

Appendix B-3. Associations used in translating Level 2 Ecological Attribute values to Level 3 Biological Performance Attribute values through rule sets.

Life stage	Level 3 Biological Performance Attribute	Level 2 Ecological Attribute							
		Primary	Secondary	Secondary	Secondary	Secondary	Tertiary	Tertiary	Tertiary
Spawning	Channel stability	Bed scour							
	Chemicals	Miscellaneous toxic pollutants - water	Metals - in water column				Metals/Pollutants - in sediments/soils	Nutrient enrichment	
	Competition (with hatchery fish)	Hatchery fish outplants							
	Competition (with other species)	Fish community richness							
	Flow	Flow - Intra daily (diel) variation							
	Food	Alkalinity							
	Habitat diversity	Gradient	Confinement - natural	Confinement - Hydromodifications	Riparian function	Wood			
	Harvest	Harassment	Habitat type - primary pools	Riparian function	Turbidity	Wood			
	KeyHabitat	Habitat type - pool tailouts/glides	Habitat type - small cobble/gravel riffles						
	Obstructions	Obstructions to fish migration							
	Oxygen	Dissolved oxygen							
	Pathogens	Fish pathogens	Fish species introductions	Temperature - daily maximum (by month)			Nutrient enrichment		
	Predation	Predation risk					Flow - changes in interannual variability		
	Sediment load	Turbidity	Flow - changes in interannual variability	Temperature - daily maximum (by month)					
	Temperature	Temperature - daily maximum (by month)	Temperature - spatial variation						
	Withdrawals	Water withdrawals							
Incubation	Channel stability	Bed scour	Icing	Riparian function	Wood		Confinement - Hydromodifications	Flow - change in interannual variability	Flow - intra-annual flow pattern
	Chemicals	Miscellaneous toxic pollutants - water	Metals/Pollutants - in sediments/soils	Metals - in water column			Nutrient enrichment		
	Competition (with hatchery fish)	Hatchery fish outplants							
	Competition (with other species)	Fish community richness							
	Flow	Flow - Intra daily (diel) variation							
	Food	Alkalinity							
	Harvest	Harassment							
	KeyHabitat	Habitat type - pool tailouts/glides	Habitat type - small cobble/gravel riffles						

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Life stage	Level 3 Biological Performance Attribute	Level 2 Ecological Attribute							
		Primary	Secondary	Secondary	Secondary	Secondary	Tertiary	Tertiary	Tertiary
	Obstructions	Obstructions to fish migration							
	Oxygen	Dissolved oxygen							
	Pathogens	Fish pathogens	Fish species introductions	Temperature - daily maximum (by month)			Nutrient enrichment		
	Sediment load	Fine sediment	Embeddedness	Turbidity					
	Temperature	Temperature - daily maximum (by month)	Temperature - spatial variation						
	Withdrawals	Water withdrawals							
Fry colonization	Channel stability	Bed scour	Icing	Riparian function	Wood		Confinement - Hydromodifications	Flow - change in interannual variability	Flow - intra-annual flow pattern
	Chemicals	Miscellaneous toxic pollutants - water	Metals - in water column				Metals/Pollutants - in sediments/soils	Nutrient enrichment	
	Competition (with hatchery fish)	Hatchery fish outplants							
	Competition (with other species)	Fish community richness	Alkalinity	Benthos diversity and production	Riparian function	Salmon Carcasses			
	Flow	Flow - change in interannual variability	Confinement - natural	Confinement - Hydromodifications	Gradient			Riparian function	Wood
	Food	Benthos diversity and production	Alkalinity	Riparian function	Salmon Carcasses				
	Habitat diversity	Gradient	Confinement - natural	Confinement - Hydromodifications	Riparian function	Wood	Embeddedness	Icing	
	Harvest	Harassment	Habitat type - primary pools	Riparian function	Turbidity	Wood			
	KeyHabitat	Habitat type - backwater pools	Habitat type - beaver ponds	Habitat type - large cobble/boulder riffles	Habitat type - primary pools	Habitat type - small cobble/gravel riffles	Habitat type - pool tailouts/glides		
	Obstructions	Obstructions to fish migration							
	Oxygen	Dissolved oxygen							
	Pathogens	Fish pathogens	Fish species introductions	Temperature - daily maximum (by month)			Nutrient enrichment		
	Predation	Predation risk	Fish community richness	Fish species introductions	Temperature - daily maximum (by month)		Flow - changes in interannual variability	Hatchery fish outplants	
	Sediment load	Turbidity	Embeddedness						
	Temperature	Temperature - daily minimum (by month)	Temperature - spatial variation						
	Withdrawals	Water withdrawals							
0-age resident rearing	Channel stability	Bed scour	Icing	Riparian function	Wood				
	Chemicals	Miscellaneous toxic pollutants - water	Metals - in water column				Metals/Pollutants - in sediments/soils	Nutrient enrichment	

