

CONSEQUENCES OF ROTENONE TREATMENT FOR BENTHIC FAUNA IN RASTADAMMARNA

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Degree project for Bachelor of Science with a major in Biology

BIO603 Biology: Bachelor's degree project (30 hec)

First cycle

Semester/year: Spring 2026

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Abstract

In 2024, goldfish (*Carassius auratus*) were discovered in the artificial ponds Rastadammarna, south of Gislaved, Sweden. These ponds function as natural treatment plants and absorb nitrogen from wastewater. The water ultimately exits the ponds into the natural waterway Nissan. The invasive goldfish pose a threat to local biodiversity due to their rapid reproduction, resilience and ability to outcompete native species. As the river Nissan is considered ecologically valuable and is of national interest for nature conservation, preventing the goldfish from spreading was of high priority. In collaboration with the Norwegian Veterinary Institute, the ponds were treated with rotenone to eradicate the goldfish. Prior to the treatment, a pre-treatment survey was conducted on the abundance and composition of zooplankton and benthic fauna. This thesis is a follow-up survey conducted nine months post-treatment to monitor changes in abundance and community composition of benthic fauna through sampling at two stations using the standardised kick-net sample method (SS-EN ISO 10870). The sampling took place in June 2026 and consisted of five quantitative subsamples per station and one qualitative sample. Both stations had high individual densities (3,396 and 2,507 ind./m², respectively), considerably higher than the pre-treatment levels of 1,537 ind./m² and 652 ind./m². With regard to species composition, rotenone-sensitive taxa like caddisflies and mayflies had decreased substantially, resulting in rotenone-tolerant species dominating. Species richness remained low at both stations, with 13 taxa each. The results suggest that functional diversity and community composition were altered by the rotenone treatment and/or the removal of the goldfish, whereas the total abundance of benthic fauna appears to have recovered relatively quickly.

Keywords: Rotenone, Benthic fauna, Invasive species, Goldfish (*Carassius auratus*)

År 2024 upptäcktes guldfisk (*Carassius auratus*) i de konstgjorda dammarna Rastadammarna, söder om Gislaved i Sverige. Dammarna fungerar som naturliga reningsanläggningar och tar upp kväve från avloppsvatten. Vattnet lämnar slutligen dammarna och rinner ut i det naturliga vattendraget Nissan. Den invasiva guldfisken utgör ett hot mot den lokala biologiska mångfalden på grund av sin snabba reproduktion, höga motståndskraft och förmåga att konkurrera ut inhemska arter. Eftersom Nissan anses vara ekologiskt värdefull och är av riksintresse för naturvården var det av hög prioritet att förhindra guldfisken från att sprida sig. I samarbete med Veterinärinstitutet i Norge behandlades dammarna med rotenon för att utrota guldfisken. Före behandlingen genomfördes en inventering av zooplankton och bottenfauna för att undersöka deras abundans och sammansättning. Denna studie utgör en uppföljande inventering som genomfördes nio månader efter behandlingen för att övervaka förändringar i bottenfaunans abundans och samhällssammansättning. Provtagning genomfördes vid två stationer med den standardiserade sparkprovetmetoden (SS-EN ISO 10870). Provtagningen ägde rum i juni 2026 och omfattade fem kvantitativa delprov per station samt ett kvalitativt prov. Båda stationerna uppvisade höga individtätheter (3 396 respektive 2 507 ind./m²), vilket var betydligt högre än nivåerna före behandlingen, som uppgick till 1 537 respektive 652 ind./m². När det gäller artsammansättningen hade rotenonkänsliga taxa, såsom nattsländor och dagsländor, minskat avsevärt, vilket resulterade i en dominans av rotenontoleranta arter. Taxarikedomen var fortsatt låg vid båda stationerna, med 13 taxa vid respektive station. Resultaten tyder på att den funktionella diversiteten och samhällssammansättningen har förändrats till följd av rotenonbehandlingen och/eller avlägsnandet av guldfisken, medan den totala abundansen av bottenfauna tycks ha återhämtat sig relativt snabbt.

Nyckelord: Rotenon, Bottenfauna, Invasiva arter, Guldfisk (*Carassius auratus*)

Introduction

Rotenone as a chemical management tool

In freshwater resource management, chemical treatment is often used to eliminate invasive fish species and protect native biodiversity (Kjærstad et al., 2022; Dalu et al., 2015). While the use of rotenone is generally forbidden in Sweden, special exemptions can be granted for conservation purposes. In Norway, for example, it is readily used to eliminate invasive fish species to prevent the spread of the salmon parasite *Gyrodactylus* (Kullingsjö, 2025; Kielland et al., 2025). According to Kielland et al. (2025), the Norwegian Veterinary Institute has achieved an almost 100% success rate using rotenone as an eradication method.

Rotenone acts by disrupting the electron transport chain in the mitochondria, thereby inhibiting cellular respiration. Because the toxin is efficiently absorbed through gill membranes, gill-breathing organisms are highly susceptible (Främberg et al., 2025).

