Goldfish Eradication from Stormwater Ponds Using Rotenone

Advisian
Worley Group

Stormwater retention ponds are a common feature to reduce sediment input from urban runoff into natural waters. However, these ponds provide high quality habitat for goldfish (*Carassius auratus*), and can be a source of invasion to surrounding waterbodies, particularly when populations become well-established. Invasive species in Alberta are managed by Alberta Environment and Parks (AEP), which has determined that facility owners and municipalities are responsible for managing invasive species in their stormwater management systems.

Goldfish Biological Traits

- **Tolerant** of water pollution, low dissolved oxygen, and poor conditions
- **Highly competitive** with rapid growth rate and generalist diet
- **Rapid reproduction** with high fecundity and spawning multiple times per season
- **Adaptable** – can reproduce sexually or asexually through gynogenesis

Once established goldfish populations are difficult to eradicate. Traditional fishing and management options can be used to control populations, but chemical treatment using rotenone piscicide has been the most cost-effective way to eradicate whole populations from ponds entirely.

Control Methods	Eradication Methods
Dewatering Freezing Traditional Fishing ▪ Seine/Gill Netting ▪ Electrofishing ▪ Minnow trapping	Pesticide Treatment (Rotenone)

Confirmation and Sourcing

Volume Estimation and Design Review

Regulatory Applications

Public Consultation and Notification

Site Access Control and Water Management

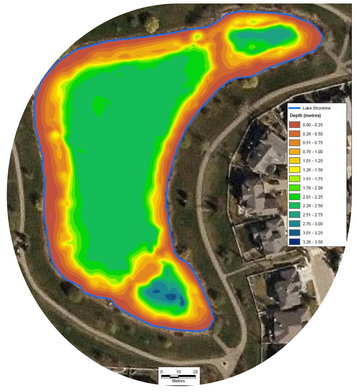
Rotenone Treatment and Fish Salvage

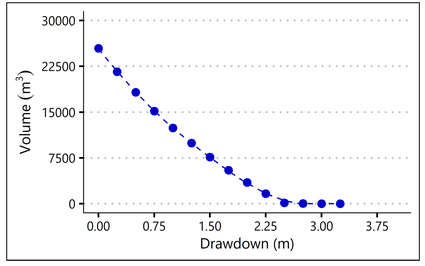
Confirmation and Source Identification

A qualified professional may need to confirm the presence of goldfish. Fish collection may be necessary where presence is suspected but not yet confirmed. Once confirmed, it is important to determine the source of the population to prevent re-establishment following eradication (e.g. connection to upstream ponds).

Advisian is working on strategies to use environmental-DNA (eDNA) to determine the presence/absence of goldfish. eDNA is used to detect and track at-risk and invasive species elsewhere in Canada, and continues to gain regulatory acceptance. Advisian hopes to use eDNA to determine goldfish presence more efficiently and conclusively, rather than using conventional, costly, labour-intensive fish collection methods.

Volume Estimation and Design Review





Water volumes are determined using detailed designs, as-builts, and/or volume tables when available. If design information is limited, then a bathymetric survey is used to measure pond volume. The decreasing relationship between volume at particular drawdown levels allows pesticide applicators to estimate volume quickly in the field immediately before treatment so as to achieve the desired concentration precisely.

Pond forebays, inlets, and outlets are identified during the design review. These features are important considerations for planning pesticide application methods, and specific volume/water level relationships may be required.

Regulatory Applications

Authorizations

- Approval for Deposit of Deleterious Materials for the Control of Aquatic Invasive Species
- Fish Research License (FRL)
- *Pesticide Special Use Approval (SUA) – Waterworks and stormwater systems are exempt from this requirement

Required Certifications

- Certified Pesticide Applicators - Special: Fish and Aquatic Invertebrate Certificate
- Pesticide Service Registration

Public Consultation and Notification

Stormwater ponds often are in populated areas that are readily accessible to the public. Therefore, public consultation and notification is integral to planning an eradication program using rotenone. Recommended engagement methods include:

- Hand-delivered notices to residents surrounding the water body
- Open houses
- Public notification (newspapers, website, and other media)

Notifications should include the following information:

- Reason for eradication
- Proposed dates
- Product information and risks
- Precautions to keep people and pets away from area
- What will occur (i.e. fish kills, fish floating on shore and water)
- Frequently Asked Questions

Site Access Control and Water Management

Fencing and signage are required for the duration of rotenone application (~6 weeks).
Signage must be installed at least 24 hours before treatment, and should be kept in place for 14 days after treatment.

Water-management planning should be part of the design review phase to ensure adequate equipment and labour can be sourced. Inflows, outflows, and springs must be identified, and plans must ensure enough capacity to divert stormwater runoff around the target pond during base-flow conditions and heavy precipitation events.

Drawing down the target pond before treatment is recommended to:

- Reduce application costs by minimizing rotenone volume and application time
- Improve effectiveness of treatment by removing potential refuges such as vegetated areas
- Avoid need to detoxify treated water by increasing dilution capacity before the pond reaches maximum operating water level

Rotenone Treatment and Fish Salvage

Initial Treatment
Application methods are determined by the characteristics of the stormwater pond, habitat present, and water level at the time of treatment. Most stormwater pond treatments use a modified gas-powered pump system to spray and mix rotenone from a boat. The water surface near shore is sprayed aerially because these areas often are shallow and well-vegetated. Advisian has a boat-mounted system for dispersing rotenone directly into the water column. This ensures the piscicide treat lower portions of the water column and other refuges where goldfish may otherwise be out of reach.

Application Method	Target Area
Surface Spraying (boat or shore)	Upper water column, near shore, submerged vegetation
Below-surface pumping	Lower water column, inlets/outlets, potential refuges
Drip Station	Flowing water, inlets/outlets
Backpack spraying	Shallow heavily vegetated shores and emergent vegetation

Fish Salvage
Approximately 1 hour after treatment starts, fish will begin to surface and become lethargic. Fish removal typically will begin then and will continue for 2 to 3 days depending on the number of fish present. Carcasses should be disposed of at a local landfill and immediately buried to prevent attracting wildlife.

Secondary Treatment

- Occurs 2 to 3 weeks after initial treatment
- Confirms success of initial treatment (no more dead larger fish) and targets fry that could hatch following the initial treatment because rotenone does not affect incubating eggs
- Rotenone concentration should be determined by laboratory analysis before the secondary treatment to ensure that the permissible target concentration is not exceeded

Cost-Efficiency and Collaboration

Advisian is able to support all stages of goldfish eradication programs and strives to minimize costs by using municipal personnel and resources where possible. Based on previous work, municipalities can realize substantial cost savings by using their own resources to assist with:

- Public notification and consultation
- Water management
- Fencing/Signage installation and removal
- Removal of dead fish for disposal
- Water sampling for lab testing of rotenone concentration