

Colored Lagoon Cockle (*Monodacna colorata*)

Ecological Risk Screening Summary

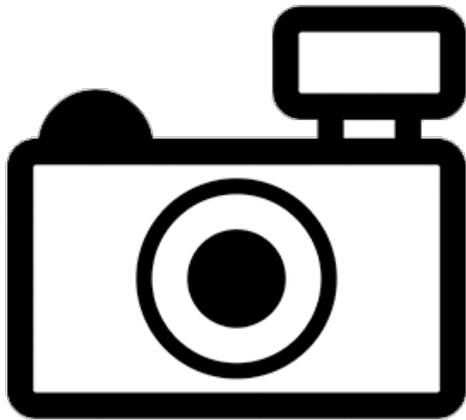
U.S. Fish and Wildlife Service, December 2022

Revised, December 2022

Web Version, 3/10/2025

Organism Type: Mollusk

Overall Risk Assessment Category: High



No Photo Available

1 Native Range and Status in the United States

Native Range

From Popa et al. (2011):

“The subgenus *Monodacna* comprises about 20 living species and/or subspecies distributed in the Black, Azov, and Caspian Seas and the connected brackish lakes (Nabozhenko 2005).”

From Wesselingh et al. (2019):

“Native to all Black Sea Basin Pontocaspian habitats and lower courses of adjacent rivers such as the Danube, Dnieper, and Dniester; [...] Occurs hundreds of kilometres upstream in major tributaries (Danube: Popa et al. 2009; [...])”

Status in the United States

No records of *Monodacna colorata* in the wild or 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

No records of *Monodacna colorata* in the wild in the United States were found.

Remarks

During the research for this assessment, additional information regarding this species was found in languages other than English. This information was not able to be incorporated into the assessment.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ter Poorten (2014):

“Animalia (Kingdom) > Mollusca (Phylum) > Bivalvia (Class) > Autobranchia (Subclass) > Heteroconchia (Infraclass) > Euheterodonta (Subterclass) > Imparidentia (Superorder) > Cardiida (Order) > Cardioidea (Superfamily) > Cardiidae (Family) > Lymnocardiinae (Subfamily) > Adacnini (Tribe) > *Monodacna* (Genus) > *Monodacna colorata* (Species)”

According to ter Poorten (2014), *Monodacna colorata* is the current valid name for this species.

Size, Weight, and Age Range

From ter Poorten (2014):

“Length L 25-40 mm”

Environment

From van de Velde et al. (2019):

“*Monodacna colorata* inhabits muddy and sandy–muddy substrates and has its optimum habitat between 0.03 and 4 psu but can tolerate higher salinities (Bogutskaya et al., 2013).”

From Klishko et al. (2020):

“[...] this species is not stenohaline and can exist under strictly freshwater conditions.”

Climate

No information was found on climate requirements for *Monodacna colorata*.

Distribution Outside the United States

Native

From Popa et al. (2011):

“The subgenus *Monodacna* comprises about 20 living species and/or subspecies distributed in the Black, Azov, and Caspian Seas and the connected brackish lakes (Nabozhenko 2005).”

From Wesselingh et al. (2019):

“Native to all Black Sea Basin Pontocaspian habitats and lower courses of adjacent rivers such as the Danube, Dnieper, and Dniester; [...] Occurs hundreds of kilometres upstream in major tributaries (Danube: Popa et al. 2009; [...])”

Introduced

From Wesselingh et al. (2019):

“[...] invasive in Caspian Sea Basin and lower Volga, as well as Lake Balkhash (Kazakhstan).”

From Klishko et al. (2020):

“[...] the modern invasion of *Monodacna colorata* in the lower and middle reaches of the Volga [Starobogatov et al. 2004] shows that this species is not stenohaline and can exist under strictly freshwater conditions.”

Means of Introduction Outside the United States

No information was found on means of introduction for *Monodacna colorata* into the wild outside the United States.

Short Description

From Wesselingh et al. (2019):

“*Monodacna colorata* appears to be a morphologically very variable species.”

Biology

From Barinova et al. (2017):

“[...] whose [*Monodacna colorata*] dietary spectrum is represented by the protists, organic matter, bacteria, and phytoplankton [Alimov 1981].”

