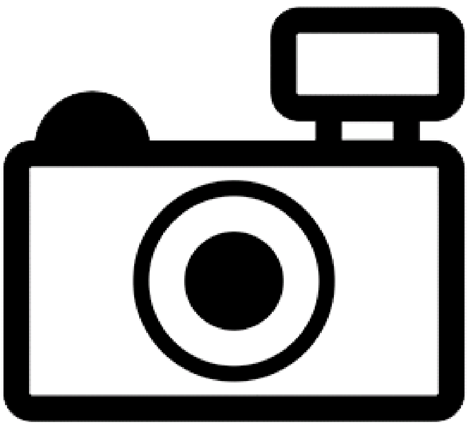
U.S. Fish & Wildlife Service

Thermocyclops crassus (a copepod, no common name)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, February 2023
Revised, March 2023, March 2025
Web Version 4/3/2025

Organism Type: Crustacean
Overall Risk Assessment Category: Uncertain



No Photo Available

1 Native Range and Status in the United States

Native Range

From Sturtevant and Alsip (2023a):

"[…] present throughout Europe, Asia, Africa and Australia. Generally considered Eurasian in origin (Ueda and Reid 2003)."

From Reid (1989):

"[…] present throughout the Palearctic, Australia, South and Southeast Asia, occurring most commonly in tropical Africa."

Status in the United States
From Simpson et al. (2023):

"established (category C3) - Individuals surviving outside of captivity or cultivation in a location. Reproduction occurring, and population self-sustaining."

From Sturtevant and Alsip (2023b):

"Established in Lake Erie and Lake Champlain."

Sturtevant and Alsip (2025) record observations of *Thermocyclops crassus* in Lake Superior and Lake Michigan as well, reporting the status of the species in Lake Michigan as "established."

From Duchovnay et al. (1992):

"The cyclopoid copepod *Thermocyclops crassus* was collected in Missisquoi Bay, Lake Champlain, Vermont, U.S.A., in May and August 1991. Since this is the first confirmed record of the species in North America, the population is considered to be introduced."

"The date of introduction of the Lake Champlain population is uncertain. Its localized distribution with the lake indicates that introduction was recent […] In spite of its inclusion in the widely used key of Yeatman (1959), *T. crassus* has not been reported in North America in recent decades. For this reason we do not believe that the species is presently distributed widely on this continent."

"Most published records of *T. crassus* from the Americas were found by Reid (1989) to refer to the similar pantropical species *T. decipiens* Kiefer 1929."

No records of *Thermocyclops crassus* in trade in the United States were found.

Regulations
No species-specific regulations on possession or trade were found within the United States.

Means of Introductions within the United States
From Sturtevant and Alsip (2023a):

"Unknown. […] The species may have reached Lake Champlain via the [St. Lawrence] Seaway, canals, ballast water or overland with recreational vessels. A study of transoceanic ships entering the Great Lakes in 2001 through 2002 -- before the current standards on flushing ballast water went into effect -- found one *Thermocyclops crassus* in the sediment of a ballast water tank on one ship. If this species invaded via ballast water, it may have done so prior to regulatory changes in 2006 but remained undetected for a decade or more."

From Duggan et al. (2005):

"We assess whether residual water and sediments of NOBOB ["no ballast on board"] ships provide an invasion risk to the Great Lakes. We examine the identity, abundances, and frequencies of live organisms associated with these residuals in NOBOB ships entering the Great Lakes. […] A total of 35 copepod species were identified from the 33 ships. […] Four species, *Mesocyclops leuckarti*, *Paracyclops fimbriatus*, *Thermocyclops crassus*, and *Thermocyclops oithonoides*, are freshwater species that do not have established populations in the Great Lakes."

Remarks

The taxonomic authorities used in Ecological Risk Screening Summaries are defined in a Standard Operating Procedure (USFWS 2024). The chosen taxonomic authority for crustaceans, including copepods (World Register of Marine Species; Walter and Boxshall 2025), does not recognize *Thermocyclops crassus* as a valid scientific name but does recognize *Thermocyclops crassus crassus* as valid. Due to the confusion this presentation of the taxonomy may cause, and because nearly all recent publications use the scientific name *Thermocyclops crassus*, this assessment follows ITIS (2025) instead of Walter and Boxshall (2025) in treating *T. crassus* as the valid scientific name. Information for this assessment was searched for using both names: *Thermocyclops crassus* and *Thermocyclops crassus crassus*.

From Sturtevant and Alsip (2023b):

"*Microcystis* blooms in the Great Lakes may give this species [*T. crassus*] an advantage over native species that are incapable of feeding on *Microcystis*. However, in Lake Erie *Thermocyclops crassus* is much less prevalent than the most similar copepod species, *Mesocyclops edax* (EPA 2016; Connolly et al. 2017), suggesting that *Microcystis* has not yet facilitated dominance by *T. crassus*."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2025):

Kingdom Animalia
 Subkingdom Bilateria
  Infrakingdom Protostomia
   Superphylum Ecdysozoa
    Phylum Arthropoda
     Subphylum Crustacea
      Superclass Altocrustacea
       Class Copepoda
        Infraclass Neocopepoda
         Superorder Podoplea
          Order Cyclopoida
           Family Cyclopidae
            Genus *Thermocyclops*

Species *Thermocyclops crassus* (Fischer, 1853)"

According to ITIS (2025), *Thermocyclops crassus* is the current valid name for this species.

