

Ruffe - *Gymnocephalus cernuus*

A small and aggressive benthic fish, the ruffe has the potential to seriously impact North American freshwater ecosystems and commercial and sport fisheries. Introduced into Lake Superior during the mid-1980's, it has been found to spread, reproduce, and mature rapidly.

Taxonomy

Phylum	▪ Chordata
Class	▪ Osteichthyes
Order	▪ Perciformes
Family	▪ Percidae

General Biology

Adult Morphology

- Body shape is similar to that of perch (Fig. 1)
- Coloration and markings are similar to the walleye (Figs. 2-3)
- Generally between 15 and 25 cm in total length
- Head lacks scales
- Two large dorsal fins are joined together; the forward fin has spiny rays and the rear fin has soft rays (Fig. 3); anal fin has spines
- Very slimy when handled (Fig. 2)
- Sensitive lateral-line system, including network of sensory pores located in the head
- Presence of well-developed tapetum lucidum assists vision capabilities in low-light and dark conditions
- Sensitive to frequencies between 50 and 150 cycles per second

Behavior

- Possesses the ability to feed in darkness, cold temperatures, and turbid conditions
- Spends daylight hours in deeper waters and moves to shallower areas to feed during the night



Fig. 1 Eurasian ruffe can inhabit both fresh and brackish waters.¹



Fig. 2 Ruffe are unusually slimy and hard to hold.²



Fig. 3 The spiny front dorsal fin and the soft rear dorsal fin are attached to each other and continuous.³

Identification

Juvenile Distinguishing Characteristics

- Slightly concave head; becoming thinner with growth
- Large swim bladder with coloration on the dorsal side
- Serrated preopercle

Adult Distinguishing Characteristics

- Total length typically <25 cm
- Similar in appearance to perch, but may be distinguished by the continuous (front and rear joined together) dorsal fin, slightly down-turned mouth, and absence (ruffe) and presence (perch) of scales on the head
- Other distinguishing characteristics are identified in Fig. 4

¹ http://nas.er.usgs.gov/fishes/accounts/percidae/gy_cernu.html

² <http://www.sgnis.umn.edu/exotics/ruffe.html>

³ http://www.sgnis.org/publicat/slide/rf_s1.htm

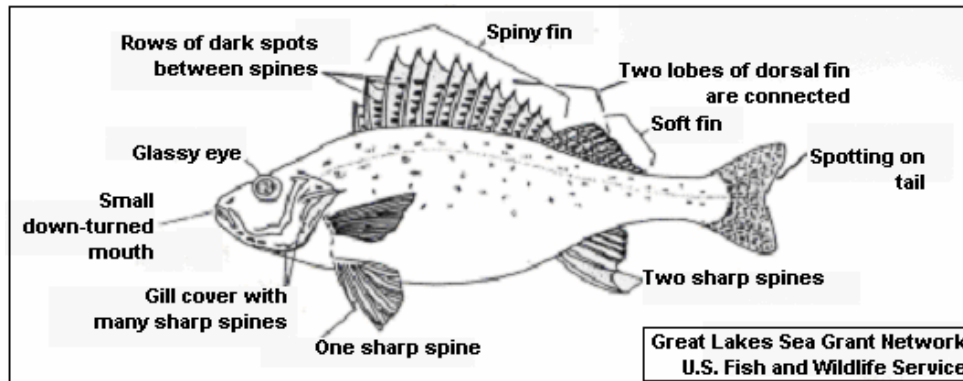


Fig. 4 Key morphological features of the Eurasian ruffe.⁴

Life Cycle

Eggs

- Females may spawn two or more batches of eggs in a season, one in winter-spring and one later in summer
- Egg size ranges between 0.34 and 1.3 mm in diameter depending upon size of the female and batch of eggs
- Eggs from first batch are larger (0.90-1.21 mm)
- Eggs from second batch are smaller (0.36-0.47 mm) and yellowish in color
- Normal egg development has very high pH range (6.5-10.5)
- Hatching occurs in 5-12 days at temperatures between 10°C and 15°C

Embryonic to Juvenile Stages

- Newly hatched embryos are 3.5-4.4 mm in size
- Cephalic lateral-line sensors of embryos are underdeveloped
- Embryos remain sedentary for 3-7 days and reach 4.5-5.0 mm in size
- Feeding begins about 1 week after hatching
- Brief pelagic larval stage
- Active feeding and swimming occurs within one week of hatching and after the yolk-sac is absorbed
- Transition to exogenous feeding in the benthopelagic layer
- Do not form schools during the larval stage

Maturity

- Maturity generally occurs within 2-3 years of age and at 11-12 cm in total length; may occur earlier in warm waters
- Growth is often more rapid in clear and brackish waters
- Poor growth may occur when the benthos is impoverished
- Females typically grow faster than males
- Adults typically <20 cm in total length; maximum of 29 cm
- Adult males and females generally do not live longer than 7 and 11 years, respectively

