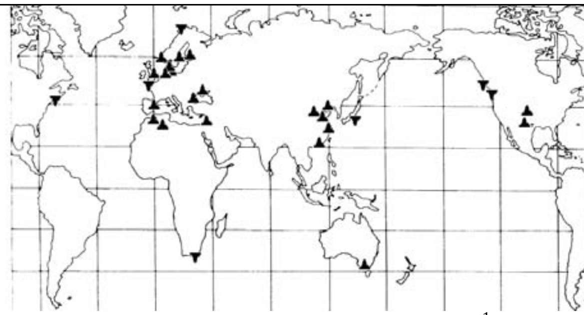
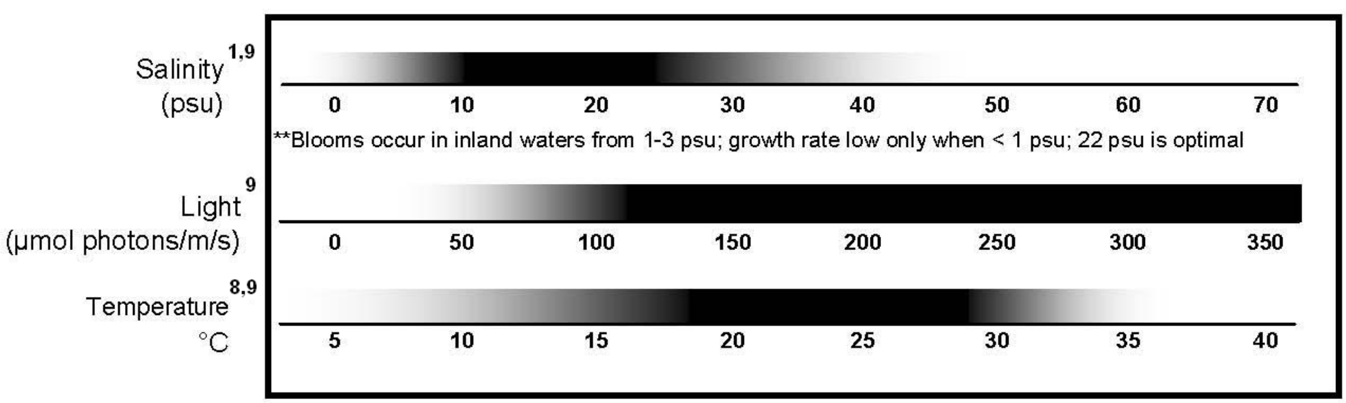
I. Current Status and Distribution — *Prymnesium parvum*

a. Range	**Global/Continental**	**Wisconsin**
Native Range Ubiquitous worldwide in temperate zones[1]	 *Figure 1: Global Distribution Map*[1]	Not recorded in Wisconsin
Abundance/Range		
Widespread:	Worldwide temperate zones[1]	Not applicable
Locally Abundant:	Baltic Sea, inland and coastal United States (Texas), China, Europe, Australia, Morocco, Israel[2]	Not applicable
Sparse:	Alabama, Arkansas, Colorado, Georgia, North Carolina, New Mexico, South Carolina, Wyoming and likely Nebraska and Oklahoma[3]; Arizona[4]	Not applicable
Range Expansion		
Date Introduced:	1980s or earlier; fish kills from the 1960s suspected to be caused by *P. parvum*[3]	Not applicable
Rate of Spread:	Maximum growth rate 0.6 day^{-1} (15° C), 1.2 day^{-1} (30° C)[2]; exceeded 50,000 cells/mL in Finland[5]	Not applicable
Density		
Risk of Monoculture:	High	Unknown
Facilitated By:	Low nutrient conditions or imbalances, low light conditions[2,6]	Unknown
b. Habitat	Lakes, ponds, river, fjords, lagoons[1]	
Tolerance	Chart of tolerances: Increasingly dark color indicates increasingly optimal range	



