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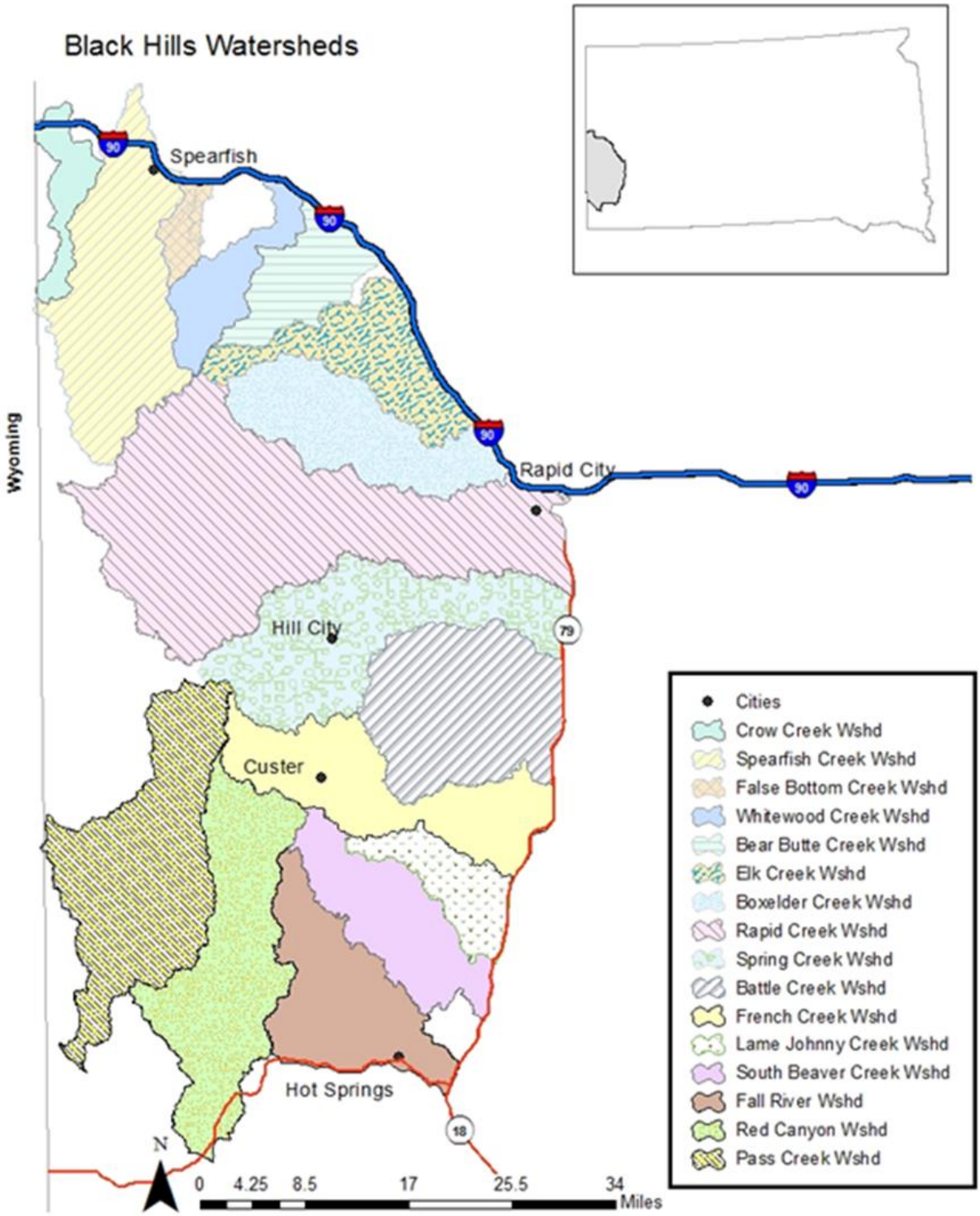

Figure 1. Watersheds within the Black Hills Fish Management Area, South Dakota.

