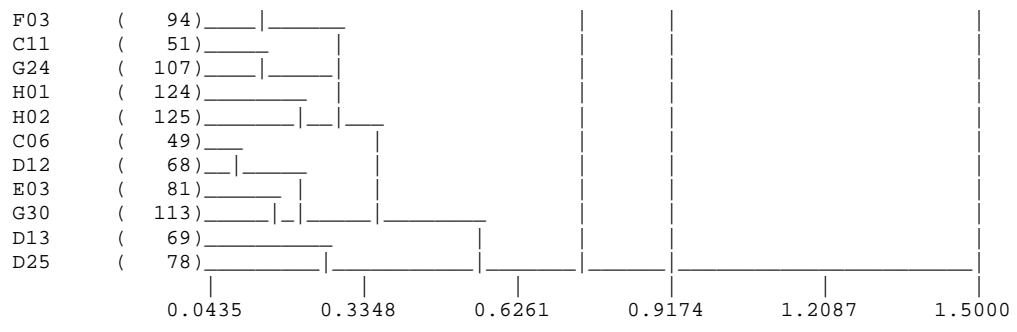




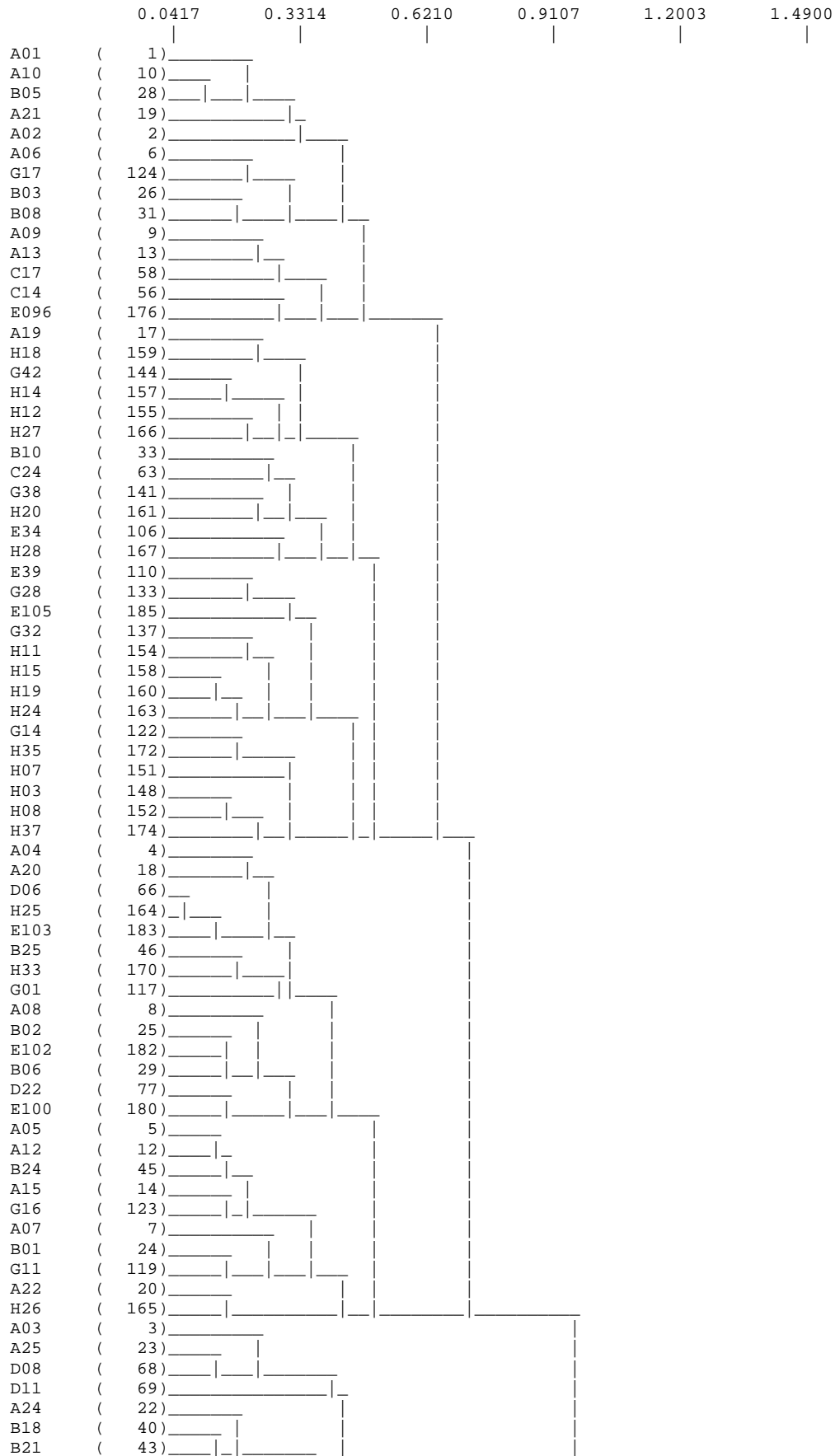
Autumn Riffle dendrogram (incorporating data from Peter's ESSA and RFA studies) with impacted sites, outliers removed. Beta= -0.2



