Refinement of the Basin-Wide Index of Biotic Integrity for Non-Tidal Streams and Wadeable Rivers in the Chesapeake Bay Watershed

APPENDICES

Appendix A: Taxonomic Classification

All taxa reported in Chessie BIBI database were assigned the appropriate Phylum, Subphylum, Class, Subclass, Order, Suborder, Family, Subfamily, Tribe, and Genus when applicable. A portion of the taxa reported were reported under an invalid name according to the ITIS database. These taxa were subsequently changed to the taxonomic name deemed valid by ITIS.

Table A-1. The taxonomic hierarchy of stream macroinvertebrate taxa included in the Chesapeake Bay non-tidal database.

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
ANNELIDA	Annelida									
CLITELLATA	Annelida	Clitellata								
HIRUDINEA	Annelida	Clitellata	Hirudinea	Hirudinea						
ARHYNCHOBDELLIDA	Annelida	Clitellata	Hirudinea	Hirudinea	Arhynchobdellida					
HIRUDINIDAE	Annelida	Clitellata	Hirudinea	Hirudinea	Arhynchobdellida		Hirudinidae			
ERPOBDELLIDAE	Annelida	Clitellata	Hirudinea	Hirudinea	Arhynchobdellida	Erpobdelliformes	Erpobdellidae			
DINA	Annelida	Clitellata	Hirudinea	Hirudinea	Arhynchobdellida	Erpobdelliformes	Erpobdellidae			Dina
ERPOBDELLA	Annelida	Clitellata	Hirudinea	Hirudinea	Arhynchobdellida	Erpobdelliformes	Erpobdellidae	Erpobdellinae		Erpobdella
MOOREOBDELLA	Annelida	Clitellata	Hirudinea	Hirudinea	Arhynchobdellida	Erpobdelliformes	Erpobdellidae	Erpobdellinae		Mooreobdella
HAEMOPIDAE	Annelida	Clitellata	Hirudinea	Hirudinea	Arhynchobdellida	Hirudiniformes	Haemopidae			
HAEMOPIS	Annelida	Clitellata	Hirudinea	Hirudinea	Arhynchobdellida	Hirudiniformes	Haemopidae	Haemopinae		Haemopis
RHYNCHOBDELLIDA	Annelida	Clitellata	Hirudinea	Hirudinea	Rhynchobdellida					
GLOSSIPHONIIDAE	Annelida	Clitellata	Hirudinea	Hirudinea	Rhynchobdellida		Glossiphoniidae			
BATRACOBDELLA	Annelida	Clitellata	Hirudinea	Hirudinea	Rhynchobdellida		Glossiphoniidae			Batracobdella
DESSEROBDELLA	Annelida	Clitellata	Hirudinea	Hirudinea	Rhynchobdellida		Glossiphoniidae	Glossiphoniinae		Desserobdella
GLOSSIPHONIA	Annelida	Clitellata	Hirudinea	Hirudinea	Rhynchobdellida		Glossiphoniidae	Glossiphoniinae		Glossiphonia
PLACOBDELLA	Annelida	Clitellata	Hirudinea	Hirudinea	Rhynchobdellida		Glossiphoniidae	Glossiphoniinae		Placobdella
ALBOGLOSSIPHONIA	Annelida	Clitellata	Hirudinea	Hirudinea	Rhynchobdellida		Glossiphoniidae	Haementeriinae		Alboglossiphonia
GLOIOBDELLA	Annelida	Clitellata	Hirudinea	Hirudinea	Rhynchobdellida		Glossiphoniidae	Haementeriinae		Gloiobdella
HELOBDELLA	Annelida	Clitellata	Hirudinea	Hirudinea	Rhynchobdellida		Glossiphoniidae	Haementeriinae		Helobdella
PISCICOLIDAE	Annelida	Clitellata	Hirudinea	Hirudinea	Rhynchobdellida		Piscicolidae			
PISCICOLA	Annelida	Clitellata	Hirudinea	Hirudinea	Rhynchobdellida		Piscicolidae	Piscicolinae		Piscicola
MYZOBDELLA	Annelida	Clitellata	Hirudinea	Hirudinea	Rhynchobdellida		Piscicolidae	Platybdellinae		Myzobdella
OLIGOCHAETA	Annelida	Clitellata	Oligochaeta							
AMPHIPODA	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda					
AORIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Gammaridea	Aoridae			

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
GRANDIDIERELLA	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Gammaridea	Aoridae			Grandidierella
COROPHIIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Gammaridea	Corophiidae			
APOCOROPHIUM	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Gammaridea	Corophiidae			Apocorophium
CRANGONYCTIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Gammaridea	Crangonyctidae			
CRANGONYX	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Gammaridea	Crangonyctidae			Crangonyx
STYGOBROMUS	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Gammaridea	Crangonyctidae			Stygobromus
SYNURELLA	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Gammaridea	Crangonyctidae			Synurella
GAMMARIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Gammaridea	Gammaridae			
GAMMARUS	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Gammaridea	Gammaridae			Gammarus
HYALELLIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Gammaridea	Hyalellidae			
HYALELLA	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Gammaridea	Hyalellidae			Hyalella
TALITRIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Gammaridea	Talitridae			
DECAPODA	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda					
ASTACIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Pleocyemata	Astacidae			
CAMBARIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Pleocyemata	Cambaridae			
CAMBARINAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Pleocyemata	Cambaridae	Cambarinae		
BARBICAMBARUS	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Pleocyemata	Cambaridae	Cambarinae		Barbicambarus
CAMBARUS	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Pleocyemata	Cambaridae	Cambarinae		Cambarus
FALLICAMBARUS	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Pleocyemata	Cambaridae	Cambarinae		Fallicambarus
ORCONECTES	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Pleocyemata	Cambaridae	Cambarinae		Orconectes
PROCAMBARUS	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Pleocyemata	Cambaridae	Cambarinae		Procambarus
PALAEMONIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Pleocyemata	Palaemonidae			
PALAEMONETES	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Pleocyemata	Palaemonidae	Palaemoninae		Palaemonetes
PANOPEIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Pleocyemata	Panopeidae			
PORTUNIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Pleocyemata	Portunidae			
ISOPODA	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Isopoda					
ANTHURIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Isopoda	Anthuridea	Anthuridae			
CYATHURA	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Isopoda	Anthuridea	Anthuridae			Cyathura
ASELLIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Isopoda	Asellota	Asellidae			
ASELLUS	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Isopoda	Asellota	Asellidae			Asellus
CAECIDOTEA	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Isopoda	Asellota	Asellidae			Caecidotea
LIRCEUS	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Isopoda	Asellota	Asellidae			Lirceus
IDOTEIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Isopoda	Valvifera	Idoteidae			
EDOTIA	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Isopoda	Valvifera	Idoteidae			Edotia

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
MYSIDA	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Mysida					
MYSIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Mysida		Mysidae			
MYSIS	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Mysida		Mysidae			Mysis
TANAIDACEA	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Tanaidacea					
LEPTOCHELIIDAE	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Tanaidacea	Tanaidomorpha	Leptocheliidae			
LEPTOCHELIA	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Tanaidacea	Tanaidomorpha	Leptocheliidae			Leptochelia
COLLEMBOLA	Arthropoda	Hexapoda	Entognatha		Collembola					
COLEOPTERA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera					
CARABIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Carabidae			
DYTISCIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae			
AGABUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Agabinae	Agabini	Agabus
ILYBIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Agabinae	Agabini	Ilybius
COLYMBETINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Colymbetinae		
COLYMBETINI	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Colymbetinae	Colymbetini	
HOPERIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Colymbetinae	Colymbetini	Hoperius
NEOSCUTOPTERUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Colymbetinae	Colymbetini	Neoscutopterus
RHANTUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Colymbetinae	Colymbetini	Rhantus
COPELATUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Copelatinae	Copelatini	Copelatus
COPTOTOMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Coptotominae	Coptotominae	Coptotomus
ACILIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Dytiscinae	Acyliini	Acilius
CYBISTER	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Dytiscinae	Cybistrini	Cybister
DYTISCUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Dytiscinae	Dytiscini	Dytiscus
HYDATICUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Dytiscinae	Hydaticini	Hydaticus
HYDROPORINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae		
BIDESSINI	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Bidessini	
BIDESSONOTUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Bidessini	Bidessonotus
BIDESSUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Bidessini	Bidessus
BRACHYVATUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Bidessini	Brachyvatus
LIODESSUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Bidessini	Liodessus
UVARUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Bidessini	Uvarus
HYDROPORINI	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Hydroporini	
DERONECTES	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Hydroporini	Deronectes
DESMOPACHRIA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Hydroporini	Desmopachria
HETEROSTERNUTA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Hydroporini	Heterosternuta

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
HYDROCOLUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Hydroporini	Hydrocolus
HYDROPORUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Hydroporini	Hydroporus
LIOPOREUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Hydroporini	Lioporeus
NEBRIOPORUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Hydroporini	Nebrioporus
NEOPORUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Hydroporini	Neoporus
OREODYTES	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Hydroporini	Oreodytes
HYDROVATUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Hydrovatini	Hydrovatus
HYGROTUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Hygrotini	Hygrotus
LACCORNIS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Laccornini	Laccornis
CELINA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Hydroporinae	Methlini	Celina
AGABETES	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Laccophilinae	Agabetini	Agabetes
LACCOPHILUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Laccophilinae	Laccophilini	Laccophilus
MATUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Dytiscidae	Matinae	Matini	Matus
GYRINIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Gyrinidae			
DINEUTUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Gyrinidae			Dineutus
GYRINUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Gyrinidae			Gyrinus
HALIPLIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Haliplidae			
HALIPLUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Haliplidae			Haliplus
PELTODYTES	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Haliplidae			Peltodytes
NOTERIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Noteridae			
HYDROCANTHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Noteridae			Hydrocanthus
SUPHISELLUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Adephaga	Noteridae	Noterinae		Suphisellus
SPHAERIUSIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Myxophaga	Sphaeriusidae			
CHRYSOMELIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Chrysomelidae			
DONACIA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Chrysomelidae	Donaciinae	Donaciini	Donacia
AGASICLES	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Chrysomelidae	Galerucinae	Alticini	Agasicles
GALERUCELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Chrysomelidae	Galerucinae	Galerucini	Galerucella
CURCULIONIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Curculionidae			
BAGOUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Curculionidae			Bagous
LIXUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Curculionidae			Lixus
DRYOPIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Dryopidae			
DRYOPS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Dryopidae			Dryops
HELICHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Dryopidae			Helichus
ELMIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Elmidae			

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
ANCYRONYX	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Elmidae	Elminae	Ancyronychini	Ancyronyx
DUBIRAPHIA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Elmidae	Elminae	Elmini	Dubiraphia
GONIELMIS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Elmidae	Elminae	Elmini	Gonielmis
MICROCYLLOEPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Elmidae	Elminae	Elmini	Microcylloepus
NARPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Elmidae	Elminae	Elmini	Narpus
NEOCYLLOEPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Elmidae	Elminae	Elmini	Neocylloepus
OPTIOSERVUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Elmidae	Elminae	Elmini	Optioservus
ORDOBREVIA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Elmidae	Elminae	Elmini	Ordobrevia
OULIMNIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Elmidae	Elminae	Elmini	Oulimnius
PROMORESIA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Elmidae	Elminae	Elmini	Promoresia
STENELMIS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Elmidae	Elminae	Elmini	Stenelmis
MACRONYCHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Elmidae	Elminae	Macronychini	Macronychus
ERIRHINIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Erirhinidae			
HELODIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Helodidae			
HELOPHORIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Helophoridae			
HELOPHORUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Helophoridae			Helophorus
HYDRAENIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydraenidae			
HYDRAENA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydraenidae	Hydraeninae	Hydraenini	Hydraena
LIMNEBIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydraenidae	Hydraeninae	Limnebiini	Limnebius
OCHTHEBIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydraenidae	Ochthebiinae	Ochthebiini	Ochthebius
HYDROCHIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrochidae			
HYDROCHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrochidae			Hydrochus
HYDROPHILIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae			
ANACAENA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Anacaenini	Anacaena
CRENITIS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Anacaenini	Crenitis
PARACYMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Anacaenini	Paracymus
BEROSUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Berosini	Berosus
DERALLUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Berosini	Derallus
CHAETARTHRIA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Chaetarthriini	Chaetarthria
CYMBIODYTA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Hydrophilini	Cymbiodyta
ENOCHRUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Hydrophilini	Enochrus
HELOCHARES	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Hydrophilini	Helochares
HELOCOMBUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Hydrophilini	Helocombus
HYDROBIOMORPHA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Hydrophilini	Hydrobiomorpha

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
HYDROBIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Hydrophilini	Hydrobius
HYDROCHARA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Hydrophilini	Hydrochara
HYDROPHILUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Hydrophilini	Hydrophilus
TROPISTERNUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Hydrophilini	Tropisternus
LACCOBIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Laccobiini	Laccobius
LACCOBIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Laccobiini	Laccobius
SPERCHOPSIS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Hydrophilidae	Hydrophilinae	Sperchopsini	Sperchopsis
LAMPYRIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Lampyridae			
LIMNICHIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Limnichidae			
LUTROCHIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Lutrochidae			
LUTROCHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Lutrochidae			Lutrochus
MELYRIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Melyridae			
PSEPHENIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Psephenidae			
DICRANOPSELAPHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Psephenidae	Eubriinae		Dicranopselaphus
ECTOPRIA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Psephenidae	Eubriinae		Ectopria
PSEPHENUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Psephenidae	Psepheninae		Psephenus
PTILODACTYLIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Ptilodactylidae			
ANCHYTARSUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Ptilodactylidae	Anchytarsinae		Anchytarsus
PTILODACTYLA	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Ptilodactylidae	Ptilodactylinae		Ptilodactyla
SCIRTIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Scirtidae			
CYPHON	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Scirtidae			Cyphon
ELODES	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Scirtidae			Elodes
PRIONOCYPHON	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Scirtidae			Prionocyphon
SCIRTES	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Scirtidae			Scirtes
STAPHYLINIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Staphylinidae			
CARPELIMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Staphylinidae	Oxytelinae		Carpelimus
CERCYON	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Staphylinidae	Sphaeridiinae	Megasternini	Cercyon
TENEBRIONIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Polyphaga	Tenebrionidae			
DIPTERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera					
BRACHYCERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera				
ATHERICIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Athericidae			
ATHERIX	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Athericidae			Atherix
CANACEIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Canaceidae			
CANACEA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Canaceidae	Canacinae	Canacini	Canacea

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
CLUSIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Clusiidae			
DOLICHOPODIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Dolichopodidae			
ACHRADOCERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Dolichopodidae	Diaphorinae		Achradocera
DOLICHOPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Dolichopodidae	Dolichopodinae		Dolichopus
HYDROPHORUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Dolichopodidae	Hydrophorinae		Hydrophorus
HYDROPOROUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Dolichopodidae	Hydrophorinae		Hydroporous
RHAPHIUM	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Dolichopodidae	Rhaphiinae		Rhaphium
AMBLYPSILOPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Dolichopodidae	Sciapodinae		Amblypsilopus
EMPIDIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae			
CLINOCERINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Clinocerinae		
CLINOCERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Clinocerinae		Clinocera
DOLICHOCEPHALA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Clinocerinae		Dolichocephala
ROEDERIODES	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Clinocerinae		Roederiodes
TRICHOCLINOCERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Clinocerinae		Trichoclinocera
WIEDEMANNIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Clinocerinae		Wiedemannia
HILARA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Empidinae		Hilara
RHAMPHOMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Empidinae		Rhamphomyia
HEMERODROMIINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Hemerodromiinae		
CHELIPODA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Hemerodromiinae	Chelipodini	Chelipoda
HEMERODROMIINI	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Hemerodromiinae	Hemerodromiini	
CHELIFERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Hemerodromiinae	Hemerodromiini	Chelifera
HEMERODROMIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia
NEOPLASTA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Hemerodromiinae	Hemerodromiini	Neoplasta
OREOGETON	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Empididae	Oreogetoninae		Oreogeton
EPHYDRIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Ephydridae			
SCATELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Ephydridae	Ephydrinae	Scatellini	Scatella
LEMNAPHILA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Ephydridae	Hydrelliinae	Hydrelliini	Lemnaphila
CALLINAPAEA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Ephydridae	Parydrinae	Parydrini	Callinapaea
MUSCIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Muscidae			
CARICEA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Muscidae	Coenosiinae	Coenosiini	Caricea
LIMNOPHORA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Muscidae	Coenosiinae	Limnophorini	Limnophora
PELECORHYNCHIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Pelecorhynchidae			
GLUTOPS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Pelecorhynchidae			Glutops
PHORIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Phoridae			

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
SARCOPHAGIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Sarcophagidae			
AGRIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Sarcophagidae	Miltogramminae	Paramacronychiini	Agria
SCATHOPHAGIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Scathophagidae			
SCIOMYZIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Sciomyzidae			
TETANOCERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Sciomyzidae	Sciomyzinae	Tetanocerini	Tetanocera
STRATIOMYIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Stratiomyidae			
ALLOGNOSTA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Stratiomyidae	Beridinae		Allognosta
NEMOTELUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Stratiomyidae	Nemotelinae		Nemotelus
CALOPARYPHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Stratiomyidae	Stratiomyinae	Oxycerini	Caloparyphus
OXYCERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Stratiomyidae	Stratiomyinae	Oxycerini	Oxycera
MYXOSARGUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Stratiomyidae	Stratiomyinae	Prosopochrysini	Myxosargus
ODONTOMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Stratiomyidae	Stratiomyinae	Stratiomyini	Odontomyia
STRATIOMYS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Stratiomyidae	Stratiomyinae	Stratiomyini	Stratiomys
SYRPHIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Syrphidae			
CHRYSOGASTER	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Syrphidae	Eristalinae	Brachyopini	Chrysogaster
NEOASCIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Syrphidae	Eristalinae	Brachyopini	Neoascia
ERISTALIS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Syrphidae	Eristalinae	Eristaliini	Eristalis
TABANIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Tabanidae			
CHRYSOPS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Tabanidae	Chrysopsinae	Chrysopsini	Chrysops
HAEMATOPOTA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Tabanidae	Tabaninae	Haematopotini	Haematopota
HYBOMITRA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Tabanidae	Tabaninae	Tabanini	Hybomitra
TABANUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Tabanidae	Tabaninae	Tabanini	Tabanus
CHLOROTABANUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Brachycera	Tabanidae	Tabininae	Diachlorini	Chlorotabanus
NEMATOCERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera				
ANTHOMYIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Anthomyiidae			
BLEPHARICERIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Blephariceridae			
BLEPHARICERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Blephariceridae	Blepharicerinae	Blepharicerini	Blepharicera
CECIDOMYIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Cecidomyiidae			
CERATOPOGONIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae			
CERATOPOGONINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Ceratopogoninae		
ALLUAUDOMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Ceratopogoninae	Ceratopogonini	Alluaudomyia
CERATOPOGON	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Ceratopogoninae	Ceratopogonini	Ceratopogon
MONOHELEA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Ceratopogoninae	Ceratopogonini	Monohelea
SERROMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Ceratopogoninae	Ceratopogonini	Serromyia

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
STILOBEZZIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Ceratopogoninae	Ceratopogonini	Stilobezzia
CULICOIDES	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Ceratopogoninae	Culicoidini	Culicoides
PALPOMYIINI	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Ceratopogoninae	Palpomyiini	
BEZZIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Ceratopogoninae	Palpomyiini	Bezzia
PALPOMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Ceratopogoninae	Palpomyiini	Palpomyia
MALLOCHOHELEA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Ceratopogoninae	Sphaeromiini	Mallochohelea
PROBEZZIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Ceratopogoninae	Sphaeromiini	Probezzia
SPHAEROMIAS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Ceratopogoninae	Sphaeromiini	Sphaeromias
DASYHELEINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Dasyheleinae		
DASYHELEA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Dasyheleinae		Dasyhelea
FORCIPOMYIINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Forcipomyiinae		
ATRICHOPOGON	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Forcipomyiinae		Atrichopogon
FORCIPOMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Forcipomyiinae		Forcipomyia
LEPTOCONOPS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ceratopogonidae	Leptoconopinae		Leptoconops
CHAOBORIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chaoboridae			
CHAOBORUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chaoboridae	Chaoborinae		Chaoborus
MOCHLONYX	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chaoboridae	Chaoborinae		Mochlonyx
EUCORETHRA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chaoboridae	Eucorethrinae		Eucorethra
CHIRONOMIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae			
CHIRONOMINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae		
CHIRONOMINI	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	
APEDILUM	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Apedilum
ASHEUM	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Asheum
AXARUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Axarus
CHIRONOMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Chironomus
CLADOPELMA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Cladopelma
CRYPTOCHIRONOMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Cryptochironomus
CRYPTOTENDIPES	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Cryptotendipes
DEMICRYPTOCHIRONOMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Demicryptochironomus
DICROTENDIPES	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Dicrotendipes
EINFELDIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Einfeldia
ENDOCHIRONOMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Endochironomus
GLYPTOTENDIPES	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Glyptotendipes
GOELDICHIRONOMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Goeldichironomus

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
HARNISCHIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Harnischia
KIEFFERULUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Kiefferulus
KLOOSIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Kloosia
LAUTERBORNIELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Lauterborniella
MICROCHIRONOMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Microchironomus
MICROTENDIPES	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Microtendipes
NILOTHAUMA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Nilothauma
OMISUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Omisus
PAGASTIELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Pagastiella
PARACHIRONOMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Parachironomus
PARACLADOPELMA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Paracladopelma
PARALAUTERBORNIELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Paralauterborniella
PARATENDIPES	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Paratendipes
PHAENOPSECTRA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Phaenopsectra
POLYPEDILUM	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Polypedilum
ROBACKIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Robackia
SAETHERIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Saetheria
SERGENTIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Sergentia
STELECHOMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Stelechomyia
STENOCHIRONOMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Stenochironomus
STICTOCHIRONOMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Stictochironomus
TRIBELOS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Tribelos
XENOCHIRONOMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Xenochironomus
XESTOCHIRONOMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Chironomini	Xestochironomus
PSEUDOCHIRONOMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Pseudochironomini	Pseudochironomus
TANYTARSINI	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Tanytarsini	
CLADOTANYTARSUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus
CONSTEMPELLINA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Tanytarsini	Constempellina
MICROPSECTRA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Tanytarsini	Micropsectra
NEOSTEMPELLINA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Tanytarsini	Neostempellina
NIMBOCERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Tanytarsini	Nimbocera
PARATANYTARSUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Tanytarsini	Paratanytarsus
RHEOTANYTARSUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus
STEMPELLINA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Tanytarsini	Stempellina

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STEMPELLINELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Tanytarsini	Stempellinella
SUBLETTEA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Tanytarsini	Sublettea
TANYTARSUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Tanytarsini	Tanytarsus
ZAVRELIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Tanytarsini	Zavrelia
ZAVRELIELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Chironominae	Tanytarsini	Zavreliella
DIAMESINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Diamesinae		
DIAMESA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Diamesinae	Diamesini	Diamesa
PAGASTIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Diamesinae	Diamesini	Pagastia
POTTHASTIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Diamesinae	Diamesini	Potthastia
PSEUDODIAMESA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Diamesinae	Diamesini	Pseudodiamesa
SYNDIAMESA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Diamesinae	Diamesini	Syndiamesa
SYMPOTTHASTIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Diamesinae	Diamesini	Sympotthastia
ORTHOCLADIINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		
ANTILLOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Antillocladius
BRILLIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Brillia
BRYOPHAENOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Bryophaenocladius
CAMPTOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Camptocladius
CARDIOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Cardiocladius
CHAETOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Chaetocladius
COMPTEROSMITTIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Compterosmittia
CORYNONEURA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Corynoneura
CRICOTOPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Cricotopus
DIPLOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Diplocladius
DOITHRIX	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Doithrix
DONCRICOTOPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Doncricotopus
ENDOTRIBELOS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Endotribelos
EPOICOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Epoicocladius
EUKIEFFERIELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Eukiefferiella
EURYHAPSIS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Euryhapsis
GEORTHOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Georthocladius
GYMNOMETRIOCNEMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Gymnometriocnemus
HELENIELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Heleniella
HETEROTRISSOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Heterotrissocladius
HYDROBAENUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Hydrobaenus

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KRENOSMITTIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Krenosmittia
LIMNOPHYES	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Limnophyes
LOPESCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Lopescladius
MESOCRICOTOPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Mesocricotopus
MESOSMITTIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Mesosmittia
METRIOCNEMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Metriocnemus
NANOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Nanocladius
NEOZAVRELIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Neozavrelia
OLIVERIDIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Oliveridia
ORTHOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Orthocladius
PARACHAETOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Parachaetocladius
PARACLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Paracladius
PARACRICOTOPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Paracricotopus
PARAKIEFFERIELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Parakiefferiella
PARALIMNOPHYES	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Paralimnophyes
PARAMETRIOCNEMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Parametriocnemus
PARAPHAENOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Paraphaenocladius
PARASMITTIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Parasmittia
PARATRICHOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Paratrichocladius
PARATRISSOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Paratrissocladius
PLATYSMITTIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Platysmittia
PSECTROCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Psectrocladius
PSEUDORTHOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Pseudorthocladius
PSEUDOSMITTIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Pseudosmittia
PSILOMETRIOCNEMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Psilometriocnemus
RHEOCRICOTOPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Rheocricotopus
RHEOSMITTIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Rheosmittia
SMITTIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Smittia
STILOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Stilocladius
SYNORTHOCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Synorthocladius
THIENEMANNIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Thienemannia
THIENEMANNIELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Thienemanniella
TOKUNAGAIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Tokunagaia
TVETENIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Tvetenia

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UNNIELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Unniella
XYLOTOPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Xylotopus
ZALUTSCHIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Orthocladiinae		Zalutschia
PODONOMINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Podonominae		
PARABOREOCHLUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Podonominae	Boreochlini	Paraboreochlus
MONODIAMESA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Prodiamesinae		Monodiamesa
ODONTOMESA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Prodiamesinae		Odontomesa
PRODIAMESA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Prodiamesinae		Prodiamesa
TANYPODINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae		
ALOTANYPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Coelotanypodini	Alotanypus
CLINOTANYPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Coelotanypodini	Clinotanypus
COELOTANYPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Coelotanypodini	Coelotanypus
APSECTROTANYPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Macropelopiini	Apsectrotanypus
BETHBILBECKIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Macropelopiini	Bethbilbeckia
BRUNDINIELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Macropelopiini	Brundiniella
MACROPELOPIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Macropelopiini	Macropelopia
PSECTROTANYPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Macropelopiini	Psectrotanypus
RADOTANYPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Macropelopiini	Radotanypus
NATARSIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Natarsiini	Natarsia
PENTANEURINI	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	
ABLABESMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Ablabesmyia
CANTOPELOPIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Cantopelopia
CONCHAPELOPIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Conchapelopia
GUTTIPELOPIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Guttipelopia
HUDSONIMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Hudsonimyia
KRENOPELOPIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Krenopelopia
LABRUNDINIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Labrundinia
LARSIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Larsia
MONOPELOPIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Monopelopia
NILOTANYPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Nilotanypus
PARAMERINA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Paramerina
PENTANEURA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneura
PENTANEURELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurella
REOMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Reomyia

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RHEOPELOPIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Rheopelopia
TELOPELOPIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Telopelopia
THIENEMANNIMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia
TRISSOPELOPIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Trissopelopia
ZAVRELIMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Pentaneurini	Zavrelimyia
DJALMABATISTA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Procladiini	Djalmabatista
PROCLADIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Procladiini	Procladius
TANYPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Chironomidae	Tanypodinae	Tanypodini	Tanypus
CORETHRELLIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Corethrellidae			
CORETHRELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Corethrellidae			Corethrella
CULICIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Culicidae			
OCHLEROTATUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Culicidae			Ochlerotatus
ANOPHELES	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Culicidae	Anophelinae		Anopheles
AEDES	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Culicidae	Culicinae	Culicini	Aedes
CULEX	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Culicidae	Culicinae	Culicini	Culex
CULISETA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Culicidae	Culicinae	Culicini	Culiseta
PSOROPHORA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Culicidae	Culicinae	Culicini	Psorophora
WYEOMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Culicidae	Culicinae	Sabethini	Wyeomyia
DIXIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Dixidae			
DIXA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Dixidae			Dixa
DIXELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Dixidae			Dixella
MYCETOPHILIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Mycetophilidae			
MYCETOPHILA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Mycetophilidae	Mycetophilinae	Mycetophilini	Mycetophila
NYMPHOMYIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Nymphomyiidae			
NYMPHOMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Nymphomyiidae			Nymphomyia
PRODIAMESINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Prodiamesinae			
PSYCHODIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Psychodidae			
PSYCHODINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Psychodidae	Psychodinae		
PERICOMA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Psychodidae	Psychodinae		Pericoma
PSYCHODA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Psychodidae	Psychodinae		Psychoda
PTYCHOPTERIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ptychopteridae			
BITTACOMORPHA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ptychopteridae	Bittacomorphinae		Bittacomorpha
BITTACOMORPHELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ptychopteridae	Bittacomorphinae		Bittacomorphella
PTYCHOPTERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Ptychopteridae	Ptychopterinae		Ptychoptera

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SCIARIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Sciaridae			
SIMULIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Simuliidae			
SIMULIINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Simuliidae	Simuliinae		
PROSIMULIINI	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Simuliidae	Simuliinae	Prosimuliini	
CNEPHIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Simuliidae	Simuliinae	Prosimuliini	Cnephia
ECTEMNIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Simuliidae	Simuliinae	Prosimuliini	Ectemnia
GRENIERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Simuliidae	Simuliinae	Prosimuliini	Greniera
PROSIMULIUM	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Simuliidae	Simuliinae	Prosimuliini	Prosimulium
STEGOPTERNA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Simuliidae	Simuliinae	Prosimuliini	Stegopterna
TWINNIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Simuliidae	Simuliinae	Prosimuliini	Twinnia
SIMULIUM	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Simuliidae	Simuliinae	Simuliini	Simulium
TANYDERIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tanyderidae			
PROTOPLASA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tanyderidae			Protoplasa
THAUMALEIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Thaumaleidae			
ANDROPROSOPA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Thaumaleidae			Androprosopa
THAUMALEA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Thaumaleidae			Thaumalea
TIPULIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae			
LIOGMA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Cylindrotominae		Liogma
TRIOGMA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Cylindrotominae		Triogma
LIMONIINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae		
ERIOPTERINI	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Eriopterini	
ARCTOCONOPA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Eriopterini	Arctoconopa
CRYPTOLABIS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Eriopterini	Cryptolabis
ERIOPTERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Eriopterini	Erioptera
GONOMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Eriopterini	Gonomyia
HESPEROCONOPA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Eriopterini	Hesperoconopa
LIPSOTHRIX	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Eriopterini	Lipsothrix
MOLOPHILUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Eriopterini	Molophilus
ORMOSIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Eriopterini	Ormosia
RHABDOMASTIX	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Eriopterini	Rhabdomastix
DACTYLOLABIS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Hexatomini	Dactylolabis
EPIPHRAGMA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Hexatomini	Epiphragma
HEXATOMA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Hexatomini	Hexatoma
LIMNOPHILA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Hexatomini	Limnophila

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
PARADELPHOMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Hexatomini	Paradelphomyia
PILARIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Hexatomini	Pilaria
PSEUDOLIMNOPHILA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Hexatomini	Pseudolimnophila
ANTOCHA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Limoniini	Antocha
HELIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Limoniini	Helius
LIMONIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Limoniini	Limonia
DICRANOTA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Pediciini	Dicranota
PEDICIA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Limoniinae	Pediciini	Pedicia
BRACHYPREMNA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Tipulinae		Brachypremna
DOLICHOPEZA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Tipulinae		Dolichopeza
LEPTOTARSUS	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Tipulinae		Leptotarsus
PRIONOCERA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Tipulinae		Prionocera
TIPULA	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Tipulidae	Tipulinae		Tipula
TRICHOCERIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Nematocera	Trichoceridae			
EPHEMEROPTERA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera					
BAETISCIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Carapacea	Baetiscidae			
BAETISCA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Carapacea	Baetiscidae			Baetisca
FURCATERGALIA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia				
CAENIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Caenidae			
BRACHYCERCUS	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Caenidae	Brachypterinae	Brachycercini	Brachycercus
CERCOBRACHYS	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Caenidae	Brachypterinae	Cercobrachini	Cercobrachys
AMERCAENIS	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Caenidae	Caeninae		Amercaenis
CAENIS	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Caenidae	Caeninae		Caenis
EPHEMERELLIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemerellidae			
ATTENELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemerellidae			Attenella
DANNELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemerellidae			Dannella
DRUNELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemerellidae			Drunella
EPHEMERELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemerellidae			Ephemerella
EURYLOPHELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemerellidae			Eurylophella
PENELOMAX	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemerellidae			Penelomax
SERRATELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemerellidae			Serratella
TELOGANOPSIS	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemerellidae			Teloganopsis
TIMPANOGA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemerellidae			Timpanoga
TSALIA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemerellidae			Tsalia

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
EPHEMERIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemeridae			
EPHEMERA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemeridae			Ephemera
HEXAGENIA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemeridae			Hexagenia
LITOBRANCHA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Ephemeridae			Litobrancha
LEPTOHYPHIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Leptohyphidae			
ASIOPLAX	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Leptohyphidae			Asioplax
LEPTOHYPHES	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Leptohyphidae			Leptohyphes
TRICORYTHODES	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Leptohyphidae			Tricorythodes
LEPTOPHLEBIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Leptophlebiidae			
CHOROTERPES	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Leptophlebiidae			Choroterpes
HABROPHLEBIA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Leptophlebiidae			Habrophlebia
HABROPHLEBIODES	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Leptophlebiidae			Habrophlebiodes
LEPTOPHLEBIA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Leptophlebiidae			Leptophlebia
PARALEPTOPHLEBIA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Leptophlebiidae			Paraleptophlebia
NEOEPHEMERIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Neoephemeridae			
NEOEPHEMERA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Neoephemeridae			Neoephemera
PALINGENIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Palingeniidae			
POLYMITARCYIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Polymitarcyidae			
EPHORON	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Polymitarcyidae			Ephoron
POTAMANTHIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Potamanthidae			
ANTHOPOTAMUS	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Potamanthidae			Anthopotamus
TRICORYTHIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Furcatergalia	Tricorythidae			
AMELETIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Ameletidae			
AMELETUS	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Ameletidae			Ameletus
BAETIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			
ACENTRELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Acentrella
ACERPENNA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Acerpenna
BAETIS	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Baetis
BARBAETIS	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Barbaetis
CALLIBAETIS	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Callibaetis
CENTROPTILUM	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Centroptilum
CLOEON	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Cloeon
DIPHETOR	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Diphetor
FALLCEON	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Fallceon

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
HETEROCLOEON	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Heterocloeon
ISWAEON	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Iswaeon
LABIOBAETIS	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Labiobaetis
PARACLOEODES	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Paracloeodes
PLAUDITUS	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Plauditus
PROCLOEON	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Procloeon
PSEUDOCENTROPTILOIDES	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Pseudocentroptiloides
PSEUDOCLOEON	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Baetidae			Pseudocloeon
HEPTAGENIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Heptageniidae			
CINYGMULA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Heptageniidae			Cinygmula
EPEORUS	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Heptageniidae			Epeorus
HEPTAGENIA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Heptageniidae			Heptagenia
LEUCROCUTA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Heptageniidae			Leucrocuta
MACCAFFERTIUM	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Heptageniidae			Maccaffertium
MACDUNNOA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Heptageniidae			Macdunnoa
NIXE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Heptageniidae			Nixe
RHITHROGENA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Heptageniidae			Rhithrogena
STENACRON	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Heptageniidae			Stenacron
STENONEMA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Heptageniidae			Stenonema
ISONYCHIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Isonychiidae			
ISONYCHIA	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Isonychiidae			Isonychia
METRETOPODIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Metretopodidae			
SIPHLOPLECTON	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Metretopodidae			Siphloplecton
OLIGONEURIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Oligoneuriidae			
SIPHLONURIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Siphlonuridae			
SIPHLONURUS	Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Pisciforma	Siphlonuridae			Siphlonurus
HEMIPTERA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera					
HETEROPTERA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera				
BELOSTOMATIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Belostomatidae			
BELOSTOMA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Belostomatidae	Belostomatinae		Belostoma
CERATOCOMBIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Ceratocombidae			
CORIXIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Corixidae			
CORIXINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Corixidae	Corixinae		
CENOCORIXA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Corixidae	Corixinae		Cenocorixa

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
CORISELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Corixidae	Corixinae		Corisella
DASYCORIXA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Corixidae	Corixinae		Dasycorixa
HESPEROCORIXA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Corixidae	Corixinae		Hesperocorixa
PALMACORIXA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Corixidae	Corixinae		Palmacorixa
SIGARA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Corixidae	Corixinae		Sigara
TRICHOCORIXA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Corixidae	Corixinae		Trichocorixa
GELASTOCORIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Gelastocoridae			
MACROVELIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Macroveliidae			
ORAVELIA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Macroveliidae			Oravelia
MESOVELIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Mesoveliidae			
MESOVELIA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Mesoveliidae	Mesoveliinae		Mesovelia
NAUCORIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Naucoridae			
PELOCORIS	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Naucoridae	Naucorinae		Pelocoris
NEPIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Nepidae			
RANATRA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Nepidae			Ranatra
NEPA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Nepidae	Nepinae		Nepa
NOTONECTIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Notonectidae			
BUENOA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Notonectidae	Anisopinae		Buenoa
NOTONECTA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Notonectidae	Notonectinae	Notonectini	Notonecta
OCHTERIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Ochteridae			
OCHTERUS	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Ochteridae			Ochterus
PLEIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Pleidae			
NEOPLEA	Arthropoda	Hexapoda	Insecta	Pterygota	Hemiptera	Heteroptera	Pleidae			Neoplea
LEPIDOPTERA	Arthropoda	Hexapoda	Insecta	Pterygota	Lepidoptera					
MEGALOPTERA	Arthropoda	Hexapoda	Insecta	Pterygota	Megaloptera					
CORYDALIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Megaloptera		Corydalidae			
CHAULIODES	Arthropoda	Hexapoda	Insecta	Pterygota	Megaloptera		Corydalidae	Chauliodinae		Chauliodes
NEOHERMES	Arthropoda	Hexapoda	Insecta	Pterygota	Megaloptera		Corydalidae	Chauliodinae		Neohermes
NIGRONIA	Arthropoda	Hexapoda	Insecta	Pterygota	Megaloptera		Corydalidae	Chauliodinae		Nigronia
CORYDALUS	Arthropoda	Hexapoda	Insecta	Pterygota	Megaloptera		Corydalidae	Corydalinae		Corydalus
SIALIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Megaloptera		Sialidae			
SIALIS	Arthropoda	Hexapoda	Insecta	Pterygota	Megaloptera		Sialidae			Sialis
NEUROPTERA	Arthropoda	Hexapoda	Insecta	Pterygota	Neuroptera					
ODONATA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata					

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
ANISOPTERA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera				
AESHNIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Aeshnidae			
AESHNA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Aeshnidae			Aeshna
ANAX	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Aeshnidae			Anax
BASIAESCHNA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Aeshnidae			Basiaeschna
BOYERIA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Aeshnidae			Boyeria
EPIAESCHNA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Aeshnidae			Epiaeschna
GOMPHAESCHNA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Aeshnidae			Gomphaeschna
NASIAESCHNA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Aeshnidae			Nasiaeschna
CORDULEGASTRIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Cordulegastridae			
CORDULEGASTER	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Cordulegastridae			Cordulegaster
CORDULIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Corduliidae			
CORDULIINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Corduliidae	Corduliinae		
EPITHECA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Corduliidae	Corduliinae		Epitheca
HELOCORDULIA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Corduliidae	Corduliinae		Helocordulia
NEUROCORDULIA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Corduliidae	Corduliinae		Neurocordulia
SOMATOCHLORA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Corduliidae	Corduliinae		Somatochlora
MACROMIINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Corduliidae	Macromiinae		
DIDYMOPS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Corduliidae	Macromiinae		Didymops
MACROMIA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Corduliidae	Macromiinae		Macromia
GOMPHIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Gomphidae			
APHYLLA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Gomphidae			Aphylla
ARIGOMPHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Gomphidae			Arigomphus
DROMOGOMPHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Gomphidae			Dromogomphus
ERPETOGOMPHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Gomphidae			Erpetogomphus
GOMPHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Gomphidae			Gomphus
HAGENIUS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Gomphidae			Hagenius
LANTHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Gomphidae			Lanthus
OPHIOGOMPHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Gomphidae			Ophiogomphus
PROGOMPHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Gomphidae			Progomphus
STYLOGOMPHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Gomphidae			Stylogomphus
STYLURUS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Gomphidae			Stylurus
LIBELLULIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Libellulidae			
CELITHEMIS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Libellulidae			Celithemis

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
DYTHEMIS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Libellulidae			Dythemis
ERYTHEMIS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Libellulidae			Erythemis
LEUCORRHINIA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Libellulidae			Leucorrhinia
LIBELLULA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Libellulidae			Libellula
PACHYDIPLAX	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Libellulidae			Pachydiplax
PERITHEMIS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Libellulidae			Perithemis
PLATHEMIS	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Libellulidae			Plathemis
SYMPETRUM	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Libellulidae			Sympetrum
TRAMEA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Libellulidae			Tramea
MACROMIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Macromiidae			
PETALURIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Petaluridae			
TACHOPTERYX	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Anisoptera	Petaluridae			Tachopteryx
ZYGOPTERA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera				
CALOPTERYGIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Calopterygidae			
CALOPTERYX	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Calopterygidae			Calopteryx
HETAERINA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Calopterygidae			Hetaerina
COENAGRIONIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Coenagrionidae			
AMPHIAGRION	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Coenagrionidae			Amphiagrion
ARGIA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Coenagrionidae			Argia
CHROMAGRION	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Coenagrionidae			Chromagrion
COENAGRION	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Coenagrionidae			Coenagrion
ENALLAGMA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Coenagrionidae			Enallagma
ISCHNURA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Coenagrionidae			Ischnura
NEHALENNIA	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Coenagrionidae			Nehalennia
LESTIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Lestidae			
ARCHILESTES	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Lestidae			Archilestes
LESTES	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Lestidae			Lestes
PROTONEURIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Zygoptera	Protoneuridae			
PLECOPTERA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera					
EUHOLOGNATHA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha				
CAPNIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Capniidae			
CAPNIA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Capniidae	Cambarinae		Capnia
ALLOCAPNIA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Capniidae	Capniinae		Allocapnia
CAPNURA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Capniidae	Capniinae		Capnura

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
NEMOCAPNIA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Capniidae	Capniinae		Nemocapnia
PARACAPNIA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Capniidae	Capniinae		Paracapnia
LEUCTRIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Leuctridae			
LEUCTRA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Leuctridae	Leuctrinae		Leuctra
PARALEUCTRA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Leuctridae	Leuctrinae		Paraleuctra
ZEALEUCTRA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Leuctridae	Leuctrinae		Zealeuctra
MEGALEUCTRA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Leuctridae	Megaleuctrinae		Megaleuctra
NEMOURIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Nemouridae			
AMPHINEMURA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Nemouridae	Amphinemurinae		Amphinemura
NEMOURA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Nemouridae	Nemourinae		Nemoura
OSTROCERCA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Nemouridae	Nemourinae		Ostrocerca
PARANEMOURA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Nemouridae	Nemourinae		Paranemoura
PODMOSTA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Nemouridae	Nemourinae		Podmosta
PROSTOIA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Nemouridae	Nemourinae		Prostoia
SHIPSA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Nemouridae	Nemourinae		Shipsa
SOYEDINA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Nemouridae	Nemourinae		Soyedina
ZAPADA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Nemouridae	Nemourinae		Zapada
TAENIOPTERYGIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Taeniopterygidae			
BOLOTOPERLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Taeniopterygidae	Brachypteryinae		Bolotoperla
OEMOPTERYX	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Taeniopterygidae	Brachypteryinae		Oemopteryx
STROPHOPTERYX	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Taeniopterygidae	Brachypteryinae		Strophopteryx
TAENIONEMA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Taeniopterygidae	Brachypteryinae		Taenionema
TAENIOPTERYX	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Euholognatha	Taeniopterygidae	Taeniopteryginae		Taeniopteryx
CHLOROPERLIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Chloroperlidae			
ALLOPERLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Chloroperlidae	Chloroperlinae		Alloperla
HAPLOPERLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Chloroperlidae	Chloroperlinae		Haploperla
RASVENA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Chloroperlidae	Chloroperlinae		Rasvena
SUWALLIA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Chloroperlidae	Chloroperlinae		Suwallia
SWELTSA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Chloroperlidae	Chloroperlinae		Sweltsa
PARAPERLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Chloroperlidae	Paraperlinae		Paraperla
UTAPERLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Chloroperlidae	Paraperlinae		Utaperla
PELTOPERLIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Peltoperlidae			
PELTOPERLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Peltoperlidae	Peltoperlinae		Peltoperla
TALLAPERLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Peltoperlidae	Peltoperlinae		Tallaperla

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
VIEHOPERLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Peltoperlidae	Peltoperlinae		Viehoperla
PERLIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlidae			
ACRONEURIA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlidae	Acroneuriinae	Acroneuriini	Acroneuria
ATTANEURIA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlidae	Acroneuriinae	Acroneuriini	Attaneuria
BELONEURIA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlidae	Acroneuriinae	Acroneuriini	Beloneuria
ECCOPTURA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlidae	Acroneuriinae	Acroneuriini	Eccoptura
HANSONOPERLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlidae	Acroneuriinae	Acroneuriini	Hansonoperla
PERLESTA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlidae	Acroneuriinae	Acroneuriini	Perlesta
PERLINELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlidae	Acroneuriinae	Acroneuriini	Perlinella
NEOPERLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlidae	Perlinae	Neoperlini	Neoperla
PERLINI	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlidae	Perlinae	Perlini	
AGNETINA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlidae	Perlinae	Perlini	Agnetina
PARAGNETINA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlidae	Perlinae	Perlini	Paragnetina
PERLODIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlodidae			
CLIOPERLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlodidae	Isoperlinae		Clioperla
ISOPERLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlodidae	Isoperlinae		Isoperla
ARCYNOPTERYX	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlodidae	Perlodinae	Arcynopterygini	Arcynopteryx
CULTUS	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlodidae	Perlodinae	Diploperlini	Cultus
DIPLOPERLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlodidae	Perlodinae	Diploperlini	Diploperla
REMENUS	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlodidae	Perlodinae	Diploperlini	Remenus
DIURA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlodidae	Perlodinae	Perlodini	Diura
HELOPICUS	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlodidae	Perlodinae	Perlodini	Helopicus
HYDROPERLA	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlodidae	Perlodinae	Perlodini	Hydroperla
ISOGENOIDES	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlodidae	Perlodinae	Perlodini	Isogenoides
MALIREKUS	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlodidae	Perlodinae	Perlodini	Malirekus
YUGUS	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Perlodidae	Perlodinae	Perlodini	Yugus
PTERONARCYIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Pteronarcyidae			
PTERONARCYS	Arthropoda	Hexapoda	Insecta	Pterygota	Plecoptera	Systellognatha	Pteronarcyidae	Pteronarcyinae	Pteronarcyini	Pteronarcys
TRICHOPTERA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera					
BERAEIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera		Beraeidae			
BERAEA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera		Beraeidae			Beraea
MACRONEMA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera		Hydropsychidae	Macronematinae	Macronematini	Macronema
DIPSEUDOPSIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Dipseudopsidae			
PHYLOCENTROPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Dipseudopsidae	Hyalopsychinae		Phylocentropus

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
HYDROPSYCHIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Hydropsychidae			
ARCTOPSYCHE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Hydropsychidae	Arctopsychinae		Arctopsyche
PARAPSYCHE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Hydropsychidae	Arctopsychinae		Parapsyche
DIPLECTRONA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Hydropsychidae	Diplectroninae		Diplectrona
HOMOPLECTRA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Hydropsychidae	Diplectroninae		Homoplectra
HYDROPSYCHINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Hydropsychidae	Hydropsychinae		
CERATOPSYCHE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Hydropsychidae	Hydropsychinae		Ceratopsyche
CHEUMATOPSYCHE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Hydropsychidae	Hydropsychinae		Cheumatopsyche
HYDROPSYCHE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Hydropsychidae	Hydropsychinae		Hydropsyche
POTAMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Hydropsychidae	Hydropsychinae		Potamyia
SYMPHITOPSYCHE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Hydropsychidae	Hydropsychinae		Symphitopsyche
MACROSTEMUM	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Hydropsychidae	Macronematinae	Macronematini	Macrostemum
PHILOPOTAMIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Philopotamidae			
CHIMARRA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Philopotamidae	Chimarrinae		Chimarra
PHILOPOTAMINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Philopotamidae	Philopotaminae		
DOLOPHILODES	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Philopotamidae	Philopotaminae		Dolophilodes
WORMALDIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Philopotamidae	Philopotaminae		Wormaldia
POLYCENTROPODIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Polycentropodidae			
POLYCENTROPODINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Polycentropodidae	Polycentropodinae		
CERNOTINA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Polycentropodidae	Polycentropodinae		Cernotina
CYRNELLUS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Polycentropodidae	Polycentropodinae		Cyrnellus
NEURECLIPSIS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Polycentropodidae	Polycentropodinae		Neureclipsis
NYCTIOPHYLAX	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Polycentropodidae	Polycentropodinae		Nyctiophylax
POLYCENTROPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Polycentropodidae	Polycentropodinae		Polycentropus
PSYCHOMYIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Psychomyiidae			
PSYCHOMYIINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Psychomyiidae	Psychomyiinae		
LYPE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Psychomyiidae	Psychomyiinae		Lype
PSYCHOMYIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Annulipalpia	Psychomyiidae	Psychomyiinae		Psychomyia
APATANIIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Apataniidae			
APATANIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Apataniidae	Apataniinae	Apataniini	Apatania
BRACHYCENTRIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Brachycentridae			
ADICROPHLEPS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Brachycentridae			Adicrophleps
BRACHYCENTRUS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Brachycentridae			Brachycentrus
MICRASEMA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Brachycentridae			Micrasema

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
CALAMOCERATIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Calamoceratidae			
ANISOCENTROPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Calamoceratidae	Anisocentropodinae		Anisocentropus
HETEROPLECTRON	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Calamoceratidae	Calamoceratinae		Heteroplectron
GOERIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Goeridae			
GOERINAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Goeridae	Goerinae		
GOERA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Goeridae	Goerinae		Goera
GOERITA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Goeridae	Goerinae		Goerita
HELICOPSYCHIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Helicopsychidae			
HELICOPSYCHE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Helicopsychidae			Helicopsyche
LEPIDOSTOMATIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Lepidostomatidae			
LEPIDOSTOMA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Lepidostomatidae	Lepidostomatinae		Lepidostoma
LEPTOCERIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Leptoceridae			
CERACLEA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Leptoceridae	Leptocerinae	Athripsodini	Ceraclea
LEPTOCERUS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Leptoceridae	Leptocerinae	Leptocerini	Leptocerus
MYSTACIDES	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Leptoceridae	Leptocerinae	Mystacidini	Mystacides
NECTOPSYCHE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Leptoceridae	Leptocerinae	Nectopsychini	Nectopsyche
OECETIS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Leptoceridae	Leptocerinae	Oecetini	Oecetis
SETODES	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Leptoceridae	Leptocerinae	Setodini	Setodes
TRIAENODES	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Leptoceridae	Leptocerinae	Triaenodini	Triaenodes
YLODES	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Leptoceridae	Leptocerinae	Triaenodini	Ylodes
LIMNEPHILIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Limnephilidae			
IRONOQUIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Limnephilidae	Dicosmoecinae		Ironoquia
FRENESIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Limnephilidae	Limnephilinae	Chilostigmini	Frenesia
PSYCHOGLYPHA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Limnephilidae	Limnephilinae	Chilostigmini	Psychoglypha
ANABOLIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Limnephilidae	Limnephilinae	Limnephilini	Anabolia
HESPEROPHYLAX	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Limnephilidae	Limnephilinae	Limnephilini	Hesperophylax
LENARCHUS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Limnephilidae	Limnephilinae	Limnephilini	Lenarchus
LIMNEPHILUS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Limnephilidae	Limnephilinae	Limnephilini	Limnephilus
PLATYCENTROPUS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Limnephilidae	Limnephilinae	Limnephilini	Platycentropus
STENOPHYLACINI	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Limnephilidae	Limnephilinae	Stenophylacini	
HYDATOPHYLAX	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Limnephilidae	Limnephilinae	Stenophylacini	Hydatophylax
PYCNOPSYCHE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Limnephilidae	Limnephilinae	Stenophylacini	Pycnopsyche
PSEUDOSTENOPHYLAX	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Limnephilidae	Pseudostenophylacinae		Pseudostenophylax
MOLANNIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Molannidae			

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
MOLANNA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Molannidae			Molanna
MOLANNODES	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Molannidae			Molannodes
ODONTOCERIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Odontoceridae			
PSILOTRETA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Odontoceridae	Odontocerinae		Psilotreta
PHRYGANEIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Phryganeidae			
AGRYPNIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Phryganeidae	Phryganeinae		Agrypnia
BANKSIOLA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Phryganeidae	Phryganeinae		Banksiola
FABRIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Phryganeidae	Phryganeinae		Fabria
HAGENELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Phryganeidae	Phryganeinae		Hagenella
OLIGOSTOMIS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Phryganeidae	Phryganeinae		Oligostomis
PHRYGANEA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Phryganeidae	Phryganeinae		Phryganea
PTILOSTOMIS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Phryganeidae	Phryganeinae		Ptilostomis
SERICOSTOMATIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Sericostomatidae			
AGARODES	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Sericostomatidae			Agarodes
FATTIGIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Sericostomatidae			Fattigia
UENOIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Uenoidae			
NEOPHYLAX	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Integripalpia	Uenoidae	Thremmatinae		Neophylax
GLOSSOSOMATIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Glossosomatidae			
AGAPETUS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Glossosomatidae	Agapetinae		Agapetus
GLOSSOSOMA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Glossosomatidae	Glossosomatinae	Glossosomatini	Glossosoma
CULOPTILA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Glossosomatidae	Protoptilinae		Culoptila
PROTOPTILA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Glossosomatidae	Protoptilinae		Protoptila
HYDROPTILIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Hydroptilidae			
AGRAYLEA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Hydroptilidae	Hydroptilinae	Hydroptilini	Agraylea
DIBUSA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Hydroptilidae	Hydroptilinae	Hydroptilini	Dibusa
HYDROPTILA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Hydroptilidae	Hydroptilinae	Hydroptilini	Hydroptila
OXYETHIRA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Hydroptilidae	Hydroptilinae	Hydroptilini	Oxyethira
LEUCOTRICHIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Hydroptilidae	Hydroptilinae	Leucotrichiini	Leucotrichia
MAYATRICHIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Hydroptilidae	Hydroptilinae	Neotrichiini	Mayatrichia
NEOTRICHIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Hydroptilidae	Hydroptilinae	Neotrichiini	Neotrichia
ITHYTRICHIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Hydroptilidae	Hydroptilinae	Ochrotrichiini	Ithytrichia
OCHROTRICHIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Hydroptilidae	Hydroptilinae	Ochrotrichiini	Ochrotrichia
ORTHOTRICHIA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Hydroptilidae	Hydroptilinae	Orthotrichiini	Orthotrichia
STACTOBIELLA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Hydroptilidae	Hydroptilinae	Stactobiini	Stactobiella

FINAL ID	PHYLUM	SUB-PHYLUM	CLASS	SUBCLASS	ORDER	SUBORDER	FAMILY	SUBFAMILY	TRIBE	GENUS
PALAEAGAPETUS	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Hydroptilidae	Ptilocolepinae		Palaeagapetus
RHYACOPHILIDAE	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Rhyacophilidae			
RHYACOPHILA	Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Spicipalpia	Rhyacophilidae			Rhyacophila
MOLLUSCA	Mollusca									
BIVALVIA	Mollusca		Bivalvia							
GASTROPODA	Mollusca		Gastropoda							
PLATYHELMINTHES	Platyhelminthes									
TREPAXONEMATA	Platyhelminthes	Rhabditophora	Trepaxonemata							
NEOOPHORA	Platyhelminthes	Rhabditophora	Trepaxonemata		Neoophora					

Appendix B: Taxonomic Attributes

An effort was made to assign each taxon reported in the Chessie BIBI database a Functional Feeding Group (FFG), Habit, Tolerance Value (TV), Beck Class, and Modified Average Score Per Taxon (ASPT) value from the literature (Barbour et al. 1999, USEPA 2008, 2012, Chalfant 2009, Bollman et al. 2010, Buchanan et al. 2011, WVDEP 2015, Smith 2016). Taxa with multiple attributes/traits were assigned a single attribute/trait based on the most frequently assigned attribute/trait or best professional judgement. However, many of the taxa were not assigned one or more taxonomic attributes/traits because they have not been described for the taxon or the assigned attributes/traits were not found during our literature search (Table B-1, Table B-2, Table B-3, and Table B-4).

Tolerance Values

Seven sources provided Tolerance Values (TV) that were applicable for benthic macroinvertebrates in the Chesapeake Bay basin (Table B-1). Table B-1 indicates the percentage of taxa assigned a TV at the Order, Family, and Genus-levels. Many of the independent sources poorly represented the taxa observed in the Chesapeake Bay basin. However, when the sources were combined 78% of families and 89% of genera were assigned tolerance values. Only 35% of order level taxa were assigned TV. TV at the order-level were under-represented, and therefore, metrics utilizing TV were not assessed during the development of order-level indices.

Table B-1. Tolerance Values (TV) were summarized and assigned from seven sources. The percentage of Order, Family, and Genus-level taxa assigned a TV was calculated for each source. The final row represents the percentage of taxa assigned a TV after summarizing the assignments from the seven available sources.

Source	Order (%)	Family (%)	Genus (%)
RBP Mid-Atlantic MAC (Barbour et al. 1999)	0	4	17
RBP Southeast NC (Barbour et al. 1999)	0	1	18
DC (Bollman et al. 2010)	9	13	19
EPA (NRSA 2008)	31	53	63
WAB (WVDEP 2015)	9	69	65
PADEP (Chalfant 2009)	13	58	71
NYSDEC (Smith 2016)	0	4	55
BIBI	**35**	**78**	**89**

Functional Feeding Groups

Functional Feeding Groups (FFG) were assigned from six sources (Table B-2). The percentage of taxa assigned a FFG was calculated for order, family, and genus-level benthic macroinvertebrates. Combining the FFG assignments from six sources increased the number of benthic macroinvertebrate taxa with an assigned FFG (family = 77% and genus = 92%). However, only 54% of order-level taxa were assigned a FFG. Like the TV results, FFG metrics were considered under-represented, and therefore, were not assessed during the development of order-level indices.

Table B-2. Functional Feeding Groups (FFG) were summarized and assigned from six sources. The percentage of Order, Family, and Genus-level taxa assigned a FFG was calculated for each source. The final row represents the percentage of taxa assigned a FFG after summarizing the assignments from the six available sources.

Source	**Order (%)**	**Family (%)**	**Genus (%)**
NYSDEC (Smith 2016)	0	4	55
DC (Bollman et al. 2010)	2	12	19
RBP (Barbour et al. 1999)	19	29	43
WAB (WVDEP 2015)	35	63	74
PADEP (Chalfant 2009)	28	60	74
EPA_FFG (NRSA 2008)	41	62	72
BIBI	**54**	**77**	**92**

Habits

Five sources were used to assign benthic macroinvertebrate Habits to taxa found in the Chesapeake Bay basin (Table B-3). Combining the Habit assignments from several sources increased the percentage of family-level taxa (65%) and genus-level taxa (84%) assigned Habit traits. In relation to TV and FFG, the percentage of families assigned a Habit was low. Habit metrics were used during the development of family-level indices but may have provided skewed results. Only 24% of the order-level taxa identified in the basin could be assigned a Habit. Therefore, Habit metrics were not utilized during the development of order-level indices.

Table B-3. Habits were summarized and assigned from five sources. The percentage of Order, Family, and Genus-level taxa assigned a Habit was calculated for each source. The final row represents the percentage of taxa assigned a Habit after summarizing the assignments from the five available sources.

Source	**Order (%)**	**Family (%)**	**Genus (%)**
DC (Bollman et al. 2010)	0	11	18
RBP (Barbour et al. 1999)	4	15	22
WAB (WVDEP 2015)	20	62	72
EPA (NRSA 2008)	24	60	73
EPA (USEPA 2012)	0	28	71
BIBI	**24**	**65**	**84**

Table B-4. Taxonomic attributes and traits assigned to each of the taxa reported in the Chesapeake Bay basin.