Survey Methods for All Watersheds

Efforts were made to satisfy the assumptions 1) the population is static, 2) capture probability remained constant across sampling periods, and 3) all fish in the population are equally vulnerable to capture (Van Den Avyle and Hayward 1999; Hayes et al. 2007). All sample reaches were 100 m in length. Block nets at the upstream and downstream boundaries were used to prevent fish from emigrating or immigrating within the sample site. Initially, a single pass was conducted. If trout over 200 mm or mountain sucker were captured, two additional passes were conducted. One backpack electrofishing unit was used when mean stream width was less than 6 m. Captured fish were anesthetized with carbon dioxide, measured to the nearest millimeter total length (TL), weighed to the nearest gram, and returned to the stream after recovery. After 50 individual TL and weights were collected from small fish (<100mm) of a specific species, bulk counts were collected to expedite data collection. For three-pass surveys, a maximum-likelihood estimator was used to estimate catchability and population (Junge and Libosvarsky 1965; cited in Hayes et al. 2007). For single-pass surveys, relative abundance was calculated as CPUE (number of fish captured per 100 m of stream). Abundances and density were compared to past data from individual sites when historical sampling occurred within comparable months. For samples completed in May or June, previous samples in May and June were used for comparison. For samples completed in July or August, previous samples in July or August were used for comparison. As a result of the small sample size, caution must be given when interpreting the data and extrapolating it to the entire stream. Current stream classifications for Black Hills Fish Management Area (BHFMA) stream trout fisheries are found in Table 1.

In addition to fish data, pH, temperature, and specific conductance were collected. Stream widths were measured every ten meters and averaged to obtain an estimate of total area sampled. Stream flow data was also downloaded from the USGS web site for water years 2000-2015 (available at: http://waterdata.usgs.gov/sd/nwis/current/?type=flow). Eighteen species of fish have been captured during sampling since 2016 (Table 2).

Table 1. Current trout classifications for streams within the Black Hills Fish Management Area, South Dakota.

Brown trout fisheries -- based on number of fish greater than 200 mm total length (8 in).	
Class BR1	number of wild brown trout exceeds 150 per acre
Class BR2	number of wild brown trout ranges from 25 to 150 per acre
Class BR3	number of wild brown trout is less than 25 per acre
Brook trout fisheries-- based on number of fish greater than 200 mm total length (8 in).	
Class BK1	number of wild brook trout exceeds 150 per acre
Class BK2	number of wild brook trout ranges from 25 to 150 per acre
Class BK3	number of wild brook trout is less than 25 per acre
Rainbow trout fisheries -- based on number of fish greater than 200 mm total length (8 in).	
Class RB1	number of wild rainbow trout exceeds 25 per acre
Class RB2	number of wild rainbow trout is less than or equal to 25 per acre

Table 2. List of species captured since 2016 within the Black Hills Fish Management Area, South Dakota.

Common name	Species code	Scientific name
Brook trout	BKT	*Salvelinus fontinalis*
Brown trout	BNT	*Salmo trutta*
Rainbow trout	RBT	*Oncorhynchus mykiss*
Cutthroat trout	CUT	*Oncorhynchus clarkii*
Brook stickleback	BRS	*Culaea inconstans*
Creek chub	CRC	*Semotilus atromaculatus*
Fathead minnow	FHM	*Pimephales promelas*
Green sunfish	GSF	*Lepomis cyanellus*
Jack Dempsey cichlid	JAD	*Rocio octofasciata*
Longnose dace	LND	*Rhinichthys cataractae*
Longnose sucker	LNS	*Catostomus catostomus*
Mountain sucker	MTS	*Catostomus platyrhynchus*
Plains topminnow	PTM	*Fundulus sciadicus*
Rock bass	ROB	*Ambloplites rupestris*
Sand shiner	SSH	*Notropis stramineus*
Stone cat	STC	*Noturus flavus*
White sucker	WHS	*Catostomus commersoni*
Shorthead Redhorse	SHR	*Moxostoma macrolepidotum*

Battle Creek Watershed

Counties: Pennington

Table 3. Abundance (estimated number in site) and 95% confidence intervals of trout species captured within three sample sites of the Battle Creek watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Site	BKT <200 mm	BKT ≥ 200 mm	BKT ≥ 200 mm/acre	BNT<200 mm	BNT≥200 mm	BNT≥200 mm/ acre
BAT05	15 (15-16)	13 (13-14)	66	1 (1)	5 (5-6)	25
BAT09	1 (1)	3 (3-4)	19	6 (6-7)	8 (8)	49

Table 4. Abundance (estimated number in site) and 95% confidence intervals of non-trout species captured within three sample sites of the Battle Creek watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Site	CRC	FHM	LND	ROB	WHS
BAT05	51(51-53)	1(1)	40(36-48)		16(16-18)
BAT09	16(13-26)	1(1)	16(13-26)	23(23-24)	76(70-85)

