Facilities
Tech Tips

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Got Duckweed? Get Carp!

Kathleen Snodgrass, Project Leader

The Forest Service provides wastewater treatment using lagoons at more than 100 ranger stations, work centers, and recreation sites. At many of these sites, one or more lagoon cells (figure 1) are infested with duckweed, which must be thinned frequently using a rake or skimmer to keep the lagoon functioning effectively.

Duckweed is the common name of a large family of small, floating water plants (*Lemnaceae*) that love nutrient-rich environments such as wastewater treatment lagoons. While duckweed is efficient at removing nutrients from

Highlights...

- Duckweed grows profusely in sewage lagoons and must be removed frequently.
- Triploid grass carp remove duckweed inexpensively.

Figure 1—In June 2006, the second cell (bright yellowish green) of the wastewater lagoon at the Red River Ranger Station near Elk City, ID, was choked with duckweed. Triploid grass carp were released into the lagoon later that month.

For additional information, contact: *Kathleen Snodgrass, project leader; USDA Forest Service, MTDC; 5785 Hwy. 10 West; Missoula, MT 59808–9361. Phone: 406–329–3922; fax: 406–329–3719; e-mail: ksnodgrass@fs.fed.us*

wastewater, it must be raked regularly to remove dead plants that would add to the nutrient load. Employees maintaining a Forest Service wastewater treatment lagoon struggled with duckweed removal for nearly 30 years before solving their problem last year. Here's the secret of their success.

Ralph Gormley, the maintenance technician for the Red River District of the Nez Perce National Forest in the Northern Region, attended a wastewater training course taught by Ray Hyde (*http://www.idahooperatortraining.com/*). At the time, Hyde was the public works director for the city of Hailey, ID. Hyde explained that triploid grass carp can control duckweed and other aquatic plants by eating them. Triploid carp cannot multiply, but will live for 8 or more years and grow to 30 pounds or more if they get enough to eat. Triploid grass carp that are 8 to 10 inches long cost about $20 each if only a few are purchased, but are less expensive if ordered in large quantities. The carp are voracious, and may eat the plants faster than the plants can regrow.

Gormley was able to prove that the lagoon configuration at the Red River Ranger Station would prevent the fish from getting into the Red River nearby. The lagoons are fenced to keep animals and people out. Water is discharged through a batch sand filter (a set amount of water goes in every so often and the rest of the time it's dry) with a bottom drain under 3 feet of sand. The filtered water is dosed with chlorine and discharged through a 200 foot-long ditch that is normally dry. Except in unusual conditions, the discharge water is absorbed through the soil under the ditch rather than entering Red River directly.

Gormley obtained a private pond permit for triploid grass carp from the Idaho Department of Fish and Game and ordered seven carp, the number recommended by the fish farm, based on the lagoon's size. He was sent nine carp. All the carp arrived healthy and were released into the lagoon.

After about a year, the carp had eliminated almost all the duckweed on the lagoon (figure 2). Gormley suspects that

Figure 2—By June 2007, the triploid grass carp had almost completely eliminated the duckweed in the Red River wastewater lagoon.

the fish have probably tripled in size, but may soon die because they've eaten all of their food. More carp will need to be purchased if the duckweed returns. Still, paying $140 for fish every few years is much cheaper than the cost of wages for raking duckweed off the lagoon every week. The presence of the triploid grass carp did not change the effectiveness of the wastewater treatment process.

Figure 3—A young grass carp looks similar to a pale goldfish. (University of Michigan Fish Specimen Image Collection, used with permission.)

Using Grass Carp Requires Caution

Grass carp (figure 3), also known as white amur (*Ctenopharyngodon idella*), are plant-eating fish native to the Amur River basin in Russia and China. They can live in water temperatures from 34 to 95 degrees Fahrenheit. Duckweed isn't their favorite food, but grass carp will eat it and thrive. They prefer grazing on a variety of pond weeds, musk grasses, and elodea, and may even eat water lilies and cattails if that's what's available. Because they eat so much of so many types of plants, releasing fertile grass carp into natural waters could be a disaster. That's why most States only allow carp that are triploid to be used for vegetation control and, even then, only under certain conditions.