Rotenone susceptibility, recovery and recolonisation of non-target benthic fauna

The impact of rotenone on benthic fauna depends largely on their respiratory systems. On one hand, highly sensitive species, such as mayflies, caddisflies and certain zooplankton, breathe through gills and absorb the toxin rapidly and efficiently. On the other hand, species that breathe using a plastron or through their cuticle, such as water bugs and diving beetles, are significantly less susceptible (Dalu et al., 2015). Dalu et al. (2015) mention crustaceans, such as crabs and crayfish, gastropods and diving beetles as highly tolerant species.

Previous studies on the effects of rotenone on non-target organisms have shown that while total abundance recovers relatively quickly, community composition can take significantly longer to return to pre-treatment levels (Kjærstad et al., 2022; Arnekleiv et al., 1997; Eriksen et al., 2009). For example, in the Fusta waterway in Norway, it was reported that even four years after the initial treatment, several sensitive taxa had still not recovered to their pre-treatment levels (Kjærstad et al. 2022). Similarly, Mangum & Madrigal (1999) observed that several rotenone-sensitive species were missing five years after treatment. In contrast, rotenone-tolerant species were briefly missing or not missing at all. Kjærstad et al. (2022) report that exposure time is more important to survival than the concentration of the toxin. While short-term river treatments showed minor impacts, a treatment conducted during autumn, where the cold temperatures caused a prolonged, low-dose leak of the chemical, impacted downstream lotic fauna substantially.

Recolonisation of benthic fauna after a disturbance, such as chemical treatment, can occur in several ways. Kjærstad et al. (2022) mention that Ephemeroptera and Plecoptera typically recolonise by rapidly drifting downstream from untreated parts upstream. Recolonisation success is also tied to the abundance of species in the local and regional species pools (Brederveld et al., 2011).

Rastadammarna and goldfish (*Carassius auratus*)

Rastadammarna are located south of Gislaved, Sweden, and cover roughly 0.2 km². The ponds are divided into four sections (Figure 1) and were constructed in 2006. The primary goal of these ponds is to serve as treatment plants, absorbing nitrogen from the wastewater being led into them through the process of denitrification, thus reducing the concentration of ammonium and nitrate nitrogen. The water flows from ponds A1 and A2 into B1 and lastly into C1 (marked with the black arrows in Figure 1). In section C1, the water exits the ponds and enters the natural waterway Nissan (Kullingsjö, 2025). To increase treatment efficiency, the ponds contain deeper sections (Figure 2), with a gradual difference in elevation. The deeper sections likely promote sedimentation, thereby allowing the settling and retention of phosphorus. In 2007, phosphorus concentrations in the wastewater exiting the ponds were reported to be 75% lower than at the inlet (Gislaveds kommun, 2008). During operational disturbances at the treatment plant, the ponds act as a buffer, preventing untreated water from exiting into the river Nissan (Kielland et al., 2025).

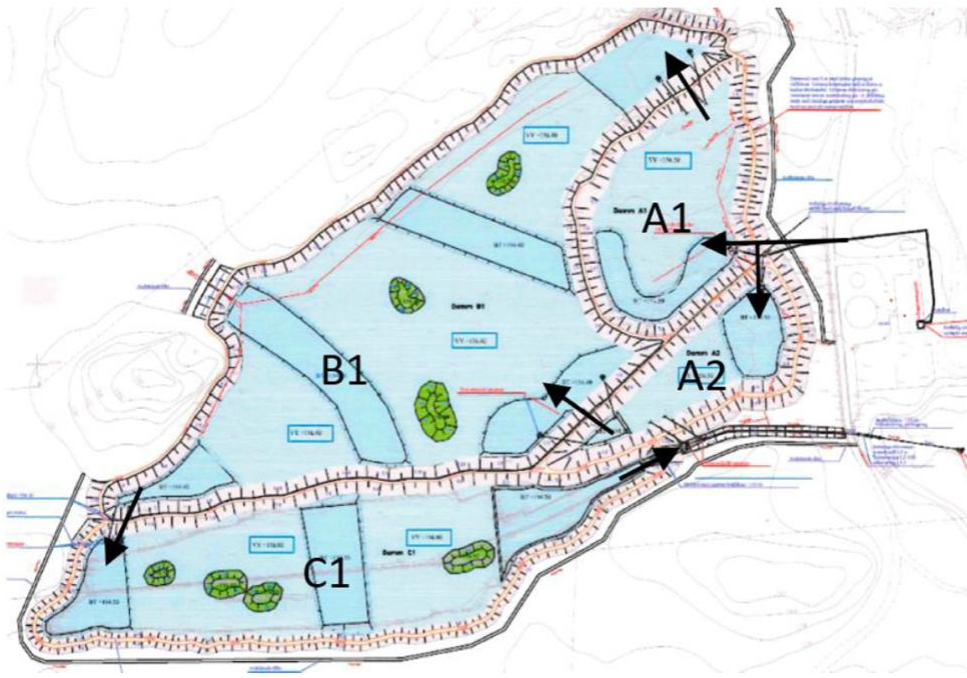


Figure 1. Map of Rastadammarna displaying section C and B where the kick-net sampling took place. Additionally, the map shows the flow of the water and the different sections of Rastadammarna (Främberg et al., 2025).