Bear Butte Creek Watershed

Counties: Lawrence, Meade

Table 5. Abundance (estimated number in site) and 95% confidence intervals of species captured within five sample sites of the Bear Butte Creek watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Site	BKT <200 mm	BKT ≥200 mm	BKT ≥200 mm per acre	LND	MTS	WHS
BBC810	168(162-175)	9(9)	93	20 (14-40)	1 (1-2)	
BBC844	70 (70-72)	4 (4)	49	181 (163-199)		
BBC887	9 (9-11)	1(1)	12	30 (29-33)		23(23-24)
BBC904	16 (16)	2 (2-3)	29	101 (88-116)	13 (12-18)	

Beaver Creek Watershed

Counties: Pennington, SD; Weston, WY

Table 6. Abundance (estimated number in site) and 95% confidence intervals of species captured within one sample site of the Beaver Creek watershed during the 2017 survey.

Site	BKT <200 mm	BKT ≥ 200 mm	BKT ≥ 200 mm per acre
BV2-01	38(38-39)	3(3)	40

Cold Springs Creek Watershed

Counties: Lawrence, SD; Weston, WY; Crook, WY

Table 7. Abundance (estimated number in site) and 95% confidence intervals of species captured within one sample site of the Cold Creek watershed during the 2017 survey.

Site	BKT ≤200 mm
CLC	6 (6-8)

Boxelder Creek Watershed

Counties: Lawrence, Meade, and Pennington

Table 8. Abundance (estimated number in site) and 95% confidence intervals of trout species captured within ten sample sites of the Boxelder Creek watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Site	BKT <200 mm	BKT > 200 mm	BKT ≥200 mm per acre	BNT < 200 mm	BNT ≥ 200 mm	BNT ≥200 mm per acre
BOX01	17(17-18)	3(3-4)	13	14(14-16)	15(15-16)	65
BOX04	15(15-16)	3(3)	43	15(15-16)	1(1)	14
JIM02	46(45-49)	2(2-3)	51			
EST1						
HAY1	24(24-26)			12(12)	1(1)	24
HAY03						
BXM02	37 (36-40)	2 (2)	49			
BXN01	72 (71-75)	1 (1-3)	3			
BXS2	14(14)			1(1)		

Table 9. Abundance (estimated number in site) and 95% confidence intervals of non-brook and brown trout species captured within ten sample sites of the Boxelder Creek watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Site	CRC	FHM	LND	MTS	STC	WHS	RBT
BOX01		1(1)	122(114-132)	7(7)	79(41-166)	23(23-24)	
BOX04			106(99-115)	1(1)		1(1)	
JIM02			49 (45-56)	1(1)		4(4)	
EST1							
HAY1			71(66-79)				
HAY03		2(2-4)	1(1-2)			5(5-6)	
BJC01	55(54-58)		206(202-211)				
BXM02			2(2-4)				
BXN01			14(14-16)				
BXS2			105(105-106)				

Elk Creek Watershed

Counties: Meade and Lawrence

Table 10. Abundance (estimated number in site) and 95% confidence intervals of trout species captured within 3 sample sites of the Elk Creek watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Site	BKT <200 mm	BKT ≥200 mm	BKT ≥200 mm per acre	BKT Class	BNT <200 mm	BNT ≥200 mm	BNT ≥ 200 mm per acre
ELK07	23(23)			0	6(6)		
MEC01	16 (16-18)			0			
ELK05	97 (95-101)	6(6)	90	2			

Table 11. Abundance (estimated number in site) and 95% confidence intervals of non-trout species captured within 3 sample sites of the Elk Creek watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Site	CRC	FHM	LND	MTS	WHS
ELK07	1 (1)		29 (28-32)	22 (22-23)	7(7-8)
MEC01			1(1-2)		
ELK05			12(12-14)	9 (9-11)	

Fall River Watershed

Counties: Fall River

Table 12. Abundance (estimated number in site) and 95% confidence intervals of species captured within 4 sample sites of the Fall River watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Site	CRC	GSF	JAD	LND	MTS	PTM	SDS	WHS
FAL1	14(14-15)	10(10-11)		19(19-20)	1(1)		3(3-4)	14(14-16)
FAL2	46(45-49)			64(58-74)		41(29-67)	4(4)	8(8-10)
FAL3				25(25-27)		6(6-7)		

False Bottom Creek Watershed

Counties: Lawrence

Table 13. Abundance (estimated number in site) and 95% confidence intervals of species captured within 3 sample sites of the False Bottom Creek watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Site	BKT < 200mm	BKT ≥ 200mm	BKT ≥ 200mm per acre	BNT < 200mm	BNT ≥ 200mm	BNT ≥ 200 mm per acre
BRG01	342 (335-349)	4 (4-5)	54			
FBC02	17 (17-18)			125 (121-131)	2 (2-4)	36
FBC02	17 (17-18)			125 (121-131)	2 (2-4)	36