Size, Weight, and Age Range

From Sturtevant and Alsip (2023a):

"Size: 0.7-1.1 mm"

No information was found on weight or age range of *Thermocyclops crassus*.

Environment

From Duchovnay et al. (1992):

"It has been collected from waters of pH 5.9-8.4, but the optimum pH is 7-8 [Rylov 1948 (1963)]. It is tolerant of salinities up to 7.2 o/oo (Löffler 1961)."

From Sturtevant and Alsip (2023a):

"*Thermocyclops crassus* is a thermophilic cyclopoid with a preference for eutrophic waters (Duchovnay et al. 1992). In its native range, *T. crassus* can be found in a broad range of habitats including rice fields, lakes, rivers, and marshes (Fernando and Ponyi 1981). It is primarily pelagic, but it also inhabits littoral zones with dense stands of immersed macrophytes (Duchovnay et al. 1992). It is able to tolerate salinities up to 7.2 % and has been collected from waters of pH 5.9-8.4, but the optimum pH is 7-8 (Duchovnay et al. 1992)."

From Kobari and Ban (1998):

"In laboratory experiments, this species did not produce eggs below 10°C (Maier, [1989]). In the present study, reproduction of *T.crassus* [sic] also occurred at water temperatures >10°C in both ponds. This suggests that *T.crassus* is adapted to the warm season, and winter diapause of this species may be a strategy to avoid low temperature. Water temperature may be an important factor influencing the life cycle pattern of *T.crassus*."

From Tackx et al. (2004):

"*T. crassus* exhibits an optimal development around 25°C. At lower temperature, the rate of development decreases […]"

Climate

From Reid (1989):

"[…] present throughout the Palearctic […]."

From Sturtevant and Alsip (2023a):

"[…] broad distribution in temperate and tropical regions throughout the world."

Distribution Outside the United States

Native

From Sturtevant and Alsip (2023a):

"[…] present throughout Europe, Asia, Africa and Australia. Generally considered Eurasian in origin (Ueda and Reid 2003)."

From Reid (1989):

"[…] present throughout the Palearctic, Australia, South and Southeast Asia, occurring most commonly in tropical Africa."

Introduced

From Campbell et al. (2024):

"*Thermocyclops crassus* has been reported as a non-indigenous species in Costa Rica in 1983 (Collado et al. 1984), northern Mexico in 1998 (Gutiérrez-Aguirre and Suárez-Morales 2000), eastern Ukraine in 2012 (Anufriieva and Shadrin 2016) […]"

"We report the first records for the Eurasian zooplankton species *Thermocyclops crassus* (Fischer, 1853) (Copepoda, Cyclopoida) from two freshwater sites in eastern Canada collected between 2020 and 2022. *Thermocyclops crassus* were found at high densities (between 8 × 103 and 2 × 105 adults/m^3) in Lake St. Pierre on the St. Lawrence River, Québec, but at very low densities (between 0.3 and 0.7 adults/m^3) in Wentzell's Lake on the LaHave River system, Nova Scotia."

From Alekseev et al. (2013):

"Two cyclopid species were supposedly introduced to Sulawesi [Indonesia]: *Mesocyclops aequatorialis similis* Van de Velde, 1984 from Africa and *Thermocyclops crassus* (Fischer, 1853) from Eurasia."

Means of Introduction Outside the United States

From Gutiérrez-Aguirre and Suárez-Morales (2000):

"The introduction of [*T. crassus*] in freshwater of Tabasco [Mexico] is probably related to aquacultural activities."

From Campbell et al. (2024):

"Large shipping transport routes through BWE [ballast water exchange] sites, overland transport of small crafts between leisure and fishing locations and coastal small-craft traffic are all considered potential pathways for this non-indigenous zooplankton species to spread across eastern North America."

From Alekseev et al. (2013):

"The presence of Eurasian and African elements in the zooplankton of Sulawesi lakes may be explained by more recent historical processes. Spanish and Portuguese galleons, followed by British and Dutch traders, first arrived here for tropical (colonial) goods. Since then, sailing ships became important vectors of human-mediated biological invasions, including freshwater fauna. Even though ships did not use freshwater as ballast until the end of 19th century, aquatic organisms may have been transported with barrels for drinking water. Before reaching destination ports, ships regularly stopped ashore to collect new freshwater. Here, usually near river mouths, they washed barrels and re-filled them with new contents. This became one of the most prominent vectors of overseas transportation of zooplankton and may explain the presence of Eurasian *T. crassus* in both Sulawesi (lakes Poso and Selica) and Ternate (lake Tolire) islands."

Short Description

From Sturtevant and Alsip (2023a):

"Cyclopoid copepod. Body short and stout and its furca is about twice as long as wide. 1:3 ratio between the outer and inner setae attached to the furca. Females 0.8-1.1mm, Males 0.7mm (Fischer 1853). Seminal receptacle with a clear "T" shape, with lateral arms relatively short, wide, and weakly recurved posteriorly, female genital somite length/width ratio exceeding 1.2, furcal length/width ratio below 2.5, and the ornamentation on the connecting lamellae of legs 1 and 4 (Gutierrez-Aguirre and Suarez-Morales 2000)."