From ter Poorten (2014):

“Feedingtype [sic] filter feeder”

Human Uses

No information was found on human uses of *Monodacna colorata*.

Diseases

No information was found associating *Monodacna colorata* with any diseases listed by the World Organisation for Animal Health (2022).

No information was found on diseases associated with *Monodacna colorata*.

Threat to Humans

No information was found on threats to humans from *Monodacna colorata*.

3 Impacts of Introductions

The following concerns documented impacts of introductions of *Monodacna colorata*:

From Barinova et al. (2017):

“In the long-term dynamics of phytoplankton of the Lake Balkhash stands out two time intervals: 1976-1995 and 1996-2012. They are divided by a sharp decrease in the total biomass of algal cells at the junction of these intervals. The average annual biomass of phytoplankton in the first two decades was $1.09 \pm 0.09 \text{ g m}^{-3}$. In subsequent years, the value of the biomass fell to $0.73 \pm 0.09 \text{ g m}^{-3}$. We showed earlier that the controlling clamping on phytoplankton of the Balkhash Lake was provided not only by climatic and environmental factors [Krupa et al. 2014, Barinova et al. 2017, Krupa et al. 2017, Krupa et al. 2017, Krupa et al. 2017] but mostly by the bivalve *Monodacna colorata* (Eichwald, 1829) [Krupa et al. 2013], whose dietary spectrum is represented by the protists, organic matter, bacteria, and phytoplankton [Alimov 1981]. Until 1995, the biomass of macrozoobenthos was formed mostly by larvae of Chironomidae, Mysidacea, and Corophiidae. Since 1996, there has been a trend of a sharp increasing in the biomass of the bottom community due to the bivalve *Monodacna colorata*. The share of *Monodacna colorata* in the total biomass of macrozoobenthos has increased in recent decades to 75.3-95.6%, while a decrease in the biomass of algal cells.”

The following concerns potential impacts of introductions of *Monodacna colorata*:

From Barinov et al. (2017):

“Therefore, if the biomass of the macrozoobenthos due to the *Monodacna colorata* persists at a high level, it is to be expected that in a few years the abundancy and biomass of the zooplankton community as a competitive consumer of phytoplankton will also decrease.”

4 History of Invasiveness

The History of Invasiveness for *Monodacna colorata* is classified as High. There is evidence of introduced populations in the Caspian Sea Basin and lower Volga River, as well as in Lake

Balkhash. *Monodacna colorata* invasion in Lake Balkhash is associated with changes in phytoplankton and benthic communities. The supporting information behind that association was not available in English.

5 Global Distribution

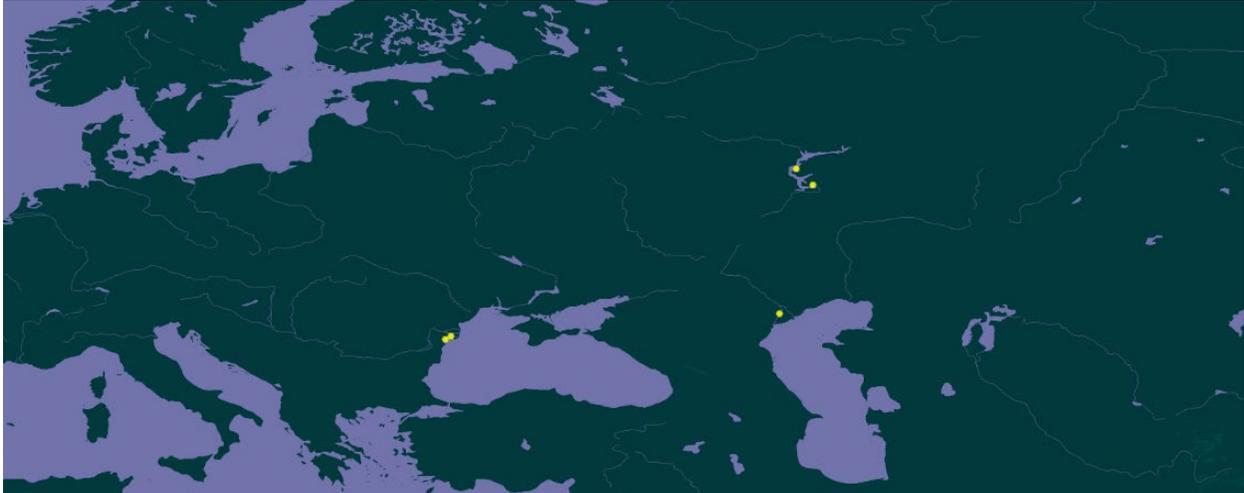


Figure 1. Reported global observations of *Monodacna colorata*. Map from GBIF Secretariat (2022). Observations are reported from Russia in both the Caspian Sea and the Volga River as well as the Romanian Coast of the Black Sea.