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
ABLABESMYIA	Genus			7	PR	SP
ACENTRELLA	Genus			4	CG	SW
ACERPENNA	Genus			5	CG	SW
ACHRADOCERA	Genus					
ACILIUS	Genus			5	PR	SW
ACRONEURIA	Genus			1	PR	CN
ADICROPHLEPS	Genus			2	SH	CN
AEDES	Genus			8	CF	SW
AESHNA	Genus			4	PR	CB
AESHNIDAE	Family	2	8	4	PR	CB
AGABETES	Genus			5	PR	SW
AGABUS	Genus			5	PR	SW
AGAPETUS	Genus			1	SC	CN
AGARODES	Genus			2	SH	SP
AGASICLES	Genus					CN
AGNETINA	Genus			2	PR	CN
AGRAYLEA	Genus			7	CG	CB
AGRIA	Genus					
AGRYPNIA	Genus			6	SH	CB
ALBOGLOSSIPHONIA	Genus			8	PR	SP
ALLOCAPNIA	Genus			2	SH	CN
ALLOGNOSTA	Genus			8	CG	
ALLOPERLA	Genus			1	PR	CN
ALLUAUDOMYIA	Genus			6	PR	BU
ALOTANYPUS	Genus			8	PR	BU
AMBLYPSILOPUS	Genus					
AMELETIDAE	Family	1		0	CG	
AMELETUS	Genus			1	CG	SW
AMERCAENIS	Genus			4	SH	SP
AMPHIAGRION	Genus			6	PR	BU
AMPHINEMURA	Genus			3	SH	SP
AMPHIPODA	Order	3		6	CG	SP
ANABOLIA	Genus			5	SH	SP
ANACAENA	Genus			5	PR	BU
ANAX	Genus			5	PR	CB
ANCHYTARSUS	Genus			4	SH	CN
ANCYRONYX	Genus			4	CG	CN
ANDROPROSOPA	Genus					
ANISOCENTROPUS	Genus			1	SH	SP

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
ANISOPTERA	Suborder	2			PR	SP
ANNELIDA	Phylum	3		9	CG	
ANOPHELES	Genus			8	CF	SW
ANTHOMYIIDAE	Family					
ANTHOPOTAMUS	Genus			4	CG	BU
ANTHURIDAE	Family	3				
ANTILLOCLADIUS	Genus					BU
ANTOCHA	Genus			4	CG	CN
AORIDAE	Family					
APATANIA	Genus			3	SC	CN
APATANIIDAE	Family	1		4	SC	CN
APEDILUM	Genus			6	CG	
APHYLLA	Genus			2	PR	BU
APOCOROPHIUM	Genus					
APSECTROTANYPUS	Genus			4	PR	BU
ARCHILESTES	Genus			9	CG	CB
ARCTOCONOPA	Genus			4	SH	
ARCTOPSYCHE	Genus			1	CF	CN
ARCYNOPTERYX	Genus			2	PR	
ARGIA	Genus			6	PR	CN
ARHYNCHOBDELLIDA	Order					
ARIGOMPHUS	Genus			3	PR	BU
ASELLIDAE	Family	3	3	7	CG	SP
ASELLUS	Genus			8	CG	SP
ASHEUM	Genus					
ASIOPLAX	Genus				SC	SP
ASTACIDAE	Family			7	SC	SP
ATHERICIDAE	Family	2		2	PR	SP
ATHERIX	Genus			3	PR	SP
ATRICHOPOGON	Genus			5	PR	CN
ATTANEURIA	Genus			2	PR	CN
ATTENELLA	Genus			2	CG	CN
AXARUS	Genus			4	CG	SP
BAETIDAE	Family	3	4	4	CG	SW
BAETIS	Genus			5	CG	SW
BAETISCA	Genus			4	CG	SP
BAETISCIDAE	Family	2		3	CG	CN
BAGOUS	Genus			6	SH	BU
BANKSIOLA	Genus			2	SH	CB
BARBAETIS	Genus			9	CG	SW
BARBICAMBARUS	Genus					

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
BASIAESCHNA	Genus			5	PR	CB
BATRACOBDELLA	Genus			7	PR	SP
BELONEURIA	Genus			2	PR	CN
BELOSTOMA	Genus			10	PR	CB
BELOSTOMATIDAE	Family	3		6	PR	CB
BERAEA	Genus			3	SC	SP
BERAEIDAE	Family			3	SC	
BEROSUS	Genus			6	CG	SW
BETHBILBECKIA	Genus			8	PR	CB
BEZZIA	Genus			6	PR	BU
BIDESSINI	Tribe					
BIDESSONOTUS	Genus			5	PR	SW
BIDESSUS	Genus					
BITTACOMORPHA	Genus			8	CG	BU
BITTACOMORPHELLA	Genus			8	CG	
BIVALVIA	Class	3		8	CF	BU
BLEPHARICERA	Genus			0	SC	CN
BLEPHARICERIDAE	Family	1		0	SC	CN
BOLOTOPERLA	Genus			3	SH	SP
BOYERIA	Genus			4	PR	CB
BRACHYCENTRIDAE	Family	1	10	1	CF	CN
BRACHYCENTRUS	Genus			1	CF	CN
BRACHYCERA	Suborder	0	0			
BRACHYCERCUS	Genus			4	CG	SP
BRACHYPREMNA	Genus			4	SH	BU
BRACHYVATUS	Genus			5	PR	SW
BRILLIA	Genus			5	SH	BU
BRUNDINIELLA	Genus			7	PR	SK
BRYOPHAENOCLADIUS	Genus			5	CG	SP
BUENOA	Genus			8	PR	SW
CAECIDOTEA	Genus			6	CG	SP
CAENIDAE	Family	3	7	7	CG	SP
CAENIS	Genus			6	CG	SP
CALAMOCERATIDAE	Family	2		4	SH	SP
CALLIBAETIS	Genus			7	CG	SW
CALLINAPAEA	Genus					
CALOPARYPHUS	Genus			7	CG	SP
CALOPTERYGIDAE	Family	3		5	PR	CB
CALOPTERYX	Genus			6	PR	CB
CAMBARIDAE	Family	3		5	CG	SP
CAMBARINAE	Subfamily					

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
CAMBARUS	Genus			6	CG	SP
CAMPTOCLADIUS	Genus			8	CG	
CANACEA	Genus					
CANACEIDAE	Family			7	SC	BU
CANTOPELOPIA	Genus					
CAPNIA	Genus			1	SH	SP
CAPNIIDAE	Family	2	10	2	SH	SP
CAPNURA	Genus			1	SH	SP
CARABIDAE	Family	2		2	PR	CN
CARDIOCLADIUS	Genus			6	PR	CN
CARICEA	Genus			6	PR	
CARPELIMUS	Genus			6	PR	CN
CECIDOMYIIDAE	Family					
CELINA	Genus			5	PR	SW
CELITHEMIS	Genus			2	PR	CB
CENOCORIXA	Genus				PR	SW
CENTROPTILUM	Genus			3	CG	SW
CERACLEA	Genus			3	CG	SP
CERATOCOMBIDAE	Family	0	0	9	PR	
CERATOPOGON	Genus			6	PR	BU
CERATOPOGONIDAE	Family	3		6	PR	SP
CERATOPOGONINAE	Subfamily				PR	BU
CERATOPSYCHE	Genus			5	CF	CN
CERCOBRACHYS	Genus				CG	SP
CERCYON	Genus			5	PR	SW
CERNOTINA	Genus			6	PR	CN
CHAETARTHRIA	Genus			5	PR	CB
CHAETOCLADIUS	Genus			5	CG	SP
CHAOBORIDAE	Family	3		7	PR	SP
CHAOBORUS	Genus			8	PR	SP
CHAULIODES	Genus			5	PR	CN
CHELIFERA	Genus			5	PR	SP
CHELIPODA	Genus			6	PR	
CHEUMATOPSYCHE	Genus			5	CF	CN
CHIMARRA	Genus			4	CF	CN
CHIRONOMIDAE	Family	3	2	6	CG	BU
CHIRONOMINAE	Subfamily			6	CG	BU
CHIRONOMINI	Tribe			6	CG	
CHIRONOMUS	Genus			9	CG	BU
CHLOROPERLIDAE	Family	1	10	1	PR	CN
CHLOROTABANUS	Genus			6	PR	SP

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
CHOROTERPES	Genus			2	CG	CN
CHROMAGRION	Genus			5	PR	CB
CHRYSOGASTER	Genus			10	CG	
CHRYSOMELIDAE	Family	3	5	6	SH	CN
CHRYSOPS	Genus			7	CG	SP
CINYGMULA	Genus			2	SC	CN
CLADOPELMA	Genus			7	CG	BU
CLADOTANYTARSUS	Genus			6	CG	CB
CLINOCERA	Genus			6	PR	CN
CLINOCERINAE	Subfamily					
CLINOTANYPUS	Genus			8	PR	BU
CLIOPERLA	Genus			2	PR	CN
CLITELLATA	Subhylum	3	3			
CLOEON	Genus			5	CG	SW
CLUSIIDAE	Family					
CNEPHIA	Genus			3	CF	CN
COELOTANYPUS	Genus			5	PR	BU
COENAGRION	Genus			8	PR	CB
COENAGRIONIDAE	Family	3	6	8	PR	CB
COLEOPTERA	Order	3		4	PR	
COLLEMBOLA	Order	3		8	CG	
COLYMBETINAE	Subfamily					
COLYMBETINI	Tribe					
COMPTEROSMITTIA	Genus				CG	
CONCHAPELOPIA	Genus			6	PR	SP
CONSTEMPELLINA	Genus			5	CG	CB
COPELATUS	Genus			6	PR	SW
COPTOTOMUS	Genus			8	PR	SW
CORDULEGASTER	Genus			4	PR	BU
CORDULEGASTRIDAE	Family	2	8	3	PR	BU
CORDULIIDAE	Family	3	8	5	PR	CB
CORDULIINAE	Subfamily					
CORETHRELLA	Genus					SW
CORETHRELLIDAE	Family		0			
CORISELLA	Genus			8	PR	SW
CORIXIDAE	Family	3	5	7	PR	SW
CORIXINAE	Subfamily					
COROPHIIDAE	Family		6			
CORYDALIDAE	Family	2		3	PR	CN
CORYDALUS	Genus			4	PR	CN
CORYNONEURA	Genus			5	CG	SP

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
CRANGONYCTIDAE	Family	3		5	CG	SP
CRANGONYX	Genus			6	CG	SP
CRENITIS	Genus			5	PR	BU
CRICOTOPUS	Genus			7	SH	CN
CRYPTOCHIRONOMUS	Genus			7	PR	SP
CRYPTOLABIS	Genus			4	SH	BU
CRYPTOTENDIPES	Genus			6	CG	SP
CULEX	Genus			8	CF	SW
CULICIDAE	Family	3		8	SC	SW
CULICOIDES	Genus			9	PR	BU
CULISETA	Genus			8	CF	SW
CULOPTILA	Genus			1	PR	CN
CULTUS	Genus			2	PR	CN
CURCULIONIDAE	Family	3	5	6	SH	CN
CYATHURA	Genus			5	CG	SP
CYBISTER	Genus			5	PR	SW
CYMBIODYTA	Genus			5	PR	BU
CYPHON	Genus			7	SC	CB
CYRNELLUS	Genus			7	CF	CN
DACTYLOLABIS	Genus			4	SH	
DANNELLA	Genus			2	CG	CN
DASYCORIXA	Genus					
DASYHELEA	Genus			5	CG	SP
DASYHELEINAE	Subfamily					
DECAPODA	Order	3		8	SH	SP
DEMICRYPTOCHIRONOMUS	Genus			6	CG	BU
DERALLUS	Genus			5	PA	BU
DERONECTES	Genus			5	PR	SW
DESMOPACHRIA	Genus			4	PR	SW
DESSEROBDELLA	Genus				PR	SP
DIAMESA	Genus			6	CG	SP
DIAMESINAE	Subfamily			6	CG	SP
DIBUSA	Genus			5	SC	CN
DICRANOPSELAPHUS	Genus			4	SC	CN
DICRANOTA	Genus			2	PR	BU
DICROTENDIPES	Genus			8	CG	BU
DIDYMOPS	Genus			4	PR	SP
DINA	Genus			8	CG	SP
DINEUTUS	Genus			4	PR	SW
DIPHETOR	Genus			5	CG	SW
DIPLECTRONA	Genus			3	CF	CN

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
DIPLOCLADIUS	Genus			7	CG	SP
DIPLOPERLA	Genus			2	PR	CN
DIPSEUDOPSIDAE	Family	3		6		
DIPTERA	Order	3		7	CG	CB
DIURA	Genus			2	PR	CN
DIXA	Genus			1	CG	CB
DIXELLA	Genus			3	CG	SW
DIXIDAE	Family	2		1	CG	SW
DJALMABATISTA	Genus			5	PR	SP
DOITHRIX	Genus			4	CG	
DOLICHOCEPHALA	Genus			5	PR	CB
DOLICHOPEZA	Genus					
DOLICHOPODIDAE	Family	2		6	PR	BU
DOLICHOPUS	Genus			4	PR	CB
DOLOPHILODES	Genus			1	CF	CN
DONACIA	Genus			6	SH	CN
DONCRICOTOPUS	Genus					
DROMOGOMPHUS	Genus			5	PR	BU
DRUNELLA	Genus			1	SC	CN
DRYOPIDAE	Family	3	5	5	SC	SP
DRYOPS	Genus			5	SC	CB
DUBIRAPHIA	Genus			6	CG	CN
DYTHEMIS	Genus			9	PR	SP
DYTISCIDAE	Family	3	5	5	PR	SW
DYTISCUS	Genus			5	PR	SW
ECCOPTURA	Genus			2	PR	CN
ECTEMNIA	Genus			1	CF	CN
ECTOPRIA	Genus			5	SC	CN
EDOTIA	Genus				CG	
EINFELDIA	Genus			8	CG	BU
ELMIDAE	Family	3	5	5	CG	CN
ELODES	Genus			8	SC	CB
EMPIDIDAE	Family	3		6	PR	SP
ENALLAGMA	Genus			8	PR	CB
ENDOCHIRONOMUS	Genus			9	SH	CN
ENDOTRIBELOS	Genus			6	CG	BU
ENOCHRUS	Genus			6	OM	BU
EPEORUS	Genus			1	SC	CN
EPHEMERA	Genus			2	CG	BU
EPHEMERELLA	Genus			2	CG	CN
EPHEMERELLIDAE	Family	2	10	2	CG	CN

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
EPHEMERIDAE	Family	2	10	4	CG	BU
EPHEMEROPTERA	Order	2		3	CG	
EPHORON	Genus			2	CG	BU
EPHYDRIDAE	Family	3		6	CG	BU
EPIAESCHNA	Genus			1	SC	CB
EPIPHRAGMA	Genus			2	PR	BU
EPITHECA	Genus			4	PR	CB
EPOICOCLADIUS	Genus			3	CG	
ERIOPTERA	Genus			6	CG	BU
ERIOPTERINI	Tribe					
ERIRHINIDAE	Family					
ERISTALIS	Genus			7	CG	BU
ERPETOGOMPHUS	Genus			4	PR	BU
ERPOBDELLA	Genus			8	PR	SP
ERPOBDELLIDAE	Family	3	3	9	PR	SP
ERYTHEMIS	Genus			5	PR	CB
EUCORETHRA	Genus			8	PR	SW
EUHOLOGNATHA	Suborder	2				
EUKIEFFERIELLA	Genus			7	CG	SP
EURYHAPSIS	Genus				CG	
EURYLOPHELLA	Genus			3	CG	CN
FABRIA	Genus			4	SH	
FALLCEON	Genus			5	CG	SW
FALLICAMBARUS	Genus			6	CG	BU
FATTIGIA	Genus				SH	BU
FORCIPOMYIA	Genus			6	SC	BU
FORCIPOMYIINAE	Subfamily				PR	SP
FRENESIA	Genus			4	SH	
FURCATERGALIA	Suborder					
GALERUCELLA	Genus					
GAMMARIDAE	Family	3	6	5	CG	SP
GAMMARUS	Genus			6	CG	SP
GASTROPODA	Class	3		7	SC	CB
GELASTOCORIDAE	Family	3		6	PR	SP
GEORTHOCLADIUS	Genus			7	CG	SP
GLOIOBDELLA	Genus			8	PR	SP
GLOSSIPHONIA	Genus			9	PR	SP
GLOSSIPHONIIDAE	Family	3	3	7	PR	SP
GLOSSOSOMA	Genus			0	SC	CN
GLOSSOSOMATIDAE	Family	1		0	SC	CN
GLUTOPS	Genus			4	PR	BU

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
GLYPTOTENDIPES	Genus			9	SH	BU
GOELDICHIRONOMUS	Genus			6	CG	BU
GOERA	Genus			1	SC	CN
GOERIDAE	Family	2	10	4		CN
GOERINAE	Subfamily					
GOERITA	Genus			4	SC	CN
GOMPHAESCHNA	Genus			2	PR	CB
GOMPHIDAE	Family	2	8	3	PR	BU
GOMPHUS	Genus			4	PR	BU
GONIELMIS	Genus			5	CG	CN
GONOMYIA	Genus			3	CG	BU
GRANDIDIERELLA	Genus					
GRENIERA	Genus			6	CF	CN
GUTTIPELOPIA	Genus			5	PR	SP
GYMNOMETRIOCNEMUS	Genus			6	CG	SP
GYRINIDAE	Family	3	5	4	PR	SW
GYRINUS	Genus			4	PR	SW
HABROPHLEBIA	Genus			3	CG	SW
HABROPHLEBIODES	Genus			4	SC	SW
HAEMATOPOTA	Genus			6	PR	
HAEMOPIDAE	Family	3	3		PR	
HAEMOPIS	Genus			8	CG	SP
HAGENELLA	Genus			5	SH	
HAGENIUS	Genus			3	PR	SP
HALIPLIDAE	Family	3	5	6	PI	CN
HALIPLUS	Genus			6	SH	CB
HANSONOPERLA	Genus			3	PR	CN
HAPLOPERLA	Genus			1	PR	CN
HARNISCHIA	Genus			8	CG	CB
HELENIELLA	Genus			3	CG	SP
HELICHUS	Genus			5	SC	CN
HELICOPSYCHE	Genus			3	SC	CN
HELICOPSYCHIDAE	Family	2		3	SC	CN
HELIUS	Genus			4	CG	BU
HELOBDELLA	Genus			8	PR	SP
HELOCHARES	Genus			5	PR	SW
HELOCOMBUS	Genus			7	CG	SW
HELOCORDULIA	Genus			3	PR	SP
HELODIDAE	Family	3	5	7	SC	CB
HELOPHORIDAE	Family	3		5	SH	
HELOPHORUS	Genus			6	SH	SW

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
HELOPICUS	Genus			2	PR	CN
HEMERODROMIA	Genus			6	PR	SP
HEMERODROMIINAE	Subfamily					
HEMERODROMIINI	Tribe	3				
HEMIPTERA	Order	3			PR	CB
HEPTAGENIA	Genus			3	SC	CN
HEPTAGENIIDAE	Family	2	10	3	SC	CN
HESPEROCORIXA	Genus			5	PI	SW
HESPEROPHYLAX	Genus			5	SH	SP
HETAERINA	Genus			5	PR	CB
HETEROCLOEON	Genus			3	SC	SW
HETEROPLECTRON	Genus			3	SH	SP
HETEROPTERA	Suborder					
HETEROSTERNUTA	Genus			5	PR	SW
HETEROTRISSOCLADIUS	Genus			3	CG	SP
HEXAGENIA	Genus			5	CG	BU
HEXATOMA	Genus			3	PR	BU
HILARA	Genus					
HIRUDINEA	Subclass	3	3	8	PR	SP
HIRUDINIDAE	Family	3	3	8	PR	SP
HOMOPLECTRA	Genus			5	CF	CN
HOPERIUS	Genus					
HUDSONIMYIA	Genus			5	PR	SP
HYALELLA	Genus			8	CG	SP
HYALELLIDAE	Family	3		8	CG	SP
HYBOMITRA	Genus			6	PR	SP
HYDATICUS	Genus			6	PR	SW
HYDATOPHYLAX	Genus			2	SH	SP
HYDRAENA	Genus			5	PR	CN
HYDRAENIDAE	Family	3		6	PR	CN
HYDROBAENUS	Genus			8	SC	SP
HYDROBIOMORPHA	Genus					SW
HYDROBIUS	Genus			5	PR	CB
HYDROCANTHUS	Genus			6	PR	CB
HYDROCHARA	Genus			6	PR	SW
HYDROCHIDAE	Family	3		5	SH	SW
HYDROCHUS	Genus			5	SH	CB
HYDROCOLUS	Genus			9	PR	SW
HYDROPERLA	Genus			1	PR	CN
HYDROPHILIDAE	Family	3	5	5	PR	SW
HYDROPHILUS	Genus			5	PR	SW

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
HYDROPHORUS	Genus			4	PR	SP
HYDROPORINAE	Subfamily					
HYDROPORINI	Tribe					
HYDROPORUS	Genus			5	PR	SW
HYDROPSYCHE	Genus			5	CF	CN
HYDROPSYCHIDAE	Family	3	5	5	CF	CN
HYDROPSYCHINAE	Subfamily				CF	
HYDROPTILA	Genus			5	SC	CN
HYDROPTILIDAE	Family	2	6	4	PI	CB
HYDROVATUS	Genus			5	PR	SW
HYGROTUS	Genus			4	PR	SW
IDOTEIDAE	Family					
ILYBIUS	Genus			5	PR	SW
IRONOQUIA	Genus			4	SH	BU
ISCHNURA	Genus			9	PR	CB
ISOGENOIDES	Genus			0	PR	CN
ISONYCHIA	Genus			3	CF	SW
ISONYCHIIDAE	Family	2		2	CG	SW
ISOPERLA	Genus			2	PR	CN
ISOPODA	Order	3		8	CG	SP
ISWAEON	Genus			4	CG	SP
ITHYTRICHIA	Genus			5	SC	CN
KIEFFERULUS	Genus			9	CG	BU
KLOOSIA	Genus					
KRENOPELOPIA	Genus			5	PR	SP
KRENOSMITTIA	Genus			3	CG	SP
LABIOBAETIS	Genus			4	CG	SW
LABRUNDINIA	Genus			6	PR	SP
LACCOBIUS	Genus			5	PR	SP
LACCOPHILUS	Genus			7	PR	SW
LACCORNIS	Genus			5	PR	SW
LAMPYRIDAE	Family					
LANTHUS	Genus			4	PR	BU
LARSIA	Genus			6	PR	SP
LAUTERBORNIELLA	Genus			6	CG	CN
LEMNAPHILA	Genus					
LENARCHUS	Genus					
LEPIDOPTERA	Order	3		6	SH	
LEPIDOSTOMA	Genus			2	SH	CB
LEPIDOSTOMATIDAE	Family	1	10	2	SH	BU
LEPTOCERIDAE	Family	2	10	4	CG	CB

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
LEPTOCERUS	Genus			4	SH	SW
LEPTOCHELIA	Genus					
LEPTOCHELIIDAE	Family					
LEPTOCONOPS	Genus			6	PR	SP
LEPTOHYPHES	Genus			3	CG	CN
LEPTOHYPHIDAE	Family	3		4	CG	CN
LEPTOPHLEBIA	Genus			4	CG	SW
LEPTOPHLEBIIDAE	Family	2	10	3	CG	CB
LEPTOTARSUS	Genus			4	SH	
LESTES	Genus			8	PR	CB
LESTIDAE	Family	3	8	9	PR	CB
LEUCORRHINIA	Genus			6	PR	BU
LEUCOTRICHIA	Genus			5	SC	CN
LEUCROCUTA	Genus			2	SC	CN
LEUCTRA	Genus			0	SH	SP
LEUCTRIDAE	Family	1	10	1	SH	CN
LIBELLULA	Genus			9	PR	SP
LIBELLULIDAE	Family	3	8	9	PR	SP
LIMNEBIUS	Genus			6	CG	CN
LIMNEPHILIDAE	Family	2	7	4	SH	SP
LIMNEPHILUS	Genus			3	SH	SP
LIMNICHIDAE	Family	3		5	SC	
LIMNOPHILA	Genus			3	PR	BU
LIMNOPHORA	Genus			6	PR	BU
LIMNOPHYES	Genus			6	CG	SP
LIMONIA	Genus			6	SH	BU
LIMONIINAE	Subfamily					
LIODESSUS	Genus			5	PR	SW
LIOGMA	Genus					
LIOPOREUS	Genus			7	PR	SW
LIPSOTHRIX	Genus			4	SH	BU
LIRCEUS	Genus			7	CG	SP
LITOBRANCHA	Genus			4	CG	BU
LIXUS	Genus			6	SH	BU
LOPESCLADIUS	Genus			5	CG	BU
LUTROCHIDAE	Family			6		
LUTROCHUS	Genus			5		SP
LYPE	Genus			2	SC	CN
MACCAFFERTIUM	Genus			4	SC	CN
MACDUNNOA	Genus			4	SC	CN
MACROMIA	Genus			3	PR	SP

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
MACROMIIDAE	Family	2	5	3		
MACROMIINAE	Family					
MACRONEMA	Genus					CN
MACRONYCHUS	Genus			4	CG	CN
MACROPELOPIA	Genus			8	PR	SP
MACROSTEMUM	Genus			3	CF	CN
MACROVELIIDAE	Family		7	9	PC	
MALIREKUS	Genus			2	PR	CN
MALLOCHOHELEA	Genus			6	PR	BU
MATUS	Genus			5	PR	SW
MAYATRICHIA	Genus			4	SC	CN
MEGALEUCTRA	Genus			0	SH	
MEGALOPTERA	Order	3	13	6	PR	
MELYRIDAE	Family				PR	
MESOCRICOTOPUS	Genus			5	CG	SP
MESOSMITTIA	Genus			4	CG	SP
MESOVELIA	Genus			9	PR	SK
MESOVELIIDAE	Family	3	5	8	PR	CN
METRETOPODIDAE	Family	2		2	CG	SP
METRIOCNEMUS	Genus			6	SC	CB
MICRASEMA	Genus			2	SH	CN
MICROCHIRONOMUS	Genus			8	CG	BU
MICROCYLLOEPUS	Genus			3	SC	CN
MICROPSECTRA	Genus			5	CG	CB
MICROTENDIPES	Genus			6	CF	CN
MOCHLONYX	Genus			8	PR	
MOLANNA	Genus			5	SC	SP
MOLANNIDAE	Family	3	10	5	SC	SP
MOLANNODES	Genus					
MOLLUSCA	Phylum	3				
MOLOPHILUS	Genus			4	SH	BU
MONODIAMESA	Genus			5	CG	CN
MONOHELEA	Genus			6	PR	CN
MONOPELOPIA	Genus			6	PR	SP
MOOREOBDELLA	Genus			8	PR	SP
MUSCIDAE	Family	3		7	PR	CN
MYCETOPHILA	Genus					
MYCETOPHILIDAE	Family					
MYSIDA	Order					
MYSIDAE	Family					
MYSIS	Genus					

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
MYSTACIDES	Genus			4	CG	SP
MYXOSARGUS	Genus			10	CG	
MYZOBDELLA	Genus				CG	
NANOCLADIUS	Genus			5	CG	SP
NARPUS	Genus			4	CG	CN
NASIAESCHNA	Genus			5	PR	CB
NATARSIA	Genus			8	PR	SP
NAUCORIDAE	Family	3	5	6	PR	CB
NEBRIOPORUS	Genus			5	PR	SW
NECTOPSYCHE	Genus			3	SH	SP
NEHALENNIA	Genus			8	PR	CB
NEMATOCERA	Suborder					
NEMOCAPNIA	Genus			1	SH	SP
NEMOTELUS	Genus			6	CG	SP
NEMOURA	Genus			1	SH	SP
NEMOURIDAE	Family	2	7	2	SH	BU
NEOASCIA	Genus			10	CG	
NEOCYLLOEPUS	Genus					CN
NEOEPHEMERA	Genus			3	CG	SP
NEOEPHEMERIDAE	Family	2		3	CG	
NEOHERMES	Genus			2	PR	CN
NEOOPHORA	Order					SP
NEOPERLA	Genus			2	PR	CN
NEOPHYLAX	Genus			3	SC	CN
NEOPLASTA	Genus			6	PR	SP
NEOPLEA	Genus			8	PR	SW
NEOPORUS	Genus			7	PR	SW
NEOSCUTOPTERUS	Genus					SW
NEOSTEMPELLINA	Genus			2	CG	CB
NEOTRICHIA	Genus			2	SC	CN
NEOZAVRELIA	Genus			6	CG	
NEPA	Genus			8	PR	CB
NEPIDAE	Family	3	5	7	PR	
NEURECLIPSIS	Genus			6	CF	CN
NEUROCORDULIA	Genus			3	PR	CB
NEUROPTERA	Order			3	PR	
NIGRONIA	Genus			3	PR	CN
NILOTANYPUS	Genus			6	PR	SP
NILOTHAUMA	Genus			3	CG	
NIMBOCERA	Genus			7	CF	SP
NIXE	Genus			2	SC	CN

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
NOTERIDAE	Family	3		5	PR	CB
NOTONECTA	Genus			9	PR	SW
NOTONECTIDAE	Family	3	5	7	PR	SW
NYCTIOPHYLAX	Genus			4	PR	CN
NYMPHOMYIA	Genus			5	CG	CN
NYMPHOMYIIDAE	Family	3		6	SC	CN
OCHLEROTATUS	Genus					
OCHROTRICHIA	Genus			4	SC	CN
OCHTERIDAE	Family	3		8	PR	
OCHTERUS	Genus			8	PR	
OCHTHEBIUS	Genus			5	SC	CN
ODONATA	Order	3		5	PR	CB
ODONTOCERIDAE	Family	1	10	0	SC	SP
ODONTOMESA	Genus			5	CG	SP
ODONTOMYIA	Genus			7	CG	SP
OECETIS	Genus			6	PR	CN
OEMOPTERYX	Genus			3	SH	SP
OLIGOCHAETA	Class	3	1	9	CG	BU
OLIGONEURIIDAE	Family	2		2	CF	BU
OLIGOSTOMIS	Genus			3	PR	CB
OLIVERIDIA	Genus			4	CG	
OMISUS	Genus			4		
OPHIOGOMPHUS	Genus			3	PR	BU
OPTIOSERVUS	Genus			4	SC	CN
ORAVELIA	Genus					
ORCONECTES	Genus			5	CG	SP
ORDOBREVIA	Genus			4	SC	CN
OREODYTES	Genus			5	PR	SW
OREOGETON	Genus			6	PR	SP
ORMOSIA	Genus			5	CG	BU
ORTHOCLADIINAE	Subfamily	3	2	6	CG	BU
ORTHOCLADIUS	Genus			6	CG	SP
ORTHOTRICHIA	Genus			6	SH	CN
OSTROCERCA	Genus			2	SH	SP
OULIMNIUS	Genus			4	SC	CN
OXYCERA	Genus			8	SC	SP
OXYETHIRA	Genus			4	CG	SP
PACHYDIPLAX	Genus			8	PR	SP
PAGASTIA	Genus			4	CG	SP
PAGASTIELLA	Genus			4	CG	SP
PALAEAGAPETUS	Genus			2	SH	SP

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
PALAEMONETES	Genus			6	CG	SP
PALAEMONIDAE	Family	3		6	CG	SP
PALINGENIIDAE	Family					
PALMACORIXA	Genus			7	PR	SW
PALPOMYIA	Genus			6	PR	BU
PALPOMYIINI	Tribe					
PANOPEIDAE	Family					
PARABOREOCHLUS	Genus			2	CG	SP
PARACAPNIA	Genus			1	SH	SP
PARACHAETOCLADIUS	Genus			3	CG	SP
PARACHIRONOMUS	Genus			7	PR	SP
PARACLADIUS	Genus				CG	SP
PARACLADOPELMA	Genus			6	CG	SP
PARACLOEODES	Genus			8	SC	SW
PARACRICOTOPUS	Genus			6	CG	SP
PARACYMUS	Genus			4	PR	CN
PARADELPHOMYIA	Genus			4	SH	BU
PARAGNETINA	Genus			2	PR	CN
PARAKIEFFERIELLA	Genus			4	CG	SP
PARALAUTERBORNIELLA	Genus			8	CG	BU
PARALEPTOPHLEBIA	Genus			1	CG	SW
PARALEUCTRA	Genus			0	SH	SP
PARALIMNOPHYES	Genus			7	CG	
PARAMERINA	Genus			5	PR	SP
PARAMETRIOCNEMUS	Genus			4	CG	SP
PARANEMOURA	Genus			2	SH	SP
PARAPERLA	Genus			1	PR	CN
PARAPHAENOCLADIUS	Genus			4	CG	SP
PARAPSYCHE	Genus			1	CF	CN
PARASMITTIA	Genus			7		
PARATANYTARSUS	Genus			6	CG	CN
PARATENDIPES	Genus			7	CG	BU
PARATRICHOCLADIUS	Genus			4	CG	SP
PARATRISSOCLADIUS	Genus					
PEDICIA	Genus			6	PR	BU
PELECORHYNCHIDAE	Family	3		5	PR	
PELOCORIS	Genus			8	PR	CB
PELTODYTES	Genus			6	SH	CB
PELTOPERLA	Genus			2	SH	CN
PELTOPERLIDAE	Family	2		2	SH	CN
PENELOMAX	Genus			2	CG	CN

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
PENTANEURA	Genus			6	PR	SP
PENTANEURELLA	Genus					
PENTANEURINI	Tribe				PR	
PERICOMA	Genus			4	CG	BU
PERITHEMIS	Genus			7	PR	SP
PERLESTA	Genus			3	PR	CN
PERLIDAE	Family	2	10	2	PR	CN
PERLINELLA	Genus			2	PR	CN
PERLINI	Tribe					
PERLODIDAE	Family	2	10	2	PR	CN
PETALURIDAE	Family	2		5	PR	
PHAENOPSECTRA	Genus			7	SC	CN
PHILOPOTAMIDAE	Family	2		3	CF	CN
PHILOPOTAMINAE	Subfamily					
PHORIDAE	Family	3		6	CG	BU
PHRYGANEA	Genus			6	SH	CB
PHRYGANEIDAE	Family	2	10	4	SH	CB
PHYLOCENTROPUS	Genus			5	CF	BU
PILARIA	Genus			7	PR	BU
PISCICOLA	Genus				PR	SP
PISCICOLIDAE	Family	3	4	7	PR	
PLACOBDELLA	Genus			7	PR	SP
PLATHEMIS	Genus			6	PR	SP
PLATYCENTROPUS	Genus			4	SH	CB
PLATYHELMINTHES	Phylum	2	5			
PLATYSMITTIA	Genus			6	CG	
PLAUDITUS	Genus			4	CG	SW
PLECOPTERA	Order	2		3	PR	CN
PLEIDAE	Family			8	PR	SW
PODMOSTA	Genus			2	SH	SP
PODONOMINAE	Subfamily				CG	BU
POLYCENTROPODIDAE	Family	3	7	6	CF	CN
POLYCENTROPODINAE	Subfamily					
POLYCENTROPUS	Genus			6	PR	CN
POLYMITARCYIDAE	Family	2		2	CG	BU
POLYPEDILUM	Genus			6	SH	CB
PORTUNIDAE	Family	3				
POTAMANTHIDAE	Family	2	10	4	CG	
POTAMYIA	Genus			5	CF	CN
POTTHASTIA	Genus			3	CG	SP
PRIONOCERA	Genus			4	SH	CN

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
PRIONOCYPHON	Genus			6	SC	CB
PROBEZZIA	Genus			6	PR	BU
PROCAMBARUS	Genus			7	SH	SP
PROCLADIUS	Genus			8	PR	SP
PROCLOEON	Genus			6	CG	SW
PRODIAMESA	Genus			5	CG	SP
PRODIAMESINAE	Family		2			SP
PROGOMPHUS	Genus			4	PR	BU
PROMORESIA	Genus			2	SC	CN
PROSIMULIINI	Tribe					
PROSIMULIUM	Genus			3	CF	CN
PROSTOIA	Genus			2	SH	SP
PROTONEURIDAE	Family	3		5		
PROTOPLASA	Genus			5	CG	SP
PROTOPTILA	Genus			1	SC	CN
PSECTROCLADIUS	Genus			7	CG	SP
PSECTROTANYPUS	Genus			9	PR	SP
PSEPHENIDAE	Family	2		4	SC	CN
PSEPHENUS	Genus			4	SC	CN
PSEUDOCENTROPTILOIDES	Genus			3	CG	CN
PSEUDOCHIRONOMUS	Genus			5	CG	BU
PSEUDOCLOEON	Genus			4	CG	SW
PSEUDODIAMESA	Genus			4	CG	SP
PSEUDOLIMNOPHILA	Genus			4	PR	BU
PSEUDORTHOCLADIUS	Genus			1	CG	SP
PSEUDOSMITTIA	Genus			6	CG	SP
PSEUDOSTENOPHYLAX	Genus			0	SH	SP
PSILOMETRIOCNEMUS	Genus			6	CG	SP
PSILOTRETA	Genus			0	SC	SP
PSOROPHORA	Genus			8	PR	SW
PSYCHODA	Genus			7	CG	BU
PSYCHODIDAE	Family	3		8	CG	BU
PSYCHODINAE	Subfamily					
PSYCHOGLYPHA	Genus			0	CG	SP
PSYCHOMYIA	Genus			2	CG	CN
PSYCHOMYIIDAE	Family	2		2	CG	CN
PSYCHOMYIINAE	Subfamily					
PTERONARCYIDAE	Family	1		1	SH	CN
PTERONARCYS	Genus			1	SH	CN
PTILODACTYLA	Genus			5	SH	
PTILODACTYLIDAE	Family	2		5	SH	CN

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
PTILOSTOMIS	Genus			5	SH	CN
PTYCHOPTERA	Genus			8	CG	BU
PTYCHOPTERIDAE	Family	3		7	CG	BU
PYCNOPSYCHE	Genus			4	SH	SP
RADOTANYPUS	Genus					SP
RANATRA	Genus			8	PR	CN
RASVENA	Genus			0	PR	CN
REMENUS	Genus			2	PR	CN
REOMYIA	Genus					
RHABDOMASTIX	Genus			3	CG	CB
RHAMPHOMYIA	Genus			6	PR	SP
RHANTUS	Genus			5	PR	SW
RHAPHIUM	Genus					
RHEOCRICOTOPUS	Genus			6	CG	SP
RHEOPELOPIA	Genus			5	PR	SP
RHEOSMITTIA	Genus			6	CG	BU
RHEOTANYTARSUS	Genus			6	CF	CN
RHITHROGENA	Genus			1	SC	CN
RHYACOPHILA	Genus			2	PR	CN
RHYACOPHILIDAE	Family	1	7	2	PR	CN
RHYNCHOBDELLIDA	Order				PR	
ROBACKIA	Genus			3	CG	BU
ROEDERIODES	Genus			6	PR	CN
SAETHERIA	Genus			4	CG	BU
SARCOPHAGIDAE	Family				CG	BU
SCATELLA	Genus				CG	CB
SCATHOPHAGIDAE	Family	3		7	SH	
SCIARIDAE	Family	3		6		
SCIOMYZIDAE	Family	3		9	PR	BU
SCIRTES	Genus			6	SH	CB
SCIRTIDAE	Family	3		6	SC	CB
SERGENTIA	Genus					
SERICOSTOMATIDAE	Family	2	10	2	SH	SP
SERRATELLA	Genus			2	CG	CN
SERROMYIA	Genus			6	PR	BU
SETODES	Genus			4	CG	SP
SHIPSA	Genus			2	SH	SP
SIALIDAE	Family	2	4	5	PR	BU
SIALIS	Genus			5	PR	BU
SIGARA	Genus			8	PI	SW
SIMULIIDAE	Family	3	5	5	CF	CN

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
SIMULIINAE	Family					
SIMULIUM	Genus			5	CF	CN
SIPHLONURIDAE	Family	3	10	7	CG	SW
SIPHLONURUS	Genus			6	CG	SW
SIPHLOPLECTON	Genus			2	CG	SW
SMITTIA	Genus			5	CG	BU
SOMATOCHLORA	Genus			3	PR	SP
SOYEDINA	Genus			1	SH	SP
SPERCHOPSIS	Genus			5	PR	CN
SPHAERIUSIDAE	Family	3				
SPHAEROMIAS	Genus			6	PR	BU
STACTOBIELLA	Genus			3	SH	CN
STAPHYLINIDAE	Family	3		7	PR	CN
STEGOPTERNA	Genus			4	CF	CN
STELECHOMYIA	Genus			6	CG	BU
STEMPELLINA	Genus			2	CG	CB
STEMPELLINELLA	Genus			4	CG	CB
STENACRON	Genus			4	CG	CN
STENELMIS	Genus			5	SC	CN
STENOCHIRONOMUS	Genus			5	CG	BU
STENONEMA	Genus			4	SC	CN
STENOPHYLACINI	Tribe					
STICTOCHIRONOMUS	Genus			7	CG	BU
STILOBEZZIA	Genus			6	PR	SP
STILOCLADIUS	Genus			5	CG	SP
STRATIOMYIDAE	Family	3		7	CG	SP
STRATIOMYS	Genus			6	CG	SP
STROPHOPTERYX	Genus			3	SH	SP
STYGOBROMUS	Genus			5	PR	SP
STYLOGOMPHUS	Genus			4	PR	BU
STYLURUS	Genus			4	PR	CB
SUBLETTEA	Genus			5	CF	
SUPHISELLUS	Genus			5	PR	CB
SUWALLIA	Genus			0	PR	CN
SWELTSA	Genus			0	PR	CN
SYMPETRUM	Genus			6	PR	SP
SYMPHITOPSYCHE	Genus					
SYMPOTTHASTIA	Genus			4	CG	SP
SYNDIAMESA	Genus					SP
SYNORTHOCLADIUS	Genus			4	CG	SP
SYNURELLA	Genus			4	CG	SP

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
SYRPHIDAE	Family	3		10	CG	BU
TABANIDAE	Family	3		6	PR	SP
TABANUS	Genus			6	PR	SP
TACHOPTERYX	Genus			5	PR	BU
TAENIONEMA	Genus			3	SH	SP
TAENIOPTERYGIDAE	Family	2	10	2	SH	SP
TAENIOPTERYX	Genus			3	SH	SP
TALITRIDAE	Family	3		8	CG	
TALLAPERLA	Genus			0	SH	CN
TANAIDACEA	Order				CF	
TANYDERIDAE	Family	3		6	CG	SP
TANYPODINAE	Subfamily			7	PR	BU
TANYPUS	Genus			9	PR	SP
TANYTARSINI	Tribe			6	CF	SP
TANYTARSUS	Genus			5	CF	BU
TELOGANOPSIS	Genus			2	CG	CN
TELOPELOPIA	Genus			8	PR	
TENEBRIONIDAE	Family		0			
TETANOCERA	Genus				PR	BU
THAUMALEA	Genus			6	OM	CN
THAUMALEIDAE	Family			5	CG	CN
THIENEMANNIA	Genus			7	CG	SP
THIENEMANNIELLA	Genus			5	CG	SP
THIENEMANNIMYIA	Genus			6	PR	SP
TIMPANOGA	Genus			2	CG	CN
TIPULA	Genus			6	SH	BU
TIPULIDAE	Family	2	5	4	SH	BU
TOKUNAGAIA	Genus			6	CG	SP
TRAMEA	Genus			4	PR	
TREPAXONEMATA	Class					
TRIAENODES	Genus			6	SH	SW
TRIBELOS	Genus			6	CG	BU
TRICHOCERIDAE	Family					
TRICHOCLINOCERA	Genus			6	PR	CN
TRICHOCORIXA	Genus			7	PR	SW
TRICHOPTERA	Order	2		4	CG	SP
TRICORYTHIDAE	Family	2		4	CG	
TRICORYTHODES	Genus			4	CG	SP
TRIOGMA	Genus			4	SH	SK
TRISSOPELOPIA	Genus			5	PR	SP
TROPISTERNUS	Genus			6	PR	CB

FINAL ID	TAXONOMIC RANK	BECK'S CLASS	ASPT	TV	FFG	HABIT
TSALIA	Genus					
TVETENIA	Genus			5	CG	SP
TWINNIA	Genus			6	CF	CN
UENOIDAE	Family	2		2	SC	CN
UNNIELLA	Genus			4	CG	BU
UTAPERLA	Genus			0	PR	CN
UVARUS	Genus			5	PR	SW
VIEHOPERLA	Genus			2	SH	
WIEDEMANNIA	Genus			6	PR	CN
WORMALDIA	Genus			1	CF	CN
WYEOMYIA	Genus			8	CF	
XENOCHIRONOMUS	Genus			4	PR	BU
XESTOCHIRONOMUS	Genus			2	CG	BU
XYLOTOPUS	Genus			4	SH	BU
YLODES	Genus				SH	SW
YUGUS	Genus			2	PR	CN
ZALUTSCHIA	Genus			5	SH	
ZAPADA	Genus			2	SH	SP
ZAVRELIA	Genus			4	CG	SW
ZAVRELIELLA	Genus			5	CG	BU
ZAVRELIMYIA	Genus			7	PR	SP
ZEALEUCTRA	Genus			0	SH	SP
ZYGOPTERA	Suborder	3			PR	CB

Appendix C: Taxonomic Standardization

The Chessie BIBI database was composed of data from twenty-nine agencies/programs that have sampled in the Chesapeake Bay watershed between 1992 and 2015. Study protocols were generally similar among agencies/programs. However, it was difficult to discern standard identification protocols. Some agencies/programs state that macroinvertebrates are identified to the genus-level or the lowest taxonomic resolution possible, but don't indicate what was the lowest taxonomic resolution. Many agencies/programs also have specific taxa that they choose to exclude from analysis and specific groups of taxa that they identify at a coarser level than the standard taxonomic resolution (e.g., genus-level). Developing indices on data that have inherently different taxonomic assemblages has the potential to reduce index performance and identify agency/program differences rather than differences in stream condition. Therefore, the taxa were aggregated at the phylum, subphylum, and class taxonomic levels to evaluate potential differences in identification protocols. The percentage of samples where the taxon was present was used as an indication of potential identification differences (Table C-1). Additionally, the relative abundance of a taxon was calculated using only the samples for which the taxon was present (Table C-2). This assessment provides an indication of the rarity of the individual as well as the frequency of a given level of taxonomic identification. The presence of the taxon and relative abundance of the taxon when present were used to establish a taxa exclusion list. Including taxa only identified by a certain agency/program(s) creates bias, and the best available option was to exclude these taxa from development of the index. Taxa exclusions are stated in the Methods section of the report.

Taxa were also evaluated for taxonomic "roll-ups" at the order- and family-levels. The percent change in taxonomic count (Equation C-1) was calculated for the order-level relative to the class-level (Table C-3) and the family-level relative to the order-level (Table C-4).

Equation C-1

$$\%\ Change = \frac{a - b}{a} \times 100$$

Where:
a = the taxonomic count at the lower taxonomic resolution
b = the taxonomic count at the higher taxonomic resolution

Often agencies/programs identify most insects to the family- or genus-level but taxa like Oligochaeta are not identified beyond the class-level in many instances. If these taxa are not rolled-up to a more common level of identification, agency/program bias may skew results. For example, samples collected by agencies/programs that identify Oligoachaeta taxa to the genus-level will have greater richness/diversity measures and taxonomic attributes/traits will be more accurately assigned. The taxonomic "roll-up" protocol is outlined in the Methods section of the report.

Table C-1. The number of samples that contained the indicated taxon was reported as "Taxon Presence." Taxon Presence and the total number of samples were used to calculate the percentage of samples containing the taxon of interest. The bold taxonomic names signify the taxa that were retained during the analyses.

Taxonomic Rank	Taxon	Taxon Presence	Total Sample Count	Percentage of Samples Reported
Phylum	**Arthropoda**	23,476	23,489	99.94
Phylum	**Annelida**	13,182	23,489	56.12
Phylum	**Mollusca**	9,444	23,489	40.21
Phylum	**Platyhelminthes**	2,619	23,489	11.15
Phylum	Nemertea	783	23,489	3.33
Phylum	Nematoda	648	23,489	2.76
Phylum	Nematomorpha	243	23,489	1.03
Phylum	Porifera	48	23,489	0.2
Phylum	Cnidaria	34	23,489	0.14
Phylum	Sarcomastigophora	33	23,489	0.14
Phylum	Bryozoa	3	23,489	0.01
Phylum	Unidentified	2	23,489	0.01
Subphylum	**Hexapoda**	23,456	23,489	99.86
Subphylum	**Clitellata**	13,141	23,489	55.95
Subphylum	**Crustacea**	11,272	23,489	47.99
Subphylum	**Unidentified**	9,461	23,489	40.28
Subphylum	**Rhabditophora**	2,585	23,489	11.01
Subphylum	Chelicerata	2,377	23,489	10.12
Subphylum	Polychaeta	40	23,489	0.17
Subphylum	Catenulida	14	23,489	0.06
Subphylum	Myriapoda	11	23,489	0.05
Subphylum	Neodermata	1	23,489	0
Class	**Insecta**	23,455	23,489	99.86
Class	**Oligochaeta**	13,001	23,489	55.35
Class	**Malacostraca**	11,250	23,489	47.89
Class	**Gastropoda**	6,705	23,489	28.55
Class	**Bivalvia**	5,952	23,489	25.34
Class	**Trepaxonemata**	2,585	23,489	11.01
Class	**Entognatha**	1,025	23,489	4.36
Class	**Hirudinea**	616	23,489	2.62
Class	**Unidentified**	60	23,489	0.26
Class	Ostracoda	29	23,489	0.12
Class	Maxillopoda	17	23,489	0.07
Class	Branchiopoda	2	23489	0.01

Table C-2. For each taxon, samples were subset to represent only the samples containing the specified taxon. The mean relative abundance of the taxon was measured for the subset of samples. The bold taxanomic names signify the taxa that were retained during the analyses.

Taxonomic Rank	Taxon	Mean Relative Abundance
Phylum	**Arthropoda**	92.49
Phylum	**Annelida**	8.28
Phylum	**Mollusca**	6.12
Phylum	**Platyhelminthes**	3.02
Phylum	Porifera	2.62
Phylum	Cnidaria	2.29
Phylum	Unidentified	1.79
Phylum	Nemertea	1.78
Phylum	Sarcomastigophora	1.48
Phylum	Nematoda	1.33
Phylum	Nematomorpha	1.18
Phylum	Bryozoa	0.26
Subphylum	**Hexapoda**	86.71
Subphylum	**Crustacea**	11.94
Subphylum	**Clitellata**	8.32
Subphylum	**Unidentified**	6.14
Subphylum	Myriapoda	3.58
Subphylum	**Rhabditophora**	3.05
Subphylum	Polychaeta	2.93
Subphylum	Chelicerata	2.04
Subphylum	Catenulida	0.93
Subphylum	Neodermata	0.85
Class	**Insecta**	86.81
Class	**Malacostraca**	11.98
Class	Branchiopoda	11.31
Class	**Oligochaeta**	8.37
Class	**Gastropoda**	4.78
Class	**Bivalvia**	4.38
Class	Ostracoda	4.12
Class	**Trepaxonemata**	3.07
Class	**Unidentified**	2.3
Class	**Entognatha**	2.08
Class	**Hirudinea**	1.46
Class	Maxillopoda	1.39

Table C-3. The count of taxa identified at the class-level were compared to the counts identified at the order-level. The "Difference" column indicates the difference in the taxonomic counts between the two taxonomic ranks. The bold taxonomic names identify taxa that were all aggregated to the class-level.

Class	Class Total Count	Order Total Count	Difference	% Change
Bivalvia	40,756	34,779	5,977	-15%
Entognatha	3,223	3,223	0	0%
Gastropoda	64,780	62,384	2,396	-4%
Hirudinea	1,922	1,414	508	-26%
Insecta	7,435,522	7,435,522	0	0%
Malacostraca	371,368	371,368	0	0%
Oligochaeta	682,807	165,832	516,975	-76%
Trepaxonemata	38,772	8,172	30,600	-79%

Table C-4. The count of taxa identified at the order-level were compared to the counts identified at the family-level. The "Difference" column indicates the difference in the taxonomic counts between the two taxonomic ranks. The bold taxonomic names identify taxa that were all aggregated to the order-level.

Order	Order Total Count	Family Total Count	Difference	% Change
Amphipoda	185,632	179,977	5,655	-3%
Architaenioglossa	1,267	1,267	0	0%
Arhynchobdellida	761	761	0	0%
Basommatophora	41,694	41,692	2	0%
Branchiobdellida	272	207	65	-24%
Coleoptera	472,492	472,425	67	0%
Collembola	3,223	1,665	1,558	-48%
Decapoda	7,958	7,941	17	0%
Diptera	4,691,172	4,689,844	1,328	0%
Enchytraeida	7,019	7,019	0	0%
Ephemeroptera	885,321	851,695	33,626	-4%
Haplotaxida	35	32	3	-9%
Hemiptera	5,906	5,860	46	-1%
Heterostropha	78	78	0	0%
Isopoda	177,778	176,050	1,728	-1%
Lepidoptera	2,117	1,138	979	-46%
Lumbriculida	13,447	13,445	2	0%
Megaloptera	24,588	24,550	38	0%
Neoophora	8,172	3,501	4,671	-57%
Neotaenioglossa	19,345	19,345	0	0%
Neuroptera	72	64	8	-11%
Odonata	41,470	41,184	286	-1%
Opistophora	1,621	1,621	0	0%
Plecoptera	346,056	339,074	6,982	-2%
Rhynchobdellida	653	653	0	0%
Trichoptera	966,328	964,090	2,238	0%
Tubificida	143,438	143,276	162	0%
Unionoida	85	85	0	0%
Veneroida	34,694	34,635	59	0%

Appendix D: Rarefaction

The number of organisms identified and counted per sample differs among the agencies/programs who contributed data to the Chessie BIBI database. Some agencies count 100 individuals while others count more (e.g., 200, 400). A positive relationship exists between the probability of finding a new taxon and the number of individuals counted (Figure 1). This relationship influences important metrics such as taxa richness and diversity indices (Buchanan et al. 2011). The agency with a greater standard count will typically have higher estimates of richness and a better representation of rare taxa.

Rarefaction is used to overcome the bias associated with taxa richness and diversity metrics created by different counting protocols. Rarefaction randomly selects a prescribed number of individuals (e.g., 100 or 200) without replacement from a sample's larger raw count to create a rarified sample. The *vegan* package in R provides several useful rarefaction functions (Oksanen et al. 2016). The function *rarefy* provides a mean taxa richness value for the rarified sample (*Equation D-1*; Hurlbert 1971) and the error associated with that value (*Equation D-2*; Heck Jr et al. 1975).

Equation D-1

(1)

$$E(S_m) = \sum_{i=1}^{S} \left[1 - \binom{N - N_i}{n} / \binom{N}{n}\right]$$

(2)

$$E(S_m) = \sum_{i=1}^{S} \left[1 - \left(\frac{(N - N_i)!}{(n!)([N - N_i] - n)!}\right) / \left(\frac{N!}{n!\,(N - n)!}\right)\right]$$

Equation D-2

$$E(S_m) = \sum_{i=1}^{S} \left\{\left[1 - \left(\frac{N - N_i}{n}\right) / \left(\frac{N}{n}\right)\right] * \left[1 - \left(\frac{N - N_i}{n}\right) / \left(\frac{N}{n}\right)\right]\right\} + 2\sum_{j=2}^{S}\sum_{i=1}^{j-1} \left\{\binom{N - N - N}{n} / \binom{N}{n} - \left[\left(\frac{N - N_i}{n}\right)\left(\frac{N - N_j}{n}\right)\right] \Big/ \left[\left(\frac{N}{n}\right)\left(\frac{N}{n}\right)\right]\right\}$$

Where:

S = the number of species in the original sample

N_i = the number of individuals in the i^{th} species

N = the total number of individuals in the original sample

n = the number of individuals in the rarefied sample (i.e., the subsample size)

Mean taxa richness is the average number of taxa (richness) that can be expected in the rarified sample for a prescribed total count. Another function in the *vegan* package, *rrarefy*, creates a taxonomic assemblage for a rarefied sample by randomly selecting taxa without replacement from the original sample (Oksanen et al. 2016). The rarefied assemblage can then be used as raw counts to calculate unbiased richness and diversity metrics associated with the standard rarified count.

Due to the random selection without replacement process, each iteration of the *rrarefy* function will, typically, produce a different combination of taxa (assemblage). However, the selection is not truly random (i.e., simple random sample). Although each individual from the original sample has an equal probability of being selected, the majority of taxa have differing probabilities of being selected (unless the sample is 100% even). Therefore, the taxon that makes up the greatest proportion of the original sample has the highest probability of being selected during the rarefaction process.

Hurlbert's (1971) method factors in the abundance of each taxon and provides the best estimate of species richness. Simberloff (1972) developed an iterative rarefaction process, using Sanders (1968) formula, to calculate the mean richness value in a rarefied sample. Tipper (1979) found that Simberloff's (1972) iterative process was equivalent to Hurlbert's (1971) equation (Equation D-1). Equation D-1 is an estimate of the expected number of species in a sample of size *n*. Therefore, the abundance of each taxon in a rarefied subsample should also represent the estimated abundance of the taxon, and not simply a random draw without replacement.

The proportion each taxon composes of the original sample is known prior to performing rarefaction. Repeatedly sampling the assemblage without replacement will form a hypergeometric distribution. Using Equation *D-3* the mean abundance of each taxon can be estimated for a rarefied sample of size *n*.

Equation D-3

$$\bar{x} = n\left(\frac{k}{N}\right)$$

Where:

k = the number of individuals identified as the taxon of interest

n = rarefaction sample size

N = number of individuals in the orginal sample

Equation 3 finds the proportion that each taxon makes up of the original sample and applies the proportion to a smaller sample size. The values are rounded to the nearest integer and a sum of all the taxa will be approximately *n*. A sample's raw counts were sorted in descending order and the estimated richness value (*Equation D-1*) was used as a threshold for selecting the most abundant taxa. Estimated rarified richness provides the number of taxa that would be expected from a rarefied sample and the most abundant taxa have the highest probability of representing the taxa in the rarified sample. We refer to this method of rarefaction as "*probabilistic rarefaction*" to avoid confusion with the standard rarefaction method.

In some cases, the original sample's taxonomic list cannot be easily sampled because several taxa near the estimated mean rarefied richness cutoff have the same raw count. When identical raw counts occur, a random selection without replacement was applied to the affected taxa to avoid bias when determining the mean taxa richness value. Taxa with the same count values are usually singletons (represented by one individual) or doubletons (represented by two individuals). Therefore, the variability produced by the final, random selection step has minimal influence on most metrics. Richness metrics for a specific taxon or taxa may be more influenced by this variability (e.g., EPT richness, Diptera richness, Collector richness). During preliminary index development, the random selection of rare taxa (singletons and doubletons) did influence metric redundancy, range, variability, and sensitivity despite the reduction in variability provided by the probabilistic rarefaction methodology. For example, if there are ten singletons and we only need to choose two taxa to represent the rarefied count the composition of the resulting assemblage may be very different with each probabilistic rarefaction iteration. One iteration may include two Ephemeroptera taxa and the next may not include any Ephemeroptera taxa consequently influencing the richness of Ephemeroptera in the sample. Ultimately, probabilistic rarefaction of richness/diversity metrics influenced the metrics composing the final index. Although this remains an issue for probabilistic rarefaction, the variability in assemblage composition has been drastically reduced relative to the standard rarefaction method.

Appendix E: Biological Metric Descriptions

Table E-1. A description of the standard set of metrics tested during the development of the Chessie BIBI. Abbreviations: Comp, Composition; FFG, Functional Feeding Group; Rich/Div, Richness/Diversity. Note: for metrics that require habits, tolerance values, functional feeding groups, or Beck's classes, NA values were omitted prior to calculations.

	METRIC CLASS	METRIC ABBREVIATION	METRIC DESCRIPTION	FORMULA	NOTES
1	Comp	GOLD	% Gastropoda, OLigochaeta, and Diptera Individuals	$100 - \left(\sum_{i}^{S_I} \frac{n_i}{N} \times 100\right)$	Where: S_I = the specified taxon or taxa
2	Comp	PCT_AMPHIPODA	% Amphipoda Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
3	Comp	PCT_RETREAT_ CADDISFLY	% Retreat Making Trichoptera Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa (i.e., Annulipalpia)
4	Comp	PCT_BIVALVIA	% Bivalvia Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
5	Comp	PCT_CC_CHIRONOMIDAE	% of Chironomus + Cricotopus Individuals Composing Chironomidae	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
6	Comp	PCT_CHIRONOMIDAE	% Chironomidae Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa

	METRIC CLASS	METRIC ABBREVIATION	METRIC DESCRIPTION	FORMULA	NOTES
7	Comp	PCT_COLEOPTERA	% Coleoptera Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
8	Comp	PCT_CORBICULIDAE	% Corbiculidae Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
9	Comp	PCT_COTE	% Coleoptera, Odonata, Trichoptera, and Ephemeroptera Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
10	Comp	PCT_DIPTERA	% Diptera Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
11	Comp	PCT_EPHEMEROPTERA	% Ephemeroptera Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
12	Comp	PCT_EPHEMEROPTERA_ NO_BAETID	% Ephemeroptera Individuals Excluding Baetidae Individuals	$\left[\left(\sum_{i}^{S_I} \frac{n_i}{N}\right) - \left(\frac{n_{Baetidae}}{N}\right)\right] \times 100$	Where: S_I = the specified taxon or taxa
13	Comp	PCT_EPT	% Ephemeroptera, Plecoptera, and Trichoptera Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
14	Comp	PCT_EPT_ CHEUMATOPSYCHE	% Ephemeroptera, Plecoptera, and Trichoptera	$\left[\left(\sum_{i}^{S_I} \frac{n_i}{N}\right) - \left(\frac{n_{Cheumatopsyche}}{N}\right)\right] \times 100$	Where: S_I = the specified taxon or taxa

	METRIC CLASS	METRIC ABBREVIATION	METRIC DESCRIPTION	FORMULA	NOTES
			Individuals Excluding Cheumatopsyche Individuals		
15	Comp	PCT_EPT_NO_HYDRO	% Ephemeroptera, Plecoptera, and Trichoptera Individuals Excluding Hydropsychidae Individuals	$\left[\left(\sum_{i}^{S_I} \frac{n_i}{N}\right) - \left(\frac{n_{Hydropsychidae}}{N}\right)\right] \times 100$	Where: S_I = the specified taxon or taxa
16	Comp	PCT_EPT_HYDRO_BAETID	% Ephemeroptera, Plecoptera, and Trichoptera Individuals Excluding Hydropsychidae and Baetidae Individuals	$\left[\left(\sum_{i}^{S_I} \frac{n_i}{N}\right) - \left(\frac{n_{H+B}}{N}\right)\right] \times 100$	Where: n_{H+B} = Hydropsychidae and Baetidae individuals Where: S_I = the specified taxon or taxa
17	Comp	PCT_HYDRO_EPT	% of Hydropsychidae Individuals Composing Ephemeroptera, Plecoptera, and Trichoptera	$\frac{n_{Hydropsychidae}}{n_{EPT}} \times 100$	
18	Comp	PCT_HYDRO_ TRICHOPTERA	% of Hydropsychidae Individuals Composing	$\frac{n_{Hydropsychidae}}{n_{Trichoptera}} \times 100$	

	METRIC CLASS	METRIC ABBREVIATION	METRIC DESCRIPTION	FORMULA	NOTES
			Trichoptera		
19	Comp	PCT_LIMESTONE	% Limestone Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa (i.e., Amphipoda, Isopoda, Ephemerellidae)
20	Comp	PCT_NON_INSECT	% Non-Insect Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
21	Comp	PCT_ODONATA	% Odonata Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
22	Comp	PCT_OLIGO_CHIRO	% Chironomidae and Oligochaeta Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
23	Comp	PCT_OLIGOCHEATA	% Oligochaeta Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
24	Comp	PCT_PLECOPTERA	% Plecoptera Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
25	Comp	PCT_POTEC	% Plecoptera, Odonata, Trichoptera, Ephemeroptera, and Coleoptera	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa

	METRIC CLASS	METRIC ABBREVIATION	METRIC DESCRIPTION	FORMULA	NOTES
			Individuals		
26	Comp	PCT_SIMULIIDAE	% Simuliidae Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
27	Comp	PCT_TANYTARSINI	% Tanytarsini Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
28	Comp	PCT_TRICHOPTERA	% Trichoptera Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
29	Comp	PCT_UNIONOIDA	% Unionoida Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
30	Rich/Div	HURLBERTS_PIE	Hurlbert's Probability of Interspecific Encounter (PIE)	$\left(\frac{N}{N-1}\right) \times \left(1 - \sum_{i}^{S} (p_i)^2\right)$	Where: p_i = the propoation of the sample represented by taxon i.
31	Rich/Div	MARGALEFS	Margalef's Index	$\frac{S-1}{\ln(N)}$	
32	Rich/Div	MENHINICKS	Menhinick's Index	$\frac{S}{\sqrt{N}}$	
33	Rich/Div	PCT_EPT_RICH	% Ephemeroptera, Plecoptera, and Trichoptera Taxa Richness	$\sum_{i}^{S_I} \frac{s_i}{S} \times 100$	Where: S_I = the specified taxon or taxa

	METRIC CLASS	METRIC ABBREVIATION	METRIC DESCRIPTION	FORMULA	NOTES
34	Rich/Div	PCT_EPT_RICH_NO_TOL	% Ephemeroptera, Plecoptera, and Trichoptera Taxa Richness Excluding Tolerant Taxa (7-10)	$\left[\left(\sum_{i}^{S_I} \frac{s_i}{S}\right) - \left(\frac{S_{Tolerant}}{S}\right)\right] \times 100$	Where: S_I = the specified taxon or taxa
35	Rich/Div	PIELOU	Pielou's Evenness	$\frac{H'}{\ln(S)}$	Where: H' = Shannon-Weiner Diveristy
36	Rich/Div	RICH	Richness	S	
37	Habit	RICH_BURROW	Burrower Richness	S_{Burrow}	
38	Habit	RICH_CLIMB	Climber Richness	S_{Climb}	
39	Habit	RICH_CLING	Clinger Richness	S_{Cling}	
40	FFG	RICH_COLLECT	Collector Richness	$S_{Gather} + S_{Filter}$	
41	Rich/Div	RICH_EPHEMEROPTERA	Ephemeroptera Richness	$S_{Ephemeroptera}$	
42	Rich/Div	RICH_EPT	Ephemeroptera, Plecoptera, and Trichoptera Richness	S_{EPT}	
43	Rich/Div	RICH_EPT_NO_TOL	Ephemeroptera, Plecoptera, and Trichoptera Richness Excluding Tolerant Taxa (7-10)	$S_{EPT} - S_{Tolerant\ EPT}$	

	METRIC CLASS	METRIC ABBREVIATION	METRIC DESCRIPTION	FORMULA	NOTES
44	FFG	RICH_FILTER	Filter Feeder Richness	S_{Filter}	
45	FFG	RICH_GATHER	Gatherer Richness	S_{Gather}	
46	Tolerance	RICH_INTOL	Intolerant Taxa Richness (0-3)	$S_{Intolerant}$	
47	Tolerance	RICH_MODTOL	Moderately Tolerant Taxa Richness (4-6)	$S_{Moderately\ Tolerant}$	
48	Rich/Div	RICH_PLECOPTERA	Plecoptera Richness	$S_{Plecoptera}$	
49	FFG	RICH_PREDATOR	Predator Richness	$S_{Predator}$	
50	FFG	RICH_SCRAPE	Scraper Richness	$S_{Scraper}$	
51	FFG	RICH_SHRED	Shredder Richness	$S_{Shredder}$	
52	Habit	RICH_SPRAWL	Sprawler Richness	$S_{Sprawler}$	
53	Habit	RICH_SWIM	Swimmer Richness	$S_{Swimmer}$	
54	Tolerance	RICH_TOL	Tolerant Taxa Richness (7-10)	$S_{Tolerant}$	
55	Rich/Div	RICH_TRICHOPTERA	Trichoptera Richness	$S_{Trichoptera}$	
56	Rich/Div	SHANNON	Shannon-Wiener Diversity	$-\sum_{i=1}^{S} p_i \ln(p_i)$	Where: p_i = the propoation of the sample represented by taxon i.
57	Rich/Div	SIMPSONS	Simpson's Diversity	$\sum_{i=1}^{S} {p_i}^2$	Where: p_i = the propoation of the sample

	METRIC CLASS	METRIC ABBREVIATION	METRIC DESCRIPTION	FORMULA	NOTES
					represented by taxon i.
58	FFG	PCT_COLLECT	% Collector Individuals (% Gatherer + % Filter Feeder)	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
59	FFG	PCT_FILTER	% Filter Feeder Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
60	FFG	PCT_GATHER	% Gatherer Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
61	FFG	PCT_PREDATOR	% Predator Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
62	FFG	PCT_SCRAPE	% Scraper Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
63	FFG	PCT_SHRED	% Shredder Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
64	Habit	PCT_BURROW	% Burrower Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
65	Habit	PCT_CLIMB	% Climber Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified

	METRIC CLASS	METRIC ABBREVIATION	METRIC DESCRIPTION	FORMULA	NOTES
					taxon or taxa
66	Habit	PCT_CLING	% Clinger Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
67	Habit	PCT_SPRAWL	% Sprawler Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
68	Habit	PCT_SWIM	% Swimmer Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
69	Tolerance	ASPT_MOD	Modified Average Score Per Taxon	$\frac{Sum\ of\ unique\ a_i}{Number\ of\ scoring\ taxa}$	Where: a_i = the taxons assigned tolerance value
70	Tolerance	BECKS_V1	Beck's Index (Version 1)	$2 \times n_1 + n_2$	Where: n_1 = Beck's class 1 n_2 = Beck's class 2
71	Tolerance	BECKS_V3	Beck's Index (Version 3)	$3(n_0) + 2(n_1) + n_2$	Where: n_0 = Beck's class 0 n_1 = Beck's class 1 n_2 = Beck's class 2
72	Tolerance	HBI	Hilsenhoff Biotic Index	$\frac{\sum_i^S n_i \times a_i}{N}$	Where: a_i = the taxons assigned tolerance value

	METRIC CLASS	METRIC ABBREVIATION	METRIC DESCRIPTION	FORMULA	NOTES
73	Tolerance	PCT_ATI	% Acid Tolerant Individuals (Smith 2016)	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa (i.e., Epeorus, Amphinemura, Leuctra, Esoperla, Rhyacophila, Simulium, Conchapelopia, Cricotopus, Eukiefferiella, and Heterotrissocladius)
74	Tolerance	PCT_DOM1	% Dominant 1 Individuals	$\frac{D_1}{N} \times 100$	Where: D_i = the taxa are ranked and i refers to the rank number
75	Tolerance	PCT_DOM2	% Dominant 2 Individuals	$\frac{D_1 + D_2}{N} \times 100$	Where: D_i = the taxa are ranked and i refers to the rank number
76	Tolerance	PCT_DOM3	% Dominant 3 Individuals	$\frac{D_1 + D_2 + D_3}{N} \times 100$	Where: D_i = the taxa are ranked and i refers to the rank number
77	Tolerance	PCT_DOM4	% Dominant 4 Individuals	$\frac{D_1 + D_2 + D_3 + D_4}{N} \times 100$	Where: D_i = the taxa are ranked and i refers to the rank number

	METRIC CLASS	METRIC ABBREVIATION	METRIC DESCRIPTION	FORMULA	NOTES
78	Tolerance	PCT_DOM5	% Dominant 5 Individuals	$\frac{D_1 + D_2 + D_3 + D_4 + D_5}{N} \times 100$	Where: D_i = the taxa are ranked and i refers to the rank number
79	Tolerance	PCT_INTOL_0_3	% Intolerant (0-3) Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
80	Tolerance	PCT_INTOL_0_4	% Intolerant (0-4) Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
81	Tolerance	PCT_MOD_TOL_4_6	% Moderately Tolerant (4-6) Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
82	Tolerance	PCT_TOLERANT_5_10	% Tolerant (5-10) Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
83	Tolerance	PCT_TOLERANT_7_10	% Tolerant (7-10) Individuals	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa
84	Tolerance	PCT_URBAN_INTOL	% Urban Intolerant Individuals* (Southerland et al. 2005)	$\sum_{i}^{S_I} \frac{n_i}{N} \times 100$	Where: S_I = the specified taxon or taxa

* Urban Intolerant Taxa: Aeshnidae, Ameletidae, Asellidae, Athericidae, Baetidae, Brachycentridae, Caenidae, Calamoceratidae, Cambaridae, Capniidae, Ceratopogonidae, Chironomidae, Chloroperlidae, Cordulegastridae, Corduliidae, Corydalidae, Crangonyctidae, Elmidae, Ephemerellidae, Ephemeridae, Glossosomatidae, Gomphidae, Heptageniidae, Hydropsychidae, Hydroptilidae, Isonychiidae, Lepidostomatidae, Leptophlebiidae, Leuctridae, Libellulidae, Metretopodidae, Nemouridae, Odontoceridae, Peltoperlidae, Perlidae,

Perlodidae, Philopotamidae, Phryganeidae, Polycentropodidae, Polymitarcyidae, Potamanthidae, Psephenidae, Pteronarcyidae, Rhyacophilidae, Sericostomatidae, Sialidae, Simuliidae, Stratiomyidae, Tabanidae, Taeniopterygidae, Tipulidae, Uenoidae, Viviparidae

Appendix F: Abiotic Parameters for Evaluating Stream Environment

Classifying sampling events as Reference or Degraded in the Chesapeake Bay basin was limited to the abiotic parameters (i.e., habitat and water quality parameters) recorded while collecting benthic macroinvertebrates. To reduce variability in the indices, site classification was based on a standard set of frequently measured abiotic parameters. Parameters that were reported for more than 75% of sampling events were used during the site classification procedure.

Twenty-four habitat parameters were reported in the Chessie BIBI data base (Table F-1). None of the habitat parameters were reported for all sampling events. Eight habitat parameters were used to classify sites during the Chessie BIBI analysis: (1) Epifaunal Substrate, (2) Bank Stability, (3) Embeddedness, (4) Channel Alteration, (5) Riffle/Run/Pool Ratio, (6) Flow, (7) Bank Vegetation, and (8) Sedimentation. The Velocity/Depth Ratio included some odd values outside of the 0-20 range and was omitted from analyses. It appears that the Riparian Vegetation Score and Riparian Vegetation Zone width may be two names for the same parameter. Combining these two parameters into a single Riparian value may be appropriate in future refienments of the Chessie BIBI. Velocity/Depth Ratio, Riparian Vegetation Score, and Riparian Vegetation Zone require further review and each of the agencies needs to be contacted to verify that measurements are collected using the same protocol. The remaining parameters were omitted from the analyses.

Table F-1. Twenty-four habitat parameters were reported for benthic macroinvertebrate sampling events in the Chesapeake Bay basin. The frequency for which a parameter was reported, was expressed as a percentage of all available sampling events.

	Habitat Parameter	**% Reporting**
1	Epifaunal Substrate	96.5
2	Bank Stability	92.8
3	Embeddedness	90.6
4	Channel Alteration	88.6
5	Riffle/Run/Pool Ratio	88.3
6	Flow	78.5
7	Bank Vegetation	78.0
8	Sedimentation	77.7
9	Velocity/Depth Ratio	76.3
10	Riparian Vegetation Score	56.2
11	Instream Habitat	34.2
12	Riparian Vegetation Zone Width	30.1
13	Pool/Glide Quality	23.4
14	Bottom Substrate & Available Cover	22.7
15	Aesthetics	20.6
16	Grazing	19.9
17	Shading	18.8
18	Thalweg Depth	13.4
19	Sinuosity	8.8
20	Pool Substrate	7.7
21	Remoteness	6.5
22	Number of Rootwads	1.7
23	Number of Wood Debris	0.1
24	Wetted Width	0.1

Seventy-eight water quality parameters were reported in the Chessie BIBI data base (Table F-2). None of the water quality parameters were reported for all sampling events. Three water quality parameters were used to classify sites: (1) specific conductivity, (2) pH, and (3) dissolved oxygen (DO) mg/L. Although temperature was the most frequently reported water quality parameter, it was excluded from the site classification procedure due to highly variable diel and monthly ranges. The remaining water quality parameters did not occur frequently enough to be used during index development. These results are similar to the results reported by Carter and Resh (2013) in their summary of US agency benthic macroinvertebrate monitoring protocols.

Table F-2. Seventy-eight water quality parameters were reported for benthic macroinvertebrate sampling events in the Chesapeake Bay basin. The frequency for which a parameter was reported, was expressed as a percentage of all available sampling events.

	Water Quality Parameter	**Units**	**% Reporting**
1	Water Temperature	Celsius	94.8
2	pH Corrected for Temperature (25°C)	Standard Units	94.0
3	Conductivity Corrected for Temperature (25°C) and Salinity	umhos/cm	92.0
4	Dissolved Oxygen	mg/L	90.8
5	Total Phosphorus	mg/L	28.3
6	Turbidity; Nephelometric Method	NTU	27.0
7	Total Chloride	mg/L	27.0
8	Total Nitrogen	mg/L	24.5
9	Total Alkalinity as CaCO3	mg/L	23.3
10	Dissolved Organic Carbon	mg/L	19.0
11	Ammonium Nitrogen as N (Filtered Sample)	mg/L	18.7
12	Nitrate Nitrogen as N (Filtered Sample)	mg/L	18.7
13	Acid Neutralizing Capacity	meq/L	17.7
14	Sulfate	mg/L	17.6
15	Orthophosphate Phosphorus as P (Filtered Sample)	mg/L	15.2
16	Nitrite Nitrogen as N (Filtered Sample)	mg/L	15.2
17	Total Suspended Solids	mg/L	11.0
18	Hardness as CaCO3	mg/L	10.5
19	Instantaneous Stream Flow	CFS	9.0

	Water Quality Parameter	Units	% Reporting
20	Total Sulfate as SO4	mg/L	8.9
21	Total Organic Carbon	mg/L	8.7
22	Total Iron	µg/L	8.2
23	Nitrate Nitrogen as N (Whole Sample)	mg/L	7.9
24	Total Manganese	µg/L	7.4
25	DO Saturation Using Probe Units in Percent	%	7.3
26	Orthophosphate Phosphorus as P (Whole Sample)	mg/L	5.7
27	Fecal Coliforms (Colonies)	col/100 mL	5.4
28	Total Aluminum	mg/L	5.3
29	Total Potassium	mg/L	4.3
30	Nitrite + Nitrate Nitrogen as N (Whole Sample)	mg/L	4.1
31	Acidity	mg/L	3.9
32	Total Dissolved Solids; Gravimetric; Dried at 180 °C	mg/L	3.8
33	Dissolved Magnesium as Mg	mg/L	3.6
34	Dissolved Sodium as Na	mg/L	3.6
35	Silica as Si (Filtered Sample)	mg/L	3.6
36	Total Calcium	mg/L	3.4
37	Total Inorganic Carbon	mg/L	3.4
38	Dissolved Calcium	mg/L	3.2
39	Ammonium Nitrogen as N (Whole Sample)	mg/L	3.2
40	Total Magnesium as Mg	mg/L	3.0
41	Nitrite Nitrogen as N (Whole Sample)	mg/L	3.0
42	Total Zinc	µg/L	2.2
43	Total Kjeldahl Nitrogen (Whole Sample)	mg/L	2.1
44	Total Copper	µg/L	1.5
45	Dissolved Copper	µg/L	1.0
46	Total Nickel	µg/L	0.9
47	Dissolved Zinc	µg/L	0.9
48	Dissolved Aluminum as Al	mg/L	0.7
49	Total Selenium	µg/L	0.7
50	Total Lead	µg/L	0.6
51	Total Iron as Fe	µg/L	0.6

	Water Quality Parameter	Units	% Reporting
52	Total Suspended Sediment Concentration	mg/L	0.6
53	Total Dissolved Phosphorus	mg/L	0.5
54	Active Chlorophyll-a	µg/L	0.4
55	Salinity	Ppt	0.4
56	True Water Color	Standard Units	0.3
57	Total Dissolved Nitrogen	mg/L	0.2
58	Silica as Si (Whole Sample)	mg/L	0.2
59	Nitrite + Nitrate Nitrogen as N (Filtered Sample)	mg/L	0.2
60	20-Day Biochemical Oxygen Demand (Filtered Sample)	mg/L	0.1
61	5-Day Biochemical Oxygen Demand (Filtered Sample)	mg/L	0.1
62	Dissolved Calcium as Ca	mg/L	0.1
63	Dissolved Potassium as K	mg/L	0.1
64	Total Kjeldahl Nitrogen (Filtered Sample)	mg/L	0.1
65	Pheophytin	µg/L	0.1
66	Turbidity; Turbidimeter (Formazin Units)	Ftu	0.1
67	Whole 5-Day Biochemical Oxygen Demand	mg/L	0.0
68	Total Suspended Organic Carbon	mg/L	0.0
69	Total Arsenic	µg/L	0.0
70	20-Day Biochemical Oxygen Demand (Whole Sample)	mg/L	0.0
71	Dissolved Cadmium as Cd	mg/L	0.0
72	Dissolved Manganese as Mn	mg/L	0.0
73	Dissolved Nickel as Ni	µg/L	0.0
74	Dissolved Lead as Pb	µg/L	0.0
75	Particulate Inorganic + Organic Carbon	mg/L	0.0
76	Particulate Inorganic Carbon	mg/L	0.0
77	Particulate Nitrogen	mg/L	0.0
78	Dissolved Selenium as S	mg/L	0.0

Appendix G: Stream Classification

Classifying and analyzing streams according to natural features in the environment reduces variability in the data analysis caused by the natural features and more clearly reveals stream responses to anthropogenic disturbance. We explored the natural differences in taxonomic assemblages of stream macroinvertebrates across the Chesapeake drainage area and identified possible ‘bioregions’ that support communities with distinct differences. Hydrology, physiography, and ecoregion (Figure G-1) are three environmental factors governing the natural landscape of the Chesapeake Bay drainage area. These three factors were used to identify and delineate bioregions.