Figure 2. Aerial image of the ponds during construction, showing the deeper sections (Kullingsjö, 2025).

The area also serves as a recreational spot and supports a diverse birdlife (Kielland et al., 2025). The river Nissan, connected to the ponds, is also considered valuable for its high biodiversity and is of national interest for nature conservation (Kullingsjö, 2025).

Due to a reduction in other fish and an increase in fish-eating birds, it came to the attention of the municipality of Gislaved in 2024 that the goldfish (*Carassius auratus*) had established a reproducing population in Rastadammarna (Figure 3). It is believed that the goldfish escaped from the nearby wastewater treatment plant, where they were previously used to control the population of mosquitoes (Kullingsjö, 2025; Kielland et al., 2025). As the species has recently been classified as invasive in Sweden,

an investigation was conducted to prevent further spread to Nissan. The presence of goldfish was confirmed in the ponds using electrofishing conducted by the County Board, with individuals found as far as the waterway Nissan (Kielland et al., 2025). The invasive status is primarily due to their longevity and resilience as they reproduce rapidly, are omnivores, and can outcompete native species efficiently (Kullingsjö, 2025). As a result of the valuable ecological status of the nearby river Nissan, strict measures were put in place to prevent any negative impacts (Kielland et al., 2025).



Figure 3. Goldfish found at the exit of the ponds (Kullingsjö, 2025).

Several alternative eradication strategies were considered before rotenone was chosen. Kielland et al. (2025) and Kullingsjö (2025) explored several treatment options such as removal of fish, complete drainage of the ponds, and enlarging the already present population of northern pike (*Esox lucius*). Removal of the fish would have been a long and costly process and has rarely been proven successful. Kielland et al. (2025) argue that the use of chemical agents has been proven to be the most effective approach. A complete drainage of the ponds would have been a time-consuming and resource-intensive task. Furthermore, according to Kielland et al. (2025), the ponds would need to stay dry for an extended period, causing greater harm to the local fauna than the effects of chemical treatments. The introduction of the northern pike, which was already present in the ponds at the time the goldfish were discovered, was also considered a possible eradication method. However, Kielland et al. (2025) argue that the presence of pike can induce changes to the goldfish's behaviour and morphology, leading to less predation pressure. This was documented by Domenici et al. (2008) where northern pike was used against crucian carp (*Carassius carassius*).

Given their invasive status in Sweden, and because alternative eradication methods were deemed less effective or impractical, Kemikalieinspektionen and the County Board ultimately granted permission to use rotenone to eradicate the goldfish (Kullingsjö, 2025; Kielland et al., 2025).

The complete removal of fish in Rastadammarna can trigger a trophic cascade. Kielland et al. (2025) state that in previous studies an increase in algae-eating zooplankton was observed after the removal of the common roach (*Rutilus rutilus*). Likewise, in the pre-treatment study by Främberg et al. (2025), the ponds were under intense predation pressure from planktivorous fish. As the rotenone treatment removed all fish from the ponds, this pressure was subsequently lifted. This results in less predation pressure on zooplankton and benthic fauna.

Sweco survey on benthic fauna and zooplankton

Benthic macroinvertebrates are widely used as indicators of aquatic ecosystem health due to their varying sensitivities to stressors and to their sedentary nature (U.S. Environmental Protection Agency, 2025). This makes them suitable for assessing the ecological impacts of rotenone treatment. In September 2025, the municipality of Gislaved commissioned Sweco to conduct a pre-treatment survey of benthic fauna and zooplankton in Rastadammarna. The survey was conducted at four stations for benthic fauna (two in the littoral zone and two in the profundal zone) and one station for zooplankton (Främberg et al., 2025). The purpose of the survey was to establish pre-treatment conditions, allowing the recovery of benthic fauna and zooplankton to be monitored over time.

Aim

The aim of this study was to do a follow-up survey of the benthic fauna of Rastadammarna following the rotenone treatment. By studying the composition and abundance of taxa and comparing it to the survey done by Främberg et al. (2025), the consequences of rotenone for benthic fauna could be documented.

It is hypothesised that benthic fauna abundance will decrease shortly after treatment due to its toxic effects on aquatic invertebrates. Community composition and abundance of certain taxa are also expected to shift, where some taxa might be more affected than others based on their sensitivity to rotenone.

Material and method

The follow-up survey took place on the 4th of June 2026 at section C and B of Rastadammarna (Figure 1). The kick-net samples were taken from two stations (Figure 4), consisting of five quantitative subsamples and one qualitative sample for each station.



Figure 4. Kick-net sample stations marked with blue (station 1) and red (station 2).

Kick-net sampling

The kick-net sampling was done using a hand-net following the SS-EN ISO 10870 standard (SIS, 2012). Each of the five subsamples was sampled for one minute, for a total of five minutes of sampling per station. The individuals collected during the kick-net sampling were placed in containers filled with 96% ethanol for conservation of the samples. Thereafter, the samples were taken to the laboratory for counting and

identification by primarily using field guides (Mandahl-Barth, 1977; Mandahl-Barth, 1986; Olsen & Coulianos, 1999). A LEICA MZ12 stereomicroscope was used to aid in identification.