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Life stage	Level 3 Biological Performance Attribute	Level 2 Ecological Attribute							
		Primary	Secondary	Secondary	Secondary	Secondary	Tertiary	Tertiary	Tertiary
	Competition (with hatchery fish)	Hatchery fish outplants	Alkalinity	Benthos diversity and production	Riparian function	Salmon Carcasses			
	Competition (with other species)	Fish community richness	Alkalinity	Benthos diversity and production	Riparian function	Salmon Carcasses			
	Flow	Flow - changes in interannual variability		Habitat type - backwater pools	Habitat type - beaver ponds	Habitat type - primary pools	Confinement - natural	Confinement - Hydromodifications	
	Food	Benthos diversity and production	Alkalinity	Riparian function	Salmon Carcasses				
	Habitat diversity	Gradient	Confinement - natural	Confinement - Hydromodifications	Riparian function	Wood	Embeddedness	Icing	
	Harvest	Harassment	Habitat type - primary pools	Riparian function	Turbidity	Wood			
	KeyHabitat	Habitat type - primary pools	Habitat type - backwater pools	Habitat type - pool tailouts/glides			Habitat type - beaver ponds	Habitat type - large cobble/boulder riffles	
	Obstructions	Obstructions to fish migration							
	Oxygen	Dissolved oxygen							
	Pathogens	Fish pathogens	Fish species introductions	Temperature - daily maximum (by month)			Nutrient enrichment		
	Predation	Predation risk	Fish community richness	Fish species introductions	Temperature - daily maximum (by month)		Flow - changes in interannual variability	Hatchery fish outplants	
	Sediment load	Turbidity	Flow - changes in interannual variability	Temperature - daily maximum (by month)					
	Temperature	Temperature - daily maximum (by month)	Temperature - spatial variation						
	Withdrawals	Water withdrawals							
0-age transient rearing	Channel stability	Bed scour	Icing	Riparian function	Wood				
	Chemicals	Miscellaneous toxic pollutants - water	Metals - in water column				Metals/Pollutants - in sediments/soils	Nutrient enrichment	
	Competition (with hatchery fish)	Hatchery fish outplants	Alkalinity	Benthos diversity and production	Riparian function	Salmon Carcasses			
	Competition (with other species)	Fish community richness	Alkalinity	Benthos diversity and production	Riparian function	Salmon Carcasses			
	Flow	Flow - changes in interannual variability		Habitat type - backwater pools	Habitat type - beaver ponds	Habitat type - primary pools	Confinement - natural	Confinement - Hydromodifications	
	Food	Benthos diversity and production	Alkalinity	Riparian function	Salmon Carcasses				
	Habitat diversity	Gradient	Confinement - natural	Confinement - Hydromodifications	Riparian function	Wood	Embeddedness	Icing	
	Harvest	Harassment	Habitat type - primary pools	Riparian function	Turbidity	Wood			
	KeyHabitat	Habitat type - primary pools	Habitat type - backwater pools	Habitat type - pool tailouts/glides			Habitat type - beaver ponds	Habitat type - large cobble/boulder riffles	
	Obstructions	Obstructions to fish migration							

Appendix B-3. Associations used in translating Level 2 Ecological Attribute values to Level 3 Biological Performance Attribute values through rule sets.

