Presentation by
Peterson Environmental Inc.
Aug 15, 2001, Fargo, ND.

Biota Transfer Risk Assessment for Devils Lake Outlet Proposal

Phase I: Methods and Problems in Developing the List of Potential Biota of Concern (PBOC)

The problem:

- Possible transfer of Devils Lake species to Sheyenne River via the outlet, which could
- 1. Establish new invasive species in Red River basin
- 2. Increase the range of species that are only locally distributed in Red River basin

Adverse effects of transfers:

- Invasive species may extirpate endemic species through competition or predation causing biodiversity loss
- Fish diseases may be introduced to or enhanced in Red River system, Lake Winnipeg, and downstream
- Invasive species are often "weedy", creating physical obstructions and other problems

Which biota are PBOC?

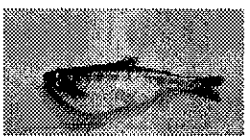
- They are species...
  - 1. with populations in the Devils Lake Basin (DLB), and either...
  - 2a. without Red River Basin (RRB) populations; or...
  - 2b. with localized distribution within the RRB
- OR
  - that are listed as invasive, exotic, or threatening

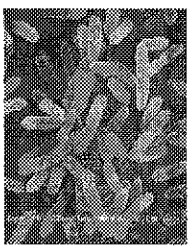
What do we mean by "biota"?

- All aquatic species from all kingdoms of organisms.
- These include:

Microbiota

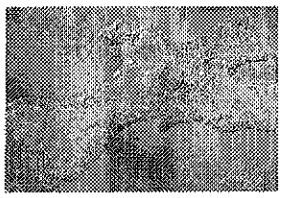
- Disease-causing viruses, bacteria, and protozoa (6 PBOC)





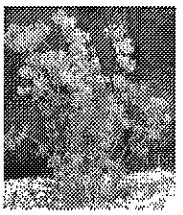
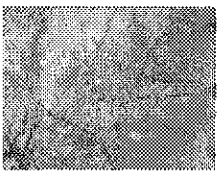
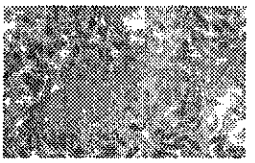
Microbiota

- Free-living protozoa (~94 PBOC)



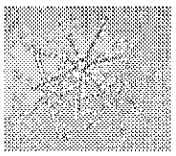
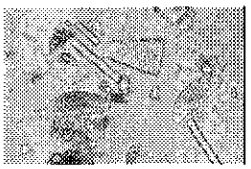
"Algae"

- Unicellular, filamentous, colonial, and macro-algae (~211 PBOC)

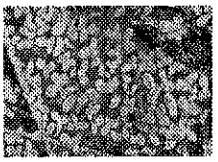
"Algae"

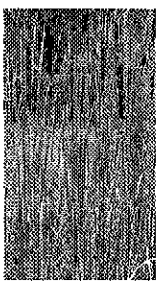
- planktonic, periphytic, and benthic


Vascular Plants (macrophytes)

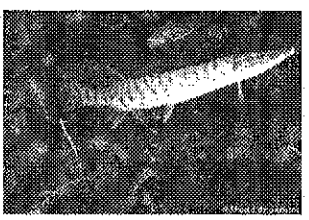
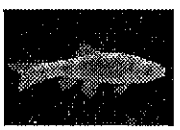
- Obligate (OBL) and Facultative Wetland (FACWT) classes





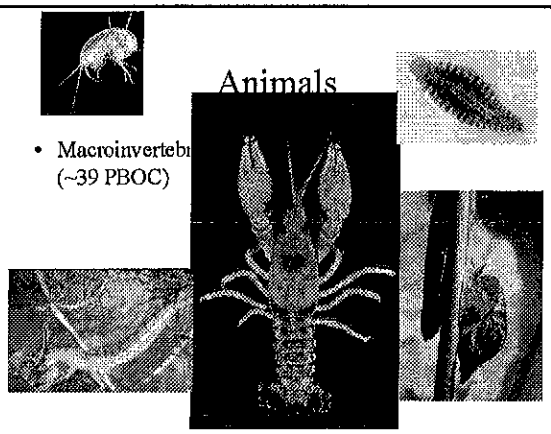
Animals

- Fishes (16 PBOC)

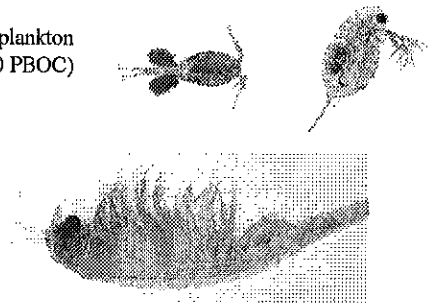
Animals

- Macroinvertebr
(~39 PBOC)



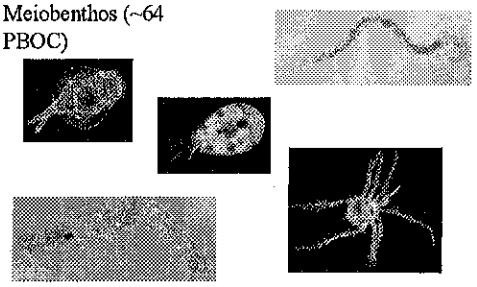
Animals

- Zooplankton
(~30 PBOC)



