

CASE STUDY

***Lagarosiphon major* – An Aggressive Invasive Species in Lough Corrib**

Introduction

Lough Corrib is the second largest lake in Ireland, occupying a surface area of 178 km². The lake comprises two main basins. The large upper lake (124 km²) supports a mean depth of 8.44m while the lower lake (54 km²) is significantly shallower, with a mean depth of 2.06m. The shorelines of both basins are deeply indented with large numbers of shallow, charophyte-dominated bays.

Lough Corrib (SAC Site Code 000297) is of major conservation importance and includes 12 habitats listed on Annex 1 of the EU Habitats Directive. The shallow, lime-rich bays of the lower lake support one of the most extensive beds of stonewort (Charophyte species) in Ireland. Lough Corrib supports a range of species listed on Annex II of the Habitats Directive including salmon, otter and slender naiad. It is also one of the top five sites in the country for wintering waterfowl, as the charophyte vegetation represents an important source of food for these birds. Furthermore, Lough Corrib is an internationally recognised wild brown trout fishery that attracts anglers from all parts of the globe.

Lagarosiphon major was first positively identified in Rinerron Bay, Lough Corrib, in April 2005. It is probable that the plant had been present in the bay for between 6 and 10 years, but only achieved nuisance proportions in 2005. Investigations conducted within the catchment have failed to determine how the plant arrived in Lough Corrib, although it is suspected that the source material came from an ornamental garden pond close to the lake. As a consequence of this important find, a *Lagarosiphon* Task Force was immediately established to assess the implications and to propose coordinated actions for the control of this highly invasive weed. The Task Force included personnel from the Central Fisheries Board, the Western Regional Fisheries Board, the National Parks and Wildlife Service, Galway County Council and the Office of Public Works.

***Lagarosiphon major* and its Impact on Indigenous Biotic Communities**

Lagarosiphon major is a native of southern Africa, where its biomass can interfere with commercial navigation and water-based recreation. It is a submerged, rooted perennial plant that can grow to a depth of 6.5m in clear water. It thrives in shallow, muddy, alkaline waters but is capable of establishing under most aquatic conditions. The roots are long (up to 50cm) and capable of penetrating deeply into the lake substrate. Single stems arise from the roots. These branch repeatedly as they rise through the water column, producing an extremely dense surface canopy. The stems are fragile and break easily under the influence of wind or wave action. This aids in the natural spread of the plant, as reproduction and dispersal are mediated solely *via* plant fragments (only female plants have been recorded in Ireland)

In those areas where *Lagarosiphon* is well established in Lough Corrib, preliminary studies have revealed that it has a significant negative impact on

indigenous macrophyte communities. Beneath the dense canopy cover produced by the plant, virtually no incident light can penetrate. Thus, in bays previously characterised by extensive charophyte meadows (Plate 1a), only *Lagarosiphon* is now present (Plate 1b).

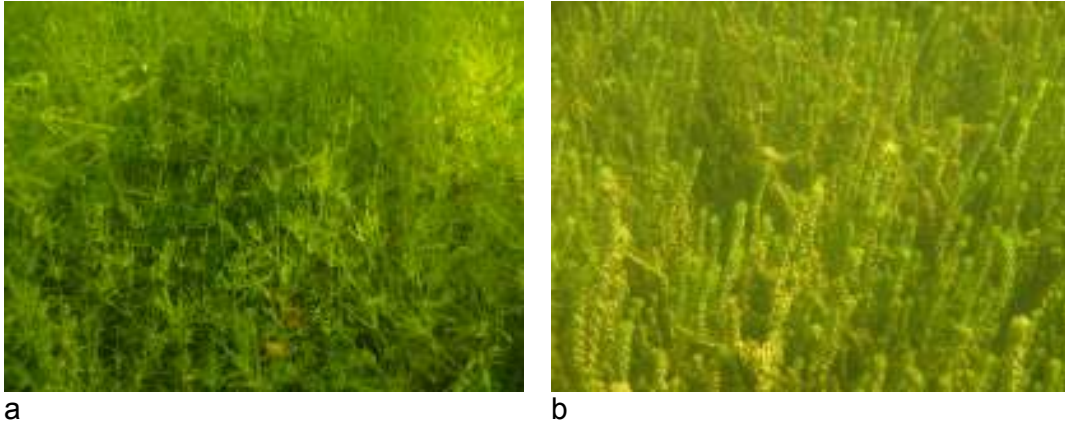


Plate 1. Extensive charophyte meadows in sheltered Lough Corrib bays (a), typical of the pre-*Lagarosiphon major* macrophyte community. (b) Dense bed of *Lagarosiphon major* in Rinerroon Bay, June 2007.