Index calculations

The abundance was calculated as individuals per square meter of sampled area. The sampling area was based on the opening of the D-shaped hand-net, measuring 30 cm in width and 15 cm in height. The area of the hand-net's opening was calculated as a semicircle ($(\pi * r^2) / 2$), yielding an area of 0.035 m². With five subsamples, the total sampled area was 0.177 m² per station. Density was calculated by dividing the total number of individuals by the total sampled area. The EPT-index was calculated as the total number of species or groups among Ephemeroptera, Plecoptera, and Trichoptera found at each station. The Shannon diversity index was calculated according to the formula $H' = -\sum(p_i * \log_2(p_i))$ where $p_i = n_i / N$.

Results

Kick-net sample 1

The individual density at station 1 was very high at 3,396 ind./m². The area was species-poor with 13 taxa. The EPT-index was very low at 3, as was the Shannon diversity index at 1.62. It was dominated by aquatic isopods (*Asellus aquaticus*) (Figure 5). A complete list of taxa can be found in Appendix 1 (Table 1x). In contrast, Främberg et al. (2025) reported a high individual density of 1,537 ind./m² and a total of 16 taxa. The EPT-index was low as well at 5, while the Shannon diversity index was slightly higher at 1.99. It was dominated by filter-feeding caddisflies, primarily the species *Hydropsyche angustipennis*, and earthworms in the family Oligochaeta (Figure 5).

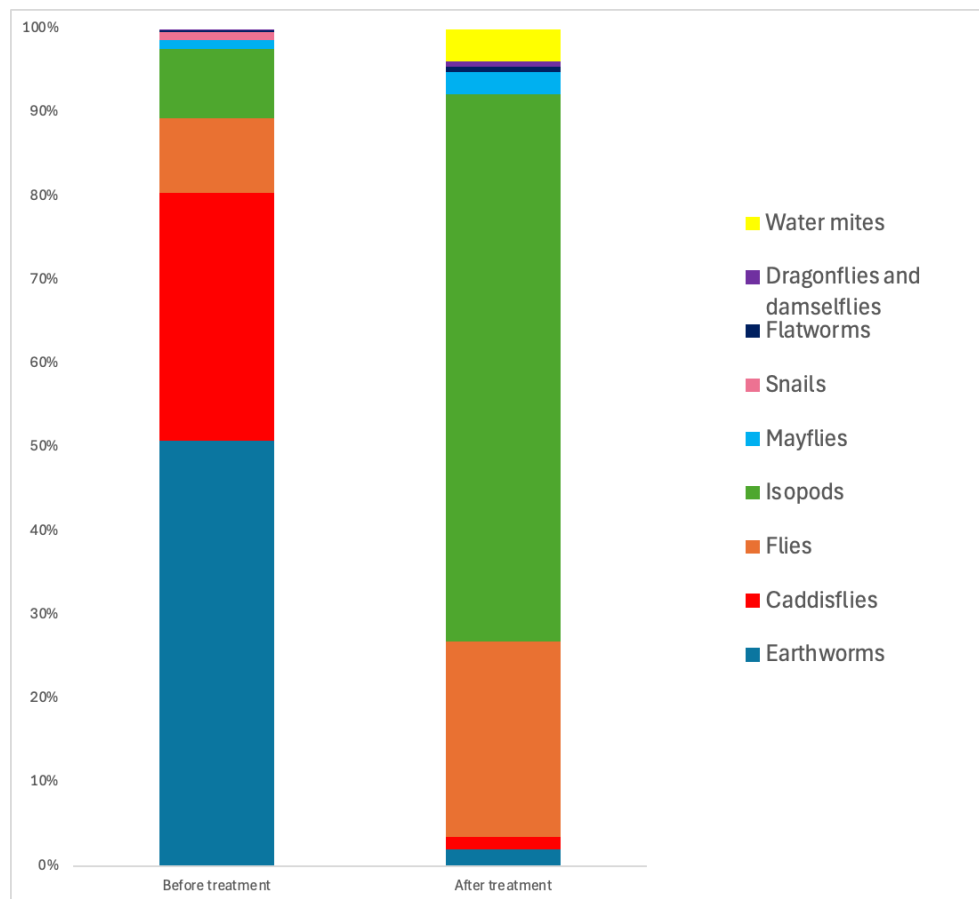


Figure 5. Relative representation (%) of benthic taxa in kick-net samples at station 1 before and after rotenone treatment. Pre-treatment data provided by Främberg et al. (2025).

The community composition of the kick-net samples at station 1 showed a large number of detritivores

(Figure 6). These primarily consisted of *Asellus aquaticus*. Similarly, the pre-treatment study was also dominated by detritivores but demonstrated a greater number of filter feeders (Figure 6).