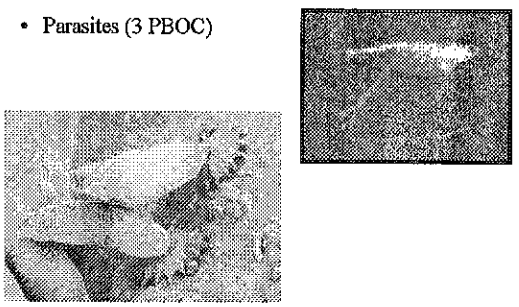
Animals

- Meiobenthos (~64 PBOC)



Animals

- Parasites (3 PBOC)



Existing Dispersal Mechanisms

- Natural:
  - Swimming and/or drifting via direct water connections
  - Passive dispersal of dessication -resistant life stages via wind (micro and meiobiota)
  - Active and passive "hitchhiking" on birds, mammals, and insects (micro and meiobiota AND some macroinvertebrates)
  - Dispersal within bodies of animals as parasites or in gut

Existing Dispersal Mechanisms

- Anthropogenic:
  - intentional, authorized stocking for sport, forage, biocontrol...
  - uncontrolled releases by private citizens
  - bait disposal
  - vehicles (boats, trailers)

PBOC selection

- Find information on biota of the basins
- Create complete Devils Lake biota list
- Add automatic species (exotics) to create candidate PBOC list
- Record occurrences of DL species in Sheyenne R., Red R., Lake Winnipeg
- Remove species not meeting distribution-based selection criteria for PBOC (except automatic-list species)

PBOC analysis

- Examine biological characteristics of candidate species
  - life history
  - modes of movement and dispersal
  - size and detection capability
  - ecological roles
  - habitat preferences
  - etc.

PBOC analysis

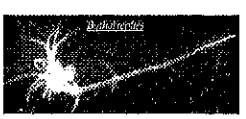
- Examine present habitats in Devils Lake, including recent changes
- Determine projected downstream habitat changes due to outlet project
- Determine pathways between basins with and without outlet project
- Determine which PBOC are likely to be favored by outlet project

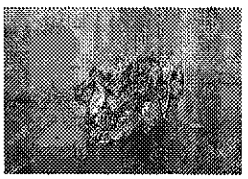
Results so far

- 1. Of 34 Minnesota Prohibited or Regulated species, none are known to be present in Devils Lake
- 2. 6 have been reported from the Sheyenne and/or Red River basins.
- 3. 28 have not been reported from any of these basins.

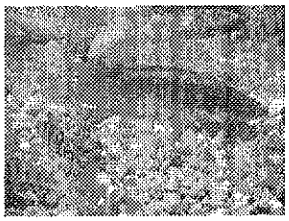
- Already in Sheyenne/Red River:
  - Rusty crayfish, *Orconectes rusticus*
  - Eurasian watermilfoil, *Myriophyllum spicatum*
  - Flowering rush, *Butomus umbellatus*
  - Curly pondweed, *Potamogeton crispus*
  - Purple loosestrife, *Lythrum salicaria*
  - Common carp, *Cyprinus carpio*

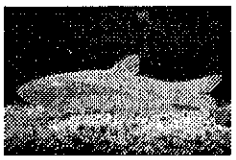
- Already in eastern Minnesota, and could be transported relatively easily to Red River basin or Devils Lake:
  - Spiny water flea, *Bythotrephes cederstroemi*
  - Zebra mussel, *Dreissena polymorpha*





- Formerly stocked in Spiritwood Lake, ND, and may still be present: Zander, *Stizostedion lucioperca*, and grass carp, *Ctenopharygodon piceus*





Results so far

- Remainder of biota classified as:
  - failing to meet PBOC criteria
  - meeting PBOC criteria (but debatable)
  - unknown - reflecting lack of information
- Substantial gaps in data/information exist

Numbers of Candidate* and PBOC** taxa

Biota group	Candidate	PBOC	Comments
fishes	27	16	All PBOC automatic listings
fish parasites	8	3	5 Candidates recorded from RRB
fish pathogens	6	6	All PBOC automatic listings
algae	365	138	227 Candidates recorded from RRB
vascular plants	?	5?	Records not basin-specific
inverts. & protozoa	149	133	Most PBOC are protozoa and microinvertebrates

* "Candidate": all taxa recorded from Devils Lake basin, plus MN listed species.
** "PBOC": Candidates minus taxa recorded from Red River basin.

Gaps in data

- Many taxonomic groups have not been studied in both basins
- Similar habitats have not been studied in both basins
- Few studies reflect biota since water-level rise began
- All existing data sets are limited in scope
- "Invasiveness" and many other life history characteristics are unknown for most species

Limitations of data sets

- Temporal: studies don't reflect changes over seasonal time
- Spatial: studies are limited to very localized sampling
- Habitat: studies are limited to one habitat
- Interacting factors: studies occurred at different times, under different water level/chemistry conditions

PBOC-listing problems arising from data gaps

- Problem 1: Species appearing to meet PBOC criteria may not really meet them.
- Reason: Many species may occur in Red River basin but we have no documentation due to lack of data
- Likelihood: high

PBOC-listing problems arising from data gaps

- Problem 2: Other species meeting PBOC criteria may be undetected
- Reason: Many species may occur in Devils Lake (and not in Red River basin) basin but but have gone undetected
- Likelihood: fairly low

Gaps in data by taxon

- Fishes: data thoroughness good; data on recent changes are lacking
- Fish parasites: data thoroughness moderate
- Fish pathogens: data do not exist
- Pathogens of other vertebrates: data do not exist

Gaps in data by taxon

- Invertebrates and free-living protozoa: data thoroughness poor; taxonomic resolution of existing data poor; comparability between basins very poor
- Vascular plants: data thoroughness very poor; existing records are few and dated
- Algae: data completeness moderately good and data are fairly recent