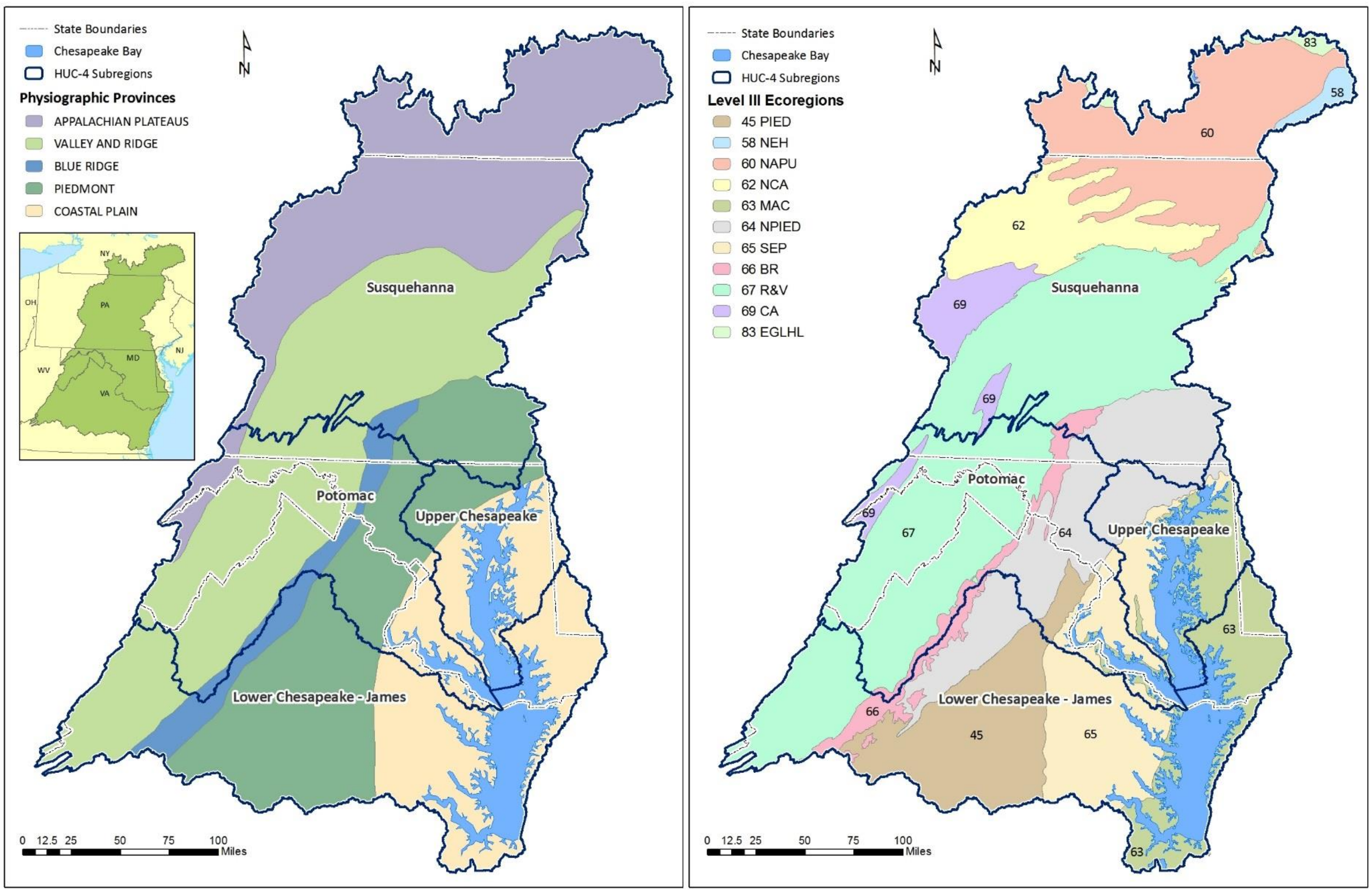


Figure G-1. Maps showing the four HUC4 hydrologic subregions of the Chesapeake Bay drainage area overlaying Physiographic Provinces (left) and Level III Ecoregions (right). Ecoregion abbreviations: 45 PIED, Piedmont; 60 NAPU, Northern Appalachian Plateau and Uplands; 62 NCA, North Central Appalachians; 63 MAC, Middle Atlantic Coastal Plain; 64 NPIED, Northern Piedmont; 65 SEP, Southeastern Plains; 66 BR, Blue Ridge; 67 R&V, Ridge and Valley; and 69 CA, Central Appalachians. Small portions of 58 NEH (Northeastern Highlands) and 83 EGLHL (Eastern Great Lakes and Hudson Lowlands) were included with 60 NAPU in the analyses.

The analysis was limited to the months of March through June because most monitoring programs collect samples at this time (Figure 1). We assumed that regional differences found in this spring and early summer period would be echoed in late summer and autumn (July – November). The analysis also was limited to 1st to 4th order streams to minimize the potential effect of stream size on biological metrics. Only biological data from comparatively undisturbed sites were used in the analysis in order to minimize the confounding effects of anthropogenic disturbances. Undisturbed sites were defined as follows in all but two ecoregions:

<u>Habitat</u> – at each sampling site, fewer than four of the eight metrics below are allowed to be (blank), all habitat scores have to be $\geq$ 10 or (blank), and the average of the scores (excluding (blanks)) has to be $\geq$ 16.

BANKS	Bank Stability
BANKV	Bank Vegetation
CH_ALT	Channel Alteration
EMBED	Embeddedness
EPI_SUB	Epifaunal Substrate
FLOW	Flow Status
RIFF	Riffle/Run/Pool Ratio
SED	Sedimentation

<u>Water Quality</u> – at least one parameter must have a measurement

SPCOND*	Specific Conductivity	$\leq$ 300 μmhos/cm or (blank)
PH	pH	5 $\leq$ pH $\leq$ 9 or (blank)
DO**	Dissolved Oxygen	$\geq$ 5.0 mg/liter or (blank)

* values less than 25 converted to (blank)
** values greater than 25 converted to (blank)

In the Mid-Atlantic Coast (MAC) and Southeastern Plain (SEP) ecoregions, different stream habitat parameters were typically collected by the three major monitoring agencies there: Delaware Department of Natural Resources and Environmental Control (DNREC), Virginia Department of Environmental Quality (VADEQ), and Maryland Department of Natural Resources (MDDNR). We considered the scores for the following nine habitat metrics if they were recorded in the MAC ecoregion: BANKS, BANKV, CH_ALT, EPI_SUB, shading (SHAD), aesthetics (AESTH), pool/glide quality (POOL), riparian vegetation zone width (RIP_ZONE), and instream habitat (INSTR). We considered these same nine metrics as well as EMBED, riffle (RIFF), velocity-depth combinations (VEL_D) in the SEP ecoregion if they were recorded. For a site to qualify as undisturbed, all the non-blank habitat scores had to be $\geq$ 10 and the average score $\geq$ 16. The sites also had to meet the water quality criteria above.

Statistical Methods

We performed both univariate and multivariate analyses using the *vegan* (Oksanen et al. 2016) and *rpart* (Therneau et al. 2015) packages available for R Statistical Software. The Bray-Curtis Dissimilarity Index was used to compare within group and between group variability based on benthic macroinvertebrate composition using the *vegan* package. This index compares the relative abundance of each taxon in a sample to that of another sample. HUC4's and Level

III Ecoregions were used to group the data prior to comparisons. Values range between 0 and 1 representing samples with the exact same composition/abundance and samples which do not share any compositional similarities, respectively. The mean variability from the Bray-Curtis Dissimilarity Index, within and between groups, was plotted as a dendrogram to visually interpret the relationship among groups of interest.

Another univariate test was performed using Multi-Response Permutation Procedures (MRPP). MRPP is a nonparametric test that utilizes a distance measure, in this case Bray-Curtis Dissimilarity, to test if within-group variability is less than would be expected by chance for a set of predefined groups. McCune et al. (2002) indicate that the chance-corrected within-group agreement (A) must be interpreted along with the p-value because large sample sizes will often result in a significant p-value but may poorly represent within group homogeneity. A-values close to zero indicate that within-group variance is not explained well by the predefined groups, and thus cannot be discerned from within-group variance expected by chance. The *vegan* package was used to test MRPP on each environmental factor independently (i.e., Subregion, Basin, Level III Ecoregions, Month, Mean HUC12 Elevation, Mean HUC12 Slope, Latitude, Strahler Stream Order).

The *vegan* package also provides a method for assessing beta-diversity using the Bray-Curtis Dissimilarity Index, called betadisper (Oksanen *et al.* 2016). Beta-diversity is a measure of the similarity between two observed assemblages. Bray-Curtis Dissimilarity was used to find the mean within-group variability, distance from the group's median spatial distance, for each pre-defined group (e.g., HUC4 or Level III Ecoregions). This function only provides within-group variability and does not test for between-group variability. An ANOVA with a post-hoc Tukey HSD test was performed pairwise for each predefined group using the mean within-group variability provided by the betadisper function. Comparing within-group variability provides a coarse assessment of similarity between different designated regions; if variability (beta-diversity) is similar between two regions it may be appropriate to join the two regions. However, this must be interpreted with caution because two groups may be considered statistically similar, due to similar within-group variability, but the assemblages may differ completely.

A Recursive Partitioning and Regression Tree (RPART) analysis (Therneau et al. 2015) was used to assess the relative influence of multiple environmental factors on a suite of seventeeen macroinvertebrate metrics. RPART is a nonparametric test that allows for multivariate comparisons. Six compositional metrics (% Non-Insect, % Chironomidae, % EPT, % Ephemeroptera, % Plecoptera, and % Trichoptera), six functional feeding group metrics (% Collectors, % Gatherers, % Filter Feeders, % Predators, % Shredders, and % Scrapers), and five habit metrics (% Burrowers, % Clingers, % Climbers, % Sprawlers, and % Swimmers) were individually assessed with the RPART analysis using four environmental variables (i.e., bioregions, watershed mean slope, watershed mean elevation, and Strahler stream order). This analysis produced a classification tree that aggregates the data into progressively similar groups based on the provided environmental variables.

Finally, sites in the Ridge and Valley (67) ecoregion were used to investigate the potential influence of surficial karst geology on stream macroinvertebrates. The 'Great Appalachian Valley,' a broad trough of valley lowlands stretching from Quebec to Alabama, forms the ecoregion's eastern side. It is a broad, relatively flat area underlain by carbonate (limestone and dolomite) bedrock. The western side of the ecoregion consists of shale and sandstone ridges and narrow, carbonate valleys. We used Kruskal-Wallis to examine differences presumably associated with karst geology.

Hydrologic Units and Physiographic Regions

The Chesapeake drainage area is 491 miles (790 km) on its longest, northeast-southwest axis and covers 64,000 square miles (165,759 square kilometers). Earlier efforts (Buchanan et al. 2011) suggested combinations of Level III Ecoregions are strong explanatory variables in the Chesapeake drainage and useful in classifying stream macroinvertebrate communities. Exploratory RPART analyses with the current data set suggested a latitudinal change in undisturbed communities may occur around 39°N – 40°N in the Appalachian Highlands region, possibly at the Susquehanna-Potomac river basin boundary. For this study, we first tested the relative importance of hydrologic subregions and physiographic region and then examined the usefulness of ecoregions in stream classification.

Figure G-2 shows Bray-Curtis Dissimilarity Index p-values for assemblages in the three major hydrologic subregions (HUC4) of the Chesapeake region: Susquehanna (0205), Potomac (0207), and the Lower Chesapeake-James (0208). The three subregions differed from each other to varying degrees, with Susquehanna showing the strongest separation. This may be due to the history of glaciation in the Susquehanna, or to seasonal temperature, precipitation, and other climatic differences between north and south. Between-group differences for Potomac and Lower Chesapeake-James subregions are relatively weak ($p = 0.111$). Both subregions are primarily in the Appalachian Highland; however, the Potomac landscape is dominated by the Ridges and Valleys Province whereas the Lower Chesapeake-James landscape is dominated by the Piedmont Province.

We expanded the analysis to include the small Upper Chesapeake subregion (0206) located downstream of the Susquehanna subregion (Figure G-1). The low salinity portion of Chesapeake Bay is the major hydrologic feature of this subregion and freshwater flow from the Susquehanna River far out-weighs contributions from the subregion's other non-tidal streams and rivers. Taxonomic variability in the Upper Chesapeake subregion proves somewhat similar to that in the larger Susquehanna subregion (0205); it differs from taxonomic variability found in the Lower Chesapeake-James and the Potomac (Figure G-3). The Susquehanna subregion continues to differ strongly from the Lower Chesapeake and Potomac subregions ($p < 0.001$), and the Potomac and Lower Chesapeake-James are still weakly different ($p = 0.187$). An argument can be made that the Upper Chesapeake subregion encompasses a drowned portion of the Susquehanna River, which makes connectivity between streams in Susquehanna and Upper Chesapeake subregions higher than connectivity between these subregions and the Potomac or lower Chesapeake. Hence, one could expect variability in the Susquehanna and Upper Chesapeake to be more similar, regardless of differences in their physiographic composition.

The Upper Chesapeake, Potomac, and Lower Chesapeake-James HUC4's overlap the Coastal Plain physiographic region. If we remove Coastal Plain from the hydrology-based analysis above, we can get a measure of the relative influence of this physiographic region. When Coastal Plain sites were excluded, the within-group and between-group dissimilarity index values dropped slightly in the three major HUC4's (Figure G-4). Taxonomic variability in the Susquehanna subregion and truncated Upper Chesapeake subregions became very similar ($p = 0.977$). Here, the Upper Chesapeake includes only samples from the Piedmont Province. Differences between the Upper Chesapeake, Potomac, and Lower Chesapeake-James subregions strengthened, although the difference between the latter two still is weak (p = 0.067). Physiographic regions appear to play a role in structuring macroinvertebrate communities within large hydrologic units. This argument has been made by Omernik (2003), Pond et al. (2011), and others.

The results suggest two major stream classifications could be applied to reduce the natural variability of stream macroinvertebrate assemblages in the Chesapeake drainage basin: a north-south division, probably at the Susquehanna-Potomac boundary, and an east-west division at the Coastal Plain and Piedmont boundary.

Level III Ecoregions

We used Level III Ecoregions to explore the usefulness of the suggested north-south and east-west divisions. Level III Ecoregions are sub-sections of the physiographic provinces. The Valley and Ridge physiographic province is a relatively large province that crosses the length of the Chesapeake drainage. It is equivalent to the long, heterogeneous Ridge and Valley (R&V) Level III Ecoregion in the Chesapeake drainage (Figure G-1). The Piedmont province is technically divided into Northern Piedmont (64) and Piedmont (45) ecoregions; however, the Northern Piedmont (64) ecoregion stretches across the Potomac-Susquehanna boundary, which makes it difficult to assign it to the northern or southern tier of the Chesapeake drainage. The Central Appalachian (69) ecoregion, a minor component of the Appalachian Highland region in the Chesapeake drainage area, is found in three relatively small areas: two in the northern Susquehanna subregion and one in the southern Potomac subregion. The remaining physiographic provinces in the Chesapeake drainage are confined to the north or south. The Appalachian Plateau province, consisting primarily of the Northern Appalachian Plateau and Upland (NAPU, 60) and North Central Appalachian (NCA, 62) ecoregions, is confined to the north. The Piedmont (45) ecoregion lies wholly in the southern tier. The thin Blue Ridge province (Level III Ecoregion 66) parallels the eastern side of the Valley and Ridge province and is located almost entirely in the southern tier. The Coastal Plain province, consisting of the Southeastern Plains (SEP, 63) and Mid-Atlantic Coastal Plain (MAC, 65) ecoregions in the Chesapeake, is confined to the southeast.

To further explore north-south differences, we divided the large Ridge and Valley Level III Ecoregion into northern (67N) and southern (67S) components at the Susquehanna-Potomac boundary. We divided the Northern Piedmont (64) Level III Ecoregion into a northern component (64N) contained in the Susquehanna (0205) and Upper Chesapeake (0206) HUC4 subregions and a southern component (64S) contained in the Potomac (0207) and Lower Chesapeake-James (0208) HUC4 subregions. Finally, adequate numbers of undisturbed sites allowed us to split the small Central Appalachian (69) segments in the Susquehanna subregion into an upper group (69N) and the small segment in the Potomac into a lower group (69S).

We compared taxonomic variability between and within these twelve possible ecoregion-based groups, focusing individually on the Coastal Plain, the northern tier, and the southern tier of the Chesapeake Bay drainage to minimize noise. The Coastal Plain analysis compared the SEP (65) and MAC (63) Level III Ecoregions. The northern tier analysis consisted of the NAPU (60), NCA (62), Northern R&V (67N), Upper Northern Piedmont (64N), and Upper Central Appalachians (69N) groups. The southern tier analysis consisted of the Southern R&V (67S), Lower Northern Piedmont (64S), Lower Central Appalachians (69S), Piedmont (45), and Blue Ridge (66). P-values were again generated using the *vegan* function betadisper with a Bray-

Curtis Dissimilarity Index and used to compare beta diversity (variability) in undisturbed stream macroinvertebrate assemblages. We found differences between many ecoregions (low p-values), indicating the ecoregion classification approach can be an effective method of further “blocking” the data and reducing noise due to natural environmental factors.

The north-south difference in taxonomic variability was very strong between the two new Ridge and Valley (67) groups ($p < 0.001$). Taxonomic variability new Upper Northern Piedmont (64N) and Lower Northern Piedmont (64S) regions also differed strongly ($p = 0.015$). These results justify the proposed north-south division of these two Level III ecoregions at the Susquehanna border. Variability in the Coastal Plain’s MAC (63) Level III Ecoregion differed from all the other ecoregions in the southern tier ($p < 0.001$). Strong differences were expected in this relatively isolated Chesapeake region, which is mostly separated from the others by Chesapeake Bay. Taxonomic variability in the Coastal Plain’s SEP (65) Level III Ecoregion is in fact like that in the adjacent Piedmont (45) ecoregion ($p = 0.990$). However, the Coastal Plain ecoregions are bound on the west by the Atlantic Seaboard Fall-Line and their geologies, elevations, and stream gradients differ substantially from those in the Piedmont. These differences were expected to affect stream macroinvertebrate assemblages and SEP (65) was maintained as a distinct bioregion.

In the northern tier of the Chesapeake drainage (Figure G-5), taxonomic variability in the two relatively small Upper Central Appalachian (69N) areas on the western side of the Susquehanna HUC4 is weakly like variability in both NAPU (60) and NCA (62). Variability in the NAPU (60) and NCA (62) ecoregions is very similar ($p = 1.000$) and values of their dissimilarity indices (within-group variability) are close. NYDEC and PADEQ consider the assemblages in these two ecoregions to be indistinguishable (Chalfant 2009, Smith 2016). The new Northern R&V (67N) group cuts diagonally across the northern tier, separating the Upper Central Appalachian (69N), NCA (62), and NAPU (60) in the north and west from the new Upper Northern Piedmont (64N) group in the southeast corner of the tier. Taxonomic variability in the Northern R&V (67N) does not differ from the other groups. However, variability in the geographically separate Upper Northern Piedmont (64N) groups does differ from the three northern and western groups ($p < 0.05$). Within-group variability is highest in the Upper Northern Piedmont (64N) group. This probably reflects the area’s more complex landscape, which consists of four of the smaller Level IV Ecoregions: Triassic Lowlands (64a), Diabase and Conglomerate Uplands (64b), Piedmont Uplands (64c), and Piedmont Limestone/Dolomite Lowlands (64d).

In the southern tier of the Chesapeake drainage, within-group values of the Bray-Curtis Dissimilarity Index fall in a tight range between 0.62 and 0.69 (Figure G-6). There are no strong differences between the five groups; the relatively high index values suggest large amounts of with-in group variability. The small Lower Central Appalachian (69S) group splits off first in the dendrogram suggesting its composition is most different from the others. Despite comparable amounts of taxonomic variability, we thought differences in the geographies of the southern tier groups could influence assemblages. For example, elevations are higher, temperatures cooler, and stream gradients steeper in the Blue Ridge (66) compared to the neighboring Piedmont (45) region (Woods et al. 1999). The ridges in the Blue Ridge (66) are geographically separated from ridges in the Southern Ridge and Valley (67S) region by the Great Appalachian Valley. We kept the regions apart pending further comparisons.

Responses of Individual Biological Metrics to Stream Classes

Analysis of the stream macroinvertebrate assemblages by hydrologic unit, physiographic province, and ecoregion yielded the twelve possible bioregions listed in Table G-1. These bioregions are intended to address some of the inherent macroinvertebrate variability due to latitude, hydrologic connectivity, and large-scale, ecoregion-specific features such as climate, geology, and physiography. The stream gradient classes (very low, low, moderate, and steep) and range of elevations associated with ecoregions, however, may not be adequate to address local effects of slope and elevation on macroinvertebrate communities. Nor will ecoregion address the potential effect of Strahler stream order on specific taxa (e.g., Shredders).

Table G-1. The twelve bioregions tested in the RPART analysis presented in this appendix.

Code	Name (Abbreviation)	USEPA Level III Ecoregion components of bioregions
60	N. App. Plateau & Uplands (NAPU)	NAPU (60) (includes slivers of NHL (58) and EGLHL (83))
62	North Central Appalachians (NCA)	NCA (62)
69N	Upper Central Appalachians (UCA)[1]	CA (69) in Susquehanna HUC4
69S	Lower Central Appalachians (LCA)[1]	CA (69) in Potomac and Lower Chesapeake-James HUC4's
67N	Northern Ridge & Valley (NRV)	R&V (67) in Susquehanna HUC4
67S	Southern Ridge & Valley (SRV)[2]	R&V (67) in Potomac/Lower Chesapeake-James HUC4's
66	Blue Ridge (BLUE)	Blue Ridge (66)
65	Mid-Atlantic Coastal Plain (MAC)	MAC (63)
63	Southeastern Plain (SEP)	SEP (65)
45	Piedmont (PIED)	Piedmont (45)
64N	Upper Northern Piedmont (UNP)	Piedmont (64) in Susquehanna and Upper Ches HUC4's
64S	Lower Northern Piedmont (LNP)	Piedmont (64) in Potomac and Lower Ches HUC4's

[1] The upper and lower Central Appalachian regions in the Chesapeake Bay drainage were eventually combined into a single Central Appalachian (CA) bioregion to ensure adequate Reference sample numbers for the Chessie BIBI refinement.

[2] The Southern Ridge and Valley bioregion was eventually divided into two bioregions: Southern Great Valley (SGV) and Southern Ridge and Valley exclusive of SGV (SRV*). This served to minimize differences found in taxonomic assemblages in the two regions. See text for details.

A Recursive Partitioning and Regression Tree (RPART) analysis was performed on undisturbed assemblages in the two possible bioregions (Table G-1) to explore how well bioregion compared to elevation, slope, and Strahler stream order as an explanatory variable. Seventeen macroinvertebrate metrics representing different habits, feeding guilds, and taxa groups were analyzed with the following algorithm:

[biological metric] ~ bioregion + mean elevation + mean slope + Strahler order

Mean elevation and mean slope of the HUC12 catchments associated with each sampling location were extracted from the USEPA Recovery Screening Tool database (see Appendix H). The stream Strahler order of each sampling location was assigned by overlaying the sample location on the NHDPlus version 1 Medium resolution 100k scale (accessed 1/31/2004) stream layer in ArcGIS 10. QA/QC was performed by comparing the stream names of the NHDPlus version 1 stream to the stream name reported by the sample's data provider.

Table G-2 provides the RPART results for undisturbed sites in the twelve bioregions. Bioregion was the first or second variable to split the regression tree for all seventeen stream macroinvertebrate metrics, indicating its strong overall influence. The relative importance of bioregion as an explanatory variable ranged from 26% to 53% when compared against elevation, slope and Strahler order. Relative importance considers the variability explained throughout the RPART tree by each explanatory parameter. Bioregion's relative importance was more than 40% for burrowers, swimmers, filterers, gatherers, Chironomidae, and Trichoptera. It shared roughly equal importance with Strahler stream order and/or slope for Plecoptera and shredders, and with elevation for Ephemeroptera, Trichoptera, and clingers. Its importance was lower than elevation and/or slope for climbers, sprawlers, and non-insects. Classifying streams by bioregion will remove a substantial amount of noise in the data but local factors need to be accounted for when evaluating and scoring the various stream macroinvertebrate metrics.

A final analysis was performed to examine the potential influence of surficial karst geology on stream macroinvertebrate communities. Karst geology is a prominent feature of the Great Appalachian Valley which cuts across the Chesapeake Bay drainage area from northeast to southwest (Figure G-7). The Valley is relatively flat and has the lowest stream density and largest contiguous area of surface karst geology in the Chesapeake drainage. The Blue Ridge bioregion borders it on the east and a chain of mountain ridges, including North Mountain and Great North Mountain, borders it on the west. Again, only assemblages from undisturbed, 1st-4th order streams sampled in spring and early summer were considered. We focused on the Southern Ridge and Valley (67S) bioregion which has the largest proportion of karst geology. The Great Appalachian Valley intersects about a third of this bioregion. We separated sites in the Great Appalachian Valley (SGV) and the remaining Southern Ridge and Valley (67S*) bioregion, and identified sampling sites as karst or no-karst in each based on Weary and Doctor's (2014) Karst GIS layer. Karst regions were defined by areas with "Karst_Type" represented by the category "Carbonate rocks at or near the land surface in a humid climate;" additionally, "RockType1"and/or "RockType2" from the map layer had to represent limestone, dolomite, or marble. This 2 x 2 analysis was limited by the fact that only 5 undisturbed sites occur on no-karst geology in the Great Valley.

In the Southern Ridge and Valley region not included in the Great Appalachian Valley (67S*), comparisons between karst (n = 69) and no-karst (n = 225) surficial geology at undisturbed sites identified only four of the 17 biological metrics with substantial differences

($p<0.05$): climbers, Ephemeroptera, EPT, and filterers. This suggests stream macroinvertebrates were not primarily responsive to karst geology. We next compared karst sites in the Great Valley (SGV) and karst sites in the Southern Ridge and Valley (67S*) to determine if our biological metrics respond to the different topographies of these two karst landscapes. Ten of the 17 biological metrics showed significant differences (Table G-3). They included climbers and Ephemeroptera but not EPT or filterers. Topographic differences in the two karst landscapes were apparently more important than karst in differentiating the stream macroinvertebrate assemblages. This conclusion is somewhat confirmed by the absence of significant differences in the SGV karst versus no-karst comparisons, although these comparisons are tenuous due to the low number of no-karst sites. Non-karst factors would include stream order, elevation and/or slope.

We decided to subdivide the proposed Southern Ridge and Valley (67S) bioregion based on the biological differences evident in SGV and SRV (67S*). We recognize some differences may prove to be due to karst while others appear related to topography. Regardless of the cause(s), we feel the taxonomic differences were strong enough to warrant subdividing the region.

Distributions of the seventeen biological metrics in each of the now thirteen possible bioregions were compared and visually examined (Figure G-8 a-q) to confirm the relevance of bioregion in classifying stream macroinvertebrate assemblages. A fair amount of variability is evident in the metric distributions, which suggests macroinvertebrate populations in streams undisturbed by anthropogenic activity are responsive to multiple natural factors, some of which are accounted for in the bioregion assignments and others which are not. Strong differences are evident between the coastal and non-coastal bioregions. Differences between the northern and southern tiers of the non-coastal bioregions are not as strong but still apparent.

In one final decision, we decided to combine the proposed upper and lower Central Appalachian bioregions overlapping the Chesapeake Bay drainage area. Individually, the number of Reference sites in the upper (n=35) and lower (n=24) regions were uncomfortably small. Also, additional Bray-Curtis Dissimilarity Index results and the distributions of many biological metrics (Figure G-8) suggested there was minimal difference in the assemblages of the two regions.

A map and the full names and descriptions of the final twelve bioregions are given in the report (Figure 3 and Table 4).

*Table G-2. Recursive Partitioning and Regression Tree (RPART) analysis results identifying the most important environmental variables explaining variation in stream macroinvertebrate assemblages from undisturbed sites in the Chesapeake drainage area. Formula: [Biological Metric] ~ Bioregion + Watershed Slope + Watershed Elevation + Strahler Order, method = "anova." X, regression tree primary split; *, regression tree secondary split(s); %, variable importance determined by RPART program[1]. Variable(s) with the highest importance are indicated. See text for details.*

Biological Metric	Bioregion	Watershed mean slope	Watershed mean elevation	Strahler stream order	Most important explanatory variable relative to the other variables in the RPART formula
Habit					
%burrower	X, *		*		Bioregion 53%
%climber	*		X, *		Elevation 42%
%clinger	X, *		*		Bioregion 34%| Elevation 30%
%sprawler	*	*		X	Slope 36%
%swimmer	X	*			Bioregion 41%
Feeding					
%collector	X			*	Bioregion 31%
%filterer	X		*		Bioregion 45%
%gatherer	X, *, *				Bioregion 50%
%predator	X, *	*			Slope 35%| Elevation 34%
%scraper	X, *	*			Bioregion 38%
%shredder	*, *			X	Strahler 31%| Bioregion 27%
Taxonomic Composition					
%Chironomidae	X, *		*		Bioregion 44%
%Non-Insect	*	*	X		Elevation 39%
%Plecoptera	*, *			X	Strahler 31%| Slope 29%| Bioregion 26%
%Trichoptera	X		*		Bioregion 42%| Elevation 38%
%Ephemeroptera	*, *	X			Elevation 35%| Bioregion 34%
%EPT	X, *	*			Bioregion 37%

[1] The proportion of variability in the biological metric explained by the parameter. From Therneau *et al.* (2015): "A variable may appear in the tree many times, either as a primary or a surrogate variable. An overall measure of variable importance is the sum of the goodness of split measures for each split for which it was the primary variable, plus goodness (adjusted agreement) for all splits in which it was a surrogate. These are scaled to sum to 100 and the rounded values are shown, omitting any variable whose proportion is less than 1%."

Table G-3. Comparisons of seventeen macroinvertebrate metrics in karst and non-karst areas. The analysis focuses on the Southern Ridge and Valley (67S) bioregion which has the largest proportion of karst geology in the Chesapeake Bay drainage area. The Southern Ridge and Valley (67S) bioregion is divided into the Great Appalachian Valley (SGV) and the remaining Southern Ridge and Valley (SRV). **Bolded** p-values are less than 0.05.*

	Median Values				**Kruskal-Wallis test p-values**		
	SGV Karst (n=57)	SGV No Karst (n=5)	SRV* Karst (n=69)	SRV* No Karst (n=225)	Karst vs. no Karst, SRV*	Karst, SRV* vs SGV	Karst vs. no Karst, SGV
% Burrower	26.7	37.1	19.3	21.8	0.1452	**0.0139**	0.7960
% Chironomidae	19.6	33.6	13.6	13.6	0.9522	**0.0089**	0.6791
% Climber	0.9	1.7	0.0	0.0	**0.0447**	**0.0047**	0.4445
% Clinger	61.8	47.8	66.7	64.2	0.0648	**0.0184**	0.8564
% Collector	80.0	83.5	67.7	65.7	0.3101	**0.0000**	0.5097
% Ephemeroptera	34.7	20.7	24.8	34.8	**0.0006**	**0.0070**	0.0627
% EPT	57.5	41.0	59.8	70.5	**0.0007**	0.1026	0.5350
% Filterer	15.3	22.4	16.5	13.7	**0.0392**	0.1873	0.4081
% Gatherer	61.0	55.6	45.0	46.0	0.4565	**0.0000**	0.1337
% Non-Insect	2.8	1.0	1.4	0.9	0.0720	**0.0271**	0.4931
% Plecoptera	3.5	6.7	13.0	14.8	0.5584	**0.0000**	0.1383
% Predator	4.5	2.9	6.0	6.6	0.1456	0.0591	0.7960
% Scraper	10.9	9.3	9.6	11.9	0.1087	0.6485	0.6051
% Shredder	1.6	2.2	9.9	10.0	0.5848	**0.0000**	0.4363
% Sprawler	1.1	0.5	1.3	1.0	0.2227	0.9412	0.6035
% Swimmer	5.1	3.0	3.6	5.0	0.0609	0.1554	0.6790
% Trichoptera	11.0	8.6	9.9	10.3	0.6141	0.2375	0.7564

Subregion	POTOMAC (0207)	SUSQUEHANNA (0205)
LOWER CHESAPEAKE-JAMES (0208)	0.111	0.000
POTOMAC (0207)	-	0.000

Subregion	Sample Number (n)
LOWER CHESAPEAKE-JAMES (0208)	676
POTOMAC (0207)	702
SUSQUEHANNA (0205)	787

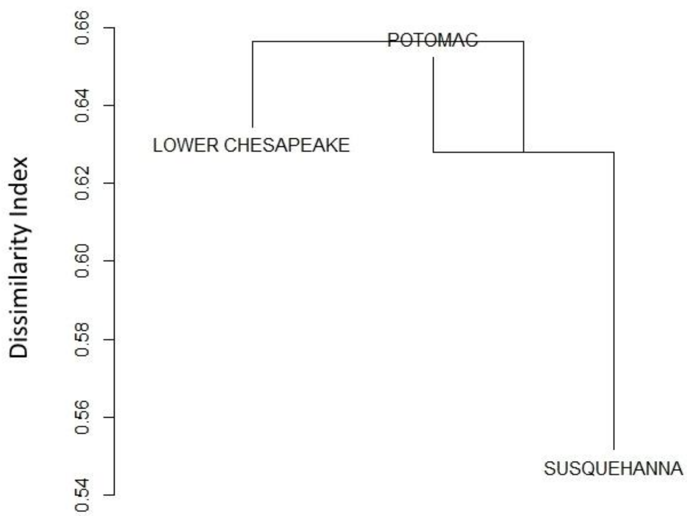


Figure G-2. Comparison of undisturbed stream macroinvertebrate communities in the Susquehanna, Potomac, and Lower Chesapeake-James HUC4 hydrologic subregions. The Bray-Curtis Dissimilarity Index was calculated for the macroinvertebrate assemblages in each spatial group (each HUC4 in this instance) and the mean within-group distances from each group's spatial median was compared pairwise using an ANOVA and a post hoc Tukey HSD test. The values in the first table are the p-values from the Tukey HSD test. High p-values indicate that variability in the assemblages is similar between spatial units but does not necessarily indicate that taxa composition is similar. The second table lists the sample sizes of each spatial unit. For the dendrogram, both within- and between-group dissimilarities are calculated with the Bray-Curtis Dissimilarity Index. The dendrogram is plotted using the means of both. The nodes indicate between-group mean dissimilarity and the leaves of the dendrogram indicate within-group dissimilarity. The reversed leaves indicate that within-group dissimilarity was greater than between-group dissimilarity. In the example above, dissimilarity between the Potomac and Susquehanna groups was 0.63 and dissimilarity within the Potomac group was somewhat higher, at 0.65.

Subregion	POTOMAC (0207)	SUSQUEHANNA (0205)	UPPER CHESAPEAKE (0206)
LOWER CHESAPEAKE-JAMES (0208)	0.187	0.000	0.062
POTOMAC (0207)	-	0.000	0.008
SUSQUEHANNA (0205)	-	-	0.319

Subregion	Sample Number (n)
LOWER CHESAPEAKE-JAMES (0208)	676
POTOMAC (0207)	702
SUSQUEHANNA (0205)	787
UPPER CHESAPEAKE (0206)	44

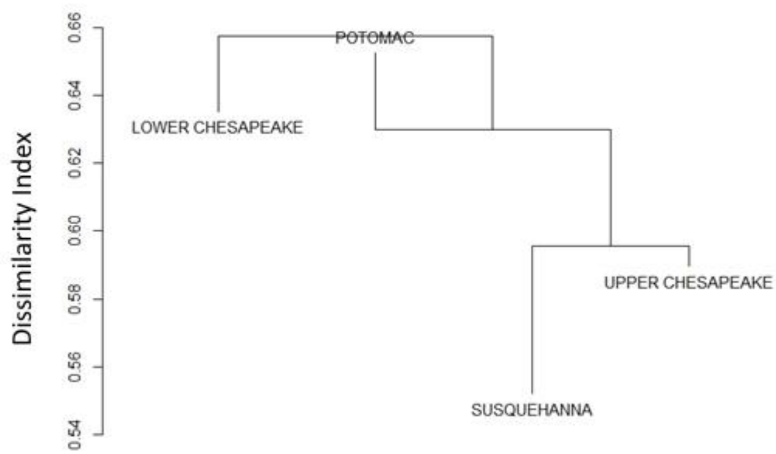


Figure G-3. Comparison of undisturbed stream macroinvertebrate communities in the Susquehanna, Potomac, and Lower Chesapeake-James HUC4 hydrologic subregions. See Figure G-2 heading for details.

Subregion (minus Coastal Plain ecoregions)	POTOMAC (0207)	SUSQUEHANNA (0205)	UPPER CHESAPEAKE (0206)
LOWER CHESAPEAKE-JAMES (0208)	0.067	0.000	0.022
POTOMAC (0207)	-	0.000	0.002
SUSQUEHANNA (0205)	-	-	0.977

Subregion	Sample Size (n)
LOWER CHESAPEAKE-JAMES (0208)	649
POTOMAC (0207)	694
SUSQUEHANNA (0205)	787
UPPER CHESAPEAKE (0206)	29

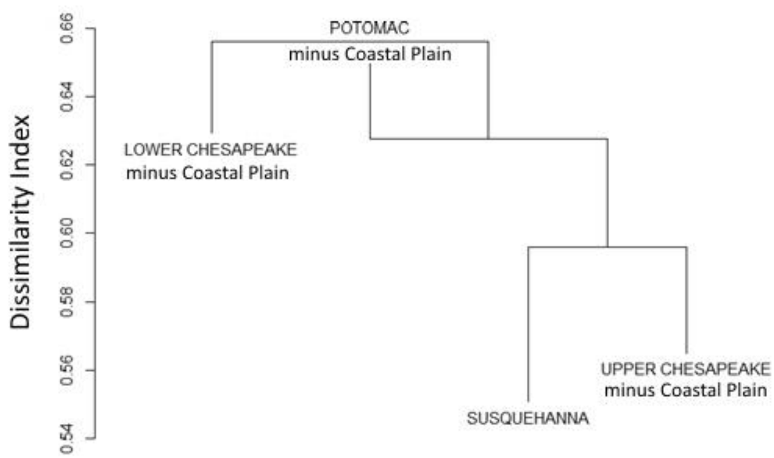


Figure G-4. Comparison of undisturbed stream macroinvertebrate communities in the Susquehanna, Potomac, Upper Chesapeake, and Lower Chesapeake-James HUC4 hydrologic subregions with those portions in the Coastal Plain physiographic province removed. See Figure G-2 heading for details.

Level III Ecoregion	North Central Appalachian (62)	Upper Northern Piedmont (64N)	Northern Ridge & Valley (67N)	Upper Central Appalachian (69N)
Northern Appalachian Plateau and Uplands (60)	1.000	0.045	0.488	0.475
North Central Appalachian (62)	-	0.020	0.322	0.360
Upper Northern Piedmont (64N)	-	-	0.501	0.005
Northern Ridge & Valley (67N)	-	-	-	0.060

Level III Ecoregion	Sample Number (n)
Northern Appalachian Plateau and Uplands (60)	138
North Central Appalachian (62)	389
Upper Northern Piedmont (64N)	71
Northern Ridge & Valley (67N)	183
Upper Central Appalachian (69N)	35

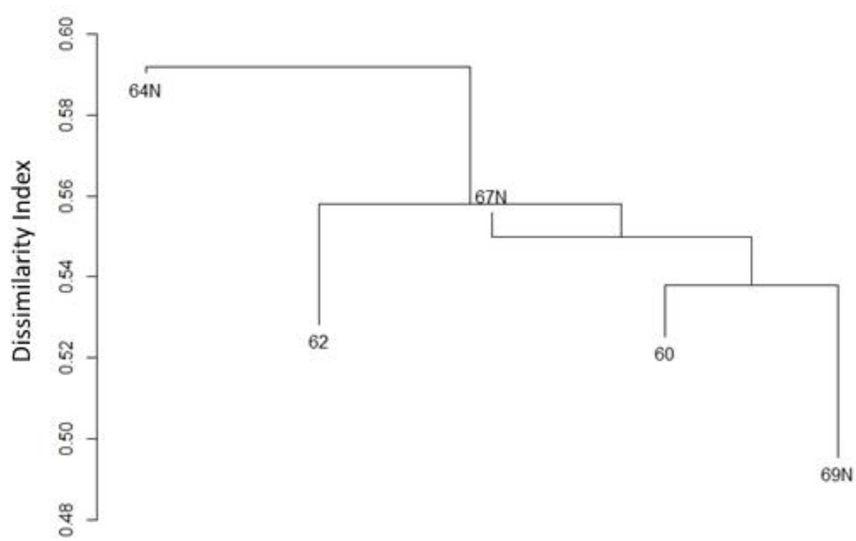


Figure G-5. Comparison of undisturbed stream macroinvertebrate communities in Level III Ecoregions of the Chesapeake drainage northern tier. See Figure G-2 heading for details.

Level III Ecoregions	Lower Northern Piedmont (64S)	Blue Ridge (66)	Southern Ridge and Valley (67S)	Lower Central Appalachians (69S)
Piedmont (45)	0.968	0.517	1.000	0.984 *
Lower Northern Piedmont (64S)	-	0.733	0.956	0.913 *
Blue Ridge (66)	-	-	0.359	0.655
Southern Ridge and Valley (67S)	-	-	-	0.968

Level III Ecoregion	Sample Number (n)
Piedmont (45)	149
Lower Northern Piedmont (64S)	370
Blue Ridge (66)	153
Southern Ridge and Valley (67S)	647
Lower Central Appalachians (69S)	24

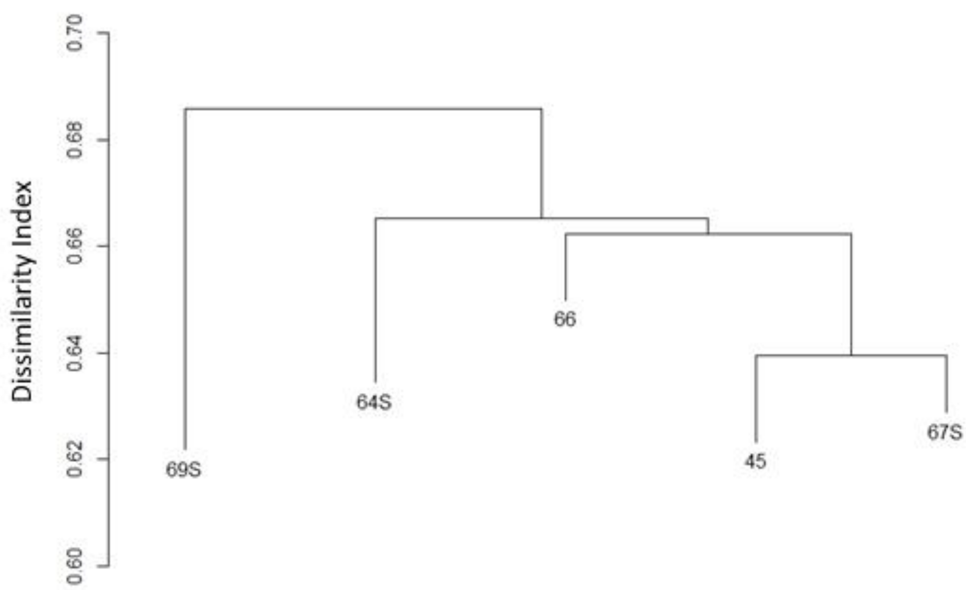


*Figure G-6. Comparison of undisturbed stream macroinvertebrate communities in Level III Ecoregions of the Chesapeake drainage southern tier. See Figure G-2 heading for details. **

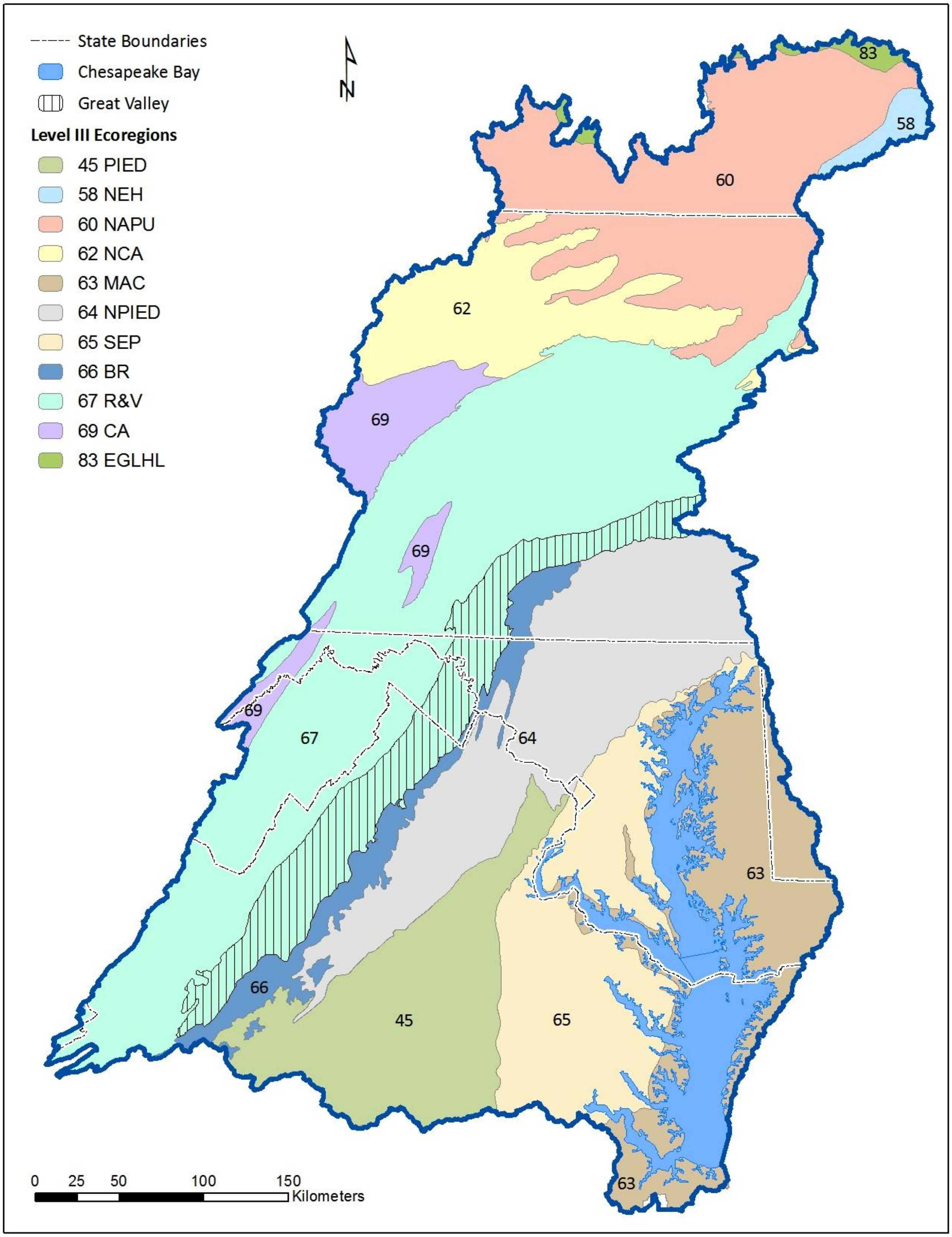


Figure G-7. Extent of the Great Appalachian Valley in the Chesapeake Bay drainage area.

a)

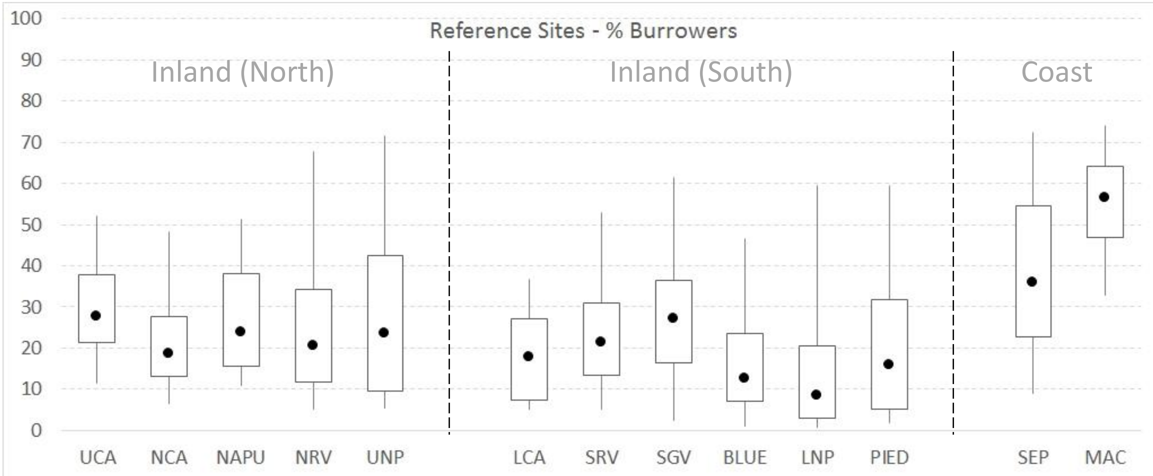


Figure G-8 a-q. Distributions of the values of seventeen macroinvertebrate metrics in undisturbed (Reference) conditions across the thirteen possible bioregions identified in this appendix. In each graph, the northern tier bioregions are grouped on the left, the southern bioregions grouped in the middle, and the coastal bioregions grouped on the right. See Table G-1 for bioregion descriptions. Note that SRV in these graphs is equivalent to 67S, or that portion of the Southern Ridge and Valley that does not include the Great Appalachian Valley. Whiskers of the distributions indicate the 5%ile and 95%ile.*

b)

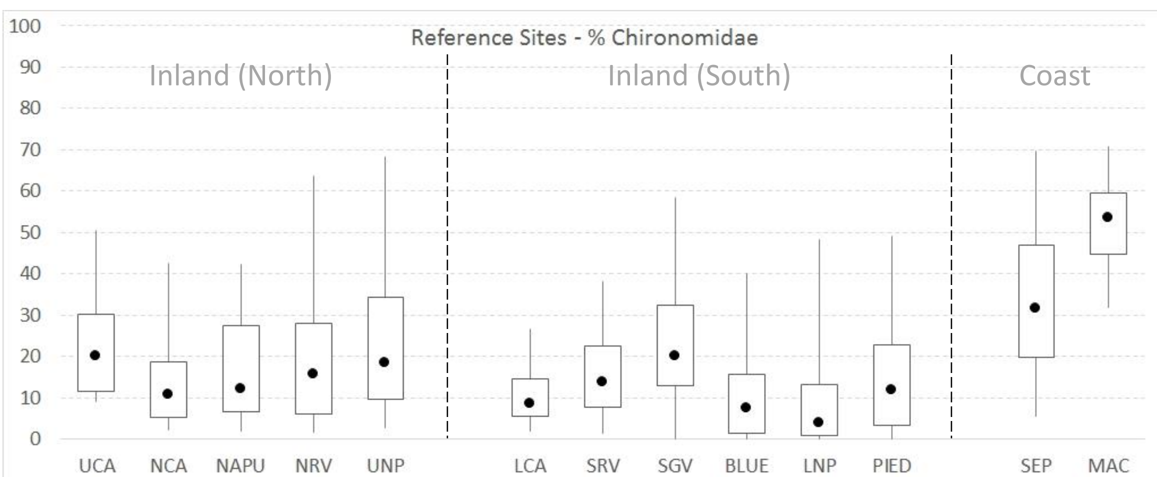


Figure G-8 a-q. Continued…

c)

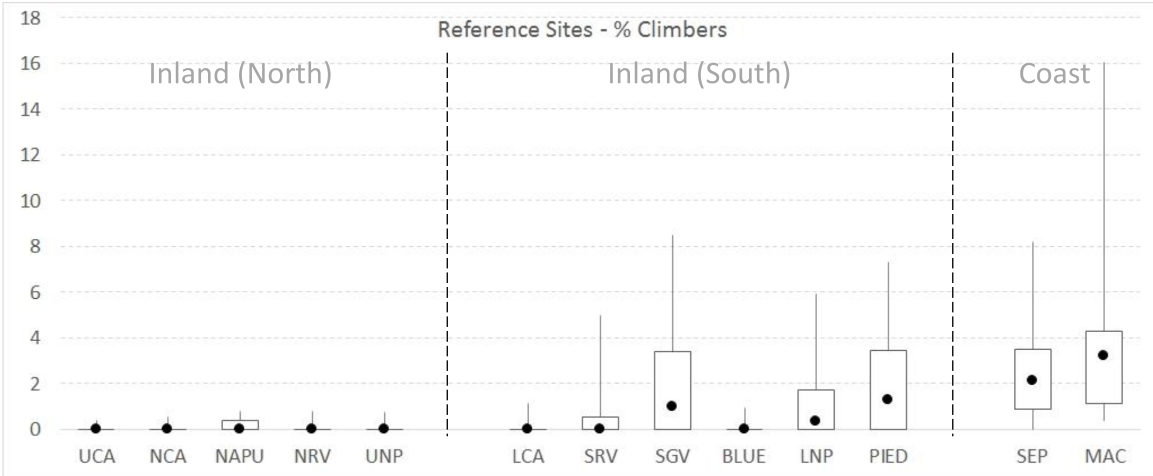


Figure G-8 a-q. Continued…

d)

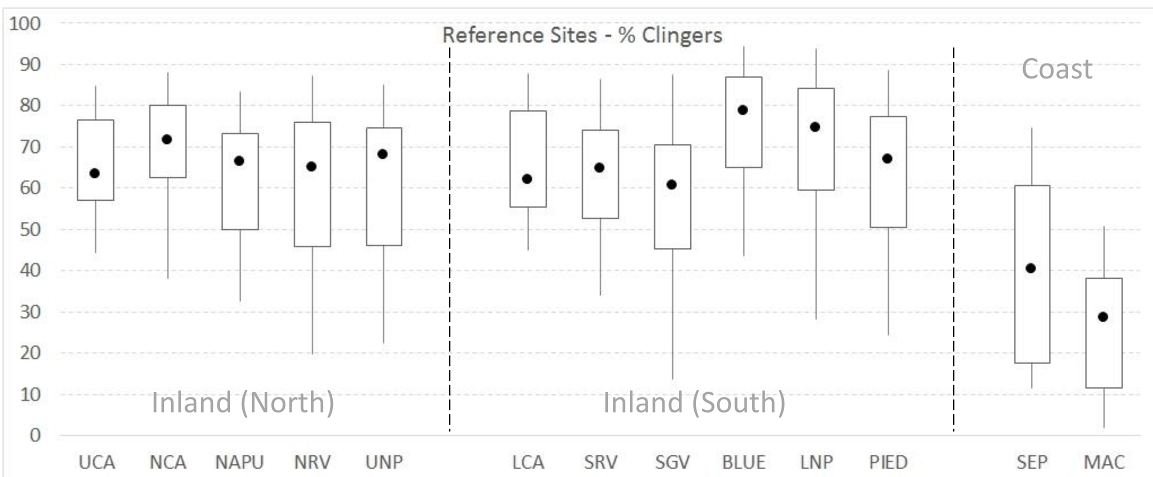


Figure G-8 a-q. Continued…

e)

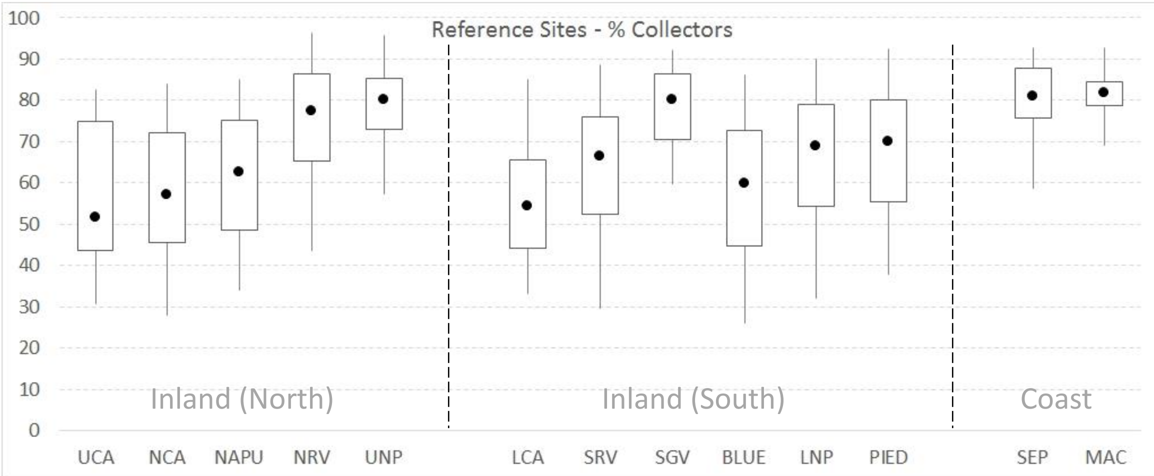


Figure G-8 a-q. Continued…

f)

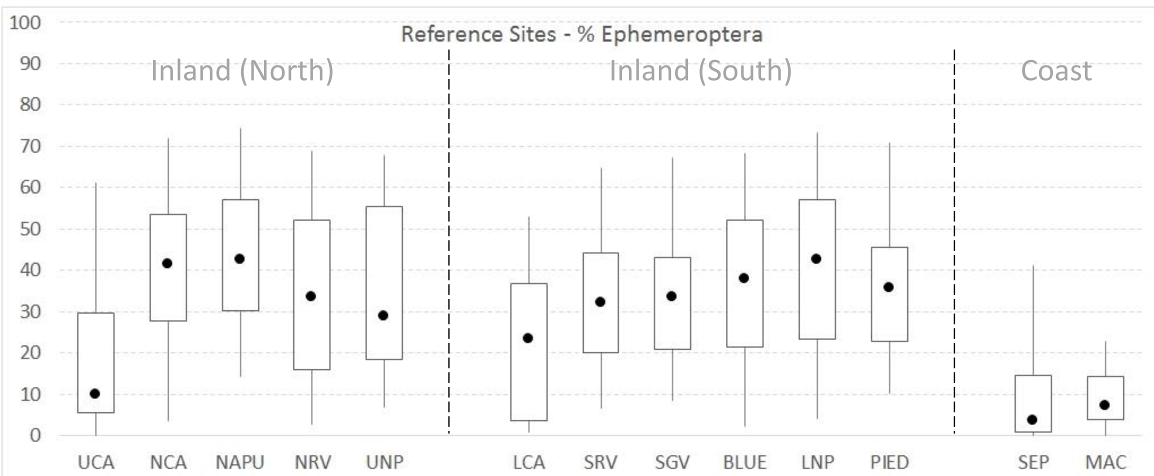


Figure G-8 a-q. Continued…

g)

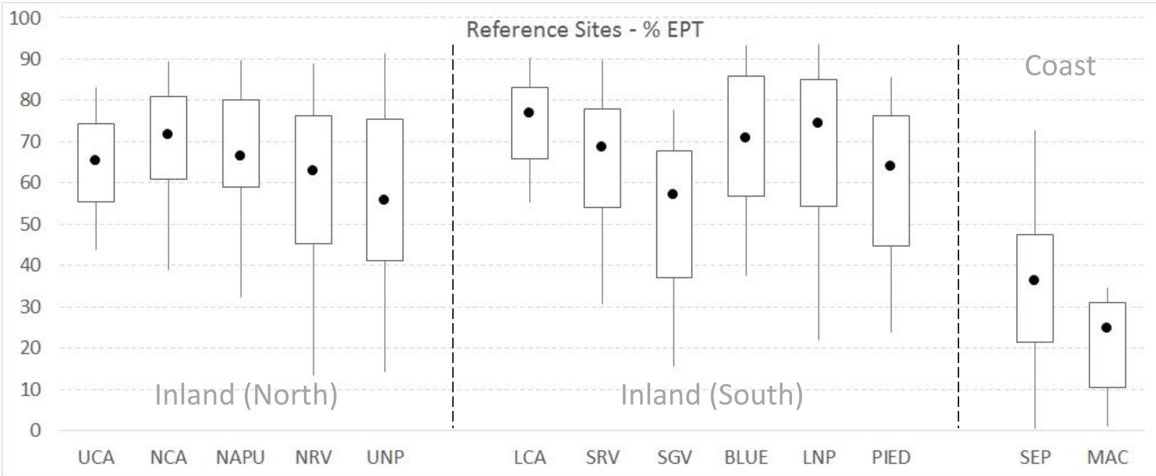


Figure G-8 a-q. Continued…

h)

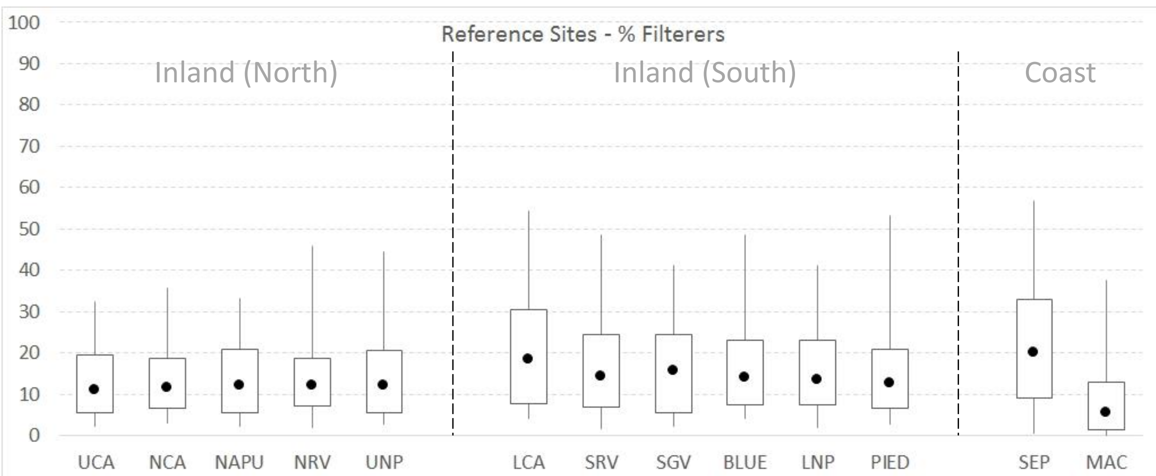


Figure G-8 a-q. Continued…

i)

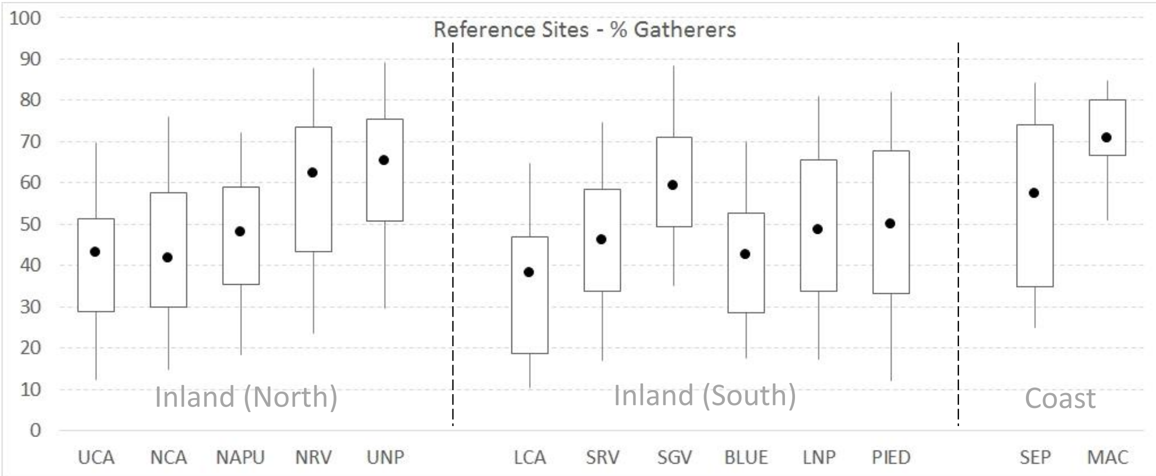


Figure G-8 a-q. Continued…

j)

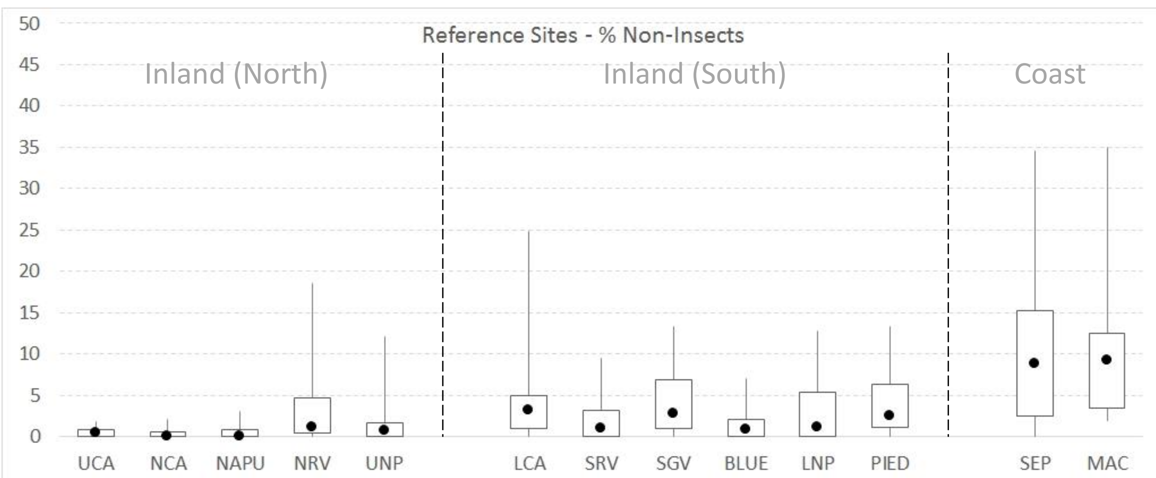


Figure G-8 a-q. Continued…

k)

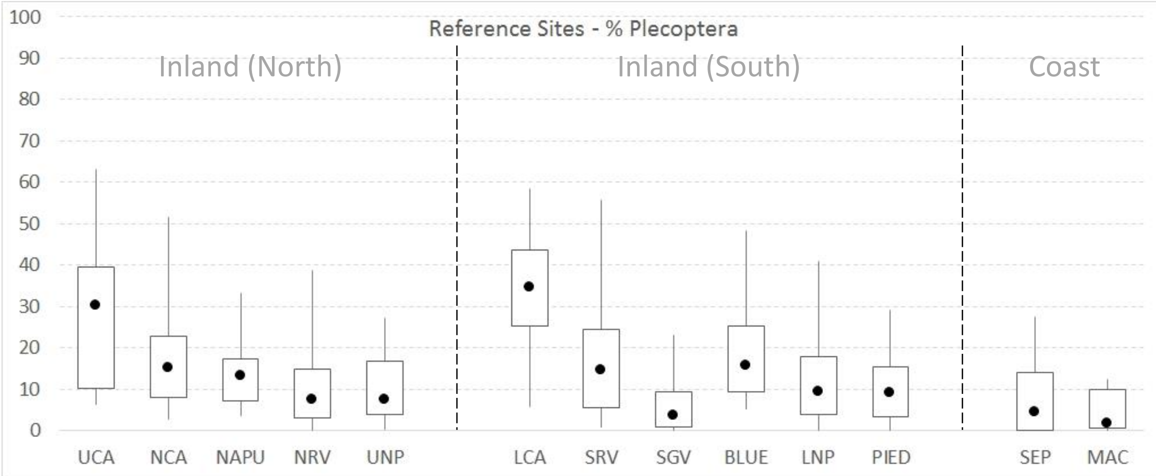


Figure G-8 a-q. Continued…

l)

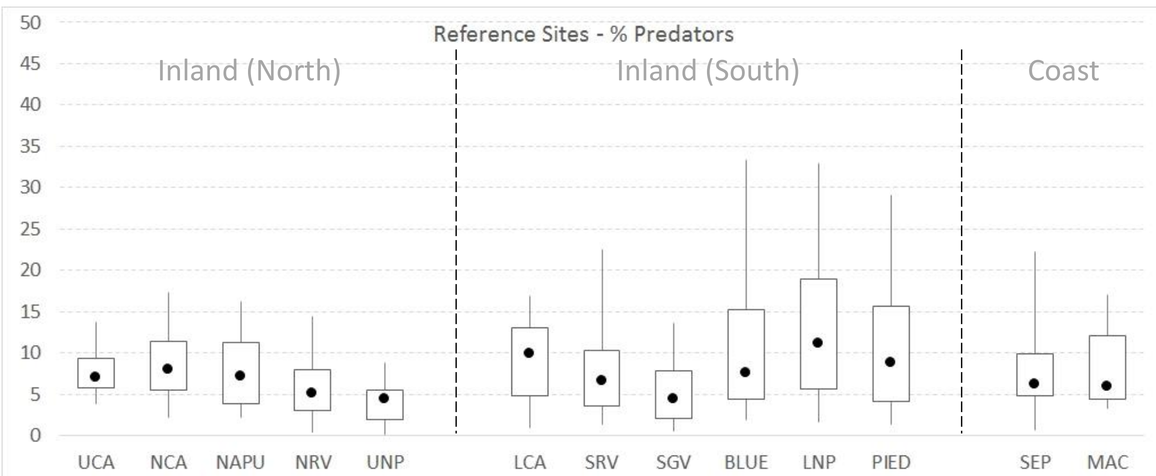


Figure G-8 a-q. Continued…

m)

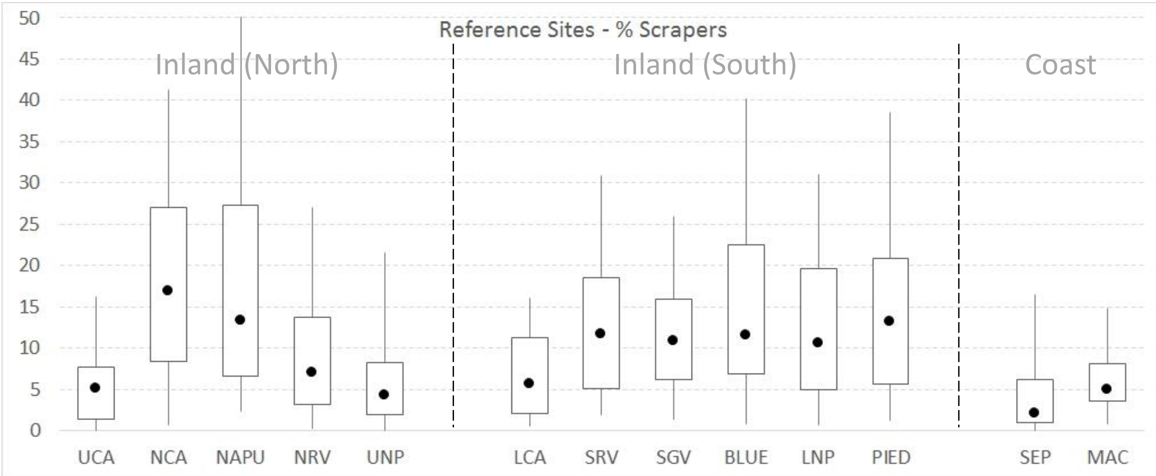


Figure G-8 a-q. Continued…

n)

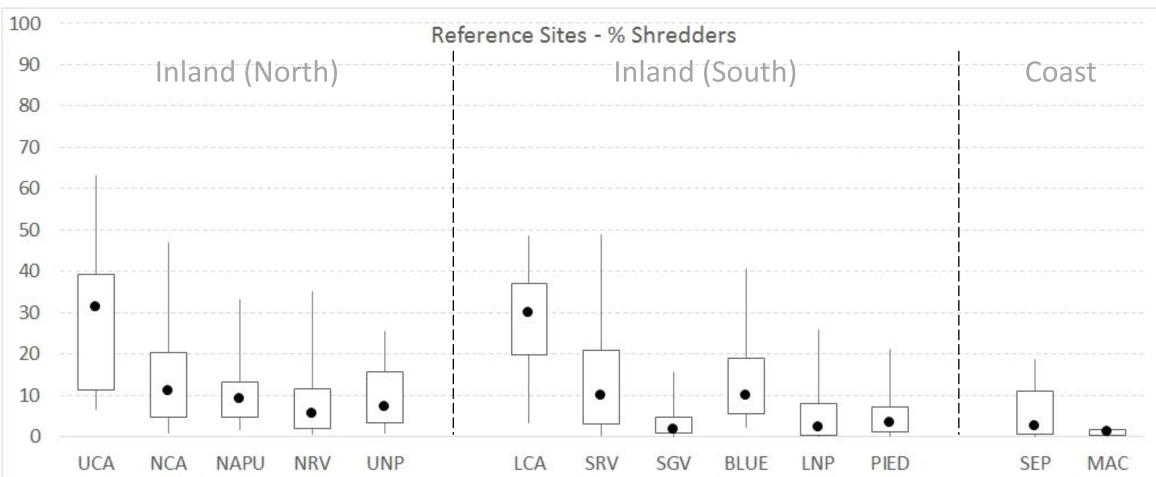


Figure G-8 a-q. Continued…

o)

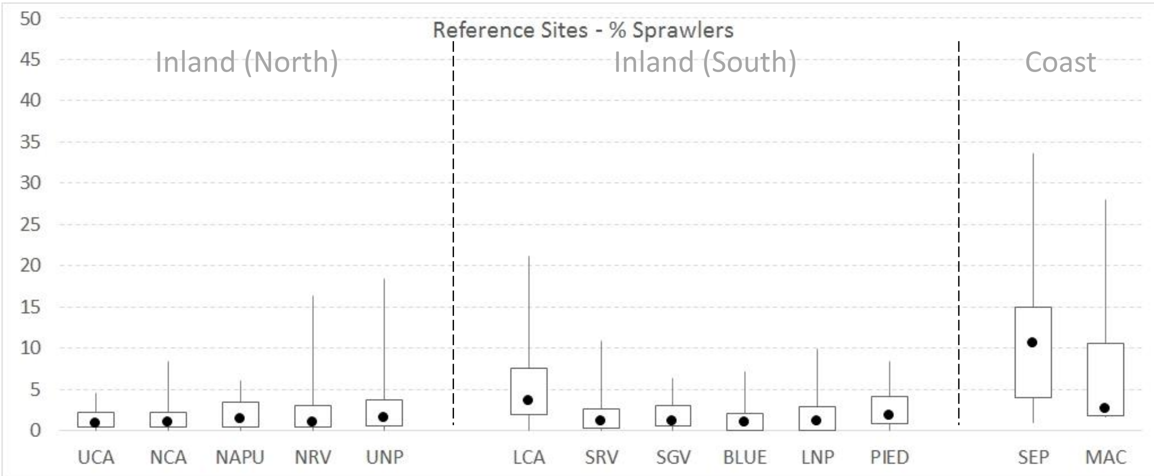


Figure G-8 a-q. Continued…

p)

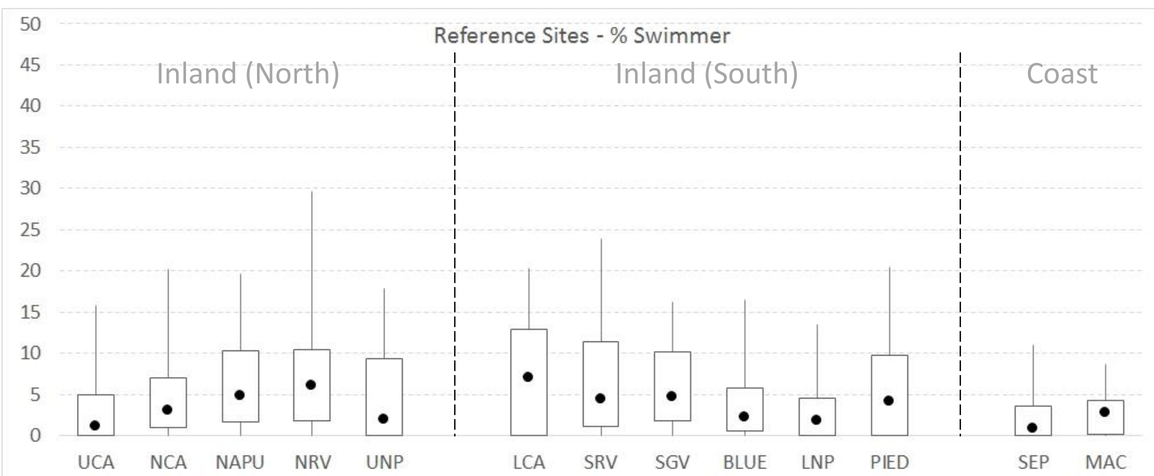


Figure G-8 a-q. Continued…

q)

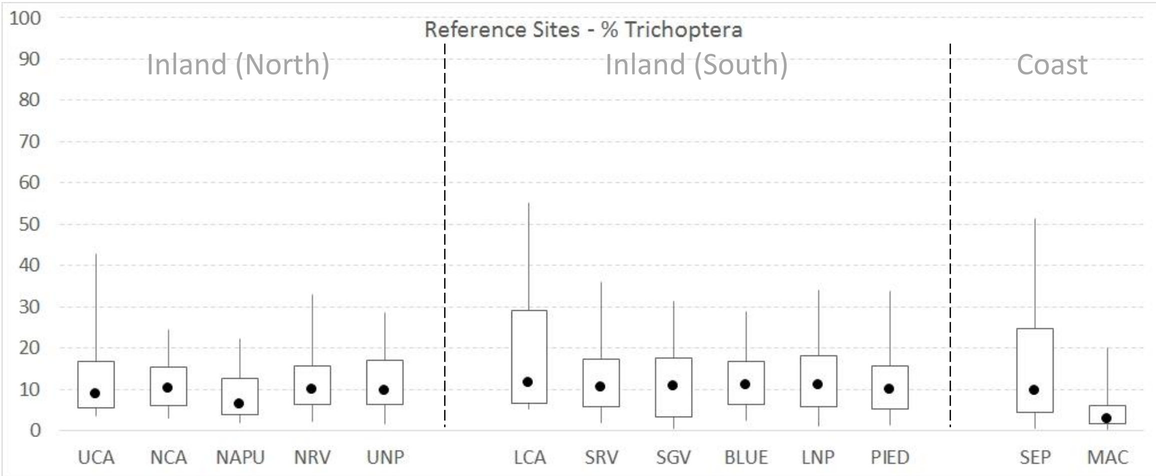


Figure G-8 a-q. Continued.