Biology

From Sturtevant and Alsip (2023a):

"[…] generally regarded to be omnivorous with a preference for herbaceous prey […]"

"This species typically thrives in mesotrophic and eutrophic waters (Duchovnay et al. 1992) and is capable of feeding on cyanobacteria—particularly *Microcystis* […]."

"*Thermocyclops crassus* bury themselves in the mud and enter diapause during or before winter when water temperature is 15-17 °C […]"

"Egg production occurs when water temperature is >10 °C […]"

Human Uses
From Nam et al. (1998):

"In 1993, the World Health Assembly officially designated dengue control and prevention as a high priority […] However, success has been limited by a lack of effective methods to control the principal vector, *Aedes aegypti* (L.), an urban mosquito that breeds in water storage containers as well as discarded containers that collect rainwater. […] Herein we report the success of a relatively new control method: cyclopoid copepods. […] Predacious cyclopoids are particularly effective because of their broad diet, consisting of algae, protozoa, rotifers, and most aquatic animals up to their own size and because they do not depend on the supply of mosquito larvae."

Diseases
No information was found associating *Thermocyclops crassus* with any diseases listed by the World Organisation for Animal Health (February 2023).

According to Poelen et al. (2014), *Thermocyclops crassus* may be susceptible to the following parasites: *Anguillicola papernai*, *Camallanus xenentodoni*, *Contracaecum micropapillatum*, *Dicranotaenia coronula*, *Diorchis acuminatus*, *Fimbriaria fasciolaris*, *Microsomacanthus compressa*, *M. paracompressa*, *Procamallanus spp.*, *P. ophiocephali*, *P. saccobranchi*, *Sobolevicanthus gracilis*, *S. krabbeella*, *S. octacantha*, and *Spirocamallanus mysti*.

Threat to Humans
No information was found on threats to humans from *Thermocyclops crassus*.

3 Impacts of Introductions
No information available on impacts of reported introductions.
The following describes a *potential* impact of *Thermocyclops crassus* introduction:

From Sturtevant and Alsip (2023b):

"Zooplankton grazing on *Microcystis* can recycle nutrients that help sustain the biomass of a *Microcystis* bloom (Paerl and Otten 2013). *Thermocyclops crassus* is known to graze on *Microcystis* (Moriarty et al. 1973) suggesting that this species could help sustain HABs [harmful algal blooms]. However, there is no indication in the literature that this species significantly impacts the sustainability of a bloom."

4 History of Invasiveness
The History of Invasiveness for *Thermocyclops crassus* is classified as Data Deficient. Introductions of *T. crassus* have been documented in several locations, mostly in North and Central America. However, no information was found to document any impacts of the introductions, or that there was a lack of impacts of the introductions.

5 Global Distribution

Figure 1. Reported global distribution of *Thermocyclops crassus*. Map from GBIF Secretariat (2023). Observations are reported from the United States, Mexico, Nigeria, Indonesia, South Korea, India, Russia, Norway, Sweden, France, Germany, Switzerland, Estonia, Belarus, Ukraine, Belgium, the Netherlands, and the United Kingdom.

Additional georeferenced occurrences used for climate matching were obtained from Collado et al. (1984; Costa Rica), Guo (1999; China), Hołyńska (2006; Australia), Hamaidi et al. (2010; Algeria), Alekseev et al. (2013; Indonesia), Dela Paz et al. (2016; Philippines), Gaponova (2019; Romania), Stamou et al. (2022; Greece), Campbell et al. (2024; Canada), and Saetang et al. (2024; Thailand).

The above georeferenced occurrences likely underrepresent the native range, particularly in Africa and Australia (see Native Range in section 1).