Substrate samples collected from beneath the canopy reveal the presence of a deep anaerobic black mud. An abundance of red Chironomid larvae reside in this fine substratum. On the leaves and stems of the plant very large numbers of green Chironomid larvae are recorded. Aquatic molluscs are also common on the leaves and stems of the plant. There is little evidence, however, of the diverse macroinvertebrate communities that typify the natural charophyte-dominated bays in other areas of Lough Corrib.

It is anticipated that the impact on natural indigenous fish communities in the lake will also be significant as the habitat conditions created by dense *Lagarosiphon* stands are not those preferred by wild brown trout. By contrast, this habitat structure will probably favour the proliferation of coarse fish, perch and pike in Lough Corrib. Many of these species deposit their adhesive egg masses on submerged plants (Plate 2) and the newly hatched fry use the protection afforded by the vegetation while at the most vulnerable stage in their life cycle. In addition, pike commonly avail of the concealment provided by the dense vegetation to stalk prey.



Plate 2. Perch spawn deposited on *Lagarosiphon major* in Birchall Bay, May 2006.

Status and Distribution of *Lagarosiphon major* in Lough Corrib

When first recorded in April 2005, circa 12 ha of Rinerroon Bay was overgrown with *Lagarosiphon* (Plate 3). A mean fresh weight biomass of 13.8 kg m^{-2} or 138 tonnes per ha of *Lagarosiphon* was recorded in the bay at that time. By October 2007 a further 7.4 ha area within Rinerroon had been infested. The invasive plant had established lesser populations at eight other locations in the upper lake in 2005, primarily in shallow bays along the more sheltered western shore. No records of the plant were recorded from the lower lake at that time.



Plate 3. Dense stands of *Lagarosiphon major* overgrow large sections of Rinerroon Bay, Summer 2005.

Further work on the distribution of the plant in 2006 and 2007 revealed the plant's ability to rapidly spread within the lake. The number of bays or lake areas infested with *Lagarosiphon* increased to 24 in 2006 and to 64 by the end of September 2007 (Figure 1). The plant has still not been recorded in the shallow lower lake, although it is considered to be only a matter of time before it establishes populations here.

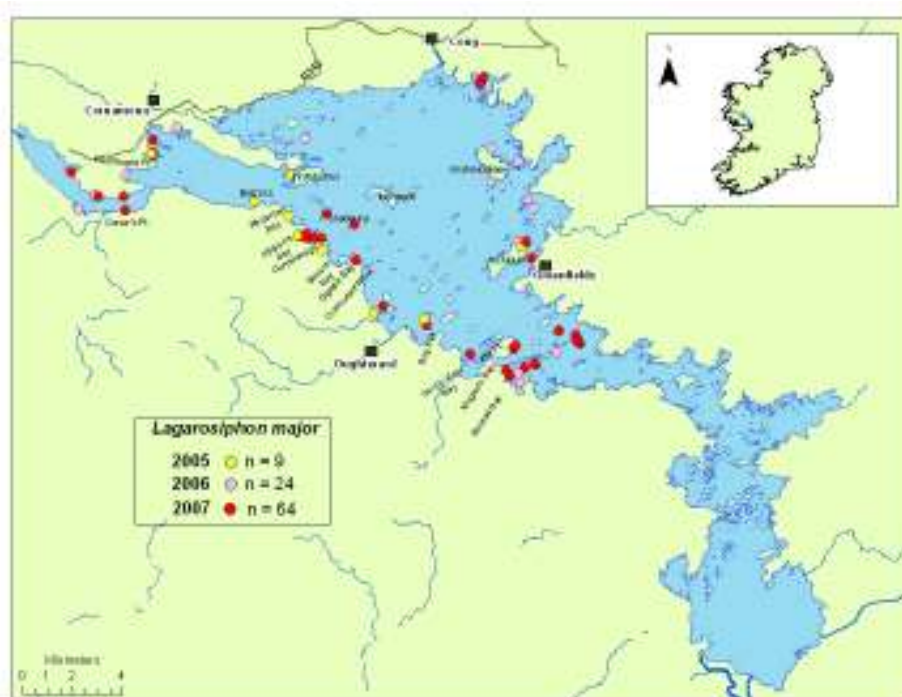


Figure 1. Distribution of *Lagarosiphon major* in Lough Corrib in 2005, 2006 and 2007.