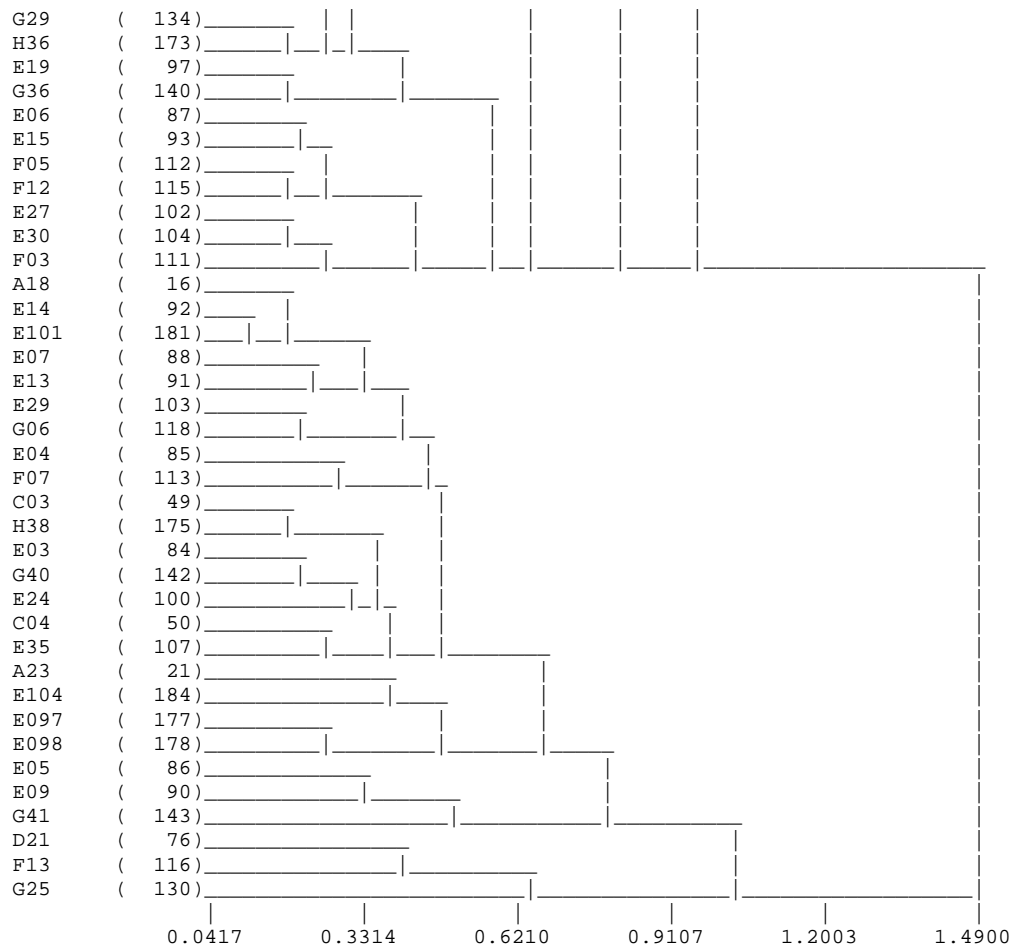




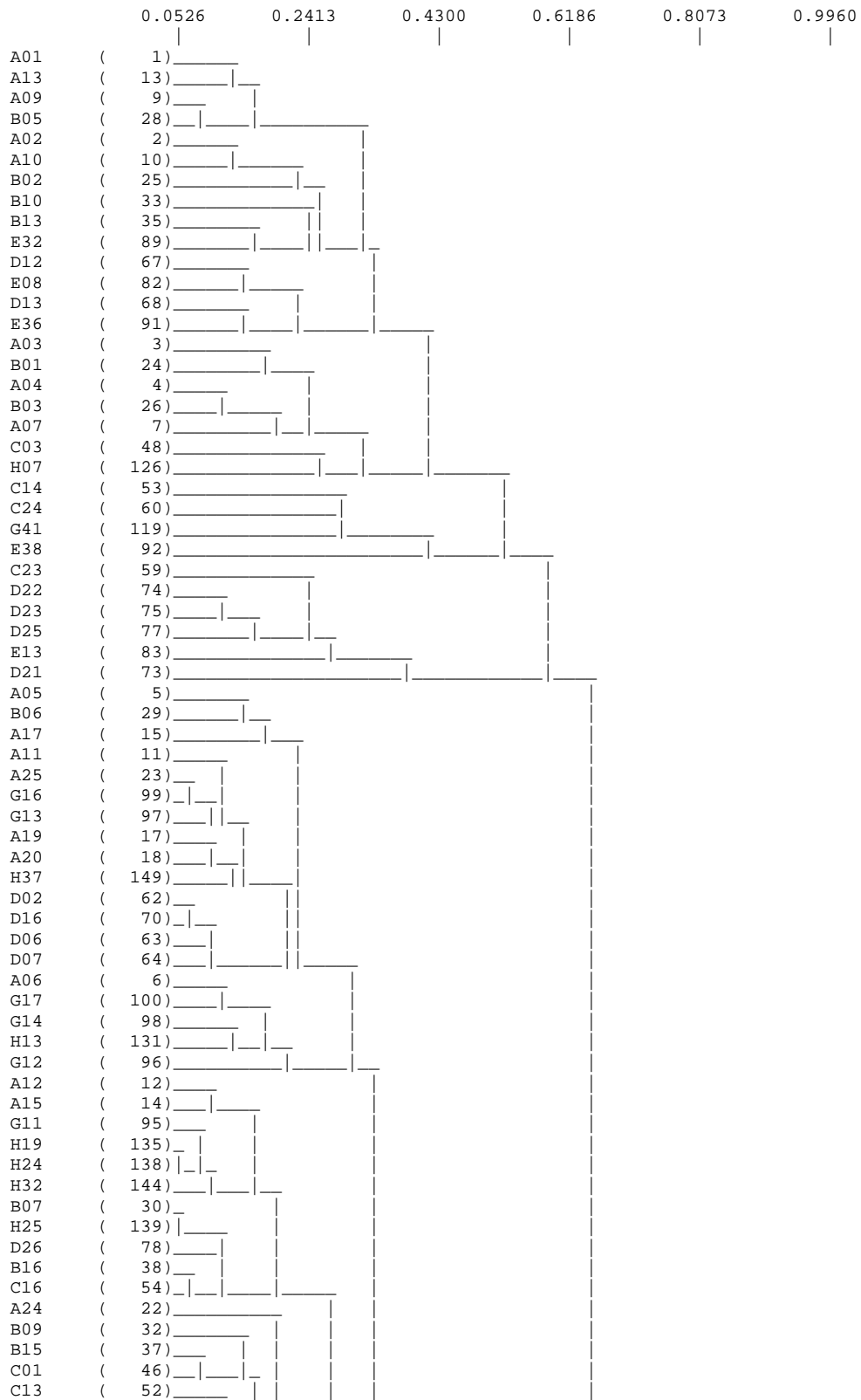
Spring Riffle dendrogram (incorporating data from Peter's ESSA and RFA studies) with impacted sites, outliers removed. Beta= -0.2