An established population was also reported in Lake Balkhash, Kazakhstan (Barinova et al. 2017) but specific observation locations were not reported.

6 Distribution Within the United States

No records of *Monodacna colorata* in the wild in the United States were found.

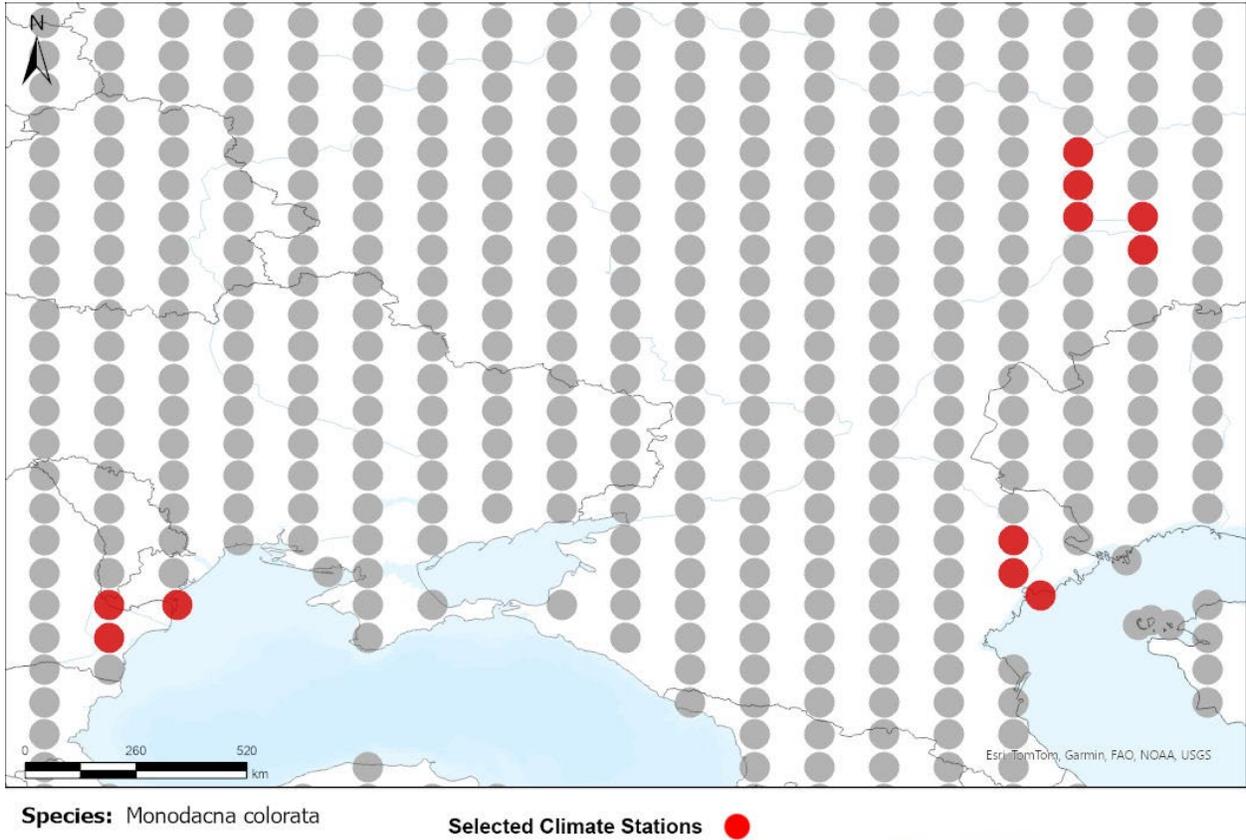
7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Monodacna colorata* to the contiguous United States was high around the western Great Lakes and in patches of the Great Basin and Colorado Plateau. Areas of low match were found in the Southeast, and along both Atlantic and Pacific coasts. The Western Mountains and Desert Southwest also had low matches. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.491, indicating that Yes, there is establishment concern for this species. 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 *Monodacna colorata* (see Appendix). These projected climate matches are provided