6 Distribution Within the United States

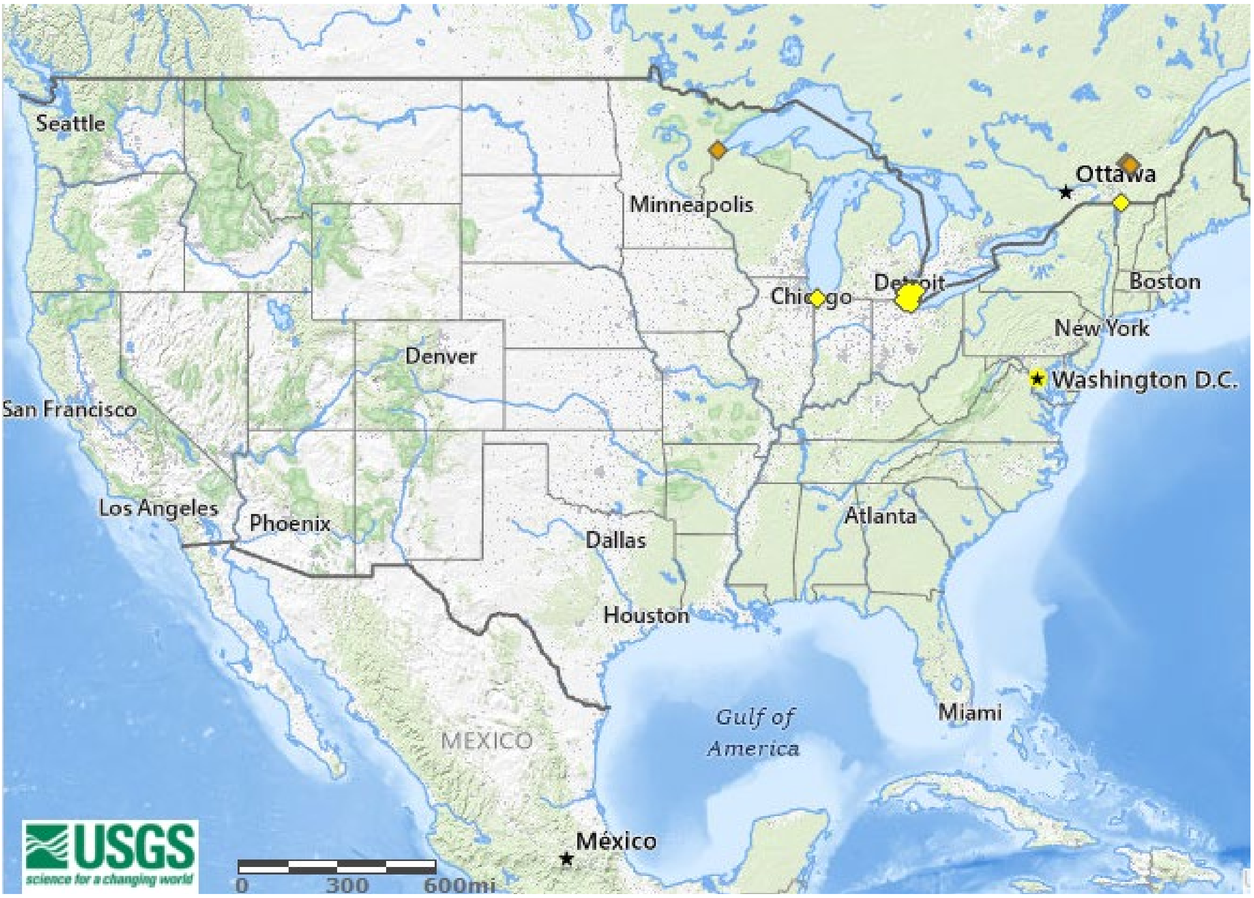


Figure 2. Reported distribution of *Thermocyclops crassus* in the United States. Map from Sturtevant and Alsip (2025). Established populations (yellow points) are reported from Vermont, Ohio, and Indiana. An occurrence with unknown status (brown point), according to Sturtevant and Alsip (2025), is reported from Wisconsin. Due to the unknown population status, this latter occurrence was excluded from selection of source points for the climate matching analysis. Map also depicts known observations in Ontario and Quebec, Canada.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Thermocyclops crassus* to the contiguous United States was highest in the Great Lakes basin, into the central Midwest and the northern Northeast. Areas with the lowest climate match were located along the Pacific Coast from northern California northward and in the Cascade Mountains. Most of the rest of the contiguous United States was estimated to have a medium to high climate match, except for the inland Southeast, central Gulf Coast, and southwestern Arizona, where the climate match ranged from low to medium. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.874, indicating that Yes, there is establishment concern. The Climate 6 score is calculated as: (count of target points with scores ≥ 6)/(count of all target points). Establishment concern is warranted for Climate 6 scores greater than or equal to 0.002 based on an analysis of the establishment success of 356 nonnative aquatic species introduced to the United States (USFWS 2024).

Projected climate matches in the contiguous United States under future climate scenarios are available for *Thermocyclops crassus* (see Appendix). These projected climate matches are provided as additional context for the reader; future climate scenarios are not factored into the Overall Risk Assessment Category.

