Minnesota Department of Natural Resources (DNR) Classification Summary for Invasive Species

Template last updated February 2020

DRAFT: Minnesota Department of Natural Resources Invasive Species Program, March 2020

Classification Screening for Tubenose Gobies, *Proterorhinus* spp.

Contents

Classification Screening for Tubenose Gobies, *Proterorhinus* spp. 1

Introduction 1

Species Summary 2

Eligibility Screening 3

Classification Screening 4

Summary 9

Appendix 10

References Cited 11

RAMP References Cited 13

Introduction

This document is a guide to the Minnesota DNR's authority under *Minnesota Statutes*, chapter 84D, to designate invasive species as prohibited or regulated invasive species. The conclusions and recommendations in this document are for information purposes only and do not require the DNR or any other entity to take a specific action.

More information about classifications of invasive species can be found on the DNR website (http://www.dnr.state.mn.us/invasives/laws.html) and in *Minnesota Statutes*, chapter 84D

(https://www.revisor.mn.gov/statutes/?id=84D). Prohibited, regulated, and unregulated species are listed in Minnesota Rules, chapter 6216 (https://www.revisor.mn.gov/rules/?id=6216).

How to fill out this classification screening

For more detailed guidance on completing this document, see the DNR's "Guidance for Invasive Species Classification Summaries". The following is a brief guide:

- Fill out the Species Summary section with the species name and a brief description of the species and its current regulatory status in Minnesota.
- Answer the questions in the Eligibility Screening section to determine whether the species is eligible for regulation under *Minnesota Statutes*, chapter 84D.
- If the species is eligible for regulation under *Minnesota Statutes*, chapter 84D, continue to answer the questions in the Classification Screening section and characterize the certainty of the answer for each question.
- At the end of the classification screening questions, summarize the most important points from the answers and judge the overall certainty of the screening.
- Finally, you should make a recommendation for classifying the species, based on the findings of the classification screening.
- Update the table of contents when the document is completed.

Species Summary

Common name: tubenose gobies

Scientific name: *Proterorhinus* spp.

Brief description: The genus *Proterorhinus* currently contains five recognized species: western tubenose goby (*P. semilunaris*), tubenose goby (*P. marmoratus)*, eastern tubenose goby (*P. nasalis*)*, P. semipellucidus,* and Chornaya tubenose goby (*P. tataricus). P. semilunaris* lives in freshwater. *P. marmoratus* tends to live in brackish to marine environments (Stepien & Tumeo 2006). The other three species live in fresh to brackish water. They are omnivores, primarily feeding on benthic invertebrates (Kocovsky et al. 2010). During warm summer months, tubenose gobies spawn multiple times (EOL 2019). They lay their eggs on the underside of objects including rocks, logs, and vegetation. Tubenose gobies look similar to native sculpins and round gobies, with average lengths around three to five inches. They can be distinguished from native gobies and round gobies by their small nostril tubes that

extend over the upper lip. Of the five *Proterorhinus* species, only the western tubenose goby (*P. semilunaris*) has been introduced to and established in the United States.

Present classification in Minnesota: Western tubenose goby (*Proterorhinus semilunaris*) is a prohibited species; the four other species are unlisted nonnative species

Proposed classification: prohibited invasive species

Current distribution of species: Tubenose gobies originate from Eurasia, in the rivers and estuaries near the Black and Caspian Sea. They live in temperate zones in shallow, near-shore waters (Fuller et al. 2016). Tubenose goby range has expanded from the Black and Caspian sea area to the rivers and lakes of northern Europe (Slynko et al. 2013). The Chornaya tubenose goby remains endemic to the Chornaya River in Ukraine. The western tubenose goby has been transported to the United States and has established in Lake St. Clair in Michigan and its tributaries, as well as Lake Superior, Lake Huron, and Lake Erie (Fuller et al. 2015).

Eligibility Screening

These three questions determine whether the DNR has authority to regulate the species under *Minnesota Statutes*, chapter 84D.

1. Is the species an aquatic plant or wild animal? For the purposes of this question, "species" includes "subspecies, genotypes, cultivars, hybrids, or genera" (*Minnesota Statutes*, section 84D.04 subd. 1).
    - Choose ☒Yes or ☐No; if yes, continue.
2. Is the species a pathogen or terrestrial arthropod regulated under *Minnesota Statutes*, sections 18G.01 to 18G.15? (*Minnesota Statutes*, section 84D.14(1))
    - Choose ☐Yes or ☒No; if no, continue.
3. Is the species a mammal or bird defined as livestock in statute? (*Minnesota Statutes*, section 84D.14(1)).
    - Choose ☐Yes or ☒No; if no, continue.

