Appendix A: Fish

Burbot

*Lota lota*

Federal Listing
State Listing
Global Rank
State Rank 55
Regional Status High

**Justification (Reason for Concern in NH)**

Burbot are one of a few self-sustaining native coldwater fish species targeted by anglers in New Hampshire. However, due to the small size of individuals encountered in lotic environments, the majority of harvest occurs in large lakes (John Viar, New Hampshire Fish and Game (NHFG), personal communication). The species was tied with brook trout (fourth) during a survey of angler preference during the ice-fishing season (Duda and Young 1996). Lake populations of burbot are restricted to a small number of water bodies. Anthropogenic eutrophication can reduce dissolved oxygen at depth, where burbot seek thermal refuge during summer. Therefore, the species may be an indicator for the condition of oligotrophic lakes (Kelso et al. 1996). Lotic populations also appear to be limited to particular coldwater rivers or streams. The degradation of these habitats may lead to declines in burbot, as well as other coldwater fish species. The burbot is a cold water species that is potentially vulnerable to climate change. It is rarely found where water temperatures exceed 70°F, with 74°F as its upper limit of temperature tolerance (Scott and Crossman 1973). As the climate warms in the northeast, rivers and streams at the southern end of the species’ range may no longer have suitable temperatures for supporting burbot populations. There may also be a reduction in the total area of deep, cold water habitat in lakes and ponds that support cold water fish species (Thill 2014). The effect of habitat degradation and angler harvest on abundance levels of both lentic and lotic populations of the species are not well understood in New Hampshire. In other locations burbot populations have been negatively impacted by lake level management, dam creation, eutrophication, competition with invasive species, and angler harvest (Stapanian et al. 2010).

**Distribution**

Burbot are found throughout the world in northern latitudes. Their range in North America extends south from Canada to Connecticut on the east coast and Oregon on the west coast. In New Hampshire, burbot are found in select medium sized and large lakes which maintain cold temperatures in deep water during the warmer months. They may also be found in cold water rivers and streams in the Connecticut, upper Merrimack, Saco, and Androscoggin River drainages.

Current records indicate burbot are found in 16 lakes and ponds in New Hampshire and several rivers and streams within the Connecticut, Merrimack, Pemigewasset, and Saco watersheds.

**Habitat**

Burbot are found in rivers and lakes. They prefer deep, large lakes (Scarola 1987) and are commonly found in the littoral zone during winter. During the summer, burbot are thermally restricted to the profundal zone, and may make night migrations to the littoral zone (Hoffman and Fischer 2002).
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rivers, burbot prefer areas with woody debris, vegetation, pools, rocky riffles, and cool temperatures. Nighttime spawning occurs in February at shallow depths over sand or gravel substrates (Scott and Crossman 1973; Roy 2001).

NH Wildlife Action Plan Habitats

- Lakes and Ponds with Coldwater Habitat
- Coldwater Rivers and Streams

Current Species and Habitat Condition in New Hampshire

Burbot are found primarily within cooler water rivers and cold water lakes and ponds. No targeted effort has focused on determining the abundance levels of any burbot population in New Hampshire. Detecting changes in abundance levels will be difficult because historical information beyond species presence is not available.

Population Management Status

There are no current management efforts specific to burbot in New Hampshire. There are no length or harvest limits for burbot in lakes and ponds or rivers and streams. There is no closed season for the species in lakes and ponds, but burbot cannot be harvested between September 16 and December 31 in rivers and streams. This seasonal closure is not specific to burbot. It was designed to protect spawning brook trout from harassment by anglers. The effect of harvest rates on burbot populations in New Hampshire is unclear.

Regulatory Protection (for explanations, see Appendix I)

- Harvest permit - season/take regulations
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Quality of Habitat

Burbot are found primarily within cooler water rivers and cold water lakes and ponds. Large lakes with extensive deep coldwater habitat have the best chance of maintaining healthy burbot populations. Smaller lakes with limited coldwater habitat are more vulnerable to the effects of climate change and cultural eutrophication (Thill 2014). Coldwater river and stream habitat is relatively intact in northern and western New Hampshire. However, climate change is expected to increase water temperatures in the northeast, which may threaten burbot populations in rivers and streams along the southern edge of their range (Lyons et al. 2010).

Habitat Protection Status

Habitat Management Status

There are currently no ongoing management or restoration efforts for burbot in New Hampshire. Restoring stream connectivity, riparian restoration and protection, and upland land protection are expected to benefit lotic populations. Efforts to address stormwater runoff, nonpoint source pollutants, introduced species, and climate change are expected to benefit lentic populations.

Threats to this Species or Habitat in NH

 Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

There are no threats ranked high or medium for this species.

List of Lower Ranking Threats:

Disturbance from water level management
Mortality from recreational harvest
Disturbance from stream crossings or dams that fragment habitat
Disturbance from reduced area of coldwater habitat

Actions to benefit this Species or Habitat in NH

Land Protection

Primary Threat Addressed: Disturbance from reduced area of coldwater habitat

Specific Threat (IUCN Threat Levels): Climate change & severe weather

Objective:
Preserve the natural ecological functions of an area by protecting land from development.