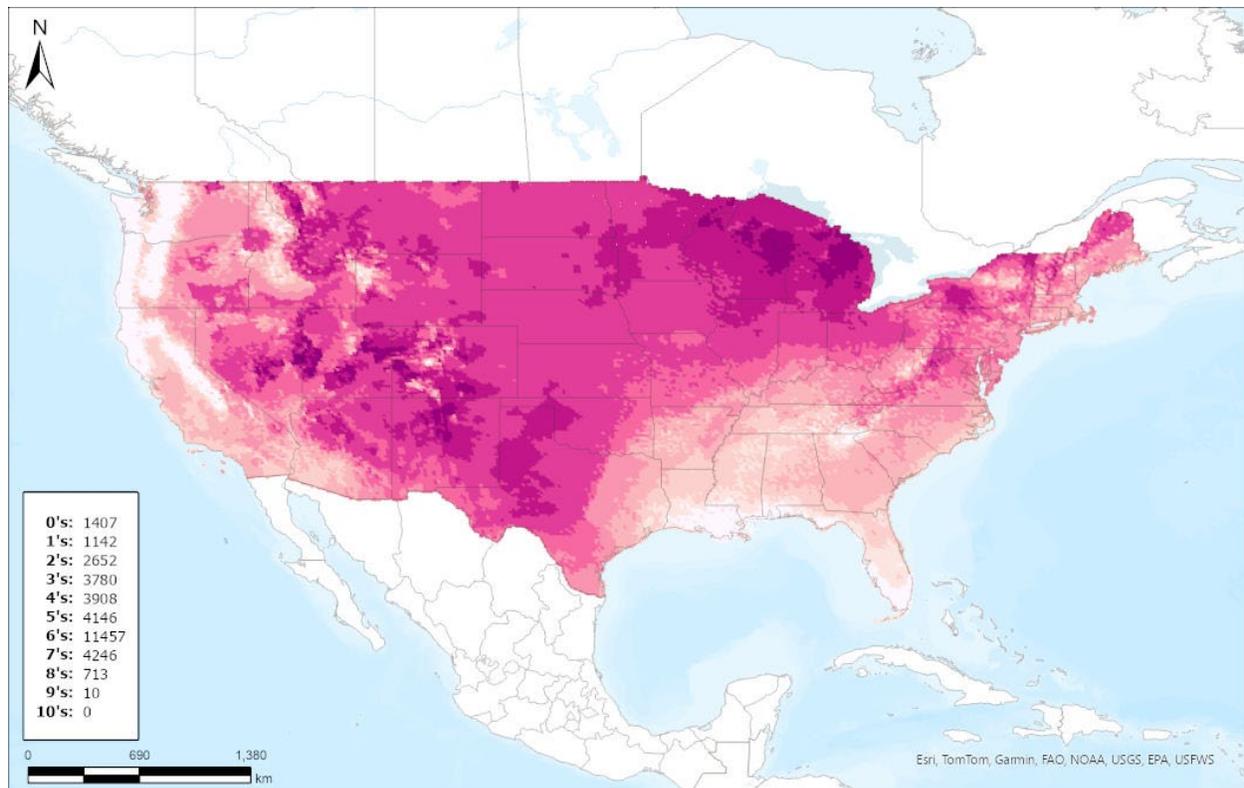
as additional context for the reader; future climate scenarios are not factored into the Overall Risk Assessment Category.



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Figure 2. RAMP (Sanders et al. 2023) source map showing weather stations around the Black Sea, Caspian Sea, and Volga River in Russia selected as source locations (red; Russia, Romania) and non-source locations (gray) for *Monodacna colorata* climate matching. Source locations from GBIF Secretariat (2022). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.