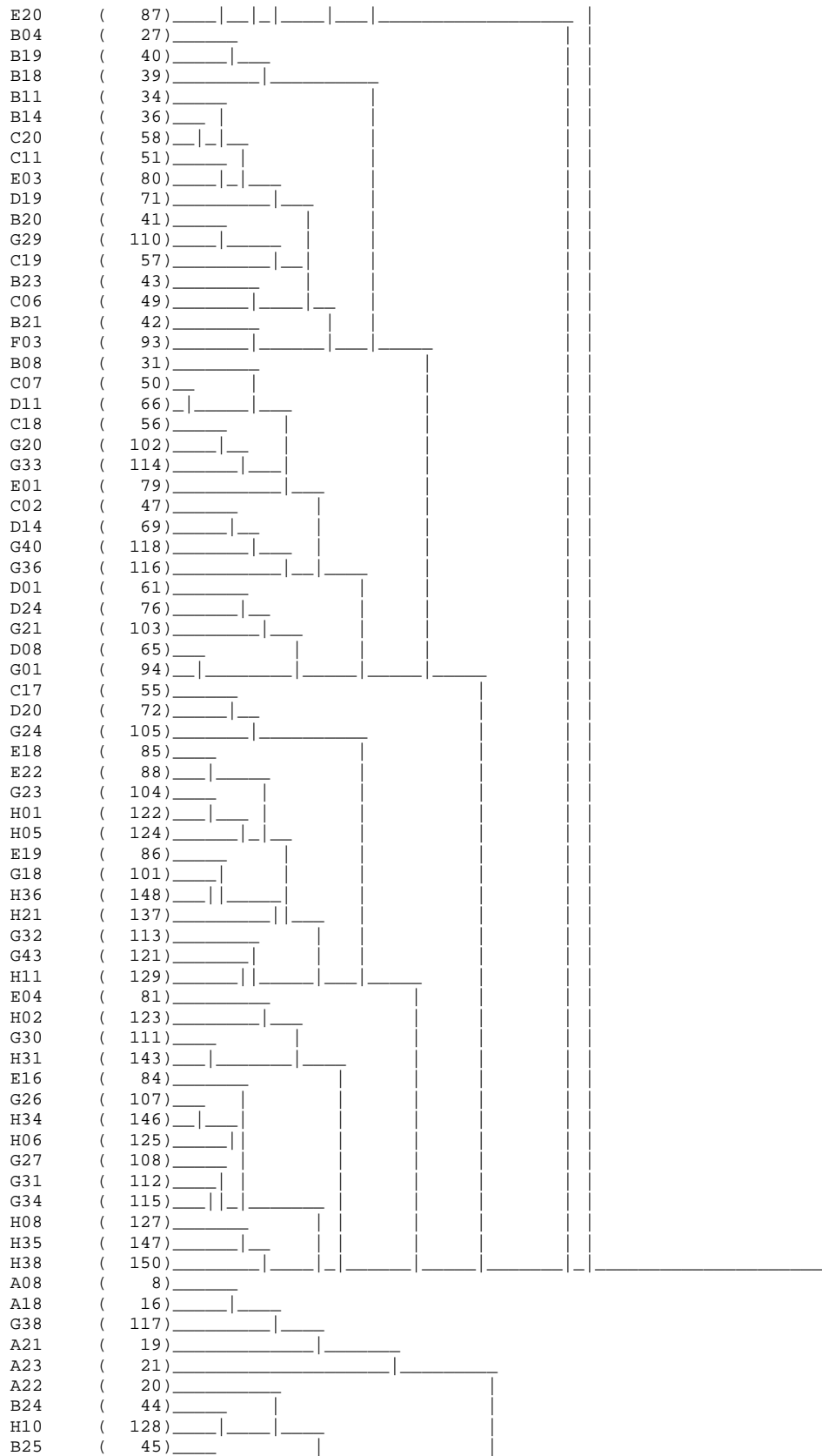


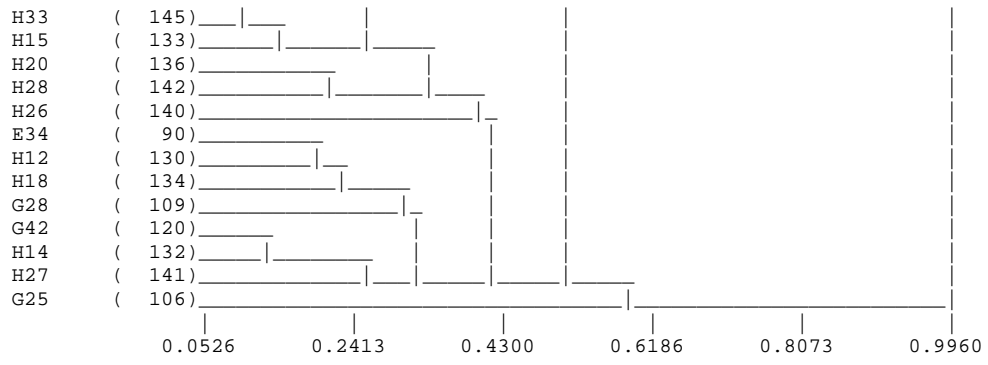
C16	(	57)	_____	|	|	
H10	(	153)	_____	|	_____	|
D07	(	67)	_____	|	_____	|
A11	(	11)	_____	|	_____	|
B15	(	37)	_____	|	_____	|
C13	(	55)	_____	|	_____	|
B09	(	32)	_____	|	_____	|
B11	(	34)	_____	|	_____	|
B14	(	36)	_____	|	_____	|
B23	(	44)	_____	|	_____	|
C01	(	47)	_____	|	_____	|
B20	(	42)	_____	|	_____	|
C20	(	61)	_____	|	_____	|
D19	(	74)	_____	|	_____	|
C06	(	52)	_____	|	_____	|
C11	(	54)	_____	|	_____	|
C18	(	59)	_____	|	_____	|
C07	(	53)	_____	|	_____	|
D13	(	71)	_____	|	_____	|
C19	(	60)	_____	|	_____	|
H06	(	150)	_____	|	_____	|
B17	(	39)	_____	|	_____	|
D01	(	64)	_____	|	_____	|
D23	(	78)	_____	|	_____	|
D25	(	80)	_____	|	_____	|
C23	(	62)	_____	|	_____	|
D14	(	72)	_____	|	_____	|
D02	(	65)	_____	|	_____	|
D16	(	73)	_____	|	_____	|
D26	(	81)	_____	|	_____	|
G34	(	139)	_____	|	_____	|
A17	(	15)	_____	|	_____	|
G13	(	121)	_____	|	_____	|
B07	(	30)	_____	|	_____	|
B16	(	38)	_____	|	_____	|
E17	(	95)	_____	|	_____	|
E16	(	94)	_____	|	_____	|
