# Category F: Aquatic Pest Control

## Aquatic Pest Control Learning Objectives

**THIS CATEGORY IS AVAILABLE ONLY TO NON-PRIVATE APPLICATORS BY TAKING A SEPARATE CATEGORY EXAM.**

**After studying this section, you should be able to:**

- ✓ **Identify the National Pollution Discharge Elimination System (NPDES) permit requirements for pesticide applications on or near water and the pesticide annual thresholds.**
- ✓ **Describe the classification of aquatic weeds.**
- ✓ **Explain the impacts of aquatic weed infestations.**
- ✓ **Identify aquatic weed management options.**
- ✓ **Describe management of aquatic invertebrate pests.**
- ✓ **Outline management of nuisance or pest fish.**

## Category F, Aquatic Pest Control

Category F, aquatic pest control, includes applications of pesticides to or near running or standing surface water bodies. It does not include applications to water for mosquito control; this is included in Category 9, Public Health Pest Control. Aquatic pests are found in and beside irrigation ditches, lakes, ornamental ponds, reservoirs, creeks and livestock water troughs. The major pest problem in the waters of Nevada is aquatic weeds. Introduced species of mollusks and nuisance or pest fish are also discussed in this chapter.

All Certified Applicators must keep records of all Restricted Use Pesticides that they apply for two years. Non-Private Certified Applicators that apply pesticides to **public lands** must keep records of both General Use and Restricted Use Pesticides that they apply for two years. For more information on record-keeping requirements, see the General Knowledge: Pesticides and the Law chapter of this manual.

**Category F, Aquatic Pest Control, is the category that concerns itself with aquatic weed pests and, to a lesser extent, aquatic animal pests, such as nuisance or pest fish, mollusks and other aquatic life.**

**Review drift prevention strategies in General Knowledge: Pesticides and the Environment chapter of this manual.**

**Review minimizing non-target organism effects in the General Knowledge: Pesticides and the Environment chapter of this manual.**

**For more information on the NPDES permit required for pesticide applications to or near water, contact the Nevada Division of Environmental Protection, https://ndep.nv.gov/water/water-pollution-control/permitting/nevada-pesticide-application-program**

As discussed in the General Knowledge: Pesticides and the Environment chapter of this manual, it is important to prevent pesticide drift. Drift prevention is vitally important when applying pesticides to or near surface waters. Drift can affect not only the application site but also downstream environments. Review drift prevention strategies in the General Knowledge: Pesticides and the Environment chapter of this manual.

As discussed in the General Knowledge: Pesticides and the Environment chapter of this manual, pesticides can affect non-target organisms. This may involve direct and immediate injury or may be due to the long-term consequences of environmental pollution. Valuable non-target plants, bees and other beneficial insects, pets, livestock and wildlife may be affected. Review the General Knowledge: Pesticides and the Environment chapter of this manual for important information on minimizing any non-target damage when applying pesticides to aquatic environments.

## NPDES Permit

The Clean Water Act (CWA) provides that the discharge of pollutants to waters of the United States from any point source is prohibited unless the discharge is in compliance with a National Pollutant Discharge Elimination System (NPDES) permit. Pesticide applications made to or near water are now considered point-source discharges and require a permit. The Nevada Division of Environmental Protection (NDEP) has issued NPDES General Permit NVG870001 for pesticide discharges in the State of Nevada. This permit authorizes qualified operators to discharge pesticides, including fungicides, herbicides, rodenticides, molluscicides and insecticides, to Waters of the United States, provided that they comply with the permit conditions. Permit conditions include annual thresholds:

- **In water:** 80 acres of treatment area per year. Applying a pesticide twice a year to a 10-acre site equals 20 acres of treatment for a year.
- **At water's edge:** 50 linear miles of treatment area per year. Treating both sides of a 10-mile-long ditch equals 20 miles of treatment.

For more information, contact the Nevada Division of Environmental Protection, https://ndep.nv.gov/water/water-pollution-control/permitting/nevada-pesticide-application-program.

## Aquatic Weeds

There are two types of aquatic vegetation that commonly become weed problems in Nevada. These are algae and flowering plants. They have different characteristics.

**Algae:** Algae are nonvascular plants that do not have roots, stems, leaves or flowers. They reproduce by spores, division or by breaking apart (fragmentation). There are three types of algae that occur in Nevada:

- **Microscopic algae**: Blooms of this type of algae discolor the water, giving it a pea-soup appearance. They may also cause red streaking at the water's surface.
- **Filamentous algae:** These algae form dense mats that either float freely or are attached to sediment or debris in the water. Filamentous algae are often the first aquatic weeds to appear in the spring.
- **Chara:** These algae are often confused with flowering plants because they attach to the sediments by structures that resemble roots. Chara has a brittle texture and is often called stonewort.