Appendix H: HUC12 Watershed Characteristics in Bioregions

We obtained from Douglas Norton (US EPA) the Excel spreadsheets underlying EPA's 2014 release of the Recovery Potential Screening Tool for the states of New York, Pennsylvania, Delaware, Maryland, West Virginia, and Virginia, and the District of Columbia. We extracted the HUC12 watersheds (n = 1971) belonging to the four 4-digit hydrologic units in the Chesapeake Bay basin (0205, 0206, 0207, 0208). In ArcGIS, we overlaid ICPRB Bioregions on these HUC12s and identified the dominant bioregion representing each HUC12. This allowed us to examine the values of some key ecological and stressor indicators (Table H-1) by bioregion. Distributions of the indicator values in each of the twelve bioregions are shown in Figures H-1 to H-5. To establish relative levels for each of the indicators, we calculated the 33^{rd} and 67^{th} percentiles of all HUC12 watershed values. These are indicated on the right in Figures H-1 to H-5, and summarized in Table H-2.

For the purpose of area-weighting the index scores for the bioregion and region versions of the Chessie BIBI, we also identified each unique HUC12-bioregion unit and calculated its area. Table H-3 lists the HUC12-bioregion units and their areas.

Table H-1. EPA descriptions of the indicators shown in Figures H-1 to H-5.

HUC12 Watershed Indicator	Indicator Description
Mean Watershed Slope	Mean value of slopes in watershed
Standard Deviation of Watershed Slopes	Standard deviation of slope values in watershed
Mean Watershed Elevation	Mean value of elevations in watershed
Range of Watershed Elevations	Range of elevations in watershed
% Forest	% of HUC12 with forest cover (2006 National Land Cover Dataset version 1; Land classes 41, 42, 43)
% Pasture/Hay Agriculture	% of HUC12 with pasture/hay cover (2006 National Land Cover Dataset version 1)
% Cultivated Crops Agriculture	% of HUC12 with cultivated crops cover (2006 National Land Cover Dataset version 1)
% Urban	% of HUC12 with urban cover (2006 National Land Cover Dataset version 1; Land classes 21, 22, 23, 24)
% Hydrologically Connected Zone (HCZ)	% of HUC12 that is in the Hydrologically Connected Zone
% Wetland	% of HUC12 with wetland cover (2006 National Land Cover Dataset version 1; Land classes 90, 95)
%Agriculture in HCZ	% of HUC12 with agricultural (crops + hay/pasture) cover in the Hydrologically Connected Zone (2006 National Land Cover Dataset version 1; Land classes 81, 82)
Agricultural Irrigation	Estimated millions of gallons of water used daily for agricultural irrigation for each HUC12. Estimates include self-supplied surface and groundwater, as well as water supplied by irrigation water providers, which may include governments, companies, or other organizations.
% Impervious Cover (2006)	Mean value of percent impervious (NLCD06 Impervious) in watershed
% Streamlength Contiguous to Impervious Cover (2006) $\geq$ 5%	Percentage of WS stream length flowing through (contiguous to IC), $\geq$ 5% IC; (NLCD2006 imperviousness) Sum of ISstr_5_14 + ISstr_15_24 + ISstr_25 [ISstr5p]
Road Density (2003)	Mean Road Density (mi / sqmi) in watershed
Number of Roads (2010) Crossings 1^{st} – 3^{rd} Order Streams	Number of Roads crossing 1st to 3rd order streams in watershed
Total Nitrogen Deposition	Estimated total annual deposition of nitrogen within each

HUC12 Watershed Indicator	Indicator Description
	HUC12 in kilograms per hectare. Includes both dry and wet deposition of oxidized and reduced nitrogen.
Synthetic Nitrogen Fertilizer Application	The mean rate of synthetic nitrogen fertilizer application to agricultural lands within each HUC12 in kg N/ha/yr.
% Streamlength 303-d Listed for Metals	Percent of stream features in HUC12 listed as impaired due to metals and requiring a TMDL under Section 303(d) of the Clean Water Act. Calculated as length of 303(d) listed metals impaired streams (STREAMLGTH_303D_METALS) divided by total stream length (STREAMLGTH_NHD + STREAMLGTH_303D_CUSTOM).
% Streamlength 303-d Listed for Sediments	Percent of stream features in HUC12 listed as impaired due to sediment and requiring a TMDL under Section 303(d) of the Clean Water Act. Calculated as length of 303(d) listed sediment impaired streams (STREAMLGTH_303D_SEDIMENT) divided by total stream length (STREAMLGTH_NHD + STREAMLGTH_303D_CUSTOM).

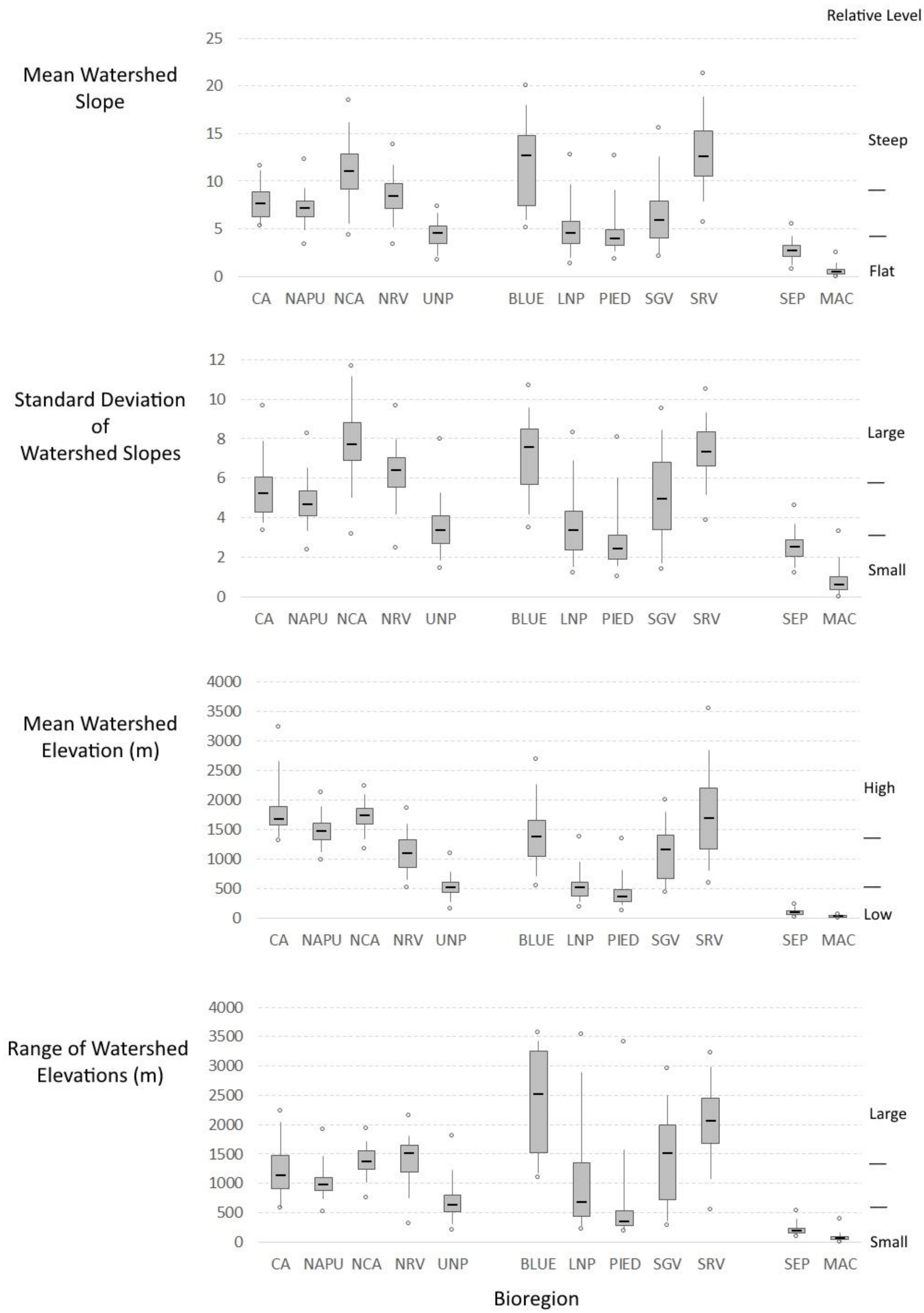


Figure H-1. Slopes and elevations in Chesapeake Bay HUC12 watersheds, by bioregion.

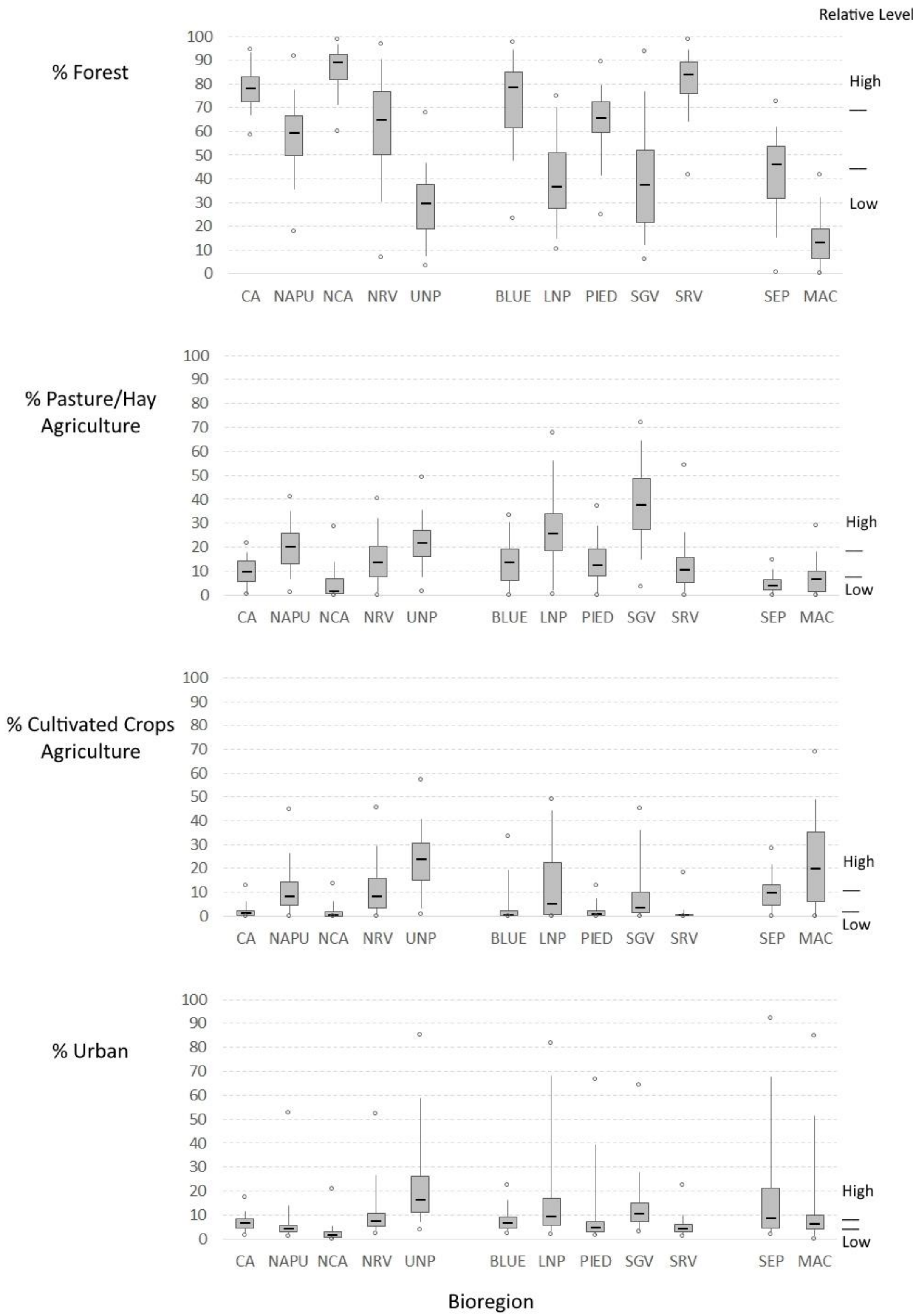


Figure H-2. Major land covers in Chesapeake Bay HUC12 watersheds, by bioregion.

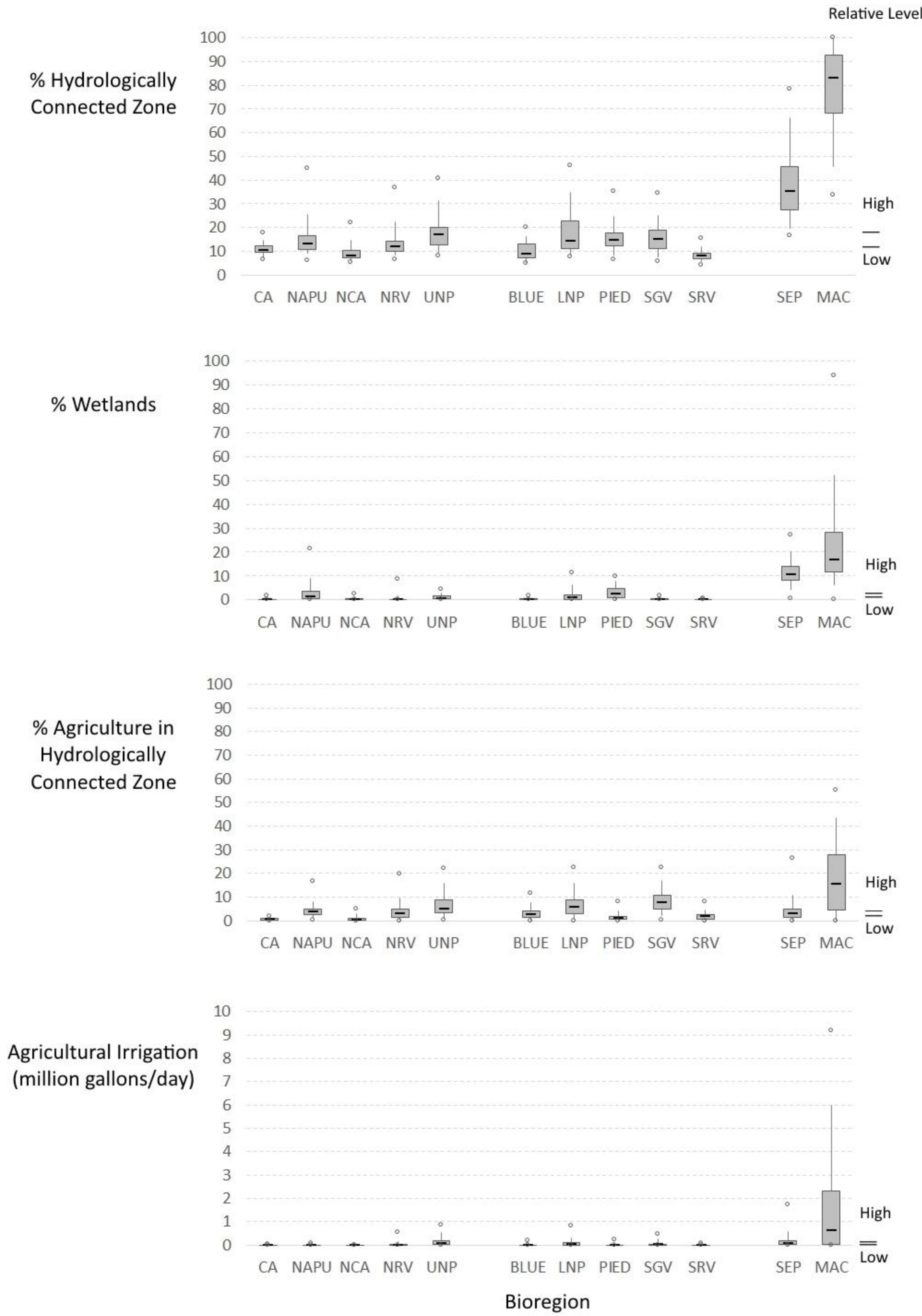


Figure H-3. Hydrologically connected zones, wetlands, and agricultural irrigation in Chesapeake Bay HUC12 watersheds, by bioregion.

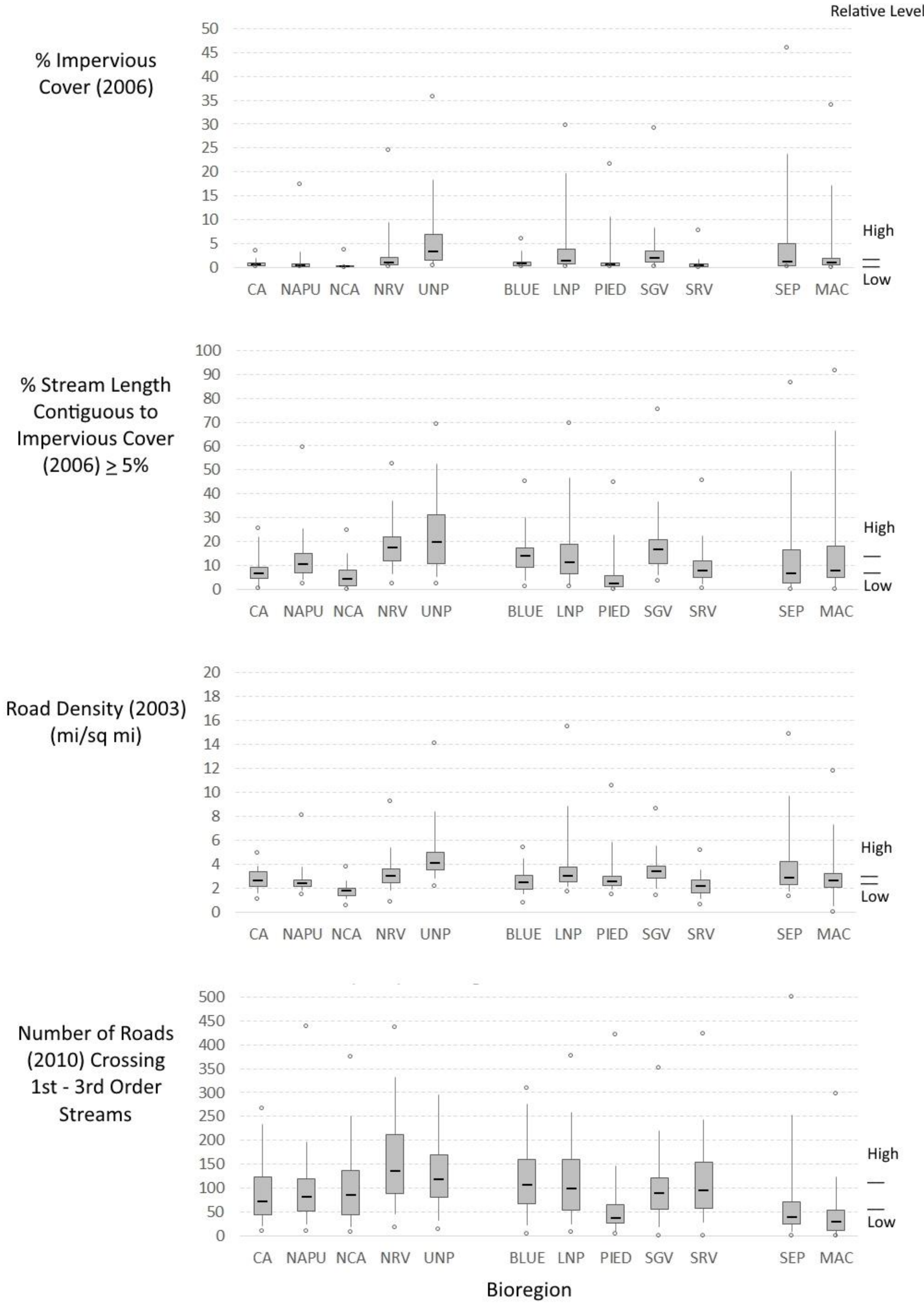


Figure H-4. % Impervious cover and roads in Chesapeake Bay HUC12 watershed, by bioregion.

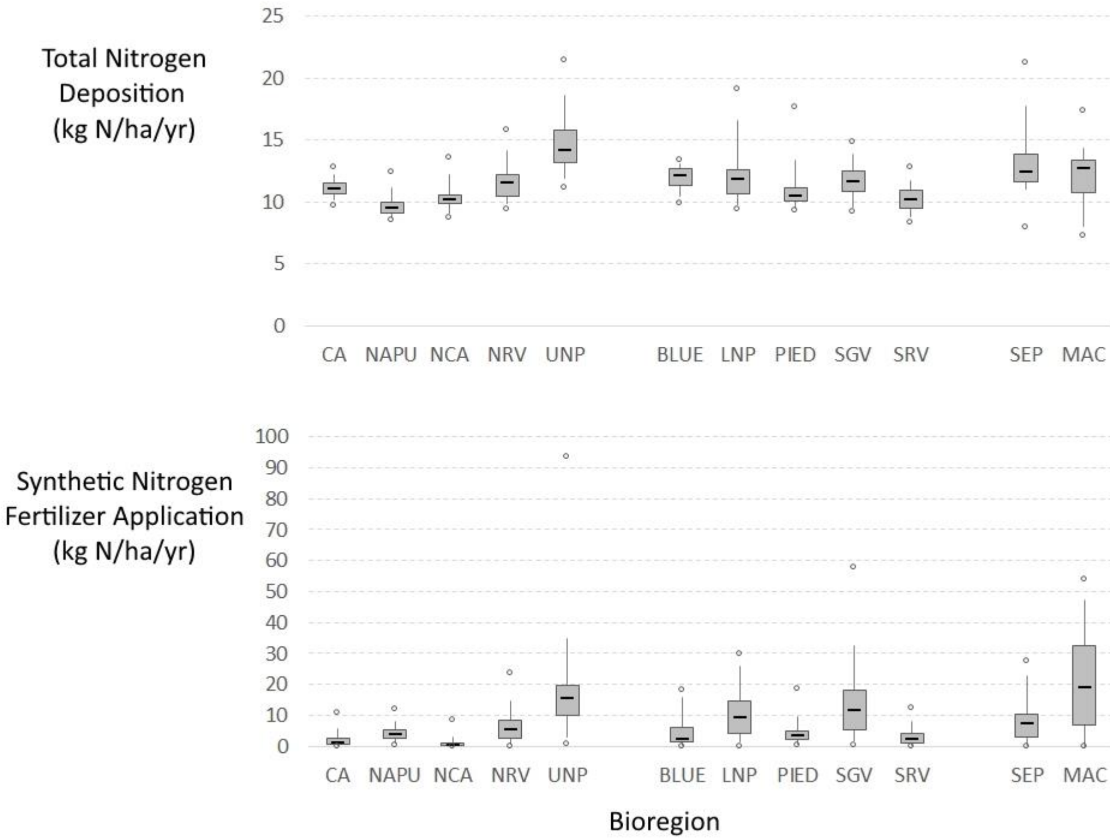


Figure H-5. Total nitrogen deposition and fertilizer application in Chesapeake Bay HUC12 watershed, by bioregion.

Table H-2. Relative levels of topographic features and land/water uses in each bioregion's HUC12 watersheds, and the bioregion's total percentages of streamlengths 303d listed for metals, sediments, or pathogens. See text for details; Figures H-1 to H-5 for relative levels.

	Northern Inlands					**Southern Inlands**					**Coastal**	
	CA	NAPU	NCA	NRV	UNP	BLUE	LNP	PIED	SGV	SRV	SEP	MAC
<u>Topographic Features</u>												
Mean of slopes			Steep	Steep		Steep		Flat		Steep	Flat	Flat
Standard deviation of slopes			Large	Large		Large		Small		Large	Small	Small
Mean of elevations (m)	High	High	High			High	Low	Low		High	Low	Low
Range of elevations (m)			Large	Large		Large		Small		Large	Small	Small
<u>Land and Water Uses</u>												
% Forest (2006)	High		High		Low	High	Low		Low	High		Low
% Pasture/hay (2006)		High	Low		High		High		High		Low	Low
% Cultivated crops (2006)	Low		Low		High	Low		Low		Low		High
% Urban (2006)		Low	Low		High		High		High	Low	High	
% Imperviousness (2006)		Low	Low		High		High		High	Low		
% Streamlength contiguous to 2006 impervious cover ≥ 5%	Low		Low	High	High			Low	High		Low	
Mean road density (2003)			Low		High				High	Low		
Number of roads (2010) crossing 1st-3rd order streams				High	High			Low			Low	Low
% Hydrologically connected zone	Low		Low			Low				Low	High	High
% Wetlands (2006)	Low			Low		Low		High	Low	Low	High	High
% Agriculture (2006) in hydrologically connected zone	Low		Low		High		High	Low	High			High
Agricultural irrigation	Low	Low	Low		High	Low		Low		Low	High	High
Total nitrogen deposition		Low	Low		High	High				Low	High	High
Synthetic N fertilizer application	Low		Low		High	Low	High		High	Low		High

	Northern Inlands					Southern Inlands					Coastal	
	CA	NAPU	NCA	NRV	UNP	BLUE	LNP	PIED	SGV	SRV	SEP	MAC
<u>% Streamlength 303d Listed</u>												
Metals	11.9%	0.0%	3.7%	2.1%	1.7%	0.0%	0.0%	0.1%	0.0%	0.5%	1.1%	0.2%
Sediments	2.0%	0.3%	1.0%	6.7%	7.3%	1.3%	2.3%	0.0%	3.5%	1.3%	5.0%	8.3%
Pathogens	0.7%	0.1%	0.0%	0.0%	0.1%	4.2%	2.1%	3.9%	9.7%	6.2%	8.0%	11.1%

Table H-3. A list of all the unique HUC12-bioregion units and their areas in the Chesapeake watershed.

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020501010101	020501010101_NAPU	NAPU	58.569
020501010102	020501010102_NAPU	NAPU	106.714
020501010103	020501010103_NAPU	NAPU	100.551
020501010201	020501010201_NAPU	NAPU	58.574
020501010202	020501010202_NAPU	NAPU	66.28
020501010203	020501010203_NAPU	NAPU	53.02
020501010204	020501010204_NAPU	NAPU	59.508
020501010301	020501010301_NAPU	NAPU	102.204
020501010302	020501010302_NAPU	NAPU	85.528
020501010303	020501010303_NAPU	NAPU	61.554
020501010304	020501010304_NAPU	NAPU	60.858
020501010401	020501010401_NAPU	NAPU	41.084
020501010402	020501010402_NAPU	NAPU	91.379
020501010403	020501010403_NAPU	NAPU	98.595
020501010404	020501010404_NAPU	NAPU	72.642
020501010405	020501010405_NAPU	NAPU	113.435
020501010406	020501010406_NAPU	NAPU	39.297
020501010501	020501010501_NAPU	NAPU	50.963
020501010502	020501010502_NAPU	NAPU	76.962
020501010503	020501010503_NAPU	NAPU	69.976
020501010504	020501010504_NAPU	NAPU	84.732
020501010601	020501010601_NAPU	NAPU	41.714
020501010602	020501010602_NAPU	NAPU	50.345
020501010603	020501010603_NAPU	NAPU	108.447
020501010604	020501010604_NAPU	NAPU	122.544
020501010605	020501010605_NAPU	NAPU	110.375
020501010606	020501010606_NAPU	NAPU	62.039
020501010701	020501010701_NAPU	NAPU	54.819
020501010702	020501010702_NAPU	NAPU	86.516
020501010703	020501010703_NAPU	NAPU	99.123
020501010801	020501010801_NAPU	NAPU	87.857
020501010802	020501010802_NAPU	NAPU	114.214
020501010803	020501010803_NAPU	NAPU	135.088
020501010901	020501010901_NAPU	NAPU	40.409
020501010902	020501010902_NAPU	NAPU	63.495
020501010903	020501010903_NAPU	NAPU	109.332
020501010904	020501010904_NAPU	NAPU	86.134
020501010905	020501010905_NAPU	NAPU	96.086
020501010906	020501010906_NAPU	NAPU	58.927
020501010907	020501010907_NAPU	NAPU	67.401
020501010908	020501010908_NAPU	NAPU	135.983
020501010909	020501010909_NAPU	NAPU	58.19
020501010910	020501010910_NAPU	NAPU	159.917
020501011001	020501011001_NAPU	NAPU	53.655
020501011002	020501011002_NAPU	NAPU	64.712
020501011003	020501011003_NAPU	NAPU	44.415
020501011004	020501011004_NAPU	NAPU	70.293
020501011005	020501011005_NAPU	NAPU	50.303
020501011101	020501011101_NAPU	NAPU	52.796
020501011102	020501011102_NAPU	NAPU	83.738
020501011103	020501011103_NAPU	NAPU	66.874
020501011104	020501011104_NAPU	NAPU	77.116
020501011105	020501011105_NAPU	NAPU	51.488
020501011201	020501011201_NAPU	NAPU	103.715
020501011202	020501011202_NAPU	NAPU	108.79
020501011203	020501011203_NAPU	NAPU	126.256
020501011204	020501011204_NAPU	NAPU	64.959
020501011205	020501011205_NAPU	NAPU	80.469
020501011206	020501011206_NAPU	NAPU	92.014
020501011207	020501011207_NAPU	NAPU	70.736
020501011208	020501011208_NAPU	NAPU	97.683
020501011209	020501011209_NAPU	NAPU	72.944

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020501011301	020501011301_NAPU	NAPU	48.118
020501011302	020501011302_NAPU	NAPU	53.65
020501011303	020501011303_NAPU	NAPU	32.561
020501011304	020501011304_NAPU	NAPU	61.915
020501011305	020501011305_NAPU	NAPU	89.105
020501011306	020501011306_NAPU	NAPU	102.496
020501011307	020501011307_NAPU	NAPU	42.539
020501011308	020501011308_NAPU	NAPU	113.905
020501011309	020501011309_NAPU	NAPU	67.951
020501011310	020501011310_NAPU	NAPU	126.204
020501011311	020501011311_NAPU	NAPU	79.29
020501011312	020501011312_NAPU	NAPU	72.158
020501011313	020501011313_NAPU	NAPU	98.683
020501020101	020501020101_NAPU	NAPU	99.095
020501020102	020501020102_NAPU	NAPU	118.185
020501020103	020501020103_NAPU	NAPU	36.696
020501020104	020501020104_NAPU	NAPU	58.246
020501020105	020501020105_NAPU	NAPU	80.145
020501020106	020501020106_NAPU	NAPU	109.944
020501020201	020501020201_NAPU	NAPU	40.703
020501020202	020501020202_NAPU	NAPU	90.16
020501020203	020501020203_NAPU	NAPU	41.802
020501020204	020501020204_NAPU	NAPU	38.624
020501020205	020501020205_NAPU	NAPU	49.371
020501020301	020501020301_NAPU	NAPU	111.004
020501020302	020501020302_NAPU	NAPU	79.012
020501020303	020501020303_NAPU	NAPU	147.47
020501020304	020501020304_NAPU	NAPU	49.029
020501020305	020501020305_NAPU	NAPU	129.47
020501020306	020501020306_NAPU	NAPU	55.257
020501020307	020501020307_NAPU	NAPU	97.537
020501020401	020501020401_NAPU	NAPU	104.131
020501020402	020501020402_NAPU	NAPU	41.652

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020501020403	020501020403_NAPU	NAPU	90.782
020501020404	020501020404_NAPU	NAPU	37.549
020501020405	020501020405_NAPU	NAPU	82.356
020501020406	020501020406_NAPU	NAPU	67.284
020501020407	020501020407_NAPU	NAPU	56.31
020501020408	020501020408_NAPU	NAPU	65.521
020501020501	020501020501_NAPU	NAPU	87.33
020501020502	020501020502_NAPU	NAPU	43.052
020501020503	020501020503_NAPU	NAPU	28.595
020501020504	020501020504_NAPU	NAPU	63.488
020501020505	020501020505_NAPU	NAPU	70.763
020501020506	020501020506_NAPU	NAPU	117.469
020501020507	020501020507_NAPU	NAPU	39.416
020501020508	020501020508_NAPU	NAPU	60.997
020501020509	020501020509_NAPU	NAPU	59.955
020501020601	020501020601_NAPU	NAPU	37.017
020501020602	020501020602_NAPU	NAPU	61.93
020501020603	020501020603_NAPU	NAPU	75.796
020501020604	020501020604_NAPU	NAPU	67.151
020501020605	020501020605_NAPU	NAPU	60.074
020501020606	020501020606_NAPU	NAPU	93.242
020501020607	020501020607_NAPU	NAPU	49.221
020501020608	020501020608_NAPU	NAPU	54.101
020501020609	020501020609_NAPU	NAPU	74.618
020501020610	020501020610_NAPU	NAPU	52.675
020501020701	020501020701_NAPU	NAPU	54.756
020501020702	020501020702_NAPU	NAPU	43.009
020501020703	020501020703_NAPU	NAPU	113.418
020501020704	020501020704_NAPU	NAPU	58.746
020501020801	020501020801_NAPU	NAPU	69.144
020501020802	020501020802_NAPU	NAPU	41.694
020501020803	020501020803_NAPU	NAPU	62.586
020501020804	020501020804_NAPU	NAPU	70.184

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020501020805	020501020805_NAPU	NAPU	113.187
020501020806	020501020806_NAPU	NAPU	43.159
020501020807	020501020807_NAPU	NAPU	90.849
020501020808	020501020808_NAPU	NAPU	64.515
020501020809	020501020809_NAPU	NAPU	78.541
020501020810	020501020810_NAPU	NAPU	81.939
020501030101	020501030101_NAPU	NAPU	61.377
020501030102	020501030102_NAPU	NAPU	59.152
020501030103	020501030103_NAPU	NAPU	44.196
020501030104	020501030104_NAPU	NAPU	68.995
020501030105	020501030105_NAPU	NAPU	60.262
020501030201	020501030201_NAPU	NAPU	78.35
020501030202	020501030202_NAPU	NAPU	50.647
020501030203	020501030203_NAPU	NAPU	51.606
020501030204	020501030204_NAPU	NAPU	45.549
020501030205	020501030205_NAPU	NAPU	60.909
020501030206	020501030206_NAPU	NAPU	47.693
020501030301	020501030301_NAPU	NAPU	78.958
020501030302	020501030302_NAPU	NAPU	71.64
020501030303	020501030303_NAPU	NAPU	100.622
020501030304	020501030304_NAPU	NAPU	58.857
020501030305	020501030305_NAPU	NAPU	80.321
020501030401	020501030401_NAPU	NAPU	47.2
020501030402	020501030402_NAPU	NAPU	66.326
020501030403	020501030403_NAPU	NAPU	41.58
020501030404	020501030404_NAPU	NAPU	50.608
020501030405	020501030405_NAPU	NAPU	55.007
020501030406	020501030406_NAPU	NAPU	45.751
020501030407	020501030407_NAPU	NAPU	44.114
020501030408	020501030408_NAPU	NAPU	55.93
020501030409	020501030409_NAPU	NAPU	93.278
020501030501	020501030501_NAPU	NAPU	112.676
020501030502	020501030502_NAPU	NAPU	61.912

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020501030503	020501030503_NAPU	NAPU	61.715
020501030504	020501030504_NAPU	NAPU	120.297
020501030505	020501030505_NAPU	NAPU	78.542
020501030601	020501030601_NAPU	NAPU	44.21
020501030602	020501030602_NAPU	NAPU	105.478
020501030603	020501030603_NAPU	NAPU	87.981
020501030604	020501030604_NAPU	NAPU	52.737
020501030605	020501030605_NAPU	NAPU	78.489
020501030701	020501030701_NAPU	NAPU	87.792
020501030702	020501030702_NAPU	NAPU	59.051
020501030703	020501030703_NAPU	NAPU	42.731
020501030704	020501030704_NAPU	NAPU	47.173
020501030705	020501030705_NAPU	NAPU	43.701
020501030706	020501030706_NAPU	NAPU	58.413
020501030707	020501030707_NAPU	NAPU	42.564
020501040101	020501040101_NAPU	NAPU	30.583
020501040102	020501040102_NAPU	NAPU	40.953
020501040103	020501040103_NAPU	NAPU	50.743
020501040104	020501040104_NAPU	NAPU	31.203
020501040201	020501040201_NAPU	NAPU	32.665
020501040202	020501040202_NAPU	NAPU	58.069
020501040203	020501040203_NAPU	NAPU	39.967
020501040204	020501040204_NAPU	NAPU	58.63
020501040205	020501040205_NAPU	NAPU	58.44
020501040301	020501040301_NAPU	NAPU	50.952
020501040302	020501040302_NAPU	NAPU	82.258
020501040303	020501040303_NAPU	NAPU	81.45
020501040304	020501040304_NAPU	NAPU	42.657
020501040305	020501040305_NAPU	NAPU	31.61
020501040306	020501040306_NAPU	NAPU	43.247
020501040401	020501040401_NAPU	NAPU	53.79
020501040402	020501040402_NAPU	NAPU	84.604
020501040403	020501040403_NAPU	NAPU	40.983

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020501040404	020501040404_NAPU	NAPU	47.801
020501040405	020501040405_NAPU	NAPU	25.782
020501040406	020501040406_NAPU	NAPU	73.286
020501040407	020501040407_NAPU	NAPU	72.599
020501040408	020501040408_NAPU	NAPU	124.769
020501040409	020501040409_NAPU	NAPU	25.078
020501040410	020501040410_NAPU	NAPU	32.492
020501040411	020501040411_NAPU	NAPU	114.94
020501040501	020501040501_NAPU	NAPU	36.182
020501040502	020501040502_NAPU	NAPU	41.771
020501040503	020501040503_NAPU	NAPU	42.239
020501040504	020501040504_NAPU	NAPU	42.54
020501040504	020501040504_NCA	NCA	13.033
020501040601	020501040601_NAPU	NAPU	26.55
020501040601	020501040601_NCA	NCA	9.349
020501040602	020501040602_NAPU	NAPU	6.463
020501040602	020501040602_NCA	NCA	23.032
020501040603	020501040603_NAPU	NAPU	30.798
020501040604	020501040604_NAPU	NAPU	73.826
020501040604	020501040604_NCA	NCA	2.59
020501040605	020501040605_NAPU	NAPU	18.71
020501040605	020501040605_NCA	NCA	23.455
020501040606	020501040606_NAPU	NAPU	24.008
020501040606	020501040606_NCA	NCA	19.545
020501040607	020501040607_NAPU	NAPU	28.697
020501040608	020501040608_NAPU	NAPU	17.087
020501040608	020501040608_NCA	NCA	34.359
020501040701	020501040701_NAPU	NAPU	67.369
020501040701	020501040701_NCA	NCA	4.288
020501040702	020501040702_NAPU	NAPU	65.41
020501040702	020501040702_NCA	NCA	13.027
020501040703	020501040703_NAPU	NAPU	9.819
020501040703	020501040703_NCA	NCA	35.696

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020501040801	020501040801_NAPU	NAPU	58.352
020501040801	020501040801_NCA	NCA	40.027
020501040802	020501040802_NAPU	NAPU	47.823
020501040802	020501040802_NCA	NCA	8.26
020501040803	020501040803_NAPU	NAPU	27.521
020501040803	020501040803_NCA	NCA	6.791
020501040804	020501040804_NAPU	NAPU	28.907
020501040804	020501040804_NCA	NCA	13.326
020501040805	020501040805_NAPU	NAPU	29.483
020501040805	020501040805_NCA	NCA	82.043
020501040806	020501040806_NAPU	NAPU	27.515
020501040806	020501040806_NCA	NCA	5.363
020501040807	020501040807_NAPU	NAPU	31.216
020501040808	020501040808_NAPU	NAPU	82.405
020501040808	020501040808_NCA	NCA	27.561
020501040809	020501040809_NAPU	NAPU	86.625
020501040901	020501040901_NCA	NCA	99.682
020501040902	020501040902_NCA	NCA	45
020501040903	020501040903_NAPU	NAPU	61.398
020501040903	020501040903_NCA	NCA	5.914
020501040904	020501040904_NAPU	NAPU	36.621
020501040904	020501040904_NCA	NCA	101.744
020501040905	020501040905_NAPU	NAPU	28.271
020501040905	020501040905_NCA	NCA	2.72
020501040906	020501040906_NAPU	NAPU	55.462
020501040906	020501040906_NCA	NCA	3.557
020501040907	020501040907_NAPU	NAPU	65.204
020501040907	020501040907_NCA	NCA	49.223
020501040908	020501040908_NAPU	NAPU	92.046
020501040908	020501040908_NCA	NCA	13.372
020501040909	020501040909_NAPU	NAPU	47.064
020501040910	020501040910_NAPU	NAPU	135.8
020501050101	020501050101_NAPU	NAPU	92.371

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020501050102	020501050102_NAPU	NAPU	66.014
020501050103	020501050103_NAPU	NAPU	78.726
020501050104	020501050104_NAPU	NAPU	105.922
020501050105	020501050105_NAPU	NAPU	63.577
020501050106	020501050106_NAPU	NAPU	97.47
020501050201	020501050201_NAPU	NAPU	68.522
020501050202	020501050202_NAPU	NAPU	54.021
020501050203	020501050203_NAPU	NAPU	55.111
020501050204	020501050204_NAPU	NAPU	101.912
020501050205	020501050205_NAPU	NAPU	70.537
020501050206	020501050206_NAPU	NAPU	69.742
020501050207	020501050207_NAPU	NAPU	53.407
020501050301	020501050301_NAPU	NAPU	42.795
020501050302	020501050302_NAPU	NAPU	93.377
020501050303	020501050303_NAPU	NAPU	74.197
020501050304	020501050304_NAPU	NAPU	57.496
020501050305	020501050305_NAPU	NAPU	47.549
020501050306	020501050306_NAPU	NAPU	133.654
020501050307	020501050307_NAPU	NAPU	116.267
020501050308	020501050308_NAPU	NAPU	23.066
020501050401	020501050401_NAPU	NAPU	89.498
020501050402	020501050402_NAPU	NAPU	44.334
020501050403	020501050403_NAPU	NAPU	91.296
020501050404	020501050404_NAPU	NAPU	144.344
020501050405	020501050405_NAPU	NAPU	48.825
020501050501	020501050501_NAPU	NAPU	48.247
020501050502	020501050502_NAPU	NAPU	84.261
020501050503	020501050503_NAPU	NAPU	73.882
020501050504	020501050504_NAPU	NAPU	74.84
020501050504	020501050504_NCA	NCA	1.511
020501050505	020501050505_NAPU	NAPU	61.982
020501050506	020501050506_NAPU	NAPU	114.905
020501050507	020501050507_NAPU	NAPU	121.186
020501050508	020501050508_NAPU	NAPU	46.985
020501050601	020501050601_NAPU	NAPU	59.125
020501050602	020501050602_NAPU	NAPU	48.17
020501050603	020501050603_NAPU	NAPU	45.026
020501050604	020501050604_NAPU	NAPU	106.377
020501050605	020501050605_NAPU	NAPU	34.011
020501050606	020501050606_NAPU	NAPU	92.147
020501050607	020501050607_NAPU	NAPU	95.077
020501050608	020501050608_NAPU	NAPU	46.455
020501060101	020501060101_NAPU	NAPU	70.237
020501060102	020501060102_NAPU	NAPU	75.234
020501060102	020501060102_NCA	NCA	6.479
020501060103	020501060103_NAPU	NAPU	42.311
020501060104	020501060104_NAPU	NAPU	107.98
020501060105	020501060105_NAPU	NAPU	69.896
020501060106	020501060106_NAPU	NAPU	43.467
020501060107	020501060107_NAPU	NAPU	71.564
020501060201	020501060201_NAPU	NAPU	0.092
020501060201	020501060201_NCA	NCA	96.142
020501060202	020501060202_NAPU	NAPU	4.973
020501060202	020501060202_NCA	NCA	111.695
020501060301	020501060301_NAPU	NAPU	153.496
020501060301	020501060301_NCA	NCA	17.389
020501060302	020501060302_NAPU	NAPU	70.596
020501060302	020501060302_NCA	NCA	1.417
020501060303	020501060303_NAPU	NAPU	81.573
020501060303	020501060303_NCA	NCA	44.909
020501060304	020501060304_NAPU	NAPU	130.155
020501060304	020501060304_NCA	NCA	5.253
020501060401	020501060401_NAPU	NAPU	57.183
020501060402	020501060402_NAPU	NAPU	74.987
020501060403	020501060403_NAPU	NAPU	132.254
020501060501	020501060501_NAPU	NAPU	137.715

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020501060502	020501060502_NAPU	NAPU	114.825
020501060502	020501060502_NCA	NCA	0.37
020501060503	020501060503_NAPU	NAPU	122.477
020501060503	020501060503_NCA	NCA	3.01
020501060601	020501060601_NAPU	NAPU	40.556
020501060602	020501060602_NAPU	NAPU	140.269
020501060701	020501060701_NAPU	NAPU	71.561
020501060702	020501060702_NAPU	NAPU	48.073
020501060703	020501060703_NAPU	NAPU	72.399
020501060704	020501060704_NAPU	NAPU	87.73
020501060705	020501060705_NAPU	NAPU	109.2
020501060801	020501060801_NAPU	NAPU	47.099
020501060802	020501060802_NAPU	NAPU	63.619
020501060803	020501060803_NAPU	NAPU	136.428
020501060804	020501060804_NAPU	NAPU	48.011
020501060901	020501060901_NCA	NCA	106.68
020501060902	020501060902_NAPU	NAPU	96.563
020501060902	020501060902_NCA	NCA	6.969
020501060903	020501060903_NAPU	NAPU	48.036
020501060903	020501060903_NCA	NCA	60.188
020501061001	020501061001_NAPU	NAPU	69.229
020501061001	020501061001_NRV	NRV	3.56
020501061002	020501061002_NAPU	NAPU	106.037
020501061101	020501061101_NAPU	NAPU	88.495
020501061101	020501061101_NRV	NRV	4.198
020501061102	020501061102_NAPU	NAPU	161.842
020501061201	020501061201_NAPU	NAPU	121.094
020501061202	020501061202_NAPU	NAPU	54.124
020501061203	020501061203_NAPU	NAPU	46.078
020501061204	020501061204_NAPU	NAPU	88.208
020501061205	020501061205_NAPU	NAPU	40.609
020501061206	020501061206_NAPU	NAPU	93.012
020501061207	020501061207_NAPU	NAPU	43.811

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020501061208	020501061208_NAPU	NAPU	150.42
020501061301	020501061301_NAPU	NAPU	40.116
020501061301	020501061301_NCA	NCA	4.03
020501061302	020501061302_NAPU	NAPU	37.474
020501061302	020501061302_NCA	NCA	105.841
020501061303	020501061303_NAPU	NAPU	48.786
020501061303	020501061303_NCA	NCA	73.917
020501061401	020501061401_NAPU	NAPU	90.934
020501061401	020501061401_NCA	NCA	5.68
020501061402	020501061402_NAPU	NAPU	51.37
020501061403	020501061403_NAPU	NAPU	100.608
020501061404	020501061404_NAPU	NAPU	121.084
020501061405	020501061405_NAPU	NAPU	99.812
020501061406	020501061406_NAPU	NAPU	73.531
020501061406	020501061406_NCA	NCA	2.624
020501061407	020501061407_NAPU	NAPU	67.678
020501061408	020501061408_NAPU	NAPU	34.942
020501061408	020501061408_NRV	NRV	11.982
020501061409	020501061409_NAPU	NAPU	108.792
020501061409	020501061409_NRV	NRV	7.623
020501070101	020501070101_NAPU	NAPU	42.155
020501070102	020501070102_NAPU	NAPU	46.845
020501070102	020501070102_NRV	NRV	2.113
020501070103	020501070103_NAPU	NAPU	23.472
020501070103	020501070103_NRV	NRV	110.597
020501070104	020501070104_NAPU	NAPU	10.418
020501070104	020501070104_NRV	NRV	76.654
020501070105	020501070105_NAPU	NAPU	26.039
020501070105	020501070105_NRV	NRV	21.768
020501070106	020501070106_NAPU	NAPU	4.178
020501070106	020501070106_NRV	NRV	85.888
020501070107	020501070107_NCA	NCA	45.892
020501070107	020501070107_NRV	NRV	99.452

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020501070108	020501070108_NCA	NCA	44.991
020501070108	020501070108_NRV	NRV	103.217
020501070109	020501070109_NRV	NRV	96.375
020501070110	020501070110_NRV	NRV	59.681
020501070201	020501070201_NAPU	NAPU	21.715
020501070201	020501070201_NRV	NRV	23.276
020501070202	020501070202_NCA	NCA	0.329
020501070202	020501070202_NRV	NRV	94.447
020501070203	020501070203_NAPU	NAPU	69.332
020501070203	020501070203_NRV	NRV	25.179
020501070204	020501070204_NCA	NCA	0.747
020501070204	020501070204_NRV	NRV	46.378
020501070205	020501070205_NAPU	NAPU	0.163
020501070205	020501070205_NRV	NRV	87.903
020501070206	020501070206_NRV	NRV	19.62
020501070207	020501070207_NRV	NRV	36.203
020501070208	020501070208_NRV	NRV	23.866
020501070301	020501070301_NAPU	NAPU	108.368
020501070301	020501070301_NCA	NCA	0.16
020501070301	020501070301_NRV	NRV	11.133
020501070302	020501070302_NAPU	NAPU	77.186
020501070302	020501070302_NRV	NRV	6.832
020501070303	020501070303_NAPU	NAPU	17.642
020501070303	020501070303_NRV	NRV	72.98
020501070304	020501070304_NRV	NRV	102.186
020501070305	020501070305_NCA	NCA	45.86
020501070305	020501070305_NRV	NRV	38.595
020501070306	020501070306_NCA	NCA	1.852
020501070306	020501070306_NRV	NRV	49.118
020501070307	020501070307_NRV	NRV	115.977
020501070401	020501070401_NCA	NCA	73.334
020501070401	020501070401_NRV	NRV	60.372
020501070402	020501070402_NRV	NRV	159.892
020501070403	020501070403_NRV	NRV	159.058
020501070501	020501070501_NAPU	NAPU	61.36
020501070501	020501070501_NCA	NCA	11.831
020501070501	020501070501_NRV	NRV	4.539
020501070502	020501070502_NAPU	NAPU	25.209
020501070502	020501070502_NCA	NCA	22.743
020501070502	020501070502_NRV	NRV	4.336
020501070503	020501070503_NAPU	NAPU	17.676
020501070503	020501070503_NRV	NRV	61.986
020501070504	020501070504_NAPU	NAPU	6.911
020501070504	020501070504_NRV	NRV	77.423
020501070601	020501070601_NAPU	NAPU	0.038
020501070601	020501070601_NCA	NCA	0.038
020501070601	020501070601_NRV	NRV	70.89
020501070602	020501070602_NRV	NRV	105.793
020501070701	020501070701_NAPU	NAPU	2.242
020501070701	020501070701_NCA	NCA	48.091
020501070702	020501070702_NAPU	NAPU	1.041
020501070702	020501070702_NCA	NCA	85.679
020501070702	020501070702_NRV	NRV	0.118
020501070703	020501070703_NAPU	NAPU	14.422
020501070703	020501070703_NCA	NCA	0.603
020501070703	020501070703_NRV	NRV	28.82
020501070704	020501070704_NAPU	NAPU	41.015
020501070704	020501070704_NCA	NCA	3.145
020501070704	020501070704_NRV	NRV	71.934
020501070705	020501070705_NRV	NRV	95.554
020501070706	020501070706_NRV	NRV	43.023
020501070707	020501070707_NRV	NRV	91.176
020501070801	020501070801_NRV	NRV	43.252
020501070802	020501070802_NRV	NRV	54.266
020501070803	020501070803_NRV	NRV	119.502
020501070804	020501070804_NRV	NRV	102.989

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020501070805	020501070805_NRV	NRV	75.15
020501070901	020501070901_NRV	NRV	94.503
020501070902	020501070902_NRV	NRV	133.096
020501071001	020501071001_NRV	NRV	85.221
020501071002	020501071002_NRV	NRV	104.94
020501071003	020501071003_NRV	NRV	87.448
020501071004	020501071004_NRV	NRV	19.913
020501071005	020501071005_NRV	NRV	82.859
020501071006	020501071006_NRV	NRV	119.934
020502010101	020502010101_CA	CA	101.86
020502010102	020502010102_CA	CA	93.778
020502010103	020502010103_CA	CA	139.405
020502010201	020502010201_CA	CA	61.578
020502010201	020502010201_NCA	NCA	64.324
020502010202	020502010202_CA	CA	73.058
020502010202	020502010202_NCA	NCA	2.661
020502010301	020502010301_CA	CA	147.16
020502010302	020502010302_CA	CA	54.151
020502010303	020502010303_CA	CA	73.006
020502010304	020502010304_CA	CA	127.598
020502010305	020502010305_CA	CA	79.823
020502010306	020502010306_CA	CA	91.484
020502010307	020502010307_CA	CA	75.104
020502010308	020502010308_CA	CA	126.472
020502010309	020502010309_CA	CA	115.201
020502010310	020502010310_CA	CA	129.401
020502010401	020502010401_CA	CA	120.108
020502010402	020502010402_CA	CA	55.451
020502010403	020502010403_CA	CA	146.564
020502010404	020502010404_CA	CA	50.094
020502010405	020502010405_CA	CA	42.723
020502010406	020502010406_CA	CA	159.958
020502010407	020502010407_CA	CA	25.407

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020502010407	020502010407_NCA	NCA	17.326
020502010408	020502010408_CA	CA	125.38
020502010408	020502010408_NCA	NCA	18.381
020502010501	020502010501_CA	CA	49.188
020502010502	020502010502_CA	CA	89.61
020502010503	020502010503_CA	CA	56.914
020502010504	020502010504_CA	CA	55.266
020502010504	020502010504_NRV	NRV	0.837
020502010505	020502010505_CA	CA	44.589
020502010505	020502010505_NRV	NRV	0.717
020502010506	020502010506_CA	CA	168.673
020502010507	020502010507_CA	CA	140.667
020502010507	020502010507_NRV	NRV	3.437
020502010508	020502010508_CA	CA	100.55
020502010601	020502010601_NCA	NCA	65.887
020502010602	020502010602_CA	CA	35.53
020502010602	020502010602_NCA	NCA	83.429
020502010701	020502010701_CA	CA	20.58
020502010701	020502010701_NCA	NCA	50.826
020502010702	020502010702_CA	CA	11.359
020502010702	020502010702_NCA	NCA	96.828
020502010703	020502010703_CA	CA	47.928
020502010704	020502010704_CA	CA	27.717
020502010704	020502010704_NCA	NCA	33.428
020502010705	020502010705_CA	CA	28.749
020502010705	020502010705_NCA	NCA	16.01
020502010706	020502010706_CA	CA	62.144
020502010707	020502010707_CA	CA	121.005
020502010707	020502010707_NCA	NCA	4.121
020502010708	020502010708_CA	CA	9.389
020502010708	020502010708_NCA	NCA	34.538
020502010709	020502010709_CA	CA	96.088
020502010709	020502010709_NCA	NCA	0.571

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020502010710	020502010710_CA	CA	40.882
020502010711	020502010711_CA	CA	0.522
020502010711	020502010711_NCA	NCA	45.164
020502010712	020502010712_CA	CA	58.873
020502010712	020502010712_NCA	NCA	23.311
020502010713	020502010713_NCA	NCA	98.412
020502020101	020502020101_NCA	NCA	56.035
020502020102	020502020102_NCA	NCA	133.648
020502020201	020502020201_NCA	NCA	115.771
020502020202	020502020202_NCA	NCA	46.742
020502020203	020502020203_NCA	NCA	48.923
020502020204	020502020204_NCA	NCA	161.41
020502020205	020502020205_NCA	NCA	79.572
020502020206	020502020206_NCA	NCA	63.626
020502020207	020502020207_NCA	NCA	118.819
020502020301	020502020301_NCA	NCA	82.027
020502020302	020502020302_NCA	NCA	76.948
020502020303	020502020303_NCA	NCA	97.838
020502020304	020502020304_NCA	NCA	66.029
020502020305	020502020305_NCA	NCA	133.825
020502020306	020502020306_NCA	NCA	58.961
020502020307	020502020307_NCA	NCA	85.67
020502020308	020502020308_NCA	NCA	64.781
020502020309	020502020309_NCA	NCA	45.505
020502020310	020502020310_NCA	NCA	43.096
020502020311	020502020311_NCA	NCA	86.162
020502020312	020502020312_NCA	NCA	108.633
020502020401	020502020401_NCA	NCA	45.201
020502020402	020502020402_NCA	NCA	47.359
020502020403	020502020403_NCA	NCA	87.167
020502020404	020502020404_NCA	NCA	84.274
020502020405	020502020405_NCA	NCA	141.892
020502020406	020502020406_NCA	NCA	155.745

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020502020407	020502020407_NCA	NCA	131.81
020502020501	020502020501_NCA	NCA	64.335
020502020502	020502020502_NCA	NCA	148.883
020502030101	020502030101_NCA	NCA	47.284
020502030102	020502030102_NCA	NCA	119.322
020502030103	020502030103_NCA	NCA	129.424
020502030104	020502030104_NCA	NCA	84.373
020502030105	020502030105_NCA	NCA	113.868
020502030106	020502030106_NCA	NCA	144.222
020502030201	020502030201_NCA	NCA	66.558
020502030202	020502030202_NCA	NCA	51.509
020502030203	020502030203_NCA	NCA	48.098
020502030204	020502030204_NCA	NCA	57.539
020502030205	020502030205_NCA	NCA	115.117
020502030301	020502030301_NCA	NCA	93.088
020502030302	020502030302_NCA	NCA	134.623
020502030401	020502030401_NCA	NCA	74.953
020502030402	020502030402_NCA	NCA	146.438
020502030403	020502030403_NCA	NCA	43.515
020502030404	020502030404_NCA	NCA	47.887
020502030405	020502030405_NCA	NCA	49.118
020502030406	020502030406_CA	CA	0.497
020502030406	020502030406_NCA	NCA	45.439
020502030407	020502030407_NCA	NCA	98.768
020502030408	020502030408_NCA	NCA	67.013
020502030409	020502030409_NCA	NCA	47.236
020502030410	020502030410_NRV	NRV	53.177
020502030411	020502030411_NCA	NCA	42.075
020502030411	020502030411_NRV	NRV	19.347
020502030412	020502030412_NCA	NCA	10.677
020502030412	020502030412_NRV	NRV	80.964
020502040101	020502040101_NRV	NRV	45.283
020502040102	020502040102_NRV	NRV	55.915

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020502040103	020502040103_NRV	NRV	44.279
020502040104	020502040104_NRV	NRV	58.384
020502040105	020502040105_NRV	NRV	70.628
020502040106	020502040106_NRV	NRV	103.776
020502040201	020502040201_CA	CA	47.418
020502040201	020502040201_NRV	NRV	0.546
020502040202	020502040202_CA	CA	54.09
020502040203	020502040203_CA	CA	108.251
020502040203	020502040203_NCA	NCA	17.327
020502040204	020502040204_CA	CA	27.803
020502040204	020502040204_NCA	NCA	61.376
020502040205	020502040205_CA	CA	75.757
020502040205	020502040205_NCA	NCA	30.424
020502040205	020502040205_NRV	NRV	21.265
020502040301	020502040301_NRV	NRV	150.678
020502040302	020502040302_NRV	NRV	109.344
020502040303	020502040303_NRV	NRV	39.224
020502040304	020502040304_NRV	NRV	63.456
020502040305	020502040305_NRV	NRV	107.442
020502040401	020502040401_CA	CA	6.306
020502040401	020502040401_NRV	NRV	120.885
020502040402	020502040402_CA	CA	2.591
020502040402	020502040402_NRV	NRV	114.387
020502040403	020502040403_CA	CA	7.695
020502040403	020502040403_NRV	NRV	51.916
020502040404	020502040404_NRV	NRV	43.907
020502040405	020502040405_NRV	NRV	152.104
020502040406	020502040406_CA	CA	16.404
020502040406	020502040406_NRV	NRV	99.218
020502040407	020502040407_NCA	NCA	6.697
020502040407	020502040407_NRV	NRV	88.924
020502050101	020502050101_NCA	NCA	55.551
020502050102	020502050102_NCA	NCA	130.097
020502050201	020502050201_NCA	NCA	42.125
020502050202	020502050202_NAPU	NAPU	16.036
020502050202	020502050202_NCA	NCA	57.912
020502050203	020502050203_NAPU	NAPU	8.739
020502050203	020502050203_NCA	NCA	82.113
020502050204	020502050204_NCA	NCA	88.821
020502050205	020502050205_NAPU	NAPU	16.602
020502050205	020502050205_NCA	NCA	42.239
020502050206	020502050206_NCA	NCA	55.137
020502050207	020502050207_NAPU	NAPU	23.734
020502050207	020502050207_NCA	NCA	32.595
020502050208	020502050208_NCA	NCA	74.667
020502050301	020502050301_NAPU	NAPU	48.534
020502050301	020502050301_NCA	NCA	4.991
020502050302	020502050302_NAPU	NAPU	1.712
020502050302	020502050302_NCA	NCA	41.47
020502050303	020502050303_NAPU	NAPU	25.951
020502050303	020502050303_NCA	NCA	87.567
020502050401	020502050401_NAPU	NAPU	12.114
020502050401	020502050401_NCA	NCA	98.516
020502050402	020502050402_NAPU	NAPU	27.127
020502050402	020502050402_NCA	NCA	32.528
020502050403	020502050403_NAPU	NAPU	47.139
020502050403	020502050403_NCA	NCA	5.828
020502050404	020502050404_NAPU	NAPU	15.48
020502050404	020502050404_NCA	NCA	29.136
020502050405	020502050405_NAPU	NAPU	5.467
020502050405	020502050405_NCA	NCA	62.538
020502050501	020502050501_NAPU	NAPU	28.425
020502050501	020502050501_NCA	NCA	25.374
020502050502	020502050502_NAPU	NAPU	10.834
020502050502	020502050502_NCA	NCA	36.598
020502050503	020502050503_NAPU	NAPU	19.74