Preferences	Blooms are likely in eutrophic, alkaline waters[8], and have occurred in low-salinity coastal and inland waters worldwide[2]; high nitrogen and phosphorous[1,5]; expresses toxic and pathogenic behavior under nutrient or light limitation[2]; insensitive to high pH[7]
c. Regulation	
Noxious/Regulated:	*Not regulated*
Minnesota Regulations:	*Not regulated*
Michigan Regulations:	*Not regulated*
Washington Regulations:	*Priority Species of Concern*
II. Establishment Potential and Life History Traits	
a. Life History	Flagellated haptophyte[2]
Fecundity	Maximum growth rate 0.3-1.4 divisions per day[1]
Reproduction	Haplo-diplontic cysts[10]
Importance of Seeds:	Not applicable
Vegetative:	Resting cysts can sink to the bottom of the water column[11]
Hybridization	Undocumented
Overwintering	
Winter Tolerance:	Likely high; established at northern latitudes (Wyoming, Scandinavia)[2,3]
Phenology:	Majority of fish kills occur during winter (55-80°F) in high-salinity lakes in Texas[3,12]
b. Establishment	
Climate	
Weather:	Undocumented
Wisconsin-Adapted:	Likely; established at both similar and more northern latitudes[2,3]
Climate Change:	Likely to facilitate growth and distribution
Taxonomic Similarity	
Wisconsin Natives:	Unknown
Other US Exotics:	Some *Prymnesium* spp. are cosmopolitan
Competition	
Natural Predators:	Various benthic grazers
Natural Pathogens:	Undocumented
Competitive Strategy:	Cytotoxic, ichthyotoxic, neurotoxic, allelopathic, grazer deterrent, and anitbacterial[2]; expresses toxic and phagotrophic behavior under nutrient or light limitation[2]
Known Interactions:	Toxins kill grazers and algal species[6]; ingests dead plankton to fuel bloom development when nutrients are limited[2]
Reproduction	
Rate of Spread:	Can be very high; bloom conditions occur frequently worldwide[2]
Adaptive Strategies:	Mixotrophic under imbalanced or limited nutrient conditions, facilitating bloom conditions[6]
Timeframe	Undocumented
c. Dispersal	
Intentional:	Unlikely
Unintentional:	Wind and water currents, boats, barges, live wells, bilge tanks, wet clothing and equipment, animals[11]
Propagule Pressure:	Likely high when blooming

Figure 2: Courtesy of Texas Parks and Wildlife[13]
Figure 3: Courtesy of Dr. Carmelo Tomas, University of North Carolina-Wilmington[14]

III. Damage Potential	
a. Ecosystem Impacts	
Composition	Inhibits cyanobacteria and dinoflagellates, diatoms and ciliates completely suppressed[12]; toxic allelopathic effects adversely impact grazer populations[2]; 12 million fish killed in Texas waterbodies from 1985-2001[11]; lysis of phytoplankton and release of dissolved organic carbon causes increase in bacterial biomass[15]
Structure	Changes phytoplankton community structure, kills other members of marine food web[12]; massive monospecific blooms negatively impact ecosystem structure[2]
Function	Toxic allelopathic effects adversely impacts grazing rates[2]; massive monospecific blooms negatively impact ecosystem function[2]
Allelopathic Effects	Cytotoxic, ichthyotoxic, neurotoxic, allelopathic, grazer deterrent, and anitbacterial activity[2,6,15,16]
Keystone Species	Undocumented
Ecosystem Engineer	Yes, under toxic conditions
Sustainability	Threatens sustainability when toxic blooms are present
Biodiversity	Decreases under toxic bloom conditions; several state and federally threatened fish species are affected[11]
Biotic Effects	Allelopathy, mixotrophy, phagotrophy, grazer deterrence increases under nutrient depletion or imbalance[6]
Abiotic Effects	Dissolved organic carbon release from algal lysis during toxic bloom conditions[15]
Benefits	Can serve as a food source when no toxins produced
b. Socio-Economic Effects	
Benefits Caveats	Undocumented Not applicable
Impacts of Restriction	Increase in monitoring, education, and research costs
Negatives	During 1981-2003, over 17.5 million fish killed in Texas, estimated value of $7 million[3]; bloom conditions are unsightly; foaming occurs when water is agitated[12]; decreased revenue to local tourism, sport fisheries[3]

Expectations	Blooms stimulated by nutrient limitation or imbalance from additions
Cost of Impacts	Decreased recreational and aesthetic value; decline in ecological integrity; increased research expenses
"Eradication" Cost	Currently no practical way to control blooms[11]
IV. Control and Prevention	
a. Detection	
Crypsis:	High
Benefits of Early Response:	Undocumented
b. Control	
Management Goal 1	Nuisance relief
Tool:	Endothall, diquat dibromide, peroxide algaecides, acrolein, copper algaecides[4]
Caveat:	Non-target species are negatively impacted[4]
Cost:	Undocumented
Efficacy, Time Frame:	Short-term (2 to 3 days) exposure of 0.2mg of Copper/L as Cutrine-Plus[4]
Tool:	Rakes and filters[4]
Caveat:	Mechanical disturbance, non-target species may be negatively impacted
Cost:	Undocumented
Efficacy, Time Frame:	Undocumented
Tool:	Un-ionized ammonia nitrogen[17]
Caveat:	Effective doses from 0.17-0.25 mg/L, bass fry mortality at concentration greater than 0.25 mg/L[(17)]
Cost:	Undocumented
Efficacy, Time Frame:	Undocumented
Tool:	Nitrogen and phosphorous fertilization[18]
Caveat:	Will reduce toxic effects, but has undesirable outcomes that generally accompany nutrient additions[18]
Cost:	Undocumented
Efficacy, Time Frame:	Undocumented
Documented Cost	Direct costs: $518,135 in Lake Whitney, Texas[4]; losses to local economies during 2001 winter fish kills estimated to exceed $18 million[11]
Monitoring	Management, control, education, and monitoring cost is projected at $7.9 million in Texas

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