**Flowering Plants:** Aquatic flowering plants have stems, roots, leaves and flowers, and reproduce by seeds or vegetatively by plant parts such as rhizomes, stolons, tubers, turions (tuber-like structure) or roots. Aquatic flowering plants are divided into four distinct groups.

- **Submersed:** These flowering plants root in the sediment and live beneath the surface of the water. The only part of the plant to extend above the surface of the water is the flower. Examples include coontail, small pondweed, curlyleaf pondweed, elodea and Eurasian watermilfoil.
- **Rooted floating:** These flowering plants are rooted in the sediment. Some species have both submersed and floating leaves, while others have only floating leaves. The flowers of these plants are often large and occur on the surface of the water. Examples include spatterdock and water lilies.
- **Free-floating:** As the name implies, these flowering aquatic plants live unattached, floating on or near the surface of the water. Their roots take up nutrients directly from the water. Since they do not get their nutrients from the soil, these plants require waters that have a high nutrient content. Examples include duckweed and watermeal.
- **Emergent:** These flowering plants grow in shallow waters, typically less than 3 feet deep. These are the most serious of the aquatic weeds in Nevada. This group also includes shoreline vegetation. Examples include cattails, bulrush, arrowhead, perennial pepperweed (also known as tall whitetop) and purple loosestrife.

**Algae are nonvascular plants that do not have roots, stems, leaves or flowers. They reproduce by spores, division or by breaking apart (fragmentation).**

**Aquatic flowering plants have stems, roots, leaves and flowers, and reproduce by seeds or vegetatively by plant parts such as rhizomes, stolons, tubers, turions (tuber-like structure) or roots.**

**Aquatic flowering plants are divided into four distinct groups:**

- **Submersed**
- **Rooted floating**
- **Free-floating**
- **Emergent**

**Aquatic weeds:**

- **Cause flooding by clogging ditches and canals.**
- **Reduce water flows.**
- **Impair water quality.**
- **Displace native plants.**
- **Interfere with recreation and access.**
- **Affect aesthetics.**
- **Provide habitat for mosquitoes.**

**Factors that affect aquatic weed growth:**

- **Nutrients**
- **Sunlight**
- **Substrate**
- **Temperature**

**Impacts of Aquatic Weeds**

Many aquatic weed species were introduced from other continents, without their natural enemies to keep them in check. Consequently, they out-compete and displace native plants. Some aquatic plants cause foul-smelling waterways. Various species of microscopic algae are toxic to livestock. Reduced aesthetics may reduce property values in areas where ornamental ponds and streams are infested. Flooding may occur when drainage ditches and other waterways become clogged with aquatic weeds. Severe weed infestations trap silt, resulting in reduced capacities in reservoirs and ponds. Aquatic weeds may limit or even eliminate recreational activities, such as water skiing, swimming or fishing, in areas that are seriously infested. By blocking waterways and preventing proper drainage, aquatic weeds provide habitat for mosquitoes.

**How Aquatic Weeds Spread**

Seeds are spread by flowing water, animals and watercraft. Aquatic weeds also propagate by breaking apart as fragments, re-rooting, and growing from the broken portions. Many species of aquatic weeds are transported to uninfested bodies of water as fragments or seeds on contaminated watercraft, such as jet skis, boats and boat trailers. This is a common means of introducing aquatic weeds to weed-free lakes and waterways.

**Factors Affecting Aquatic Weed Growth**

- All plants require sunlight to survive. Waters that have limited light penetration because of depth or turbidity are inhospitable to aquatic weeds, particularly algae.
- Nutrients, such as nitrogen and phosphorus, are essential for plant growth. Nutrients enter water in many ways, including erosion from unstable soils and runoff from feedlots and urban areas. Nutrients may also enter water by other means, such as improper fertilizer applications.
- Plants do not grow well if the temperature is too high or too low.
- Aquatic weeds, like all living things, require space. Rooted species may not be able to become established if desirable plants occupy the bottom and perimeter of the watercourse, pond or lake. Avoid disturbing these areas to keep weeds in check. Bare ground around water invites the establishment of aquatic weeds.