Classification Screening

Is it nonnative?

To be classified as an invasive species under Minnesota Statutes, the species must be "nonnative"; that is, not "native" as defined in Minnesota Statutes, section 84D.01, subd. 11. This has two components.

1. **Is the species nonnative in Minnesota?**

   1.1. Is the species naturally present or reproducing in Minnesota? No. Tubenose gobies are not naturally present or reproducing in Minnesota.

   1.2. Does the species naturally expand from its historic range into Minnesota? No; tubenose gobies are not native to North America.

   How certain are these answers? Very certain, supported by peer-reviewed literature.

Likelihood of introduction

This is a criterion for classification of an invasive species under Minnesota Statutes, section 84D.04, subd. 2(1). The terms "introduce" and "introduction" are defined in Minnesota Statutes, section 84D.01.

2. **Is the species likely to be introduced to Minnesota if it is allowed to enter or exist in the state?** Tubenose gobies could be (and in some cases, have been) introduced to Minnesota by the following pathways:

   - **Fishing:** The western tubenose goby may be spread through fishing. Tubenose goby species are not commercially marketed as baitfish in the U.S. but the discontinuous ranges in the Great Lakes basin suggests introduction through bait buckets (Kocovsky et al. 2011). This indicates that some anglers may be catch wild tubenose gobies and use them as bait, accidentally or intentionally releasing them into new areas. Additionally, these gobies lay their eggs in shallow waters on aquatic plants and could spread further into Minnesota via leftover vegetation on boats and trailers.

     It is unlikely for the other four species of tubenose gobies to be introduced to Minnesota through fishing due to their lack of value as trophy fish, bait, or food. If they are transported to the United States, there is a greater possibility for their introduction into Minnesota via fishing.

   - **Aquaria:** This genus is could possibly be introduced via aquarium trade. Only the western tubenose goby (*Proterorhinus semilunaris*) is currently a prohibited invasive species in Minnesota. As cryptic species, the five species within the *Proterorhinus* are difficult to

distinguish from one another. If someone were to order one of the species online, the vendor and/or receiver may have difficulty correctly identifying the species. Once tubenose gobies enter Minnesota through the aquaria trade, it is would be possible for tubenose gobies to be released into Minnesota's waters.

- **Aquaculture:** Tubenose gobies are unlikely to be introduced via aquaculture. These species lack commercial value as baitfish or edible fish.

- **Food markets:** There is little to no evidence of human shipment and consumption of tubenose gobies. There are some reports of people consuming the round goby they catch (Brock 2009), but there is little commercial food market interest in gobies overall.

- **Ballast water:** Western tubenose gobies likely entered the United States and spread around the Great Lakes basin through the ballast tanks of transoceanic cargo ships (Jude et al. 1992; Moen 2002). If one of the five species can travel via ballast tank, there may be potential for the other four species to be introduced in a similar way.

- **Natural expansion:** The western tubenose goby was first detected in Lake St. Clair in Michigan and has since dispersed through natural dispersal, use as baitfish by fisherman, and ballast water. It can expand its range by swimming to connected waters, but this dispersal is comparatively slower than human-facilitated transport. As it has spread to Lake Superior, there is now a greater chance for it to expand further into Minnesota. If another species of tubenose goby arrives to the Great Lakes, literature has suggested that passive expansion can occur in larval and juvenile stages via water currents (Zitek et al. 2004). Flooding events and upstream movement are other likely forms of range expansion that could lead to tubenose goby introduction in Minnesota (Ondračkova et al. 2019).

How certain is this answer? Moderately certain; supported by both peer-reviewed studies and anecdotal evidence.

Likelihood of survival

This is a criterion for classification of an invasive species under Minnesota Statutes, section 84D.04, subd. 2(2). The term "naturalize" is defined in Minnesota Statutes, section 84D.01 as "to establish a self-sustaining population…in the wild."