Life stage	Level 3 Biological Performance Attribute	Level 2 Ecological Attribute								
		Primary	Secondary	Secondary	Secondary	Secondary	Tertiary	Tertiary	Tertiary	
	Oxygen	Dissolved oxygen								
	Pathogens	Fish pathogens	Fish species introductions	Temperature - daily maximum (by month)				Nutrient enrichment		
	Predation	Predation risk	Fish community richness	Fish species introductions	Temperature - daily maximum (by month)			Flow - changes in interannual variability	Hatchery fish outplants	
	Sediment load	Turbidity	Flow - changes in interannual variability	Temperature - daily maximum (by month)						
	Temperature	Temperature - daily maximum (by month)	Temperature - spatial variation							
	Withdrawals	Water withdrawals								
0-age migrant	Channel stability	Bed scour								
	Chemicals	Miscellaneous toxic pollutants - water	Metals - in water column					Metals/Pollutants - in sediments/soils	Nutrient enrichment	
	Competition (with hatchery fish)	Hatchery fish outplants								
	Competition (with other species)	Fish community richness								
	Flow	Flow - changes in interannual variability								
	Food	Benthos diversity and production	Alkalinity	Riparian function	Salmon Carcasses					
	Habitat diversity	Gradient	Confinement - natural	Confinement - Hydromodifications	Riparian function	Wood				
	Harvest	Harassment								
	KeyHabitat	<all habitat types applied equally>								
	Obstructions	Obstructions to fish migration								
	Oxygen	Dissolved oxygen								
	Pathogens	Fish pathogens	Fish species introductions	Temperature - daily maximum (by month)				Nutrient enrichment		
	Predation	Predation risk	Fish community richness	Fish species introductions	Temperature - daily maximum (by month)			Flow - changes in interannual variability	Hatchery fish outplants	
	Sediment load	Turbidity						Flow - changes in interannual variability	Temperature - daily maximum (by month)	
	Temperature	Temperature - daily minimum (by month)	Temperature - spatial variation							
	Withdrawals	Water withdrawals								
Inactive	Channel stability	Bed scour	Icing	Riparian function	Wood			Confinement - Hydromodifications	Flow - change in interannual variability	Flow - intra-annual flow pattern
	Chemicals	Miscellaneous toxic pollutants - water	Metals - in water column					Metals/Pollutants - in sediments/soils	Nutrient enrichment	

Appendix B-3. Associations used in translating Level 2 Ecological Attribute values to Level 3 Biological Performance Attribute values through rule sets.

Life stage	Level 3 Biological Performance Attribute	Level 2 Ecological Attribute							
		Primary	Secondary	Secondary	Secondary	Secondary	Tertiary	Tertiary	Tertiary
	Competition (with hatchery fish)	Hatchery fish outplants							
	Competition (with other species)	Fish community richness							
	Flow	Flow - change in interannual variability	Confinement - natural	Confinement - Hydromodifications	Gradient			Riparian function	Wood
	Food	Benthos diversity and production	Alkalinity	Riparian function	Salmon Carcasses				
	Habitat diversity	Gradient	Confinement - natural	Confinement - Hydromodifications	Riparian function	Wood	Embeddedness	Icing	
	Harvest	Harassment							
	KeyHabitat	Habitat type - primary pools	Habitat type - backwater pools	Habitat type - beaver ponds			Habitat type - large cobble/boulder riffles		
	Obstructions	Obstructions to fish migration							
	Oxygen	Dissolved oxygen							
	Pathogens	Fish pathogens	Fish species introductions	Temperature - daily maximum (by month)			Nutrient enrichment		
	Predation	Predation risk	Fish community richness	Fish species introductions	Temperature - daily minimum (by month)		Flow - changes in interannual variability	Hatchery fish outplants	
	Sediment load	Embeddedness	Turbidity				Fine sediment		
	Temperature	Temperature - daily minimum (by month)	Temperature - spatial variation						
	Withdrawals	Water withdrawals							
1-age resident rearing	Channel stability	Bed scour	Icing	Riparian function	Wood				
	Chemicals	Miscellaneous toxic pollutants - water	Metals - in water column				Metals/Pollutants - in sediments/soils	Nutrient enrichment	
	Competition (with hatchery fish)	Hatchery fish outplants	Alkalinity	Benthos diversity and production	Riparian function	Salmon Carcasses			
	Competition (with other species)	Fish community richness	Alkalinity	Benthos diversity and production	Riparian function	Salmon Carcasses			
	Flow	Flow - change in interannual variability	Confinement - natural	Confinement - Hydromodifications	Gradient			Riparian function	Wood
	Food	Benthos diversity and production	Alkalinity	Riparian function	Salmon Carcasses				
	Habitat diversity	Gradient	Confinement - natural	Confinement - Hydromodifications	Riparian function	Wood	Embeddedness	Icing	
	Harvest	Harassment	Habitat type - primary pools	Riparian function	Turbidity	Wood			
	KeyHabitat	Habitat type - primary pools	Habitat type - backwater pools	Habitat type - pool tailouts/glides			Habitat type - beaver ponds	Habitat type - large cobble/boulder riffles	
	Obstructions	Obstructions to fish migration							

Appendix B-3. Associations used in translating Level 2 Ecological Attribute values to Level 3 Biological Performance Attribute values through rule sets.