Spawning

- Often moves from deep to shallow areas to spawn
- Spawning occurs intermittently (usually during April and July), with eggs being laid in two or more batches per year
- Spawning begins when water temperatures reach 6°C
- Number of eggs are greatest in first batch and reduced in subsequent batches
- Female will lay 10,000-150,000 eggs each year
- Male gonadal activity occurs during spring and autumn
- Eggs are extruded from the female without sticking together

⁴ Adapted from Great Lakes Sea Grant Network and United States Fish and Wildlife Service

- Upon contact with water, eggs become adhesive and will attach to various substrates (e.g., submerged plants, logs, branches, rocks)
- Able to hybridize with *Perca fluviatilis* and *Gymnocephalus baloni* (hybrids are less active, grow faster, and are more resistant to starvation and extremes in temperature and pollutants)

Habitat Characteristics

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|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preferred Environment | <ul style="list-style-type: none"> ▪ Tolerant of a wide range of ecological and environmental conditions including: <ul style="list-style-type: none"> ▪ Fresh and brackish waters ▪ Lacustrine and lotic systems ▪ From 0.25-85 m in depth ▪ Montane and submontane areas ▪ Oligotrophic to eutrophic waters ▪ Exhibit preference for slow-moving waters with soft bottoms, usually without vegetation ▪ Generally increase in abundance with increased eutrophication ▪ Developed adaptations for living in dark environments |
| Temperature | <ul style="list-style-type: none"> ▪ Tolerant of temperatures near freezing ▪ Upper lethal temperature for juveniles is between 30°C and 34°C ▪ Optimal temperature for larval growth is 25-30°C ▪ Compared to perch, foraging ability (e.g., capture rate, swimming performance, reaction distance) is less impaired by cold temperature |
| Oxygen | <ul style="list-style-type: none"> ▪ Prefer oxygen concentrations of 5-6 mg/l |
| Salinity | <ul style="list-style-type: none"> ▪ Can tolerate salinities up to 12‰ |
| Water Quality | <ul style="list-style-type: none"> ▪ Ruffe are able to tolerate turbidity and pollution |

Distribution

- | | |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Native Range | <ul style="list-style-type: none"> ▪ Europe and Asia |
| North American Distribution | <ul style="list-style-type: none"> ▪ See Fig. 5 |
| Probable Means of Introduction | <ul style="list-style-type: none"> ▪ Ballast water discharged by transoceanic ships (believed to have originated from the Danube basin) |