E20	(	98)	_____	|	_____	|
H13	(	156)	_____	|	_____	|
G12	(	120)	_____	|	_____	|
E02	(	83)	_____	|	_____	|
E08	(	89)	_____	|	_____	|
E36	(	108)	_____	|	_____	|
E22	(	99)	_____	|	_____	|
H01	(	146)	_____	|	_____	|
E099	(	179)	_____	|	_____	|
G31	(	136)	_____	|	_____	|
G26	(	131)	_____	|	_____	|
H05	(	149)	_____	|	_____	|
G27	(	132)	_____	|	_____	|
G33	(	138)	_____	|	_____	|
H32	(	169)	_____	|	_____	|
H34	(	171)	_____	|	_____	|
H02	(	147)	_____	|	_____	|
H31	(	168)	_____	|	_____	|
B13	(	35)	_____	|	_____	|
H21	(	162)	_____	|	_____	|
D20	(	75)	_____	|	_____	|
G18	(	125)	_____	|	_____	|
E25	(	101)	_____	|	_____	|
F11	(	114)	_____	|	_____	|
E32	(	105)	_____	|	_____	|
C02	(	48)	_____	|	_____	|
G20	(	126)	_____	|	_____	|
G21	(	127)	_____	|	_____	|
C05	(	51)	_____	|	_____	|
G24	(	129)	_____	|	_____	|
D24	(	79)	_____	|	_____	|
E18	(	96)	_____	|	_____	|
E01	(	82)	_____	|	_____	|
D12	(	70)	_____	|	_____	|
G30	(	135)	_____	|	_____	|
E38	(	109)	_____	|	_____	|
G43	(	145)	_____	|	_____	|
B04	(	27)	_____	|	_____	|
B19	(	41)	_____	|	_____	|
G23	(	128)	_____	|	_____	|