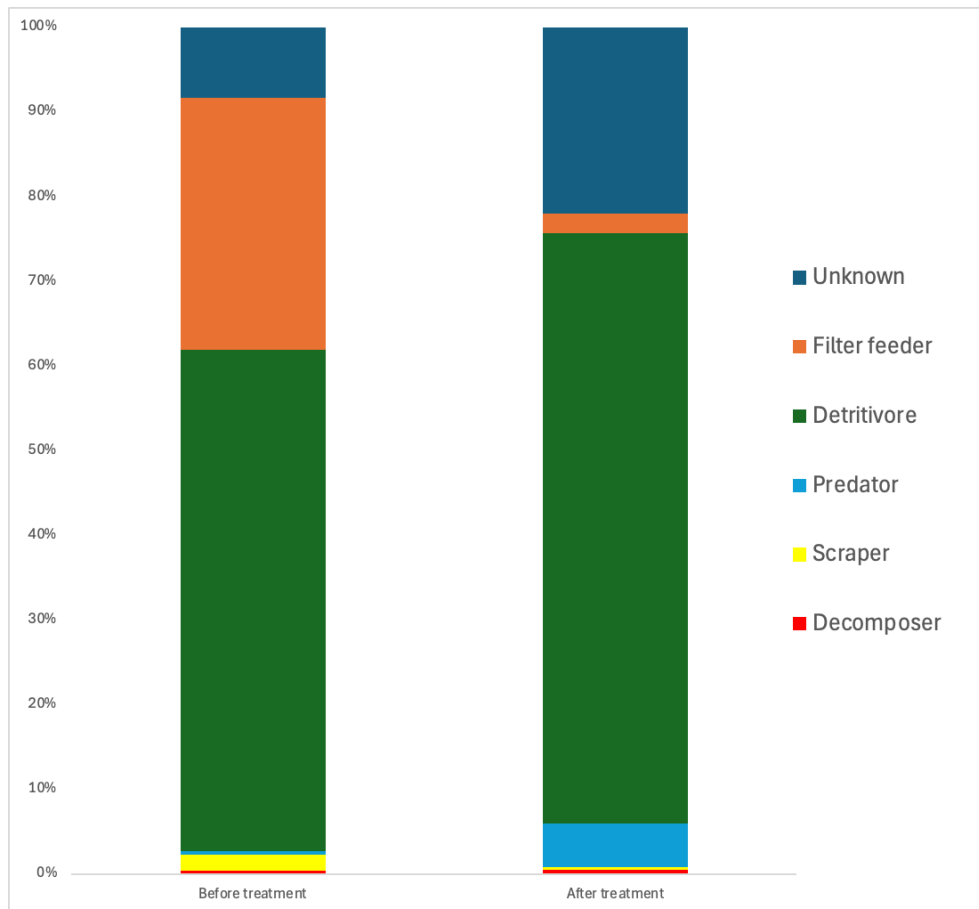


Figure 6. Relative representation (%) of trophic categories of benthic fauna found in kick-net samples at station 1 before and after rotenone treatment. Pre-treatment data provided by Främberg et al. (2025).

Kick-net sample 2

Kick-net sample station 2 displayed a high individual density at 2,507 ind./m² and species-poor with 13 taxa. The EPT-index was very low at 3 and the Shannon diversity index was also low at 2.30. A complete list of the taxa can be found in Appendix 1 (Table 2x). The community was dominated by flies (Diptera), predominantly by filter-feeding black fly larvae in the family Simuliidae (Figure 7). In comparison, Främberg et al. (2025) observed a relatively high individual density of 652 ind./m² and species-poor with 19 taxa. The EPT-index was very low at 6, and the Shannon diversity index was also low at 2.59. The samples reported by Främberg et al. (2025) contained predominantly mayflies followed by flies and isopods (Figure 7).

