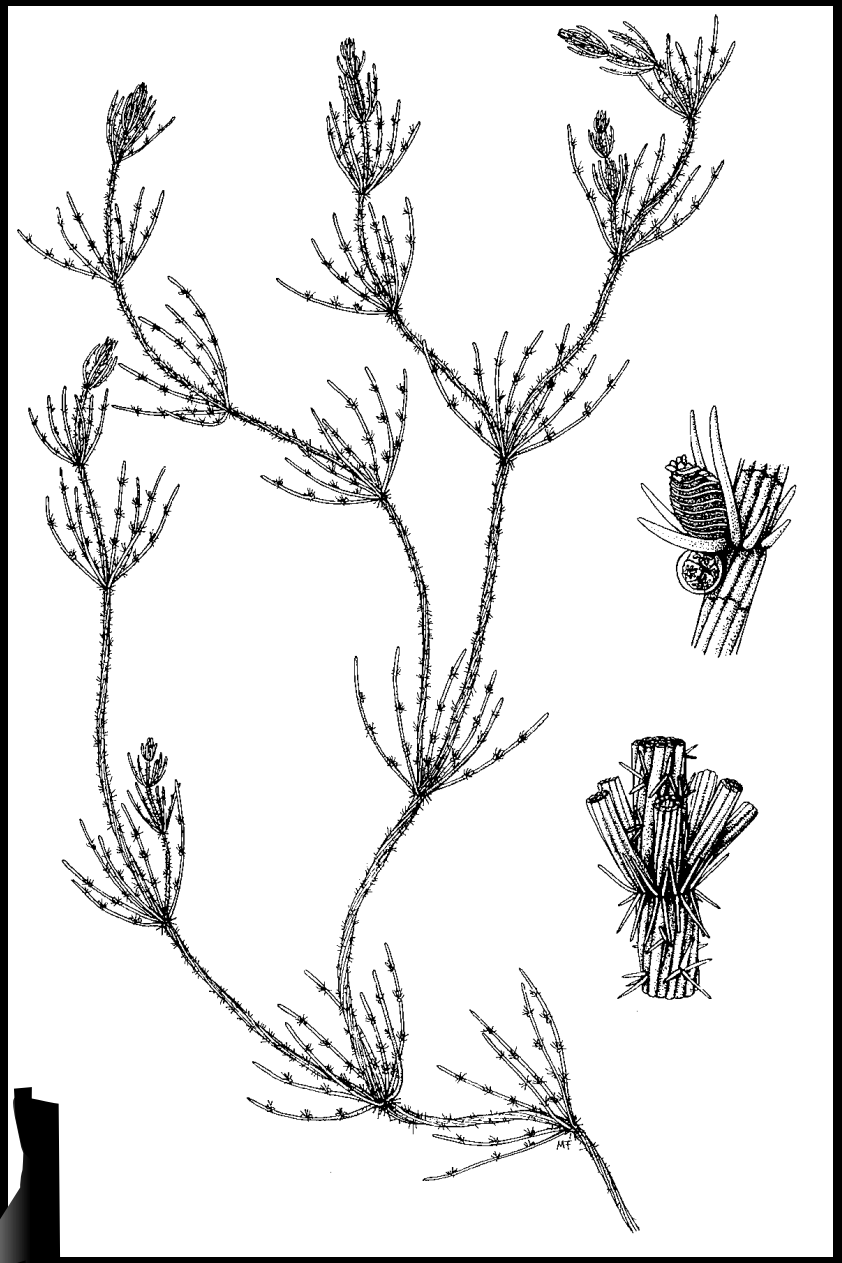
THE CLONES LAKES: HOW WATER QUALITY DECLINE IS REFLECTED IN CHAROPHYTE LAKES

Nick Stewart
Yvonne McElarney
Frances Lucey
Joerg Arnscheidt
Sara Meehan
Darren Garland
Raymond Wilson