Combined Seasons Riffle dendrogram with impacted sites and outliers removed. Beta = -0.2







The best E-Ball Model found by the ranking procedure for Dataset: AEO_E.csv

Note: this is just a recommendation, all other models should be evaluated by a skilled operator

Intercept= 0.96 Slope= 0.93 R-Sq= 0.171

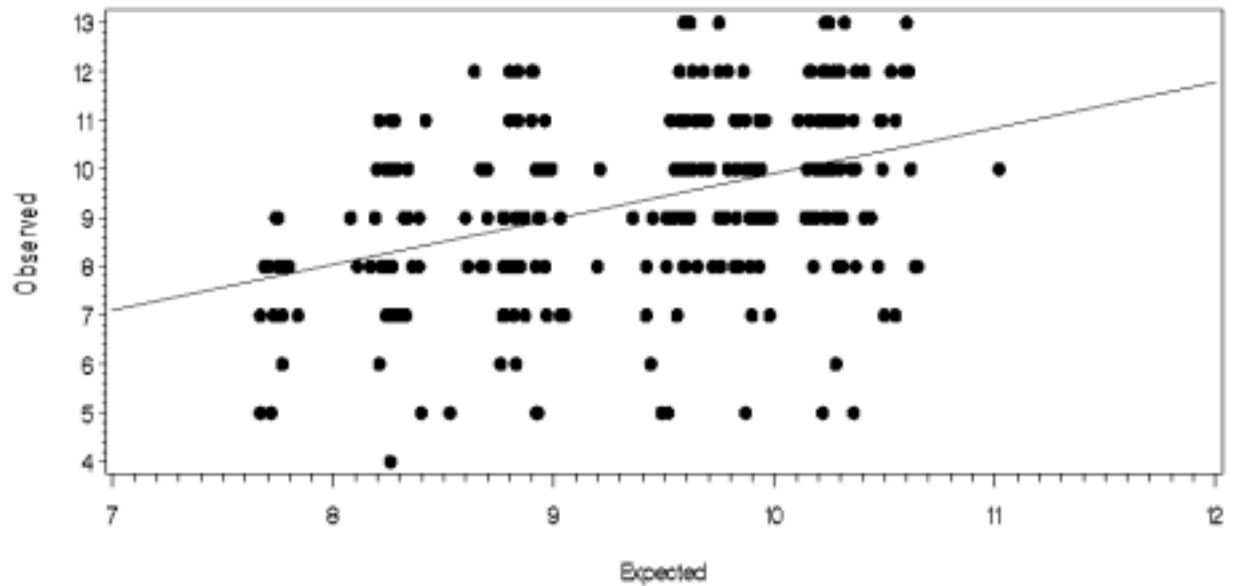
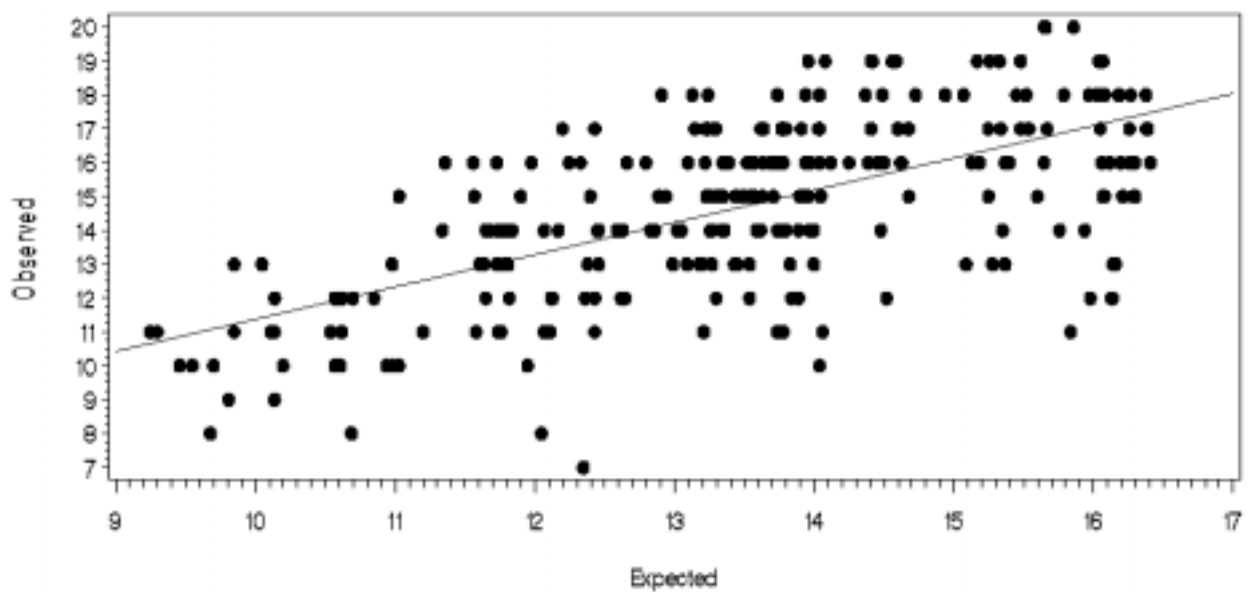