Species: *Monodacna colorata*

Current

Climate 6 Score: 0.491



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Figure 3. Map of RAMP (Sanders et al. 2023) climate matches for *Monodacna colorata* in the contiguous United States based on source locations reported by GBIF Secretariat (2022). 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 *Monodacna colorata* is classified as Low. There is limited information in English on this species' biology, ecology, introduction history, and impacts. Much of the supporting information was available in languages other than English and not accessible for this assessment. Portions of the species' range may not be represented in the climate matching analysis which reduces the certainty in the interpretation of the results.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Monodacna colorata, Colored Lagoon Cockle, is a mollusk that is native to the Black Sea basin. This bivalve can tolerate fresh and brackish water and can be found in muddy and sandy substrates. It has been introduced to the Caspian Sea basin and Lake Balkhash in Kazakhstan. The introduction in Lake Balkhash is associated with changes in phytoplankton and benthic

biomass and communities. The History of Invasiveness for *Monodacna colorata* is classified as High. The climate matching analysis for the contiguous United States indicates establishment concern. The Southeast and West Coast had low climate matches. Areas east of the Rocky Mountains, through the Midwest and into the Northeast had medium to high matches. The Certainty of Assessment is classified as Low due to the inaccessibility of information regarding the species and gaps in the distribution information used for the climate matching analysis. The Overall Risk Assessment Category for *Monodacna colorata* in the contiguous United States is High.

Assessment Elements

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

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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GBIF Secretariat. 2022. GBIF backbone taxonomy: *Monodacna colorata* (Eichwald, 1829). Copenhagen: Global Biodiversity Information Facility. Available: <https://www.gbif.org/species/4372509> (December 2022).

Klishko OK, Kovychev EV, Vinarski MV, Bogan AE, Yurgenson GA. 2020. The Pleistocene-Holocene aquatic molluscs as indicators of the past ecosystem changes in Transbaikalia (Eastern Siberia, Russia). *PLoS ONE* 15(9):e0235588.

Popa L, Popa O, Iorgu E, Kelemen B, Murariu D. 2011. Molecular insights into the taxonomy of *Hypanis* (Bivalvia, Cardiidae, Lymnocardiinae) in the Black Sea lagoons. *Helgoland Marine Research* 66:153–158.

Sanders S, Castiglione C, Hoff M. 2023. Risk Assessment Mapping Program: RAMP. Version 5.0. U.S. Fish and Wildlife Service.

ter Poorten JJ. 2014. *Monodacna colorata* (Eichwald, 1829). World Register of Marine Species. Available: <https://www.marinespecies.org/aphia.php?p=taxdetails&id=381900> (December 2022).

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<https://www.fws.gov/media/standard-operating-procedures-how-prepare-ecological-risk-screening-summary-2024> (March 2025).

van de Velde S, Jorissen EL, Neubauer TA, Radan S, Pavel AB, Stoica M, Van Baak CGC, Gándara, Popa L, de Stigter H, Abels, HA, Krijgsman W, Wesselingh FP. 2019. A conservation palaeobiological approach to assess faunal response of threatened biota under natural and anthropogenic environmental change. *Biogeosciences* 16:2423–2442.

Wesselingh FP, Neubauer TA, Anistratenko VV, Vinarski MV, Yanina T, ter Poorten JJ, Kijashko P, Albrecht C, Anistratenko OYu, D’Hont A, Frolov P, Martínez Gándara A, Gittenberger A, Gogaladze A, Karpinsky M, Lattuada M, Popa L, Sands AF, van de Velde S, Vandendorpe J, Wilke T. 2019. Mollusc species from the Pontocaspian region – an expert opinion list. *ZooKeys* 827:31–124.

World Organisation for Animal Health. 2022. Animal diseases. Paris: World Organisation for Animal Health. Available: <https://www.woah.org/en/what-we-do/animal-health-and-welfare/animal-diseases/> (December 2022).

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.

Alimov AF. 1981. Functional ecology of bivalve mollusks. *Proceedings of Zoological Institute of the Academy of Sciences of the USSR. Leningrad: Nauka Leningrad Branch* 96:248.

Barinova S, Krupa E, Kadyrova U. 2017. Spatial dynamics of species richness of phytoplankton of Lake Balkhash (Kazakhstan) in the gradient of abiotic factors. *Transylvanian Review of Systematical and Ecological Research, The Wetlands Diversity* 19(2):1–18.