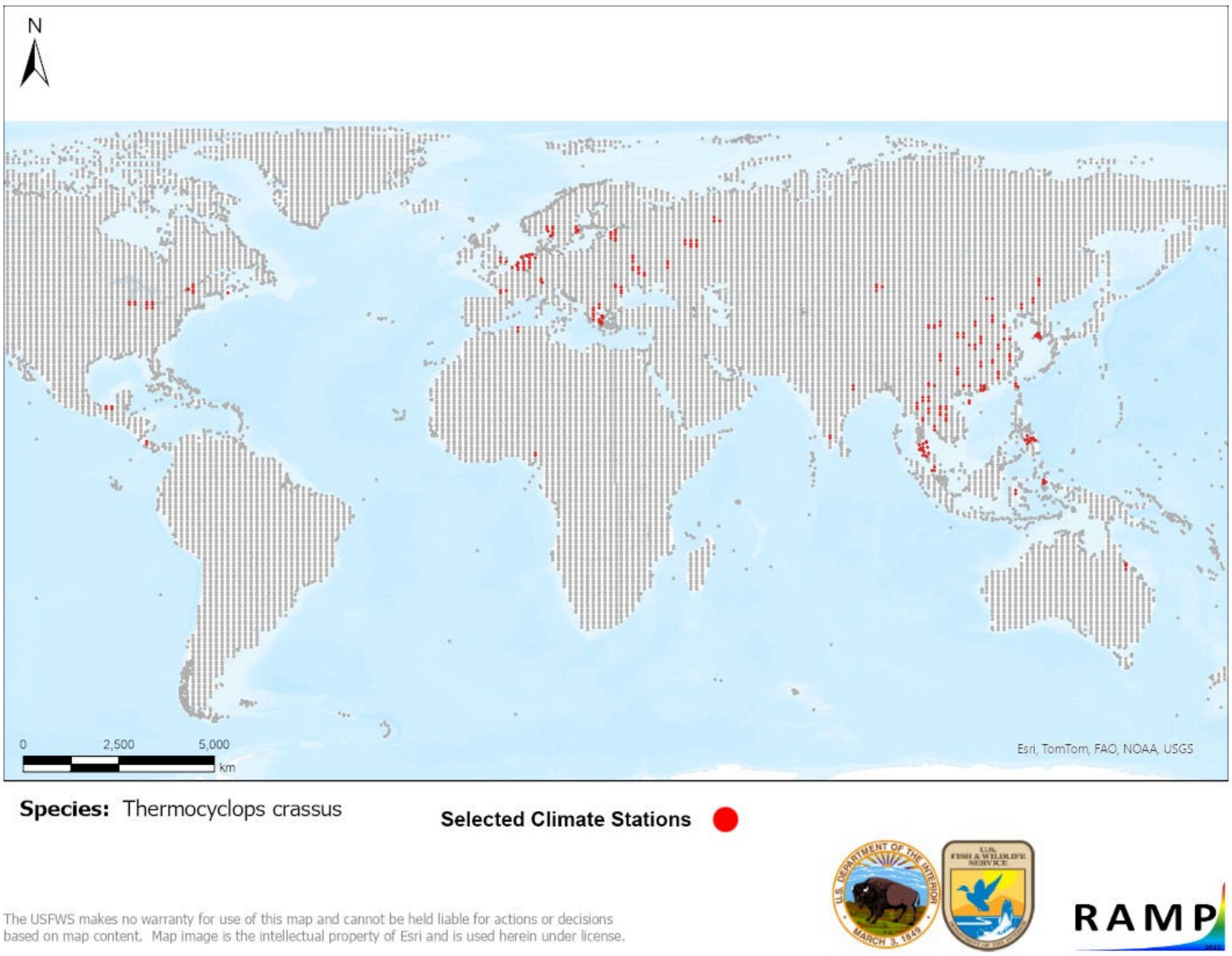


Figure 3. RAMP (Sanders et al. 2023) source map showing weather stations in the world selected as source locations (red; United States, Canada, Mexico, Costa Rica, Nigeria, Algeria, Australia, Indonesia, the Philippines, Thailand, Malaysia, Laos, Myanmar, China, Taiwan, South Korea, India, Russia, Norway, Sweden, Estonia, Latvia, Belarus, Ukraine, Moldova, Romania, Bulgaria, Greece, North Macedonia, France, Germany, Switzerland, Netherlands, Belgium, United Kingdom) and non-source locations (gray) for *Thermocyclops crassus* climate matching. Source locations from GBIF Secretariat (2023), supplemented with additional source locations from Collado et al. (1984), Guo (1999), Hołyńska (2006), Hamaidi et al. (2010), Alekseev et al. (2013), Dela Paz et al. (2016), Gaponova (2019), Stamou et al. (2022), Campbell et al. (2024), and Saetang et al. (2024). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