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020502050503	020502050503_NCA	NCA	31.783
020502050504	020502050504_NAPU	NAPU	34.128
020502050504	020502050504_NCA	NCA	66.35
020502050505	020502050505_NCA	NCA	59.664
020502050506	020502050506_NCA	NCA	154.464
020502050601	020502050601_NAPU	NAPU	27.499
020502050601	020502050601_NCA	NCA	159.511
020502050602	020502050602_NCA	NCA	97.753
020502050603	020502050603_NCA	NCA	116.74
020502050604	020502050604_NCA	NCA	124.85
020502050605	020502050605_NCA	NCA	43.231
020502050606	020502050606_NCA	NCA	119.32
020502050607	020502050607_NCA	NCA	55.499
020502050607	020502050607_NRV	NRV	56.336
020502060101	020502060101_NCA	NCA	60.266
020502060101	020502060101_NRV	NRV	4.358
020502060102	020502060102_NCA	NCA	33.063
020502060102	020502060102_NRV	NRV	12.507
020502060103	020502060103_NCA	NCA	81.44
020502060103	020502060103_NRV	NRV	39.162
020502060201	020502060201_NAPU	NAPU	61.098
020502060201	020502060201_NCA	NCA	17.918
020502060202	020502060202_NAPU	NAPU	52.774
020502060202	020502060202_NCA	NCA	53.939
020502060203	020502060203_NAPU	NAPU	0.157
020502060203	020502060203_NCA	NCA	73.051
020502060204	020502060204_NAPU	NAPU	0.031
020502060204	020502060204_NCA	NCA	70.055
020502060205	020502060205_NAPU	NAPU	0.18
020502060205	020502060205_NCA	NCA	51.477
020502060206	020502060206_NCA	NCA	130.44
020502060207	020502060207_NCA	NCA	37.706
020502060207	020502060207_NRV	NRV	20.768
020502060208	020502060208_NCA	NCA	42.104
020502060208	020502060208_NRV	NRV	92.554
020502060301	020502060301_NCA	NCA	51.367
020502060302	020502060302_NAPU	NAPU	0.712
020502060302	020502060302_NCA	NCA	130.892
020502060303	020502060303_NAPU	NAPU	1.242
020502060303	020502060303_NCA	NCA	40.099
020502060304	020502060304_NAPU	NAPU	0.005
020502060304	020502060304_NCA	NCA	117.985
020502060401	020502060401_NAPU	NAPU	42.988
020502060401	020502060401_NCA	NCA	18.663
020502060402	020502060402_NAPU	NAPU	131.475
020502060402	020502060402_NCA	NCA	19.908
020502060501	020502060501_NAPU	NAPU	25.863
020502060501	020502060501_NCA	NCA	33.828
020502060502	020502060502_NAPU	NAPU	51.169
020502060502	020502060502_NCA	NCA	35.864
020502060503	020502060503_NCA	NCA	156.491
020502060504	020502060504_NCA	NCA	60.878
020502060505	020502060505_NCA	NCA	44.32
020502060506	020502060506_NCA	NCA	94.98
020502060507	020502060507_NCA	NCA	19.009
020502060507	020502060507_NRV	NRV	40.252
020502060508	020502060508_NCA	NCA	36.695
020502060508	020502060508_NRV	NRV	25.166
020502060509	020502060509_NCA	NCA	79.13
020502060509	020502060509_NRV	NRV	25.075
020502060601	020502060601_NRV	NRV	144.317
020502060602	020502060602_NRV	NRV	165.639
020502060603	020502060603_NRV	NRV	42.238
020502060604	020502060604_NRV	NRV	85.878
020502060605	020502060605_NRV	NRV	113.195
020502060701	020502060701_NCA	NCA	2.684

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020502060701	020502060701_NRV	NRV	86.26
020502060702	020502060702_NRV	NRV	122.98
020502060801	020502060801_NCA	NCA	105.872
020502060802	020502060802_NCA	NCA	90.441
020502060802	020502060802_NRV	NRV	11.9
020502060803	020502060803_NCA	NCA	6.584
020502060803	020502060803_NRV	NRV	100.704
020502060901	020502060901_NRV	NRV	54.763
020502060902	020502060902_NRV	NRV	119.361
020502061001	020502061001_NRV	NRV	59.02
020502061002	020502061002_NRV	NRV	48.079
020502061003	020502061003_NRV	NRV	70.296
020502061004	020502061004_NRV	NRV	49.156
020502061005	020502061005_NRV	NRV	119.326
020502061101	020502061101_NRV	NRV	45.338
020502061102	020502061102_NRV	NRV	138.857
020502061103	020502061103_NRV	NRV	105.269
020502061201	020502061201_NRV	NRV	117.004
020502061202	020502061202_NRV	NRV	173.664
020502061203	020502061203_NRV	NRV	56.031
020502061204	020502061204_NRV	NRV	30.068
020502061205	020502061205_NRV	NRV	87.319
020502061206	020502061206_NRV	NRV	21.8
020502061207	020502061207_NRV	NRV	92.874
020503010101	020503010101_NRV	NRV	82.026
020503010102	020503010102_NRV	NRV	82.328
020503010103	020503010103_NRV	NRV	75.428
020503010104	020503010104_NRV	NRV	114.536
020503010201	020503010201_NRV	NRV	147.119
020503010202	020503010202_NRV	NRV	95.605
020503010301	020503010301_NRV	NRV	86.532
020503010302	020503010302_NRV	NRV	47.94
020503010303	020503010303_NRV	NRV	47.326

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020503010304	020503010304_NRV	NRV	151.633
020503010305	020503010305_NRV	NRV	118.63
020503010401	020503010401_NRV	NRV	106.348
020503010402	020503010402_NRV	NRV	130.961
020503010403	020503010403_NRV	NRV	158.483
020503010404	020503010404_NRV	NRV	51.899
020503010405	020503010405_NRV	NRV	157.409
020503010406	020503010406_NRV	NRV	134.319
020503010501	020503010501_NRV	NRV	170.379
020503010502	020503010502_NRV	NRV	78.173
020503010503	020503010503_NRV	NRV	158.001
020503010601	020503010601_NRV	NRV	96.175
020503010602	020503010602_NRV	NRV	74.375
020503010603	020503010603_NRV	NRV	54.406
020503010701	020503010701_NRV	NRV	82.459
020503010702	020503010702_NRV	NRV	116.825
020503010801	020503010801_NRV	NRV	116.028
020503010802	020503010802_NRV	NRV	110.89
020503010901	020503010901_NRV	NRV	89.631
020503010902	020503010902_NRV	NRV	50.309
020503010903	020503010903_NRV	NRV	45.314
020503010904	020503010904_NRV	NRV	116.182
020503011001	020503011001_NRV	NRV	91.653
020503011002	020503011002_NRV	NRV	110.381
020503011003	020503011003_NRV	NRV	102.004
020503011004	020503011004_NRV	NRV	83.601
020503011005	020503011005_NRV	NRV	102.799
020503011006	020503011006_NRV	NRV	112.081
020503020101	020503020101_NRV	NRV	59.709
020503020102	020503020102_NRV	NRV	88.584
020503020103	020503020103_NRV	NRV	45.028
020503020104	020503020104_NRV	NRV	41.65
020503020105	020503020105_CA	CA	1.74

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020503020105	020503020105_NRV	NRV	43.41
020503020106	020503020106_NRV	NRV	49.305
020503020201	020503020201_CA	CA	24.987
020503020201	020503020201_NRV	NRV	47.285
020503020202	020503020202_CA	CA	43.136
020503020202	020503020202_NRV	NRV	110.615
020503020301	020503020301_NRV	NRV	61.935
020503020302	020503020302_NRV	NRV	59.563
020503020303	020503020303_NRV	NRV	65.818
020503020304	020503020304_NRV	NRV	129.952
020503020305	020503020305_NRV	NRV	152.73
020503020401	020503020401_NRV	NRV	75.569
020503020402	020503020402_NRV	NRV	61.776
020503020403	020503020403_NRV	NRV	69.44
020503020404	020503020404_NRV	NRV	76.1
020503020501	020503020501_CA	CA	41.274
020503020501	020503020501_NRV	NRV	18.205
020503020502	020503020502_CA	CA	5.221
020503020502	020503020502_NRV	NRV	131.921
020503020503	020503020503_CA	CA	27.455
020503020503	020503020503_NRV	NRV	19.473
020503020504	020503020504_CA	CA	36.612
020503020504	020503020504_NRV	NRV	99.87
020503020505	020503020505_NRV	NRV	75.581
020503020506	020503020506_CA	CA	0.739
020503020506	020503020506_NRV	NRV	148.829
020503020601	020503020601_NRV	NRV	85.958
020503020602	020503020602_NRV	NRV	77.304
020503020701	020503020701_NRV	NRV	49.665
020503020702	020503020702_NRV	NRV	130.786
020503020703	020503020703_NRV	NRV	48.486
020503020704	020503020704_NRV	NRV	114.28
020503020801	020503020801_NRV	NRV	46.55
020503020802	020503020802_NRV	NRV	70.431
020503020803	020503020803_NRV	NRV	31.976
020503030101	020503030101_CA	CA	2.907
020503030101	020503030101_NRV	NRV	93.616
020503030102	020503030102_CA	CA	21.886
020503030102	020503030102_NRV	NRV	110.593
020503030102	020503030102_SRV	SRV	0.049
020503030103	020503030103_NRV	NRV	63.809
020503030104	020503030104_NRV	NRV	47.811
020503030105	020503030105_NRV	NRV	77.186
020503030201	020503030201_NRV	NRV	49.066
020503030202	020503030202_CA	CA	8.108
020503030202	020503030202_NRV	NRV	112.024
020503030301	020503030301_CA	CA	1.326
020503030301	020503030301_NRV	NRV	112.288
020503030302	020503030302_CA	CA	0.163
020503030302	020503030302_NRV	NRV	110.142
020503030303	020503030303_NRV	NRV	116.563
020503030401	020503030401_CA	CA	53.888
020503030401	020503030401_NRV	NRV	2.216
020503030402	020503030402_NRV	NRV	94.924
020503030403	020503030403_CA	CA	23.954
020503030403	020503030403_NRV	NRV	47.958
020503030501	020503030501_NRV	NRV	108.641
020503030502	020503030502_NRV	NRV	36.702
020503030503	020503030503_NRV	NRV	46.121
020503030504	020503030504_CA	CA	8.448
020503030504	020503030504_NRV	NRV	132.477
020503030505	020503030505_CA	CA	72.031
020503030505	020503030505_NRV	NRV	71.234
020503030601	020503030601_NRV	NRV	49.618
020503030602	020503030602_NRV	NRV	129.977
020503030603	020503030603_CA	CA	2.11

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020503030603	020503030603_NRV	NRV	66.764
020503030701	020503030701_CA	CA	73.361
020503030702	020503030702_CA	CA	146.96
020503030702	020503030702_NRV	NRV	0.992
020503030801	020503030801_CA	CA	56.325
020503030801	020503030801_NRV	NRV	0.73
020503030802	020503030802_CA	CA	49.302
020503030802	020503030802_NRV	NRV	48.887
020503030803	020503030803_CA	CA	25.344
020503030803	020503030803_NRV	NRV	81.631
020503030804	020503030804_CA	CA	13.26
020503030804	020503030804_NRV	NRV	123.858
020503040101	020503040101_NRV	NRV	53.576
020503040102	020503040102_NRV	NRV	43.682
020503040103	020503040103_CA	CA	15.126
020503040103	020503040103_NRV	NRV	173.245
020503040201	020503040201_CA	CA	68.908
020503040202	020503040202_CA	CA	12.071
020503040202	020503040202_NRV	NRV	54.725
020503040203	020503040203_CA	CA	50.377
020503040203	020503040203_NRV	NRV	64.607
020503040301	020503040301_NRV	NRV	77.237
020503040302	020503040302_NRV	NRV	110.8
020503040401	020503040401_NRV	NRV	56.55
020503040402	020503040402_NRV	NRV	101.933
020503040403	020503040403_CA	CA	2.455
020503040403	020503040403_NRV	NRV	79.383
020503040404	020503040404_NRV	NRV	158.338
020503040501	020503040501_NRV	NRV	109.764
020503040502	020503040502_NRV	NRV	115.557
020503040503	020503040503_NRV	NRV	116.906
020503040601	020503040601_NRV	NRV	80.822
020503040602	020503040602_NRV	NRV	63.97

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020503040603	020503040603_NRV	NRV	98.035
020503040701	020503040701_NRV	NRV	125.325
020503040702	020503040702_NRV	NRV	126.577
020503040801	020503040801_NRV	NRV	155.766
020503040802	020503040802_NRV	NRV	103.339
020503040803	020503040803_NRV	NRV	92.631
020503040901	020503040901_NRV	NRV	66.228
020503040902	020503040902_NRV	NRV	137.459
020503040903	020503040903_NRV	NRV	39.772
020503040904	020503040904_NRV	NRV	59.412
020503040905	020503040905_NRV	NRV	129.386
020503040906	020503040906_NRV	NRV	118.206
020503040907	020503040907_NRV	NRV	149.389
020503041001	020503041001_NRV	NRV	73.745
020503041002	020503041002_NRV	NRV	92.423
020503041101	020503041101_NRV	NRV	73.414
020503041102	020503041102_NRV	NRV	112.439
020503041201	020503041201_NRV	NRV	153.379
020503041202	020503041202_NRV	NRV	56.112
020503041203	020503041203_NRV	NRV	52.072
020503041204	020503041204_NRV	NRV	133.156
020503050101	020503050101_NRV	NRV	105.806
020503050102	020503050102_NRV	NRV	41.846
020503050103	020503050103_NRV	NRV	51.04
020503050104	020503050104_NRV	NRV	71.323
020503050105	020503050105_NRV	NRV	69.413
020503050106	020503050106_NRV	NRV	151.65
020503050107	020503050107_NRV	NRV	142.389
020503050201	020503050201_UNP	UNP	48.799
020503050202	020503050202_NRV	NRV	14.381
020503050202	020503050202_UNP	UNP	49.403
020503050203	020503050203_NRV	NRV	113.598
020503050203	020503050203_UNP	UNP	52.243

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020503050301	020503050301_BLUE	BLUE	24.387
020503050301	020503050301_UNP	UNP	27.279
020503050302	020503050302_BLUE	BLUE	19.86
020503050302	020503050302_UNP	UNP	47.059
020503050303	020503050303_NRV	NRV	10.344
020503050303	020503050303_UNP	UNP	34.594
020503050304	020503050304_UNP	UNP	62.332
020503050305	020503050305_UNP	UNP	7.422
020503050306	020503050306_NRV	NRV	33.297
020503050306	020503050306_UNP	UNP	113.587
020503050307	020503050307_NRV	NRV	26.144
020503050307	020503050307_UNP	UNP	16.575
020503050308	020503050308_NRV	NRV	16.609
020503050308	020503050308_UNP	UNP	97.75
020503050401	020503050401_UNP	UNP	63.867
020503050402	020503050402_UNP	UNP	49.692
020503050403	020503050403_NRV	NRV	15.585
020503050403	020503050403_UNP	UNP	91.94
020503050404	020503050404_UNP	UNP	56.477
020503050405	020503050405_UNP	UNP	45.926
020503050406	020503050406_NRV	NRV	11.484
020503050406	020503050406_UNP	UNP	60.542
020503050407	020503050407_UNP	UNP	46.136
020503050408	020503050408_NRV	NRV	5.908
020503050408	020503050408_UNP	UNP	48.435
020503050501	020503050501_BLUE	BLUE	61.601
020503050501	020503050501_UNP	UNP	37.722
020503050502	020503050502_BLUE	BLUE	25.612
020503050502	020503050502_UNP	UNP	37.336
020503050503	020503050503_BLUE	BLUE	119.519
020503050503	020503050503_UNP	UNP	3.788
020503050504	020503050504_BLUE	BLUE	48.955
020503050504	020503050504_UNP	UNP	83.816
020503050505	020503050505_UNP	UNP	146.312
020503050601	020503050601_NRV	NRV	62.87
020503050602	020503050602_NRV	NRV	125.833
020503050603	020503050603_NRV	NRV	92.102
020503050604	020503050604_NRV	NRV	46.127
020503050605	020503050605_NRV	NRV	106.407
020503050606	020503050606_NRV	NRV	27.723
020503050606	020503050606_UNP	UNP	36
020503050701	020503050701_NRV	NRV	24.671
020503050701	020503050701_UNP	UNP	24.189
020503050702	020503050702_NRV	NRV	15.688
020503050702	020503050702_UNP	UNP	89.78
020503050703	020503050703_NRV	NRV	1.669
020503050703	020503050703_UNP	UNP	100.766
020503050801	020503050801_UNP	UNP	38.707
020503050802	020503050802_UNP	UNP	159.704
020503050901	020503050901_NRV	NRV	2.513
020503050901	020503050901_UNP	UNP	83.349
020503050902	020503050902_NRV	NRV	25.713
020503050902	020503050902_UNP	UNP	100.351
020503050903	020503050903_NRV	NRV	40.993
020503050903	020503050903_UNP	UNP	42.48
020503050904	020503050904_UNP	UNP	62.29
020503050905	020503050905_NRV	NRV	3.776
020503050905	020503050905_UNP	UNP	66.808
020503050906	020503050906_UNP	UNP	96.49
020503051001	020503051001_NRV	NRV	78.706
020503051002	020503051002_NRV	NRV	117.15
020503051003	020503051003_NRV	NRV	91.954
020503051004	020503051004_NRV	NRV	46.626
020503051005	020503051005_NRV	NRV	49.37
020503051006	020503051006_NRV	NRV	67.826
020503051006	020503051006_UNP	UNP	18.508

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020503051007	020503051007_NRV	NRV	6.993
020503051007	020503051007_UNP	UNP	63.965
020503051008	020503051008_UNP	UNP	29.551
020503051009	020503051009_UNP	UNP	46.082
020503051010	020503051010_UNP	UNP	136.003
020503051011	020503051011_UNP	UNP	120.129
020503060101	020503060101_UNP	UNP	87.386
020503060102	020503060102_UNP	UNP	102.841
020503060201	020503060201_BLUE	BLUE	66.174
020503060201	020503060201_UNP	UNP	21.453
020503060202	020503060202_BLUE	BLUE	74.945
020503060202	020503060202_UNP	UNP	32.873
020503060203	020503060203_UNP	UNP	116.008
020503060204	020503060204_UNP	UNP	67.274
020503060301	020503060301_BLUE	BLUE	33.826
020503060301	020503060301_UNP	UNP	22.676
020503060302	020503060302_BLUE	BLUE	3.638
020503060302	020503060302_UNP	UNP	77.984
020503060303	020503060303_BLUE	BLUE	28.751
020503060303	020503060303_UNP	UNP	118.418
020503060401	020503060401_UNP	UNP	76.871
020503060402	020503060402_UNP	UNP	92.605
020503060501	020503060501_UNP	UNP	45.759
020503060502	020503060502_UNP	UNP	111.731
020503060503	020503060503_UNP	UNP	60.216
020503060504	020503060504_UNP	UNP	93.711
020503060601	020503060601_UNP	UNP	84.536
020503060602	020503060602_UNP	UNP	115.201
020503060603	020503060603_UNP	UNP	102.743
020503060701	020503060701_UNP	UNP	61.603
020503060702	020503060702_UNP	UNP	43.538
020503060703	020503060703_UNP	UNP	85.898
020503060704	020503060704_UNP	UNP	54.19

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020503060705	020503060705_UNP	UNP	67.575
020503060706	020503060706_UNP	UNP	47.87
020503060707	020503060707_UNP	UNP	55.767
020503060801	020503060801_UNP	UNP	76.624
020503060802	020503060802_UNP	UNP	115.222
020503060803	020503060803_UNP	UNP	44.425
020503060804	020503060804_UNP	UNP	90.045
020503060901	020503060901_UNP	UNP	123.681
020503060902	020503060902_UNP	UNP	83.669
020503060903	020503060903_UNP	UNP	91.282
020503060904	020503060904_UNP	UNP	63.991
020503061001	020503061001_UNP	UNP	94.728
020503061002	020503061002_UNP	UNP	74.92
020503061101	020503061101_UNP	UNP	41.655
020503061102	020503061102_UNP	UNP	92.287
020503061103	020503061103_UNP	UNP	158.485
020503061104	020503061104_UNP	UNP	70.752
020503061105	020503061105_UNP	UNP	45.049
020503061106	020503061106_UNP	UNP	145.993
020503061107	020503061107_UNP	UNP	142.592
020503061201	020503061201_UNP	UNP	132.312
020503061202	020503061202_UNP	UNP	125.375
020503061203	020503061203_UNP	UNP	55.391
020503061204	020503061204_UNP	UNP	87.76
020503061301	020503061301_UNP	UNP	113.362
020503061302	020503061302_UNP	UNP	72.738
020503061303	020503061303_UNP	UNP	73.282
020503061304	020503061304_UNP	UNP	98.959
020503061401	020503061401_UNP	UNP	46.81
020503061402	020503061402_UNP	UNP	52.963
020503061403	020503061403_UNP	UNP	134.884
020503061501	020503061501_UNP	UNP	124.367
020503061502	020503061502_UNP	UNP	99.16

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020503061503	020503061503_UNP	UNP	86.274
020503061601	020503061601_UNP	UNP	137.885
020503061602	020503061602_UNP	UNP	100.377
020503061603	020503061603_UNP	UNP	98.379
020503061604	020503061604_UNP	UNP	105.757
020503061701	020503061701_UNP	UNP	49.285
020503061702	020503061702_UNP	UNP	97.935
020503061703	020503061703_UNP	UNP	88.479
020503061704	020503061704_UNP	UNP	129.645
020503061705	020503061705_UNP	UNP	49.379
020503061706	020503061706_UNP	UNP	43.887
020503061707	020503061707_UNP	UNP	49.525
020503061708	020503061708_UNP	UNP	113.593
020503061709	020503061709_UNP	UNP	110.288
020503061710	020503061710_UNP	UNP	104.231
020503061711	020503061711_UNP	UNP	100.805
020503061712	020503061712_UNP	UNP	61.37
020503061713	020503061713_MAC	MAC	2.595
020503061713	020503061713_SEP	SEP	7.786
020503061713	020503061713_UNP	UNP	71.975
020600010000	020600010000_MAC	MAC	6.678
020600010000	020600010000_SEP	SEP	4.173
020600020101	020600020101_SEP	SEP	10.034
020600020101	020600020101_UNP	UNP	38.56
020600020102	020600020102_SEP	SEP	15.384
020600020102	020600020102_UNP	UNP	81.04
020600020103	020600020103_SEP	SEP	31.163
020600020103	020600020103_UNP	UNP	36.372
020600020104	020600020104_SEP	SEP	39.115
020600020105	020600020105_SEP	SEP	9.208
020600020201	020600020201_UNP	UNP	41.09
020600020202	020600020202_SEP	SEP	41.233
020600020202	020600020202_UNP	UNP	67.727

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020600020203	020600020203_MAC	MAC	1.18
020600020203	020600020203_SEP	SEP	22.639
020600020203	020600020203_UNP	UNP	99.701
020600020204	020600020204_MAC	MAC	96.966
020600020205	020600020205_MAC	MAC	27.885
020600020205	020600020205_SEP	SEP	32.38
020600020206	020600020206_MAC	MAC	129.932
020600020207	020600020207_MAC	MAC	63.241
020600020207	020600020207_SEP	SEP	18.946
020600020301	020600020301_MAC	MAC	104.442
020600020302	020600020302_MAC	MAC	103.628
020600020401	020600020401_MAC	MAC	97.737
020600020402	020600020402_MAC	MAC	119.673
020600020403	020600020403_MAC	MAC	52.259
020600020404	020600020404_MAC	MAC	62.045
020600020405	020600020405_MAC	MAC	92.099
020600020406	020600020406_MAC	MAC	139.904
020600020407	020600020407_MAC	MAC	142.767
020600020408	020600020408_MAC	MAC	101.842
020600020409	020600020409_MAC	MAC	94.87
020600020410	020600020410_MAC	MAC	90.403
020600020411	020600020411_MAC	MAC	87.57
020600020501	020600020501_MAC	MAC	52.133
020600020502	020600020502_MAC	MAC	91.866
020600020503	020600020503_MAC	MAC	32.851
020600020504	020600020504_MAC	MAC	23.082
020600020601	020600020601_MAC	MAC	48.216
020600020602	020600020602_MAC	MAC	72.735
020600020603	020600020603_MAC	MAC	32.211
020600020604	020600020604_MAC	MAC	34.786
020600020605	020600020605_MAC	MAC	102.884
020600020606	020600020606_MAC	MAC	27.256
020600020607	020600020607_MAC	MAC	41.301

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020600020608	020600020608_MAC	MAC	17.834
020600020609	020600020609_MAC	MAC	0.938
020600030101	020600030101_UNP	UNP	93.747
020600030102	020600030102_MAC	MAC	0.139
020600030102	020600030102_SEP	SEP	11.223
020600030102	020600030102_UNP	UNP	38.336
020600030103	020600030103_MAC	MAC	0.452
020600030103	020600030103_SEP	SEP	7.327
020600030103	020600030103_UNP	UNP	83.962
020600030104	020600030104_MAC	MAC	10.017
020600030104	020600030104_SEP	SEP	11.428
020600030104	020600030104_UNP	UNP	17.862
020600030105	020600030105_MAC	MAC	38.734
020600030105	020600030105_SEP	SEP	14.046
020600030105	020600030105_UNP	UNP	0.479
020600030201	020600030201_MAC	MAC	16.183
020600030201	020600030201_SEP	SEP	10.48
020600030201	020600030201_UNP	UNP	39.906
020600030202	020600030202_MAC	MAC	39.258
020600030203	020600030203_MAC	MAC	36.541
020600030203	020600030203_SEP	SEP	0.888
020600030204	020600030204_MAC	MAC	30.786
020600030301	020600030301_UNP	UNP	80.498
020600030302	020600030302_UNP	UNP	126.024
020600030401	020600030401_UNP	UNP	139.756
020600030402	020600030402_UNP	UNP	125.008
020600030403	020600030403_UNP	UNP	50.668
020600030404	020600030404_UNP	UNP	114.12
020600030405	020600030405_UNP	UNP	56.929
020600030406	020600030406_UNP	UNP	94.579
020600030501	020600030501_SEP	SEP	9.334
020600030501	020600030501_UNP	UNP	141.486
020600030502	020600030502_MAC	MAC	0.524

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020600030502	020600030502_SEP	SEP	12.151
020600030502	020600030502_UNP	UNP	106.873
020600030601	020600030601_MAC	MAC	8.369
020600030601	020600030601_SEP	SEP	56.902
020600030601	020600030601_UNP	UNP	0.01
020600030602	020600030602_MAC	MAC	44.451
020600030602	020600030602_SEP	SEP	16.018
020600030701	020600030701_MAC	MAC	23.834
020600030701	020600030701_SEP	SEP	0.861
020600030702	020600030702_MAC	MAC	2.406
020600030702	020600030702_SEP	SEP	69.727
020600030702	020600030702_UNP	UNP	8.841
020600030703	020600030703_MAC	MAC	40.179
020600030703	020600030703_SEP	SEP	25.755
020600030801	020600030801_UNP	UNP	54.237
020600030802	020600030802_UNP	UNP	53.317
020600030803	020600030803_UNP	UNP	41.718
020600030804	020600030804_UNP	UNP	114.965
020600030805	020600030805_UNP	UNP	118.719
020600030806	020600030806_UNP	UNP	58.089
020600030901	020600030901_UNP	UNP	46.068
020600030902	020600030902_SEP	SEP	10.549
020600030902	020600030902_UNP	UNP	116.693
020600031001	020600031001_UNP	UNP	49.893
020600031002	020600031002_UNP	UNP	59.736
020600031003	020600031003_UNP	UNP	47.635
020600031004	020600031004_UNP	UNP	65.071
020600031101	020600031101_UNP	UNP	120.135
020600031102	020600031102_SEP	SEP	75.17
020600031102	020600031102_UNP	UNP	36.766
020600031103	020600031103_SEP	SEP	42.807
020600031103	020600031103_UNP	UNP	9.266
020600031201	020600031201_SEP	SEP	11.43

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020600031201	020600031201_UNP	UNP	138.427
020600031202	020600031202_SEP	SEP	87.782
020600031203	020600031203_MAC	MAC	10.639
020600031203	020600031203_SEP	SEP	40.112
020600031204	020600031204_MAC	MAC	37.626
020600031204	020600031204_SEP	SEP	58.261
020600040101	020600040101_SEP	SEP	55.68
020600040102	020600040102_MAC	MAC	2.676
020600040102	020600040102_SEP	SEP	36.283
020600040201	020600040201_SEP	SEP	65.626
020600040202	020600040202_SEP	SEP	38.162
020600040203	020600040203_MAC	MAC	14.245
020600040203	020600040203_SEP	SEP	58.353
020600040301	020600040301_SEP	SEP	54.595
020600040302	020600040302_SEP	SEP	91.441
020600040401	020600040401_MAC	MAC	20.262
020600040401	020600040401_SEP	SEP	43.029
020600040402	020600040402_MAC	MAC	34.199
020600040402	020600040402_SEP	SEP	92.931
020600040403	020600040403_MAC	MAC	2.046
020600040403	020600040403_SEP	SEP	99.798
020600040404	020600040404_MAC	MAC	67.631
020600040404	020600040404_SEP	SEP	14.105
020600050101	020600050101_MAC	MAC	87.662
020600050102	020600050102_MAC	MAC	47.645
020600050103	020600050103_MAC	MAC	56.532
020600050104	020600050104_MAC	MAC	97.036
020600050105	020600050105_MAC	MAC	110.539
020600050201	020600050201_MAC	MAC	94.217
020600050202	020600050202_MAC	MAC	147.465
020600050203	020600050203_MAC	MAC	105.038
020600050204	020600050204_MAC	MAC	66.663
020600050205	020600050205_MAC	MAC	105.016

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020600050206	020600050206_MAC	MAC	151.19
020600050301	020600050301_MAC	MAC	58.761
020600050302	020600050302_MAC	MAC	78.144
020600050303	020600050303_MAC	MAC	62.111
020600050304	020600050304_MAC	MAC	115.737
020600050401	020600050401_MAC	MAC	73.704
020600050402	020600050402_MAC	MAC	78.647
020600050501	020600050501_MAC	MAC	79.001
020600050502	020600050502_MAC	MAC	63.425
020600050503	020600050503_MAC	MAC	55.088
020600050504	020600050504_MAC	MAC	112.921
020600050505	020600050505_MAC	MAC	44.219
020600050506	020600050506_MAC	MAC	28.683
020600050507	020600050507_MAC	MAC	17.619
020600050508	020600050508_MAC	MAC	0.041
020600050509	020600050509_MAC	MAC	8.892
020600050601	020600050601_MAC	MAC	41.965
020600050602	020600050602_MAC	MAC	54.487
020600050603	020600050603_MAC	MAC	32.389
020600050604	020600050604_MAC	MAC	13.219
020600050605	020600050605_MAC	MAC	16.799
020600060101	020600060101_UNP	UNP	90.977
020600060102	020600060102_UNP	UNP	71.945
020600060103	020600060103_UNP	UNP	41.294
020600060104	020600060104_UNP	UNP	72.5
020600060105	020600060105_SEP	SEP	0.244
020600060105	020600060105_UNP	UNP	65.442
020600060201	020600060201_SEP	SEP	0.268
020600060201	020600060201_UNP	UNP	150.055
020600060202	020600060202_SEP	SEP	49.944
020600060202	020600060202_UNP	UNP	121.776
020600060203	020600060203_SEP	SEP	96.419
020600060301	020600060301_SEP	SEP	41.041

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020600060302	020600060302_SEP	SEP	78.951
020600060303	020600060303_SEP	SEP	60.367
020600060304	020600060304_SEP	SEP	108.89
020600060401	020600060401_SEP	SEP	122.331
020600060401	020600060401_UNP	UNP	3.038
020600060402	020600060402_SEP	SEP	103.292
020600060403	020600060403_SEP	SEP	83.299
020600060501	020600060501_SEP	SEP	50.005
020600060502	020600060502_MAC	MAC	6.889
020600060502	020600060502_SEP	SEP	89.889
020600060503	020600060503_MAC	MAC	1.715
020600060503	020600060503_SEP	SEP	50.946
020600060504	020600060504_MAC	MAC	19.014
020600060504	020600060504_SEP	SEP	77.093
020600060505	020600060505_MAC	MAC	4.515
020600060505	020600060505_SEP	SEP	66.414
020600060506	020600060506_MAC	MAC	27.57
020600060506	020600060506_SEP	SEP	66.946
020600060507	020600060507_MAC	MAC	17.834
020600060507	020600060507_SEP	SEP	79.844
020600060601	020600060601_MAC	MAC	38.994
020600060601	020600060601_SEP	SEP	97.289
020600060602	020600060602_MAC	MAC	9.862
020600060602	020600060602_SEP	SEP	82.185
020600060603	020600060603_MAC	MAC	8.43
020600060603	020600060603_SEP	SEP	74.796
020600060604	020600060604_MAC	MAC	22.766
020600060604	020600060604_SEP	SEP	52.211
020700010101	020700010101_SRV	SRV	164.396
020700010102	020700010102_SRV	SRV	75.894
020700010103	020700010103_SRV	SRV	83.626
020700010104	020700010104_NRV	NRV	0.001
020700010104	020700010104_SRV	SRV	101.578

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020700010105	020700010105_SRV	SRV	75.398
020700010106	020700010106_SRV	SRV	117.108
020700010107	020700010107_SRV	SRV	83.85
020700010108	020700010108_CA	CA	0.462
020700010108	020700010108_SRV	SRV	120.711
020700010201	020700010201_CA	CA	2.999
020700010201	020700010201_SRV	SRV	136.349
020700010202	020700010202_SRV	SRV	91.664
020700010301	020700010301_SRV	SRV	78.965
020700010302	020700010302_SRV	SRV	69.915
020700010303	020700010303_SRV	SRV	115.238
020700010304	020700010304_SRV	SRV	133.193
020700010305	020700010305_SRV	SRV	111.768
020700010306	020700010306_SRV	SRV	91.036
020700010307	020700010307_SRV	SRV	52.157
020700010308	020700010308_SRV	SRV	94.355
020700010309	020700010309_SRV	SRV	80.398
020700010310	020700010310_SRV	SRV	55.887
020700010401	020700010401_SRV	SRV	122.009
020700010402	020700010402_SRV	SRV	148.698
020700010501	020700010501_SRV	SRV	123.526
020700010502	020700010502_SRV	SRV	69.566
020700010503	020700010503_SRV	SRV	72.636
020700010504	020700010504_SRV	SRV	85.581
020700010505	020700010505_SRV	SRV	69.337
020700010506	020700010506_SRV	SRV	86.276
020700010507	020700010507_SRV	SRV	78.619
020700010508	020700010508_SRV	SRV	76.83
020700010509	020700010509_SRV	SRV	81.911
020700010601	020700010601_SRV	SRV	133.332
020700010602	020700010602_SRV	SRV	104.771
020700010603	020700010603_SRV	SRV	104.518
020700010604	020700010604_SRV	SRV	62.139

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700010605	020700010605_SRV	SRV	89.165
020700010606	020700010606_SRV	SRV	126.786
020700010607	020700010607_SRV	SRV	58.709
020700010608	020700010608_SRV	SRV	137.175
020700010609	020700010609_SRV	SRV	73.811
020700020101	020700020101_CA	CA	14.987
020700020101	020700020101_SRV	SRV	105.023
020700020102	020700020102_CA	CA	0.228
020700020102	020700020102_SRV	SRV	44.778
020700020103	020700020103_CA	CA	37.38
020700020103	020700020103_SRV	SRV	97.814
020700020201	020700020201_CA	CA	106.22
020700020202	020700020202_CA	CA	151.747
020700020202	020700020202_SRV	SRV	0.07
020700020203	020700020203_CA	CA	114.466
020700020204	020700020204_CA	CA	113.293
020700020204	020700020204_SRV	SRV	1.509
020700020205	020700020205_CA	CA	108.57
020700020205	020700020205_SRV	SRV	0.01
020700020206	020700020206_CA	CA	87.426
020700020206	020700020206_SRV	SRV	1.054
020700020207	020700020207_CA	CA	72.187
020700020207	020700020207_SRV	SRV	0.994
020700020301	020700020301_CA	CA	97.572
020700020302	020700020302_CA	CA	93.552
020700020302	020700020302_SRV	SRV	1.285
020700020401	020700020401_CA	CA	1.355
020700020401	020700020401_SRV	SRV	137.623
020700020402	020700020402_CA	CA	26.284
020700020402	020700020402_SRV	SRV	80.707
020700020403	020700020403_CA	CA	6.35
020700020403	020700020403_SRV	SRV	107.143
020700020501	020700020501_CA	CA	11.544

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700020501	020700020501_SRV	SRV	78.08
020700020502	020700020502_CA	CA	8.513
020700020502	020700020502_SRV	SRV	94.616
020700020503	020700020503_CA	CA	1.535
020700020503	020700020503_SRV	SRV	117.001
020700020504	020700020504_CA	CA	42.511
020700020504	020700020504_SRV	SRV	10.44
020700020505	020700020505_CA	CA	86.496
020700020505	020700020505_SRV	SRV	11.953
020700020506	020700020506_CA	CA	31.002
020700020506	020700020506_SRV	SRV	95.464
020700020507	020700020507_CA	CA	25.372
020700020507	020700020507_SRV	SRV	41.413
020700020601	020700020601_SRV	SRV	134.463
020700020602	020700020602_SRV	SRV	63.689
020700020603	020700020603_SRV	SRV	46.575
020700020701	020700020701_CA	CA	0.925
020700020701	020700020701_SRV	SRV	77.398
020700020702	020700020702_SRV	SRV	85.56
020700020703	020700020703_SRV	SRV	48.813
020700020704	020700020704_SRV	SRV	96.212
020700020705	020700020705_SRV	SRV	84.758
020700020706	020700020706_SRV	SRV	59.527
020700020707	020700020707_SRV	SRV	112.303
020700020708	020700020708_SRV	SRV	104.94
020700020709	020700020709_SRV	SRV	62.372
020700020801	020700020801_SRV	SRV	79.791
020700020802	020700020802_SRV	SRV	56.366
020700020803	020700020803_SRV	SRV	106.639
020700030101	020700030101_SRV	SRV	63.706
020700030102	020700030102_SRV	SRV	80.422
020700030103	020700030103_SRV	SRV	31.982
020700030104	020700030104_SRV	SRV	119.486

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020700030105	020700030105_SRV	SRV	51.727
020700030106	020700030106_SRV	SRV	59.74
020700030201	020700030201_SRV	SRV	75.169
020700030202	020700030202_SRV	SRV	41.903
020700030203	020700030203_SRV	SRV	57.571
020700030204	020700030204_SRV	SRV	49.642
020700030205	020700030205_SRV	SRV	58.73
020700030301	020700030301_SRV	SRV	94.917
020700030302	020700030302_SRV	SRV	65.271
020700030401	020700030401_SRV	SRV	44.745
020700030402	020700030402_SRV	SRV	56.194
020700030403	020700030403_SRV	SRV	41.786
020700030404	020700030404_SRV	SRV	72.494
020700030405	020700030405_SRV	SRV	54.312
020700030501	020700030501_SRV	SRV	59.261
020700030502	020700030502_SRV	SRV	116.071
020700030503	020700030503_SRV	SRV	66.67
020700030504	020700030504_SRV	SRV	148.035
020700030505	020700030505_SRV	SRV	72.817
020700030601	020700030601_SRV	SRV	149.834
020700030602	020700030602_SRV	SRV	99.932
020700030603	020700030603_SRV	SRV	93.593
020700030604	020700030604_SRV	SRV	58.531
020700030605	020700030605_SRV	SRV	55.865
020700030606	020700030606_SRV	SRV	75.664
020700030701	020700030701_SRV	SRV	122.527
020700030702	020700030702_SRV	SRV	116.246
020700030703	020700030703_SRV	SRV	77.825
020700030704	020700030704_SRV	SRV	51.4
020700030705	020700030705_SRV	SRV	147.555
020700030706	020700030706_SRV	SRV	97.201
020700030707	020700030707_SRV	SRV	71.49
020700030708	020700030708_SRV	SRV	85.012

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020700030801	020700030801_SRV	SRV	63.833
020700030802	020700030802_SRV	SRV	109.264
020700030803	020700030803_SRV	SRV	66.594
020700040101	020700040101_CA	CA	2.2
020700040101	020700040101_SRV	SRV	136.029
020700040102	020700040102_CA	CA	8.36
020700040102	020700040102_SRV	SRV	148.861
020700040201	020700040201_SRV	SRV	109.15
020700040202	020700040202_SRV	SRV	90.825
020700040203	020700040203_SRV	SRV	72.496
020700040204	020700040204_SRV	SRV	51.792
020700040205	020700040205_SRV	SRV	52.002
020700040301	020700040301_CA	CA	4.579
020700040301	020700040301_SRV	SRV	135.744
020700040302	020700040302_SRV	SRV	148.479
020700040303	020700040303_SRV	SRV	74.755
020700040304	020700040304_CA	CA	3.073
020700040304	020700040304_SRV	SRV	121.434
020700040305	020700040305_SRV	SRV	63.776
020700040401	020700040401_SRV	SRV	101.539
020700040402	020700040402_SRV	SRV	84.192
020700040403	020700040403_SGV	SGV	2.598
020700040403	020700040403_SRV	SRV	105.124
020700040404	020700040404_SRV	SRV	75.191
020700040405	020700040405_SGV	SGV	23.558
020700040405	020700040405_SRV	SRV	47.543
020700040406	020700040406_SRV	SRV	44.765
020700040407	020700040407_SRV	SRV	90.066
020700040408	020700040408_SRV	SRV	51.72
020700040409	020700040409_SRV	SRV	83.461
020700040501	020700040501_SRV	SRV	65.325
020700040502	020700040502_SRV	SRV	54.03
020700040503	020700040503_SRV	SRV	38.892

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700040504	020700040504_SRV	SRV	60.002
020700040505	020700040505_SGV	SGV	0.45
020700040505	020700040505_SRV	SRV	72.615
020700040601	020700040601_SRV	SRV	65.097
020700040602	020700040602_SRV	SRV	89.996
020700040603	020700040603_SGV	SGV	23.38
020700040603	020700040603_SRV	SRV	109.509
020700040604	020700040604_SGV	SGV	47.618
020700040604	020700040604_SRV	SRV	40.745
020700040605	020700040605_SGV	SGV	114.079
020700040605	020700040605_SRV	SRV	24.462
020700040701	020700040701_SGV	SGV	40.782
020700040701	020700040701_SRV	SRV	5.657
020700040702	020700040702_SGV	SGV	98.72
020700040702	020700040702_SRV	SRV	33.015
020700040703	020700040703_SGV	SGV	49.801
020700040703	020700040703_SRV	SRV	8.132
020700040801	020700040801_BLUE	BLUE	47.677
020700040802	020700040802_BLUE	BLUE	48.572
020700040803	020700040803_BLUE	BLUE	48.019
020700040803	020700040803_SGV	SGV	107.811
020700040804	020700040804_SGV	SGV	51.805
020700040805	020700040805_SGV	SGV	155.261
020700040806	020700040806_SGV	SGV	113.86
020700040806	020700040806_SRV	SRV	4.337
020700040807	020700040807_SGV	SGV	142.635
020700040807	020700040807_SRV	SRV	1.08
020700040901	020700040901_SGV	SGV	149.456
020700040901	020700040901_SRV	SRV	1.439
020700040902	020700040902_SGV	SGV	48.835
020700040902	020700040902_SRV	SRV	0.058
020700040903	020700040903_SGV	SGV	105.804
020700040904	020700040904_SGV	SGV	145.086

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700040905	020700040905_SGV	SGV	67.703
020700040905	020700040905_SRV	SRV	16.96
020700040906	020700040906_SGV	SGV	99.386
020700040906	020700040906_SRV	SRV	7.478
020700040907	020700040907_SGV	SGV	51.833
020700040907	020700040907_SRV	SRV	16.735
020700040908	020700040908_SGV	SGV	89.177
020700040909	020700040909_SGV	SGV	92.242
020700041001	020700041001_BLUE	BLUE	28.887
020700041001	020700041001_SGV	SGV	13.35
020700041002	020700041002_BLUE	BLUE	59.859
020700041002	020700041002_SGV	SGV	32.513
020700041003	020700041003_BLUE	BLUE	19.981
020700041003	020700041003_SGV	SGV	87.27
020700041004	020700041004_BLUE	BLUE	24.394
020700041004	020700041004_SGV	SGV	39.543
020700041005	020700041005_SGV	SGV	82.207
020700041006	020700041006_SGV	SGV	47.442
020700041007	020700041007_BLUE	BLUE	34.961
020700041007	020700041007_SGV	SGV	52.076
020700041008	020700041008_BLUE	BLUE	29.806
020700041008	020700041008_SGV	SGV	52.92
020700041009	020700041009_BLUE	BLUE	15.464
020700041009	020700041009_SGV	SGV	132.81
020700041101	020700041101_SGV	SGV	37.441
020700041101	020700041101_SRV	SRV	6.463
020700041102	020700041102_SGV	SGV	23.969
020700041102	020700041102_SRV	SRV	22.86
020700041103	020700041103_SGV	SGV	121.431
020700041103	020700041103_SRV	SRV	3.55
020700041104	020700041104_SGV	SGV	54.474
020700041105	020700041105_SGV	SGV	42.628
020700041106	020700041106_SGV	SGV	145.585

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700041107	020700041107_BLUE	BLUE	0.96
020700041107	020700041107_SGV	SGV	47.569
020700041108	020700041108_BLUE	BLUE	31.251
020700041108	020700041108_SGV	SGV	21.958
020700050101	020700050101_SGV	SGV	143.116
020700050101	020700050101_SRV	SRV	18.221
020700050102	020700050102_SGV	SGV	32.803
020700050102	020700050102_SRV	SRV	44.566
020700050103	020700050103_SGV	SGV	31.098
020700050103	020700050103_SRV	SRV	61.346
020700050104	020700050104_SGV	SGV	40.812
020700050105	020700050105_SGV	SGV	53.029
020700050105	020700050105_SRV	SRV	16.803
020700050201	020700050201_SGV	SGV	118.116
020700050202	020700050202_SGV	SGV	49.612
020700050203	020700050203_SGV	SGV	111.058
020700050301	020700050301_SGV	SGV	72.375
020700050302	020700050302_SGV	SGV	85.354
020700050303	020700050303_SGV	SGV	92.377
020700050401	020700050401_SRV	SRV	102.825
020700050402	020700050402_SRV	SRV	65.868
020700050403	020700050403_SGV	SGV	24.048
020700050403	020700050403_SRV	SRV	104.28
020700050404	020700050404_SGV	SGV	40.877
020700050405	020700050405_SGV	SGV	79.118
020700050405	020700050405_SRV	SRV	36.06
020700050501	020700050501_SRV	SRV	100.947
020700050502	020700050502_SRV	SRV	88.577
020700050503	020700050503_SGV	SGV	55.068
020700050503	020700050503_SRV	SRV	26.526
020700050504	020700050504_SGV	SGV	28.892
020700050504	020700050504_SRV	SRV	11.725
020700050601	020700050601_SGV	SGV	48.017

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700050602	020700050602_SGV	SGV	50.409
020700050603	020700050603_SGV	SGV	64.025
020700050604	020700050604_SGV	SGV	59.559
020700050605	020700050605_SGV	SGV	102.854
020700050606	020700050606_SGV	SGV	65.863
020700050701	020700050701_BLUE	BLUE	30.829
020700050701	020700050701_SGV	SGV	78.109
020700050702	020700050702_BLUE	BLUE	29.013
020700050702	020700050702_SGV	SGV	74.682
020700050703	020700050703_BLUE	BLUE	92.726
020700050703	020700050703_SGV	SGV	15.198
020700050704	020700050704_BLUE	BLUE	57.035
020700050704	020700050704_SGV	SGV	79.175
020700050705	020700050705_BLUE	BLUE	48.455
020700050705	020700050705_SGV	SGV	102.701
020700050801	020700050801_BLUE	BLUE	63.86
020700050801	020700050801_SGV	SGV	52.855
020700050802	020700050802_SGV	SGV	69.54
020700050803	020700050803_BLUE	BLUE	68.687
020700050803	020700050803_SGV	SGV	69.581
020700050804	020700050804_BLUE	BLUE	37.394
020700050804	020700050804_SGV	SGV	102.774
020700050805	020700050805_BLUE	BLUE	91.749
020700050805	020700050805_SGV	SGV	21.962
020700050901	020700050901_BLUE	BLUE	14.948
020700050901	020700050901_SGV	SGV	71.529
020700050902	020700050902_SGV	SGV	39.848
020700050903	020700050903_BLUE	BLUE	26.315
020700050903	020700050903_SGV	SGV	37.861
020700050904	020700050904_SGV	SGV	59.348
020700050905	020700050905_SGV	SGV	84.072
020700050906	020700050906_BLUE	BLUE	72.004
020700050906	020700050906_SGV	SGV	52.045

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700050907	020700050907_BLUE	BLUE	61.327
020700050907	020700050907_SGV	SGV	45.729
020700051001	020700051001_BLUE	BLUE	37.471
020700051001	020700051001_SGV	SGV	71.787
020700051002	020700051002_BLUE	BLUE	46.544
020700051002	020700051002_SGV	SGV	103.093
020700051003	020700051003_BLUE	BLUE	47.396
020700051003	020700051003_SGV	SGV	23.417
020700051004	020700051004_BLUE	BLUE	5.948
020700051004	020700051004_SGV	SGV	68.411
020700051005	020700051005_BLUE	BLUE	40.669
020700051005	020700051005_SGV	SGV	16.595
020700060101	020700060101_SRV	SRV	80.773
020700060102	020700060102_SRV	SRV	74.304
020700060103	020700060103_SRV	SRV	125.959
020700060104	020700060104_SRV	SRV	81.639
020700060105	020700060105_SRV	SRV	94.952
020700060106	020700060106_SRV	SRV	82.391
020700060201	020700060201_SGV	SGV	56.698
020700060202	020700060202_SGV	SGV	55.491
020700060203	020700060203_SGV	SGV	58.127
020700060204	020700060204_BLUE	BLUE	0
020700060204	020700060204_SGV	SGV	102.618
020700060301	020700060301_SGV	SGV	44.851
020700060301	020700060301_SRV	SRV	15.045
020700060302	020700060302_SGV	SGV	118.527
020700060302	020700060302_SRV	SRV	1.661
020700060303	020700060303_SGV	SGV	138.974
020700060303	020700060303_SRV	SRV	1.57
020700060304	020700060304_SGV	SGV	60.899
020700060304	020700060304_SRV	SRV	1.163
020700060305	020700060305_SGV	SGV	70.738
020700060305	020700060305_SRV	SRV	49.956
020700060306	020700060306_SGV	SGV	70.664
020700060401	020700060401_SRV	SRV	134.419
020700060402	020700060402_SRV	SRV	44.817
020700060403	020700060403_SGV	SGV	103.107
020700060403	020700060403_SRV	SRV	11.755
020700060501	020700060501_SGV	SGV	137.625
020700060501	020700060501_SRV	SRV	20.643
020700060502	020700060502_SGV	SGV	57.694
020700060502	020700060502_SRV	SRV	8.016
020700060503	020700060503_SGV	SGV	85.876
020700060503	020700060503_SRV	SRV	7.65
020700060601	020700060601_SRV	SRV	106.483
020700060602	020700060602_SRV	SRV	74.599
020700060603	020700060603_SRV	SRV	45.296
020700060604	020700060604_SGV	SGV	23.79
020700060604	020700060604_SRV	SRV	33.976
020700060605	020700060605_SGV	SGV	107.859
020700060605	020700060605_SRV	SRV	15.831
020700060701	020700060701_SGV	SGV	130.695
020700060702	020700060702_SGV	SGV	96.899
020700060703	020700060703_SGV	SGV	48.246
020700070101	020700070101_SGV	SGV	122.473
020700070102	020700070102_BLUE	BLUE	36.246
020700070102	020700070102_LNP	LNP	4.943
020700070102	020700070102_SGV	SGV	48.255
020700070103	020700070103_BLUE	BLUE	38.959
020700070103	020700070103_SGV	SGV	57.182
020700070104	020700070104_BLUE	BLUE	32.878
020700070104	020700070104_SGV	SGV	29.718
020700070105	020700070105_SGV	SGV	55.546
020700070201	020700070201_BLUE	BLUE	25.922
020700070201	020700070201_SGV	SGV	43.385
020700070202	020700070202_BLUE	BLUE	55.96

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700070202	020700070202_SGV	SGV	86.034
020700070203	020700070203_SGV	SGV	51.025
020700070301	020700070301_BLUE	BLUE	0.001
020700070301	020700070301_SGV	SGV	56.226
020700070302	020700070302_SGV	SGV	52.073
020700070303	020700070303_BLUE	BLUE	20.976
020700070303	020700070303_SGV	SGV	16.905
020700070304	020700070304_BLUE	BLUE	30.111
020700070304	020700070304_SGV	SGV	47.209
020700080101	020700080101_BLUE	BLUE	87.137
020700080102	020700080102_BLUE	BLUE	55.812
020700080102	020700080102_LNP	LNP	73.928
020700080103	020700080103_BLUE	BLUE	12.532
020700080103	020700080103_LNP	LNP	82.904
020700080201	020700080201_BLUE	BLUE	33.751
020700080202	020700080202_BLUE	BLUE	49.719
020700080202	020700080202_LNP	LNP	110.094
020700080301	020700080301_BLUE	BLUE	25.45
020700080301	020700080301_LNP	LNP	120.549
020700080302	020700080302_BLUE	BLUE	9.483
020700080302	020700080302_LNP	LNP	84.127
020700080401	020700080401_BLUE	BLUE	20.535
020700080401	020700080401_LNP	LNP	85.399
020700080402	020700080402_LNP	LNP	48.693
020700080403	020700080403_BLUE	BLUE	17.115
020700080403	020700080403_LNP	LNP	139.475
020700080501	020700080501_BLUE	BLUE	15.054
020700080501	020700080501_LNP	LNP	62.637
020700080502	020700080502_BLUE	BLUE	20.652
020700080502	020700080502_LNP	LNP	136.846
020700080503	020700080503_BLUE	BLUE	18.229
020700080503	020700080503_LNP	LNP	55.869
020700080504	020700080504_LNP	LNP	48.897

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700080505	020700080505_LNP	LNP	78.569
020700080601	020700080601_BLUE	BLUE	13.084
020700080601	020700080601_LNP	LNP	125.406
020700080602	020700080602_BLUE	BLUE	5.255
020700080602	020700080602_LNP	LNP	110.04
020700080701	020700080701_LNP	LNP	143.082
020700080702	020700080702_LNP	LNP	67.608
020700080703	020700080703_LNP	LNP	44.34
020700080704	020700080704_LNP	LNP	55.48
020700080801	020700080801_LNP	LNP	98.893
020700080802	020700080802_LNP	LNP	162.22
020700080803	020700080803_LNP	LNP	74.51
020700080901	020700080901_LNP	LNP	68.439
020700080902	020700080902_LNP	LNP	60.342
020700080902	020700080902_PIED	PIED	0.98
020700080903	020700080903_LNP	LNP	72.115
020700080904	020700080904_LNP	LNP	77.344
020700080905	020700080905_LNP	LNP	54.606
020700080905	020700080905_PIED	PIED	4.164
020700081001	020700081001_LNP	LNP	50.389
020700081002	020700081002_LNP	LNP	57.685
020700081003	020700081003_LNP	LNP	66.197
020700081004	020700081004_LNP	LNP	71.504
020700081004	020700081004_PIED	PIED	79.361
020700081005	020700081005_LNP	LNP	151.645
020700090101	020700090101_LNP	LNP	66.186
020700090102	020700090102_LNP	LNP	98.207
020700090201	020700090201_BLUE	BLUE	27.616
020700090201	020700090201_LNP	LNP	28.447
020700090202	020700090202_BLUE	BLUE	27.219
020700090202	020700090202_LNP	LNP	38.225
020700090203	020700090203_LNP	LNP	86.62
020700090301	020700090301_BLUE	BLUE	53.073

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700090301	020700090301_LNP	LNP	5.87
020700090302	020700090302_BLUE	BLUE	21.859
020700090302	020700090302_LNP	LNP	47.313
020700090303	020700090303_BLUE	BLUE	46.26
020700090303	020700090303_LNP	LNP	55.434
020700090401	020700090401_LNP	LNP	85.798
020700090402	020700090402_LNP	LNP	76.309
020700090403	020700090403_LNP	LNP	53.575
020700090404	020700090404_LNP	LNP	133.746
020700090405	020700090405_LNP	LNP	150.125
020700090501	020700090501_LNP	LNP	63.636
020700090502	020700090502_LNP	LNP	89.151
020700090503	020700090503_LNP	LNP	39.159
020700090504	020700090504_BLUE	BLUE	53.646
020700090504	020700090504_LNP	LNP	49.313
020700090505	020700090505_BLUE	BLUE	61.929
020700090505	020700090505_LNP	LNP	46.051
020700090506	020700090506_BLUE	BLUE	0.434
020700090506	020700090506_LNP	LNP	71.522
020700090601	020700090601_BLUE	BLUE	48.438
020700090601	020700090601_LNP	LNP	97.929
020700090602	020700090602_LNP	LNP	50.701
020700090603	020700090603_LNP	LNP	52.582
020700090604	020700090604_LNP	LNP	54.503
020700090605	020700090605_LNP	LNP	72.5
020700090606	020700090606_BLUE	BLUE	9.392
020700090606	020700090606_LNP	LNP	149.873
020700090701	020700090701_LNP	LNP	82.612
020700090702	020700090702_LNP	LNP	63.648
020700090703	020700090703_LNP	LNP	107.23
020700090704	020700090704_BLUE	BLUE	9.919
020700090704	020700090704_LNP	LNP	135.307
020700100101	020700100101_LNP	LNP	105.707

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700100102	020700100102_LNP	LNP	76.891
020700100102	020700100102_SEP	SEP	15.612
020700100103	020700100103_LNP	LNP	54.107
020700100103	020700100103_PIED	PIED	4.631
020700100103	020700100103_SEP	SEP	36.211
020700100201	020700100201_LNP	LNP	92.89
020700100201	020700100201_SEP	SEP	42.571
020700100202	020700100202_LNP	LNP	43.755
020700100202	020700100202_SEP	SEP	36.926
020700100203	020700100203_SEP	SEP	113.585
020700100204	020700100204_SEP	SEP	119.59
020700100301	020700100301_LNP	LNP	9.035
020700100301	020700100301_PIED	PIED	17.803
020700100301	020700100301_SEP	SEP	75.06
020700100302	020700100302_LNP	LNP	42.27
020700100302	020700100302_PIED	PIED	31.889
020700100302	020700100302_SEP	SEP	44.446
020700100303	020700100303_SEP	SEP	67.413
020700100304	020700100304_SEP	SEP	47.546
020700100305	020700100305_SEP	SEP	132.21
020700100306	020700100306_SEP	SEP	46.772
020700100307	020700100307_SEP	SEP	107.627
020700100401	020700100401_PIED	PIED	80.075
020700100401	020700100401_SEP	SEP	15.433
020700100402	020700100402_LNP	LNP	13.925
020700100402	020700100402_PIED	PIED	89.676
020700100402	020700100402_SEP	SEP	41.612
020700100501	020700100501_LNP	LNP	97.939
020700100502	020700100502_LNP	LNP	95.239
020700100503	020700100503_LNP	LNP	67.345
020700100504	020700100504_LNP	LNP	98.614
020700100601	020700100601_LNP	LNP	74.698
020700100602	020700100602_LNP	LNP	95.749

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700100603	020700100603_LNP	LNP	66.095
020700100604	020700100604_LNP	LNP	44.94
020700100605	020700100605_LNP	LNP	87.129
020700100605	020700100605_PIED	PIED	16.581
020700100606	020700100606_LNP	LNP	74.179
020700100606	020700100606_PIED	PIED	48.29
020700100701	020700100701_LNP	LNP	99.094
020700100702	020700100702_LNP	LNP	70.933
020700100703	020700100703_LNP	LNP	71.203
020700100704	020700100704_LNP	LNP	130.407
020700100704	020700100704_PIED	PIED	5.241
020700100705	020700100705_LNP	LNP	24.897
020700100705	020700100705_PIED	PIED	100.381
020700100801	020700100801_LNP	LNP	6.95
020700100801	020700100801_PIED	PIED	67.434
020700100802	020700100802_PIED	PIED	90.856
020700100803	020700100803_PIED	PIED	28.475
020700100803	020700100803_SEP	SEP	23.143
020700100804	020700100804_PIED	PIED	47.223
020700100804	020700100804_SEP	SEP	10.053
020700100805	020700100805_PIED	PIED	4.522
020700100805	020700100805_SEP	SEP	61.128
020700110101	020700110101_SEP	SEP	142.983
020700110102	020700110102_SEP	SEP	97.321
020700110103	020700110103_PIED	PIED	34.388
020700110103	020700110103_SEP	SEP	12.067
020700110104	020700110104_PIED	PIED	65.869
020700110104	020700110104_SEP	SEP	32.543
020700110105	020700110105_PIED	PIED	58.158
020700110105	020700110105_SEP	SEP	28.008
020700110106	020700110106_SEP	SEP	87.535
020700110201	020700110201_PIED	PIED	48.427
020700110201	020700110201_SEP	SEP	0.072

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700110202	020700110202_PIED	PIED	95.893
020700110203	020700110203_PIED	PIED	12.548
020700110203	020700110203_SEP	SEP	61.679
020700110204	020700110204_PIED	PIED	11.899
020700110204	020700110204_SEP	SEP	45.815
020700110205	020700110205_PIED	PIED	76.23
020700110205	020700110205_SEP	SEP	2.48
020700110206	020700110206_PIED	PIED	2.886
020700110206	020700110206_SEP	SEP	82.272
020700110207	020700110207_MAC	MAC	4.877
020700110207	020700110207_SEP	SEP	56.275
020700110301	020700110301_MAC	MAC	0.436
020700110301	020700110301_SEP	SEP	67.717
020700110302	020700110302_MAC	MAC	21.228
020700110302	020700110302_SEP	SEP	99.727
020700110303	020700110303_MAC	MAC	24.535
020700110303	020700110303_SEP	SEP	19.576
020700110304	020700110304_MAC	MAC	7.388
020700110304	020700110304_SEP	SEP	106.422
020700110305	020700110305_MAC	MAC	44.314
020700110305	020700110305_SEP	SEP	29.69
020700110306	020700110306_MAC	MAC	21.105
020700110306	020700110306_SEP	SEP	15.309
020700110401	020700110401_SEP	SEP	135.697
020700110402	020700110402_SEP	SEP	61.204
020700110403	020700110403_SEP	SEP	100.428
020700110501	020700110501_SEP	SEP	118.013
020700110502	020700110502_SEP	SEP	34.801
020700110503	020700110503_SEP	SEP	100.116
020700110504	020700110504_MAC	MAC	15.705
020700110504	020700110504_SEP	SEP	19.945
020700110505	020700110505_MAC	MAC	13.921
020700110505	020700110505_SEP	SEP	1.048

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700110601	020700110601_MAC	MAC	18.132
020700110601	020700110601_SEP	SEP	98.36
020700110602	020700110602_MAC	MAC	20.909
020700110602	020700110602_SEP	SEP	37.778
020700110603	020700110603_MAC	MAC	16.76
020700110603	020700110603_SEP	SEP	53.314
020700110604	020700110604_MAC	MAC	54.66
020700110604	020700110604_SEP	SEP	40.702
020700110701	020700110701_MAC	MAC	25.066
020700110701	020700110701_SEP	SEP	92.538
020700110702	020700110702_SEP	SEP	98.491
020700110703	020700110703_MAC	MAC	7.292
020700110703	020700110703_SEP	SEP	34.655
020700110704	020700110704_MAC	MAC	31.344
020700110704	020700110704_SEP	SEP	21.668
020700110801	020700110801_MAC	MAC	8.839
020700110801	020700110801_SEP	SEP	112.747
020700110802	020700110802_MAC	MAC	18.139
020700110802	020700110802_SEP	SEP	19.503
020700110803	020700110803_MAC	MAC	79.517
020700110803	020700110803_SEP	SEP	15.178
020700110804	020700110804_MAC	MAC	32.802
020700110804	020700110804_SEP	SEP	81.104
020700110805	020700110805_MAC	MAC	18.852
020700110805	020700110805_SEP	SEP	49.383
020700110806	020700110806_MAC	MAC	56.398
020700110806	020700110806_SEP	SEP	30.955
020700110901	020700110901_SEP	SEP	84.097
020700110902	020700110902_MAC	MAC	11.067
020700110902	020700110902_SEP	SEP	58.118
020700110903	020700110903_MAC	MAC	22.854
020700110903	020700110903_SEP	SEP	4.613
020700110904	020700110904_MAC	MAC	22.159

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020700110904	020700110904_SEP	SEP	6.52
020700111001	020700111001_MAC	MAC	6.925
020801010000	020801010000_MAC	MAC	8.479
020801020101	020801020101_MAC	MAC	30.76
020801020101	020801020101_SEP	SEP	5.785
020801020102	020801020102_MAC	MAC	18.9
020801020102	020801020102_SEP	SEP	122.086
020801020103	020801020103_MAC	MAC	15.608
020801020104	020801020104_MAC	MAC	37.32
020801020104	020801020104_SEP	SEP	25.732
020801020105	020801020105_MAC	MAC	45.156
020801020105	020801020105_SEP	SEP	7.779
020801020201	020801020201_SEP	SEP	117.508
020801020202	020801020202_SEP	SEP	61.159
020801020203	020801020203_SEP	SEP	82.74
020801020204	020801020204_SEP	SEP	102.584
020801020301	020801020301_MAC	MAC	1.026
020801020301	020801020301_SEP	SEP	131.332
020801020302	020801020302_MAC	MAC	31.863
020801020302	020801020302_SEP	SEP	8.787
020801020303	020801020303_MAC	MAC	65.009
020801020401	020801020401_MAC	MAC	1.016
020801020401	020801020401_SEP	SEP	79.246
020801020402	020801020402_MAC	MAC	0.536
020801020402	020801020402_SEP	SEP	39.843
020801020403	020801020403_MAC	MAC	27.183
020801020403	020801020403_SEP	SEP	6.763
020801020404	020801020404_MAC	MAC	63.873
020801020404	020801020404_SEP	SEP	16.316
020801020405	020801020405_MAC	MAC	46.375
020801020406	020801020406_MAC	MAC	58.332
020801020407	020801020407_MAC	MAC	67.276
020801020407	020801020407_SEP	SEP	3.509

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020801020408	020801020408_MAC	MAC	0.021
020801030101	020801030101_BLUE	BLUE	19.618
020801030101	020801030101_LNP	LNP	83.339
020801030102	020801030102_BLUE	BLUE	33.001
020801030102	020801030102_LNP	LNP	55.741
020801030103	020801030103_LNP	LNP	35.257
020801030104	020801030104_LNP	LNP	93.707
020801030201	020801030201_LNP	LNP	40.507
020801030202	020801030202_LNP	LNP	143.61
020801030203	020801030203_LNP	LNP	158.928
020801030301	020801030301_BLUE	BLUE	76.548
020801030301	020801030301_LNP	LNP	56.613
020801030302	020801030302_BLUE	BLUE	63.283
020801030302	020801030302_LNP	LNP	45.389
020801030303	020801030303_BLUE	BLUE	3.837
020801030303	020801030303_LNP	LNP	67.146
020801030304	020801030304_LNP	LNP	93.711
020801030401	020801030401_BLUE	BLUE	58.51
020801030401	020801030401_LNP	LNP	65.57
020801030402	020801030402_BLUE	BLUE	23.417
020801030402	020801030402_LNP	LNP	37.791
020801030403	020801030403_LNP	LNP	138.771
020801030404	020801030404_LNP	LNP	76.463
020801030405	020801030405_LNP	LNP	101.464
020801030501	020801030501_LNP	LNP	125.233
020801030502	020801030502_LNP	LNP	46.082
020801030503	020801030503_LNP	LNP	53.518
020801030503	020801030503_PIED	PIED	11.169
020801030601	020801030601_LNP	LNP	114.419
020801030601	020801030601_PIED	PIED	6.258
020801030602	020801030602_LNP	LNP	92.545
020801030602	020801030602_PIED	PIED	8.903
020801030603	020801030603_PIED	PIED	104.331

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020801030604	020801030604_LNP	LNP	0.188
020801030604	020801030604_PIED	PIED	98.935
020801030701	020801030701_BLUE	BLUE	75.702
020801030701	020801030701_LNP	LNP	33.348
020801030702	020801030702_BLUE	BLUE	51.842
020801030702	020801030702_LNP	LNP	23.113
020801030703	020801030703_BLUE	BLUE	33.889
020801030703	020801030703_LNP	LNP	109.534
020801030801	020801030801_LNP	LNP	100.701
020801030802	020801030802_LNP	LNP	84.407
020801030803	020801030803_LNP	LNP	60.465
020801030804	020801030804_LNP	LNP	64.629
020801030901	020801030901_BLUE	BLUE	78.514
020801030901	020801030901_LNP	LNP	6.812
020801030902	020801030902_BLUE	BLUE	20.741
020801030902	020801030902_LNP	LNP	63.423
020801030903	020801030903_BLUE	BLUE	17.978
020801030903	020801030903_LNP	LNP	36.953
020801030904	020801030904_LNP	LNP	160.145
020801030905	020801030905_LNP	LNP	60.76
020801030906	020801030906_LNP	LNP	58.061
020801031001	020801031001_LNP	LNP	72.384
020801031002	020801031002_LNP	LNP	73.658
020801031003	020801031003_LNP	LNP	124.637
020801031003	020801031003_PIED	PIED	6.158
020801031101	020801031101_LNP	LNP	29.838
020801031101	020801031101_PIED	PIED	53.425
020801031102	020801031102_PIED	PIED	96.399
020801031103	020801031103_PIED	PIED	104.869
020801031104	020801031104_PIED	PIED	42.797
020801031105	020801031105_PIED	PIED	56.964
020801040101	020801040101_PIED	PIED	90.742
020801040101	020801040101_SEP	SEP	11.397

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020801040102	020801040102_PIED	PIED	4.35
020801040102	020801040102_SEP	SEP	133.001
020801040103	020801040103_PIED	PIED	10.626
020801040103	020801040103_SEP	SEP	88.93
020801040104	020801040104_SEP	SEP	79.865
020801040201	020801040201_SEP	SEP	155.781
020801040202	020801040202_SEP	SEP	89.993
020801040203	020801040203_SEP	SEP	121.358
020801040301	020801040301_SEP	SEP	96.537
020801040302	020801040302_SEP	SEP	52.652
020801040303	020801040303_SEP	SEP	103.31
020801040304	020801040304_SEP	SEP	127.393
020801040305	020801040305_SEP	SEP	112.681
020801040401	020801040401_SEP	SEP	118.139
020801040402	020801040402_SEP	SEP	75.04
020801040403	020801040403_SEP	SEP	67.604
020801040404	020801040404_SEP	SEP	75.17
020801040405	020801040405_SEP	SEP	148.658
020801040406	020801040406_SEP	SEP	80.077
020801040501	020801040501_SEP	SEP	56.675
020801040502	020801040502_SEP	SEP	116.437
020801040503	020801040503_SEP	SEP	43.483
020801040504	020801040504_SEP	SEP	81.331
020801040601	020801040601_SEP	SEP	75.301
020801040602	020801040602_SEP	SEP	92.908
020801040603	020801040603_SEP	SEP	85.25
020801040701	020801040701_SEP	SEP	106.847
020801040702	020801040702_MAC	MAC	0.303
020801040702	020801040702_SEP	SEP	62.881
020801040703	020801040703_SEP	SEP	27.574
020801040704	020801040704_MAC	MAC	6.647
020801040704	020801040704_SEP	SEP	26.782
020801040705	020801040705_MAC	MAC	25.128