## Aquatic Weed Management

**Prevention:** It is nearly impossible to prevent weed spread by wild animals or water. However, we can reduce the spread of aquatic weeds by carefully inspecting and cleaning watercraft and boat trailers when removing them from waters that are infested with aquatic weeds.

Aquatic weeds can also be controlled by altering one or a combination of factors that affect their growth. Nontoxic dyes are most effective in ponds that have no outflow. Dyes reduce the light available to the plants, inhibiting the growth of submersed plants and algae. The dye must be applied before plants begin growing in the spring. Light penetration is also limited by the depth of water. Waters that are 3 feet deep or more will have fewer aquatic weed infestations. Deepening ponds can help reduce weed infestations.

Prevent nutrient inputs into waterways and ponds by reducing runoff and stabilizing erodible slopes with vegetation. Maintain a buffer zone of at least 10 feet around the edge of ponds and waterways to help prevent aquatic weed growth. Do not apply fertilizers or pasture animals within the buffer zone. If nutrients are entering a pond from an incoming stream, settling ponds may be constructed upstream from the main pond. Nutrients trapped by the settling pond before they reach the main pond can be removed from the settling pond by periodic dredging.

Proper planning and construction of ponds or waterways can help prevent aquatic weed growth. Many aquatic weeds require stable soil to germinate and take root. Aquatic weed infestations can be prevented by using sand in ponds and watercourses. Sand shifts with water currents and does not allow seeds to germinate. Likewise, large gravel or boulders can be used in ponds or waterways. Emergent weed growth on the edge of ponds and waterways can be prevented by piling large boulders, also known as riprap, in the shallow areas on the water's edge out to a depth of about 3 feet. Weed infestations may also be prevented by installing plastic liners. However, inflow of nutrient-rich sediments may cover the liner and provide a substrate for the weeds to take root. Irrigation ditches are often lined with concrete to prevent weed infestations. This is done to reduce ditch maintenance, to improve flow and to reduce loss of water by seepage.

Good light penetration and somewhat warmer temperatures allow aquatic weeds to grow best in shallow areas at the waters' edge. Constructing ponds with steep banks that have slopes of 1:1 or 1:1.5 out to a depth of 3 feet will prevent weed establishment. However, steep banks may result in safety hazards, especially for small children and the elderly.

**Weed prevention methods:**

- **Reduce nutrient inflows.**
- **Place riprap around pond edges.**
- **Eliminate shallow areas.**
- **Clean watercraft.**
- **Line ponds or ditches.**
- **Construct nutrient settling ponds.**

**Most aquatic weeds are perennial plants. They will grow back quickly if their roots are not removed.**

**Mechanical removal can increase perennial weed infestations. Broken portions of the original plants can regenerate, resulting in more weeds. Always identify the weed and its life cycle before developing a control plan.**

**Only sterile grass carp may be released in Nevada. Permits are required and can be obtained from the Nevada Department of Wildlife, http://www.ndow.org/. Click on the Forms and Resources button.**

**Cultural Control:** If possible, partial pond draw-down or draining can be effective at controlling or reducing aquatic weeds. Roots that are dried out or exposed to freezing temperatures may die. For this method to be effective, the pond should remain empty for an extended period of time, usually in the winter months. Draw-down provides easier access for mechanical weed control, such as digging or burning. It also allows access to the plants for herbicide applications.

**Mechanical Control:** Physically removing small infestations is effective if plants are near the shoreline. Mechanical controls include cutting, pulling, digging and chaining weeds. Chaining is done by dragging a large chain through weed-infested water using boats or tractors. Mechanical weed harvesters remove weeds that are growing in deep waters. Mechanical control of weeds shows quick results, but there are some disadvantages. Most aquatic weeds are perennial plants and will quickly grow back if root systems are not removed. This results in the need for repeated management. Plants are often broken apart and fragmented during mechanical removal, which may result in plant regeneration and a bigger infestation. Mechanical control is often very costly and is most effective in small areas.

Burning can be effective and helps to increase water flow in ditches. Green vegetation is seared and then thoroughly burnt seven to 10 days later. Herbicide applications may be more effective on emergent weeds when old growth is removed by burning. This exposes new growth to the herbicide. Burn permits may be necessary in some areas, and the risk of wildfire is an issue.

**Biological Control:** Biological control of aquatic weeds includes the use of insects, waterfowl and fish that feed on vegetation. The most common biological control agent used to control aquatic weeds in Nevada is the white amur, also known as the grass carp. Grass carp are vegetarian fish used to control submersed weeds and algae. The number of fish needed depends on the degree of the weed infestation, the species of weed, the size of the pond and the size of the fish stocked.