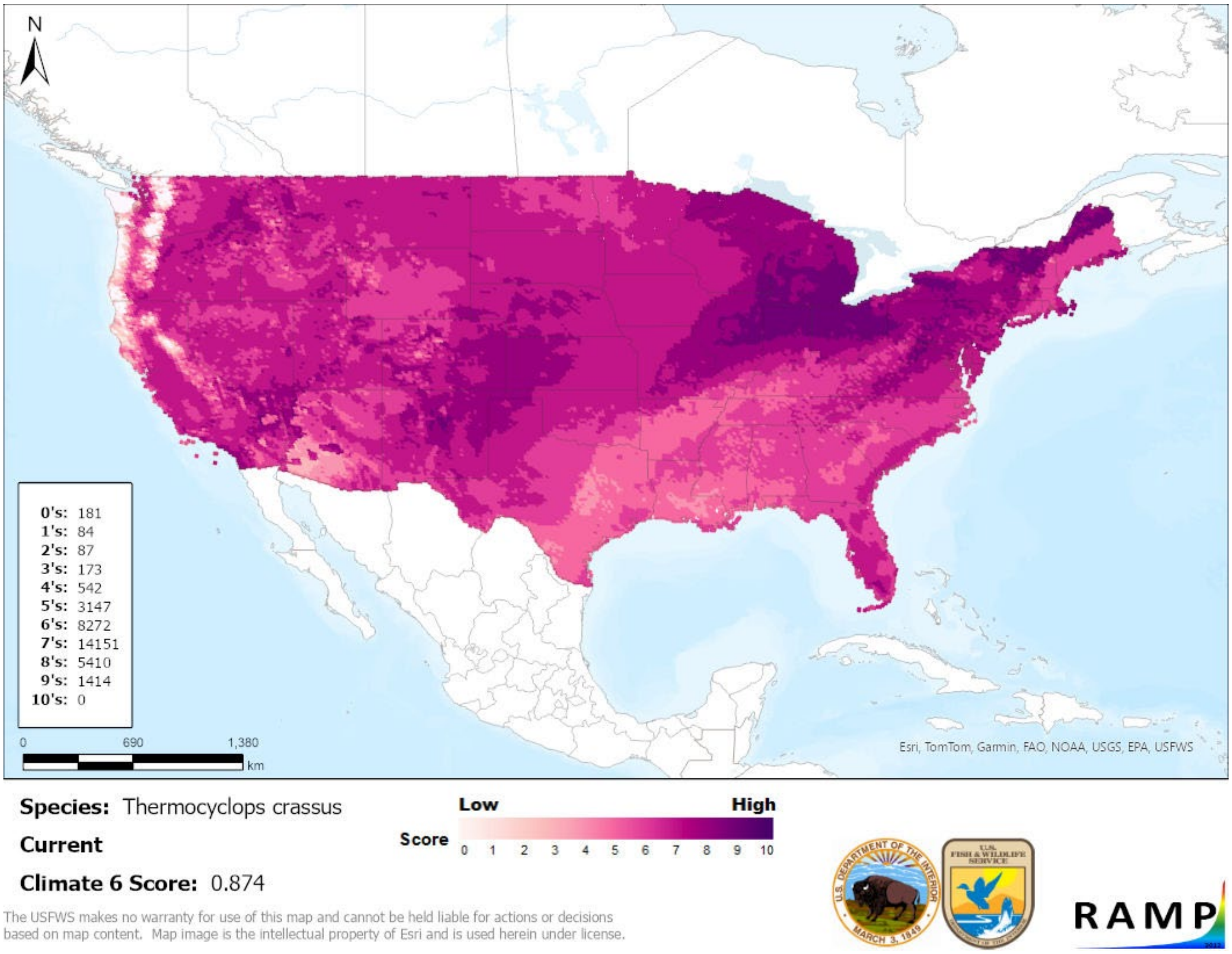


Figure 4. Map of RAMP (Sanders et al. 2023) climate matches for *Thermocyclops crassus* in the contiguous United States based on source locations reported by GBIF Secretariat (2023). Additional source locations from Collado et al. (1984), Guo (1999), Hołyńska (2006), Hamaidi et al. (2010), Alekseev et al. (2013), Dela Paz et al. (2016), Gaponova (2019), Stamou et al. (2022), Campbell et al. (2024), and Saetang et al. (2024) Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Thermocyclops crassus* is classified as Low. There was no information found regarding the realized impacts of introduction of this species. The native range of this species has been described in very general terms, and georeferenced occurrences to inform the climate matching analysis were not available consistently across the native range.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Thermocyclops crassus is a copepod that is native to Europe, Asia, Africa, and Australia. *T. crassus* is tolerant of a broad range of habitats and environmental conditions, although it prefers eutrophic waters. This species can feed on cyanobacteria, particularly *Microcystis*. *T. crassus* has been established in Lake Champlain, Vermont, since the 1990s. It has recently been introduced into the Great Lakes, where it is considered established in Lake Erie and Lake Michigan. There are no species-specific state regulations. *T. crassus* is hypothesized to be introduced to non-native regions through ballast water, natural dispersal through canals, via aquaculture, or overland via recreational vessels. However, the exact means by which past introductions occurred remain unknown. The History of Invasiveness for *Thermocyclops crassus* is classified as Data Deficient due to there being a lack of data on realized impacts resulting from introductions outside its native range. The climate matching analysis for the contiguous United States indicates establishment concern for this species. Locations with the highest climate match were in the Great Lakes basin, the Midwest, and the northern Northeast, around the locations where *T. crassus* is already recorded as established. The Certainty of Assessment for this ERSS is classified as Low due to the lack of data regarding *T. crassus*'s history of invasiveness. The Overall Risk Assessment Category for *Thermocyclops crassus* in the contiguous United States is Uncertain.

Assessment Elements

- **History of Invasiveness (see section 4): Data Deficient**
- **Establishment Concern (see section 7): High**
- **Certainty of Assessment (see section 8): Low**
- **Remarks, Important additional information: None**
- **Overall Risk Assessment Category: Uncertain**

10 Literature Cited

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in section 11.

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11 Literature Cited in Quoted Material

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

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Appendix

Summary of Future Climate Matching Analysis

Future climate projections represent two Shared Socioeconomic Pathways (SSP) developed by the Intergovernmental Panel on Climate Change (IPCC 2021): SSP5, in which emissions triple by the end of the century; and SSP3, in which emissions double by the end of the century. Future climate matches were based on source locations reported by GBIF Secretariat (2023), supplemented with additional source locations from Collado et al. (1984), Guo (1999), Hołyńska (2006), Hamaidi et al. (2010), Alekseev et al. (2013), Dela Paz et al. (2016), Gaponova (2019), Stamou et al. (2022), Campbell et al. (2024), and Saetang et al. (2024).

Under the future climate scenarios (figure A1), on average, high climate match for *Thermocyclops crassus* was projected to occur in the Great Lakes region of the contiguous United States. Under most scenarios, there were also areas of high match on the Colorado Plateau and in the northern Northeast. Parts of the Northern Pacific Coast were projected to have low climate match across all scenarios, while low match was projected to expand in the interior Southeast from 2055 to 2085 and to be larger under SSP5 than SSP3 at both time steps. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.47 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.828 (model: MRI-ESM2-0, SSP5, 2055). All future scenario Climate 6 scores were above the Establishment Concern threshold, indicating that Yes, there is establishment concern for this species under future scenarios. The Climate 6 score for the current climate match (0.874, figure 4) falls above the range of scores for future projections. The time step and climate scenario with the most change relative to current conditions was SSP5, 2085, the most extreme climate change scenario. Particularly at the 2055 time step, areas within the Southwest saw a large increase in the climate match relative to current conditions. Additionally, under one or more time step and climate scenarios, areas within the Colorado Plateau and Northern Pacific Coast saw a moderate increase in the climate match relative to current conditions. Particularly at the 2085 time step, areas within the Appalachian Range, Great Lakes, Mid-Atlantic, Northeast, and Southeast saw a large decrease in the climate match relative to current conditions. Additionally, areas within California, the Colorado Plateau, Great Basin, Gulf Coast, Southern Atlantic Coast, Southern Florida, Southern Plains, Southwest, and Western Mountains saw a moderate decrease in the climate match relative to current conditions. Additional, very small areas of large or moderate change may be visible on the maps (figure A3).