3. **Is the species likely to naturalize in Minnesota if it were introduced?** Yes, tubenose goby species would likely naturalize if introduced in Minnesota. The tubenose goby genus is from the Black and Caspian Sea region which has a temperate climate similar to Minnesota's. Previous studies on the western tubenose goby indicate tolerance to a variety of habitats (lowland rivers, brooks,

backwaters, reservoirs), feeding plasticity, and ability to cope with parasites and low levels of dissolved oxygen in introduced areas (Ondračkova et al. 2019). As close relatives, the other species in the genus may share these characteristics, however this has not been documented in peer-reviewed literature.

The western tubenose goby has already established in Minnesota. The Great Lakes basin, much of the upper Midwest, and northeastern United States have a high climate match for the western tubenose goby (Figure 1). Considering that the tubenose goby was originally considered one species, the other four species of tubenose gobies may have similar potential for establishment.

How certain is this answer? Reasonably uncertain, supported by peer-reviewed literature on western tubenose gobies, however there are few peer-reviewed studies of the other goby species' ecological tolerances.

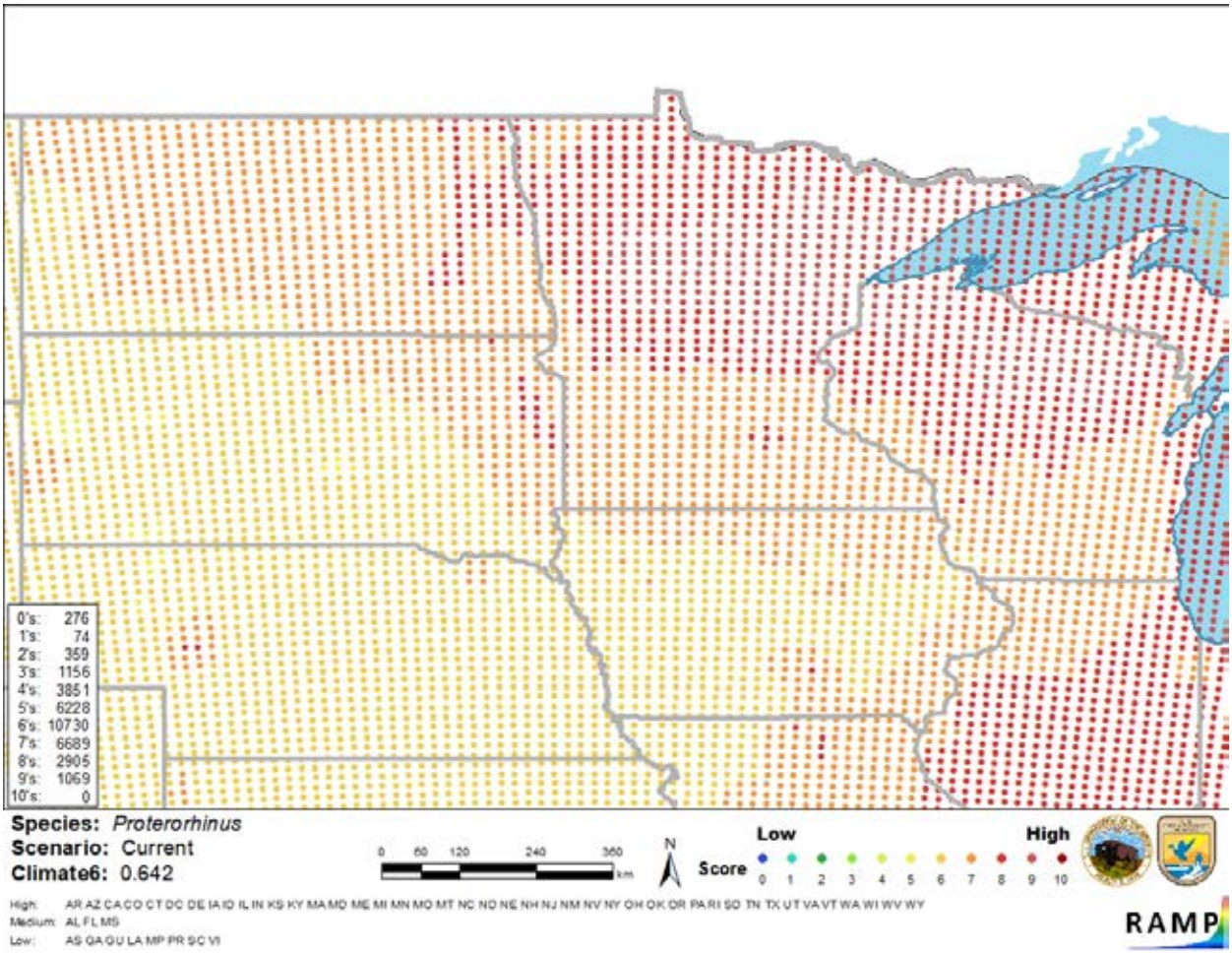

Figure 1. Risk Assessment Mapping Program (RAMP; Sanders et al. 2014) climate risk assessment for the genus *Proterorhinus* in Minnesota and neighboring states. Assessment was conducted in

2019 using GBIF data, USGS NAS Database (Nico et al. 2019), and literature sources. 0 = Lowest Match, 10 = Highest match.