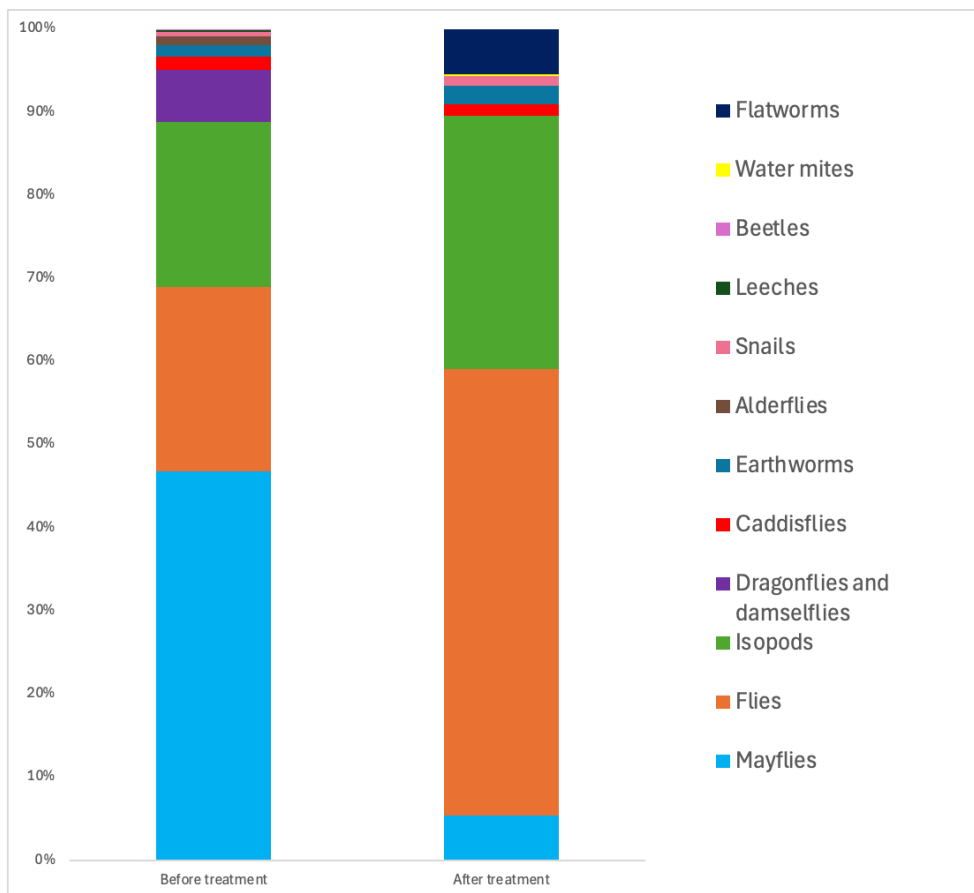


Figure 7. Relative representation (%) of benthic taxa in kick-net samples at station 2 before and after rotenone treatment. Pre-treatment data provided by Främberg et al. (2025).

The community composition was dominated by filter feeders in the family Simuliidae and detritivores like the aquatic isopod *Asellus aquaticus* (Figure 8). While the samples collected by Främberg et al. (2025) were also dominated by detritivores such as *Asellus aquaticus*, they also contained a large number of scrapers and a significantly lower amount of filter feeders (Figure 8).

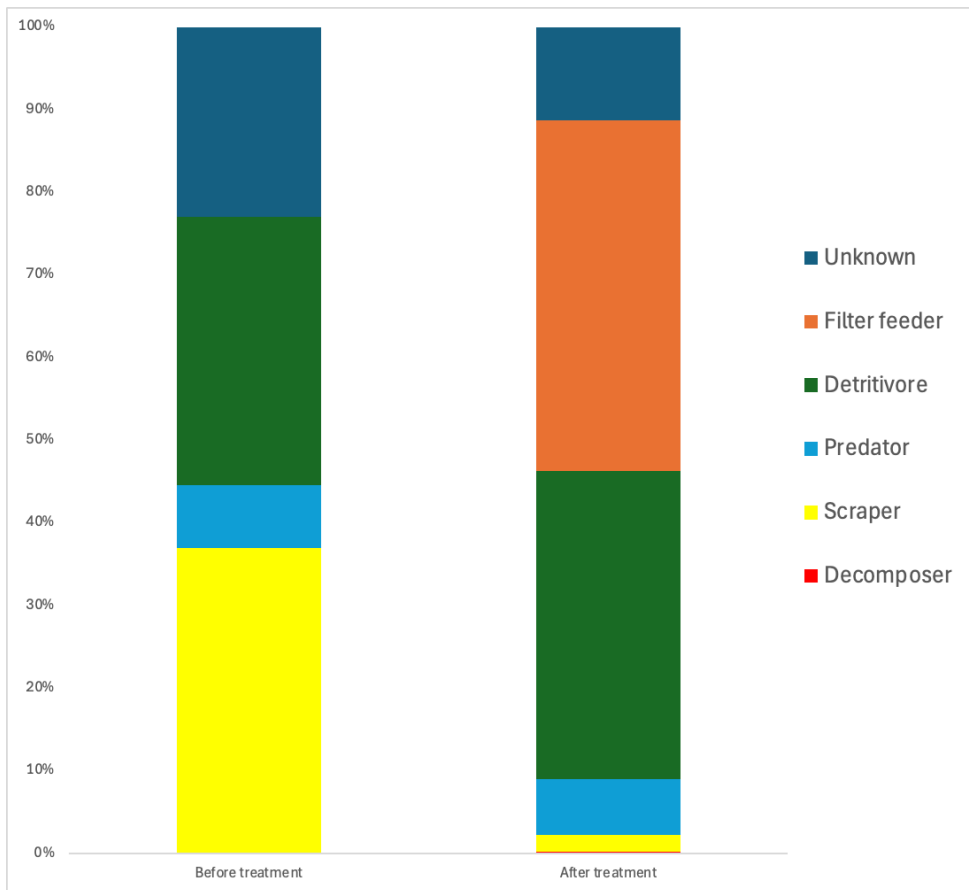


Figure 8. Relative representation (%) of trophic categories of benthic fauna found in kick-net samples at station 2 before and after rotenone treatment. Pre-treatment data provided by Främberg et al. (2025).

Discussion

The results obtained indicate a strong initial recovery in total abundance, but a shift in community composition. These findings agree with Kjærstad et al. (2022), who report that total invertebrate abundance generally returns to pre-treatment levels much faster than community composition and species distribution.