General Strategy:
Land protection is a strategy that can be used to ensure a level of habitat quality that is necessary to
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support certain species and habitats of conservation concern. For aquatic species, land protection prevents many of the impacts caused by sprawling development. Groundwater recharge, intact riparian zones, and unrestricted migration corridors are some of the benefits. Species with limited ranges and mobility may be protected almost entirely through land conservation. For wider ranging species, such as burbot, land protection will be part of a greater restoration strategy. Land protection projects in New Hampshire usually require the coordination of a variety of funding sources, with involvement from town conservation commissions, local land trusts and watershed associations, government agencies, and state or national NGO’s. Since 2005, the NH Wildlife Action Plan has helped direct land protection efforts toward conserving habitat for species and habitats of concern. The effectiveness of land conservation could be improved by identifying and addressing barriers to land conservation in New Hampshire and increasing outreach to help prioritize projects that benefit species and habitats of concern.

<table>
<thead>
<tr>
<th>Political Location:</th>
<th>Watershed Location:</th>
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<tbody>
<tr>
<td><strong>Map spawning habitat</strong></td>
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**Objective:**
Map the distribution of coldwater fish spawning habitat in deep water lakes.

**General Strategy:**
Although some important spawning reefs have been well documented, the extent of spawning habitat for coldwater fish species remains undocumented in most lakes where they occur. Acoustic or radio telemetry, gill or fyke net surveys, underwater cameras, and visual observations are potential methods for identifying important spawning areas. Depth recordings at spawning areas well help inform water level management policy.

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<tr>
<th>Political Location:</th>
<th>Watershed Location:</th>
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<tr>
<td><strong>Population assessment</strong></td>
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**Objective:**
Assess the status of burbot populations in New Hampshire.

**General Strategy:**
Explore methods for assessing the populations of burbot in lakes where they are known to occur. Confirm and update the current distribution of the species in New Hampshire.

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<thead>
<tr>
<th>Political Location:</th>
<th>Watershed Location:</th>
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<tr>
<td><strong>Water level management</strong></td>
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**Primary Threat Addressed:** Disturbance from water level management
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Specific Threat (IUCN Threat Levels): Natural system modifications

Objective:
Reduce the aquatic habitat impacts associated with artificial water level fluctuation at dams.

General Strategy:
Work with dam managers to achieve water level fluctuations that mimic natural flow regimes. Practices such as rapid changes in water level, excessive winter drawdown, and shutting off downstream flow to refill a waterbody should be avoided. For coldwater species that spawn on shallow reefs, including lake trout, round whitefish, lake whitefish, and burbot, it is important that water levels do not drop significantly after the spawning season, such that the eggs would be exposed. Engaging stakeholders, including shorefront property owners, boaters, anglers, and hydropower project owners is critical to changing long established water level management traditions. The NHDES Dam Bureau is the lead on dam management issues in New Hampshire. The best strategy for improving water level management practices for fish and wildlife is to work with the Dam Bureau to identify opportunities to create more natural water level fluctuations at a certain dams and then make slow incremental changes. This allows stakeholders to adjust to the changes and make comments when conflicts arise.

Political Location:  
Watershed Location:

### Riparian Buffer Protection

**Primary Threat Addressed:** Disturbance from reduced area of coldwater habitat

**Specific Threat (IUCN Threat Levels):** Climate change & severe weather

**Objective:**
Preserve the water and habitat quality of rivers, streams and the shorelines of lakes and ponds by preventing development in the riparian zone.

**General Strategy:**
Riparian buffer protection can be achieved through town ordinances, state law (i.e. the Shoreland Water Quality Protection Act), deed restriction, conservation easement, or voluntary land use practices (such as forestry best management practices). In general, the wider the buffer protected, the more ecological benefit. A buffer of at least 10 m will provide a minimum level of water quality and habitat benefits. A protected buffer of 100m or greater provides maximum water quality and habitat benefits while also acting as a migration corridor for larger species of wildlife. Buffer protection is lacking on headwater streams despite the cumulative effect that intact riparian zones in headwater streams have on downstream water quality. Protecting riparian buffers along coldwater rivers and streams may help mitigate some of the impacts of a warming climate by shading streams and promoting groundwater recharge.

Political Location:  
Watershed Location:
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References, Data Sources and Authors

Data Sources
Published literature, stream survey data, and angler reports were used to establish habitat needs and statewide distribution. Records of burbot are entered into the NHFG fish survey database. Anecdotal reports of burbot are frequently submitted by anglers.

Data Quality
There are many gaps in the distribution map of burbot, especially in river and stream habitat. They are occasionally encountered during backpack electrofishing surveys, but these surveys are limited to shallow rivers and streams. Although burbot populations are known to exist in the large coldwater lakes, distribution data in lakes and ponds may be incomplete, especially from smaller waterbodies with suitable habitat conditions near the edge of their range. Historical records suggest that burbot may have been present in certain waterbodies within the coastal watersheds, but there have been no recent reports. Information describing the status and abundance of the species is very limited for both lentic and lotic habitats.

2015 Authors:
Benjamin Nugent, NHFG, Matthew Carpenter, NHFG

2005 Authors:

Literature