Data status by group

BIOTA GROUP	DATA THOROUGHNESS	DATA AGE	INTERBASIN COMPARABILITY
fishes	very good	recent	very good
fish parasites	moderate	moderate	moderate
fish pathogens	very poor	n.a.	very poor
other pathogens	very poor	n.a.	very poor
algae	good	recent	moderate
vascular plants	very poor	old	very poor
inverts. & protozoa	poor	mixed, mostly old	very poor

Conclusions

- Many species must be treated as PBOC due to lack of distribution data
- Species known from Devils Lake basin but not known from Sheyenne/Red basin will be analyzed as if they are not in the latter

Conclusions

- The PBOC list will be further narrowed based on known dispersal mechanisms and life history limitations of these species
- Even in these cases, paucity of species-specific biological information will hinder analysis. In such cases we will analyze the next higher taxonomic level, if possible.

Next Steps

- Finalize PBOC list based on available life history data.
- Complete report on PBOC selection documenting how we made PBOC selections
- Circulate PBOC list and report to agencies for suggested additions/deletions
- Move forward with development of BRA list

Handout by Peterson-Environ.
Aug 15, 2001
Fargo, N.D.

Table 1. PBOC protozoa of Stump Lake (SL) and Devils Lake (DL).

Taxon	SL	DL	Taxon	ESL	DL
Acineta unknown 1	X	X	*Holosticha vernalis*		X
Acineta unknown 2	X		*Lacrymaria cohnii*	X	
Actinophrys sol		X	*Lacrymaria lagenula*		X
Amoeba guttula		X	*Lacrymaria olor*		X
Amoeba limax		X	*Lacrymaria truncaum*		X
Amoeba proteus		X	*Lionotus fasciola*	X	X
Amoeba radiosa		X	*Lionotus* sp.		X
Amoeba sp.		X	*Loxocephalus granulosus*		X
Amoeba striata		X	*Mesodinium pulex*		X
Amoeba verrucosa		X	*Metopus es*		X
Amphileptus meleagris	X	X	*Monas* sp.		X
Anisonema grande		X	*Nassula ornata*		X
Arcella vulgaris		X	*Nassula rubens*		X
Aspidisca costata		X	*Notosolenus* sp.	X	X
Astasia tricophora		X	*Oxytricha bifaria*		X
Carchesium epistylis		X	*Oxytricha fallax*		X
Cercomonas (longicauda?)	X		*Oxytricha pellionella*		X
Chaenea teres		X	*Oxytricha* sp.		X
Chilodonella caudata		X	*Paramecium caudatum*		X
Chilodonella cucullulus		X	*Paramecium trichinum*		X
Chilophrya labiata		X	*Petalomonas mediocanellata*		X
Colpidium sp.		X	*Petalomonas* sp.		X
Cothurnia curva		X	*Pleuronema chrysalis*	X	X
Cothurnia imberbis	X	X	*Pleurotricha lanceolata*		X
Cyclidium glaucoma		X	*Podophrya libera*		X
Cyclidium litomesum		X	*Prorodon edentatus*		X
Cyphoderia ampulla		X	*Spathidium spatula*		X
Didinium nasutum		X	*Sphaerophrya magna*	X	X
Difflugia constricta		X	*Spirostomum ambiguum*		X
Difflugia pyriformis		X	*Stentor* sp.		X
Dysteria pusilla		X	*Stylonychia notophora*		X
Enchelys sp.		X	*Tachysoma parvistyla*	X	
Epistylis branchiophila		X	*Tetrahymena patula*		X
Epistylis plicatilis		X	*Tillina saprophila*		X
Euglypha alveolata		X	*Trepomonas agilis*		X
Euplotes charon		X	Trimastigidae unknown		X
Euplotes patella	X	X	*Uroleptus agilis*		X
Frontonia leucas		X	*Uroleptus rattulus*		X
Gerda sp.		X	*Vaginicola crystallina*	X	X
Glaucoma scintillans		X	*Vorticella convallaria*		X
Glaucoma sp.	X	X	*Vorticella microstoma*		X
Halteria grandinella		X	*Vorticella octava*		X
Heteromita globosa		X	*Vorticella telescopica*		X
Heteromita sp.		X	*Vorticella* unknown 1		X
Heteronema acus		X	*Vorticella* unknown 2		X
Histriculus erethisticus		X	*Zoothamnion* sp.	X	X
Holophrya ovum		X	*Zoothamnium alterans*	X	

Source: Young 1924.

Table 2. PBOC invertebrates of Stump Lake (SL) and Devils Lake (DL), and their occurrences in the Upper Sheyenne River (US), Lake Ashtabula (LA), Lower Sheyenne River (LS), Red River of the North (RRN), and Lake Winnipeg (LW). Numbers correspond to sources listed below.