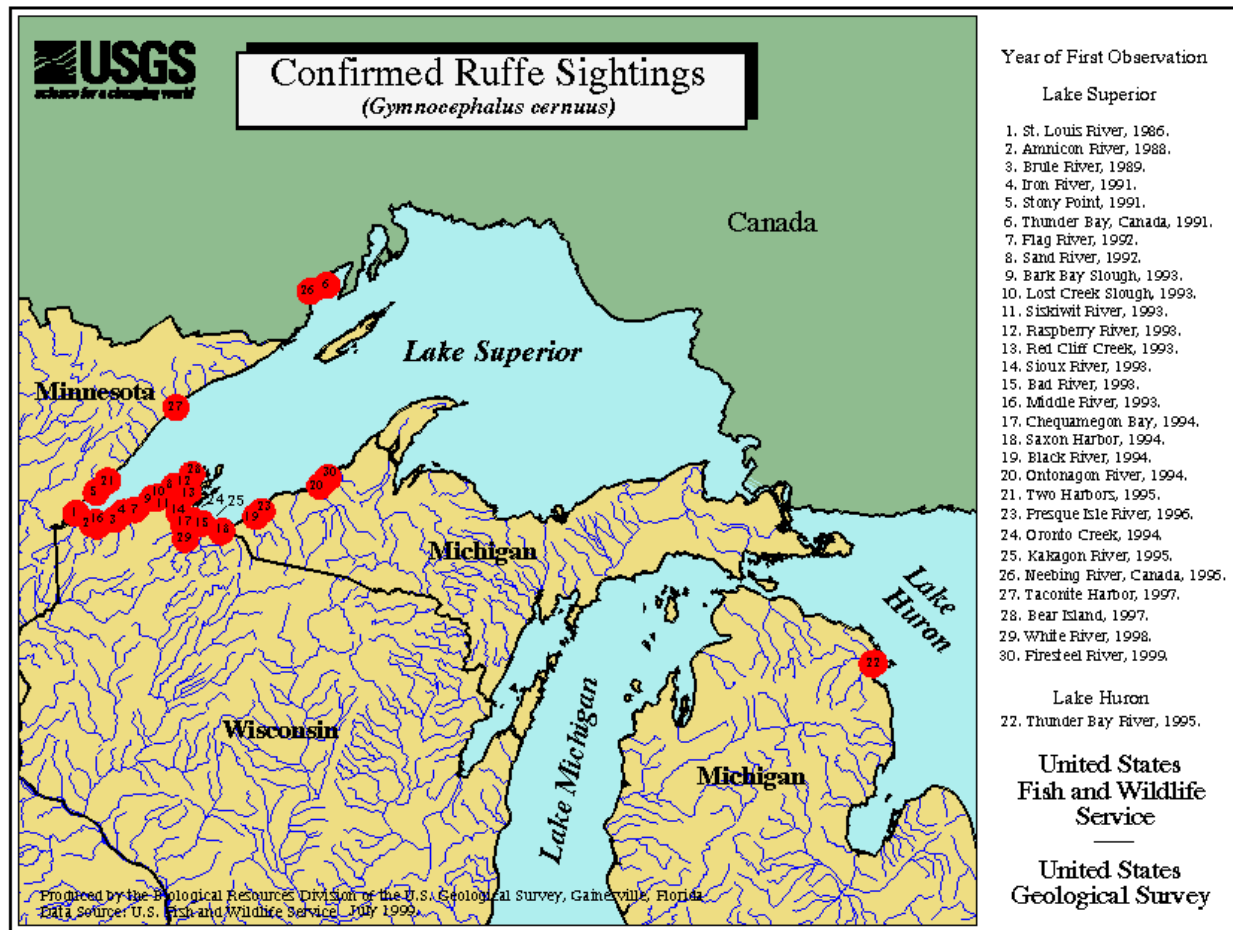


Fig. 5 North American distribution of the Eurasian ruffe.⁵

Diet

- Newly hatched ruffe feed on rotifers and copepod nauplii, and then larger cyclopoid copepods, cladocerans, and chironomid larvae
- Juvenile and adult ruffe feed on chironomids and other benthic invertebrates, macrocrustaceans, detritus, fish eggs, zooplankton, and small fish (in tidal estuaries ruffe tend to be planktivorous)
- Following the switch to a largely macrobenthos diet, little change in food selection with growth

Impacts

Negative

- Compete for food resources with other benthivorous fish (e.g., *Coregonus* species, eel, perch, smelt, and sturgeon)
- Appear to be strong competitors for benthos
- Predation on fish eggs
- Considered a significant potential threat to North American fisheries (species has already made a strong impact on populations of commercially important

⁵ http://nas.er.usgs.gov/fishes/images/ruffe_map.gif

fish species and on the commercial fishing industry in some areas of the Laurentian Great Lakes)

Positive

- Decrease in populations of native species (e.g., yellow perch, emerald shiners) caught in survey trawls as populations of ruffe have increased
- Food source for bullheads, northern pike, yellow perch, smallmouth bass, black crappie, burbot, cormorants, heron, kingfisher, and smew; predation on ruffe by most predators remains low, but has increased slightly

Management

Control Measures

- Use of alarm pheromone has potential to exclude ruffe from particular locations (e.g., spawning areas, entrances to other waterbodies) (Maniak et al. 2000 for further information)
- Use of sex pheromone has potential to assist in attracting and trapping ruffe (Murphy et al. 1999 for further information)
- Use of alarm sperm antibody has potential to assist in the disruption of the reproductive processes (Flynn et al. 1998 for further information)
- Ballast water management can reduce the chance of ruffe being transported to uninfested waters
- Use of chemical piscicides on the periphery of reproducing populations has potential to limit range of infestation
- Prohibiting transport of ruffe for use as live bait to limit spread
- Effectively monitoring commercial rearing and transport of fish species used for stocking, to avoid accidental introduction into new bodies of water; most likely to be confused with species such as perch, white bass and freshwater drum
- Further investigation into use of parasites specific for North America which cause severe pathology in ruffe populations (Pronin et al. 1997 for further information)
- Use of lampricide TFM is effective in eliminating up to 97% of ruffe and lamprey (*Petromyzon marinus*) with minimal non-target mortality
- Thoroughly draining livewells, bilge water, and bait buckets will limit spread

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Web Sites

<http://www.dnr.state.mn.us/exotics/aquatic/ruffe.html>

Ruffe - *Gymnocephalus cernuus*

<http://sgnis.org/> (keyword "ruffe")

Sea Grant Non Indigenous Species Home Page

<http://www.seagrant.umn.edu/exotics/ruffeid.html>

Ruffe ID Watch Card

This report was prepared by Danielle M. Crosier and Daniel P. Molloy (New York State Museum) with assistance from J. Ellen Marsden (University of Vermont).