Life stage	Level 3 Biological Performance Attribute	Level 2 Ecological Attribute							
		Primary	Secondary	Secondary	Secondary	Secondary	Tertiary	Tertiary	Tertiary
	Oxygen	Dissolved oxygen							
	Pathogens	Fish pathogens	Fish species introductions	Temperature - daily maximum (by month)				Nutrient enrichment	
	Predation	Predation risk	Fish community richness	Fish species introductions	Temperature - daily maximum (by month)			Flow - changes in interannual variability	Hatchery fish outplants
	Sediment load	Turbidity	Flow - changes in interannual variability	Temperature - daily maximum (by month)					
	Temperature	Temperature - daily minimum (by month)	Temperature - spatial variation						
	Withdrawals	Water withdrawals							
1-age migrant	Channel stability	Bed scour							
	Chemicals	Miscellaneous toxic pollutants - water	Metals - in water column					Metals/Pollutants - in sediments/soils	Nutrient enrichment
	Competition (with hatchery fish)	Hatchery fish outplants							
	Competition (with other species)	Fish community richness							
	Flow	Flow - changes in interannual variability							
	Food	Benthos diversity and production	Alkalinity	Riparian function	Salmon Carcasses				
	Habitat diversity	Gradient	Confinement - natural	Confinement - Hydromodifications	Riparian function	Wood		Embeddedness	Icing
	Harvest	Harassment							
	KeyHabitat	<all habitat types applied equally>							
	Obstructions	Obstructions to fish migration							
	Oxygen	Dissolved oxygen							
	Pathogens	Fish pathogens	Fish species introductions	Temperature - daily maximum (by month)				Nutrient enrichment	
	Predation	Predation risk	Fish community richness	Fish species introductions	Temperature - daily maximum (by month)			Flow - changes in interannual variability	Hatchery fish outplants
	Sediment load	Turbidity						Flow - changes in interannual variability	Temperature - daily maximum (by month)
	Temperature	Temperature - daily minimum (by month)	Temperature - spatial variation						
	Withdrawals	Water withdrawals							
Prespawning migrant	Channel stability	Bed scour							
	Chemicals	Miscellaneous toxic pollutants - water	Metals - in water column					Metals/Pollutants - in sediments/soils	Nutrient enrichment

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Life stage	Level 3 Biological Performance Attribute	Level 2 Ecological Attribute							
		Primary	Secondary	Secondary	Secondary	Secondary	Tertiary	Tertiary	Tertiary
	Competition (with hatchery fish)	Hatchery fish outplants							
	Competition (with other species)	Fish community richness							
	Flow	Flow - changes in interannual variability							
	Food	Alkalinity							
	Habitat diversity	Gradient	Confinement - natural	Confinement - Hydromodifications	Riparian function	Wood			
	Harvest	Harassment	Habitat type - primary pools	Riparian function	Turbidity	Wood			
	KeyHabitat	<all habitat types applied equally>							
	Obstructions	Obstructions to fish migration							
	Oxygen	Dissolved oxygen							
	Pathogens	Fish pathogens	Fish species introductions	Temperature - daily maximum (by month)					Nutrient enrichment
	Predation	Predation risk					Flow - changes in interannual variability		
	Sediment load	Turbidity	Flow - changes in interannual variability	Temperature - daily maximum (by month)					
	Temperature	Temperature - daily maximum (by month)	Temperature - spatial variation						
	Withdrawals	Water withdrawals							
Prespawning holding	Channel stability	Bed scour							
	Chemicals	Miscellaneous toxic pollutants - water	Metals - in water column				Metals/Pollutants - in sediments/soils	Nutrient enrichment	
	Competition (with hatchery fish)	Hatchery fish outplants							
	Competition (with other species)	Fish community richness							
	Flow	Flow - changes in interannual variability		Habitat type - backwater pools	Habitat type - beaver ponds	Habitat type - primary pools	Confinement - natural	Confinement - Hydromodifications	
	Food	Alkalinity							
	Habitat diversity	Gradient	Confinement - Hydromodifications	Riparian function	Wood				
	Harvest	Harassment	Habitat type - primary pools	Riparian function	Turbidity	Wood			
	KeyHabitat								
	Obstructions	Obstructions to fish migration							

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Life stage	Level 3 Biological Performance Attribute	Level 2 Ecological Attribute							
		Primary	Secondary	Secondary	Secondary	Secondary	Tertiary	Tertiary	Tertiary
	Oxygen	Dissolved oxygen							
	Pathogens	Fish pathogens	Fish species introductions	Temperature - daily maximum (by month)			Nutrient enrichment		
	Predation	Predation risk					Flow - changes in interannual variability		
	Sediment load	Turbidity	Flow - changes in interannual variability	Temperature - daily maximum (by month)					
	Temperature	Temperature - daily maximum (by month)	Temperature - spatial variation						
	Withdrawals	Water withdrawals							