Bogutskaya NG, Kijashko PV, Naseka AM, Orlova MI. 2013. Identification keys for fish and invertebrates. Volume 1: Fish and molluscs. St. Petersburg, Russia: KMK Scientific Press.

Krupa EG, Tsoy VN, Lopareva TYa, Ponomareva LP, Anuryeva AN. 2013. Long-term dynamics of the hydrobionts of Lake Balkhash and its relationship with environmental factors. *Bulletin of the Astrakhan State Technical University, Series: Fisheries* 2:85–96.

Krupa E, Slyvinskiy G, Barinova S. 2014. The effect of climatic factors on the long-term dynamics of aquatic ecosystem of the Balkhash Lake (Kazakhstan, Central Asia). *Advanced Studies in Biology* 6(3):115–136.

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- Krupa EG, Barinova SS, Tsoy VN, Lopareva TY, Sadyrbaeva NN. 2017. Spatial analysis of hydrochemical and toxicological variables of the Balkhash Lake, Kazakhstan. *Research Journal of Pharmaceutical, Biological and Chemical Sciences* 8(3):1827–1839.
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- Nabozhenko MV. 2005. Distribution of the genus *Hypanis* Pander in Ménétriés, 1832 (Bivalvia, Cardioidea: Limnocardiidae) in the Taganrogsky Gulf (The Sea of Azov). *Ekol Morya* 69:44–49. (In Russian.)
- Starobogatov YI, Prozorova LA, Bogatov VV, Sayenko EM. 2004. Mollusca. In Tsalolikhin SY, editor. *Key to freshwater invertebrates of Russia and adjacent lands. Volume 6. Molluscs, Polychaetes, nemerteans.* Saint Petersburg, Russia: Nauka.

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 (2022).

Under the future climate scenarios (figure A1), no region of the contiguous United States was projected to have a high climate match for *Monodacna colorata*. Areas of low climate match were projected to occur in the Appalachian Range, California, Gulf Coast, Mid-Atlantic, Northeast, Northern Pacific Coast, Southeast, Southern Atlantic Coast, and Southern Florida regions. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.092 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.392 (model: MPI-ESM1-2-HR, 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 (0.491, figure 3) 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. Under one or more time step and climate scenarios, areas within the Colorado Plateau saw a moderate increase in the climate match relative to current conditions. No large increases were observed regardless of time step and climate scenarios. Under one or more time step and climate scenarios, areas within the Appalachian Range, Colorado Plateau, Gulf Coast, Mid-Atlantic, Northeast, Southeast, Southern Atlantic Coast, Southern Plains, and Southwest saw a large decrease in the climate match relative to current conditions. Additionally, areas within California, the Great Basin, Great Lakes, Northern Plains, Southern Florida, 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). The magnitude of change from current conditions was more pronounced in time step 2085 than in time step 2055 under both scenarios, SSP3 and SSP5.

