THE CLONES LAKES: HOW WATER QUALITY DECLINE IS REFLECTED IN CHAROPHYTE LAKES

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Charophytes (Stoneworts)
Importance of charophytes in Ireland

• 30 species recorded

• 40% of the European flora and about 8% of the global flora

• High diversity with numerous sites with >5 species
### Richiest 10 km squares for charophytes

**Ireland**

<table>
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<tr>
<th>Hectad</th>
<th>Species total</th>
<th>County</th>
<th>Location</th>
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<tr>
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<tr>
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<tr>
<td>M17</td>
<td>14</td>
<td>Mayo</td>
<td>Lough Carra area</td>
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<tr>
<td>O13</td>
<td>14</td>
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<td>N45</td>
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**Britain**

<table>
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<tr>
<th>Hectad</th>
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<th>County</th>
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<tr>
<td>TG42</td>
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<td>Norfolk</td>
<td>Thurne Broads, Norfolk Broads</td>
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</table>
Associated with some important aquatic habitats including:

- Marl loughs
- Pools in calcareous fens
- Machair loughs
- Sand dune pools
- Turloughs
- Brackish loughs
- Soft water loughs
- Also of note are canals, gravel pits and limestone quarries
Marl loughs

Lough Bunny
AQUATIC VEGETATION OF THE MAGHERAVEELY/CLONES LAKES
Collaborative cross-border initiative to improve wetland habitats in the border regions of Ireland and Scotland

Involves a range of wetland habitats from peat bogs to lakes

Supported by the EU’s INTERREG VA Programme, managed by the Special EU Programmes Body (SEUPB)

This lake survey was managed by Agri-Food and Biosciences Institute (AFBI)
THE MAGHERAVEELY/CLONES LAKES

- This survey focussed on a group of small lakes straddling the national border between Fermanagh and Monaghan.
THE MAGHERAVEELEY/CLONES LAKES

- 12 small lakes;
- Knockballymore Loughs A, B, C
- Dummy’s Lough
- Kilroosky/Horseshoe Lough
- Little Kilroosky Lough
- Ramages Lough
- Summerhill Lough
- Burdautien Lough
- Annaghullion Lough
- Drumacrittin Lough
- Black Lough

Together these form:

NI side
- Magheraveely Marl Loughs SAC and Ramsar sites & Various individual ASSIs

RoI side
- Kilroosky Lough Cluster SAC
THE MAGHERAVEELY/CLONES LAKES

Designated for (among other interests):
“Hard oligo-mesotrophic standing waters with benthic vegetation of Chara formations” (Natura code 3140).

However recent surveys have suggested that there had been a significant decline in this vegetation associated with a decline in water quality.

This survey aimed at assessing the current state of these lakes and the pressures on them.

In tandem with several other surveys, including water chemistry monitoring by Ulster University.
Previous surveys

- Northern Ireland Lough Survey 1988 - 1989. Includes maps of aquatic vegetation over the whole lakes

- Two surveys by ENSIS for NIEA in 2006 and 2014, using Leafpacs monitoring method. 8 lakes in 2006, 6 in 2014


- Various additional survey notes available from NIEA internal files.

This survey

- Qualitative mapping of vegetation by zig-zagging around lake

- Quantitative transects using Leafpacs monitoring method (combination of wader transects along shore and boat transects into lake)
Overview of vegetation

• All are small lakes between 1 to 10 hectares

• All have small catchments largely of farmland and woodland with a few scattered houses and farms

• Kettle hole-type lakes in depressions in glacial till

• Ramages Lough is now almost entirely swamp

• The remainder are very similar in character
• Floating vegetation; Yellow Water Lily *Nuphar lutea*, White Water Lily *Nymphaea alba* and sometimes Common Pondweed *Potamogeton natans*. Also sometimes scattered Duckweed *Lemna minor*.

• Submerged species – nutrient sensitive; Charophytes *Chara* species, Reddish Pondweed *Potamogeton alpinus*, Shining Pondweed *Potamogeton lucens*, Bladderwort *Utricularia australis* and Marestail *Hippuris vulgaris*.

• Submerged species – nutrient tolerant; Canadian Pondweed *Elodea canadensis*, Willow Moss *Fontinalis anitpyretica*, Ivy Duckweed *Lemna trisulca*, Spiked Milfoil *Myriophyllum spicatum*. 
Drumacrittin Lough

Chara beds

Isolated Potamogeton alpinus patches
From healthy Chara beds

From edge of Chara beds facing the main part of the lake

From healthy Chara beds
Phase 0 – Pristine state with extensive Chara beds down to >4 metres depth and gin clear water
Phase 1 – initial deterioration and break-up of the *Chara* beds occurs in the open water outside the fringing swamp. In this phase there are still charophyte beds in the open water but these are very patchy and often with rather sparse cover. Also often the charophytes can be rather unhealthy in appearance, particularly in periods when water clarity is reduced.
Phase 2 – by this stage the charophytes in the open water have all but disappeared although it may be possible to find the occasional plants in deeper water. However, charophytes remain healthy and well distributed around the margins of the lake within the swamp zone, occurring where there are cavities within the swamp or where the swamp cover is thinner.
Phase 3 – in this stage the charophytes still occur within the swamp zone but have now become highly localised and are present around less than 10% of the lake margin. The surviving locations are restricted to where clean ground water is entering the lake from adjacent calcareous fen or springs.
Phase 4 – charophytes have completely disappeared or may occasionally reappear briefly and locally as a result of disturbance events which expose fresh mineral substrates. However these substrates are usually quickly covered by filamentous algae and mobile organic silt and the charophytes soon disappear.
## Charophyte deterioration phases in the Magheraveely/ Clones loughs

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LEAFPACS ECOLOGICAL QUALITY RATIOS

• Way of assessing status for Water Framework Directive monitoring
• Uses a number of calculated parameters, of which the most important is the “Lake Macrophyte Nutrient Index” based on the nutrient tolerance of the species present
• “Reference State” targets for these parameters calculated based on chemical and geographic parameters (alkalinity, lake area, mean depth, altitude etc)
• Actual measured parameters compared with the “Reference State” targets using black box calculations
• Resulting score is banded High – Good – Moderate – Poor – Bad based on distance of actual measurement from “Reference State
<table>
<thead>
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<th>Location</th>
<th>Deterioration phase in 2018</th>
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<tr>
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Comparison of Ecological Quality Ratios and Deterioration phases

Based on all Leafpacs surveys in 2006, 2014 & 2018
FREE MACROPHYTE INDEX

- RoI equivalent of Leafpacs
- Uses different transect design
- Assesses using different metrics
- Includes a charophyte abundance metric but does not differentiate between species
- Results in a score that is similarly banded High – Good – Moderate – Poor – Bad
- Data only available for Summerhill Lough