Chara spp. and *Nitella* spp.

Chara and nitella

Family: Characeae
Range: Throughout North America.
Habitat: Ponds, lakes, reservoirs, rivers, streams, bogs, canals, and rice fields. Some species inhabit brackish water. Chara often grows in hard water.
Origin: All species are native to North America.
Impacts: Chara and nitella provide food and cover for wildlife and are important components of natural aquatic ecosystems. These algae sometimes grow in rice fields and canals, but are rarely of importance as weeds. At first glance, chara and nitella are easily mistaken for vascular aquatic plants.

These submerged plant-like green algae are usually anchored to the substrate by well-developed, colorless rhizoids. There are several species that occur in various regions of the western United States. Central axes of chara and nitella are regularly jointed, solid between nodes, with whorls of branches at each node, to 12 inches long or more. These algae do not have leaves. *Chara* species are typically coarse, gray-green, sometimes encrusted with carbonates, making plants rough to touch, and often have a garlic or skunk-like odor. *Nitella* species are usually dark green, delicate, never encrusted with carbonates, and lack an unpleasant odor.

These species reproduce vegetatively from fragmentation and sexually by egg cells and motile sperm. After fertilization, the zygote (oospore) remains dormant for a period before germination occurs.

NON-CHEMICAL CONTROL

Mechanical (pulling, cutting, dredging)	Repeated mechanical harvesting can help reduce stem densities, but escaped stem fragments can drift elsewhere and develop into new plants. Removing and destroying stem fragments from recreational equipment such as boat propellers, docking lines, and fishing gear can help prevent the spread of chara and nitella. Several types of "bottom barriers" are available to cover and smother specific infested areas. Materials used include polyvinyl chloride (PVC) sheets, small-mesh screens and natural fibers such as jute and burlap. Bottom barriers are best installed in spring before plants produced large biomass and exceed 10 inches tall.
Cultural	Reducing nutrient inputs can help prevent invasion. Establishment of native pondweeds or other native submersed plants can reduce space and light needed by chara and nitella.
Biological	Triploid (sterile) grass carp is the only effective biological control agent available for these two algal species, but it is relatively nonselective and state or local permits are usually required. If other native plants are desired, careful monitoring of feeding impacts should be part of the management program so that grass carp can be removed (or added) as needed.

CHEMICAL CONTROL

The following specific use information is based on reports by researchers and land managers. Other trade names may be available, and other compounds also are labeled for this weed. Directions for use may vary between brands; see label before use. Herbicides are listed by mode of action and then alphabetically. The order of herbicide listing is not reflective of the order of efficacy or preference.

CONTACT PHOTOSYNTHETIC INHIBITORS	
Diquat *Reward*	**Rate:** 0.1 to 0.25 ppm **Timing:** Apply directly to water in late spring to early summer. Diquat is a fast-acting contact herbicide that can also be effective in mid- to late summer, but if biomass is large, only a portion of the infested sites should be treated to minimize effects of reduced dissolved oxygen. **Remarks:** Diquat is quickly bound to, and becomes inactivated on, suspended clay particles and it should not be used in moderately or highly turbid water.
Flumioxazin *Clipper*	**Rate:** For in-water treatment: 100 to 400 ppb **Timing:** Apply directly to water from early spring to early summer, during the plants' rapid growth phase. **Remarks:** Flumioxazin is rapidly degraded and is inactive if pH exceeds 8.5. Thus, it is important to use only if pH will not exceed 8.5. It is best to apply flumioxazin in the early morning when the pH is low.
INORGANIC HERBICIDES	
Chelated copper *Cutrine-plus*, *Nautique*	**Rate:** 0.5 to 1 ppm elemental copper **Timing:** Apply directly to water in early summer (short plants and small biomass). **Remarks:** Chelated copper is a fast-acting contact herbicide. Retreatment may be required within 3 to 5 weeks. If biomass is large, treat only one-third of infested area to minimize decrease in dissolved oxygen. Chelated copper products are less affected by high pH than inorganic copper products (see "Inorganic copper" below).
Inorganic copper Various granular and liquid products	**Rate:** 0.5 to 1 ppm elemental copper **Timing:** Apply directly to water in early summer (short plants and small biomass). **Remarks:** Copper is a fast-acting contact herbicide. Retreatment may be required within 3 to 5 weeks. If biomass is large, treat only one-third of infested area to minimize decrease in dissolved oxygen. Most inorganic copper formulations have poor efficacy in "hard water" (e.g. > 125 ppb calcium carbonate equivalent) and high pH (> 8).
NON-HERBICIDAL CHEMICALS	
Dyes or colorants *Aquashade*	Although technically not herbicides, dyes and colorants control submerged aquatic plants by absorbing light in the water column and reducing photosynthesis. Applications should be made in early spring and repeated to maintain concentration recommended on the label. Colorants are not as effective on well-established plants in mid- to late summer.

RECOMMENDED CITATION: DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center, University of California. 544 pp.