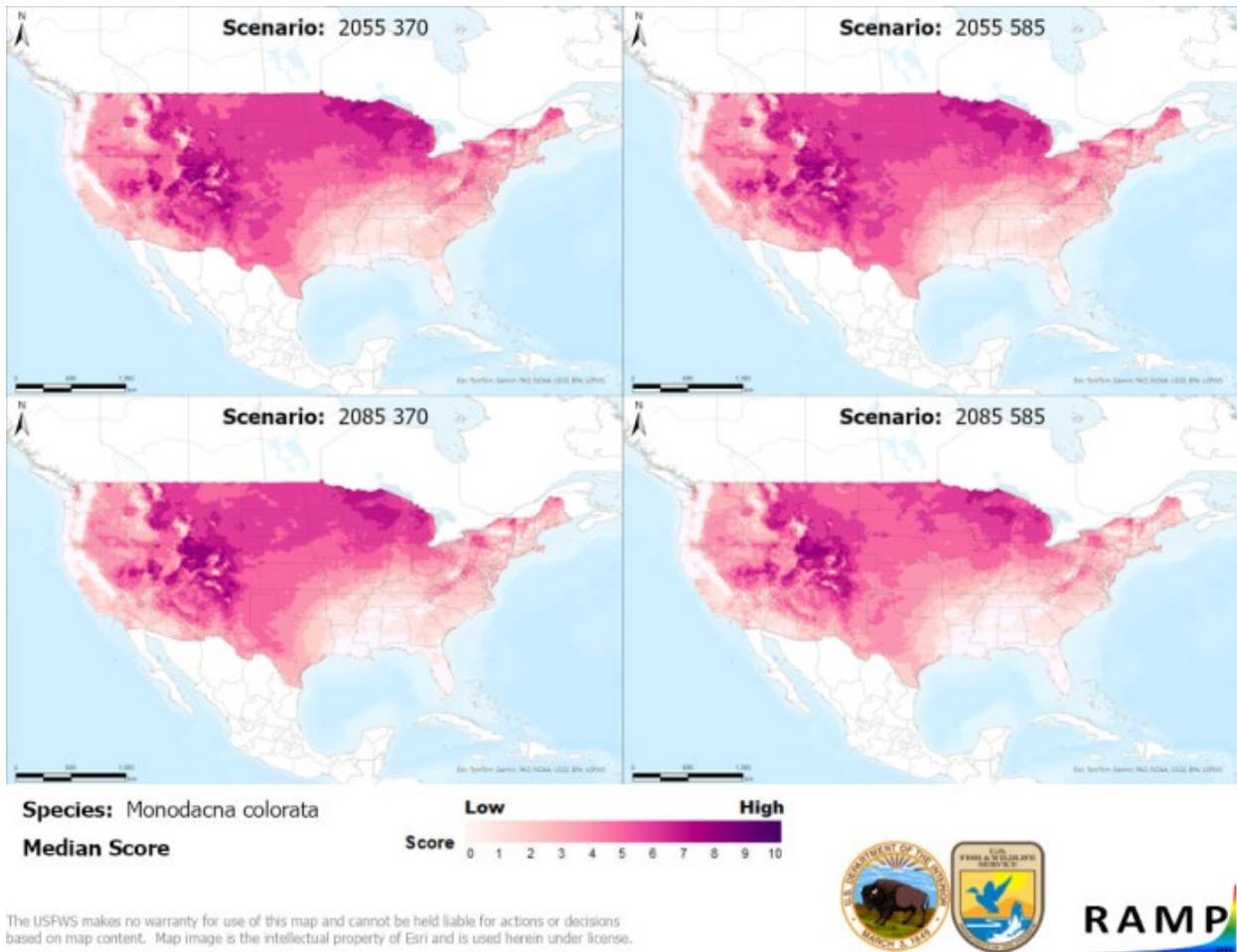


Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Monodacna colorata* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2022). Shared 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.

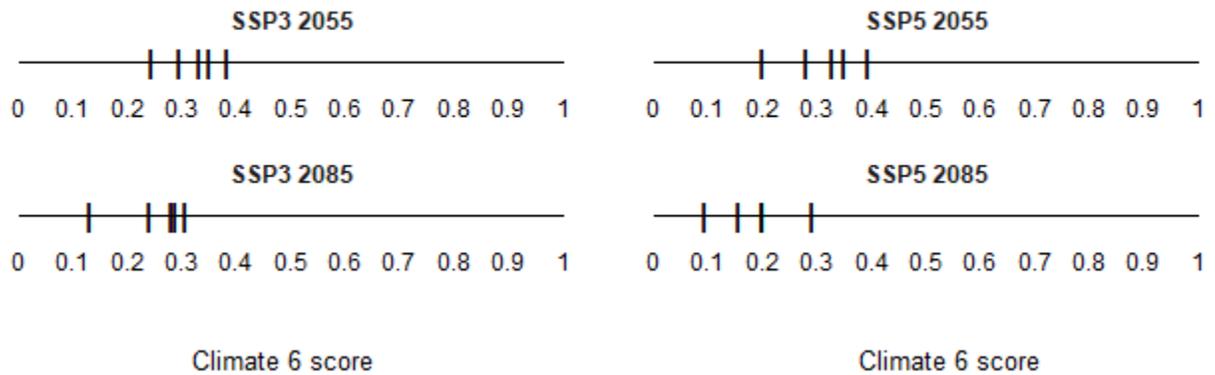


Figure A2. Comparison of projected future Climate 6 scores for *Monodacna colorata* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; 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.