Taxon name	Common Name	SL	DL	US	LA	LS	RR	LW
				14	10	4	5,6,8,9	2,3,8,9,12
Phylum Rotifera	rotifers	7						
Asplancha sp.	"		13					
Asplanchna silvestris	"		15					
Atrochus tentaculatus	"		13					
Brachionus calyciflorus pala	"		15					
Brachionus capsuliflorus quadridentatus	"	15	15					
Brachionus dolabratus	"		15					
Brachionus havanaensis	"		13					
Brachionus plicatilis	"	15	15					
Brachionus plicatilis spatiosus	"	15	15					
Brachionus pterodinoides	"		6,15					
Brachionus satanicus	"	15	15					
Brachionus sp.	"	7	6,7					
Brachionus urceolaris	"		6,15					
Cephalodella catellina	"		15					
Cephalodella megalocephala	"		15					
Cephalodella sterea	"		15					
Collotheca cornuta	"		15					
Colurella adriatica	"		15					
Colurella colurus	"		15					
Filinia longiseta	"		6,15					
Hexarthra sp.	"	7						
Hexarthra fennica	"		15					
Keratella cochlearis	"		6,15					
Keratella quadrata	"	15	6,15					
Lecane sp.	"		13					
Lecane inermis	"		15					
Lecane luna	"	15	15					
Lepadella sp.	"		13					
Lepadella patella	"		15					
Monostyla bulla	"	15	15					
Monostyla cornuta	"		15					
Monostyla lunaris	"		15					
Monostyla quadridentata	"		15					
Mytilina ventralis brevispina	"		15					
Notholca acuminata	"		13					
Notholca striata	"		15					
Notommatidae unknown	"		13					
Philodina sp.	"		13					
Platyias quadricornis	"	15	15					
Ptygura sp.	"		15					
Squatinella mutica	"		15					
Testudinella patina	"		15					
Trichocerca sp.	"		13					

Taxon name	Common Name	ESL	DL	US	LA	LS	RR	LW
Phylum Gastrotricha	gastrotrichs							
Chaetonotus maximus	"		15					
Phylum Platyhelminthes	flatworm						5,X	X
Gyratrix hermaphroditus	"		15					
Phylum Nematoda	roundworm	7					5	
Achromadora sp.	"		15					
Cephalobus sp.	"		15					
Chromadora sp.	"		15					
Diplogaster sp.	"		15					
Dorylaimus unknown 1	"		15					
Dorylaimus unknown 2	"		15					
Ironus sp.	"		15					
Monohystera unknown 1	"		15					
Monohystera unknown 2	"		15					
Plectus sp.	"		15					
Phylum Arthropoda								
Cladocera	water fleas	7,11	11					
Alona sp.	"		13					
Alona rectangula	"		11,15					
Bosmina longirostris	"		15					
Ceriodaphnia pulchella	"		15					
Daphnia longispina	"		15					
Daphnia magna	"		15					
Daphnia psittacea	"	15	15					
Daphnia similis	"	11	6,11					
Diaphanosoma birgei	"		6					
Diaphanosoma brachyurum	"		15					
Moina affinis	"		6					
Moina macrocopa	"	15	15					
Simocephalus vetulus	"		15					
Copepoda	copepods	11	11					
Acanthocyclops robustus	"		13					
Aglaodiaptomus clavipes	"		6					
Cletocampus albuquerquensis	"	11	11,15					
Cyclops viridis americanus	"		15					
Cyclops leuckarti	"		15					
Cyclops serrulatus	"		15					
Diacyclops navus	"		13					
Diacyclops thomasi	"		13					
Diaptomus leptopus piscinae	"		15					
Diaptomus nevadensis	"	11	11					
Diaptomus shoshone	"		15					
Diaptomus siciloides	"	15	15					
Hesperodiaptomus nevadensis	"		6					
Laophonte sp.	"		15					

Taxon name		Common Name	ESL	DL	US	LA	LS	RR	LW
Ostracoda		ostracods	7	11					
	Cypris pellucida	"		15					
Anostraca	- *Artemia salina*	brine shrimp	7,11						
Conchostraca	- unknown species	clam shrimp		11,13					
INSECTA									
Anisoptera		dragonflies	7						
	Sympetrum corruptum	"	15						
Corixidae		water boatmen		11				5	
	Arctecorixa sp.	"	15	15					
	Corixa sp.	"	15	13,15					
Notonectidae		backswimmers							
	Buenoa margaritacea	"		15					
	Notonecta undulata	"		15					
Trichoptera		caddisflies	7,11	11				5	
	Limnophilus rhombicus	"		13,15					
	Phryganea sp.	"		15					
	Triaenodes flavescens	"		15					
Coleoptera		beetles		11				5	
	Agabus sp.	"		15					
	Berosus sp.	"		15					
	Bidessus lacustris	"		15					
	Deronectes sp.	"	15	15					
	Hydrophilus triangularis	"		15					
	Hygrotus unknown 1	"		15					
	Hygrotus unknown 2	"		15					
	Hygrotus nubilus	"		15					
	Ochthebius sp.	"	15	15					
Chaoboridae		phantom midge							
	Chaoborus sp.	"		15					
Chironomidae		midge	7,11	11				5,X	
	Chironomus unknown 1	"		15					
	Chironomus unknown 2	"							
	Chironomus unknown 3	"							
	Protenthes punctipennis	"		15					
	Tanypus sp.	"		15					
Ephydridae		shore flies	7						
	Ephydra sp.	"		15					
Stratiomyidae		soldier fly						5	
	Nemotelus sp.	"		15					
	Odontomyia sp.	"	15	15					
Syrphidae		hover fly						5	
	Eristalis tenax	"		15					
HYDRACARINA		water mites		11,15				5	
	Diplodontus despiciens	"		15					
	Eylais sp.	"		15					
	Hydrachna schneideri	"		15					
	Hydrachna sp.	"		15					

Taxon name	Common Name	ESL	DL	US	LA	LS	RR	LW
Hydrachna valida	"		15					
Hydryphantes sp.	"		15					

1. Cvancara 1983; 2. Cobb 1996; 3. Flannagan et al. 1994; 4. Frostie and Holloway 1984; 5. Goldstein 2001; 6. Leland and Berkas 1998; 7. Neel 1974; 8. Patalas 1981; 9. Patalas and Salki 1992; 10. Peterka 1972; 11. Peterka 1986; 12. Salki 1996; 13. Sando and Sether; 14. Sutherland and Holloway 1979; 15. Young 1924

Table 3. PBOC fishes of Devils Lake, and their occurrences in the Upper Sheyenne River (US), Lake Ashtabula (LA), Lower Sheyenne River (LS), Red River of the North (RRN), and Lake Winnipeg (LW).