A proper balance of plants must be maintained, because grass carp show preference for some plants over others and will graze the more palatable species before moving to less preferred ones. In some cases, grass carp may eliminate all submersed plants. Without adequate vegetation, fish will stir up silt, resulting in cloudy, unsightly water.

The Nevada Department of Wildlife issues permits for the stocking of grass carp. Requirements for the permit include that only triploid (sterile) fish may be introduced into a closed aquatic system. A closed aquatic system is a water body where fish are prevented from ingress (entering) or egress

(leaving) by erecting a natural or manmade barrier. Contact the Nevada Department of Wildlife for information on the process for permitting grass carp release.

**Chemical Control:** There are several factors to consider before making the decision to manage aquatic vegetation with herbicides.

- Use of the water to be treated (is it used for drinking water, etc.?)
- Species of the weed
- Stage of plant growth
- Effect on non-target species
- Characteristics of the water
  - Temperature
  - Turbidity
  - Depth
  - Velocity

Aquatic weed control with herbicides is often less expensive than other management measures. However, aquatic herbicide applications include restrictions on applications to recreational waters and drinking water sources. Remember that pesticide discharge permits (NPDES) are required. Also, there is much public opposition to pesticide applications in or near water. Finally, herbicides may affect non-target species, including desirable plants, invertebrates and fish.

After an herbicide application, natural decomposition of the dead plant material may deplete oxygen levels in the water, especially if there is a large amount of dead material. This may result in a fish kill. To reduce the risk, practice limited area application of pesticides. Apply pesticides to no more than one-quarter to one-third of the surface area at a time. Wait two weeks before the next application to allow time for plants to adequately decompose and the oxygen levels in the water to stabilize. These steps are also listed on pesticide labels. Read the label!

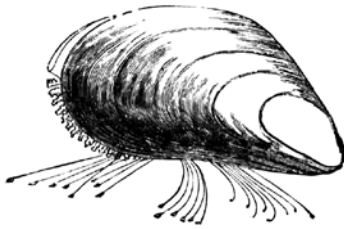
**Chemical Control of Flowering Plants:** Herbicides labeled for aquatic use are formulated as granules and liquids. Liquid formulations are applied as sprays and are used for rooted-floating, free-floating, and emergent weeds. Granular formulations are preferred when controlling submersed plants, because they sink to the bottom and perform similarly to soil treatments. Granular applications work best when applied uniformly. They may be broadcast from spreaders mounted on boats. Foliar sprays are best for rooted-floating plants. Products may be applied by aircraft, ground rigs or boats.

**Limited Area Application is the practice of treating only part of an aquatic infestation at a time to allow oxygen levels in the water to stabilize.**

**Liquid formulations are applied as sprays and are used to control rooted-floating, free-floating, and emergent weeds.**

**Granular formulations are preferred for controlling submersed plants, because they sink to the bottom and perform similarly to soil treatments.**

**Herbicide formulations change frequently. Check with your local dealer for the newest products available.**



Weeds growing on the bank and emergent weeds present the most serious aquatic weed problems in Nevada. Weed species vary depending on presence of moisture. Cattails and bulrushes grow in the water and at the water's edge. Weeds that do not require as much water, such as leafy spurge, perennial pepperweed (tall whitetop) and Canada thistle grow adjacent to water but are also found in much drier sites.

**Chemical Control of Algae:** There are herbicides are available for use in flowing irrigation systems. Copper compounds are also used in flowing water. Application of copper for algae control should be done early in the season, but only after the water temperature reaches at least 60 F. Thorough dispersal of copper compounds is essential to ensure effectiveness. Herbicides are also available to control algae in static, ponded water. Herbicide formulations change all the time. Check with your local dealer for the newest products available.

## Management of Nuisance Aquatic Invertebrates

Mollusks are a large group of invertebrates that include snails, slugs, clams, mussels and many other animals. While slugs and snails are often pest species in wet and humid areas, they pose a little to no risk in Nevada due to the dry climate.