Figure 1. Observed versus Expected regression for the Autumn Edgewater model.

The best E-Ball Model found by the ranking procedure for Dataset: ARO_E.csv

Note: this is just a recommendation, all other models should be evaluated by a skilled operator

Intercept= 1.85 Slope= 0.95 R-Sq= 0.405



The best E-Ball Model found by the ranking procedure for Dataset: SEO_E.csv

Note: this is just a recommendation, all other models should be evaluated by a skilled operator

Intercept= -2.34 Slope= 1.22 R-Sq= 0.441

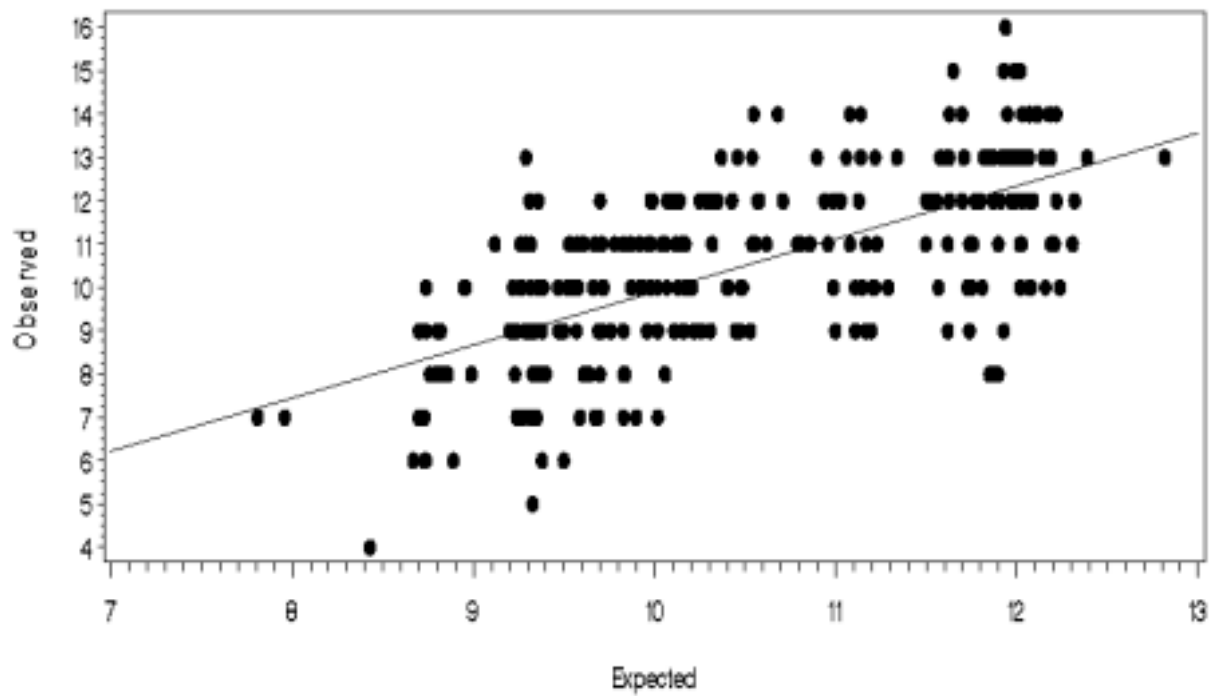


Figure 2. Observed versus Expected regression for the Autumn Riffle model.

Figure 3. Observed versus Expected regression for the Spring Edgewater model

The best E-Ball Model found by the ranking procedure for Dataset: SRO_E.csv

Note: this is just a recommendation, all other models should be evaluated by a skilled operator

Intercept= 1.22 Slope= 0.92 R-Sq= 0.176

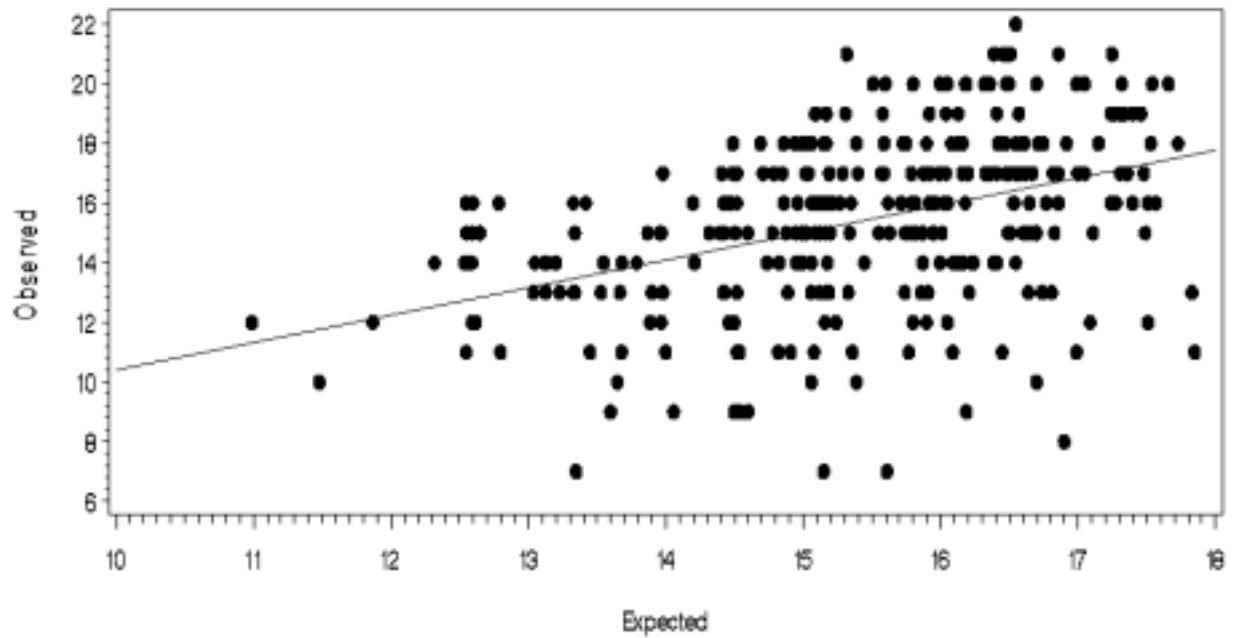


Figure 4. Observed versus Expected regression for the Spring Riffle model.

The best E-Ball Model found by the ranking procedure for Dataset: CEO_E.csv

Note: this is just a recommendation, all other models should be evaluated by a skilled operator