SPECIES	COMMON NAME	OTHER LOCATIONS
Morone saxatilis[1]	striped bass	none

[1]sustained presence in Devils Lake uncertain; reproduction appears highly unlikely
Source: DLWG 1996.

Table 4. PBOC parasites of fishes of Devils Lake, and their occurrences in the Upper Sheyenne River (US), Lake Ashtabula (LA), and the Lower Sheyenne River (LS).

SPECIES	HOSTS	OTHER LOCATIONS
Monogenea		
Gyrodactylus hoffmani	*P. promelas* *M. chrysops*	none recorded
Cestoidea		
Ligula intestinalis	*P. promelas* *E. lucius* *S. vitreum*	none recorded
Acanthocephala		
Rhadinorhynchus sp.	*P. flavescens* *M. chrysops* *S. vitreum*	none recorded

Sources: Frostie and Holloway 1984; Reinisch 1981; Sutherland and Holloway 1979.

PBOC algae from Devils Lake.

Cyanobacteria - blue-green algae

Anabaena spiroides
Anabaenopsis elenkinii
Anacystis nidulans
Anacystis saxicola
Aphanocapsa delicatissima
Aphanocapsa elachista var. *coferta*
Coelosphaerium collinsii
Coelosphaerium dubium
Dactylococcopsis acicularis
Dactylococcopsis fascicularis
Gloeocapsa lacustris var. *compacta*
Marsoniella elegans
Microspora sp.
Nodularia spumigena
Oscillatoria hamelii
Oscillatoria nigra
Oscillatoria subtilissima
Oscillatoria tenuis var. *tergestina*
Phormidium mucicola
Planktolyngbya subtilus
Pseudabaena mucicola
Rhabdoderma irregulare
Rhabdoderma sigmoidea
Rhabdoderma sigmoidea f. minor
Rhabdogloea ellipsoidea
Spirulina major
Synechococcus sp.

Chrysophyta; Order Chrysophyceae

Chrysamoeba radians
Chrysocapsa vernalis
Chrysococcus ornatus
Kephyrion globosum
Kephyrion impletum
Kephyrion planktonicum
Kephyrion skujae
Ochromonas fragilis

Chrysophyta; Order Xanthophyceae

Characiopsis cylindrica
Characiopsis subulata

Chrysophyta; Order Bacillariophyceae

Achnanthes clevei
Amphiprora sp.
Amphora momoeoneis sphaerophora
Amphora serians
Caloneis bacillaris var. *thermalis*
Catacombus gaillonii
Chaetoceros muelleri

Coscinodiscus lacustris
Craticula ambigua
Cyclotella pediculus
Cymatopleura sp.
Diatoma tenue var. *tenue*
Gomphonema brebissoni
Melosira granulata var. *angustissima*
Navicula accomoda
Navicula agnewii
Navicula fonticula
Navicula minnewaukonensis
Navicula navicularis
Navicula subminiscula
Navicula vaucheriae
Navicula ventosa
Navicula tryblionella
Nitzschia adapta
Nitzschia attenuata
Nitzschia gandersheimiensis
Nitzschia halophila
Nitzschia hungarica
Stephanodiscus dubius
Stephanodiscus rotula
Stephanodiscus tenuis
Surirella fastuosa
Surirella peisonis
Surirella robusta
Surirella striatula
Synedra montana
Synedra tabulata
Euglenophyta - euglenoids
Euglena deses
Euglena polymorpha
Euglena viridis
Eutreptia viridis
Phacus pyrum
Trachelomonas horrida
Cryptophyta
Chroomonas sp.
Cryptochrysis commutata
Cryptomonas curvata
Cryptophyta sp.
Rhodomonas rubra
Chlorophyta - green algae
Ankyra judayi
Characium sp.
Chlamydomonas pulvisculus
Chlorella vulgaris
Chlorococcum sp.

Chlorogonium sp.
Choricystis minor
Cladophora crispata
Cladophora fracta
Closterium acutum
Closterium pronum
Coccomonas sp.
Coccomyxa sp.
Coenochloris pyrenoidosa
Coenochloris sp.
Dunaliella sp.
Dunaliella viridus
Dysmorphococcus sp.
Elakatothrix gelatinosa
Elakatothrix viridis
Enteromorpha intestinalis
Enteromorpha prolifera
Gloecoccus sp.
Gloeocystis major
Gongrosira sp.
Kentrosphaeria sp.
Keratococcus sp.
Kirchneriella contorta
Kirchneriella elongata
Kirchneriella subsolitaria
Monoraphidium mirabile
Nannochloris sp.
Oocystis crassa
Oocystis gloecystiformis
Oocystis pyriformis
Oocystis submarina
Pediastrum sp.
Polytoma uvella
Pseudosphaerocystis lacustris
Pseudoulvella sp.
Scenedesmus bicaudatus
Scenedesmus granulatus
Scenedesmus linearis
Scenedesmus opoliensis
Scenedesmus subspicatus
Schroederia judayi
Selanastrum capricornutum
Stephanoptera gracillis
Stichococcus sp.
Stigeoclonium attenuatum
Tetraselmis cordiformis
Ulothrix acqualis
Uronema marinum

Table 5. Invertebrates of Stump Lake (SL) and Devils Lake (DL) omitted from the PBOC list, and their occurrences in the Upper Sheyenne River (US), Lake Ashtabula (LA), Lower Sheyenne River (LS), Red River of the North (RRN), and Lake Winnipeg (LW). Numbers correspond to sources listed below.