Potential negative impacts

For a nonnative species to be defined as "invasive" under Minnesota Statutes, section 84D.01, subd. 9a, the species must: cause, or have the potential to cause economic or environmental harm, harm to human health; or threaten or have the potential to threaten the use of natural resources in the state. This question has four components: economic, environmental, health, and natural resources.

4. Is the nonnative species an invasive species as defined under Minnesota law?

4.1. Does the species cause, or may it cause, economic harm? No. Current literature does not describe any significant economic harm caused by tubenose goby introductions.

How certain is this answer? Reasonably uncertain, no information was found about the economic impacts tubenose gobies could have.

4.2. Does the species cause, or may it cause, environmental harm? Yes. Tubenose gobies will potentially compete for food and reproduction sites with native benthic species. A previous study showed an overlap in the diets of western tubenose gobies with rainbow darters (*Etheostoma caeruleum*) and northern madtoms (*Noturus stigmosus*) (French & Jude 2001). Johnny darters, rainbow darter, and tubenose gobies may all compete for similar reproduction sites as well (Kocovsky et al. 2011). Tubenose gobies would also potentially change food web dynamics by becoming forage food for perch, bass, and walleye. In Europe, as tubenose gobies expanded in range they became both predators to invertebrates and prey to young European catfish (*Silurus glanis*) and perch (*Perca fluviatilis*) (Libor et al. 2017).

How certain is this answer? Reasonably certain, supported by peer-reviewed studies, though little information exists on the magnitude of these competitive effects.

4.3. Does the species cause, or may it cause, harm to human health? No. No literature suggests tubenose goby introductions will be harmful to human health (Froese & Pauly 2015).

How certain is this answer? Reasonably certain.

4.4. Does the species threaten, or may it threaten, the use of natural resources in the state? Possibly. Tubenose gobies could potentially out-compete native benthic fish, however the magnitude and overall ecosystem impact is unknown and needs further study.

How certain is this answer? Reasonably uncertain, lack of evidence.

Natural resource impacts

This is a criterion for classification of an invasive species under Minnesota Statutes, section 84D.04, subd. 2(3).

5. **Would the species have potential adverse impacts in Minnesota, in particular on: native species, outdoor recreation, commercial fishing, and other uses of natural resources in the state?**

   - Choose ☒Yes or ☐No; if yes, continue to 5.1.

   5.1. If so, what would be the magnitude of these adverse impacts? Tubenose gobies have potentially adverse impacts on Minnesota's native benthic species. Tubenose gobies may compete with darters and madtoms for food and reproduction sites. They could change food web dynamics as a predator of aquatic invertebrates and as prey for perch, catfish, and walleye. It is unknown how the food web alteration might change the aquatic ecosystem. There is no evidence from previous European and U.S. invasions that their introduction will cause extirpation of other species. The overall impact of western tubenose goby on the Great Lakes ecosystem is unknown.

   How certain is this answer? Reasonably uncertain, only western tubenose goby invasions have been studied and their ecological impacts have not been quantified. The impacts of other species in this genus have been studied even less.

Management options

This is a criterion for classification of an invasive species under Minnesota Statutes, section 84D.04, subd. 2(4).

6. **Would we be able to eradicate, or control the spread of, the species once it is introduced in Minnesota?** No. Currently, there are no common methods of eradication for tubenose gobies.

   Education, effective cleaning of boats, trailers, and ballast tanks could help control the spread of tubenose gobies (Moen 2002; MISIN 2019). Potential management and control measures include use of barriers, use of piscicides, and draining standing water.

