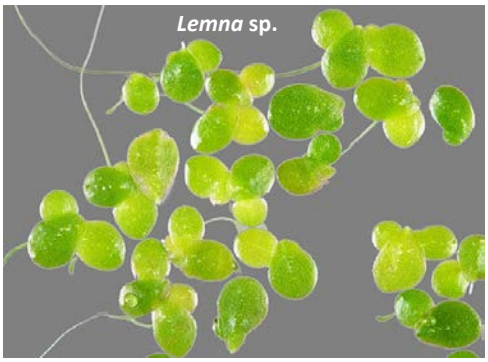
Lemna spp.; duckweeds
Spirodela spp.; duckweeds and duckmeats
Wolffia spp.; watermeals

Duckweeds, duckmeats, and watermeals


Lemna sp.


Spirodela sp.

Family: Lemnaceae
Range: Throughout the United States.
Habitat: Ponds, lakes, slow-moving streams, ditches, and canals, sometimes on mud. Inhabit freshwater with intermediate to high nutrient levels. Tolerate a broad pH range and heavy shade. Grow best under warm conditions.
Origin: All species are native in the western states, and most are widespread in other areas of the United States and elsewhere. Common duckweed, duckmeat, and a few other species occur nearly worldwide.
Impacts: Common duckweed is used as animal feed in Asia and in bioassays to detect water pollution levels, because it can sequester certain pollutants. Duckweeds are common in the aquarium and ornamental pond trade. All duckweed, duckmeat, and watermeal species are a valuable food source for wildlife, especially waterfowl. In irrigation canals they can form dense colonies and clog filters, and in ponds with high organic matter duckweeds can grow rapidly and cover the surface in a very short time.

The Lemnaceae includes three genera of similar plants that often grow together. These are duckweed (*Lemna* spp.), duckmeat or giant duckweed (*Spirodela* spp.), and watermeal (*Wolffia* spp.). All are very small floating perennials, often growing in clusters and forming dense colonies. The plant bodies are stems, often called fronds, typically in pairs or trios and slightly obovate and succulent. Daughter fronds bud from a marginal pouch on each side at the base of the parent frond. Roots vary with the genus. *Wolffia* has no roots, *Lemna* has one root and *Spirodela* has more than two roots.

Flowers are minute and are rarely even seen. Fruits are very small and are not generally important in reproduction of the Lemnaceae. Plants primarily reproduce vegetatively by budding. During the warm season the rate of budding can be very high, with each plant producing a daughter plant about every 3 days. Plants and seeds typically disperse with water or by clinging to the feet, fur, and feathers of animals. Some members of the Lemnaceae, particularly *Spirodela* and *Wolffia* species, develop minute winter buds (turions) that separate from the mother fronds and sink to the sediment. As the water warms in spring, the buds float to the surface.

NON-CHEMICAL CONTROL

Mechanical (floating booms, suction devices)	Manual or mechanical removal can help control troublesome colonies. For small infestations (1 to 2 acres), floating booms can be dragged (preferably "down wind") from the shore or pushed by boats to consolidate mats of duckweed that can then be removed with rakes. These duckweeds provide good composting material. In large lakes, mechanical harvesters equipped with surface "skimmers" or surface suction devices can remove mats.
Cultural	Use of water-circulation devices can sometimes reduce accumulation of large biomass. Reducing nutrient inputs can also be helpful (e.g. divert runoff from turf or other areas that provide nutrients).
Biological	Biological control organisms for the control of duckweeds include ducks, fish, turtles and crustaceans (water shrimp, crayfish, ostracods, freshwater prawns, daphnia, amphipods, etc.). The triploid (sterile) grass carp

	(white amur) is a relatively nonselective herbivorous fish that will consume duckweeds and other small floating plants (e.g. *Azolla*). The fish do not selectively feed on "non-native" plants so careful monitoring of feeding impacts is necessary. There are a number of other species of freshwater fish that eat duckweeds to supplement their diets.

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.

AROMATIC AMINO ACID INHIBITORS	
Glyphosate *Rodeo, Aquamaster*	**Rate:** 2% v/v solution *Rodeo* or *Aquamaster* for foliar treatment, with approved surfactant at 0.5% **Timing:** Postemergence from spring to mid-summer. **Remarks:** Glyphosate is a slow-acting, systemic herbicide. The *Lemna* species can often form thick mats which can prevent glyphosate (or other foliar-applied herbicides) from penetrating the canopy, and unexposed plants will reestablish the population.
BRANCHED-CHAIN AMINO ACID INHIBITORS	
Bispyribac-sodium *Tradewind*	**Rate:** 8 oz product/acre (6.4 oz a.i./acre). Repeated applications may be necessary, but allow 30 days between applications and apply up to 4 times per year. **Timing:** Postemergence from spring to mid-summer. **Remarks:** Slow-acting herbicide: may take 4 to 6 weeks for control.
Imazapyr *Habitat*	**Rate:** Broadcast treatment to emergent shoots: 2 to 3 pt product/acre (8 to 16 oz a.e./acre). Spot treatment: 1% v/v solution using 100 gal/acre for adequate coverage. **Timing:** Postemergence in early spring to early summer when new growth is present. **Remarks:** May require repeated applications to achieve desired effect.
Penoxsulam *Galleon*	**Rate:** 5.6 to 11.2 oz product/acre (1.4 to 2.8 oz a.i./acre). Apply in 20 to 100 gal spray solution/acre. **Timing:** Postemergence from spring to mid-summer. **Remarks:** Penoxsulam is a slow-acting herbicide and may take 4 to 6 weeks to achieve effective control.
PIGMENT SYNTHESIS INHIBITORS	
Fluridone *Sonar*	**Rate:** For in-water treatment: 10 to 30 ppb **Timing:** Apply directly to water from spring to mid-summer before large biomass has developed. **Remarks:** Fluridone is a slow-acting herbicide and may take several weeks to control. It needs a long contact period to achieve maximum effectiveness.
CONTACT PHOTOSYNTHETIC INHIBITORS	
Diquat *Reward, Redwing*	**Rate:** 2 to 4 lb product/surface acre (0.5 to 1 lb a.i./surface acre) **Timing:** Postemergence from spring to mid-summer. **Remarks:** Diquat is a fast-acting contact herbicide; repeated applications may be needed. *Lemna* species often form thick mats which can prevent diquat (or other foliar-applied herbicides) from penetrating the canopy, and unexposed plants will reestablish the population.
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 only use if pH will not exceed 8.5. It is best to apply flumioxazin in the early morning when the pH is low.

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.