French Creek Watershed

Counties: Custer

Table 14. Abundance (estimated number in site) and 95% confidence intervals of trout species captured within two sample sites of the French Creek watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Species	BKT < 200 mm	BKT ≥ 200 mm	BNT < 200 mm	BNT ≥ 200 mm	BNT ≥ 200 mm per acre
FRC741			36 (26-61)	4(4-5)	29
FRC981			11 (11-13)	4(4-5)	34

Table 15. Abundance (estimated number in site) and 95% confidence intervals of species other than brook and brown trout captured within two sample sites of the French Creek watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Species	CRC	SMB	LND	MTS	RBT ≥200mm	RBT ≥ 200mm per acre	WHS
FRC741	85(79-94)	6(6-8)	108 (107-111)				41 (37-50)
FRC981	30(29-34)		333(263-403)	8 (7-14)			82 (76-91)

Lame Johnny Watershed

Counties: Custer

Table 16. Abundance (estimated number in site) and 95% confidence intervals of species captured within 2 sample sites of the Lame Johnny watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Species	BKT< 200 mm	BKT ≥ 200 mm	BKT ≥ 200 mm per acre	CRC	LND	MTS
FLN1				22(15-44)	36(33-43)	4(4-5)
FLN1*		1(1)	28	110 (22-802)	12 (11-17)	27 (25-33)
FLN3				17(14-27)	62(57-70)	13(13)

Rapid Creek Watershed

Counties: Pennington and Lawrence

Table 17. Abundance (estimated number in site) and 95% confidence intervals of brook and brown trout captured within 35 sample sites of the Rapid Creek watershed during the 2017 survey. Sites are listed in order from downstream to upstream.

Species	BKT <200 mm	BKT ≥200 mm	BKT ≥200 mm per acre	BNT <200 mm	BNT ≥200 mm	BNT ≥200 mm per acre
RAP1927(July)				105 (21-786)	7 (7-9)	41
RAP1927(Oct)				34(34-36)	22(22)	113
RAP1932(July)				58(34-112)	8(8-10)	32
RAP1932(Oct)				46(46-47)	29(29)	105
RAP1945(July)				31(28-38)	10(10-12)	59
RAP1945(Oct)				43(40-50)	15(15-17)	90
RAP1947(July)				37(35-42)	20(20-21)	114
RAP1947(Oct)				68(66-73)	32(32-33)	174
RAP1962(July)				103(91-117)	20(20)	90
RAP1962(Oct)				120(113-129)	22(22)	103
RAP2093				44(43-47)	15(15-17)	113
RAP2127				23(23-25)	7(7)	48
RCN01				27(17-58)	9(9)	111
RCN02	21(21)					
RCN04	12(12-13)	2(2-3)	19	19(19-20)	10(10)	96
RCS01				50(31-93)	4(4)	48
RCS02				168(151-185)	11(11)	112
CAS153				55(48-67)	12(12-14)	78
CAS181				65(59-74)	20(20-22)	209
CAS186				35(29-48)	8(8-9)	68
CAS312	6(6-9)			43(43-45)	29(29)	258
CAS324	8(8-9)	2(2)	16	37(37-38)	8(8-9)	64
CAS334	19(19-21)	20(19-24)	154	54(51-60)	107(104-112)	825
CAS337	25(25-27)	2(2-6)	14	131(121-142)	13(13)	91
CAS356	53(52-56)	53(53-55)	381	71(65-80)	114(113-117)	819
CAS362	110(105-117)	117(117-119)	796	72(70-77)	101(100-104)	687
CCS3	166(165-169)	9(9-10)	96			
CCS20	134(129-141)	1(1)	11			
SLC2	13(13)	1(1)	31	4(4-5)		
SLC03	3(3)	4(4)	53	3(3-4)		
SWD3	54(54-56)			26(26-27)	2(2)	31

SWD3*	97(96-100)	7(7)	237		
GIM2	20(20)			2(2)	

*Sampled twice

Redwater River Watershed

Counties:

Table 19. Abundance (estimated number in site) and 95% confidence intervals of brown trout (BNT) captured within 5 sample sites of the Redwater River watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Species	BNT < 200 mm	BNT ≥ 200 mm	BNT ≥ 200 mm per acre
CRW5	49(45-57)	135(131-141)	965

Table 20. Abundance (estimated number in site) and 95% confidence intervals of non-salmonid species captured within 5 sample sites of the Redwater River watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Species	GSF	LMB	LNS	RBT < 200 mm	RBT ≥ 200 mm	RBT ≥ 200 mm per acre	WHS
CRW5	20 (4-328)	1(1)	11(11)	1(1)	18(18)	129	10

Spearfish Creek Watershed

Counties: Lawrence

Table 21. Abundance (estimated number in site) of brook trout captured within sample sites of the Spearfish Creek Watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream. Confidence intervals (95%) are shown in parenthesis.