Quagga and zebra mussels are freshwater aquatic mollusks native to the Black and Caspian Seas. Both species were first detected in the Great Lakes in the late 1980s. It is believed that the mussels were introduced to North America in ballast discharge water from transoceanic ships. Quagga mussels were detected in Lake Mead in 2007. Efforts are underway to prevent their spread to other water bodies in Nevada. As of 2021, neither species has been detected in Lake Tahoe. Efforts are underway to prevent their spread to Tahoe and other waterways in Nevada. In 2011, the Nevada Legislature passed Assembly Bill 167, requiring an Aquatic Invasive Species (AIS) decal for all motorized and non-motorized vessels capable of retaining water, such as canoes and kayaks. Paddleboards and float tubes are exempt. Go to https://www.ndow.org/wp-content/uploads/2021/11/Fisheries_kt_AIS-Decal-Brochure_current.pdf for more information.

Both quagga and zebra mussels are prolific filter feeders that reduce the microscopic plants and animals that form the base of the food web, ultimately disrupting the ecological balance of entire water bodies. In addition, both species are capable of displacing native mollusk species.

Quagga and zebra mussels attach to surfaces, such as piers, pilings, water intakes and fish screens. Intake structures become clogged, reducing water

flows to municipalities and power plants. The mussels colonize hulls, engines and other parts of watercraft, which then transport mussels to other water bodies. Boats and other watercraft are the primary routes by which quagga and zebra mussels are moved from infested areas to uninfested areas.

Watercraft must be immediately drained after leaving a water body to keep runoff that could contain quagga and zebra mussels from reaching storm drains and uninfested water bodies. Many water bodies now have either voluntary or mandatory "clean, drain and dry" orders for watercraft to prevent the spread of these invasive pests.

**Many water bodies now have either voluntary or mandatory "clean, drain and dry" orders for watercraft to prevent the spread of Quagga and zebra mussels.**

## Management of Nuisance and Pest Fish

Pest fish are often non-indigenous (exotic) species that were intentionally transported and introduced to a body of water. Introductions of pest fish often result in adverse economic or environmental impacts. Pest fish compete with native fish for food and other resources, and they often prey on desirable species. In addition, pest fish may introduce parasites and diseases into the native population.

Occasionally, desirable species may overpopulate a body of water, exhausting the food supply and resulting in stunted fish. An unusually high fish population, whether of desirable or undesirable species, requires some type of control. Fortunately, various techniques to control fish are available.

**Pest fish are often non-indigenous (exotic) species that were intentionally transported and introduced to a body of water.**

**Mechanical Control:** Barriers can be used to prevent movement of pest fish into new areas. Devices such as seines, nets and traps are used to remove undesirable species. Mechanical methods are rarely effective at eradicating pest fish but may be used to reduce their numbers. If eradication of the pest species is desired, draining the body of water or using pesticides will be necessary.

**Habitat Modification:** Species that have overpopulated a body of water or an undesirable species of fish can be eliminated from ponds, reservoirs, and lakes by draining the body of water. Partial drawdown of a pond during the winter months that results in a body of water freezing solid kills all fish in the pond.

**Chemical Control:** Often, mechanical control and habitat modifications are neither effective nor practical in reducing or eradicating a fish population. In this case, a pesticide application may be necessary. Pesticides used for fish control are called piscicides. The product most commonly used for control of pest fish contains the active ingredient rotenone. Various formulations, such as liquids and dusts, are available. You must contact the Nevada Department of Wildlife before initiating any chemical control of fish.

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**Read, understand and follow pesticide label directions.**

If possible, it is best to lower water levels in lakes and ponds prior to applying pesticides. This reduces the amount of pesticide needed and limits downstream flow. If treating only a portion of a body of water, such as a cove, it is important to begin the application at the farthest point from shore and work inward. This reduces the number of fish that are able to escape to deeper, untreated waters.

## Conclusion

Aquatic environments provide habitats for many species of fish, birds, mammals and plants. Occasionally, aquatic areas, such as waterways, ponds or lakes become infested with pest species, such as weeds and fish. These pests can have undesirable effects on the environment, including reduced water quality, flooding and competition with desirable species. Water from aquatic areas may eventually be used for domestic drinking water or agricultural irrigation. When considering control methods, it is essential to take into account downstream effects and impacts on beneficial uses.

Proper identification of the pest is essential. Assistance with species identification is available from the University of Nevada, Reno Extension or the Nevada Department of Agriculture. Once the pest has been identified, take the integrated pest management (IPM) approach for its control by considering multiple control methods. Consult the General Knowledge: IPM chapter of this manual for more information on IPM.

When applied properly, pesticides provide safe, economical and beneficial results. If applied improperly, pesticide products may cause environmental harm or adverse health effects to humans, animals and desirable plants. You must read pesticide labels thoroughly before purchasing and applying pesticides. Apply products according to the rates and only to sites that are listed on the label.

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