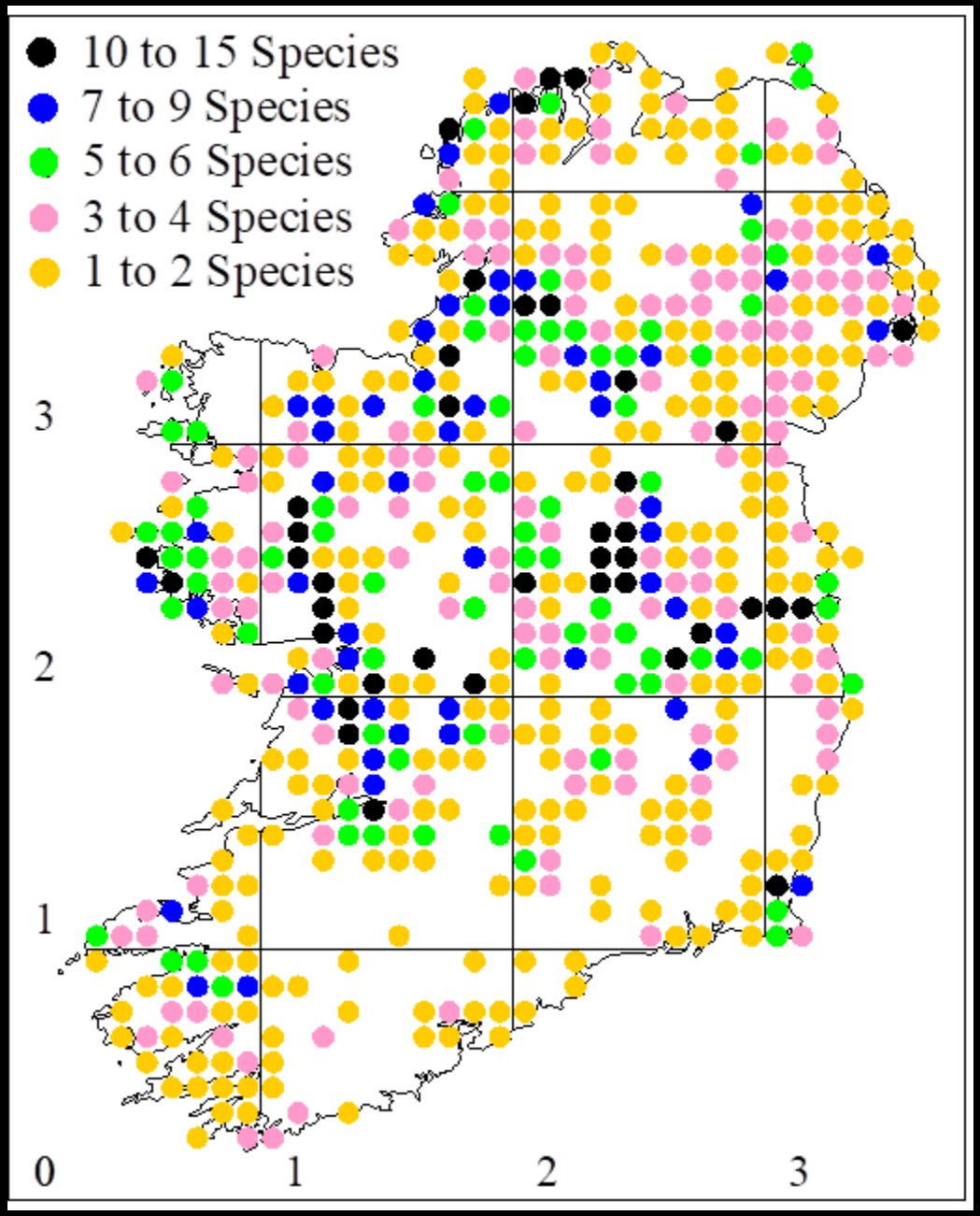
Charophytes (Stoneworts)



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

National Park & Wildlife Service



Richest 10 km squares for charophytes

Ireland

Hectad	Species total	County	Location
R39	15	Clare/Galway	Gort lakes
C14	14	Donegal	Fanad Peninsula
M17	14	Mayo	Lough Carra area
O13	14	Dublin	Dublin City (Royal & Grand Canals)
N45	14	Westmeath	Mullingar lakes

Britain

Hectad	Species total	County	Location
TG42	15	Norfolk	Thurne Broads, Norfolk Broads

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

CANN
COLLABORATIVE ACTION
for the NATURA NETWORK

AQUATIC VEGETATION OF THE MAGHERAVEELY/ CLONES LAKES

Interreg
EUROPEAN UNION
Northern Ireland - Ireland - Scotland
European Regional Development Fund