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020801040705	020801040705_SEP	SEP	21.419
020801050101	020801050101_PIED	PIED	88.346
020801050101	020801050101_SEP	SEP	46.406
020801050102	020801050102_PIED	PIED	134.44
020801050103	020801050103_PIED	PIED	43.631
020801050104	020801050104_PIED	PIED	41.248
020801050104	020801050104_SEP	SEP	20.628
020801050105	020801050105_SEP	SEP	54.556
020801050201	020801050201_PIED	PIED	40.646
020801050202	020801050202_PIED	PIED	70.615
020801050203	020801050203_PIED	PIED	26.186
020801050203	020801050203_SEP	SEP	32.071
020801050204	020801050204_PIED	PIED	66.941
020801050204	020801050204_SEP	SEP	95.646
020801050205	020801050205_SEP	SEP	132.732
020801050301	020801050301_PIED	PIED	27.574
020801050301	020801050301_SEP	SEP	99.893
020801050302	020801050302_SEP	SEP	70.098
020801050303	020801050303_SEP	SEP	102.549
020801050401	020801050401_SEP	SEP	127.424
020801050402	020801050402_SEP	SEP	158.727
020801050403	020801050403_SEP	SEP	68.896
020801050501	020801050501_SEP	SEP	96.181
020801050502	020801050502_SEP	SEP	59.001
020801050503	020801050503_SEP	SEP	122.276
020801050504	020801050504_SEP	SEP	160.515
020801050601	020801050601_SEP	SEP	88.165
020801050602	020801050602_SEP	SEP	74.867
020801050603	020801050603_SEP	SEP	94.742
020801050604	020801050604_SEP	SEP	114.903
020801060101	020801060101_LNP	LNP	16.551
020801060101	020801060101_PIED	PIED	109.734
020801060102	020801060102_PIED	PIED	78.067

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020801060103	020801060103_PIED	PIED	134.97
020801060201	020801060201_PIED	PIED	115.429
020801060202	020801060202_PIED	PIED	148.484
020801060203	020801060203_PIED	PIED	49.717
020801060204	020801060204_PIED	PIED	103.804
020801060301	020801060301_PIED	PIED	95.825
020801060302	020801060302_PIED	PIED	92.236
020801060303	020801060303_PIED	PIED	102.08
020801060303	020801060303_SEP	SEP	4.46
020801060304	020801060304_PIED	PIED	105.968
020801060304	020801060304_SEP	SEP	51.946
020801060401	020801060401_LNP	LNP	18.739
020801060401	020801060401_PIED	PIED	121.702
020801060402	020801060402_PIED	PIED	53.105
020801060403	020801060403_PIED	PIED	64.129
020801060404	020801060404_PIED	PIED	86.124
020801060501	020801060501_LNP	LNP	30.195
020801060501	020801060501_PIED	PIED	121.439
020801060502	020801060502_PIED	PIED	114.329
020801060503	020801060503_PIED	PIED	51.887
020801060601	020801060601_PIED	PIED	56.561
020801060602	020801060602_PIED	PIED	52.476
020801060603	020801060603_PIED	PIED	114.302
020801060701	020801060701_PIED	PIED	153.799
020801060702	020801060702_PIED	PIED	124.18
020801060702	020801060702_SEP	SEP	28.731
020801060801	020801060801_PIED	PIED	109.427
020801060802	020801060802_PIED	PIED	107.386
020801060803	020801060803_PIED	PIED	29.971
020801060803	020801060803_SEP	SEP	101.668
020801060901	020801060901_SEP	SEP	159.356
020801060902	020801060902_SEP	SEP	52.379
020801060903	020801060903_SEP	SEP	69.813

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020801060904	020801060904_SEP	SEP	79.212
020801061001	020801061001_SEP	SEP	59.192
020801061002	020801061002_SEP	SEP	68.001
020801061003	020801061003_SEP	SEP	83.226
020801061004	020801061004_SEP	SEP	135.568
020801061005	020801061005_SEP	SEP	71.735
020801061101	020801061101_SEP	SEP	156.316
020801061102	020801061102_SEP	SEP	130.122
020801070101	020801070101_SEP	SEP	57.913
020801070102	020801070102_SEP	SEP	109.222
020801070103	020801070103_SEP	SEP	106.648
020801070104	020801070104_SEP	SEP	87.904
020801070201	020801070201_SEP	SEP	59.192
020801070202	020801070202_SEP	SEP	61.515
020801070203	020801070203_MAC	MAC	0.148
020801070203	020801070203_SEP	SEP	100.55
020801070204	020801070204_MAC	MAC	35.291
020801070204	020801070204_SEP	SEP	5.36
020801080101	020801080101_MAC	MAC	106.999
020801080102	020801080102_MAC	MAC	53.734
020801080103	020801080103_MAC	MAC	60.313
020801080104	020801080104_MAC	MAC	34.155
020801080201	020801080201_MAC	MAC	150.794
020801080202	020801080202_MAC	MAC	67.636
020801090101	020801090101_MAC	MAC	67.845
020801090102	020801090102_MAC	MAC	98.558
020801090201	020801090201_MAC	MAC	71.473
020801090202	020801090202_MAC	MAC	63.937
020801090203	020801090203_MAC	MAC	46.032
020801090204	020801090204_MAC	MAC	77.75
020801090205	020801090205_MAC	MAC	61.198
020801090301	020801090301_MAC	MAC	53.533
020801090302	020801090302_MAC	MAC	112.957

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020801090303	020801090303_MAC	MAC	103.779
020801090304	020801090304_MAC	MAC	73.016
020801090305	020801090305_MAC	MAC	64.802
020801090306	020801090306_MAC	MAC	102.405
020801090307	020801090307_MAC	MAC	58.253
020801090401	020801090401_MAC	MAC	78.169
020801090402	020801090402_MAC	MAC	112.051
020801090403	020801090403_MAC	MAC	98.836
020801090404	020801090404_MAC	MAC	97.182
020801090405	020801090405_MAC	MAC	110.898
020801090406	020801090406_MAC	MAC	110.047
020801090501	020801090501_MAC	MAC	74.904
020801090502	020801090502_MAC	MAC	65.8
020801090503	020801090503_MAC	MAC	64.001
020801090504	020801090504_MAC	MAC	134.09
020801090505	020801090505_MAC	MAC	85.177
020801100101	020801100101_MAC	MAC	84.978
020801100102	020801100102_MAC	MAC	142.155
020801100103	020801100103_MAC	MAC	66.566
020801100201	020801100201_MAC	MAC	65.269
020801100202	020801100202_MAC	MAC	83.395
020801100203	020801100203_MAC	MAC	128.613
020801100204	020801100204_MAC	MAC	60.504
020801100205	020801100205_MAC	MAC	51.512
020801100206	020801100206_MAC	MAC	38.243
020801100301	020801100301_MAC	MAC	100.425
020801100302	020801100302_MAC	MAC	59.914
020801100303	020801100303_MAC	MAC	75.07
020801100304	020801100304_MAC	MAC	82.595
020801100305	020801100305_MAC	MAC	87.115
020801100306	020801100306_MAC	MAC	70.087
020801100307	020801100307_MAC	MAC	82.071
020801100401	020801100401_MAC	MAC	51.145

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020801100402	020801100402_MAC	MAC	43.421
020801100403	020801100403_MAC	MAC	94.083
020801100404	020801100404_MAC	MAC	66.637
020801100405	020801100405_MAC	MAC	84.482
020801100501	020801100501_MAC	MAC	13.433
020801100502	020801100502_MAC	MAC	27.243
020801100503	020801100503_MAC	MAC	0.112
020801100601	020801100601_MAC	MAC	33.229
020801100602	020801100602_MAC	MAC	22.341
020801110101	020801110101_MAC	MAC	94.77
020801110102	020801110102_MAC	MAC	85.451
020801110201	020801110201_MAC	MAC	133.798
020801110202	020801110202_MAC	MAC	121.487
020801110203	020801110203_MAC	MAC	143.976
020801110204	020801110204_MAC	MAC	77.962
020801110205	020801110205_MAC	MAC	81.316
020801110301	020801110301_MAC	MAC	161.607
020801110302	020801110302_MAC	MAC	148.296
020801110303	020801110303_MAC	MAC	119.979
020801110401	020801110401_MAC	MAC	86.409
020801110402	020801110402_MAC	MAC	82.951
020801110501	020801110501_MAC	MAC	92.394
020801110502	020801110502_MAC	MAC	65.326
020801110601	020801110601_MAC	MAC	69.557
020801110602	020801110602_MAC	MAC	103.324
020801110701	020801110701_MAC	MAC	6.253
020801110702	020801110702_MAC	MAC	50.836
020801110703	020801110703_MAC	MAC	59.066
020801110801	020801110801_MAC	MAC	73.221
020801110802	020801110802_MAC	MAC	49.902
020801110803	020801110803_MAC	MAC	67.038
020801110804	020801110804_MAC	MAC	70.229
020801110901	020801110901_MAC	MAC	72.701

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020801110902	020801110902_MAC	MAC	80.989
020802010101	020802010101_SRV	SRV	125.72
020802010102	020802010102_SRV	SRV	144.738
020802010103	020802010103_SRV	SRV	141.243
020802010201	020802010201_SRV	SRV	98.911
020802010202	020802010202_SRV	SRV	151.147
020802010203	020802010203_SRV	SRV	70.758
020802010204	020802010204_SRV	SRV	45.61
020802010205	020802010205_SRV	SRV	118.013
020802010301	020802010301_CA	CA	7.649
020802010301	020802010301_SRV	SRV	101.384
020802010302	020802010302_SRV	SRV	122.186
020802010303	020802010303_SRV	SRV	102.131
020802010304	020802010304_SRV	SRV	103.415
020802010401	020802010401_SRV	SRV	50.937
020802010402	020802010402_SRV	SRV	67.908
020802010403	020802010403_SRV	SRV	152.346
020802010404	020802010404_SRV	SRV	127.531
020802010405	020802010405_SRV	SRV	52.912
020802010501	020802010501_SRV	SRV	92.879
020802010502	020802010502_SRV	SRV	84.014
020802010503	020802010503_SRV	SRV	79.306
020802010504	020802010504_SRV	SRV	89.118
020802010505	020802010505_SRV	SRV	41.505
020802010506	020802010506_SRV	SRV	87.493
020802010507	020802010507_SRV	SRV	88.324
020802010601	020802010601_SRV	SRV	38.537
020802010602	020802010602_SRV	SRV	64.152
020802010603	020802010603_SRV	SRV	94.347
020802010604	020802010604_SRV	SRV	162.316
020802010605	020802010605_SRV	SRV	124.604
020802010701	020802010701_SRV	SRV	90.484
020802010702	020802010702_SRV	SRV	70.076

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020802010703	020802010703_SRV	SRV	86.624
020802010704	020802010704_SRV	SRV	128.531
020802010801	020802010801_SRV	SRV	149.478
020802010802	020802010802_SRV	SRV	68.459
020802010803	020802010803_SRV	SRV	128.337
020802010901	020802010901_SRV	SRV	60.084
020802010902	020802010902_SRV	SRV	57.178
020802010903	020802010903_SRV	SRV	58.491
020802010904	020802010904_SRV	SRV	47.927
020802011001	020802011001_SRV	SRV	134.961
020802011002	020802011002_SRV	SRV	35.139
020802011003	020802011003_SRV	SRV	120.601
020802011101	020802011101_SRV	SRV	146.901
020802011102	020802011102_SRV	SRV	126.25
020802011201	020802011201_SRV	SRV	40.797
020802011202	020802011202_SRV	SRV	96.594
020802011203	020802011203_SRV	SRV	154.161
020802011204	020802011204_SRV	SRV	64.3
020802011205	020802011205_SRV	SRV	48.031
020802011301	020802011301_SRV	SRV	135.918
020802011302	020802011302_SRV	SRV	164.373
020802011401	020802011401_SRV	SRV	54.634
020802011402	020802011402_SRV	SRV	115.912
020802011403	020802011403_BLUE	BLUE	32.365
020802011403	020802011403_SRV	SRV	129.963
020802011501	020802011501_BLUE	BLUE	17.454
020802011501	020802011501_SGV	SGV	14.241
020802011501	020802011501_SRV	SRV	31.441
020802011502	020802011502_BLUE	BLUE	91.893
020802011502	020802011502_SGV	SGV	0.353
020802011503	020802011503_BLUE	BLUE	16.273
020802011503	020802011503_SGV	SGV	49.793
020802011503	020802011503_SRV	SRV	7.582

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020802011504	020802011504_SGV	SGV	31.396
020802011504	020802011504_SRV	SRV	10.153
020802011505	020802011505_BLUE	BLUE	64.521
020802011505	020802011505_SGV	SGV	36.775
020802020101	020802020101_SRV	SRV	58.324
020802020102	020802020102_SRV	SRV	55.764
020802020103	020802020103_SRV	SRV	99.219
020802020104	020802020104_SRV	SRV	49.586
020802020105	020802020105_SRV	SRV	103.444
020802020106	020802020106_SRV	SRV	117.856
020802020107	020802020107_SRV	SRV	74.841
020802020108	020802020108_SRV	SRV	53.785
020802020201	020802020201_SRV	SRV	129.276
020802020202	020802020202_SRV	SRV	87.543
020802020203	020802020203_SGV	SGV	16.532
020802020203	020802020203_SRV	SRV	22.839
020802020204	020802020204_SGV	SGV	55.144
020802020204	020802020204_SRV	SRV	16.923
020802020205	020802020205_SGV	SGV	136.207
020802020205	020802020205_SRV	SRV	0.815
020802020301	020802020301_SGV	SGV	78.932
020802020301	020802020301_SRV	SRV	0.238
020802020302	020802020302_SGV	SGV	40.269
020802020302	020802020302_SRV	SRV	52.275
020802020303	020802020303_SGV	SGV	112.082
020802020303	020802020303_SRV	SRV	8.657
020802020401	020802020401_BLUE	BLUE	40.907
020802020402	020802020402_BLUE	BLUE	61.278
020802020402	020802020402_SGV	SGV	81.491
020802020403	020802020403_BLUE	BLUE	67.101
020802020403	020802020403_SGV	SGV	1.034
020802020404	020802020404_BLUE	BLUE	11.116
020802020404	020802020404_SGV	SGV	44.931

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020802020501	020802020501_BLUE	BLUE	59.373
020802020501	020802020501_SGV	SGV	54.128
020802020502	020802020502_SGV	SGV	27.995
020802020502	020802020502_SRV	SRV	27.329
020802020503	020802020503_SGV	SGV	28.743
020802020503	020802020503_SRV	SRV	25.005
020802020504	020802020504_SGV	SGV	58.755
020802020504	020802020504_SRV	SRV	36.062
020802020505	020802020505_SGV	SGV	110.898
020802020505	020802020505_SRV	SRV	6.955
020802020506	020802020506_BLUE	BLUE	14.13
020802020506	020802020506_SGV	SGV	49.35
020802030101	020802030101_BLUE	BLUE	101.504
020802030101	020802030101_PIED	PIED	34.456
020802030102	020802030102_BLUE	BLUE	26.144
020802030102	020802030102_PIED	PIED	31.102
020802030103	020802030103_BLUE	BLUE	21.96
020802030103	020802030103_PIED	PIED	40.626
020802030201	020802030201_BLUE	BLUE	88.608
020802030202	020802030202_BLUE	BLUE	43.438
020802030202	020802030202_PIED	PIED	45.583
020802030203	020802030203_BLUE	BLUE	24.026
020802030203	020802030203_PIED	PIED	75.847
020802030301	020802030301_BLUE	BLUE	10.024
020802030301	020802030301_PIED	PIED	76.471
020802030302	020802030302_BLUE	BLUE	26.936
020802030302	020802030302_PIED	PIED	98.234
020802030303	020802030303_BLUE	BLUE	14.755
020802030303	020802030303_PIED	PIED	82.418
020802030304	020802030304_PIED	PIED	72.896
020802030305	020802030305_PIED	PIED	102.031
020802030306	020802030306_PIED	PIED	95.735
020802030401	020802030401_PIED	PIED	61.318

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020802030402	020802030402_PIED	PIED	127.872
020802030403	020802030403_PIED	PIED	44.56
020802030404	020802030404_PIED	PIED	151.966
020802030405	020802030405_PIED	PIED	55.308
020802030406	020802030406_PIED	PIED	80.748
020802030501	020802030501_BLUE	BLUE	81.096
020802030502	020802030502_BLUE	BLUE	68.787
020802030502	020802030502_PIED	PIED	30.542
020802030503	020802030503_BLUE	BLUE	28.28
020802030503	020802030503_PIED	PIED	22.205
020802030504	020802030504_BLUE	BLUE	1.244
020802030504	020802030504_PIED	PIED	43.553
020802030505	020802030505_BLUE	BLUE	102.655
020802030505	020802030505_PIED	PIED	21.226
020802030506	020802030506_BLUE	BLUE	4.401
020802030506	020802030506_PIED	PIED	55.638
020802030601	020802030601_BLUE	BLUE	79.211
020802030601	020802030601_PIED	PIED	37.64
020802030602	020802030602_BLUE	BLUE	15.325
020802030602	020802030602_PIED	PIED	134.354
020802030603	020802030603_PIED	PIED	46.187
020802030604	020802030604_PIED	PIED	85.875
020802030701	020802030701_LNP	LNP	4.686
020802030701	020802030701_PIED	PIED	51.37
020802030702	020802030702_BLUE	BLUE	37.027
020802030702	020802030702_LNP	LNP	22.669
020802030702	020802030702_PIED	PIED	70.754
020802030703	020802030703_LNP	LNP	5.318
020802030703	020802030703_PIED	PIED	35.335
020802030801	020802030801_PIED	PIED	107.931
020802030802	020802030802_PIED	PIED	72.778
020802030803	020802030803_PIED	PIED	70.038
020802030804	020802030804_PIED	PIED	115.895
020802030901	020802030901_BLUE	BLUE	77.754
020802030901	020802030901_LNP	LNP	64.789
020802030902	020802030902_BLUE	BLUE	69.521
020802030902	020802030902_LNP	LNP	19.576
020802030903	020802030903_BLUE	BLUE	73.485
020802030903	020802030903_LNP	LNP	71.678
020802031001	020802031001_BLUE	BLUE	28.305
020802031001	020802031001_LNP	LNP	27.922
020802031002	020802031002_BLUE	BLUE	22.128
020802031002	020802031002_LNP	LNP	49.016
020802031002	020802031002_PIED	PIED	58.063
020802031003	020802031003_LNP	LNP	26.579
020802031003	020802031003_PIED	PIED	53.387
020802031101	020802031101_PIED	PIED	91.608
020802031102	020802031102_PIED	PIED	68.76
020802031103	020802031103_PIED	PIED	78.836
020802031104	020802031104_PIED	PIED	62.913
020802031201	020802031201_BLUE	BLUE	14.431
020802031201	020802031201_LNP	LNP	76.365
020802031202	020802031202_BLUE	BLUE	18.238
020802031202	020802031202_LNP	LNP	71.246
020802031202	020802031202_PIED	PIED	18.877
020802031203	020802031203_LNP	LNP	5.656
020802031203	020802031203_PIED	PIED	95.221
020802031204	020802031204_PIED	PIED	57.414
020802031301	020802031301_PIED	PIED	107.282
020802031302	020802031302_PIED	PIED	90.301
020802031303	020802031303_PIED	PIED	95.808
020802031304	020802031304_PIED	PIED	97.761
020802031401	020802031401_PIED	PIED	93.561
020802031402	020802031402_PIED	PIED	102.755
020802031403	020802031403_PIED	PIED	48.9
020802031501	020802031501_PIED	PIED	71.113

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020802031502	020802031502_PIED	PIED	155.365
020802040101	020802040101_BLUE	BLUE	31.576
020802040101	020802040101_LNP	LNP	116.899
020802040102	020802040102_BLUE	BLUE	16.142
020802040102	020802040102_LNP	LNP	92.868
020802040103	020802040103_BLUE	BLUE	63.06
020802040103	020802040103_LNP	LNP	2.521
020802040104	020802040104_BLUE	BLUE	42.781
020802040104	020802040104_LNP	LNP	29.572
020802040105	020802040105_BLUE	BLUE	21.463
020802040105	020802040105_LNP	LNP	41.059
020802040201	020802040201_BLUE	BLUE	33.394
020802040201	020802040201_LNP	LNP	60.266
020802040202	020802040202_LNP	LNP	76.977
020802040203	020802040203_LNP	LNP	65.427
020802040301	020802040301_BLUE	BLUE	67.302
020802040301	020802040301_LNP	LNP	83.901
020802040302	020802040302_BLUE	BLUE	32.322
020802040302	020802040302_LNP	LNP	78.096
020802040303	020802040303_LNP	LNP	53.189
020802040304	020802040304_LNP	LNP	102.585
020802040305	020802040305_LNP	LNP	41.499
020802040401	020802040401_LNP	LNP	61.977
020802040402	020802040402_LNP	LNP	91.059
020802040403	020802040403_LNP	LNP	10.57
020802040403	020802040403_PIED	PIED	81.727
020802040404	020802040404_LNP	LNP	19.908
020802040404	020802040404_PIED	PIED	72.411
020802040405	020802040405_LNP	LNP	20.011
020802040405	020802040405_PIED	PIED	142.97
020802040501	020802040501_PIED	PIED	67.103
020802040502	020802040502_PIED	PIED	94.057
020802040503	020802040503_PIED	PIED	49.673

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020802040504	020802040504_PIED	PIED	128.036
020802050101	020802050101_PIED	PIED	137.002
020802050102	020802050102_PIED	PIED	50.675
020802050103	020802050103_PIED	PIED	104.436
020802050201	020802050201_PIED	PIED	100.107
020802050202	020802050202_PIED	PIED	99.074
020802050203	020802050203_PIED	PIED	75.453
020802050204	020802050204_PIED	PIED	133.172
020802050205	020802050205_PIED	PIED	49.13
020802050301	020802050301_PIED	PIED	74.588
020802050302	020802050302_PIED	PIED	65.421
020802050303	020802050303_PIED	PIED	125.286
020802050401	020802050401_PIED	PIED	41.975
020802050402	020802050402_PIED	PIED	105.964
020802050403	020802050403_PIED	PIED	60.721
020802050404	020802050404_PIED	PIED	145.961
020802050405	020802050405_PIED	PIED	62.47
020802050501	020802050501_PIED	PIED	45.582
020802050502	020802050502_PIED	PIED	84.448
020802050503	020802050503_PIED	PIED	99.705
020802050504	020802050504_PIED	PIED	79.696
020802050505	020802050505_PIED	PIED	104.799
020802050601	020802050601_PIED	PIED	80.266
020802050602	020802050602_PIED	PIED	93.412
020802050603	020802050603_PIED	PIED	76.297
020802050604	020802050604_PIED	PIED	61.864
020802050605	020802050605_PIED	PIED	162.753
020802050606	020802050606_PIED	PIED	43.861
020802050607	020802050607_PIED	PIED	34.302
020802050607	020802050607_SEP	SEP	51.301
020802060101	020802060101_SEP	SEP	126.289
020802060102	020802060102_PIED	PIED	117.564
020802060102	020802060102_SEP	SEP	39.348

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020802060103	020802060103_PIED	PIED	0.096
020802060103	020802060103_SEP	SEP	133.117
020802060104	020802060104_SEP	SEP	51.059
020802060105	020802060105_SEP	SEP	48.53
020802060106	020802060106_SEP	SEP	97.134
020802060201	020802060201_SEP	SEP	130.561
020802060202	020802060202_SEP	SEP	83.275
020802060203	020802060203_SEP	SEP	77.806
020802060204	020802060204_SEP	SEP	71.15
020802060205	020802060205_SEP	SEP	51.347
020802060301	020802060301_SEP	SEP	69.351
020802060302	020802060302_SEP	SEP	79.427
020802060303	020802060303_SEP	SEP	111.738
020802060304	020802060304_SEP	SEP	30.194
020802060401	020802060401_PIED	PIED	74.195
020802060401	020802060401_SEP	SEP	0
020802060402	020802060402_PIED	PIED	3.691
020802060402	020802060402_SEP	SEP	94.467
020802060403	020802060403_PIED	PIED	17.84
020802060403	020802060403_SEP	SEP	85.369
020802060501	020802060501_SEP	SEP	120.996
020802060502	020802060502_SEP	SEP	64.223
020802060503	020802060503_SEP	SEP	70.386
020802060504	020802060504_SEP	SEP	69.054
020802060505	020802060505_SEP	SEP	116.887
020802060506	020802060506_SEP	SEP	69.117
020802060601	020802060601_SEP	SEP	43.592
020802060602	020802060602_SEP	SEP	113.57
020802060603	020802060603_SEP	SEP	46.313
020802060604	020802060604_SEP	SEP	73.983
020802060605	020802060605_SEP	SEP	134.97
020802060701	020802060701_SEP	SEP	30.062
020802060702	020802060702_SEP	SEP	56.9

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km²)
020802060703	020802060703_MAC	MAC	0.488
020802060703	020802060703_SEP	SEP	55.515
020802060704	020802060704_MAC	MAC	67.292
020802060704	020802060704_SEP	SEP	38.055
020802060801	020802060801_SEP	SEP	35.575
020802060802	020802060802_MAC	MAC	34.338
020802060802	020802060802_SEP	SEP	18.271
020802060803	020802060803_MAC	MAC	47.971
020802060804	020802060804_MAC	MAC	27.296
020802060901	020802060901_MAC	MAC	113.664
020802060901	020802060901_SEP	SEP	1.111
020802060902	020802060902_MAC	MAC	53.572
020802060903	020802060903_MAC	MAC	78.321
020802060904	020802060904_MAC	MAC	49.593
020802060905	020802060905_MAC	MAC	71.256
020802060906	020802060906_MAC	MAC	61.14
020802070101	020802070101_PIED	PIED	87.954
020802070102	020802070102_PIED	PIED	83.539
020802070103	020802070103_PIED	PIED	129.222
020802070201	020802070201_PIED	PIED	80.943
020802070202	020802070202_PIED	PIED	81.639
020802070203	020802070203_PIED	PIED	111.429
020802070204	020802070204_PIED	PIED	68.274
020802070205	020802070205_PIED	PIED	135.319
020802070206	020802070206_PIED	PIED	31.46
020802070301	020802070301_PIED	PIED	110.317
020802070302	020802070302_PIED	PIED	88.016
020802070303	020802070303_PIED	PIED	45.181
020802070304	020802070304_PIED	PIED	44.861
020802070305	020802070305_PIED	PIED	113.668
020802070401	020802070401_PIED	PIED	62.877
020802070402	020802070402_PIED	PIED	99.052
020802070403	020802070403_PIED	PIED	65.288

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020802070404	020802070404_PIED	PIED	97.406
020802070405	020802070405_PIED	PIED	49.947
020802070406	020802070406_PIED	PIED	37.338
020802070501	020802070501_PIED	PIED	84.754
020802070502	020802070502_PIED	PIED	99.601
020802070503	020802070503_PIED	PIED	66.63
020802070504	020802070504_PIED	PIED	115.174
020802070601	020802070601_PIED	PIED	139.551
020802070602	020802070602_PIED	PIED	65.003
020802070603	020802070603_PIED	PIED	104.118
020802070604	020802070604_PIED	PIED	145.717
020802070701	020802070701_PIED	PIED	148.491
020802070702	020802070702_PIED	PIED	103.66
020802070703	020802070703_PIED	PIED	124.32
020802070704	020802070704_PIED	PIED	82.611
020802070705	020802070705_PIED	PIED	73.132
020802070801	020802070801_PIED	PIED	103.679
020802070802	020802070802_PIED	PIED	66.588
020802070803	020802070803_PIED	PIED	47.412
020802070804	020802070804_PIED	PIED	163.438
20802070805	020802070805_PIED	PIED	45.137
020802070806	020802070806_PIED	PIED	55.571
020802070806	020802070806_SEP	SEP	1.102
020802070901	020802070901_PIED	PIED	167.032
020802070902	020802070902_PIED	PIED	106.02

HUC12	HUC12-Bioregion_ID	Bioregion	Area (km^2)
020802070902	020802070902_SEP	SEP	9.325
020802070903	020802070903_PIED	PIED	77.422
020802070903	020802070903_SEP	SEP	0.513
020802070904	020802070904_PIED	PIED	13.182
020802070904	020802070904_SEP	SEP	97.607
020802071001	020802071001_PIED	PIED	7.481
020802071001	020802071001_SEP	SEP	142.382
020802071002	020802071002_SEP	SEP	94.618
020802080101	020802080101_MAC	MAC	61.823
020802080102	020802080102_MAC	MAC	103.522
020802080103	020802080103_MAC	MAC	76.946
020802080104	020802080104_MAC	MAC	91.962
020802080105	020802080105_MAC	MAC	107.408
020802080106	020802080106_MAC	MAC	106.012
020802080201	020802080201_MAC	MAC	68.36
020802080202	020802080202_MAC	MAC	45.803
020802080203	020802080203_MAC	MAC	116.627
020802080204	020802080204_MAC	MAC	101.455
020802080205	020802080205_MAC	MAC	96.029
020802080206	020802080206_MAC	MAC	61.076
020802080301	020802080301_MAC	MAC	20.871
020802080302	020802080302_MAC	MAC	31.645
020802080303	020802080303_MAC	MAC	45.738
020802080304	020802080304_MAC	MAC	0.379

Appendix I: Index Methodologies

Karr's (1981) original index of biotic integrity (IBI) included twelve equally weighted metrics selected to represent different aspects of the fish community. The twelve metrics were individually scored and the scores averaged to produce the index score of a sampling event. Most IBI's do not deviate drastically from this formula. We tested eight methods of constructing the index in each of the twelve identified bioregions (Figure I-1). We used custom R-scripts to run the tests on family-level metrics. Several of the methods were not intended to be used in the development of the final Chessie BIBI indices but were instead done to gain insight into the effects of different index structures and metrics. We did not remove repeat samples collected at the same station, but this should not affect comparisons of the eight methods.

Methods

The distributions of biological metric values in Reference and Degraded conditions are used to establish metric scoring protocols. Therefore, the choice of criteria for defining Reference and Degraded is critical. In the following analysis, the Reference criteria are identical to those used in the bioregion-specific Chessie BIBI refinement (Tables 2, 3). The Degraded criteria, however, are somewhat relaxed:

Stricter Degraded criteria used in Chessie BIBI refinement	Relaxed Degraded criteria used in this analysis
$\geq$ 50% of available habitat scores $\leq$ 6	$\geq$ 50% of available habitat scores $\leq$ 6
and	*or*
at least two of the three water quality parameters exceeding minimally stressful thresholds or one parameter exceeding moderately stressful thresholds	at least one of the three water quality parameters exceeding minimally stressful thresholds

This was to allow sufficient numbers of Degraded samples for jackknife validation steps. Basic characteristics of the twelve bioregions and their numbers of Reference and Degraded samples are shown in Table I-1.

All metrics were scored according to procedures described in *Report Section II.G. Metric Scoring Approach*. The Best Separation Point (BSP) and the median of a metric's Reference distribution are used to establish the "middle" and "ceiling" of the scoring scale of 0 – 100. The Best Separation Point (BSP) is the metric value that yields the highest Balanced Discrimination Efficiency (BDE) between Reference and Degraded distributions of the metric. The "floor" of the scoring scale is established by extrapolating linearly from the Reference median and the BSP. Metric values between the floor and ceiling thresholds are scored on a continuous gradient from 0 – 100. Metric values greater than the ceiling threshold are scored 100; values less than the floor are scored 0.

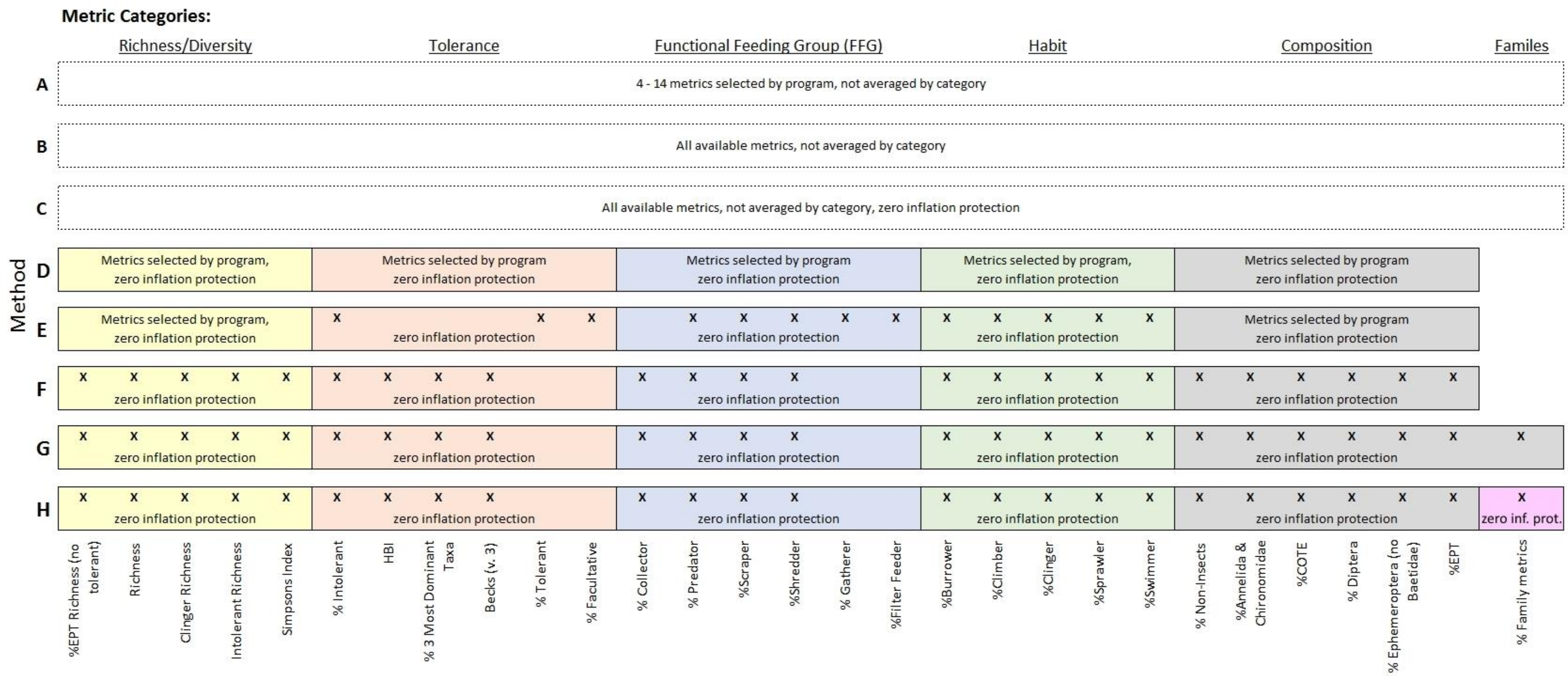


Figure I-1. Metric composition of the eight possible multi-metric indices tested. "X" indicates the metric was included in that method's index. Metrics selected by the computer program were assessed with range, variability, and redundancy tests. For methods D – H, the metric scores are first averaged by metric category. Then, metric category averages are averaged to obtain an index score. See Table I-1 and text for details.

Table I-1. Bioregion characteristics and numbers of Reference and Degraded samples. Mean slope is the area-weighted average of all HUC12 watershed mean slopes in a bioregion. Mean elevation is the area-weighted average of all HUC12 watershed mean elevations in a bioregion. REF, Reference; DEG, Degraded.

	Bioregion	Total Area (km^2)	Mean Slope	Range of Mean Slopes	Mean Elevation (m)	# REF	# DEG
Northern Inland	CA	5,986	7.8	5.3 - 11.6	1,805	39	41
	NAPU	24,690	7.2	3.4 - 12.2	1,461	94	51
	NCA	10,964	11.3	4.3 - 18.5	1,717	317	55
	NRV	21,471	8.6	3.3 - 13.8	1,097	161	54
	UNP	12,294	4.4	1.7 - 7.4	521	82	148
Southern Inland	BLUE	5,175	12.1	5.1 - 20.1	1,425	134	6
	LNP	10,989	5.1	1.3 - 12.7	545	357	139
	PIED	15,660	4.5	1.8 - 12.6	417	135	25
	SGV	8,910	6.5	2.1 - 15.6	1,083	182	91
	SRV	20,052	13.0	5.7 - 21.3	1,775	433	49
Coast	SEP	16,464	2.7	0.8 - 5.5	97	51	212
	MAC	14,345	0.6	0.0 - 2.5	23	21	226
	Total	167,000					

Index Development Methodologies

In general, IBI's are developed by assessing sensitivity, range, variability, and redundancy of multiple metrics and then selecting representative metrics to include in the final index (*Report Section II.F. Metric Testing*). Method A was developed with this general approach. It should be considered a baseline from which to compare the remaining methodologies. For Method A, the metrics are divided into five metric categories (i.e., Richness/Diversity, Tolerance, Functional Feeding Groups, Habit, and Composition) and the most sensitive metric from each category is selected to represent the category. Of the five categories, the four most sensitive metrics are first selected to be the foundation of the index. This means that one category is not represented initially. Additional sensitive metrics are then added to the index only if they improve the Classification Efficiency (CE). Metrics omitted during the selection of the top four metrics are readmitted if the metric improves the final CE.

Method B represents one extreme in index development. The index includes all 84 of the available metrics in the five metric categories (Table E-1), the % Family metrics for all families present in the sample, and the percentage metrics for Phylum, Subphylum, Class, Subclass, Order, and Suborder. The index score is the mean of all of the metric scores. No range, variability, and redundancy checks are performed and no zero inflation protection is applied. Zero inflation is a common issue with ecological data and occurs when abundance values for a given taxon are dominated by zeros and mask underlying differences between Reference and

Degraded conditions (McCune et al. 2002, Martin et al. 2005). Thresholds selected by the program for scoring metrics can be forced to zero if a taxon is rare and its abundance distribution includes many zeros.

Method C is similar to method B but protects against zero inflation. To alleviate the dominance of zeros, the percentage of Reference samples containing zero values are assessed and the zeros are omitted from the metric sensitivity analysis if more than 5% of the samples are represented by zero. BSP and Reference median values are set according to distributions of non-zero values in Reference and Degraded conditions. Instances where metric zero values were removed are not scored, and a sample's index score is calculated from the average of the remaining metric scores.

The index scores in Methods A – C above are calculated by averaging the individual metric scores, regardless of category. In Methods D – H below, metric scores are first grouped and averaged by metric category. Then, the five (or six) category scores are averaged to calculate the index score. It is important to represent a diversity of metric types in an index to ensure that the index captures the biological community's responses to a range of possible stressors (Karr 1981, Karr et al. 1986, Barbour et al. 1999). Preliminary analyses of the Chesapeake Bay basin macroinvertebrate data showed that representing most or all of the metric categories in the index allows for the inclusion of metrics that are often excluded due to low sensitivity, low range, or high variability. Although these individual metrics do not perform as strongly, they can improve an index's overall sensitivity. Initial analyses also suggested that averaging the scores of multiple metrics in each category improved the stability of the final index. Random variability associated with a single metric can incorrectly indicate Reference or Degraded conditions but the average of multiple metrics in a metric category counter-balanced that error.

Method D is similar to Method A but metrics are grouped and averaged by metric category before the index is calculated and zero inflation protection is applied. The program checks the range, variability, and redundancy of the possible metrics in each metric category and then selects metrics to include in the category. No limits are set on the number of metrics that can be included in a category. A category can be excluded from the index if metrics within the category do not meet the selection criteria or are insensitive to disturbance.

Method E follows the same procedures as Method D for the Richness/Diversity and Composition categories but pre-selects the FFG, Habit, and Tolerance category metrics to be included in each bioregion-specific index (Figure I-1). FFG, Habit, and Tolerance metrics are often excluded from other indices because they involve rare taxa or groups. For example, the % Predator metric is typically excluded from indices because the percentage of predators usually is not greater than ~10% (Vannote 1981). Preliminary analyses showed that when zero values are removed and only non-zero values are evaluated, % Predator showed substantial declines with disturbance. The benefit of pre-selecting metrics for the FFG, Habit, and Tolerance categories is that, rather than one or no metrics representing a particular category, an average of multiple metric scores represent the category and can provide a more holistic assessment of the category.

For Methods F, G, and H, all of the metrics are pre-selected and there is no assessment of metric range, variability, or redundancy. Zero inflation protection is applied. Method F, G, and H test 4 – 6 pre-selected metrics in each category for a total of 24 metrics (Figure I-1). Methods G and H also consider the suite of percent family metrics (% Chironomidae, % Hydrophilidae, % Tipulidae, etc.). An R script was developed to find the percentages of all families identified in a sample. Method G combines the Composition metrics listed in Figure I-1 and the scores of the percent family metrics. Method H creates a sixth metric category that contains the scores of all the percent family metrics.

A delete-d Jackknife procedure was used to assess the precision of the CEs obtained with each method (See *Report Section II.I. Index Classification Efficiency*). In each of 100 iterations, 25% of the Reference and Degraded data are removed and figuratively discarded. The index is reconstructed on the remaining 75% Reference and Degraded data using the same biological metrics chosen in the original index development. The metrics are rescored with the resulting new thresholds, and the index scores are used to calculate a CE for the smaller dataset. Differences between the CEs of the 100 iterations and the mean of those CEs are then used to calculate Root Mean Standard Error (RMSE). Variation around the mean CE indicates how much variability can be expected based on the "training" dataset used to construct the index.

In addition, a delete-d Jackknife Cross Validation (CV) procedure was used to assess the accuracy of the CEs obtained with each method (see *Report Section II.I. Index Classification Efficiency*). In each of 100 iterations, the bioregion-specific Reference and Degraded data are divided into training (75%) and validation (25%) sets. The index is reconstructed on the training set using the same biological metrics chosen in the original index development. The metrics are rescored with the resulting new thresholds, and the index scores are used to calculate a CE for the training dataset. The new metric thresholds are then used to score the validation dataset and the index scores are used to calculate that dataset's CE. Differences between the CEs of the 100 iterations of the validation dataset and the mean of those CEs are then used to calculate validation dataset's RMSE. Variation around the mean indicates how well the index would perform on an independent dataset.

Results

All eight methods produce index scores that clearly separate the macroinvertebrate assemblages from Reference and Degraded conditions (Table I-2). The overall mean CE derived from the complete dataset varies only 3.2% across the eight methods, from 74.4% (Method F) to 77.6% (Method C). The index is constructed to identify Reference and Degraded equally well, which amounts to about three-quarters of Reference samples and three-quarters of Degraded samples correctly identified. The delete-d Jackknife Cross Validation (CV) test for accuracy and the delete-d Jackknife test for precision produce CEs results very similar to the original CEs. For the former, overall mean CE varies 3.1% between methods, from 72.6% (Method D) to 75.8% (Method A). For the latter, overall mean CE various 2.9% between methods, from 75.2% (Method D) to 78.1 (Method C).

Table I-2. Classification Efficiencies (CE) for eight index methodologies (A – H) in twelve Chesapeake bioregions. Original, CE of the full dataset. CV mean, the average CE produced by a delete-d Jackknife Cross Validation (CV) procedure. Jackknife mean, the average CE produced by a delete-d Jackknife Precision procedure. The means of all bioregion CE values indicates the overall performance of each method. See Table I-1 and text for names and descriptions of bioregions. See text for details of the jackknife procedures.

		BLUE	**CA**	**LNP**	**MAC**	**NAPU**	**NCA**	**NRV**	**PIED**	**SEP**	**SGV**	**SRV**	**UNP**	**Overall Mean**
A	Original	77.6	76.8	86.5	71.9	71.1	79.8	70.8	76.9	71.6	79.9	71.3	87.7	76.8
	CV Mean	78.3	74.6	86.1	66.3	70.5	79.7	69.4	75.9	69.3	80.2	70.6	88.3	75.8
	Jackknife Mean	78.5	76.3	86.2	70.9	70.0	79.2	69.7	76.7	72.1	79.8	70.9	87.8	76.5
B	Original	77.7	81.7	87.5	79.6	67.6	77.6	70.6	76.3	71.8	79.8	71.6	85.1	77.2
	CV Mean	72.1	76.2	87.5	70.5	66.1	77.4	71.0	74.3	70.4	79.8	70.7	84.5	75.0
	Jackknife Mean	75.4	80.6	87.6	77.4	67.8	78.6	71.7	77.2	72.4	80.1	71.2	84.9	77.1
C	Original	76.9	79.3	87.7	76.5	68.5	79.4	69.4	82.2	75.4	79.5	70.9	85.9	77.6
	CV Mean	67.1	75.0	85.4	69.6	66.3	72.4	68.5	70.2	72.9	79.6	70.7	81.3	73.3
	Jackknife Mean	77.1	81.1	87.5	81.8	68.7	79.3	70.5	80.5	75.3	79.5	71.1	84.8	78.1
D	Original	76.2	66.5	87.4	81.0	70.2	77.6	67.3	77.7	67.9	76.1	67.9	84.0	75.0
	CV Mean	74.2	65.3	87.0	63.9	67.4	77.3	66.9	75.2	65.7	77.3	67.6	83.8	72.6
	Jackknife Mean	75.4	68.2	87.2	81.3	69.6	77.6	67.6	77.0	69.9	76.9	68.0	84.0	75.2
E	Original	76.2	72.5	88.5	76.8	69.3	78.3	66.1	77.7	73.7	77.4	68.7	84.3	75.8
	CV Mean	75.8	70.8	88.1	71.2	68.9	76.4	67.3	77.4	70.4	77.6	68.5	84.4	74.7
	Jackknife Mean	76.4	72.5	87.9	79.5	69.8	77.5	66.1	78.0	73.7	77.8	68.5	83.8	75.9
F	Original	72.4	69.5	87.5	71.4	66.5	72.4	69.7	80.2	71.0	79.0	70.2	83.0	74.4
	CV Mean	70.5	72.9	87.5	70.7	65.3	72.8	68.7	75.1	71.8	79.6	70.5	83.5	74.1
	Jackknife Mean	72.3	73.6	87.6	77.7	66.1	73.1	68.8	79.7	71.6	78.8	70.0	83.3	75.2
G	Original	72.7	74.4	87.7	76.6	69.3	74.0	68.8	81.2	73.0	79.5	71.0	83.2	76.0
	CV Mean	71.6	73.9	86.9	68.8	64.7	72.5	69.2	72.4	72.8	79.2	71.3	82.5	73.8
	Jackknife Mean	73.8	76.2	87.5	81.4	68.9	74.2	69.5	80.0	73.4	79.3	70.3	83.5	76.5
H	Original	70.8	73.2	86.2	77.2	67.5	74.9	69.9	81.2	72.0	80.3	70.3	83.0	75.5
	CV Mean	69.0	73.5	86.5	70.9	65.6	72.4	68.6	72.2	72.2	80.6	71.4	81.7	73.7
	Jackknife Mean	71.9	76.7	86.7	80.0	68.4	75.2	69.3	80.4	72.4	80.0	70.4	83.5	76.2

The original, jackknife CV, and jackknife precision CEs for each individual bioregions are also very close. Differences between bioregions, however, can be large. The NAPU bioregion, followed by NRV and SRV have the lowest CEs of each method tested. These are the three largest bioregions (Table I-1). UNP and LNP have the highest CEs of each method tested. These bioregions are moderately sized with relatively large numbers of Reference and Degraded samples. The remaining seven bioregions have intermediate CEs, are small to moderately sized, and some have relatively few numbers of Reference and/or Degraded samples. Variation in the bioregion CEs does not correspond to obvious environmental differences such as area-weighted mean slope, range of watershed mean slopes, or area-weighted mean elevation (Table I-1).

The RMSE estimates generated from the delete-d Jackknife Cross Validation (CV) test for accuracy in each bioregion are only a few percent larger than the corresponding RMSE generated from the delete-d Jackknife test for precision (Figure I-2). Also, the CEs developed from the original, complete dataset typically fall inside the RMSE ranges. The metric scoring thresholds developed on the training datasets are accurately classifying the validation datasets. Changes in the reconstructed metric scoring thresholds over the 100 jackknife iterations are minimal and introduce little new uncertainty in the index values and CEs. Most of the uncertainty appears to be driven by inherent variability in the macroinvertebrate samples used to create the indices. It is worth noting that bioregions with the largest RSME either had very few Reference samples (MAC), very few Degraded samples (BLUE), or very few of both (CA).

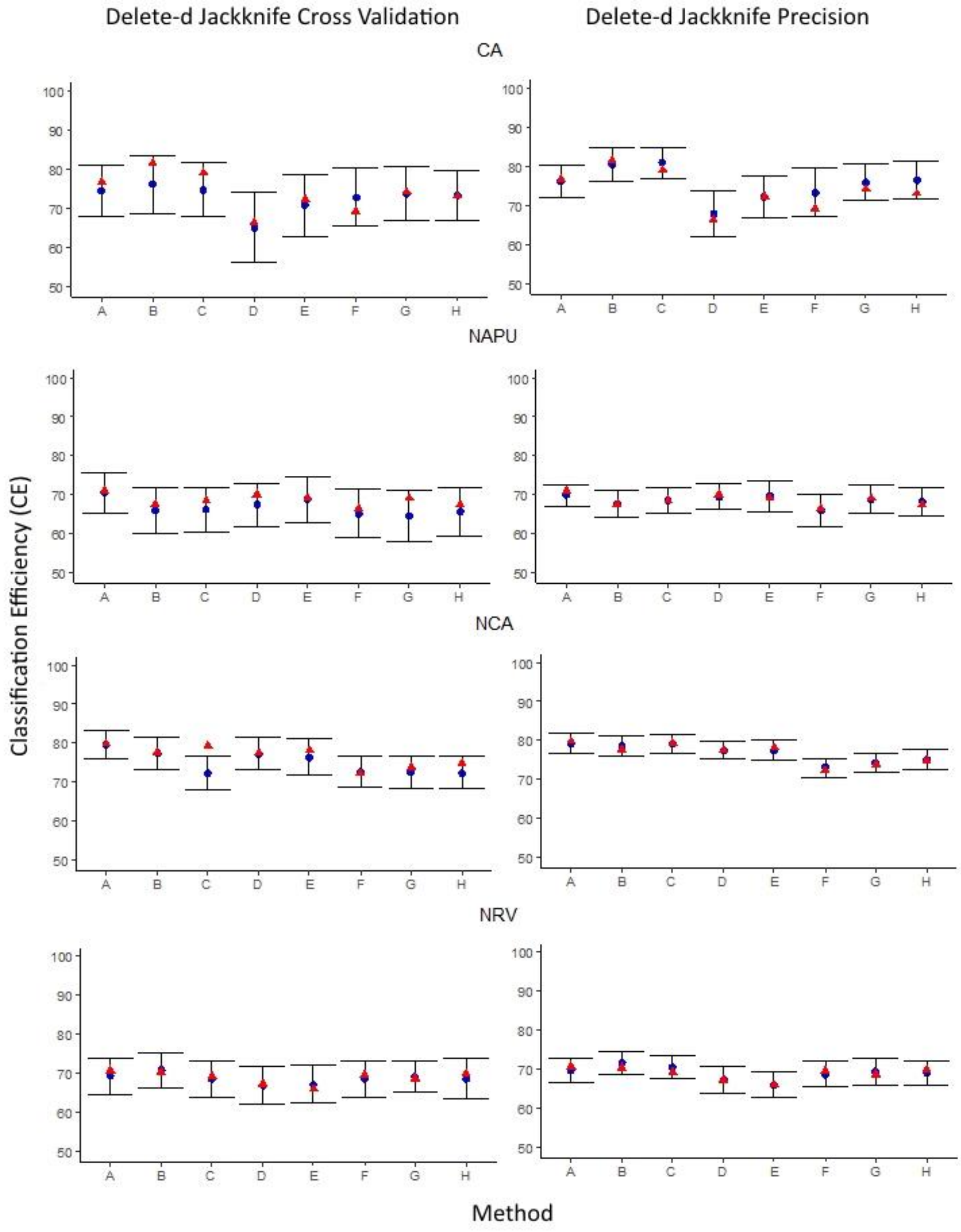


Figure I-2. Classification Efficiencies (CE) for eight methods of index development in twelve bioregions (see Table I-1 for bioregion names). Left, the blue circle represents the mean CE value of the validation datasets generated in 100 jackknife iterations. Right, the blue circle represents the mean CE value of the training datasets generated in 100 jackknife iterations. Extending from the blue circles are the RSME values calculated from the 100 iterations. Red triangle, the original CE of the index developed with all the data (for comparison purposes).

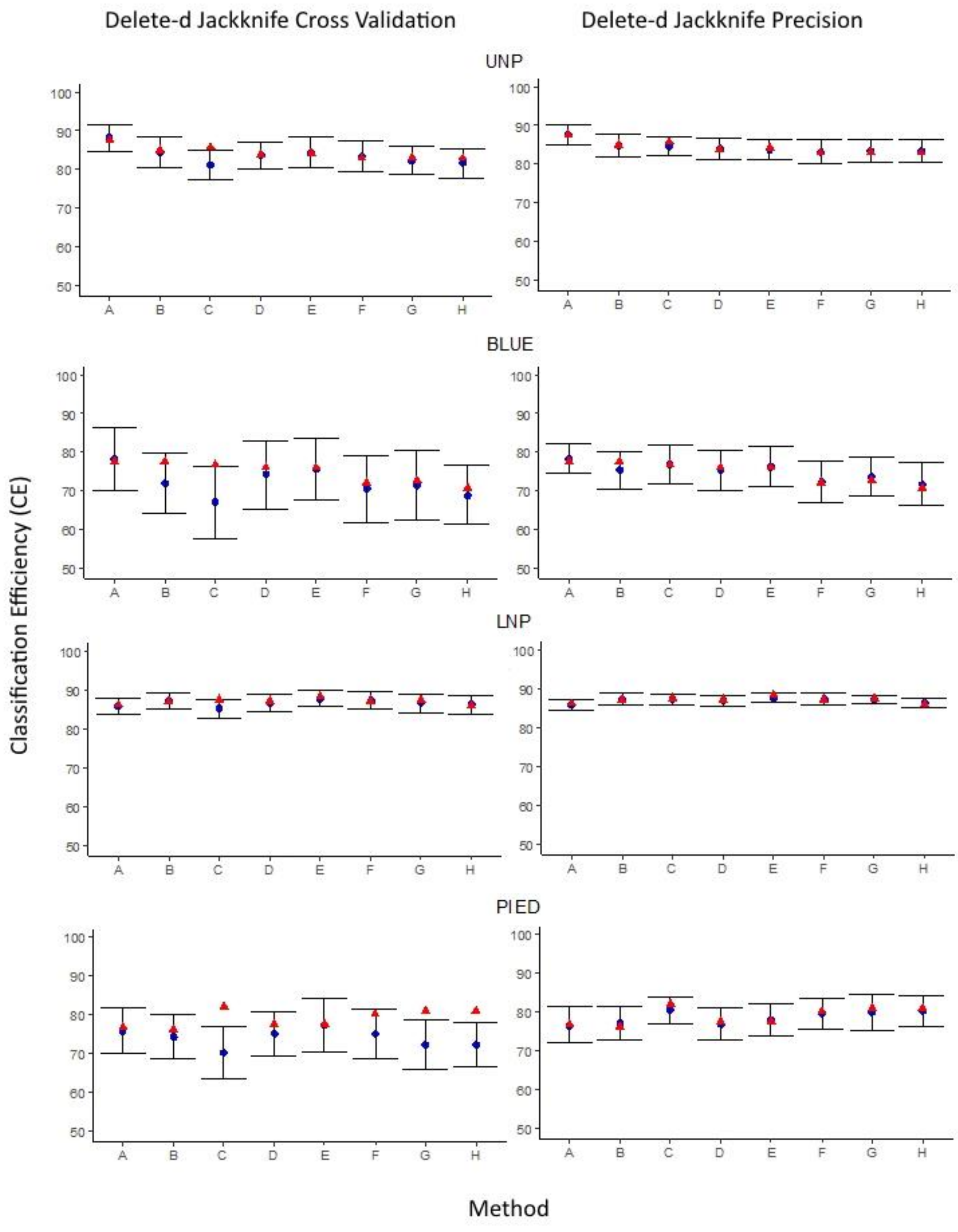


Figure I–2. Cont.

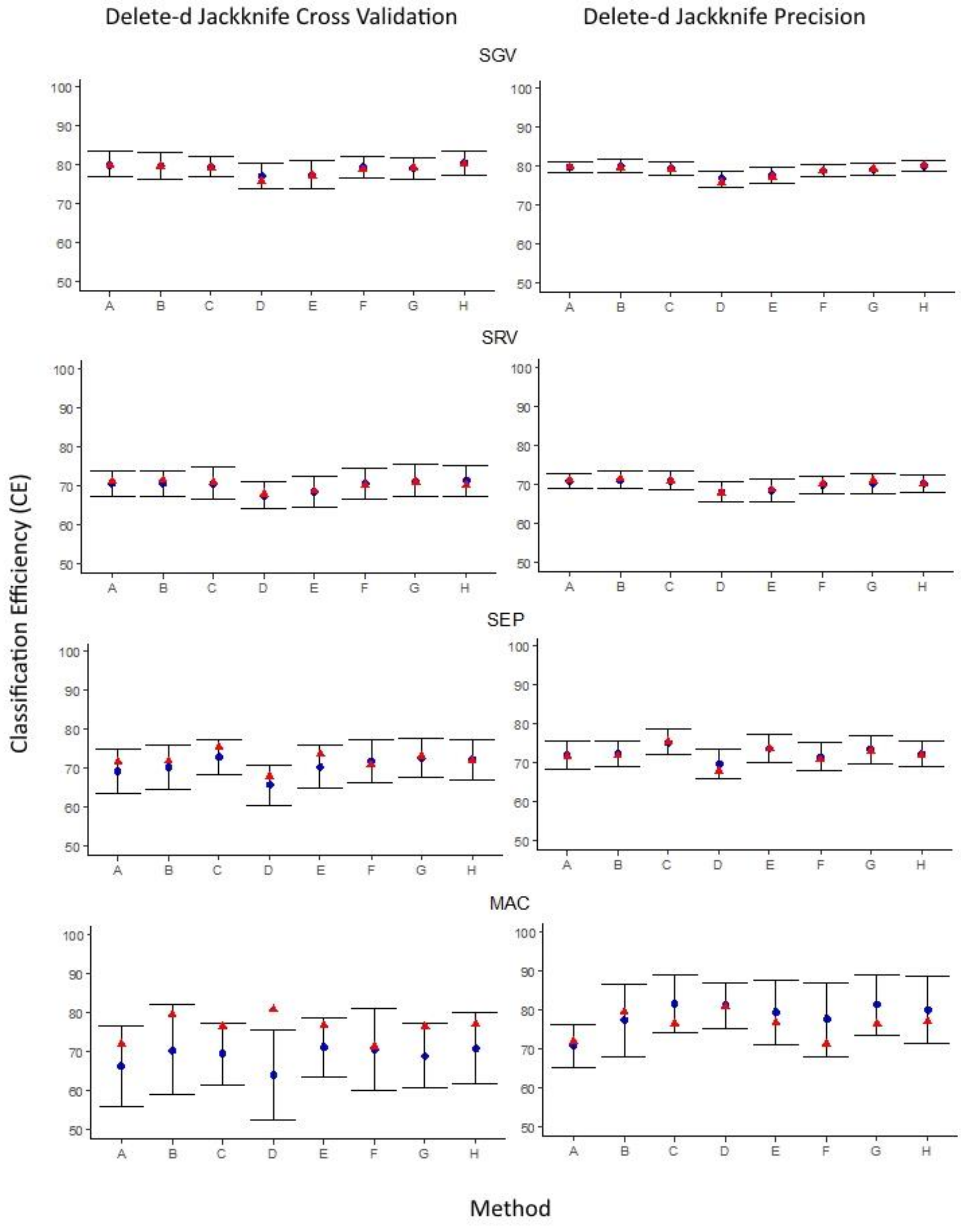


Figure I–2. Cont.

Despite application of the same water quality and stream habitat criteria to identify Reference and Degraded conditions, distributions of index scores in Reference and Degraded are not identical across the eight methods (Figure I-3). Reference distributions in UNP and LNP are typically more compact and have the highest medians across all methods while MAC and SRV have the lowest median values. Reference distributions in NAPU, NRV, and SEP have the largest interquartile ranges. Degraded distributions of the index scores also vary. UNP and LNP have the lowest median scores in each of the eight methods; MAC, CA, NAPU, SRV, and PIED had the higher median scores. UNP and LNP have the highest CEs as a result of the large separation between their Reference and Degraded distributions. The persistent overlap in the Reference and Degraded distributions of NAPU, NRV and SRV in all eight methods exemplifies their low CEs.

Figure I-3 (next four pages). Bioregion-specific, Reference (REF, blue) and Degraded (DEG, white) distributions of index scores produced with the eight index constructs. Box-and-whisker plots indicate 95th, 75th, median, 25th, and 5th percentiles; ♦, 10th percentile of Reference distribution. Median of the Reference medians and Degraded medians shown on the right. See Figure I-1 for method descriptions and Table 4 for bioregion names.

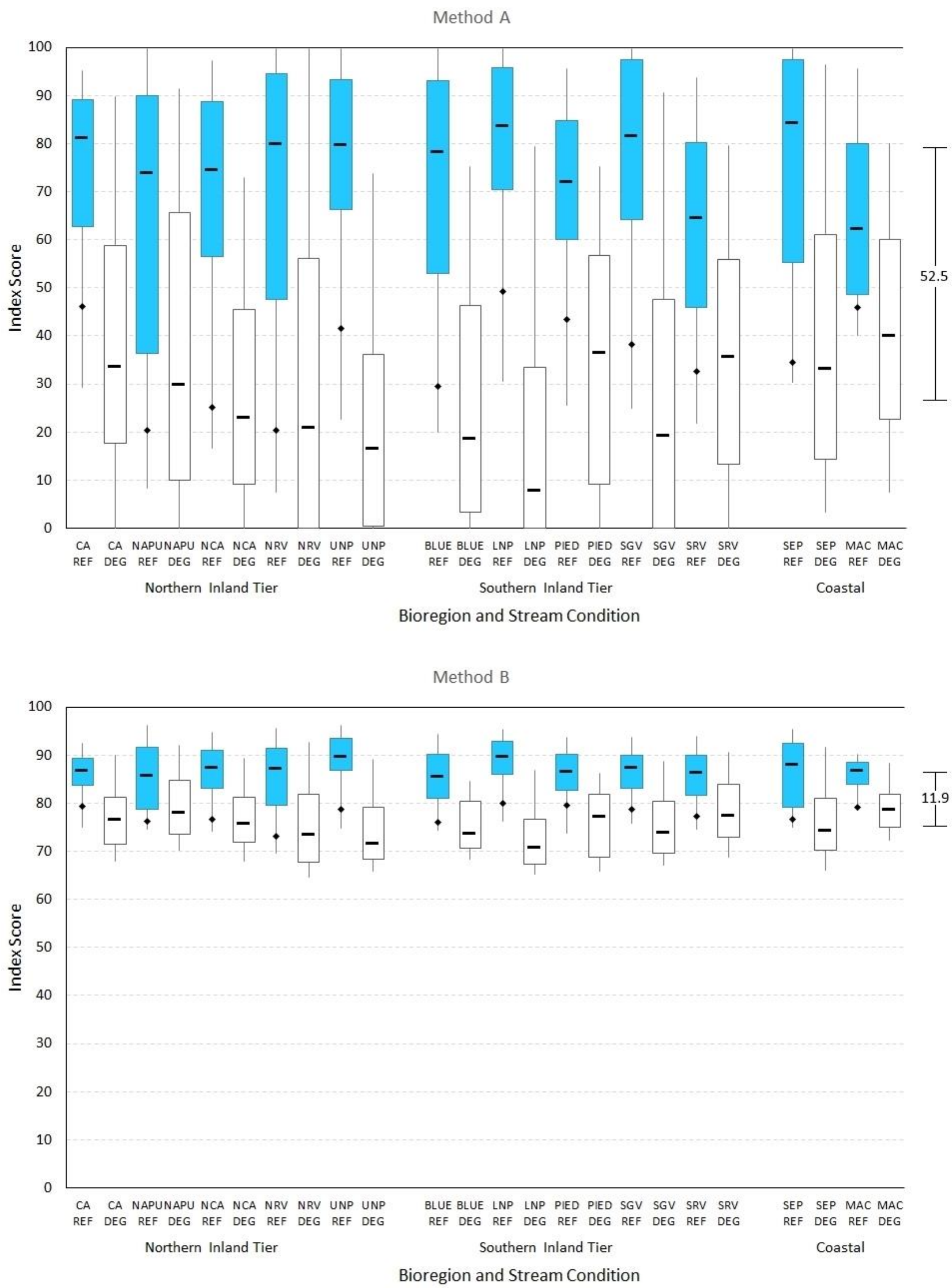
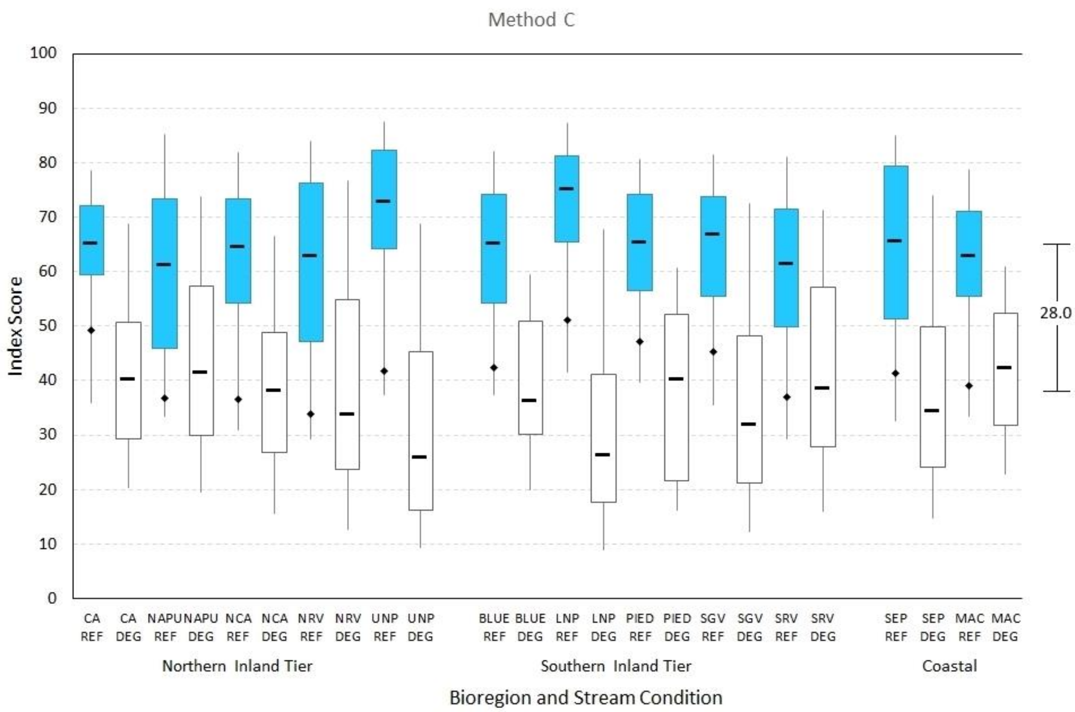


Figure I – 3. Cont.



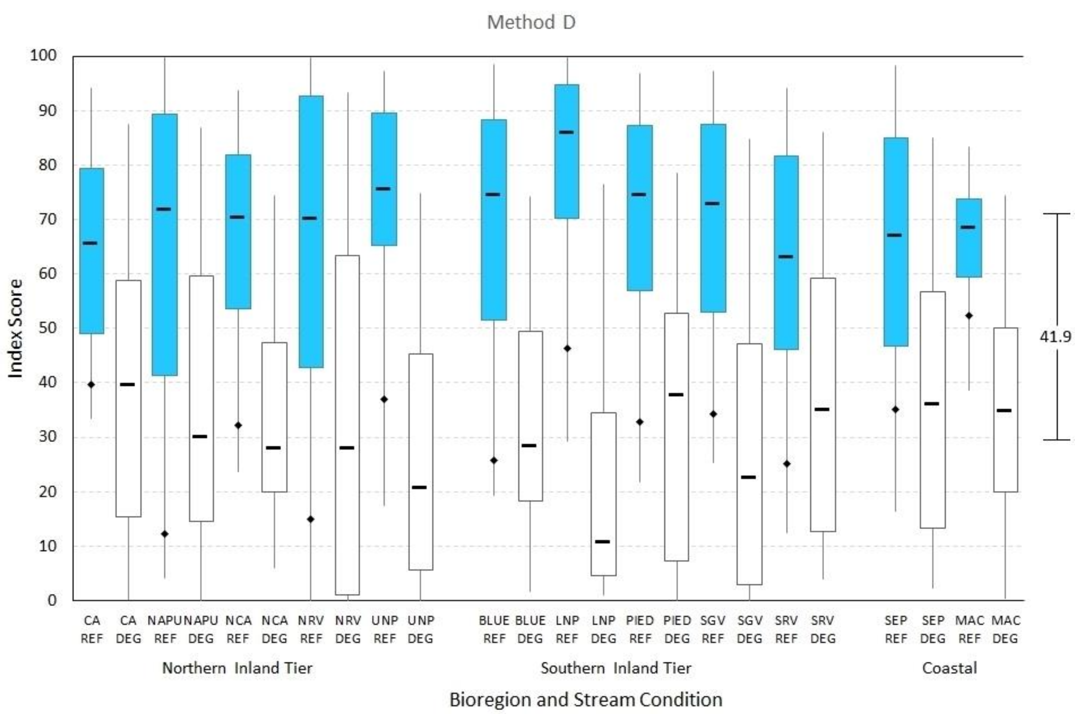


Figure I-3. Cont.