Site	BKT <200mm	BKT ≥200 mm	BKT ≥200 mm/acre
ANN3			
ANN11			
LCG1			

Table 22. Abundance (estimated number in site) of brown trout and rainbow trout captured within sample sites of the Spearfish Creek Watershed in 2017. Sites are listed in order from furthest downstream to upstream. Confidence intervals (95%) are shown in parenthesis.

Site	BNT <200 mm	BNT ≥200 mm	BNT ≥ 200 mm/acre	RBT <200 mm	RBT ≥ 200 mm	RBT ≥200 mm/acre
ANN3						
ANN11						
LCG1						

[+]single pass; [*]sampled twice

Spring Creek Watershed

Counties: Pennington

Table 23. Abundance (estimated number in site) and 95% confidence intervals of salmonid-species captured within 4 sample sites of the Spring Creek watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Species	BKT <200 mm	BKT ≥ 200 mm	BKT ≥ 200 mm per acre	BNT < 200 mm	BNT ≥ 200mm	BNT ≥ 200 mm per acre
SPR1				3(3)	3(3)	14
SPR6	102(98-108)					
SPR7*					2(2)	
SPR12*					14(12-21)	

**Widths were not taken*

Table 24. Abundance (estimated number in site) and 95% confidence intervals of additional species captured within 4 sample sites of the Spring Creek watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Species	CRC	LND	MTS	RBT	RBT ≥ 200 mm per acre	ROB	SMB	WHS
SPR1	710(683-737)	16(16)				123(118-130)		50(49-53)
SPR6								
SPR7*	130(78-205)	295(262-328)	1(1-5)	1(1-2)		27(26-30)	1(1-5)	307(294-320)
SPR12*	359(323-395))			6(6)		126(117-136)	1(1)	101(101-103)

**Widths were not taken*

Whitewood Creek Watershed

Counties: Lawrence

Table 25. Abundance (estimated number in site) and 95% confidence intervals of salmonid species captured within 15 sampled sites of the Whitewood Creek watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Species	CUT	BKT <200 mm	BKT ≥200 mm	BKT ≥200mm per acre	BNT<200 mm	BNT ≥200 mm	BNT ≥200mm per acre	RBT
WWC14		1(1-2)			119(115-125)	30(30-31)	242	
WWC21								
WWC15		5(5-6)	1(1)	7	110(109-113)	13(13)	85	
WWC19					2(2)			
WWC28					1(1)	3(3)	16	
WWC5						12(12)	81	
WWC30		79(79-81)						
WWC3					13(13-14)	84(84-85)	482	
WWC25	1(1)				46(16-207)	36(36-38)	239	2(2-3)
WWC1					41(41-43)	72(72-73)	460	
WWC8					19(18-23)	43(43-45)	430	
WWC6		4(4-5)	1(1)	7	60(55-68)	17(17)	120	
GGC2		29(29-30)						
WWC24		116(114-120)	1(1)	10	163(158-169)	13(13)	135	

Table 26. Abundance (estimated number in site) and 95% confidence intervals of non-salmonid species captured within 15 sampled sites of the Whitewood Creek watershed during the 2017 survey. Sites are listed in order from furthest downstream to upstream.

Species	CRC	GSF	LND	FHM	MTS	SDS	SHR	STC	WHS
WWC14									
WWC21	26(18-49)	2(2)	47(26-104)		1(1-2)			70(14-623)	17(17-18)
WWC15			6(6-7)						
WWC19	3(3-5)		324(150-551)		5(5)				9(9-19)
WWC28			734(696-772)	1(1-2)	639(496-782)				38(34-46)
WWC5			225(202-256)		57(39-91)				65(49-91)
WWC30			112(99-127)		301(284-318)				
WWC3			80(53-124)		31(13-122)				
WWC25			750(150-2,566)		165(33-1,023)				
WWC1			12(9-25)		19(19-21)				
WWC8			1(1-5)		1(1)				
WWC22									
WWC20									

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