Taxon name	Common Name	SL	DL	US	LA	LS	RR	LW
				14	10	4	5,6,8,9	2,3,8,9,12
Phylum Mollusca								
Stagnicola caperata	snail		1	X		X	1	
Stagnicola elodes	"		1	X			1	
Phylum Arthropoda								
Cladocera	water fleas	7,11	11					
Ceriodaphnia quadrangula	"		6				X	X
Chydorus sphaericus	"		6,15					X
Daphnia galeata mendotae	"		13	X				X
Daphnia pulex	"	11	6,11,15	X			X	X
Daphnia schoedleri	"		13				X	X
Diaphanosoma leuchtenbergiannum	"		11					X
Copepoda	copepods	11	11					
Acanthocyclops vernalis	"		13					X
Diaptomus sicilis	"	11	6,11,15					X
Macrocyclops albidus	"		13					X
Mesocyclops edax	"		11				X	X
Amphipoda	scud							
Hyalella azteca	"	11	11,15				5,X	X
Gammarus lacustris	"		13					X
Tanypus sp.	"		15					
Dolichopodidae	long-legged fly	7					5	
Ephydridae	shore flies	7						
Ephydra sp.	"		15					
Stratiomyidae	soldier fly						5	
Nemotelus sp.	"		15					
Odontomyia sp.	"	15	15					
Stratiomyia sp.	"	15	15				5,X	
Syrphidae	hover fly						5	
Eristalis tenax	"		15					
Tabanidae	horse fly	7						
Chrysops sp.	"		15				X	
Tabanus sp.	"		15				X	

1. Cvancara 1983; 2. Cobb 1996; 3. Flannagan et al. 1994; 4. Frostie and Holloway 1984; 5. Goldstein 2001; 6. Leland and Berkas 1998; 7. Neel 1974; 8. Patalas 1981; 9. Patalas and Salki 1992; 10. Peterka 1972; 11. Peterka 1986; 12. Salki 1996; 13. Sando and Sether; 14. Sutherland and Holloway 1979; 15. Young 1924

Table 6. Fishes of Devils Lake omitted from the PBOC list, and their occurrences in the Upper Sheyenne River (US), Lake Ashtabula (LA), Lower Sheyenne River (LS), Red River of the North (RRN), and Lake Winnipeg (LW).

SPECIES	COMMON NAME	OTHER LOCATIONS
Catastomus commersoni	white sucker	US, LA, LS, RRN, LW
Culaea inconstans	brook stickleback	all sites
Esox lucius	northern pike	all sites
Esox masquinongy	muskellunge	LS, RRN
E. luciusXmasquinongy[1]	tiger muskie	none
Ictalurus melas	black bullhead	US, LA, LS, RRN
Morone chrysops	white bass	all sites
Perca flavescens	yellow perch	all sites
Pimephales promelas	fathead minnow	all sites
Pomoxis nigromaculatus	black crappie	all sites
Stizostedion vitreum	walleye	all sites

[1]stocked; non-reproducing sterile hybrids
Sources: DLWG 1996; Peterka and Koel 1996.

Table 7. Parasites of fishes of Devils Lake omitted from the PBOC list, and their occurrences in the Upper Sheyenne River (US), Lake Ashtabula (LA), and the Lower Sheyenne River (LS).

SPECIES	HOSTS	OTHER LOCATIONS
Digenea		
Diplostomum spathaceum	*M. chrysops*	US,LA,LS
Neascus sp.	*P. promelas*	US,LA,LS
	M. chrysops	
Cestoidea		
Proteocephalus pinguis	*E. lucius*	US,LA,LS
Proteocephalus sp.	*C. commersoni*	US,LA,LS
	P. flavescens	
	M. chrysops	
	E. lucius	
Nematoda		
Contracaecum spiculigerum	*M. chrysops*	US,LA,LS

Sources: Frostie and Holloway 1984; Reinisch 1981; Sutherland and Holloway 1979.

Algae omitted from PBOC list.

Taxon Name	non-DL locations
Cyanobacteria - blue-green algae	
Anabaena flos aquae	US
Aphanizomenon flos-aquae	LA, LS
Aphanocapsa elachista	US,LA,LS
Chroococcus dispersus	RRN
Chroococcus limneticus	US,LA,LS
Chroococcus minimus	RRN
Coelosphaerium kuetzingianum	RRN
Coelosphaerium naegelianum	RRN
Dactylococcopsis rhaphidioides	RRN
Gloeocapsa aeruginosa	US, LA, LS
Gomphosphaeria aponina	RRN
Gomphosphaeria lacustris	RRN
Lyngbya birgei	LA
Lyngbya limnetica	RRN
Merismopedia tenuissima	US,RRN
Microcystis aeruginosa	LA, RRN
Microcystis incerta	LA, RRN
Myxosarcina spectabilis	US,LA
Nostoc spongiiforme	RRN
Oscillatoria angustissima	US, LA, LS
Oscillatoria lacustris	US, LA, LS
Oscillatoria limnetica	RRN
Oscillatoria limosa	RRN
Oscillatoria minima	LS
Oscillatoria prolifica	RRN
Oscillatoria splendida	RRN
Oscillatoria tenuis	RRN
Chrysophyta; Order Chrysophyceae	
Chromulina nebulosa	US, LS
Chromulina ovalis	LS
Chromulina pseudonebulosa	US, LS
Chrysococcus cordiformis	US, LA, LS
Chrysococcus elegans	LS
Chrysococcus punctiformis	US, LA, LS
Chrysococcus rufescens	US, LS
Kephyrion cordatum	LS
Kephyrion limneticum	US, LS
Kephyrion littorale	US, LA, LS
Kephyrion sitta	US, LS
Mallomonas lata(sic- annulata or aerolata)	(aerolata - LS)
Ochromonas minuta	US, LS
Chrysophyta; Order Xanthophyceae	
Peroniella planktonica	US, LS
Chrysophyta; Order Bacillariophyceae	
Achnanthes hauckiana	RRN
Amphora coffeaeformis	RRN