Främberg et al. (2025) reported high individual density (1,537 ind./m²) and relatively few (16) taxa at station 1. The primary functional groups at station 1 were, according to Främberg et al. (2025), detritivores and filter feeders consisting of earthworms and caddisflies. However, the samples in the follow-up study were dominated by aquatic isopods and flies in the family Chironomidae. Similar results were reported at station 2, with a relatively high individual density of 652 ind./m² and was species-poor with 19 taxa. The samples were dominated by mayflies, isopods, and flies. Therefore, the largest functional groups were scrapers and detritivores (Främberg et al., 2025). However, in this follow-up survey a smaller number of mayflies were found, with isopods and flies in the family Simuliidae dominating. This resulted in detritivores and filter feeders being the largest functional groups. The rare snail *Gyraulus crista*, identified by Främberg et al. (2025), was also found in the post-treatment samples.

The abundance of more sensitive taxa, like caddisflies and mayflies, has decreased while more tolerant groups like isopods, Chironomidae and black flies are dominating in the follow-up survey. This is reflected in the community composition at station 1 (Appendix 1, Table 1x), where it consisted primarily of *Asellus aquaticus* and Chironomidae, while Främberg et al. (2025) observed the filter-feeding caddisfly *Hydropsyche*. Similarly, at station 2 (Appendix 1, Table 2x) Simuliidae and *Asellus aquaticus* were dominating, whereas mayflies such as *Cloeon* had dominated the pre-treatment survey by Främberg et al.

(2025). At both stations the more sensitive taxa, mayflies and caddisflies, were reduced. This is reflected in the EPT-index, which decreased from 5 to 3 at station 1 and 6 to 3 at station 2. According to Dalu et al. (2015), mayflies experience 100% mortality at rotenone concentrations greater than 25 µg/L, with 100 µg/L being the target concentration in Rastadammarna by Kielland et al. (2025). Both caddisflies and mayflies experienced large depletions, corresponding to the findings of Dalu et al. (2015) on rotenone sensitivity of aquatic fauna. Gill-breathing organisms, such as caddisflies and mayflies, are more susceptible as they absorb rotenone rapidly, whereas plastron-breathers or those with open circulatory systems are less susceptible to the toxin (Dalu et al., 2015; Kjærstad et al., 2022). Kjærstad et al. (2022) found that the abundance can recover within eight months; however, species composition and distribution can take more than four years to return to its original place. This is evident from the Shannon diversity index, which declined from 1.99 to 1.62 at station 1 and from 2.59 to 2.30 at station 2, indicating a reduction in community evenness and diversity.

Recolonisation of benthic fauna in Rastadammarna may be constrained due to the isolated state of the ponds. As Rastadammarna have no upstream inlets, recolonisation depends primarily on aerial dispersal rather than downstream drift (Kjærstad et al., 2022; Brederveld et al., 2011). This may limit the recolonisation of certain taxa.

The goldfish posed a potential threat to the local fauna and ecosystem of the river Nissan due to its connection to Rastadammarna (Kielland et al., 2025). This was particularly concerning given its longevity, rapid reproduction, resilience and the ability to outcompete native fish species (Kullingsjö, 2025). The rotenone treatment successfully removed the goldfish population, thereby preventing its establishment and spread into Nissan. However, the treatment also caused a significant shift in benthic community composition, as observed in this study and in previous studies (Kjærstad et al., 2022; Arnekleiv et al., 1997; Eriksen et al., 2009). These effects on non-target organisms should therefore be considered when evaluating the use of rotenone to manage invasive species.

The substantially higher individual density compared to the survey by Främberg et al. (2025) is also a notable difference. This may be due to the difference in sample area as Främberg et al. (2025) sampled an area of 0.25 m² per subsample, while the area of the net's opening, corresponding to 0.035 m² per subsample, was used in the follow-up survey. Främberg et al. (2025) also collected a larger number of individuals, reaching 1,921 individuals in one sample and 815 individuals in the other. There are several factors that may explain this difference. The removal of the goldfish and, consequently, the remaining fish from Rastadammarna has released the predation pressure exerted by fish on the benthic fauna. It is therefore possible that benthic fauna and zooplankton densities have increased. Seasonal variation and small differences in sampling location and habitat conditions may also have contributed to the difference in individual density.

Limitations

Several limitations should be considered when interpreting the results. The pre-treatment and follow-up surveys were conducted during different seasons. The pre-treatment survey by Främberg et al. (2025) was conducted in September 2025, whereas the follow-up sampling was conducted in June 2026.

Macroinvertebrate communities can vary seasonally due to differences in the life cycles of individual taxa. Seasonal differences can therefore influence both the taxa detected and the community diversity (Hill et al., 2016; Bonacina et al., 2023). Natural seasonal variation in temperature, precipitation, and food availability may have influenced the results, and some of the observed changes may be due to these natural variations rather than the rotenone treatment.

Methodological differences between the surveys may also have affected the comparison. As previously mentioned, Främberg et al. (2025) sampled an area of 0.25 m² per subsample, whereas in the follow-up survey it was based on the 0.035 m² opening of the hand-net. Small differences in sampling location, such as the addition of new stones on top of the older ones at the waterfall between sections B and C, and local habitat conditions may also have influenced the abundance and composition of taxa.