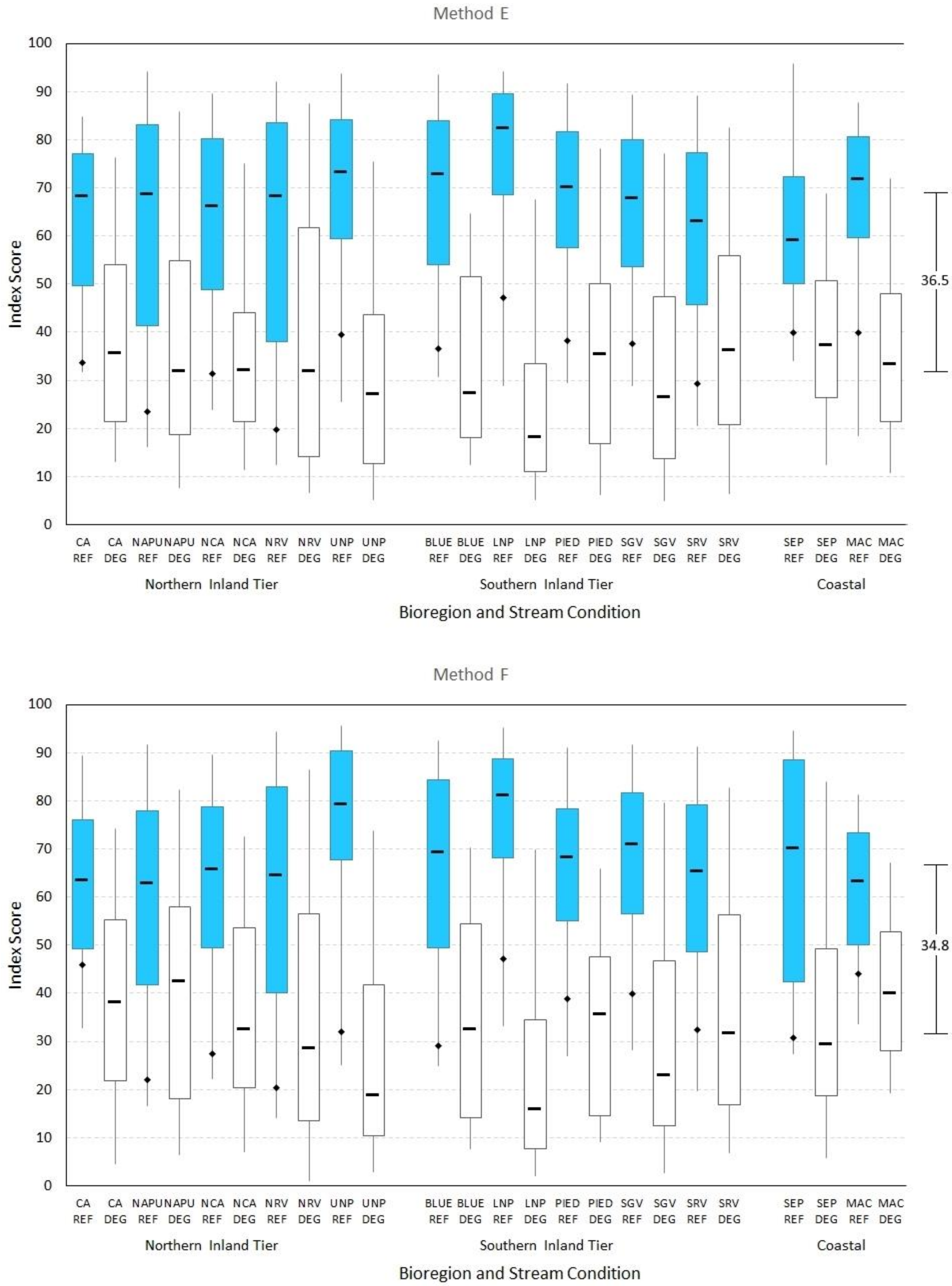
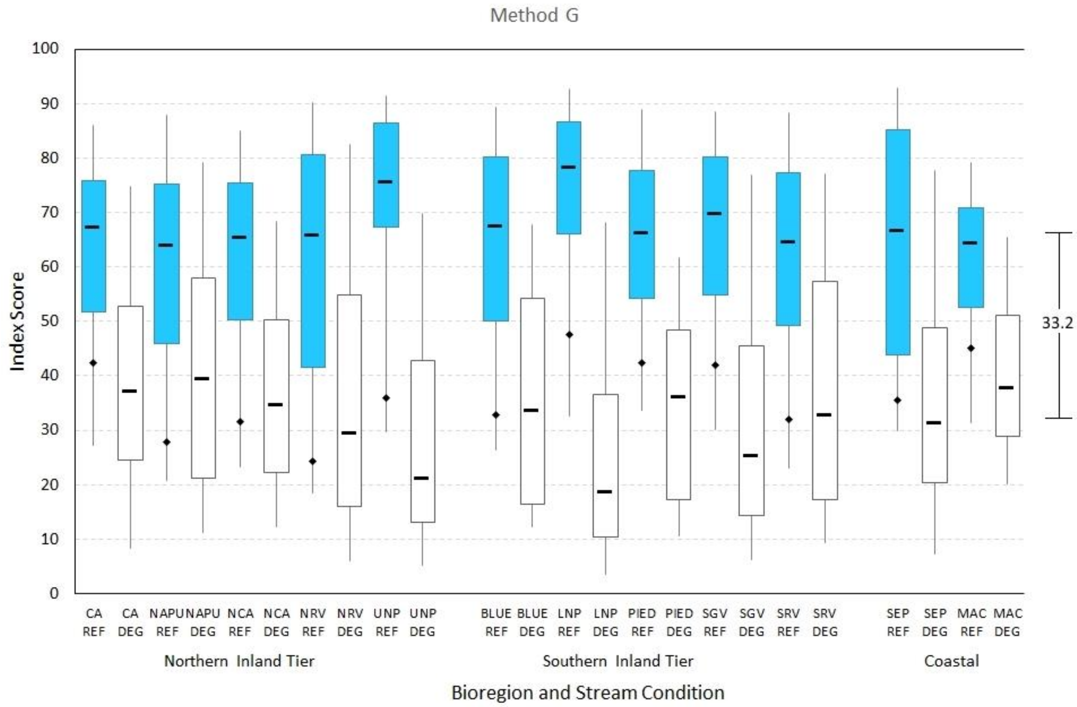


Figure I-3. Cont.



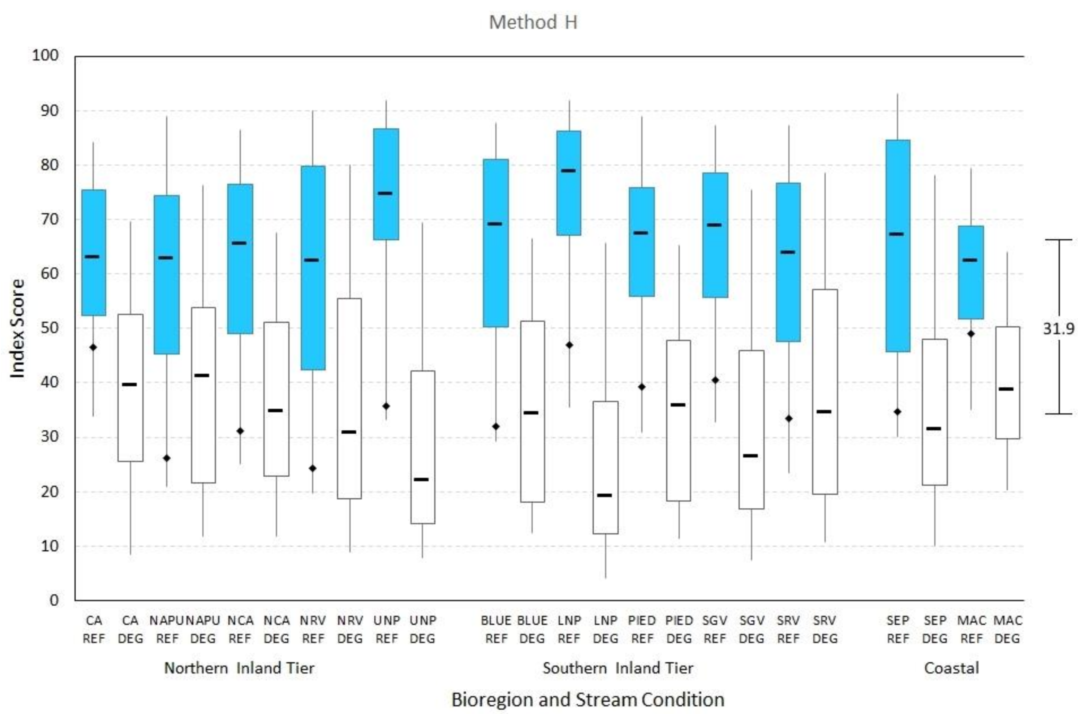


Figure I-3. Cont.

Discussion

Within each bioregion, the eight methods of constructing an index are equally sensitive and none of the methods outperforms the others in terms of CE. The CEs and their associated variability (RSME) are effectively the same regardless of whether the index for a given bioregion is constructed with the most sensitive metrics, averages of metric categories, the same suite of metrics, or all available metrics. We believe this is due in large part to a counter-balancing effect in the metric scoring. Metrics in a Reference-quality sample that score low are typically countered by a larger number of metrics that score high, resulting in an overall high index score that classifies the sample correctly as Reference-like. Similarly, a metric in a Degraded-quality sample that scores high is typically countered by several that score low, correctly classifying the sample as Degraded-like. The key is to have sufficient metrics so the counter-balancing effect can occur. The Method A indices are the average of 5 to 16 individual metrics, depending on bioregion; Method D indices are the average of 5 metric category averages derived from 5 or more program-picked metrics; Method F indices are the average of 5 metric category averages derived from 24 standard metrics; Method C indices have upwards of 150 metrics; and Method B indices have 272 metrics. Based on our results it would appear that five metrics are sufficient to achieve this counter-balancing effect.

Within each bioregion, variation in the Reference and Degraded distributions across the eight methods is mostly related to the methods' component metrics and scoring approaches. Method B scores are universally high and have the smallest separation between Reference and Degraded because the method lacks zero inflation protection. Method C is identical to B but has zero inflation protection. It pulls Reference and Degraded scores towards the middle of the 0 – 100 index scale because numerous mediocre and weak metrics are included. Methods F, G, and H are fairly well separated and produce nearly identical results. They are composed of a standard suite of mostly sensitive metrics and employ zero inflation protection. The addition of a sixth group, Families, in Method H does not significantly change the Reference and Degraded index distributions. The appeal of these three methods is they use a consistent suite of richness/diversity, tolerance, FFG, and habit metrics across all bioregions. Finally, Methods D and A show the largest separation between Reference and Degraded distributions. They allow the R-program to select and include the most discriminating metrics in all five metric categories, and they employ zero inflation protection. One drawback is they are made up of different metrics. Sensitive metrics like EPT might not be selected for inclusion in a given bioregion index because the group is less abundant in that bioregion. For example, EPT represents a smaller percentage of the assemblages in MAC and SEP compared to the other bioregions (Figure G-8g). EPT-based metrics are not selected by Method A for the MAC and SEP bioregions but are selected frequently for other bioregions.

Within each index method, a consistent pattern of differences occurs across the twelve bioregions in the original CEs and in the overall distributions of Reference and Degraded index scores. Variation in the *quality* of Reference and Degraded conditions is perhaps the most obvious factor causing these bioregion differences. For example, the BLUE bioregion can be considered a minimally disturbed bioregion with high quality Reference conditions because it is mostly forested and largely within the protected Shenandoah National Forest. Of the 446 stream samples from BLUE, 134 (30.0%) were identified as coming from sites that meet the Reference water quality and stream habitat criteria. All the Reference sites were in predominantly forested watersheds. In contrast, the coastal MAC region is heavily impacted by human activity and true Reference sites are difficult to find. Most of MAC watersheds have less than 30.0% forest cover, most of the bioregions' stream channels have been altered by ditching, and agriculture draws heavily on groundwater aquifers and affects baseflow. Of the 1,589 stream samples collected in MAC, only 21 meet the standardized habitat and water quality criteria for Reference, the lowest number for any bioregion. None are in predominantly forested watersheds. The consistent differences between BLUE and MAC distributions of Reference index scores across all eight index methods can be largely attributed to the fact that Reference conditions in BLUE are of a higher quality than in MAC, even though both Reference groups meet the study's standard water quality and habitat criteria for Reference.

Bioregional differences in the Reference index score distributions may also be related to natural features which can alter macroinvertebrate assemblages and taxa behaviors. The influences of natural factors are confounded to some extent by differences in the quality of Reference conditions (mentioned above), but can be discerned in some cases. Take the CA, NCA, BLUE, and SRV bioregions that are heavily forested but have different mean slopes (Table I-1). Low gradient, slow-moving, soft-bottomed streams present challenges and opportunities for taxa that differ from higher gradient, faster-moving, hard-bottomed streams. The median percentage of burrowers in Reference conditions is 24.0% in CA where the overall mean slope is 7.8; the median percentage of burrowers is 8.0% - 15.0% in the other three bioregions where the overall mean slopes are steeper and the range of HUC12 watershed mean slopes is comparatively large. Medians of a metric's bioregion-specific Reference values are used as scoring thresholds in all eight index methods. Therefore, in methods where % Burrower is included in the index, % Burrower will score 100 when its values are $\leq$ 8.0% in BLUE, $\leq$ 15.0% in NCA and SRV, and $\leq$ 24.0% in CA. Metric scoring in each bioregion is thus tailored to that bioregion's Reference and Degraded assemblages. So, although metric scores of 100 always represent Reference conditions in a given bioregion, they are not necessarily directly comparable across the twelve bioregions.

Despite the sometimes large differences in metric scoring thresholds between bioregions, jackknife results suggest the influence of these differences on the final index may be small. RMSE across all methods are only slightly higher in the jackknife CV results compared to the jackknife precision results (Figure I-2). This suggests variability associated with the index itself – its component metrics and their thresholds – is small. None of the methods appear to be overfitting to the data because differences between the original CE values and the jackknife CV mean CE are small. Method C had the largest difference ($\bar{x}$ = 4.4%); Method F had the smallest difference ($\bar{x}$ = 0.3%).

In Methods A – E, some of the variability expressed in RMSE also may be due to random variability introduced by the rarefaction procedure used in data preparation (Appendix D). As mentioned in the report, the rarefaction program selects in descending order the most frequently occurring taxa in a sample and builds a standardized sample (100 organisms in this study). When faced with equally frequent taxa near the end of the selection process, the program randomly selects taxa until a count of 100 is reached. The effect of this random selection can be slight differences in metric values produced by multiple program runs, and hence slight differences in the index CE's.

Method A was designated the top performing method because it had the greatest CV mean CE value ($\bar{x}$ = 75.8%) and a relatively low mean difference between the CE value calculated using all the available data ($\bar{x}$ = 1.4%). Although Method A was not always the top performing index in all bioregions, the CV mean CE was consistently within 5.0% of the top performing methods' CV mean CE value.

Method A was not as precise as Methods B and C, but all three methods produced a mean jackknife CE within 2.0% of one another (Table I-3). The weight of each metric in the final index score was substantially lower for Methods B and C compared to Method A. Method A is more susceptible to random variability of individual metrics. Methods B and C reduce variability by increasing the number of metrics contributing to the final index score; therefore, random variability of individual metrics is smoothed by the large number of contributing metrics. However, the increase in precision estimate provided by Methods B and C was not considered a significant improvement from the precision estimate of Method A.

Method A follows the general index development strategy outlined in literature (Barbour et al. 1996, Gerritsen et al. 2000b, Pond et al. 2011). Our assessment does not justify the use of any modified index development methodology. Additionally, following the principle of parsimony, Method A in general requires fewer metrics and is a more simplistic model than the other methods assessed (Hawkins 2004); therefore, Method A should be preferred to other methods with similar results. Finally, it would be inappropriate to apply different index development methods to each bioregion. Each bioregion index will be subjected to a standard categorical rating system for the Chesapeake Bay basin assessment. The results do not provide a clear pattern of method performance, suggesting unique biases among methodologies. Standardizing the results of multiple index development methodologies may provide skewed results. Therefore, Method A was used to develop all indices used in the Chessie BIBI assessment.

Range, variability, and redundancy assessments inform the R-program's metric selections in Methods A, D, and E. Metrics selected for an index should reflect ecological responses to environmental degradation and not "overfit" the data by responding to noise in the data (Barbour et al. 1999). Setting standards for metric range and variability can protect against over fitting the index. For range and variability assessments only the Reference data are used. Blocksom and Johnson (2009) calculated range as the difference between the minimum and maximum metric values. To avoid outlier influences, we calculated range as the difference between the Reference 5th and 95th percentiles. For richness metrics a range greater than 5 was required. Percent metrics required a range greater than or equal to 10.0%. Selecting metrics with low range restricts the Reference criteria beyond expected natural variability (i.e., in effect creating high probability for false-negatives). Measuring variability acts as a counter measure to range. Preferably metrics with high range and low variability are selected for further analysis. Variability was measured as Reference interquartile range (IQR) relative to the range between 0 and the Reference 25th percentile (Blocksom and Johnson 2009). Metrics were selected if the IQR was not greater than the range between 0 to the Reference 25th percentile.

Spearman correlation was used to assess and remove redundant metrics in Methods A, D, and E. Including two significantly correlated metrics ($r \geq 0.85$ or ≤ -0.85) in an index would be like including a single metric twice. An r value of 0.85 is relatively high but has been used in other indices (Gerritsen et al. 2000a, Butcher et al. 2003) and indicates ~72.0% of metric values are in common among two metrics of interest. Redundant metrics ($r \geq 0.85$ or ≤ -0.85) were compared pairwise using a Wilcoxon-Rank Sum test. No α-value was specified because the test was only used to indicate which metric had greater separation between the Reference and

Degraded distributions. The metric with the lower p-value were retained. The metrics remaining after the redundancy analysis were considered for the index.

A common issue in ecological data is community compositions dominated by zeros. Underlying differences in the distributions of Reference and Degraded values may be masked by the dominance of zeros. If more than 5% of Reference sample values were zero, only the subset of metrics with values greater than zero were used to evaluate sensitivity. If the sample size in each metric category after the removal of all zero values was deemed acceptable and the metric was considered sensitive, the metric was held for further review within the index. This “zero inflation protection” was applied in Methods C, D, E, F, G, and H. Metrics selected in Method A did not experience a zero problem.

Appendix J: Scoring Methodologies

To develop an Index of Biotic Integrity (IBI), biological metrics sensitive to a defined disturbance gradient are used to create a single index representing stream biological condition. Many metric values are not directly comparable and must be standardized, or scored, prior to including them in the index. A variety of methodologies are available for scoring metrics. Biological metrics can be scored using continuous or discrete scoring methodologies. Discrete scoring methodologies aggregate a range of data into distinct groups. Traditionally, the discrete groups are scored 1, 3, and 5. Continuous scoring methodologies transform the metric values to a standardized continuous scale – usually a continuous scale from 0 – 100.

An in-depth assessment of three discrete and three continuous scoring methodologies was reported by Blocksom (2003). Blocksom found a continuous scoring method, referred to as CAU, was the most robust for the Mid-Atlantic Highlands Assessment (MAHA) dataset. The CAU method uses the 95th percentile of all the samples to establish the ceiling of the scoring scale and 0 to establish the floor. (For metrics that increase with disturbance, the ceiling is the 5th percentile and the maximum possible value is the floor.) From this point on, this scoring scheme will be referred to as the CAU scoring method to remain consistent with Blocksom's (2003) terminology. Another common continuous scoring methodology called the All Gradient method (ALL GRAD) is similar to the CAU method but uses the minimum and maximum value of all the data to establish the floor and ceiling of the scoring scale. A third continuous scoring method (REF GRAD) uses the minimum and maximum values of the Reference values only to establish the floor and ceiling of the scoring scale. In this appendix, these three methods are compared to the continuous scoring method used to score metrics for the Chessie BIBI.

Best Separation Point

The Chessie BIBI scoring methodology, called the Balanced Discrimination Efficiency method, was a modification of an approach described in Buchanan *et al.* (2011). It finds the threshold at which the percentage of Reference and Degraded samples correctly identified are approximately equal. During assessments of metric sensitivity, an iterative process is used to assess each Reference distribution percentile as a potential threshold for separating Reference and Degraded distributions (*Report Section II.F. Metric Testing*). This threshold is the Best Separation Point (BSP) and is more specific than the arbitrary threshold of the 25th or 75th percentile of Reference values that is often used (see for example Figure 4 in the report). The BSP was used to identify the midpoint on the 0 – 100 metric scoring scale (*Report Section II.G. Metric Scoring Approach).* Including the BSP, along with floor and ceiling thresholds, in the scoring procedure improves the interpretability of the results because the BSP represents the point that equally separates the expected Reference and Degraded distributions. Therefore, this scheme identifies the poorest biological condition (values less than the floor), the best biological condition (values greater than or equal to the ceiling), and the point of greatest uncertainty in biological condition (BSP).

Scoring methodologies such as CAU can provide scores like those derived with the BSP when the Reference and Degraded distributions are approximately evenly divided. However, when distributions of biological metrics are skewed in Reference or Degraded conditions, scoring without the accounting for the BSP will provide less meaningful scores. The percentage

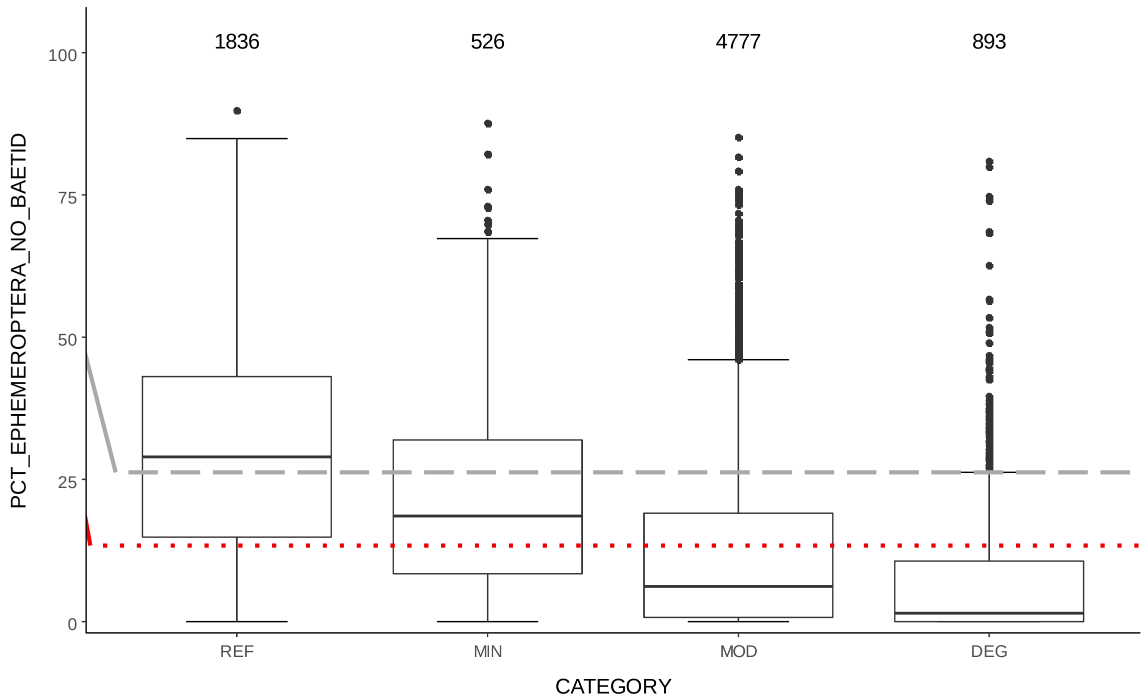


Figure J-1. The box-and-whisker plots represent the distribution of raw metric values for the percentage of Ephemeroptera individuals excluding individuals from the family Baetidae (PCT_EPHEMEROPTERA_NO_BAETID) in each disturbance gradient category. The red dotted line at 13.4% represents the BSP for the metric and receives a score of 50. The gray dashed line at 26.3% represents the value that would be scored 50 using the CAU scoring methodology (floor = 0, ceiling = 95th percentile of all values). Numbers at the top are the sample size of each disturbance gradient category.

of Ephemeroptera individuals excluding individuals from the family Baetidae (EPHEMEROPTERA_NO_BAETID) exemplifies the potential issue with the CAU scoring methodology (Figure J-1). It is a sensitive metric for the family-level Inland index. In Figure J-1, the distribution of both Refence and Degraded samples extend from 0 – 100 but this metric was considered sensitive to the defined disturbance gradient (DE = 80.7%, BDE =78.4%) and the metric depicts a declining trend from Reference to Degraded. Applying the CAU scoring methodology, the ceiling would be set at a metric value of 52.5% and the floor would be 0%; therefore, a score of 50 would be equivalent to a raw metric value of 26.3%. Using the BSP to inform the continuous scoring gradient, a score of 50 would be equivalent to a raw metric value of 13.4%. The distribution of CAU-scored PCT_EPHEMEROPTERA_NO_BAETID would be similar to Figure J-1 and would continue to discriminate between Reference and Degraded distributions well. However, a CAU score of 50 is difficult to interpret because it represents the midpoint of the range of metric values and is more influenced by the proportions of good and bad sites than the defined disturbance gradient. A score of 50 from a scoring method incorporating the BSP better identifies metric values that are found in the middle of the disturbance gradient. As scores increase from 50, more confidence is gained that the sample represents a Reference condition. As scores decrease from 50, more confidence is gained that the sample represents a Degraded condition.

Results

The metrics selected for the family-level Inland index were used to examine the different outcomes of the the four scoring methods. Figure J-2 depicts the distribution of each scoring method relative to the disturbance gradient categories. The methods do not provide the exact same results but each method distribution roughly represents a truncated or elongated distribution of the other three methods. The Balanced Discrimination Efficiency method used to score metrics for the Chessie BIBI is best at spreading index scores from a broad range of environmental conditions across the entire 0 – 100 scale. Median scores in Reference and Degraded conditions also show the greatest separation. For CAU and Chessie BIBI, scores in Reference conditions fall mostly above 50, the mid-point of the 0 – 100 index scale, and scores in Degraded conditions fall mostly below 50. Classification efficiencies are essentially the same across all four methods.

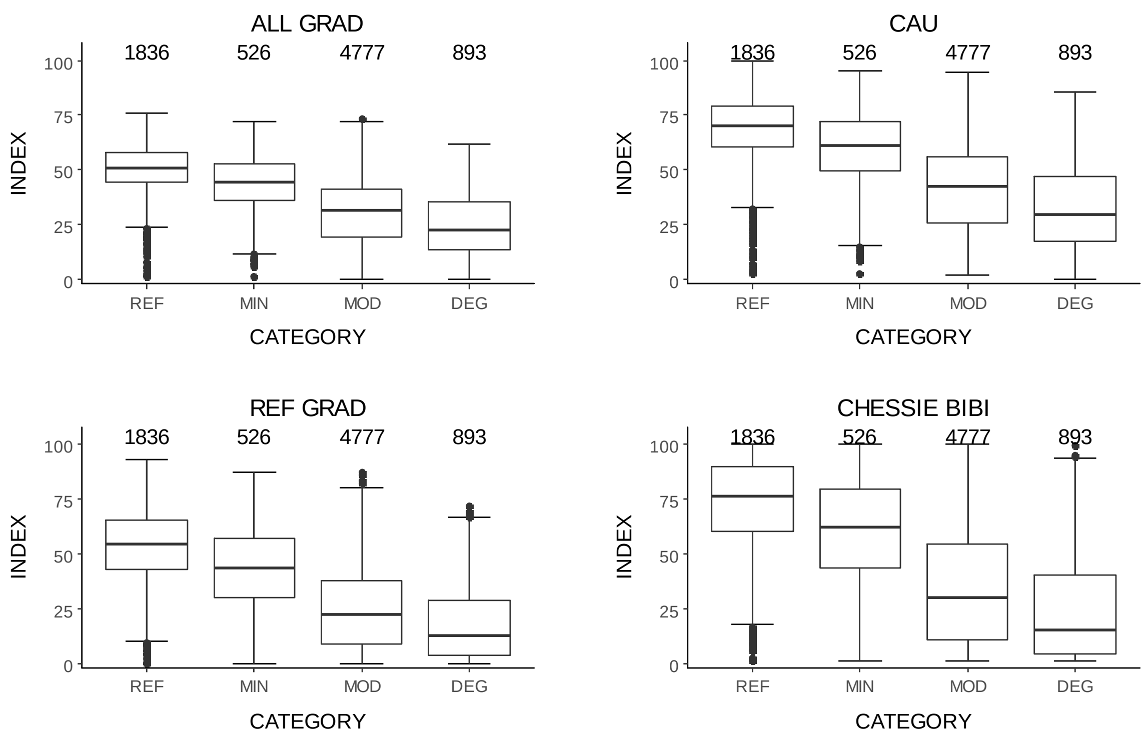


Figure J-2. Distributions of index scores for family-level Inland index scored using four scoring methods: All Gradient based on the minimum and maximum values from all of the available data (ALL GRAD), All Gradient based on the 5th and 95th percentiles of all of the available data (ALL GRAD (5, 95)), Reference Gradient (REF GRAD), and the scoring procedure outlined in this report (CHESSIE BIBI). The whisker lengths are designated by the Interquartile Range multiplied by 1.5.

The approach used in this report to assign narrative rating to index scores was applied to all four scoring method outcomes, i.e., rating thresholds are the 50th, 25th, 10th and half of 10th percentiles of the Reference distributions (*II. M. Narrative Rating Categories*). The proportion of sampling events in each of the five rating categories is summarized in Figure J-3. The proportion of sampling events classified as Excellent, Good, and Fair differed by less than 2%. The proportion of Excellent, Good, and Fair sites is the measure used by the Chesapeake Bay Program to track improvement in stream health. Proportional differences between the Poor and

Very Poor rating categories were greater. The ALL GRAD and CAU methods had low proportion of Very Poor sampling events and the REF_GRAD and Chessie BIBI methods had the highest proportions.

The larger proportion of sampling events classified as Very Poor in the REF GRAD and CHESSIE BIBI is because the index scoring scale is determined by percentiles of the values in Reference conditions rather than in the entire data pool. The range of metric values used to create the 0 – 100 scoring scale for the ALL GRAD and CAU methods is larger and has a lower threshold for degraded biological condition than the range of metric values used to create the 0 – 100 scale for the REF GRAD and CHESSIE BIBI methods. Thus, metrics scored with the REF GRAD and CHESSIE BIBI methods tend to have a greater proportion of samples rated as Poor or Very Poor than the ALL GRAD and CAU methods.

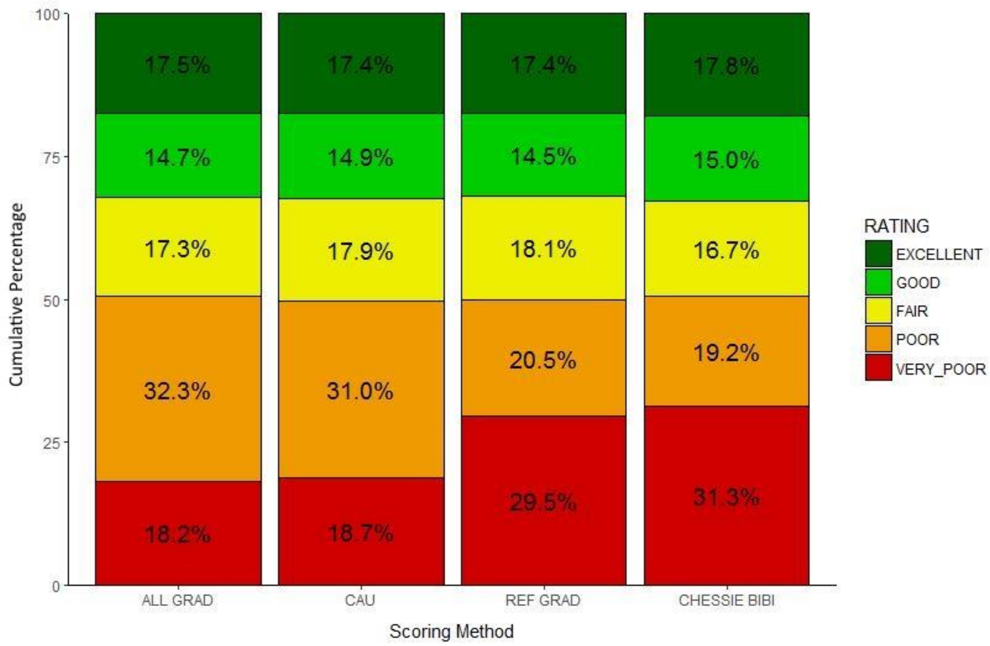


Figure J-3. A standard rating protocol was applied to each scoring method and the stacked bar plots represent the percent of samples in each rating category.

Conclusion

CBP ultimately wants to increase the proportion of stream miles supporting health stream communities in the Chesapeake Bay watershed. All four of the scoring methods tested are roughly equal in their ability to classify Excellent, Good, and Fair health. Because the REF_GRAD and Chessie BIBI methods are derived from metric values observed in least-disturbed, or Reference, streams, they are better able to identify biological communities that diviate substantially from a healthy status. This is seen in their larger proportions of Very Poor status in Figure J-3.

Appendix K: Index Performance, Accuracy, and Precision

Benthic macroinvertebrate indices were developed for three spatial resolutions (Chesapeake-wide, Region, and Bioregion) and three taxonomic tiers (order, family, and genus). The performance, accuracy, and precision of the indices were compared to indicate which index provided the best representation of stream condition in the Chesapeake Bay basin.

The accuracy and precision of each of the indices was evaluated using the variability associated with the index's Classification Efficiency (CE) and Best Separation Point (BSP). Each index developed was subset using a delete-d jackknife procedure repeated five-hundred times. The jackknife was used to create a Training dataset and Validation dataset. Training datasets were used to re-establish scoring thresholds for each unique iteration. Because the Training dataset was used to develop the scoring thresholds, the CE and BSP of the Training dataset was considered dependent, and therefore, were estimates of index precision. Training dataset scoring thresholds were applied to the Validation dataset for each iteration. The Validation dataset was independent of the establishment of scoring thresholds, and therefore, provided an estimate of index accuracy.

Chesapeake-Wide

The Chesapeake-Wide indices provided promising results with relatively high CE values and low RMSE values for each taxonomic tier (Table K-1 and Figure K-1). CE of each tier was within 4.5% of one another. All the taxonomic resolutions had the same Training RMSE (0.4%). The family-level index had the lowest Validation RMSE (1.0%).

Table K-1. A delete-d Jackknife procedure was used to measure the CE and BSP variability for each taxonomic tier at the Chesapeake-wide scale. In addition, a delete-d Jackknife cross validation procedure was used to verify CE. The Original value represents the value calculated with all the available data. The Mean Simulated Value and RMSE are calculated during the five-hundred jackknife iterations.

Spatial Resolution	Taxonomic Tier	Measure	Original Value	Mean Simulated Value	RMSE
BASIN	Order	Training CE	81.5	81.4	0.4
BASIN	Order	Validation CE	81.5	81.6	1.2
BASIN	Order	BSP	49.0	54.4	0.6
BASIN	Family	Training CE	84.9	85.2	0.4
BASIN	Family	Validation CE	84.9	85.2	1.0
BASIN	Family	BSP	49.0	52.0	0.8
BASIN	Genus	Training CE	85.0	85.2	0.4
BASIN	Genus	Validation CE	85.0	85.2	1.1
BASIN	Genus	BSP	46.0	48.5	0.8

A.

B.

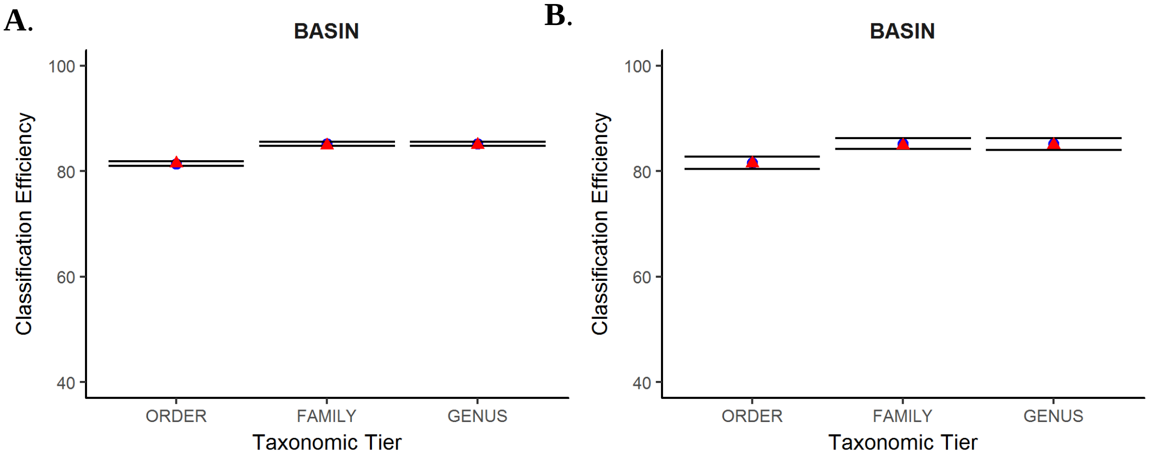


Figure K-1. The precision (A) and the accuracy (B) of each Chesapeake-Wide index was calculated using a delete-d jackknife procedure. Precision estimates utilized the training datasets created during the delete-d jackknife procedure, while the accuracy estimates use the validation datasets. Blue circles represent the mean simulated CE and the black bars represent the mean simulated CE ± RMSE calculated during the five-hundred delete-d jackknife iterations. The red triangles depict the CE of the index created with all the available data.

Region

CE's of all the Inland indices were greater than or equal to 70.0% (Table K-2 and Figure K-2ab). The family- and genus-level Coast indices had CE's greater than 70.0% but the order-level index CE was just below this threshold (CE = 69.5%). Genus-level indices for both regions provided the greatest CE values but the CE's of all three taxonomic tiers did not differ more than 6.0%. The Inland RMSE values associated with accuracy and precision did not differ greatly between the three taxonomic tiers. Coast RMSE values were lowest for the family-level index (Training RMSE = 1.5; Validation RMSE = 4.8). For both Regions, the BSP values did not differ more than 5.0% from the expected value of 50.0% and the RMSE values were all less than 2.0%.

Table K-2. A delete-d Jackknife procedure was used to measure the CE and BSP variability for each taxonomic tier at the regional scale. In addition, a delete-d Jackknife cross validation procedure was used to verify CE. The Original value represents the value calculated with all the available data. The Mean Simulated Value and RMSE are calculated during the five-hundred jackknife iterations.

Bioregion	Taxonomic Tier	Measure	Original Value	Mean Simulated Value	RMSE
COAST	Order	Training CE	69.5	70.0	2.4
COAST	Order	Validation CE	69.5	67.4	5.8
COAST	Order	BSP	53.0	48.1	1.9
COAST	Family	Training CE	72.3	73.3	1.5
COAST	Family	Validation CE	72.3	73.6	4.8
COAST	Family	BSP	53.0	49.2	1.3
COAST	Genus	Training CE	74.6	73.6	2.5
COAST	Genus	Validation CE	74.6	72.3	6.4
COAST	Genus	BSP	55.0	55.5	1.6
INLAND	Order	Training CE	77.6	77.8	0.6
INLAND	Order	Validation CE	77.6	77.9	1.5
INLAND	Order	BSP	54.0	54.9	0.6
INLAND	Family	Training CE	82.4	83.2	0.5
INLAND	Family	Validation CE	82.4	83.1	1.3
INLAND	Family	BSP	53.0	52.0	0.8
INLAND	Genus	Training CE	82.6	82.2	0.5
INLAND	Genus	Validation CE	82.6	82.0	1.4
INLAND	Genus	BSP	50.0	50.3	0.5

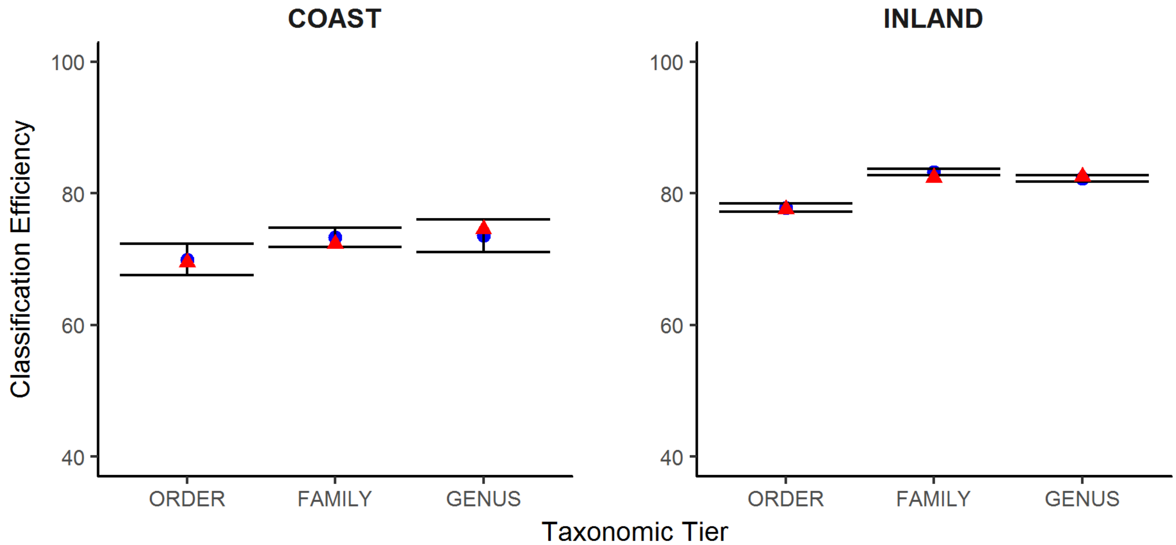


Figure K-2a. For the regional indices, the precision of the Classification Efficiency (CE) measured for each taxonomic tier was estimated using a delete-d jackknife procedure. Blue circles represent the mean simulated CE of the training sets and the black bars represent the mean simulated CE ± RMSE calculated during the five-hundred delete-d jackknife iterations. The red triangles depict the CE of the index created with all the available data.

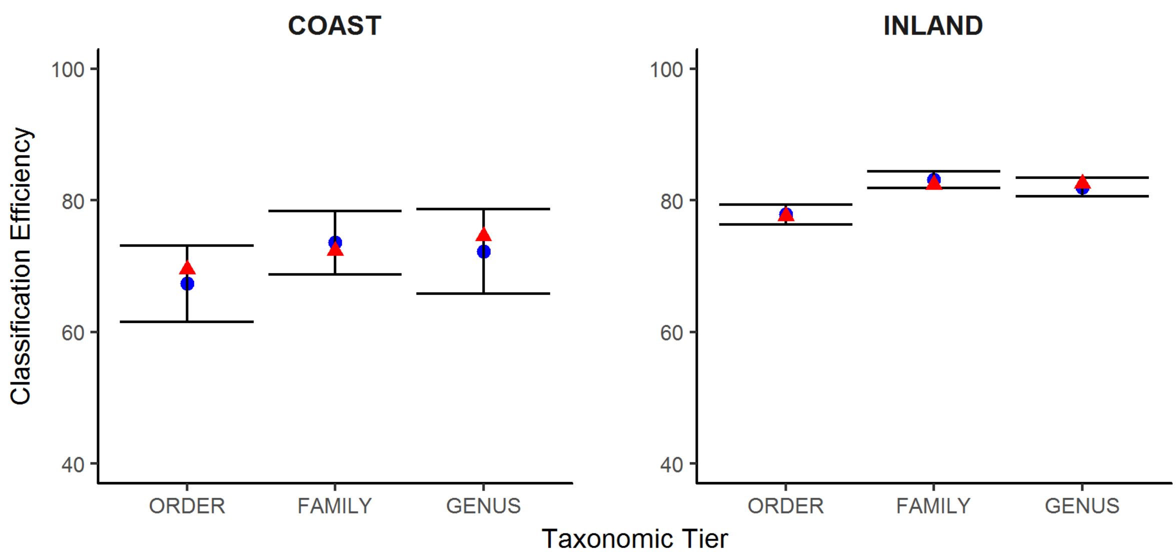


Figure K-2b. For the regional indices, the accuracy of the Classification Efficiency (CE) measured for each taxonomic tier was estimated using a delete-d jackknife cross validation procedure. Blue circles represent the mean simulated CE of the validation sets and the black bars represent the mean simulated CE ± RMSE calculated during the five-hundred delete-d jackknife cross validation iterations. The red triangles depict the CE of the index created with all the available data.

Bioregion

The performance of the individual bioregion indices varied (Table K-3). At the order-level CE ranged from as low as 57.8% in NAPU and as high as 87.6% in LNP. NAPU also had the lowest CE at the family-level (70.4%) but UNP had the greatest CE (90.0%). The lowest CE for the genus-level was 72.7% in NAPU and the greatest CE was 89.4% in NRV. Despite the large range in CE at each taxonomic tier, the general trend indicated that as taxonomic resolution increased, CE increased but RMSE associated with precision and accuracy did not differ greatly (Table K-3 and Figure K-4). The average CE by taxonomic tier was 74.2% (order), 81.6% (family), and 83.3% (genus). Although on average the genus-level assessment provided the greatest CEs, there was not a large improvement in the average family-level CE. The greatest improvement in CE occurred between the order and family-level indices.

The mean Training RMSE values did not differ by more than 0.1 and the mean Validation RMSE values did not differ by more than 0.8. Therefore, all indices have approximately equal variability associated with CE. The BSP was another value for which to measure precision of the indices. BSP values typically did not deviate drastically from the expected value of fifty and had RMSE values less than four (Table K-3). BLUE and MAC tended to have larger RMSE values associated with BSP than the other bioregions.

Table K-3. A delete-d Jackknife procedure was used to measure the CE and BSP variability for each taxonomic tier for the twelve bioregions in the Chesapeake Bay basin. In addition, a delete-d Jackknife cross validation procedure was used to verify CE. The Original value represents the value calculated with all the available data. The Mean Simulated Value and RMSE are calculated during the five-hundred jackknife iterations.

Bioregion	Taxonomic Tier	Measure	Original Value	Mean Simulated Value	RMSE
BLUE	Order	Training CE	85.3	82.0	4.4
BLUE	Order	Validation CE	85.3	82.2	13.9
BLUE	Order	BSP	47.0	43.9	4.1
BLUE	Family	Training CE	85.7	86.5	9.0
BLUE	Family	Validation CE	85.7	84.1	9.8
BLUE	Family	BSP	60.0	48.6	16.8
BLUE	Genus	Training CE	87.0	89.0	6.0
BLUE	Genus	Validation CE	87.0	86.5	11.3
BLUE	Genus	BSP	50.0	48.0	1.7
CA	Order	Training CE	76.9	73.6	3.3
CA	Order	Validation CE	76.9	72.1	6.5
CA	Order	BSP	55.0	49.6	2.9
CA	Family	Training CE	82.1	77.0	2.8
CA	Family	Validation CE	82.1	76.2	6.7
CA	Family	BSP	54.0	51.1	2.4
CA	Genus	Training CE	84.4	84.7	3.0
CA	Genus	Validation CE	84.4	82.5	7.5

Bioregion	Taxonomic Tier	Measure	Original Value	Mean Simulated Value	RMSE
CA	Genus	BSP	53.0	51.5	2.4
LNP	Order	Training CE	87.6	88.0	0.9
LNP	Order	Validation CE	87.6	87.9	2.6
LNP	Order	BSP	63.0	54.3	1.1
LNP	Family	Training CE	89.6	89.3	0.8
LNP	Family	Validation CE	89.6	89.3	2.4
LNP	Family	BSP	61.0	49.7	1.2
LNP	Genus	Training CE	87.9	86.7	1.1
LNP	Genus	Validation CE	87.9	86.6	3.0
LNP	Genus	BSP	57.0	49.0	1.5
MAC	Order	Training CE	74.8	76.1	3.9
MAC	Order	Validation CE	74.8	71.6	9.7
MAC	Order	BSP	59.0	53.3	5.7
MAC	Family	Training CE	76.8	77.7	3.9
MAC	Family	Validation CE	76.8	76.0	8.7
MAC	Family	BSP	57.0	53.5	2.4
MAC	Genus	Training CE	82.6	82.4	3.9
MAC	Genus	Validation CE	82.6	82.3	8.2
MAC	Genus	BSP	53.0	52.2	5.8
NAPU	Order	Training CE	57.8	58.4	2.9
NAPU	Order	Validation CE	57.8	53.3	6.8
NAPU	Order	BSP	50.0	50.4	1.1
NAPU	Family	Training CE	70.4	69.2	2.6
NAPU	Family	Validation CE	70.4	66.8	6.8
NAPU	Family	BSP	48.0	55.4	2.1
NAPU	Genus	Training CE	72.7	74.6	2.7
NAPU	Genus	Validation CE	72.7	74.2	7.5
NAPU	Genus	BSP	55.0	54.2	1.8
NCA	Order	Training CE	68.8	71.3	2.4
NCA	Order	Validation CE	68.8	70.7	4.7
NCA	Order	BSP	55.0	52.8	2.0
NCA	Family	Training CE	82.4	82.8	1.4
NCA	Family	Validation CE	82.4	82.4	4.6
NCA	Family	BSP	47.0	46.6	2.2
NCA	Genus	Training CE	88.6	88.3	1.4
NCA	Genus	Validation CE	88.6	87.9	4.5
NCA	Genus	BSP	49.0	47.7	2.6
NRV	Order	Training CE	73.1	74.5	2.6
NRV	Order	Validation CE	73.1	74.0	5.4

Bioregion	Taxonomic Tier	Measure	Original Value	Mean Simulated Value	RMSE
NRV	Order	BSP	54.0	54.8	1.2
NRV	Family	Training CE	77.8	80.8	2.2
NRV	Family	Validation CE	77.8	81.2	4.5
NRV	Family	BSP	50.0	50.8	1.9
NRV	Genus	Training CE	89.4	90.1	1.3
NRV	Genus	Validation CE	89.4	91.0	4.1
NRV	Genus	BSP	46.0	46.3	1.6
PIED	Order	Training CE	69.8	78.1	3.0
PIED	Order	Validation CE	69.8	77.3	5.6
PIED	Order	BSP	49.0	53.3	2.4
PIED	Family	Training CE	83.9	85.1	1.9
PIED	Family	Validation CE	83.9	84.2	5.0
PIED	Family	BSP	60.0	60.7	2.5
PIED	Genus	Training CE	84.4	84.9	2.8
PIED	Genus	Validation CE	84.4	81.9	6.5
PIED	Genus	BSP	50.0	53.9	2.1
SEP	Order	Training CE	73.2	75.3	2.2
SEP	Order	Validation CE	73.2	73.6	6.0
SEP	Order	BSP	56.0	53.2	1.7
SEP	Family	Training CE	75.4	77.0	2.1
SEP	Family	Validation CE	75.4	75.8	5.8
SEP	Family	BSP	55.0	54.0	2.3
SEP	Genus	Training CE	77.1	77.5	2.1
SEP	Genus	Validation CE	77.1	76.2	6.0
SEP	Genus	BSP	58.0	56.6	1.1
SGV	Order	Training CE	74.7	74.8	1.7
SGV	Order	Validation CE	74.7	74.0	4.8
SGV	Order	BSP	54.0	53.8	1.2
SGV	Family	Training CE	85.1	83.7	1.6
SGV	Family	Validation CE	85.1	83.2	4.0
SGV	Family	BSP	61.0	53.7	1.2
SGV	Genus	Training CE	80.7	79.1	2.0
SGV	Genus	Validation CE	80.7	77.3	4.7
SGV	Genus	BSP	54.0	51.4	1.0
SRV	Order	Training CE	70.5	70.1	2.2
SRV	Order	Validation CE	70.5	69.3	4.8
SRV	Order	BSP	56.0	53.4	1.7
SRV	Family	Training CE	79.7	80.0	1.8
SRV	Family	Validation CE	79.7	79.4	4.1

Bioregion	Taxonomic Tier	Measure	Original Value	Mean Simulated Value	RMSE
SRV	Family	BSP	53.0	48.2	1.4
SRV	Genus	Training CE	75.5	74.1	2.3
SRV	Genus	Validation CE	75.5	74.2	5.0
SRV	Genus	BSP	52.0	51.0	1.0
UNP	Order	Training CE	77.7	77.9	1.9
UNP	Order	Validation CE	77.7	78.8	4.8
UNP	Order	BSP	53.0	53.4	1.6
UNP	Family	Training CE	90.0	89.6	1.3
UNP	Family	Validation CE	90.0	90.2	3.7
UNP	Family	BSP	57.0	55.1	2.0
UNP	Genus	Training CE	89.3	88.6	1.4
UNP	Genus	Validation CE	89.3	88.8	3.9
UNP	Genus	BSP	59.0	55.9	2.3

Table K-4. The mean CE of the bioregion indices and the associated mean RMSE values from the delete-d jackknife (Mean Training RMSE) and delete-d jackknife cross validation (Mean Validation RMSE) were calculated for each taxonomic tier.

Taxonomic Tier	Mean Original CE	Mean Training RMSE	Mean Validation RMSE
Order	74.2	2.6	6.3
Family	81.6	2.6	5.5
Genus	83.3	2.5	6.0

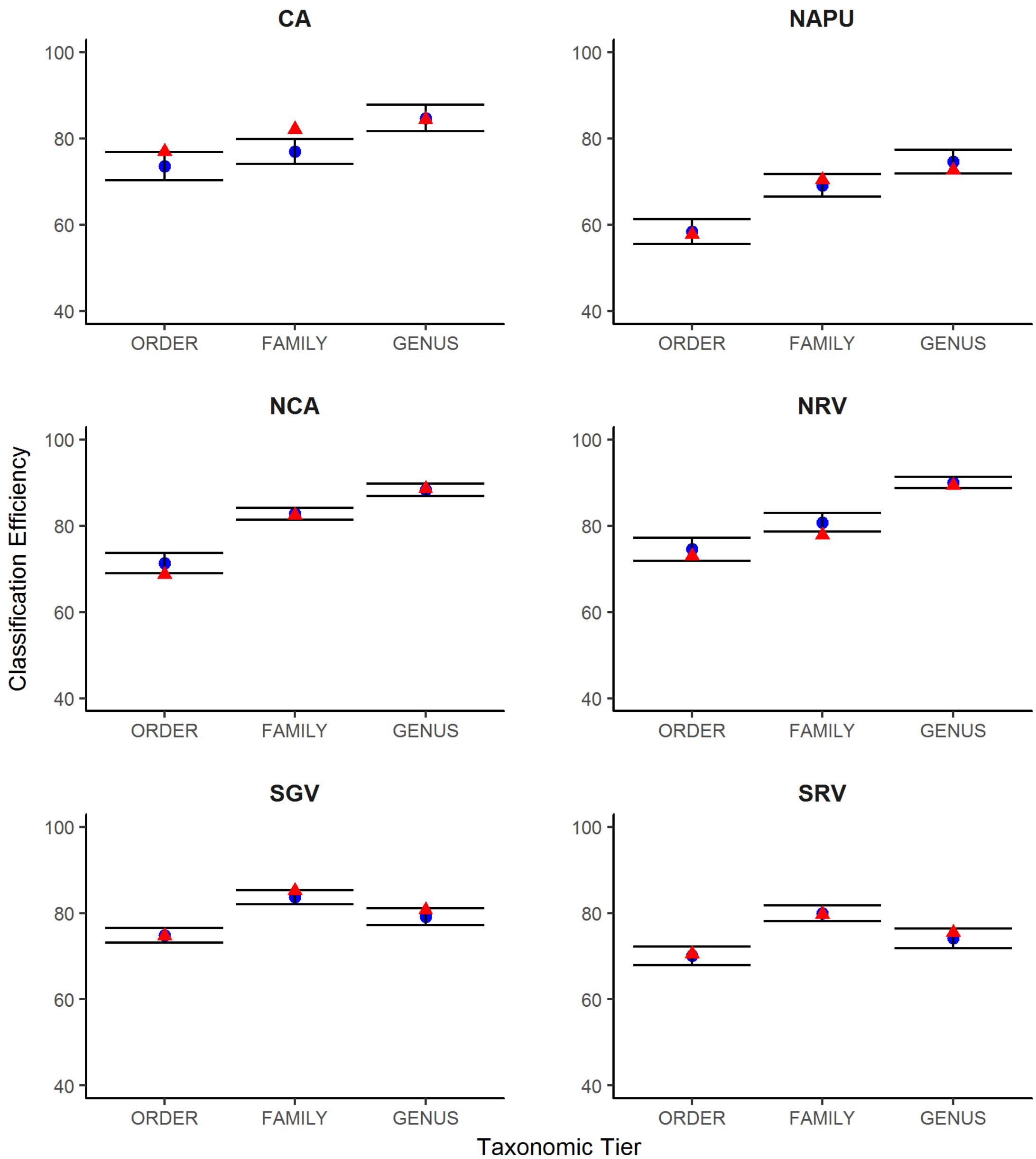


Figure K-3. For the bioregion indices, the precision of the Classification Efficiency (CE) measured for each taxonomic tier was estimated using a delete-d jackknife procedure. Blue circles represent the mean simulated CE of the training sets and the black bars represent the mean simulated CE ± RMSE calculated during the five-hundred delete-d jackknife iterations. The red triangles depict the CE of the index created with all the available data.

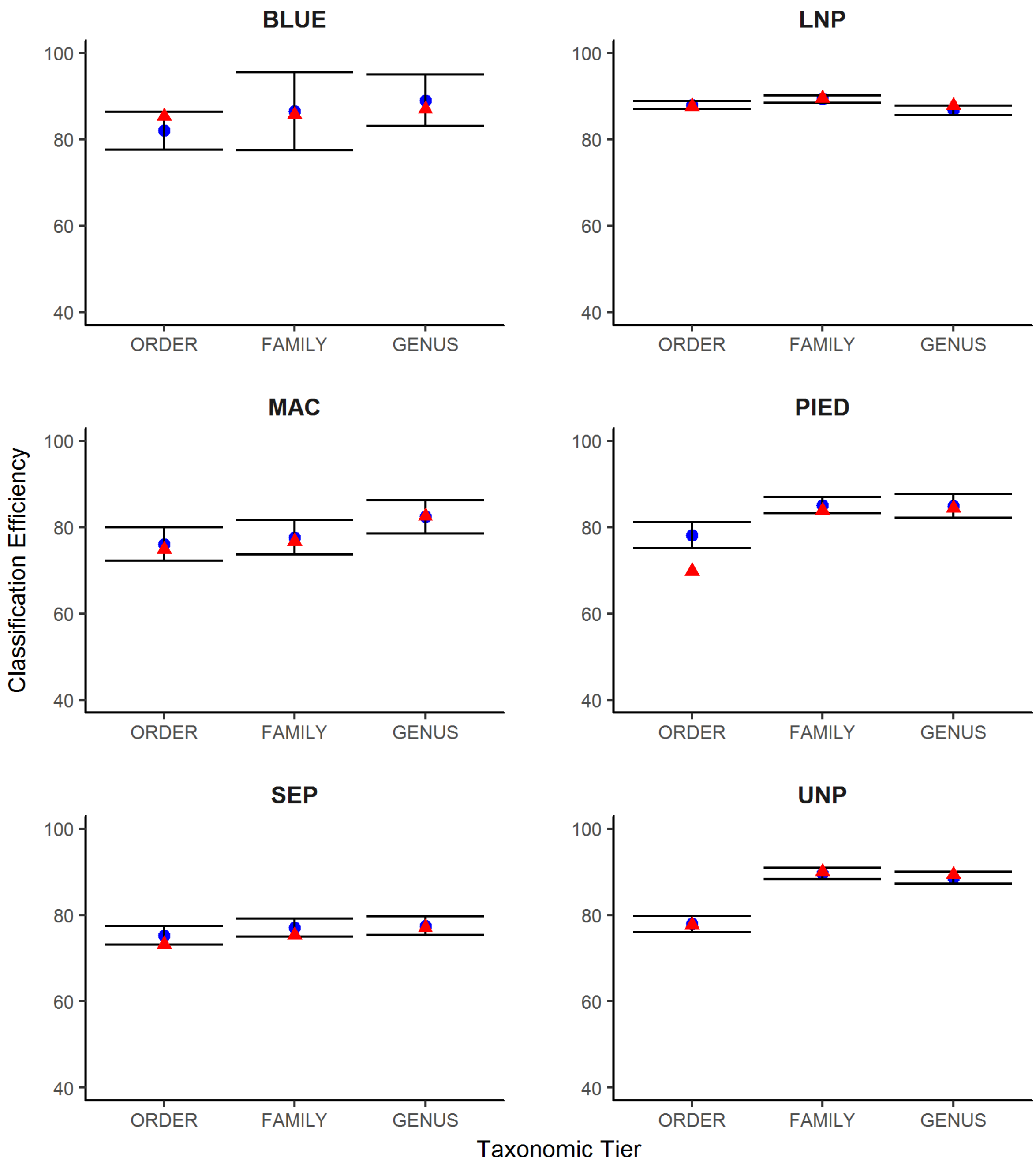


Figure K-3. Continued…

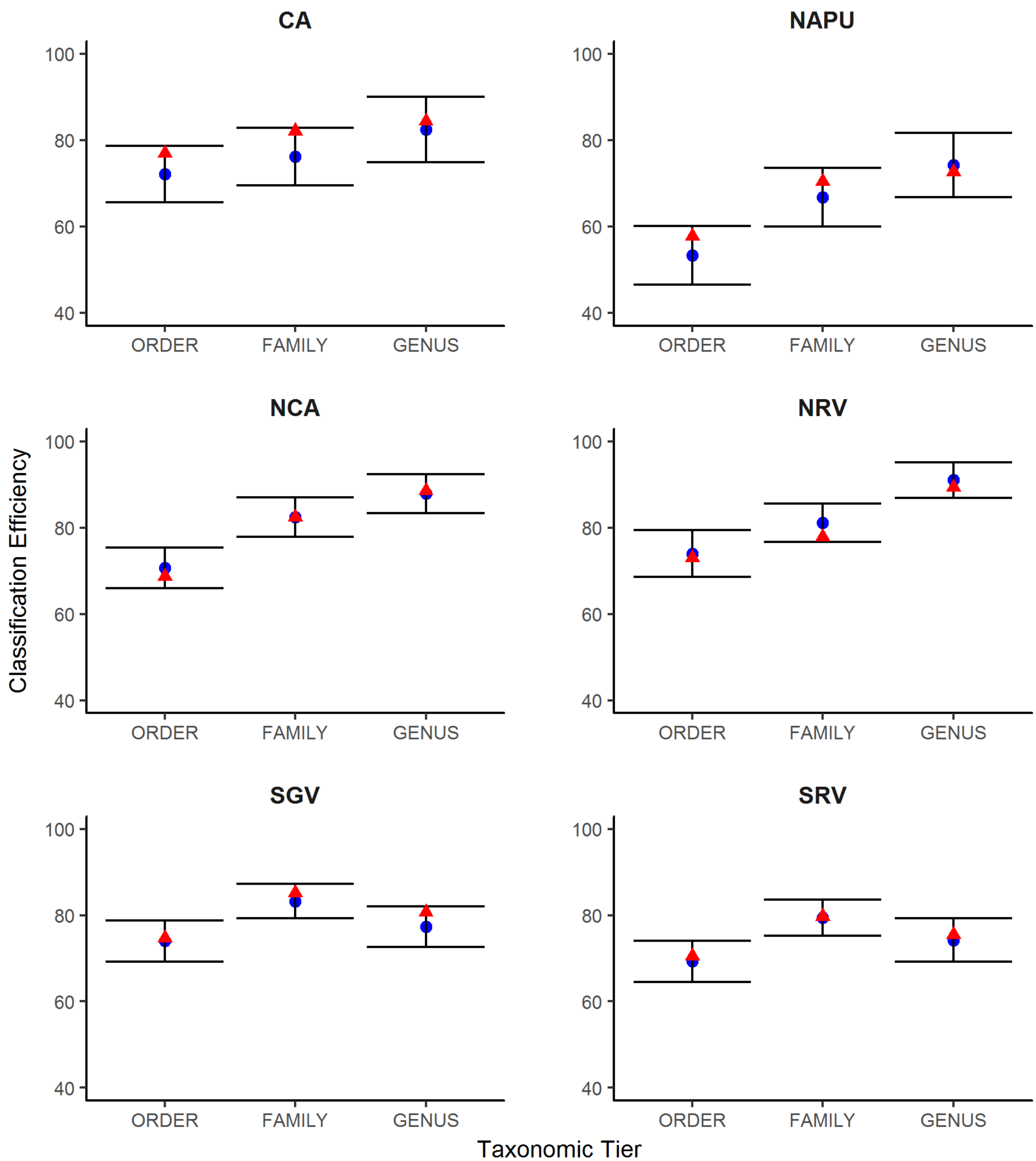


Figure K-4. For the bioregion indices, the accuracy of the Classification Efficiency (CE) measured for each taxonomic tier was estimated using a delete-d jackknife cross validation procedure. Blue circles represent the mean simulated CE of the validation datasets and the black bars represent the mean simulated CE ± RMSE calculated during the five-hundred delete-d jackknife cross validation iterations. The red triangles depict the CE of the index created with all the available data.

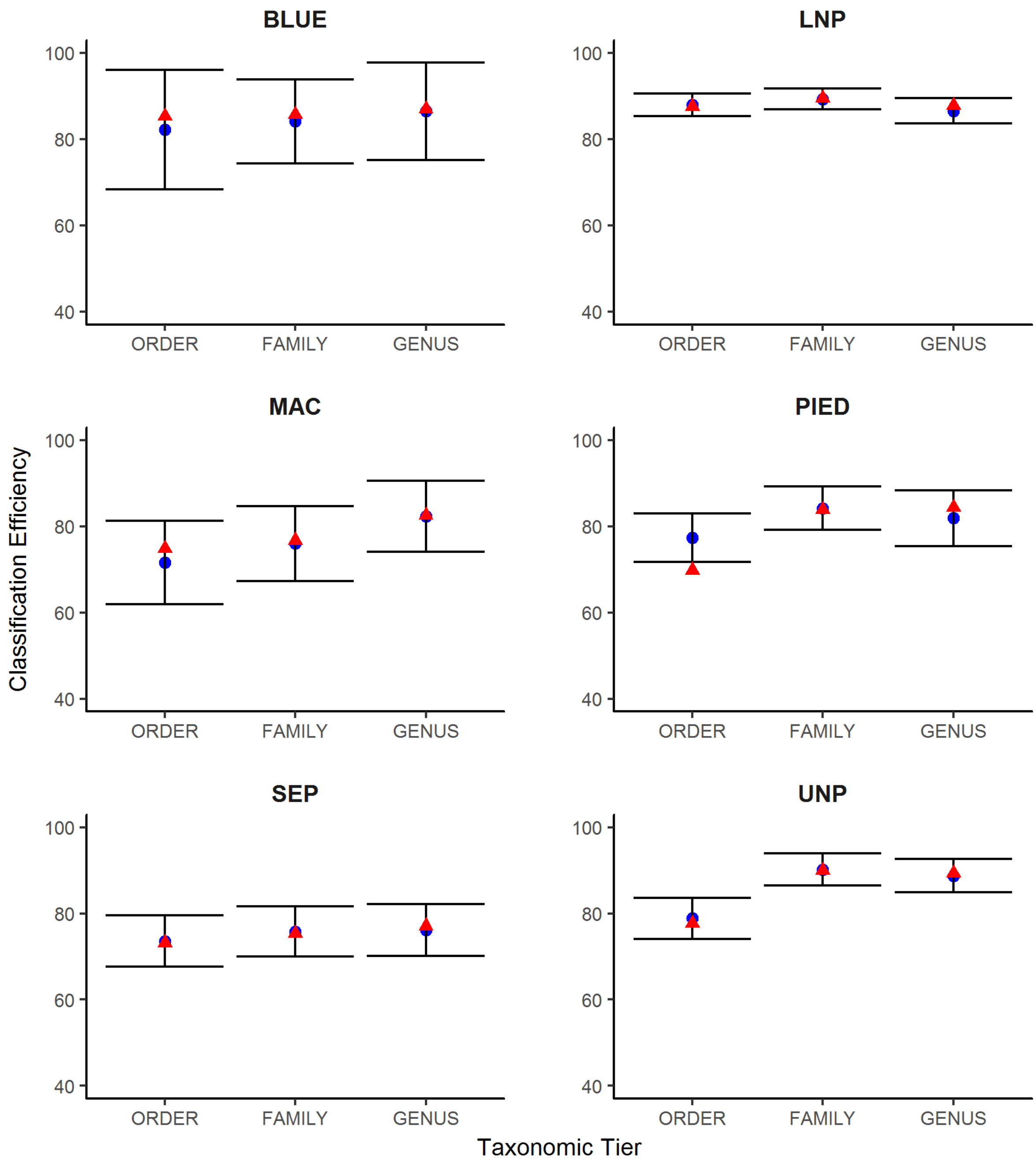


Figure K-4. Continued…

Appendix L: Narrative Ratings and Maps of Index Scores

Table 5 in the report provide the numeric values of the rating thresholds for the order-, family-, and genus-level versions of the Chesapeake-wide, region, and bioregion indices, respectively. These thresholds are used to assign narrative ratings to numeric scores of the benthic macroinvertebrate indices. Report section *II. N. Area-Weighting of Rating Results* describes the procedure for area-weighting the narrative rating results. The HUC12 area information needed to calculate the factors used in area-weighting each station rating is provided in Table H-3 and in the Excel file <Chesapeake_HUC12_Areas.xlsx>.

The stacked bar plots in Figures L-1 and L-2 were generated for the family- and genus-level versions of the index rating scheme to illustrate the ranges of the actual index scores for each rating. Figures L-3 – L-11 are maps of the Chesapeake Bay basin representing the area-weighted results of each of the nine ratings schemes (3 taxonomic tiers x 3 spatial scales). The rating maps can be visually compared to the 2006 map of the National Land Cover Data shown in Figure L-12 (Fry et al. 2011). National Land Cover Data in the Chesapeake Bay basin was aggregated into seven land-use classes. The land use data are an independent source of environmental conditions within the basin. Two HUC12 land use characteristics (percentages of forest and urban land cover) can significantly affect stream quality. Correlations between these land uses and the habitat/water quality parameters used to establish stream condition categories were evaluated using Spearman Correlation (Table L-1).

To create the maps, station scores were first averaged by high resolution catchments ("Retrieved [03/15/2017], from the ecosheds product downloads, http://ecosheds.org/assets/nhdhrd/v2/" n.d.). This reduces the potential of spatial autocorrelation caused by stations with different names that are essentially at the same location. If less than three catchments are scored in a HUC12, the average score of each catchment is represented as a dot on the maps. If three or more catchments are scored in a HUC12, then the averaged catchment scores were again averaged together to represent a single score for that HUC12. HUC12 scores were rated according to the thresholds provided in Table 5. Any score equal to a rating threshold was assigned to the better of the two ratings. Catchment ratings were area-weighted by HUC12 before percentages of the five ratings were calculated for the bioregion, region, and Chesapeake-wide spatial scales. If a HUC12 overlapped a region or bioregion boundary, it's area is apportioned to each of it's component regions or bioregions.

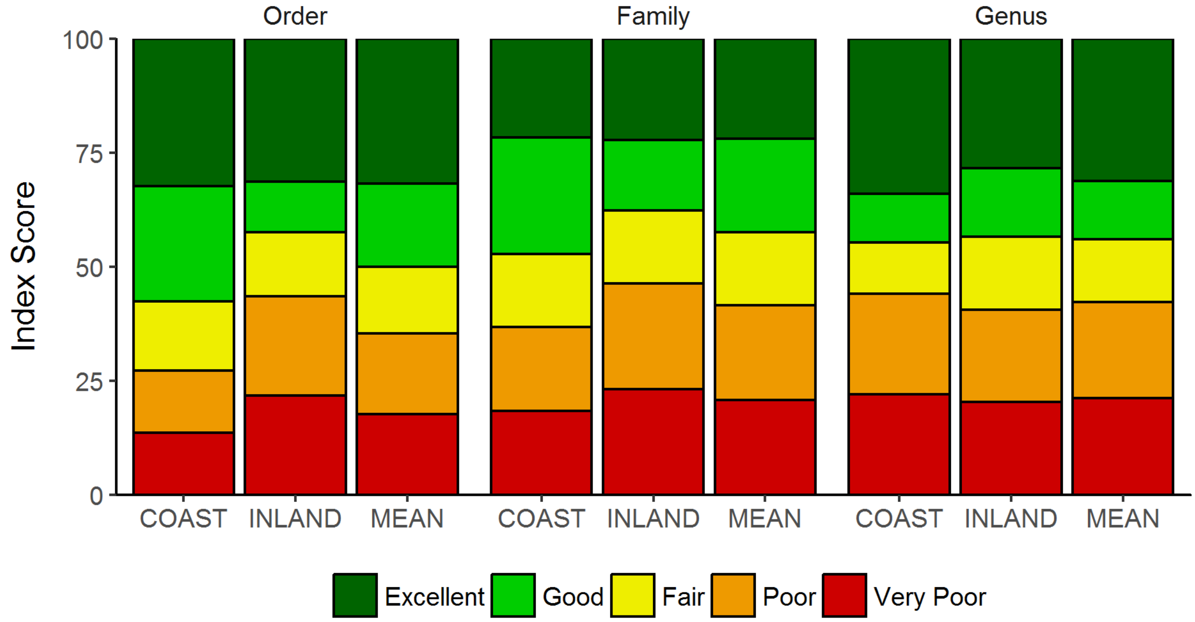


Figure L-1. The ranges of the Chessie BIBI index scores representing each of the five rating categories are shown as stacked bars for the three taxonomic versions of the Coast and Inland regional indices. The "MEAN" bars represent the range of the categories based on the average rating thresholds of the regional indices.