Amphora ovalis	US, LA, LS, RRN
Amphora veneta	US, LA, RRN
Anomoeoneis serians	RRN
Anomoeoneis sphaerophora	RRN
Asterionella formosa	US, RRN
Aulacoseira granulata	US, LS, RRN, LW
Aulacoseira granulata var. augustissima	LA, LS
Aulacoseira italica	RRN
Caloneis amphisbaena	RRN
Chaetoceros elmorei	RRN
Cocconeis placentula var. eu	US, LA, LS, RRN
Cocconeis placentula	RRN
Craticula acommoda	RRN
Cyclotella bodanica	RRN
Cyclotella glomerata	RRN
Cyclotella meneghiniana	US, LA, RRN
Cyclotella stelligera	RRN
Cymbella mexicana	US, LA, RRN
Cymbella prostrata	LA
Cymbella proxima	US, LA
Cymbella minuta	LS, RRN
Cymbella turgida	RRN
Diatoma tenue	US, LA, LS, RRN
Entomoneis paludosa	RRN
Epithemia sorex	US, LA, RRN
Epithemia turgida	US, RRN
Fragilaria capucina var. mes.	US, LA, LS, RRN
Fragilaria crotensis	LA, RRN
Fragilaria vaucheriae	US, LA, LS, RRN
Gomphonema acuminatum	RRN
Gomphonema angustatum	US, LA, LS, RRN
Gomphonema gracile	US, RRN
Gomphonema intricatum	US, RRN
Gomphonema olivaceum	US, LA, LS, RRN
Gomphonema olivaceum var 1	US, LA, LS
Gomphonema parvulum	US, LA, LS, RRN
Gomphonema subclavatum	RRN
Gomphonema subclavatum var. mex.	US, LA
Gomphonema truncatum	RRN
Gyrosigma accenuatum	US
Gyrosigma spencerii	LS
Hanaea arcus	LS, RRN
Hantzschia amphioxys	US, RRn
Melosira granulata	LA
Navicula capitata	US, LA, LS, RRN
Navicula cincta	RRN
Navicula cryptenella	LS
Navicula cryptocephala	RRN
Navicula decussis	RRN

Navicula heufleri	US, LS, RRN
Navicula miniscula	RRN
Navicula oblonga	RRN
Navicula pelliculosa	RRN
Navicula reinhardtii	US, LA, LS, RRN
Navicula tripunctata	US, LA, LS, RRN
Nitzschia acicularis	RRN
Nitzschia dissipata	US, LA, LS, RRN
Nitzschia fonticola	LA, RRN
Nitzschia frustulum	US, LS, RRN
Nitzschia gracilis	US, RRN
Nitzschia hantzschiana	RRN
Nitzschia inconspicua	US, LA, LS
Nitzschia kuetzingiana	RRN
Nitzschia linearis	RRN
Nitzschia lorenziana	RRN
Nitzschia palea	LS, RRN
Nitzschia pura	RRN
Nitzschia reversa	RRN
Nitschia sigmoidea	RRN
Nitzschia subacicularis	RRN
Nitzschia tryblionella	RRN
Nitzschia umbonata	RRN
Nitzschia vermicularis	RRN
Pinnularia microstauron	RRN
Rhoicosphenia curvata	US, LA, LS,
Rhopalodia gibba	US, LS, RRN
Stephanodiscus actrea	RRN
Stephanodiscus agassizensis	RRN, LW
Stephanodiscus alpinus	RRN
Stephanodiscus hantzschii	RRN
Stephanodiscus minutulus	US, RRN
Stephanodiscus niagarae	LA, LS, RRN, LW
Surirella angustata	LA, LS, RRN
Surirella brebissonii	US
Surirella ovalis	US, LS, RRN
Surirella ovata	US, LA, LS, RRN
Synedra acus	US, LA, LS, RRN
Synedra delicatissima	US, RRN
Synedra fasciculata	US, LS, RRN
Synedra fasciculata truncata	RRN
Synedra pulchella	RRN
Synedra rumpens	LA, LS
Synedra ulna	US, LS
Tetraedron caudatum	RRN
Tetraedron minimum	RRN
Tryblionella appiculata	US, LS
Euglenophyta - euglenoids	
Euglena limnephila var. minor	US, LS