***Lagarosiphon* Control Trials**

In December 2006 and January 2007 pilot trials to determine the most appropriate control methods to tackle *Lagarosiphon* were conducted in Rinerron Bay and in an adjacent, recently infested lake area. The trials were conducted in designated 50 x 50 m plots. Control plots that would remain untreated were established adjacent to the treatment plots and would be used for comparative purposes. *Lagarosiphon* abundance, as percentage cover within each plot, was estimated pre-treatment and again in September, eight months after treatment. Four weed control methods were trialled during this period. These were: manual removal using scuba divers (in a bay recently colonised by *Lagarosiphon*), approved herbicide (dichlobenil), light occlusion using black geotextile and mechanical cutting.

Neither manual removal nor herbicide proved effective in reducing the percentage cover of *Lagarosiphon* in the treatment plots. In respect of the manual control, this reflected the fact that the lake substrate in which the *Lagarosiphon* had become established was extremely fine and was brought into suspension with the slightest disturbance. Visibility was, therefore, reduced to zero as soon as the plant removal operation commenced. This led to the abandonment of the operation on this occasion. With regard to the herbicide treatment, *Lagarosiphon* occupied circa 60% of the plot at the time of spraying and a dense surfaced vegetation canopy was present. It is probable that a significant proportion of the herbicide granules were trapped within the vegetation and failed to reach the lake bed, which is the site of activity for this herbicide. The net result would have been a non-toxic dose of dichlobenil in the mud within the trial plot.

The results where it was possible to fix the black geotextile to the lake bed were good and little or no vegetation growth was recorded when the light occluding material was lifted in September. Serious difficulty, however, was encountered in laying the product and in fixing it in place so that it did not buoy up to the surface.

A weed cutting boat fitted with a deep-cutting V-blade trailed on an 8m-length of chain was used to apply the mechanical cut. The cut weed was harvested immediately and removed from the lake. Divers estimated that in excess of 95% of the *Lagarosiphon* was removed during this operation. In September percentage bottom cover in this plot was *circa* 8% (Plate 4). This high level of control was unexpected and possibly demonstrates the susceptibility of the plant to disruptive weed cutting that is conducted at or near root level.

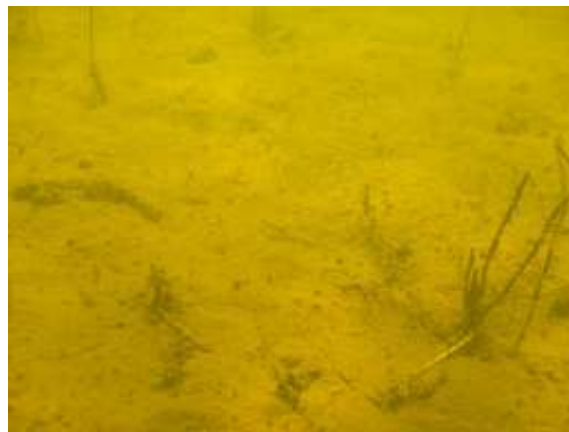


Plate 4. Relatively clear lake bed in Rinerron Bay following mechanical cutting in January 2007.

Future Management Plans

It will be important to continue surveillance monitoring in Lough Corrib in order to provide quantitative information on the rate and extent of *Lagarosiphon* spread within the lake, but also to register new sites as they become colonised.

In an effort to reduce the rate of spread of *Lagarosiphon* within the lake, those areas where large surface-reaching stands are present will be mechanically cut and the weed removed off site. Simultaneously, in bays where the plant is currently expanding its population, a variety of appropriate control techniques will be employed. These methods will aim to specifically target *Lagarosiphon* while causing the minimum of collateral damage to resident indigenous macrophytes. Where new populations of *Lagarosiphon* are discovered in the lake, these will immediately be removed by divers and/or other suitable control methods.

New and innovative control methods will be explored and trialled on the lake in an effort to expand the armoury available to combat this aggressive invader.

Based on ongoing research efforts on *Lagarosiphon* in Lough Corrib and following extensive consultations with international experts, a management

programme for the lake is currently being formulated. If adequate funding is provided to this project, there is reason to be hopeful that we will bring *Lagarosiphon* under control and eradicate it from large sectors of the lake.

Dr Joe Caffrey
Dr Silvana Acevedo
Central Fisheries Board

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