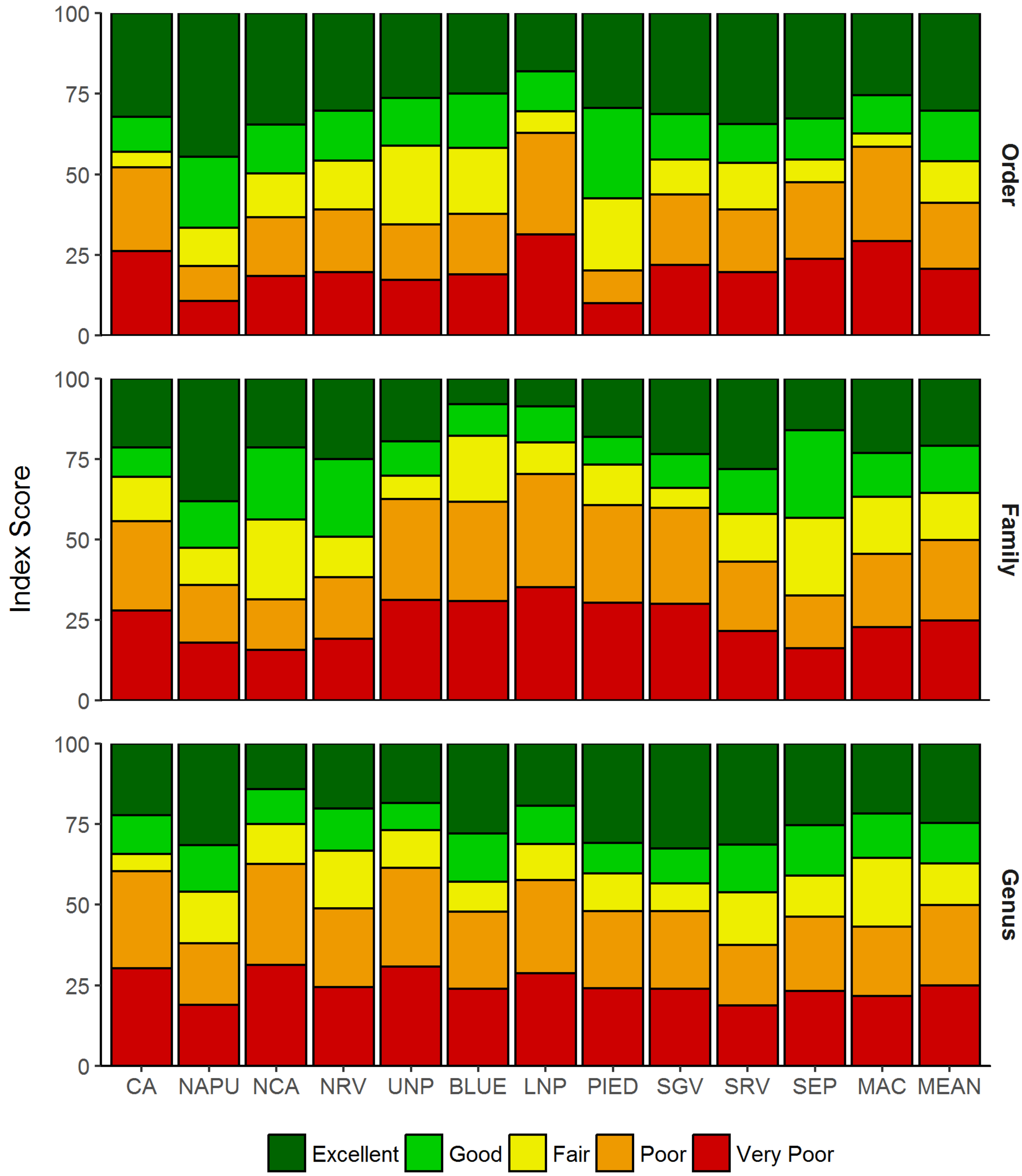


Figure L-2. The ranges of the Chessie BIBI index scores representing each of the five rating categories are shown as stacked bars for the three taxonomic versions of the bioregion indices. The "MEAN" bars represent the range of the categories based on the average rating thresholds of the regional indices. CA, Central Appalachians; NAPU, Northern Appalachian Plateau & Uplands; NCA, North Central Appalachians; NRV, Northern Ridge & Valley; UNP, Upper Northern Piedmont; BLUE, Blue Ridge; LNP, Lower Northern Piedmont; PIED, Piedmont; SGV, Southern Great Valley; SRV, Southern Ridge & Valley; SEP, Southeastern Plains; MAC, Mid-Atlantic Coast.

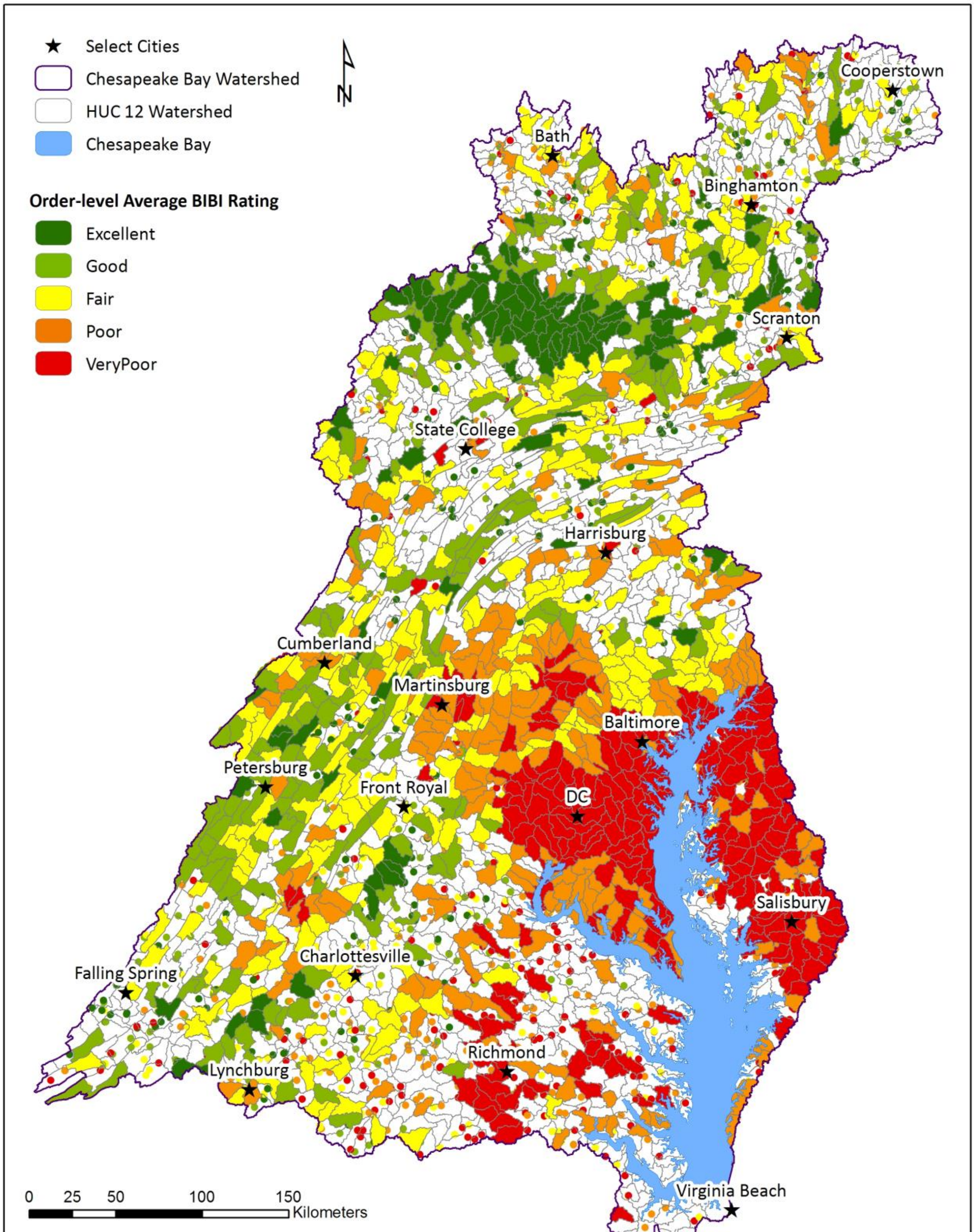


Figure L-3. Order-level Chesapeake-wide index scores aggregated by HUC12. Use of this version of the index is not recommended.

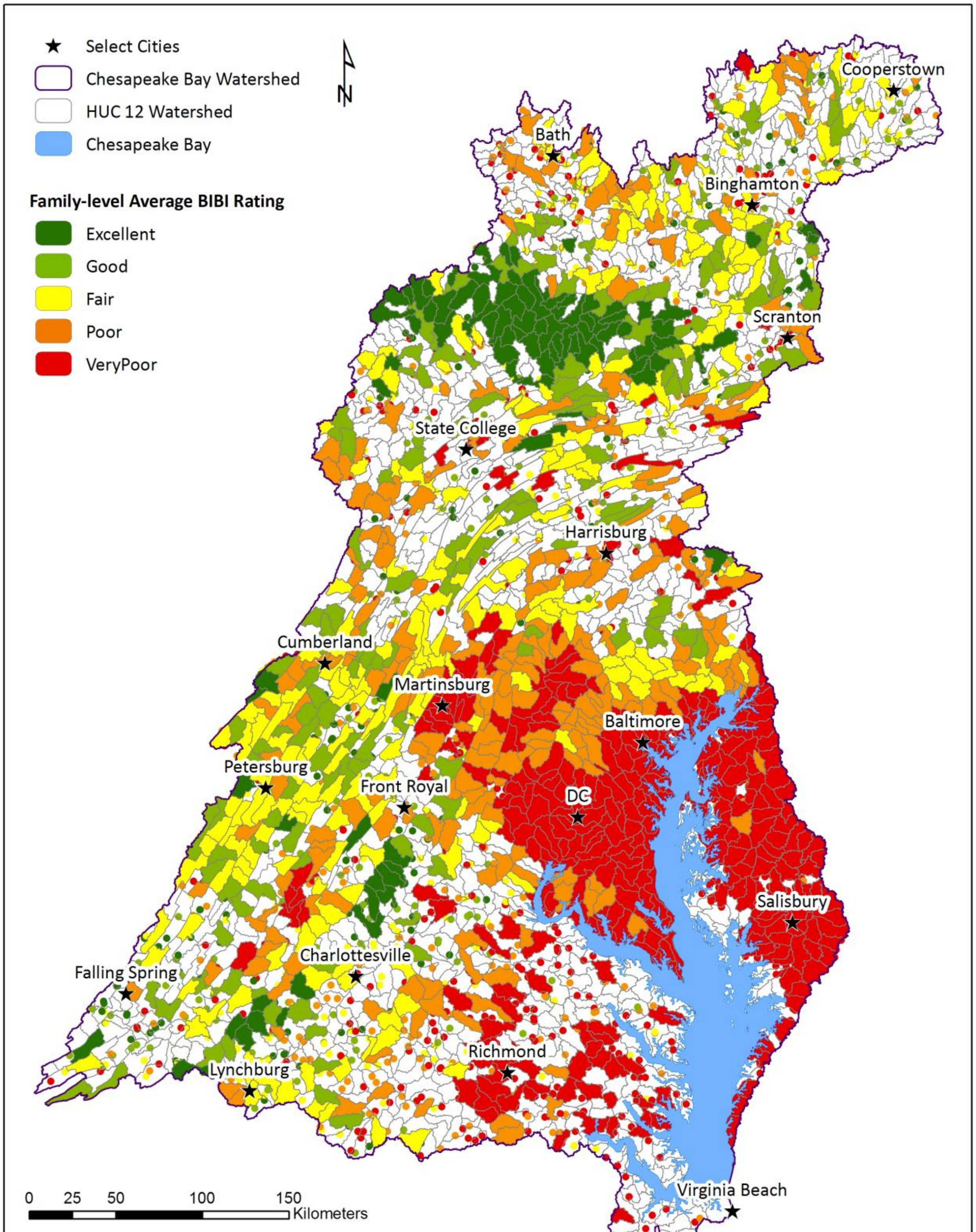


Figure L-4. Family-level Chesapeake-wide index scores aggregated by HUC12. Use of this version of the index is not recommended.

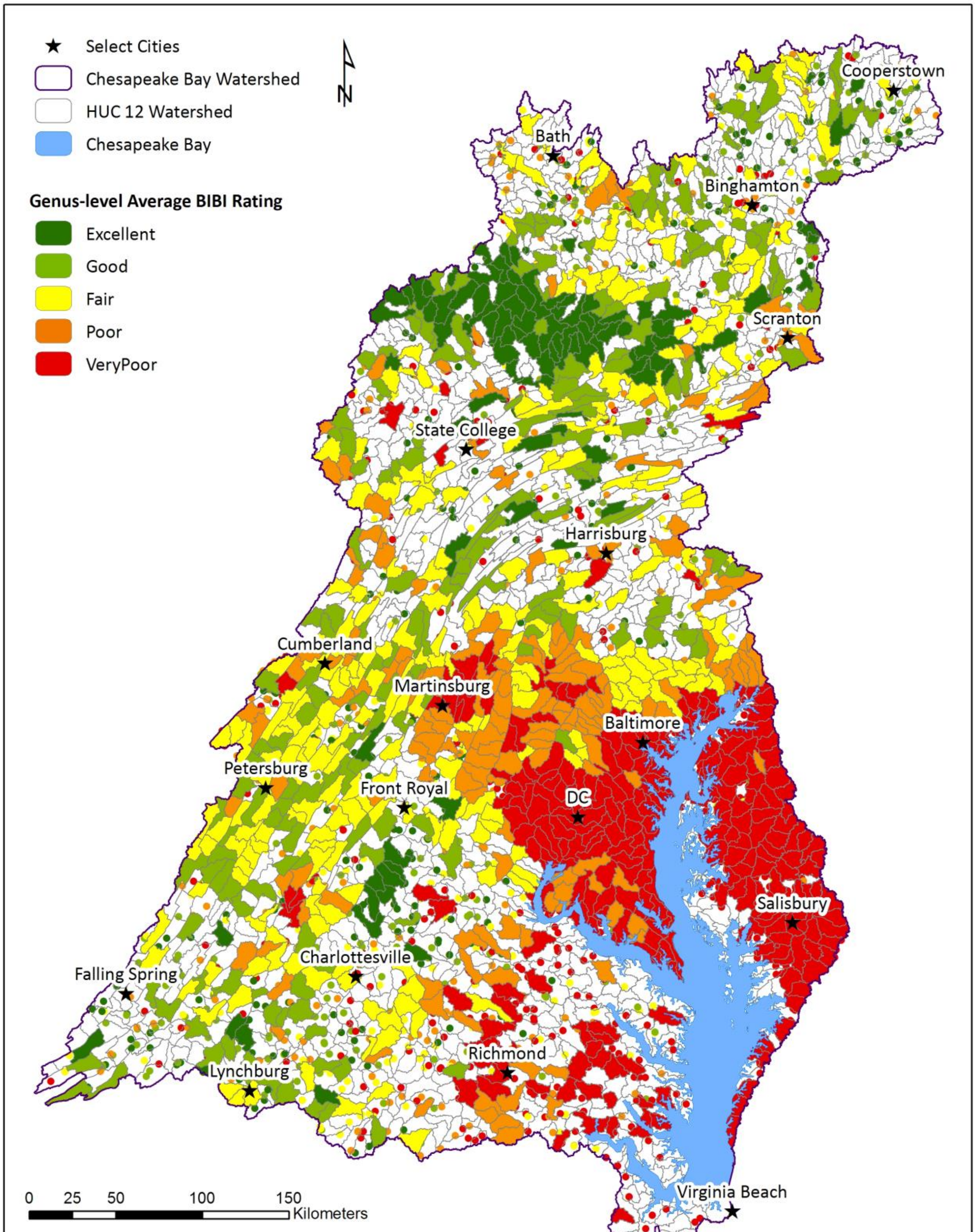


Figure L-5. Genus-level Chesapeake-wide index scores aggregated by HUC12. Use of this version of the index is not recommended.

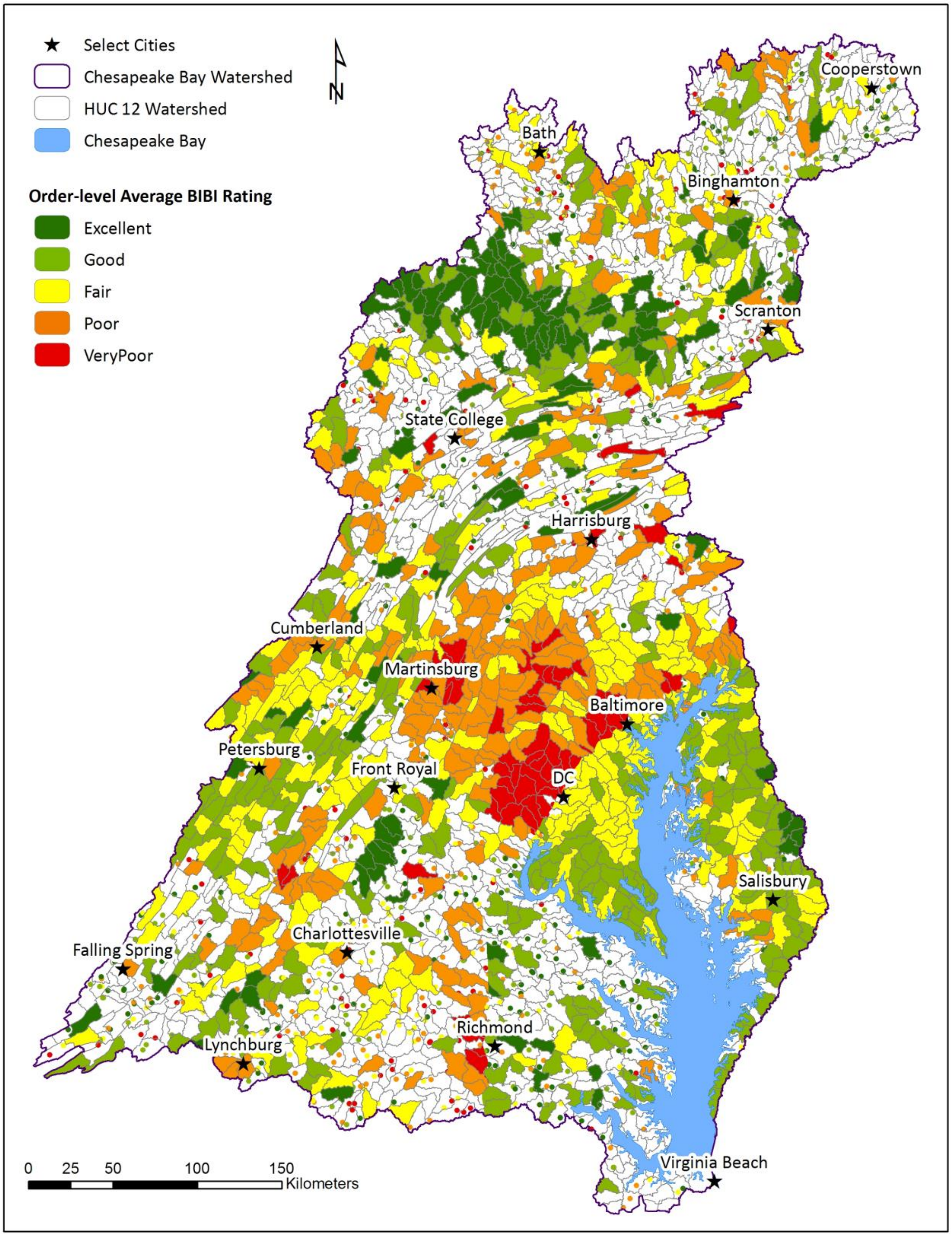


Figure L-6. Order-level region index scores aggregated by HUC12.

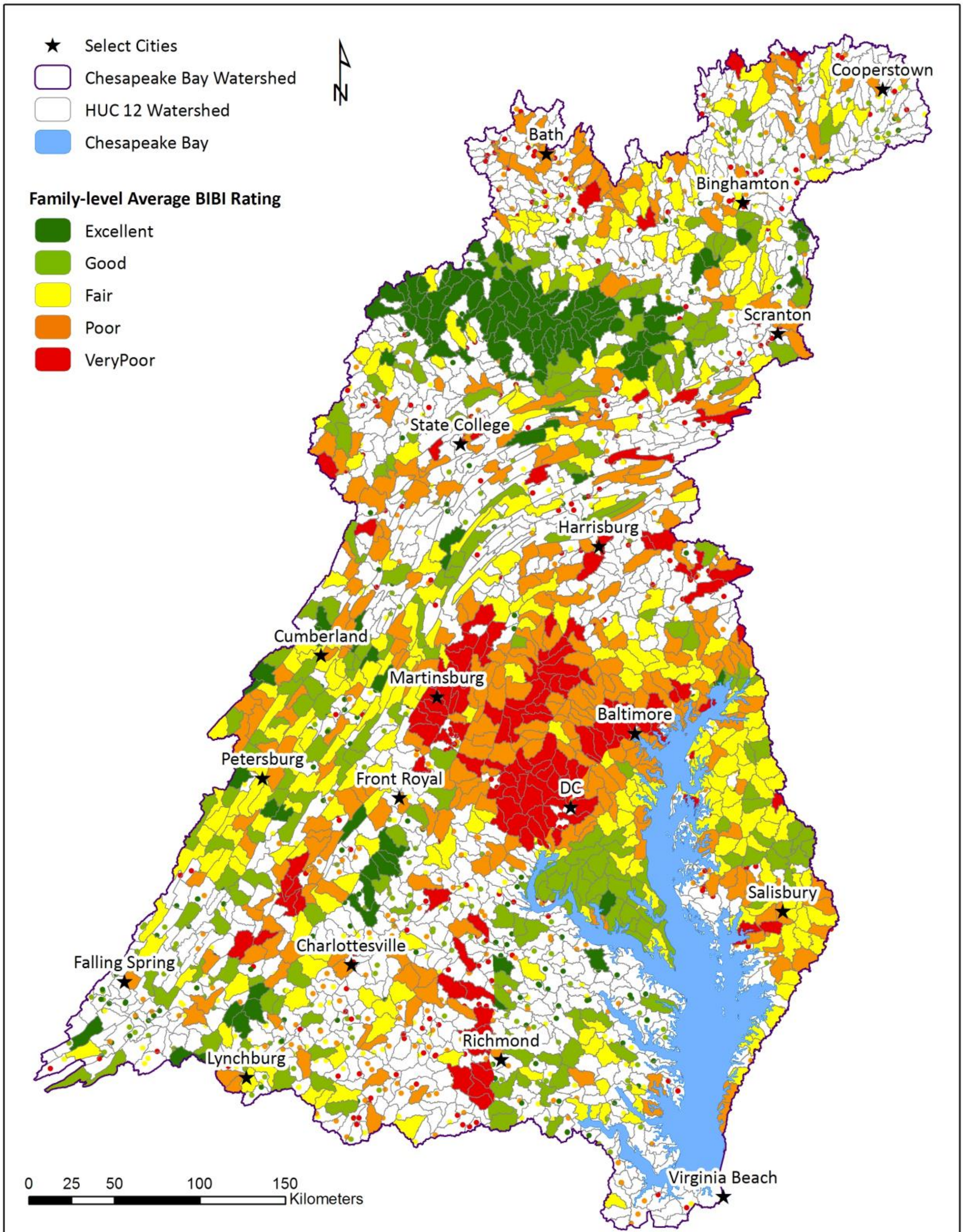


Figure L-7. Family-level region index scores aggregated by HUC12. (Also shown in the report's Executive Summary.)

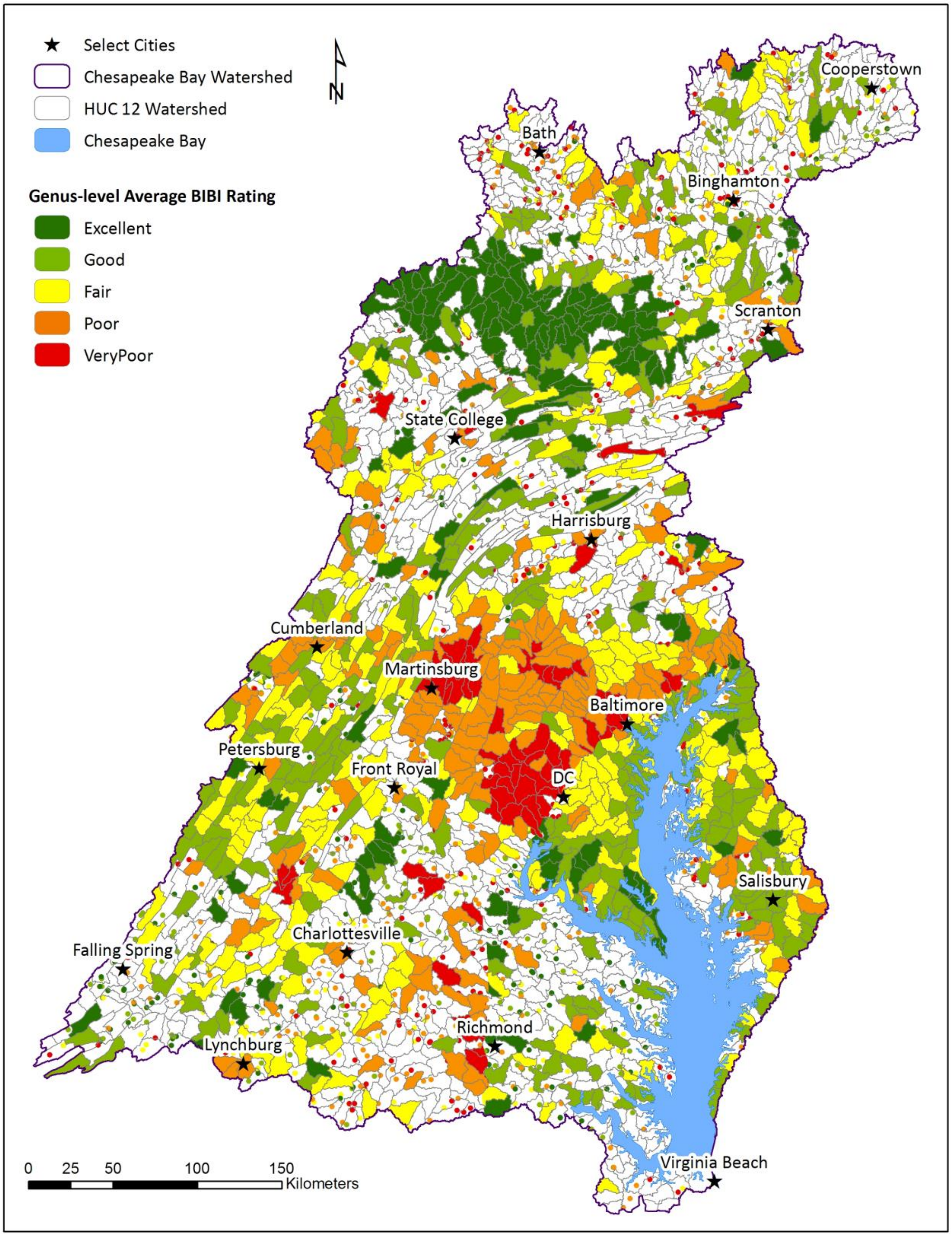


Figure L-8. Genus-level region index scores aggregated by HUC12.

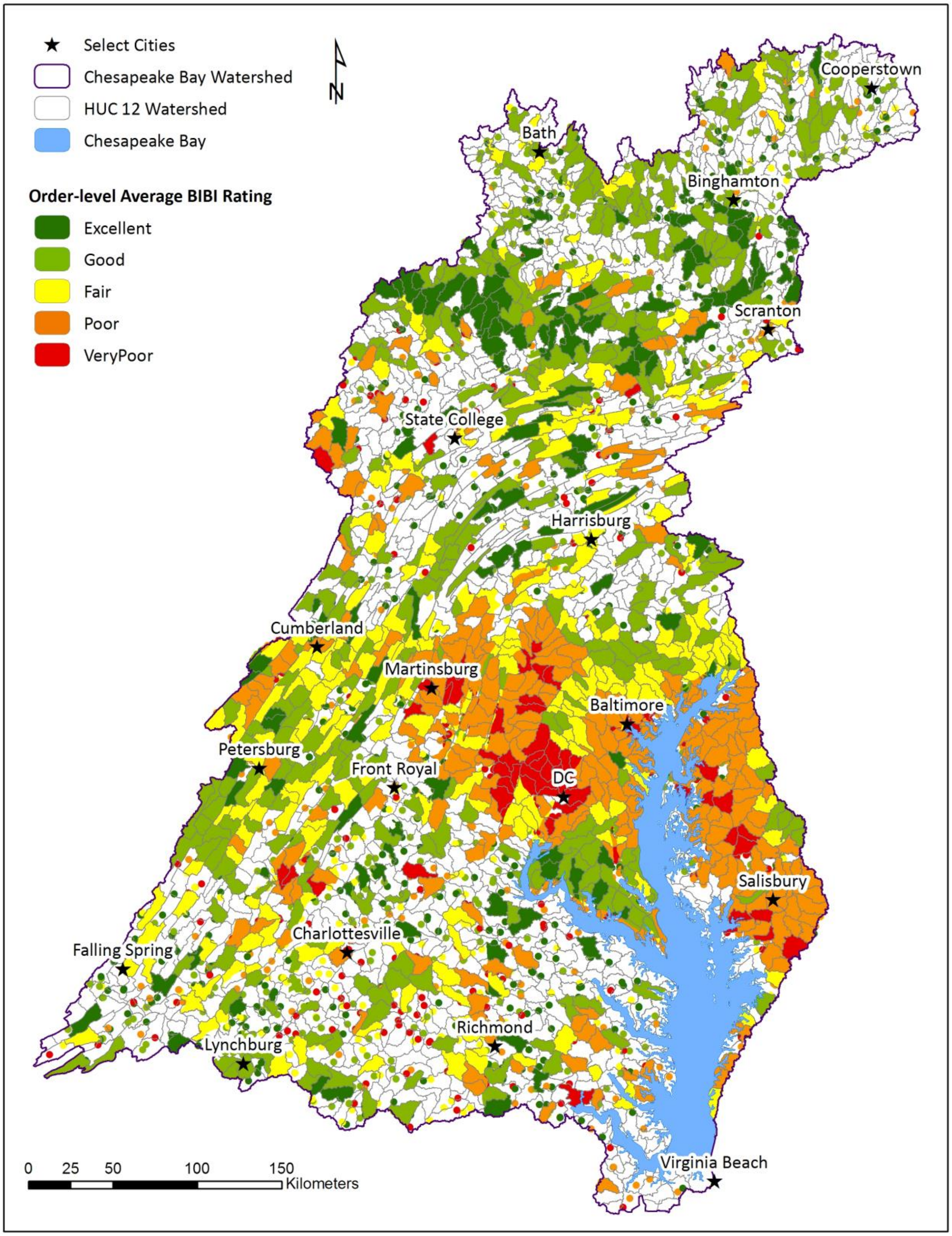


Figure L-9. Order-level bioregion index scores aggregated by HUC12.

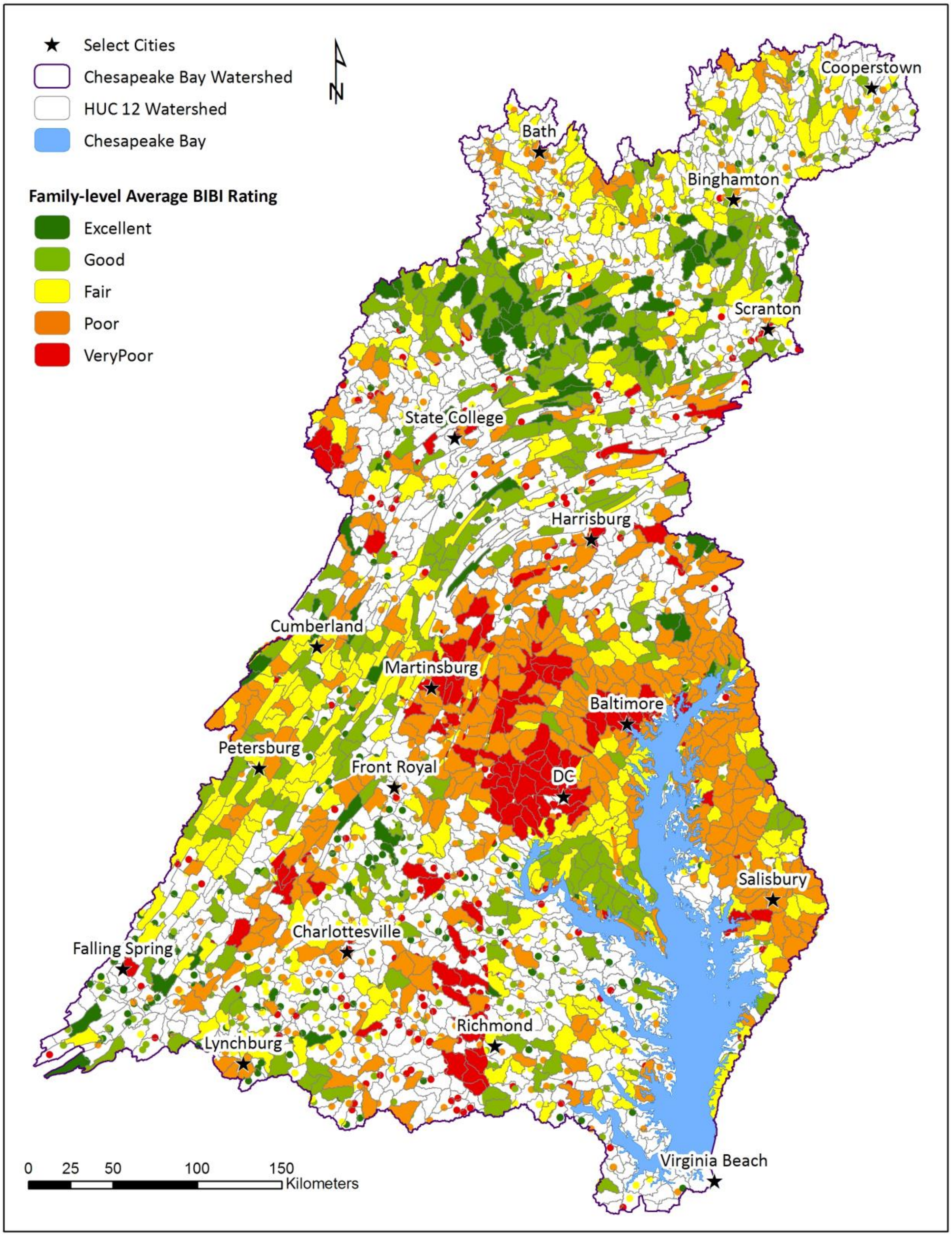


Figure L-10. Family-level bioregion index scores aggregated by HUC12.

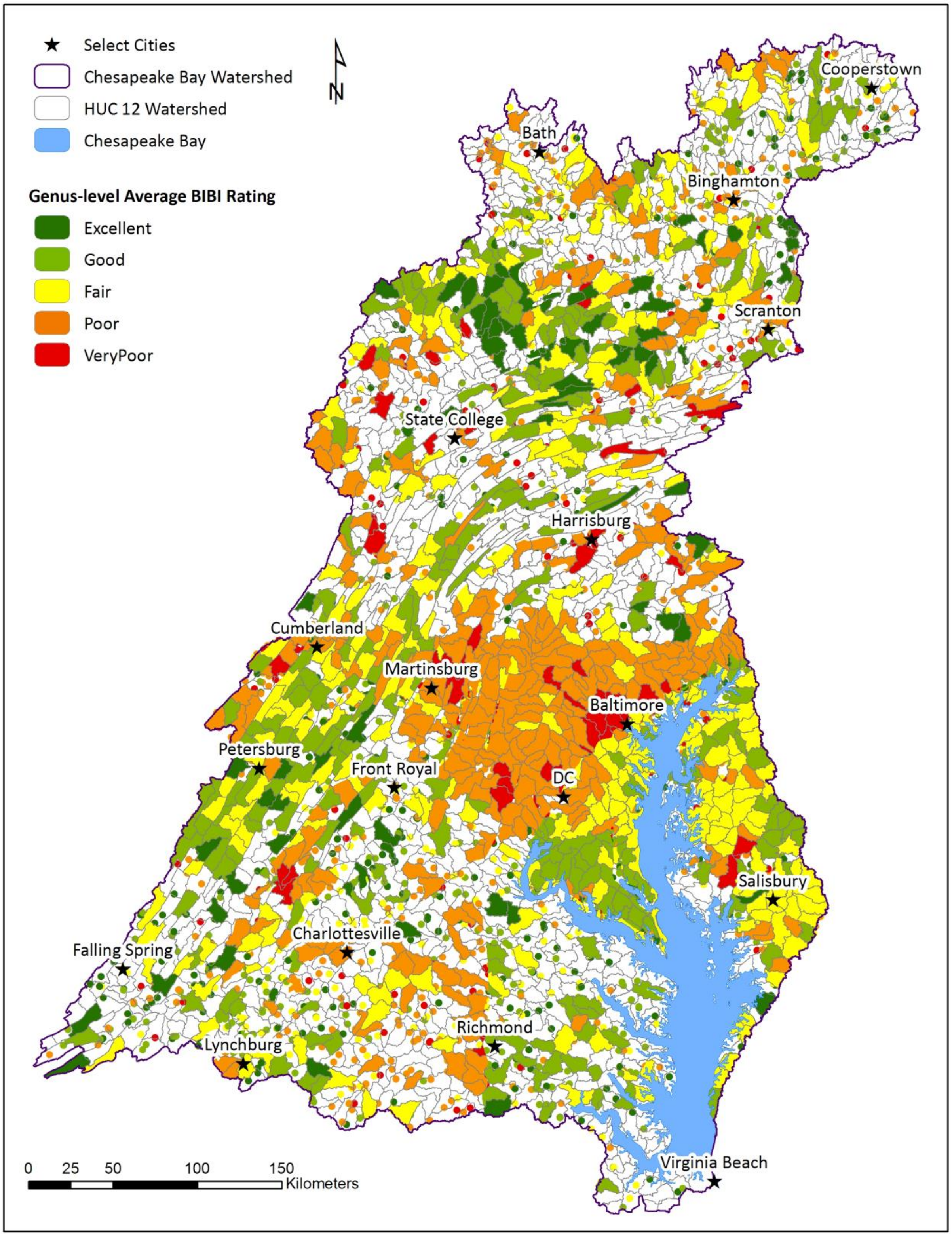


Figure L-11. Genus-level bioregion index scores aggregated by HUC12.

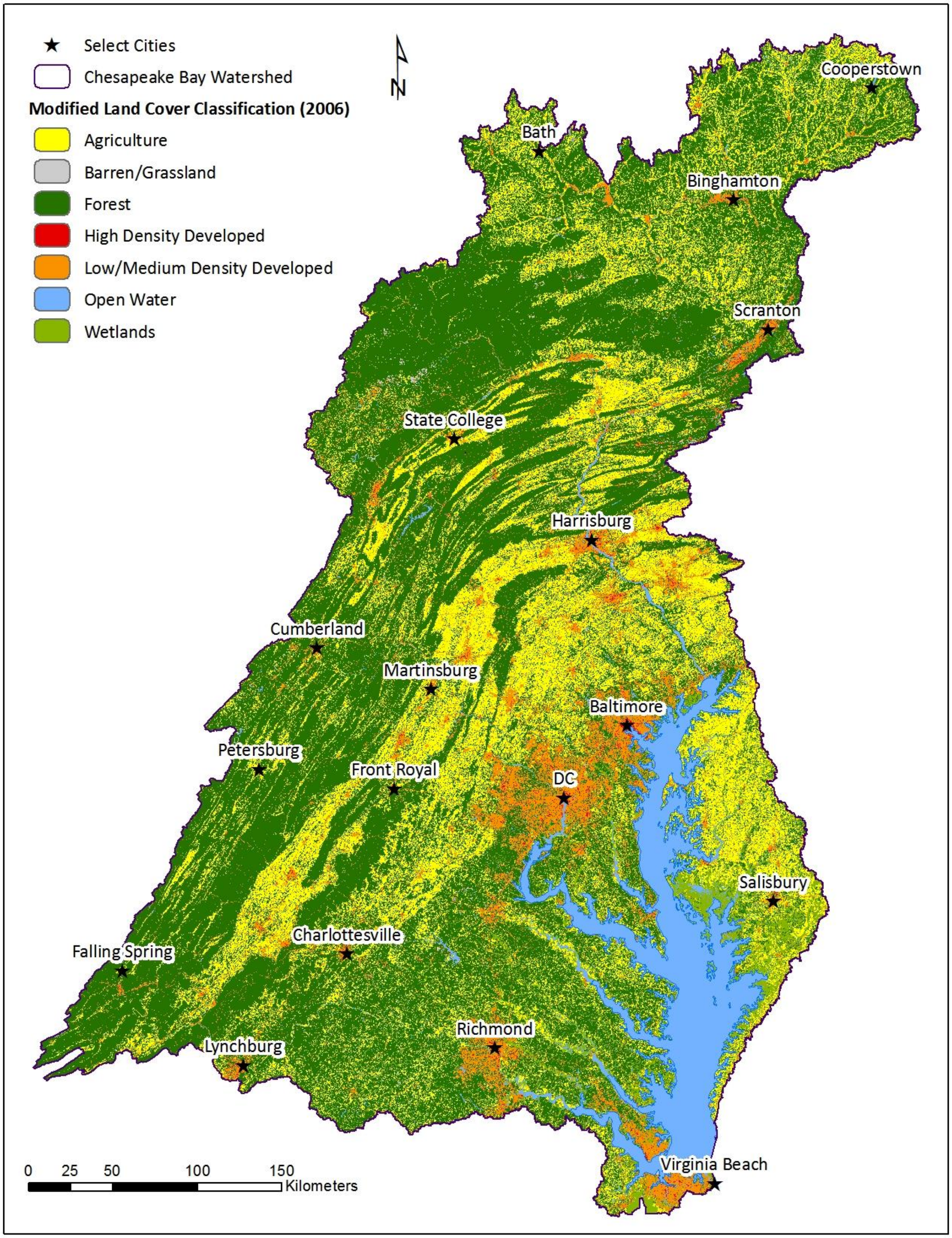


Figure L-12. National Land Cover Data from 2006 (Fry et al. 2011) was aggregated to represent 7 land-use classes in the Chesapeake Bay basin.

Table L-1. Spearman correlation was evaluated between HUC12 land use and the habitat/water quality parameters used to classify stream condition. See Appendix F and Appendix H for more parameter interpretation.

Parameter	**HUC12 %Forest**	**HUC12 %Urban**
BANKS	0.4	-0.3
BANKV	0.3	-0.3
CH_ALT	0.1	-0.1
EMBED	0.4	-0.4
EPI_SUB	0.4	-0.3
FLOW	0.1	-0.1
RIFF	0.4	-0.3
SED	0.4	-0.4
PH	-0.2	0.2
SPCOND	-0.5	0.5
DO	-0.1	0.1

Appendix M: Potential Biases in the Regional Index Ratings

Appendix G explored the influence of hydrologic subregion (river basin), physiographic province (Coastal Plain, Piedmont, Valley & Ridge), and Level III ecoregion (Woods et al. 1999, Omernik 2003) on individual stream macroinvertebrate metrics. The results were used to establish the twelve Chesapeake bioregions. A bioregion spatial resolution best serves local stream evaluation and restoration efforts because it accounts for local (bioregion) natural factors that can influence outcomes, such as elevation, slope, latitude, seasonal temperature and precipitation patterns, geology, soils, and land cover. Improvements observed over time with the bioregion-specific indices should be due more to human intervention than to underlying differences in natural features.

Regional indices were also developed for the Chesapeake watershed. These indices represent two large geographical areas (Coast, Inland) which experience wide ranges of one or more environmental features. Thus, they may not be sensitive to features specific to the smaller, more homogenous bioregions. Regional indices were developed because the Chesapeake Bay Program (CBP) wants an indicator of stream health it can apply watershed-wide to track the proportion of stream miles with a rating of Fair or better. The report recommends the family-level regional indices (Coast, Inland) for that purpose. In this appendix, we ask the question "Do natural features substantially influence the *narrative ratings* produced by the two family-level regional indices?" We expect to find small differences in the region and bioregion index scores that can be traced back to the local influence of specific natural features. We want to know if the narrative ratings, derived from distributions of the scores in least-disturbed (Reference) conditions, are similarly influenced. If the influences are minimal, narrative ratings for both the region and bioregion indices can be considered comparable indicators of stream condition and restoration progress.

Bioregion

The bioregions capture most of the natural landscape features that can affect macroinvertebrate communities in the Chesapeake Bay watershed. Comparisons of the bioregion and region index narrative ratings should indicate if the natural features accounted for in the bioregion indices are collectively influencing—biasing—the region index ratings. The family-level region index scores and ratings were analyzed by bioregion and compared to their family-level bioregion index counterparts. The family-level Coast index results were subset into their Southeastern Plains (SEP) and Mid-Atlantic Coast (MAC) bioregions. Similarly, the family-level Inland index results were subset into their respective Blue Ridge Mountains (BLUE), Northern Appalachian Platue (NAPU), Northern Central Applachians (NCA), Central Appalachians (CA), Northern Ridge and Valley (NRV), Southern Ridge and Valley (SRV), Southern Great Valley (SGV), Upper Northern Piedmont (UNP), Lower Northern Piedmont (LNP), and Piedmont (PIED) bioregions. Results were further divided into the four standardized condition categories, i.e., Reference, Minimally Degraded, Moderately Degraded, and Degraded.

When parsed by bioregion, the Coast and Inland region index scores show the expected decline as condition category changes from Reference to Degraded (Figure M-1), and the plots are similar to those for the family-level bioregion indices (Figures 12 and 13). A bioregion-related bias would be expected to dramatically alter category distributions of the region index scores relative to each other. This appears to occur in one case, the MAC Reference condition category, but this is mostly likely an artifact of the MAC's low Reference sample size, i.e. 17. Distributions of the regional index scores in some bioregions do shift up or down in all four condition categories relative to their bioregion counterparts. For example, the Inland index scores in NCA are overall higher than in other bioregions (Figure M-1). They are also higher than the NCA bioregion index scores (Figure 12). In another example, the Inland index scores in UNP and LNP are substantially lower than in other bioregions (Figure M-1). They are also lower than the UNP and LNP bioregion index scores (Figure 13). The differences between these region and bioregion index scores suggest that, in the context of the entire region, conditions in the four condition categories may be of a higher quality in NCA and of a lower quality in UNP and LNP for reasons that are not accounted for by the three water quality and eight stream habitat parameters used to classify streams (see *Report Section ii D. Environmental Condition Classification*). NCA is sparsely populated and heavily forested while UNP and LNP include the densely populated Baltimore-Washington metropolitan region (Tables H-2 and H-3).

The common scheme for assigning narrative ratings to index scores is intended to circumvent the differences described above to some degree. Each bioregion or region is rated against threshold values corresponding to the 50th, 25th, 10th and ½ of 10th percentile of the index scores in its Reference condition category. A comparison of *ratings* derived from the region and bioregion indices in the Reference condition category shows mostly good agreement in the frequency of Excellent, Good, and Fair ratings (%EGF) (Table M-1). These three ratings are considered desirable by CBP in achieving its stream health goal. The %EGFs derived from bioregion indices are tightly centered on an average of 86.2% (SD 3.2%). The %EGFs derived from the region indices average nearly the same (85.2%) but show more variability (SD 9.0%). Six of the twelve bioregions show little disagreement between the region and bioregion index ratings (less than ±10%). The region indices generate somewhat higher %EGFs than the bioregion index for BLUE (13.4%) and CA (10.7%); they generate somewhat lower %EGFs for MAC (-14.3%), NAPU (-16.3%), NRV (-13.4%), and UNP (-15.4%).

Rating differences in MAC could be discounted because the small Reference sample sizes in these bioregions make the indices less precise (Table M-1). Only MAC data in the Chesapeake watershed were considered in building the indices, which limited the number of Reference sites. The BLUE bioregion index may be less discriminatory because a very small Degraded sample size (n = 7) was used to build the index. In these two bioregions, the region index may prove to be more robust and representative of stream conditions because it is derived from a greater number of Reference samples.

It is not clear from this comparison if natural features in NAPU, NRV, and UNP cause the relatively large differences in the index ratings of these bioregions. Elsewhere, the region and bioregion family-level indices can be expected to generate comparable ratings overall.

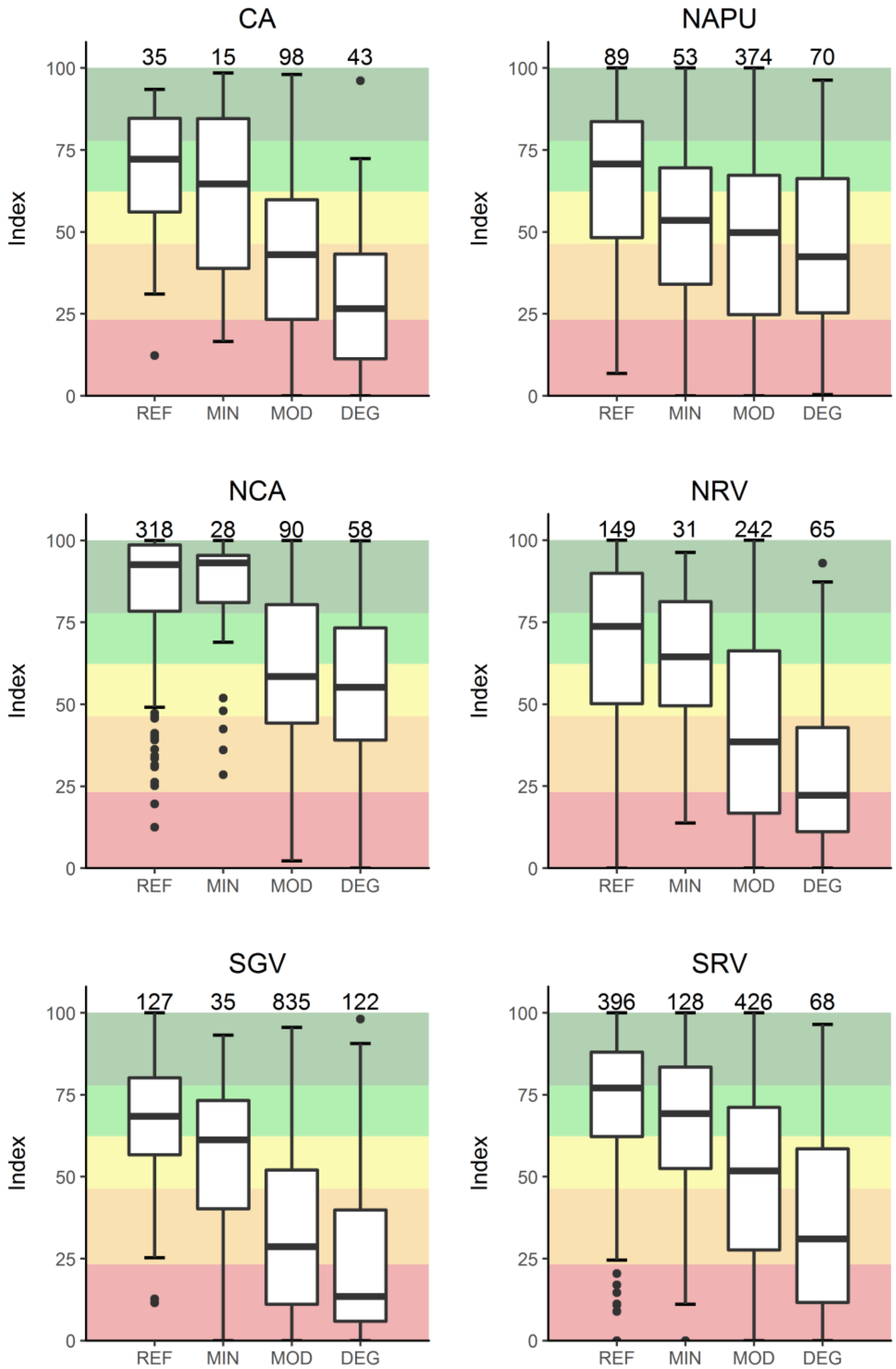


Figure M-1. The family-level Inland and Coast (region) index scores shown by bioregion. Condition categories: Reference (REF), Minimally Disturbed (MIN), Moderately Disturbed (MOD), Degraded (DEG). Sample size (n) of each category is indicated at top. Color gradient identifies narrative ratings for family-level region index: dark green = Excellent; light green = Good; yellow = Fair; orange = Poor; and red = Very Poor.

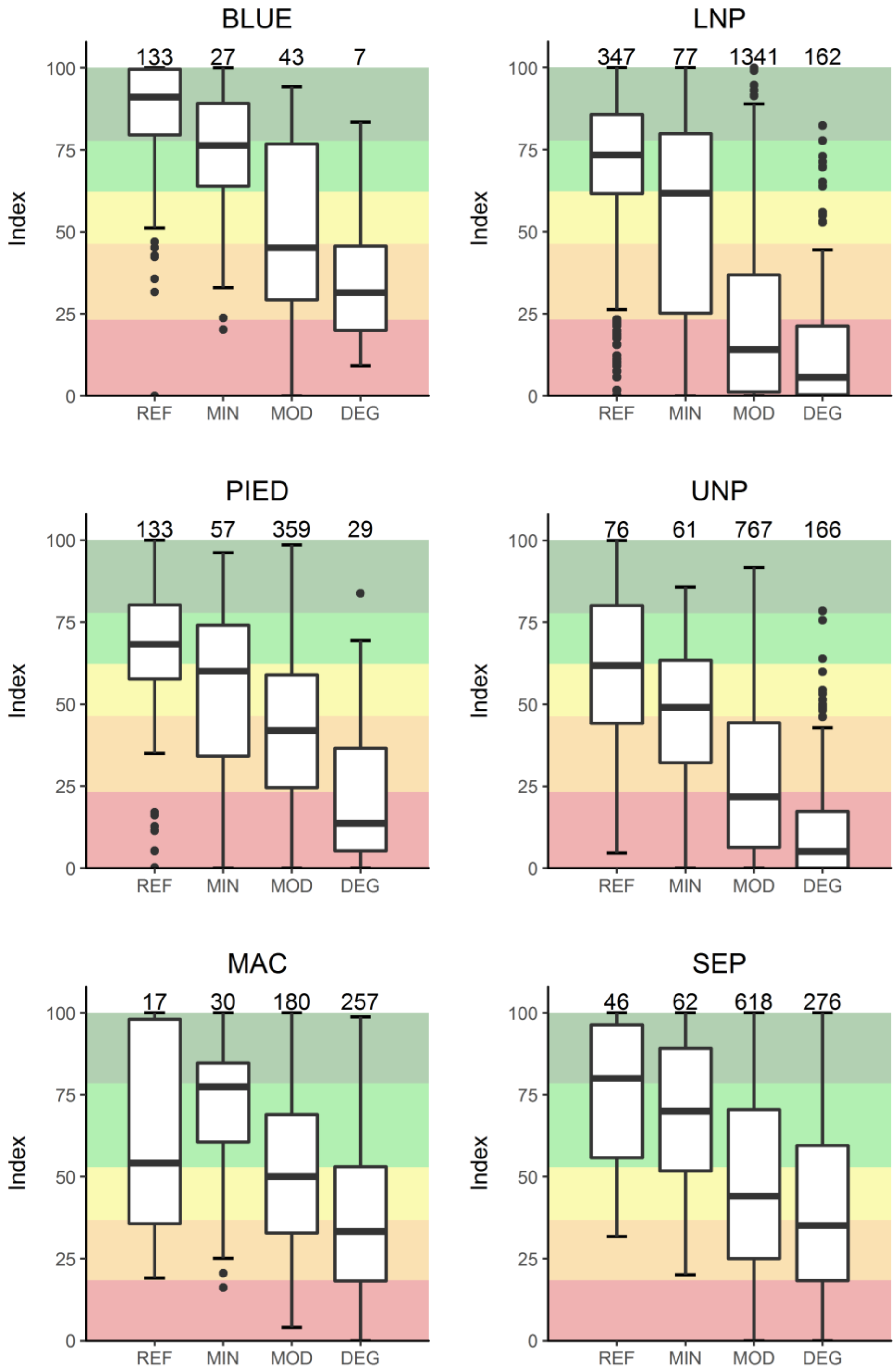


Figure M-1. Cont.

Table M-1. Frequency of Excellent, Good, and Fair ratings derived with the region and bioregion indices for Reference (least-disturbed) conditions. Percent change is the difference between the two indices relative to the bioregion index.

Bioregion	REF n	Regional Index	Bioregion Index	% Change
BLUE	133	95.5%	84.2%	13.4%
CA	35	88.6%	80.0%	10.7%
LNP	347	87.3%	84.4%	3.4%
MAC	17	70.6%	82.4%	-14.3%
NAPU	89	75.3%	89.9%	-16.3%
NCA	318	95.0%	88.7%	7.1%
NRV	149	77.9%	89.9%	-13.4%
PIED	133	87.2%	84.2%	3.6%
SEP	46	95.7%	89.1%	7.3%
SGV	127	86.6%	87.4%	-0.9%
SRV	396	90.4%	88.9%	1.7%
UNP	76	72.4%	85.5%	-15.4%
Average		85.2%	86.2%	
StDev		9.0%	3.2%	

Season

Season can potentially influence index scores and ratings. For example, some insects emerge in spring and become less abundant or less detectable (i.e., early instars) in the summer or fall. The family-level region index scores and ratings were divided into two seasons, March – June (spring and early summer) and July – November (late summer and early fall), and compared. Scores of the Coast and Inland region indices show the expected declining trend from Reference to Degraded in both seasons (Figure M-2). In the Reference category, where anthropengenic impacts are minimized, seasonal distributions of the region and bioregion index scores were not different in eight bioregions (Table M-2). In the heavily sampled LNP, the Wilcoxon test finds the region and bioregion scores are different ($p<0.01$); however, %EGFs differ by only 9.9%. The MAC bioregion within the Chesapeake watershed has insufficient samples. The NAPU and UNP bioregions show the largest differences in region index scores and %EGF ratings.

The relatively small differences between most region and bioregion %EGFs suggest season does not bias the region index ratings. Differences in NAPU and UNP may be due to seasonal changes but more likely this reflects agency bias.

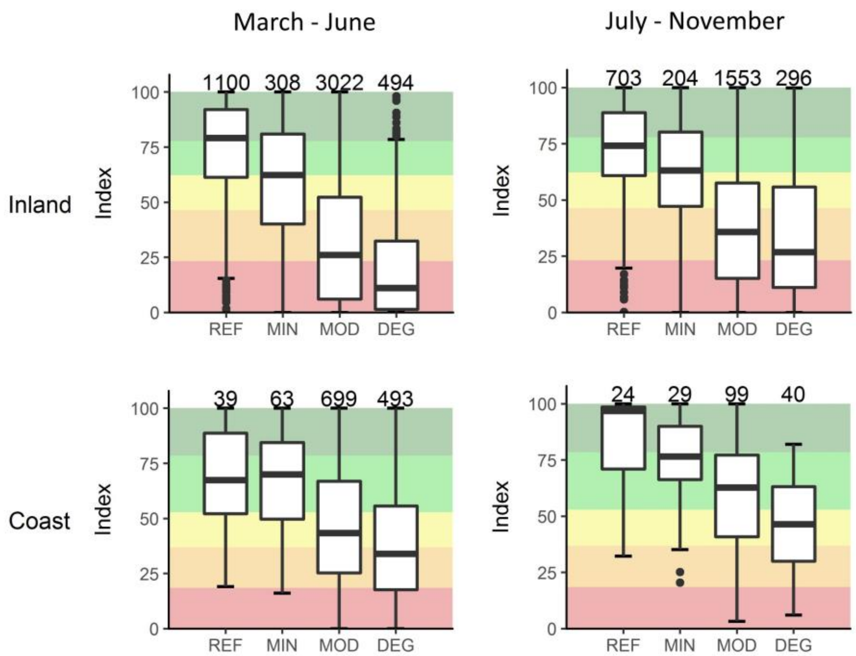


Figure M-2. Distributions of family-level Inland and Coast (region) index scores, by season: March – June and July – November. Condition categories: Reference (REF), Minimally Disturbed (MIN), Moderately Disturbed (MOD), Degraded (DEG). Sample size (n) of each category is indicated at top. Color gradient identifies narrative ratings for family-level region index: dark green = Excellent; light green = Good; yellow = Fair; orange = Poor; and red = Very Poor.

*Table M-2. Percent of Excellent, Good, and Fair ratings (%EGF) in Reference conditions, for the Coast and Inland region indices. Wilcoxon test p-values <0.01 are shown. * Average and StDev exclude MAC.*

	July - November		March - June			Wilcoxon
Bioregion	%EGF	REF n	%EGF	REF n	% Change	p-value
BLUE	96.2%	53	95.0%	80	1.3%	ns
CA	85.7%	14	90.5%	21	-5.3%	ns
LNP	92.5%	133	84.1%	214	9.9%	<0.01
MAC	90.0%	10	42.9%	7	Too few data	-
NAPU	56.4%	39	90.0%	50	-37.3%	<0.01
NCA	95.4%	131	94.7%	187	0.8%	ns
NRV	80.6%	31	77.1%	118	4.6%	ns
PIED	92.6%	54	83.5%	79	10.8%	ns
SEP	100.0%	14	93.8%	32	6.7%	ns
SGV	88.9%	63	84.4%	64	5.3%	ns
SRV	90.9%	164	90.1%	232	0.9%	ns
UNP	81.0%	21	69.1%	55	17.2%	<0.01
Average*	87.3%		86.6%			
StDev*	11.9%		8.0%			

Karst

Karst geology could potentially alter benthic macroinvertebrate community composition. Therefore, areas with karst geology might benefit from a modified index or an independent index constructed specifically for assessing areas with karst. The Coast region did not contain any karst, and is excluded from this comparison. The Inland region was divided into sampling events collected at sites without karst geology (Non-Karst) and sites with karst geology (Karst). The two types were further divided into the four condition categories and plotted against the Inland index scores (Figure M-2).

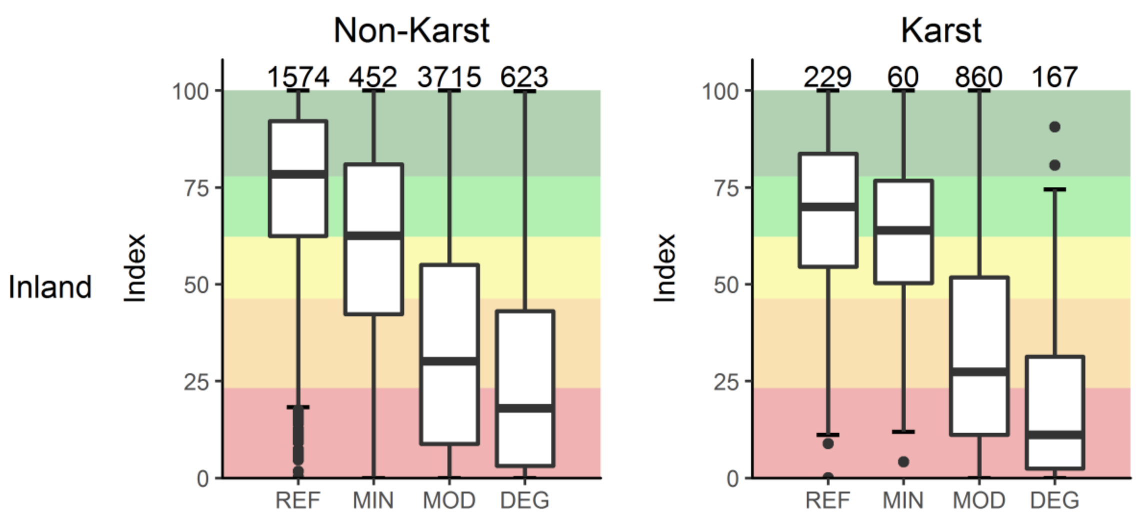


Figure M-3. Inland family-level index scores were divided into areas with and without karst geology. The box-and-whisker plots depict the trend in scores from Reference (REF) to Degraded (DEG) for each subset of data. The numbers at the top of the plots indicate the sample size (n) of each environmental class. The color gradient behind the box plots identifies the range of each rating category defined using all the applicable data for a region. Narrative ratings for family-level region index: dark green = Excellent; light green = Good; yellow = Fair; orange = Poor; and red = Very Poor.

We also compared region index scores and ratings (%EGF) in the karst-dominated SGV bioregion and the neighboring SRV bioregion which has karst intrusions but is dominated by shale, sandstone, and other non-calcareous rock. The region (Inland) index scores in Reference conditions do not differ in the two bioregions ($p < 0.01$). Average scores are 86.7 in SGV and 88.6 in SRV. The %EGFs are also close, with 86.6% in SGV and 90.4% in SRV (Table M-1).

Karst geology does not affect the Inland family-level index. The results agree with another analysis which found many of the macroinvertebrate metrics considered in building the indices insensitive to karst (Table G-3, karst vs. no karst SRV* and karst vs. no karst SGV). This is not to say karst does not influence individual macroinvertebrate taxa. Only that the metrics selected for the bioregion and region family-level indices (Tables 9 and 15) apparently do not respond strongly to karst.

Monitoring Program

We noticed three montoring programs stood out as having much lower than expected region index %EGF in Reference conditions: Loudon County Steam Quality Assessment Program (LC-DBD_LCSAP), Montgomery County Stream Monitoring Program (MC-SPS_MCSMP), and New York Statewide Monitoring Program (NYDEC_RSMP) (Table M-3). Each provided data with sites that appeared to meet the three water quality and eight habitat criteria for Reference condition (*II. Methods D. Environmental Condition Classification*).

We prepared the analysis data set by including only samples collected with a kick-net or similar procedure, excluding taxa counted by only a few programs, rarefying counts, and standardizing taxonomic attributes (*II. Methods. B. Taxonomic Preparation*). Therefore, the bias related to field sampling methods or laboratory enumeration methods have been reduced. We suspect differences in Table M-3 may be related to how agency staff evaluate one or several of the stream habitat parameters we used to classify sites, namely bank stability, bank vegetation, channel alteration, embeddedness, epifaunal substrate, flow, riffle/run/pool ratio, and sedimentation. The results suggest scoring is less stringent or somehow different in at least these three programs compared to other programs. This would explain the programs' lower %EGF at what are technically least-disturbed, or Reference, sites. We have no way to verify the comparability of agency habitat scores for these eight parameters and take them as submitted.

Table M-3. Percent of Excellent, Good, and Fair ratings (%EGF) of the Coast and Inland region indices for sites in Reference conditions, by monitoring program. Percentages for sample sizes <10 not considered.

		March - June		July - November	
AGENCY_CODE	Region	%EGF	Fraction	%EGF	Fraction
AAC_DPW_WERS	COAST		2/4		0/0
DNREC_DEBM	COAST		0/0	90.0%	9/10
MC-SPS_MCSMP	COAST		1/1		0/0
MDDNR_MBSS	COAST		5/5		0/0
PGC-DER_PGCSS	COAST		1/1		0/0
USEPA_WSA	COAST		0/0		1/1
VADEQ_SA	COAST	86.4%	19/22	100.0%	12/12
VCU_INSTAR	COAST		5/6		1/1
BC_DEP_BCWMP	INLAND		1/2		0/0
FC-DPW_FCWMP	INLAND		4/4		0/0
HC_DPW_HCBMSA	INLAND		4/4		0/0
LC-DBD_LCSAP	INLAND	41.7%	5/12		0/0
MC-SPS_MCSMP	INLAND	54.8%	17/31		0/0
MDDNR_MBSS	INLAND	81.7%	49/60		0/0
NYDEC_RSMP	INLAND		0/0	25.0%	4/16
PADEP_PAOWQA	INLAND	96.0%	72/75	95.4%	62/65
PADEP_PASWM	INLAND	87.3%	214/245	90.8%	69/76
PADEP_PAUSGS	INLAND		0/0		1/1
PADEP_PAUW	INLAND		2/2		5/5
SRBC_TMDL	INLAND		0/0		0/2
SRBC_WA	INLAND	77.0%	47/61	83.6%	46/55
USEPA_EMAP	INLAND	88.6%	31/35		1/1
USEPA_MAHA	INLAND		3/3	70.6%	12/17
USEPA_WSA	INLAND		0/0		6/7
VADEQ_SA	INLAND	91.4%	433/474	94.8%	365/385
VCU_INSTAR	INLAND		0/2		1/1
WVDEP_SA	INLAND	81.1%	73/90	80.6%	58/72

The NAPU bioregion index has been flagged as problematic in the report. Distributions of its order-, family-, and genus-level bioregion index scores in Reference and Degraded conditions are poorly separated (Figures 11, 13, and 15), causing the index to have a poor classification efficiency for each taxonomic version of the bioregion index (Table 14). NYDEC_RSMP samples comprise 16 (18%) of the 89 Reference sites used to develop the NAPU bioregion indices, thus their impact on index score distributions in Reference and NAPU scoring thresholds is potentially large. Most of LC-DBD_LCSAP and MC-SPS_MCSMP samples that met our Reference criteria were collected in the LNP and UNP bioregion. Although their samples comprise less of their respective Reference pools, they still impacted the LNP and UNP bioregion indices. Less obvious differences in how other programs score habitat conditions may affect additional bioregion indices, given the relatively large differences seen in CA, NRV, and PIED in Tables M-1 and M-2.

Conclusions

The natural features collectively represented by bioregion do not appear to substantially change the narrative ratings of the two family-level region indices relative to the twelve family-level bioregion indices. Most bioregions showed less than ±10% change in %EGF between region and bioregion index ratings. NAPU shows the greatest change in %EGF (-16.3%) followed by UNP (-15.4%). Rating differences are also less than ±10% in most of bioregions when scores and ratings of the region indices are compared by season and karst. Only LNP, UNP, and NAPU show seasonal differences in %EGF greater than ±10%. These results corroborate direct comparisons of individual ratings which show less than 10% disagreement between the bioregion and region family-level index ratings (Table 20A). Overall, we believe the differences are not large enough to dissuade use of the family-level region indices.

We suspect differences in the criteria used by some monitoring programs to score habitat parameters effectively bias the bioregion indices, and cause the large differences observed between bioregion and region indices in some bioregions. Sites that are scored differently or less stringently can diminish the overall quality of sites in the Reference category. One of the most important aspects of IBI development is the classification of Reference and Degraded conditions. Environmental condition classification influences metric selection, metric scoring, and sensitivity of the final index. Standard evaluation procedures for a common suite of habitat parameters performed by all monitoring programs would make it easier for the programs to collaborate, review, verify previous conclusions, and rapidly improve the science.

Appendix Citations

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