Trachelomonas hispida	US, LS, RRN
Trachelomonas hispida var. papillata	US, LS
Trachelomonas pulchella	US, LS
Trachelomonas varians	US
Cryptophyta	
Chroomonas acuta	US, LS
Chroomonas nordstedtii	US, LA, LS
Cryptomonas erosa	US, LS
Cryptomonas gracilis	US, LS
Cryptomonas marsonii	US, LA, LS
Cryptomonas ovata	US, LA, LS
Cryptomonas reflexa	US, LS
Rhodomonas minuta	US, LA, LS
Rhodomonas minuta var. nannoplanktica	US, LA, LS
Rhodomonas pusilla	US, LA, LS
Pyrrhophyta, Class Dinophyceae	
Ceratium hirundinella	LA, RRN
Chlorophyta - green algae	
Actinastrum hantzschii	RRN
Ankistrodesmus convolutus	LA, RRN
Ankistrodesmus falcutus	LA
Botryococcus braunii	LA
Characium hookeri	RRN
Chlamydomonas globosa	US, LS
Closteriopsis longissima	RRN
Closterium lunata	US
Closterium parvulum var. aug.	RRN
Coelastrum microporum	US, RRN
Coelastrum sphaericum	RRN
Crucigenia apiculata	RRN
Crucigenia quadrata	RRN
Crucigenia tetrapedia	RRN
Dictyosphaerium ehrenbergianum	US, RRN
Dictyosphaerium pulchellum	US, RRN
Eudorina elegans	RRN
Gloeocystis gigas	US, RRN
Kirchneriella lunaris	RRN
Micractinium pulsillum	RRN
Monoraphidium contortum	US, LA, LS
Monoraphidium minutum	US, LA, LS
Monoraphidium pusillum	US, LA, LS
Monoraphidium tortile	US, LS
Nephrocytium agardhianum	US
Nephrocytium limnetica	RRN
Nephrocytium lunatum	US
Oocystis borgei	LA, RRN
Oocystis eremosphaeria	LA, RRN
Oocystis lacustris	RRN
Oocystis parva	LA

Oocystis pusilla	RRN
Pediastrum boryanum	US, RRN
Pediastrum duplex	US, LS, RRN
Pediastrum duplex var. Clathratum	US, RRN
Scenedesmus abundans	RRN
Scenedesmus acuminatus	RRN
Scenedesmus bijuga	RRN(alternans)
Scenedesmus dimorphus	US, LA, RRN
Scenedesmus quadricauda	US, LA, RRN
Schroederia setigera	LA, RRN
Sphaerocystis schroeteri	RRN
Tetrastrum heteracanthum	RRN
Tetrastrum staurogeniaeforme	LA, RRN

Minnesota 6216.0250 PROHIBITED EXOTIC SPECIES (excluding birds, mammals)

1. Aquatic plants
   A. African oxygen weed (Lagarosiphon major) (Ridley) Moss ex Wagner;
   B. aquarium watermoss or giant salvinia (Salvinia molesta) Mitchell;
   C. Australian stonecrop (Crassula helmsii) (Kirk) Cockayne;
   D. curly-leaf pondweed (Potamogeton crispus) Linnaeus;
   E. Eurasian water milfoil (Myriophyllum spicatum) Linnaeus;
   F. European frog-bit (Hydrocharis morsus-ranae) Linnaeus;
   G. flowering rush (Butomus umbellatus) Linnaeus;
   H. hydrilla (Hydrilla verticillata) (Carl von Linnaeus) Royle;
   I. Indian swampweed (Hygrophila polysperma) (Roxburgh) T. Anders;
   J. purple loosestrife (Lythrum salicaria, Lythrum virgatum, or any variety, hybrid, or cultivar thereof) Linnaeus;
   K. water aloe or water soldiers (Stratiotes aloides) Linnaeus; and
   L. water chestnut (Trapa natans) Linnaeus.
2. Fish. The following fish are designated as prohibited exotic species:
   A. bighead carp (Hypophthalmichthys nobilis) Richardson;
   B. black carp (Mylopharyngodon piceus) (Richardson) Peters;
   C. grass carp (Ctenopharyngodon idella) Valenciennes;
   D. round goby (Neogobius melanostomus);
   E. rudd (Scardinius erythrophthalmus) Linnaeus;
   F. ruffe (Gymnocephalus cernuus) Linnaeus;
   G. sea lamprey (Petromyzon marinus) Linnaeus;
   H. silver carp (Hypophthalmichthys molitrix) Valenciennes;
   I. white perch (Morone americana) Gmelin; and
   J. zander (Stizostedion lucioperca) Linnaeus.
3. Invertebrates.
   A. zebra mussel (Dreissena spp.).

Minnesota 6216.0260, REGULATED EXOTIC SPECIES (excluding birds, mammals)

1. Aquatic plants.
   A. Carolina fanwort or fanwort (Cabomba caroliniana) A. Gray;
   B. parrot's feather (Myriophyllum aquaticum) (da Conceicao Vellozo) Verdcourt;
   C. nonnative waterlilies (Nymphaea spp.) Linnaeus, or any variety, hybrid, or cultivar thereof. Native Minnesota waterlilies are: Nymphaea odorata subsp. odorata Aiton, N. leibergeii Morong, and N. Odorata Aiton subsp. tuberosa (Paine) Wiersema &>Hellquist.
2. Fish.
   A. alewife (Alosa pseudoharengus) Wilson;
   B. common carp, koi (Cyprinus carpio) Linnaeus;
   C. goldfish (Carassius auratus) Linnaeus;
   D. rainbow smelt (Osmerus mordax) Mitchell; and
   E. tilapia (Tilapia, Oneochromis, Sartheradon spp.).
3. Invertebrates.
   A. Chinese mystery snail, Japanese trap door snail (Cipangopaludina spp.) Hannibal;
   B. rusty crayfish (Orconectes rusticus) Girard; and
   C. spiny water flea (Bythotrephes cederstroemi) Schoedler.