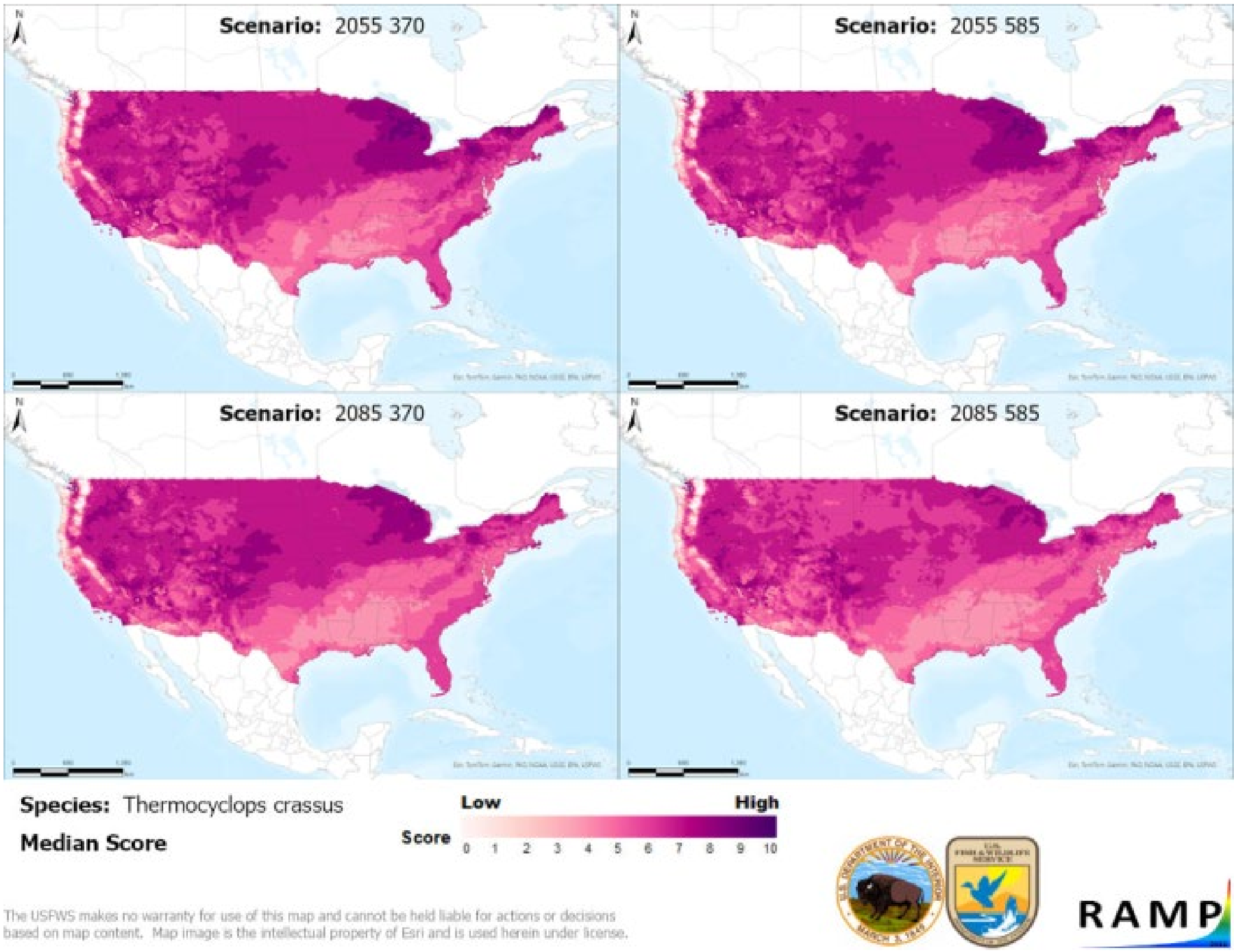

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Thermocyclops crassus* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023), supplemented with additional source locations from Collado et al. (1984), Guo (1999), Hołyńska (2006), Hamaidi et al. (2010), Alekseev et al. (2013), Dela Paz et al. (2016), Gaponova (2019), Stamou et al. (2022), Campbell et al. (2024), and Saetang et al. (2024). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