THE MAGHERAVEELY/ CLONES LAKES

CANN
COLLABORATIVE ACTION for the NATURA NETWORK

- 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)

Interreg
EUROPEAN UNION
Northern Ireland - Ireland - Scotland
European Regional Development Fund

THE MAGHERAVEELY/ CLONES LAKES

CANN
COLLABORATIVE ACTION for the NATURA NETWORK

- This survey focussed on a group of small lakes straddling the national border between Fermanagh and Monaghan

Interreg
EUROPEAN UNION
Northern Ireland - Ireland - Scotland
European Regional Development Fund

THE MAGHERAVEELY/ 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

CANN
COLLABORATIVE ACTION for the NATURA NETWORK

Interreg
EUROPEAN UNION
Northern Ireland - Ireland - Scotland
European Regional Development Fund

THE MAGHERAVEELY/ CLONES LAKES

CANN
COLLABORATIVE ACTION for the NATURA NETWORK

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

Interreg
EUROPEAN UNION
Northern Ireland - Ireland - Scotland
European Regional Development Fund

THE MAGHERAVEELY/ CLONES LAKES

CANN
COLLABORATIVE ACTION for the NATURA NETWORK

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
- EPA surveys of Summerhill Lough in 2007, 2010, 2013 and 2016 using their standard monitoring method
- 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)

Interreg
EUROPEAN UNION
Northern Ireland - Ireland - Scotland
European Regional Development Fund

Overview of vegetation

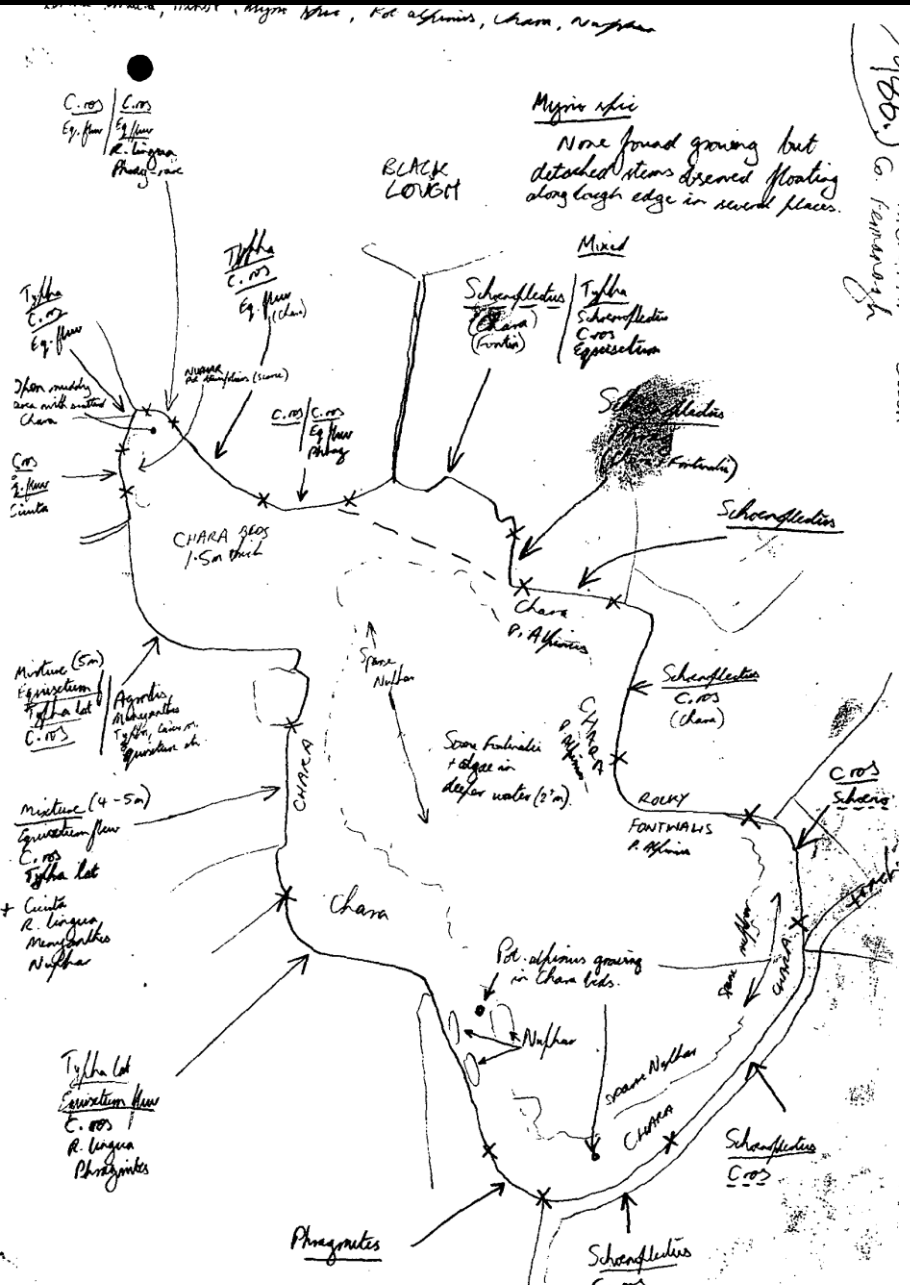
- All are small lakes between 1 to 10 hectares
- All have small catchments largely of farmland and woodland with a few scattered houses and farms
- Kettle hole-type lakes in depressions in glacial till
- Ramages Lough is now almost entirely swamp
- The remainder are very similar in character

