

Guidelines for Reducing the Spread of “Fishhook waterfleas” (*Cercopagis pengoi*)

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Introduction

Cercopagis (sir-coh-PAGE-is) or “Cp” for short (Fig. 1) is an aggressive, predatory zooplankton that preys on smaller zooplankton and poses a threat to the food webs of North American lakes. Adult Cp was first discovered fouling up fishing lines, down rigger cables and fish nets in Lake Ontario in 1998. In many cases, the fouling was so intense that anglers could not reel in their lines because of clogging. The mass of Cp on the lines resembled a yellowish-green gelatinous “goop” or wet cotton. (Fig. 2)

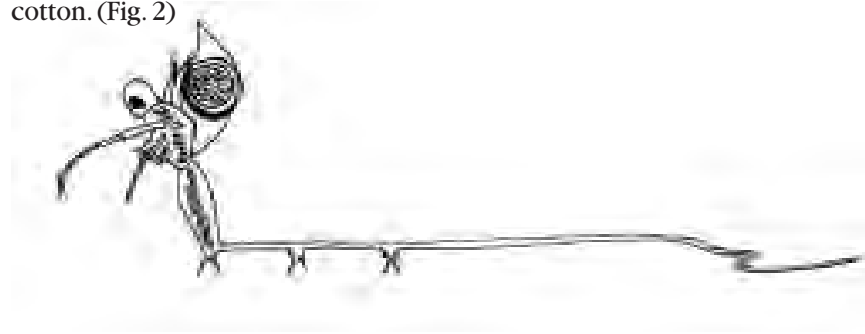


Figure 1. Adult female Cp with resting egg. Illustration by Elaine Langer

Cercopagis has a history of invading many European lakes and reservoirs, and the Baltic Sea, which is the most likely source of the North American invasion. Within a little more than a year after its discovery, Cp spread to six NY Finger lakes (Seneca, Cayuga, Otisco, Canandaigua, Owasco and Keuka). In these lakes, Cp now dominates the offshore zooplankton community during the summer and fall. It is also present in Lakes Michigan and Erie.

Biology and Life Cycle of *Cercopagis*

In Lake Ontario, Cp is generally found at depths between the surface and 100 feet, and is most abundant at around 50 feet. Cp generally prefers warmer waters above the thermocline, but can occasionally be found in deeper waters below the thermocline. In Lake Ontario, Cp first appears each season in warmer, near surface waters as water temperatures reach 63 ° F (17°C), typically during June or July. Cp reaches peak abundance (1-3 individuals per gallon of lake water or 300 - 2000

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Figure 2. A mass of Cercopagis.
Photo courtesy of Ted Lewis, SUNY Brockport

68° to 73°F (20° to 23°C), usually in August. Cp abundance declines in the fall as water temperatures drop from 61° to 55°F (16° to 13°C). The adults are generally not found in the water column as water temperatures reach 50°F (10°C), but may occasionally be found in temperatures as low as 46°F (8°C).

During the summer months, Cp produces offspring, essentially clones or genetic “carbon copies” of the parent, from unfertilized eggs. Unlike resting eggs produced later in the season, these delicate eggs are highly susceptible to damage. It is unlikely that these eggs are important in spreading the animal around. As summer peaks and wanes and surface water temperatures decline, each Cp begins producing overwintering or resting eggs; however, Cp has also been known to produce resting eggs anytime during the year when environmental conditions become inhospitable.

Resting eggs can successfully overwinter in an inactive state and replenish the population after hatching in the spring. Resting eggs are also resistant to desiccation, freeze-drying and ingestion by predators. They can be easily transported to other systems by a variety of vectors, particularly if they are still in the female’s body because of the barbed, sticky tail spines that allow it to attach to ropes, lines, vegetation and aquatic gear. Resting eggs can still hatch, regardless of whether the female is alive or dead. If removed from the water, an adult Cp dies quickly from desiccation or air-drying and just by being moved. Adults alone are not likely to be important in spread of Cp to new water bodies.

Cercopagis is likely to invade much of North America because:

- Cp can live in both fresh and brackish water. By comparison, fresh water has 0.1 parts per thousand salinity (ppt); brackish, up to 14 ppt; and seawater, 30 ppt.
- Sticky, barbed tail spines of adults allow them to cling to gear and equipment.
- A small number of individuals can successfully start a population. Females are able to reproduce asexually (without needing males).
- Females produce a hardy, resting eggs stage, which can withstand extreme environmental conditions, being eaten by fish, and being transported.
- Resting eggs, whether still in the female’s body or separated, may be dispersed by a variety of possible vectors:
 - Fishing gear, bait buckets
 - Bilge (possibly) and ballast water
 - Vegetation
 - Mud, sediments
 - Boat trailers
 - Aquatic sampling gear
 - Waterfowl plumage

What can we do to reduce the risk of transporting *Cercopagis*?