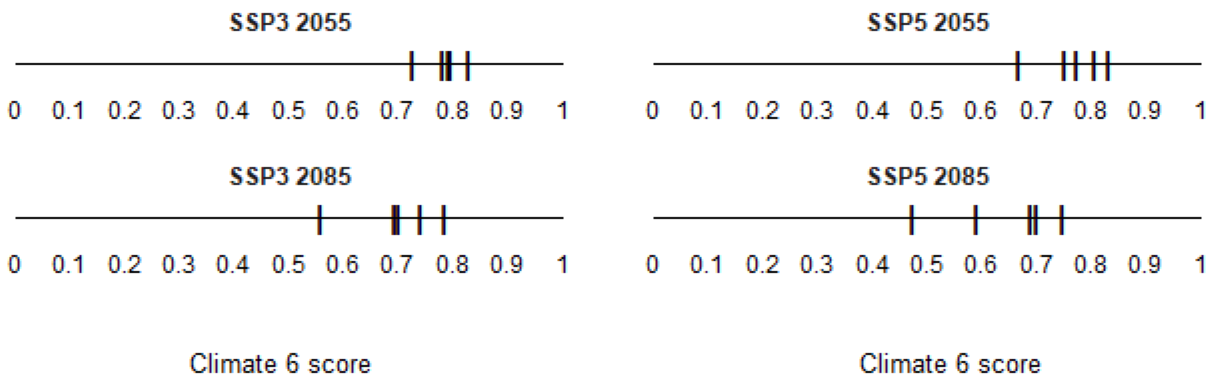

Figure A2. Comparison of projected future Climate 6 scores for *Thermocyclops crassus* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0.

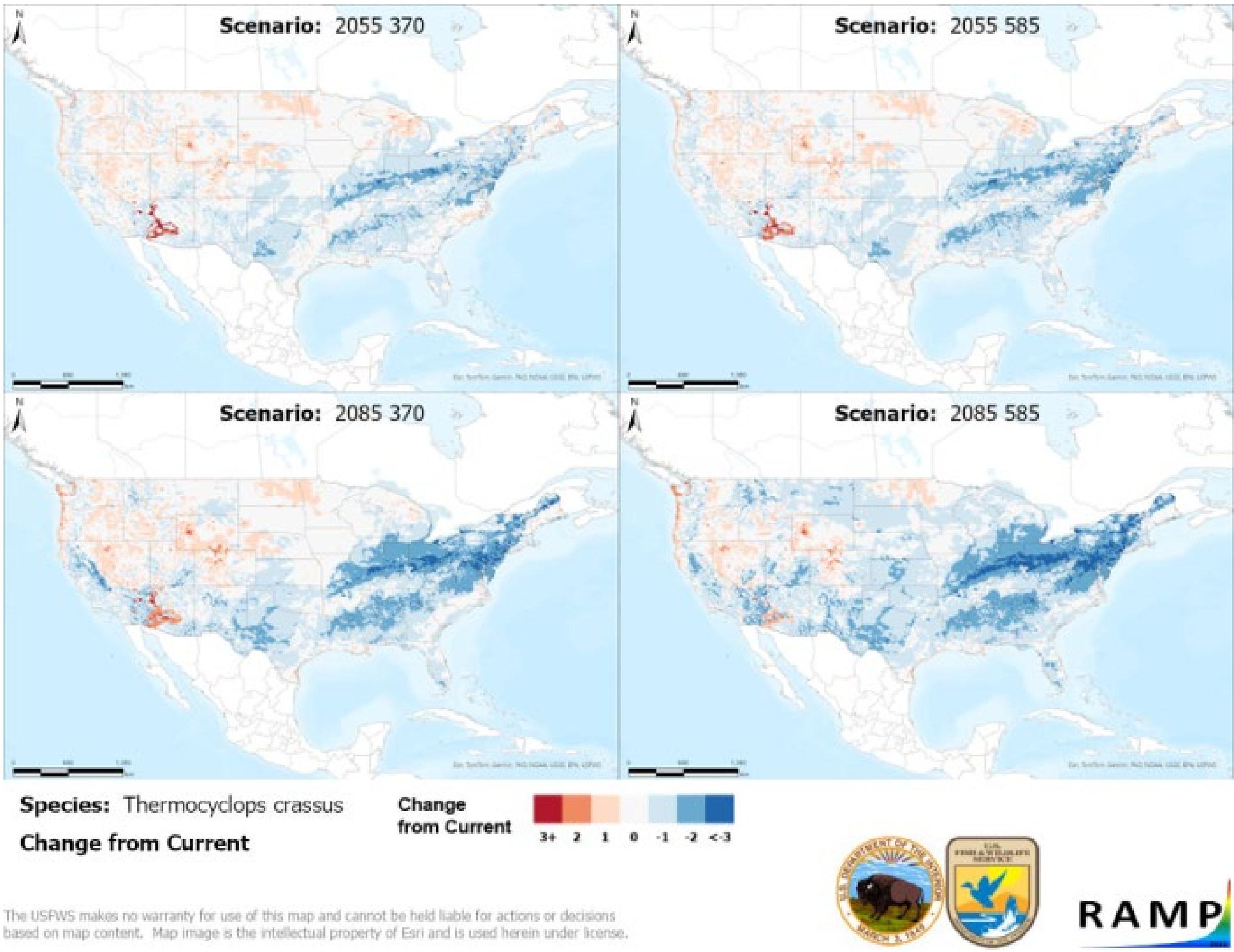

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Thermocyclops crassus* based on source locations reported by GBIF Secretariat (2023), supplemented with additional source locations from Collado et al. (1984), Guo (1999), Hołyńska (2006), Hamaidi et al. (2010), Alekseev et al. (2013), Dela Paz et al. (2016), Gaponova (2019), Stamou et al. (2022), Campbell et al. (2024), and Saetang et al. (2024). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. Shades of blue indicate a lower target point score under future scenarios than under current conditions. Shades of red indicate a higher target point score under future scenarios than under current conditions. Darker shades indicate greater change.

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