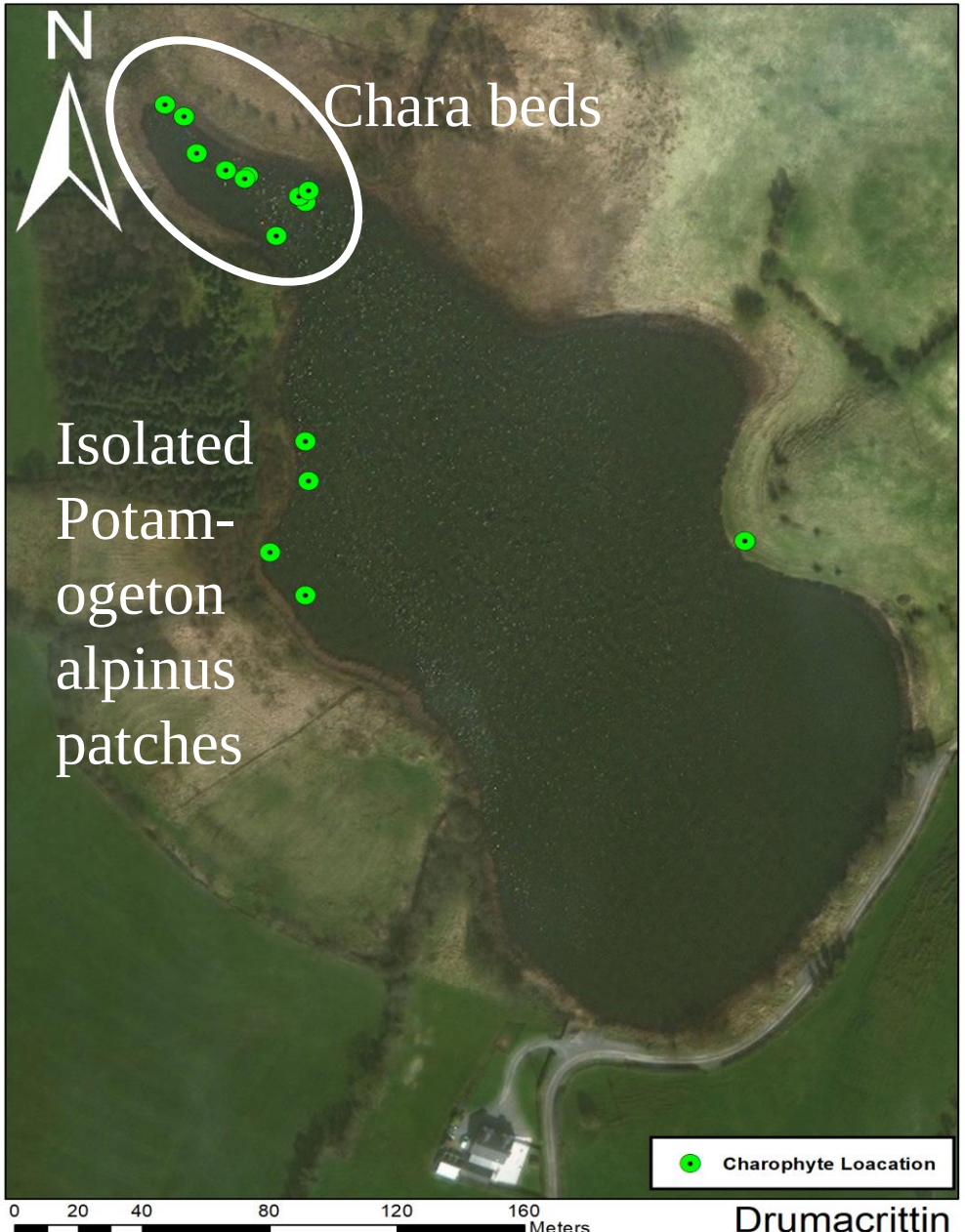
- Floating vegetation; Yellow Water Lily *Nuphar lutea*, White Water Lily *Nymphaea alba* and sometimes Common Pondweed *Potamogeton natans*. Also sometimes scattered Duckweed *Lemna minor.*