Intercept= 4.51 Slope= 0.71 R-Sq= 0.101

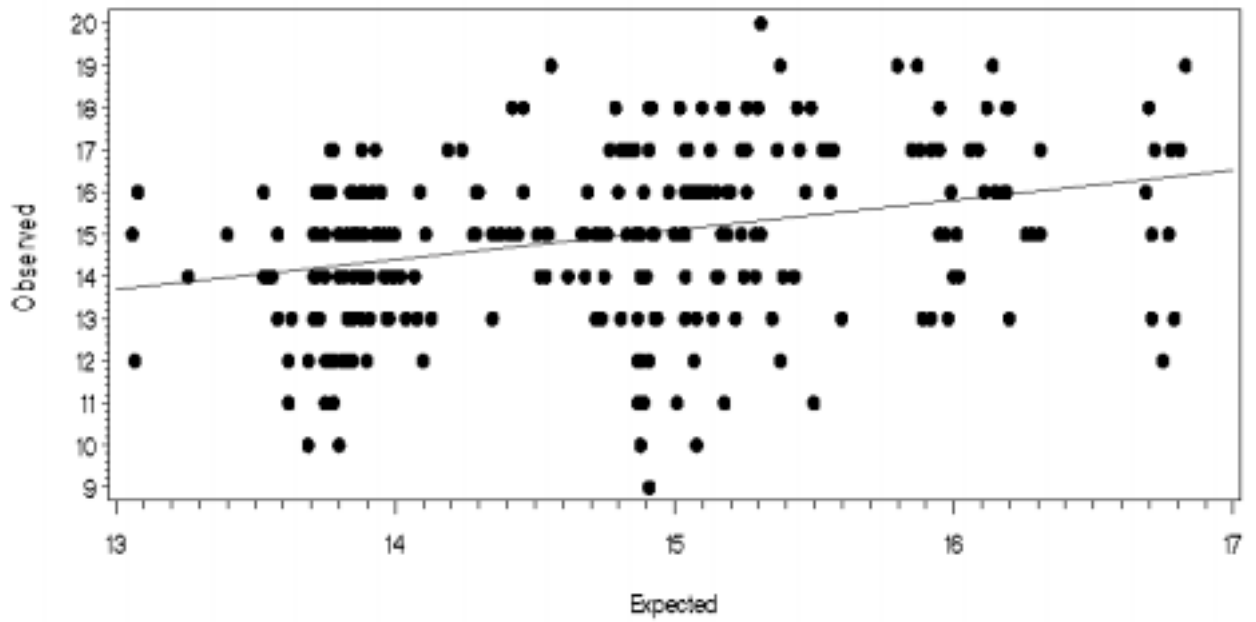


Figure 5. Observed versus Expected regression for the Combined Edgewater model.

The best E-Ball Model found by the ranking procedure for Dataset: CRO_E.csv

Note: this is just a recommendation, all other models should be evaluated by a skilled operator

Intercept= 5.65 Slope= 0.72 R-Sq= 0.121

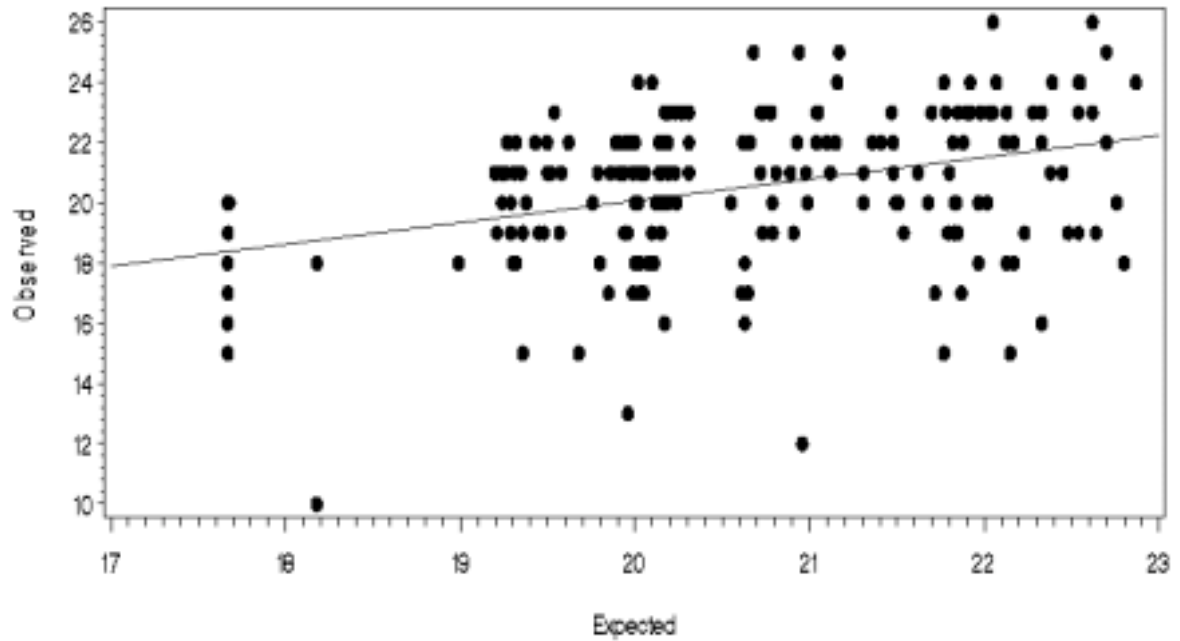


Figure 6. Observed versus Expected regression for the Combined Riffle model.