Researchers at SUNY Colleges of Environmental Science and Forestry (ESF) and SUNY Brockport, discovered a number of resting egg disinfection agents that can effectively reduce the risk of spreading Cp from one water body to the next. The disinfection agents tested against Cp resting eggs were:

- 10% household bleach (1 part bleach to 9 parts water)
- 5% vinegar (1/2 part vinegar to 9 1/2 parts water)
- General boat cleaner: alkyl dimethyl benzyl ammonium chloride, dimethyl ethylbenzyl ammonium chloride
- Bilge cleaner: ethylene glycol, monobutyl dodecylbenzene-sulfonic acid, sodium metasilicate and sodium tripolyphosphate
- Hull cleaner: oxalic acid
- 10% hydrochloric acid
- Phosphate free detergent
- 2 ppt formalin
- Full strength saltwater (30 ppt or 1/3 part salt to 9 2/3 parts water)
- Desiccation (air drying)
- Steam/boiling water
- Nitrogen gas bubbles

Table 1. Cp (free) resting egg treatments listed in order of decreasing effectiveness measured by percentage of resting eggs killed during the treatments. Data from M. Snyder and K. Schulz.

Treatment	Test Duration	%Eggs killed
10% bleach	1 hour	100%
	24 hours	100%
Air dry	1 month	100%
Boat cleaner	10 seconds	95%
Boiling water	10 seconds	95%
30 ppt salt water	30 minutes	95%
2 ppt formalin	15 minutes	90%
Air dry	1 week	89%
10% bleach	10 minutes	89%
Boat cleaner	1 hour	89%
Hull cleaner	2 minutes	85%
Boat cleaner	3 minutes	83%
Nitrogen gas	1 week	84%
	1 day	83%
	2 minutes	74%
Bilge cleaner	2 minutes	74%
Hull cleaner	1 hour	73%
	10 seconds	72%
1% detergent	10 minutes	70%
	1 hour	70%
	24 hours	68%
Air dry	6 hours	65%
Nitrogen gas	3 days	65%
Bilge cleaner	1 hour	58%
Nitrogen gas	2 days	55%
40°C water	10 seconds	50%

Which agents work best?

Recommendations

The results of the testing are found in Table 1. Several of these agents: chlorine bleach, dessication, saltwater, common boat cleaner, boiling water and vinegar showed considerable success in killing resting eggs (90 - 100%). Researchers also noted that resting eggs enclosed in the female parent's body were generally about 5 - 10% more resistant to treatment with most of the treatments than some of the agents compared to the separated, or "free" resting eggs. Enclosed resting eggs treated with boat cleaner and nitrogen gas, however, were about 50% and 70% (respectively) more resistant than the same treatments applied to free resting eggs.

Although chlorine bleach was 100% effective in killing resting eggs, bleach should not be used for disinfection of Cp near any lake because of its toxic effects on aquatic life and it can also damage boat equipment and gear. If chlorine bleach is to be used to disinfect a boat or gear, make sure that no bleach is applied where it can enter ground or surface water.

Cercopagis

The most environmentally friendly control measures are dessication and boiling water or steam cleaning. These disinfection agents are most highly recommended. For dessication alone to be effective against Cp introduction, it is recommended that the boat or equipment be completely air-dried for at least a week (up to a month) prior to relocating the gear to another waterbody. In contrast, dessication treatment against zebra and quagga mussels can be effective within 2 to 4 days, in direct sunlight.

- If you are not planning to steam clean or use the dessication method, please apply some of the less effective (but more environmentally damaging!) treatments. Examples are boat cleaners, vinegar, salt water. These can be used in combination (but do not mix), away from the water body, prior to moving the boat or equipment agents in combination, but separate applications, to insure a more effective disinfection.
- After fishing, all live bait and bait water should be dumped on dry land before transport of boat and gear to another water body. Cp resting eggs can pass through the digestive tract of fish unharmed.
- Drain and clean motor; disinfect the following using recommended agents: bilge, transom, live wells, bait buckets, fishing apparatus and gear.
- Examine the boat, anchor lines, fishing lines, trailer and gear and remove all mud, plant fragments from boat, and equipment. Remove any Cp "goop."
- The temperature range when Cp is present in the water body during the year, as mentioned earlier, lies between 63° to 66°F (17 to 24°C) in the early summer and 61° to 55°F (16° to 10°C) in the fall. However, because zebra and quagga mussels may also be present, it is recommended that suitable disinfection agents be applied throughout the boating season.

Acknowledgements

We thank: Ted Lewis, SUNY Brockport, and Mike Snyder, SUNY ESF, for assistance in the field collection of *Cercopagis* samples; Chuck O'Neill, NY Sea Grant, for valuable review comments; Ed Sander, Monroe County Fisheries, Advisory Board for advice on boat cleaning compounds used in this study; Elizabeth Damaske, SUNY Brockport, for laboratory processing of field samples; Kara Lynn Dunn and Sharon O'Donovan, for layout of this publication. The supporting research and publication costs for this fact sheet were funded by a grant (R/CMB-28) from New York Sea Grant. Additional free copies of this fact sheet are available from:

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