- 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*.

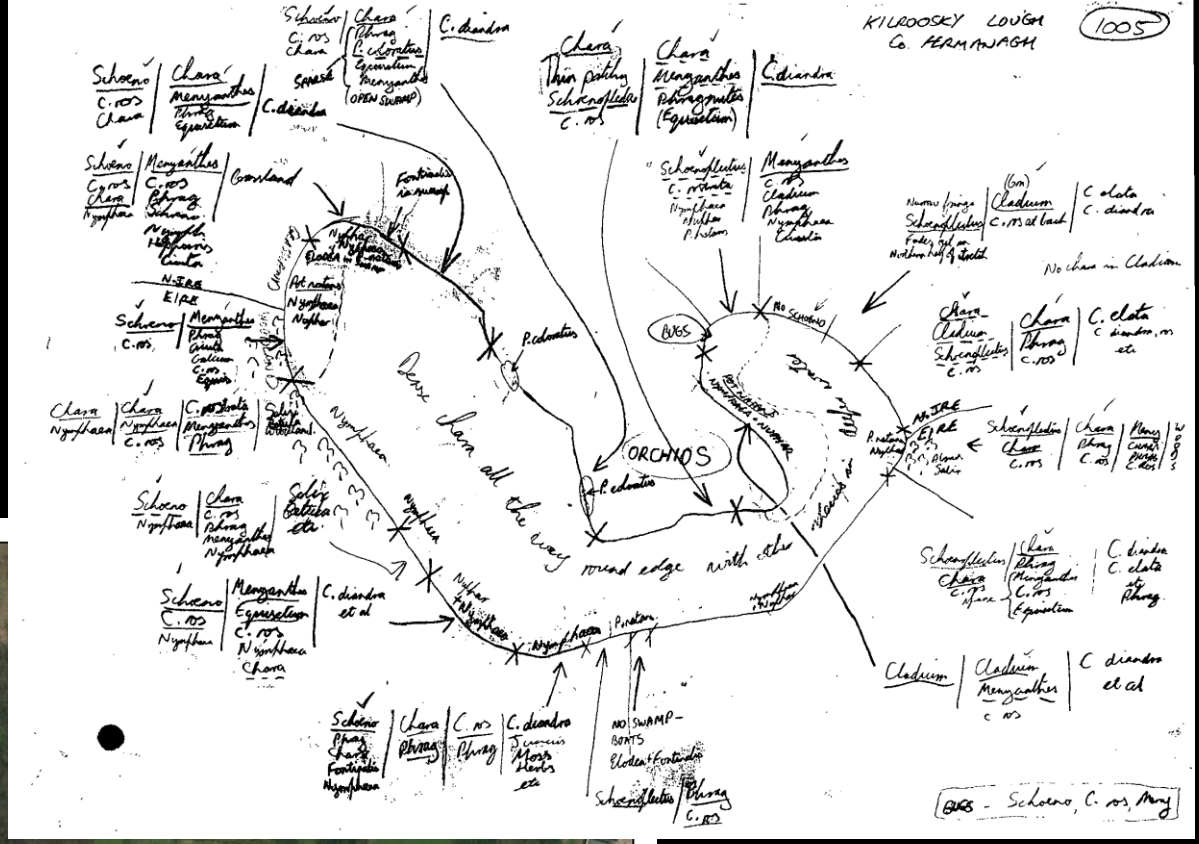
Drumacrittin Lough