The study cannot distinguish between the direct effects of rotenone and the indirect effects resulting from the removal of fish. The decline of rotenone-sensitive taxa, particularly mayflies and caddisflies, is consistent with the toxic effect of rotenone (Dalu et al., 2015). However, the removal of all fish within the ponds may at the same time have altered predation pressure. Eloranta et al. (2022) demonstrated that benthic communities in rotenone-treated lakes are shaped by both the direct toxicity of the rotenone and the indirect effects of fish removal. The higher overall densities across both stations in the present study may reflect reduced or absent fish predation, as well as other indirect ecological effects such as reduced competition or changes in food web dynamics. Eloranta et al. (2022) used a Before-After-Control-Impact (BACI) design to compare changes in rotenone-treated lakes with untreated lakes. The follow-up survey is limited to one pre-treatment and one post-treatment survey conducted during different seasons. There is also no data before the presence of fish in the ponds. Therefore, it is not possible to determine the community composition of benthic fauna in the ponds before the establishment of fish populations.

Furthermore, the sampling took place in the littoral zone only, meaning that the recovery of benthic fauna in the deeper parts remains unknown. Nevertheless, given the high densities at both stations, it is likely that the ponds have generally become dominated by rotenone-tolerant species. Further monitoring, including both littoral and deeper habitats, is needed to fully assess the recovery of benthic fauna across the entire pond system.

Conclusions

This follow-up study has documented the consequences of rotenone on the benthic fauna in Rastadammarna. Contrary to the hypothesis, total benthic fauna abundance did not decrease following rotenone treatment. Instead, abundance was higher than in the pre-treatment study. Community composition and abundance of certain taxa shifted, with sensitive taxa declining sharply and tolerant taxa becoming dominant. This study demonstrates that, in agreement with Dalu et al. (2015) and Kjærstad et al. (2022), abundance may recover quickly; however, the biodiversity and functional groups take longer to recover. As Främberg et al. (2025) recommended, further annual sampling should take place to monitor the recovery of the benthic fauna community.

Acknowledgements

I would like to thank Stina Kullingsjö and the municipality of Gislaved for the opportunity to do something I truly enjoy, which is working with nature conservation. I would also like to thank Sweco for providing me with a comprehensive report that served as a valuable reference throughout my work.

I'm especially grateful to my supervisor, Johan Höjesjö, for his support and guidance. Finally, I would like to thank my colleague, Elise Evertsson, who helped me with the field sampling and analysis of the dataset.

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Appendix 1

Table 1x. Complete species list including quantitative samples and the qualitative sample at station 1.

SPECIES/TAXA	SAMPLE		
	QUANTITATIVE	QUALITATIVE	%
ARACHNIDA, spiders			
<i>Argyroneta aquatica</i>	*	1	
ISOPODA, isopods			
<i>Asellus aquaticus</i>	392	50	65,3
DIPTERA, flies			
Chironomidae	132	11	22
Simuliidae	5		0,8
Tipulidae	3		0,5
EPHEMEROPTERA, mayflies			
<i>Cloeon dipterum</i>	2		0,3
<i>Caenis sp.</i>	14	1	2,3
HYDRACHNIDIA, water mites			
Hydrachnidia	23	8	3,8
ODONATA, dragonflies and damselflies			
<i>Libellula sp.</i>	1		0,2
<i>Coenagrion sp.</i>	2		0,3
<i>Ischnura sp.</i>	1		0,2
OLIGOCHAETA, earthworms			
Oligochaeta	12	3	2
TRICHOPTERA, caddisflies			
<i>Hydropsyche sp.</i>	9	4	1,5
TURBELLARIA, flatworms			
Turbellaria (Planariidae/DugesIIDae)	4	1	0,7
TOTAL (number of individuals):	600	79	100
TOTAL (number of taxa):	13	8	

* = taxa only found in qualitative sample

% = percentage found in samples based only on the quantitative samples

Table 2x. Complete species list including quantitative samples and the qualitative sample at station 2.

SPECIES/TAXA	SAMPLE		
	QUANTITATIVE	QUALITATIVE	%
DIPTERA, flies			
Chironomidae	50	8	11,3
Simuliidae	182	9	41,1
Tipulidae	1		0,2
Chaoboridae	5		1,1
EPHEMEROPTERA, mayflies			
<i>Caenis sp.</i>	20	5	4,5
<i>Cloeon dipterum</i>	4		0,9
GASTROPODA, snails			
<i>Ampullaceana balthica</i>	3		0,7
<i>Gyraulus crista</i>	2		0,5
HYDRACHNIDIA, water mites			
Hydrachnidia	1		0,2
ISOPODA, isopods			
<i>Asellus aquaticus</i>	135	4	30,5
ODONATA, dragonflies and damselflies			
<i>Libellula sp.</i> *		1	
OLIGOCHAETA, earthworms			
Oligochaeta	10	1	2,3
TRICHOPTERA, caddisflies			
<i>Hydropsyche sp.</i>	6		1,4
TURBELLARIA, flatworms			
Turbellaria (Planariidae/DugesIIDae)	24	1	5,4
TOTAL (number of individuals):	443	29	100
TOTAL (number of taxa):	13	7	

* = taxa only found in qualitative sample

% = percentage found in samples based only on the quantitative samples