Triploid carp have a third set of chromosomes, which prevents them from reproducing. Triploid fish are created by subjecting fertilized fish eggs to a temperature or pressure shock. After the fish have hatched, a blood test can determine whether they are normal (diploid) or triploid. You can learn more about testing triploid grass carp at *http://www.fws.gov/warmsprings/FishHealth/frgrscrp.html*.

Only purchase grass carp that are certified by the U.S. Fish and Wildlife Service to be triploid and disease free. Other carp may carry disease or be capable of reproducing. Certification is important because accidental releases can occur due to unsuccessful predation, floods, or other causes. For instance, an osprey could catch a fish from a lagoon and drop it into a stream nearby. Introduced grass carp already have altered aquatic habitats in several areas, harming native species.

Grass carp shorter than 4 inches eat bugs as well as plants and aren't very efficient at removing duckweed and other aquatic plants. Predators also tend to kill more of the small fish. The best size carp for removing plants in a pond or lagoon is from 8 to 11 inches long.

In most States, permits are required to possess or stock nonnative fish such as triploid grass carp. In some States, a fish transport permit and environmental documentation may be required. Both normal (diploid) and triploid grass carp are prohibited in New Jersey and New Hampshire.

Aquatic farms produce triploid grass carp in most regions of the United States, although they are most common in the Southeast. Some States that allow triploid grass carp to be used don't allow aquatic farms to breed nonnative fish such as grass carp. Suppliers of carp in your area can be found by searching the Web. Gormley obtained carp for the Red River lagoon from:

Opaline Aqua Farms
Otto and Sharon Cunningham
9347 Fish Pond Lane
Melba, ID 83641
Phone (208) 495–2654
Gormley's contact was Rich Cunningham.

The contact information above is provided for the convenience of the reader and does not constitute an endorsement.

More Information About Grass Carp

More information about using triploid grass carp to control aquatic plants is available from:

- Washington State Department of Ecology (*http://www.ecy.wa.gov/programs/wq/plants/management/aqua024.html*)
- University of Florida (*http://edis.ifas.ufl.edu/FA043*)
- West Virginia University (*http://www.wvu.edu/~agexten/aquaculture/triploid.htm*)

About the Author

Kathleen Snodgrass came to MTDC as a project leader in 2001. She received a bachelor of science degree in architectural studies from Washington State University in 1974 and then spent 10 years in highway design and construction with the Idaho Division of Highways. She began her career with the Forest Service in 1984. Snodgrass worked in facilities, landscape architecture, land line, and general engineering on the Nez Perce National Forest for 10 years, and was the forest's facilities architect for 7 years before coming to MTDC.

Library Card

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Many Forest Service wastewater treatment lagoons are infested with duckweed, which must be removed regularly to keep the lagoon functioning properly. This tech tip explains how triploid grass carp can be used in most States to remove duckweed inexpensively, providing that precautions and regulations intended to prevent the accidental release of triploid grass carp are followed.

Keywords: aquatic weeds, biological treatment, duckweed, facilities, grass carp, lagoons, sewage treatment, triploids, waste water, waste water treatment, wastewater

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http://www.fs.fed.us/eng/t-d.php

Forest Service and Bureau of Land Management employees can search a more complete collection of MTDC's documents, videos, and CDs on their internal computer networks at:

http://fsweb.mtdc.wo.fs.fed.us/search/

For additional information about controlling duckweed in wastewater lagoons, contact Kathleen Snodgrass at MTDC:

USDA Forest Service, Missoula Technology and Development Center
5785 Hwy. 10 West
Missoula, MT 59808–9361
Phone: 406–329–4719
Fax: 406–329–3922
E-mail: *ksnodgrass@fs.fed.us*

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