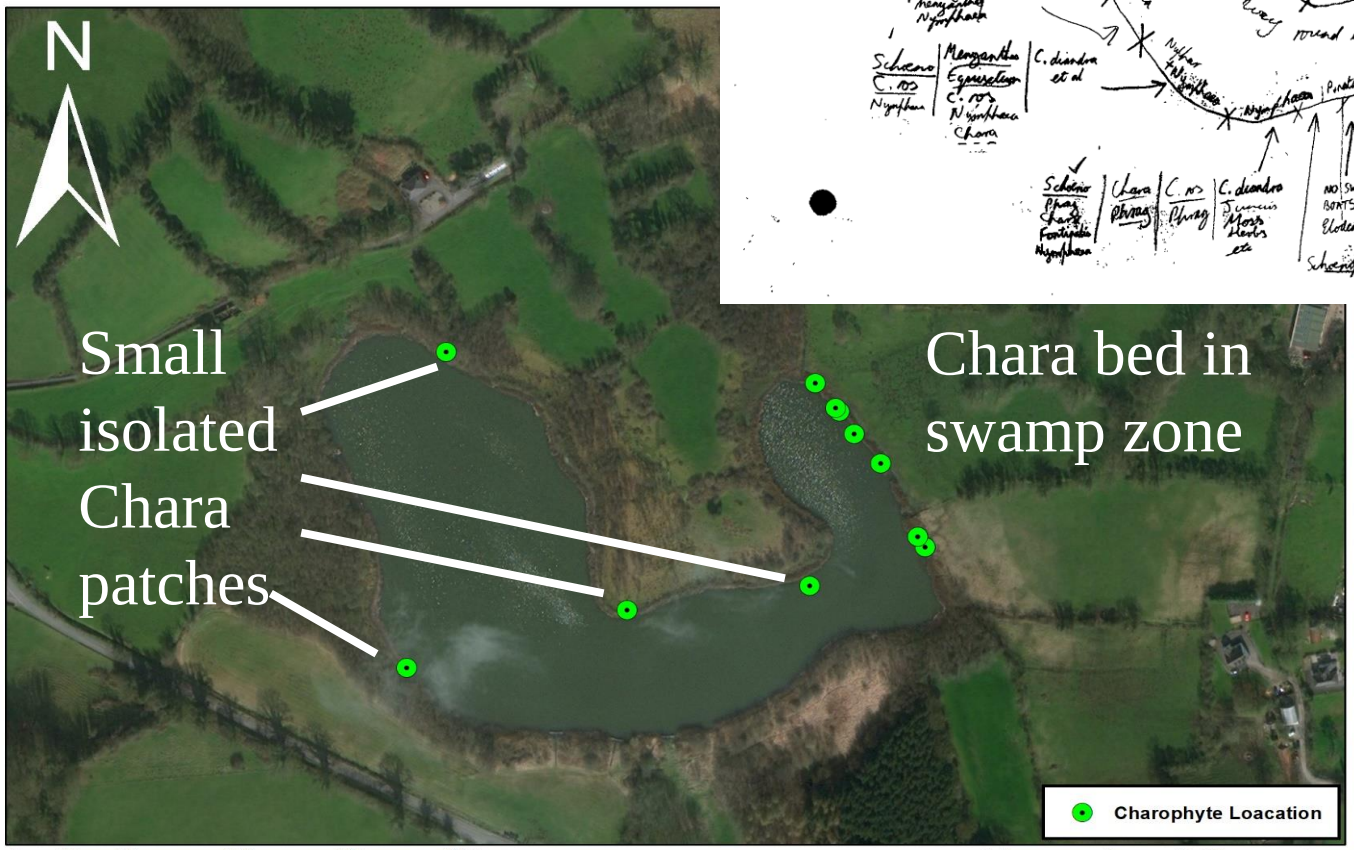




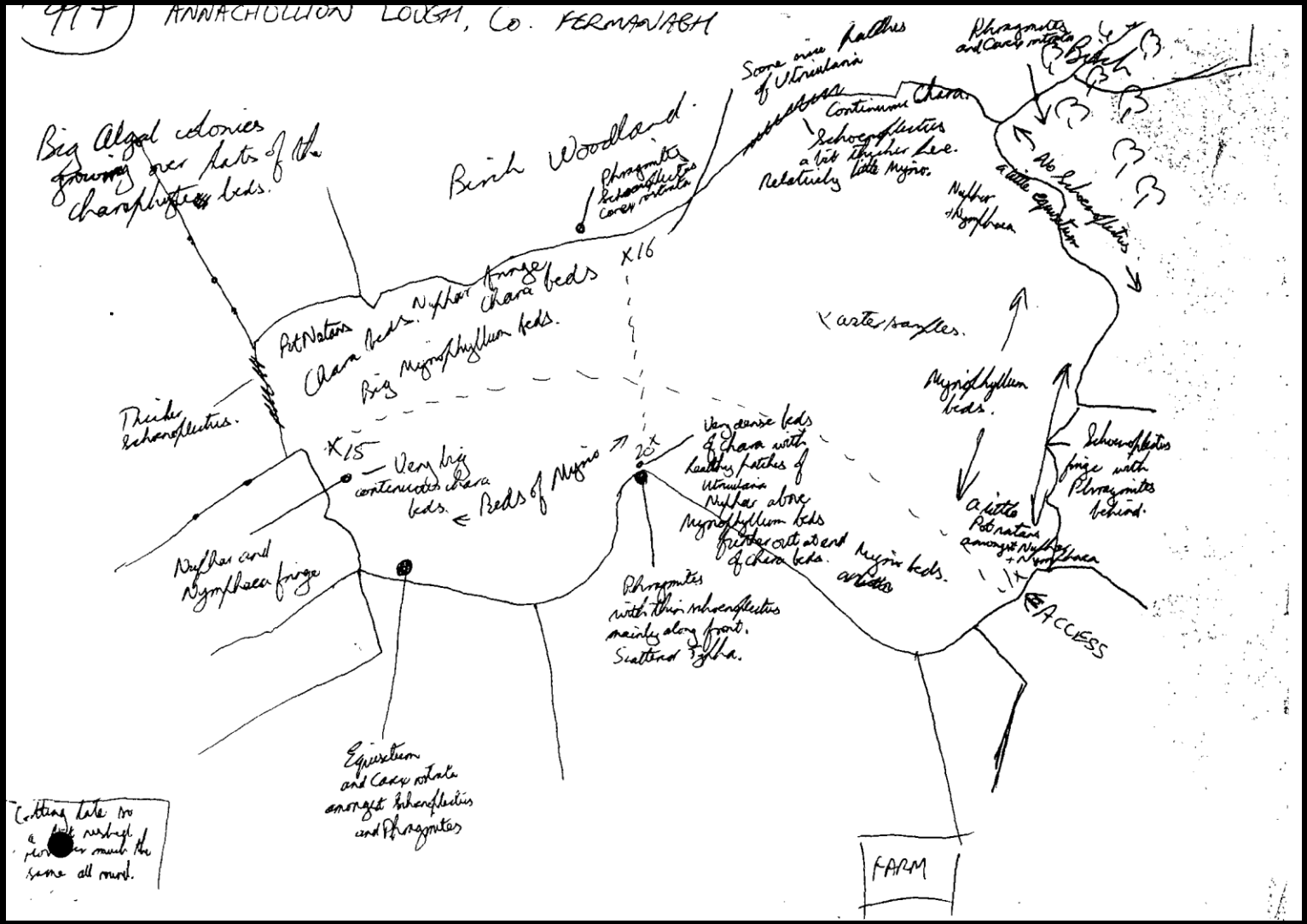

From edge of Chara beds facing the main part of the lake
From healthy Chara beds

Kilroosky Lough





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.