   Management of the round goby (*Neogobius melanostomus*) could inform control of tubenose gobies. Depending on the voltage and pulse, electric barriers deter and kill round goby (Savino et al. 2001). These could potentially be used in man-made waterway connections to stop tubenose goby spread. This does require further study of non-target impacts. Schreier et al. (2008) showed that bottom-release of Bayluscide® and antimycin may be able to remove gobies, however native

species would likely be impacted. Tubenose goby specific studies are needed to determine possible piscicide solutions.

The Chornaya tubenose goby is threatened in Ukraine due to river water extraction for irrigation. Water extraction causes greater river dry-down in the summer, which threatens the endemic goby (Freyhof & Naseka 2007). Draining small bodies of water could potentially be applied to tubenose gobies in invaded regions.

Experimental studies are needed to determine what biological, physical, or chemical controls are best suited to control the spread of tubenose gobies.

How certain is this answer? Reasonably uncertain, there is little peer-reviewed literature on control and eradication for tubenose gobies.

Other relevant information

This is a criterion for classification of an invasive species under Minnesota Statutes, section 84D.04, subd. 2(5). Information that may be included here includes, but is not limited to: economic impacts; regulations in other jurisdictions; and ongoing monitoring programs.

7. Are there other criteria the DNR commissioner deems appropriate? If so, discuss.

- Regulations in other jurisdictions:
    - Minnesota and New York list western tubenose goby (*Proterorhinus semilunaris*) as a prohibited species (Minn. R. 6216.0250 (2019); 6 NYCRR 575 (2014)).
    - North Dakota, Ohio, and Wisconsin prohibit or restrict the presence of tubenose goby (*Proterorhinus marmoratus*) (NDCC § 20.1-17 (2018); Howell 2018; Ohio Admin. Code 1501:31-19-01 (2016); Wis. Admin. Code § NR 40.04 (2015))

Summary

Summarize the findings of the screening form, including whether the species is nonnative and invasive as defined by Minnesota Statutes, chapter 84D, and characterize the overall certainty of the answers provided above.

Note that certain answers in the screening form may indicate that the species is not a good candidate for designating as a prohibited or regulated invasive species under *Minnesota Statutes*, chapter 84D:

- If you answered "Yes" to **either** 1a or 1b, the species is not "nonnative" as defined under *Minnesota Statutes*, chapter 84D; consider regulation under other authorities.
- If you answered "No" to **all** of 4a, 4b, 4c, and 4d, then the species is nonnative but may not be "invasive" as defined under *Minnesota Statutes*, chapter 84D; consider whether proposed introductions of this species should follow *Minnesota Rules*, part 6216.0290.

Summary: There are currently five tubenose goby species within the *Proterorhinus* genus. This genus was split into five species relatively recently so little information is available for four of the species. The different species are difficult to discern from one another. The western tubenose goby (*Proterorhinus semilunaris*) is better studied than the other four species and informed much of this screening. This is the only *Proterorhinus* species currently present in the United States, having entered the country through transcontinental ships ballast tanks. This species has established in Lake Superior and overlaps several native benthic species in diet and preferred reproductive sites. Because of their relatively recent invasion little is known about their overall impact aside from increased competitive pressure on native species. Less is known about the invasive potential of the other four species but they may have similar potential to their close relative.

How certain is this classification summary, overall? Reasonably certain, however there is little peer-reviewed literature about other *Proterorhinus* species besides the western tubenose goby.

Recommendation

The DNR may choose to recommend whether to designate the species as a prohibited invasive species, a regulated invasive species, or whether the species should be an unlisted nonnative species (Minnesota Statutes, section 84D.06). Briefly justify this recommendation and include any additional information such as recommended deadlines for updating this screening form and revisiting this decision and gaps in our knowledge that could be addressed by researchers.

Recommendation: Designate as a prohibited invasive species.

Appendix

Qualitative uncertainty ratings

Uncertainty rating	Description	Abbreviation
Very certain	As certain as I am going to get	VC
Reasonably certain	Reasonably certain	RC
Moderately certain	More certain than not	MC

Uncertainty rating	Description	Abbreviation
Reasonably uncertain	Reasonably uncertain	RU
Very uncertain	A guess	VU

Uncertainty ratings from: "Generic Nonindigenous Aquatic Organisms Risk Analysis Review Process", Risk Assessment and Management Committee report to the Aquatic Nuisance Species Task Force, 1996. Available online (www.anstaskforce.gov/Documents/ANSTF_Risk_Analysis.pdf; accessed February 14, 2020).

Version notes

References to Minnesota Statutes are to the 2019 version.

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