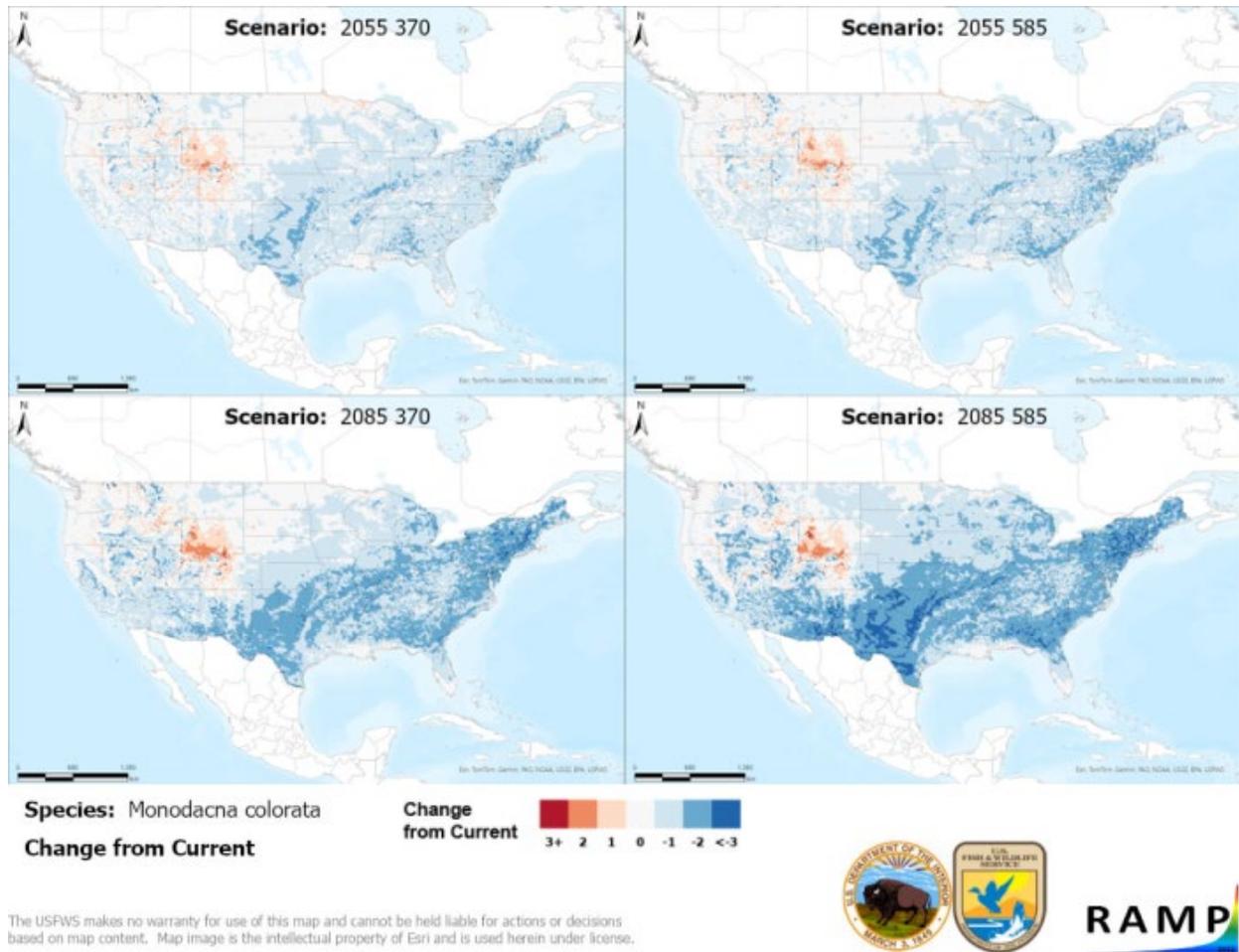


Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Monodacna colorata* based on source locations reported by GBIF Secretariat (2022). 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.

Literature Cited

- GBIF Secretariat. 2022. GBIF backbone taxonomy: *Monodacna colorata* (Eichwald, 1829). Copenhagen: Global Biodiversity Information Facility. Available: <https://www.gbif.org/species/4372509> (December 2022).
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