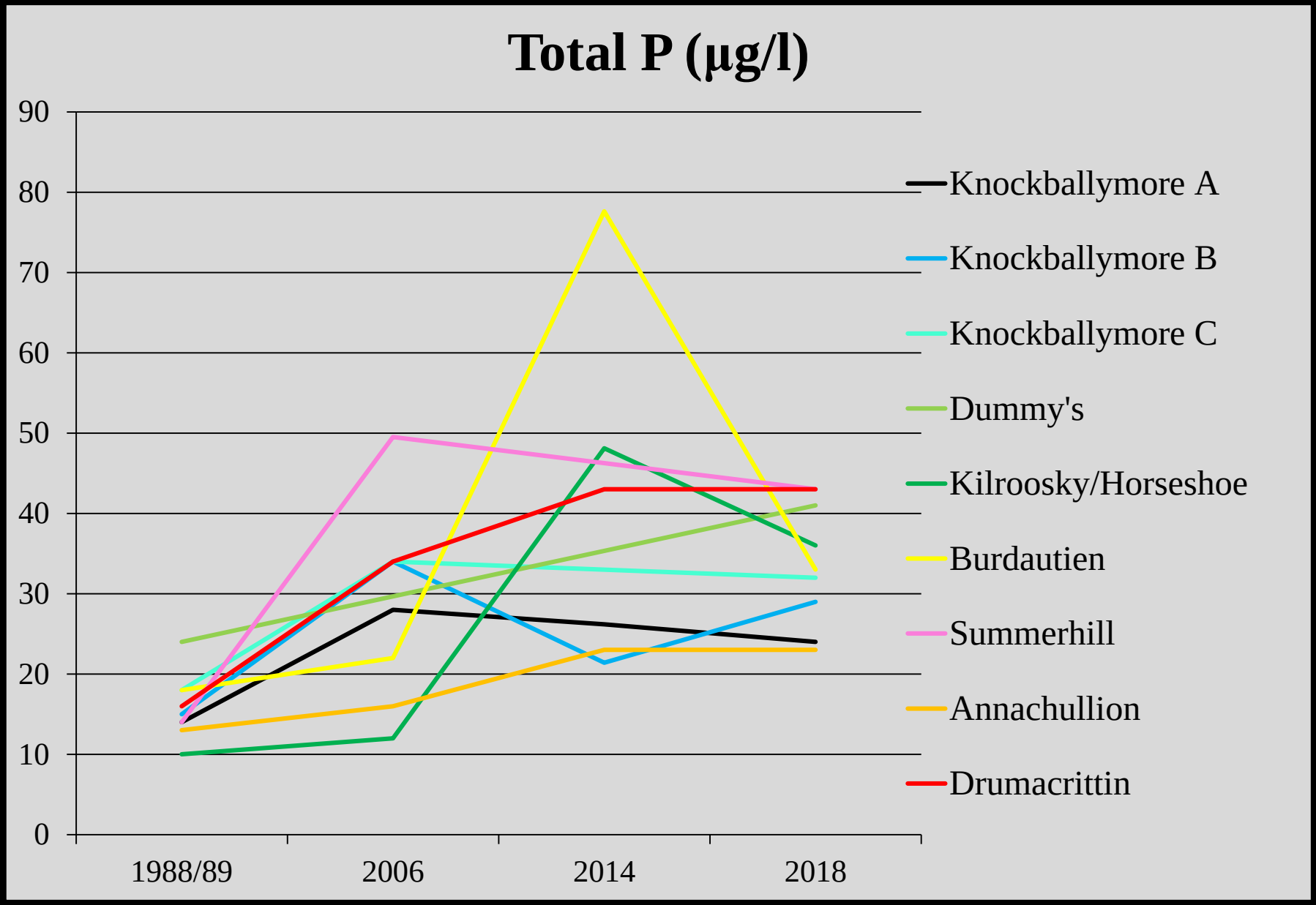
Phase 3 – in this stage the charophytes still occur within the swamp zone but have now become highly localised and are present around less than 10% of the lake margin. The surviving locations are restricted to where clean ground water is entering the lake from adjacent calcareous fen or springs.

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.


N
Charophyte Loacation
0 20 40 80 120 160
Meters
Summerhill

Charophyte deterioration phases in the Magheraveely/ Clones loughs

	Weyl 1980	NILS 1988/ 1989	Corbett/ Waterman 1992-1994	ENSIS 2006	ENSIS 2014	NFS 2018
Knockballymore A	?2	2	?	?2	?2	2
Knockballymore B		3	?	?3	?3	3
Knockballymore C	3?	4	?	4		4
Dummy's	?	3				4
Kilroosky/ Horseshoe	0	0	0	0	1	3
Little Kilroosky		4				4
Ramages						4
Burdautien	?	3	3	3	4	4
Summerhill		2	2	2?	?	3
Annachullion		0	0	0	3	4
Drumacrittin		0	0	1	3?	3
Black		4				4

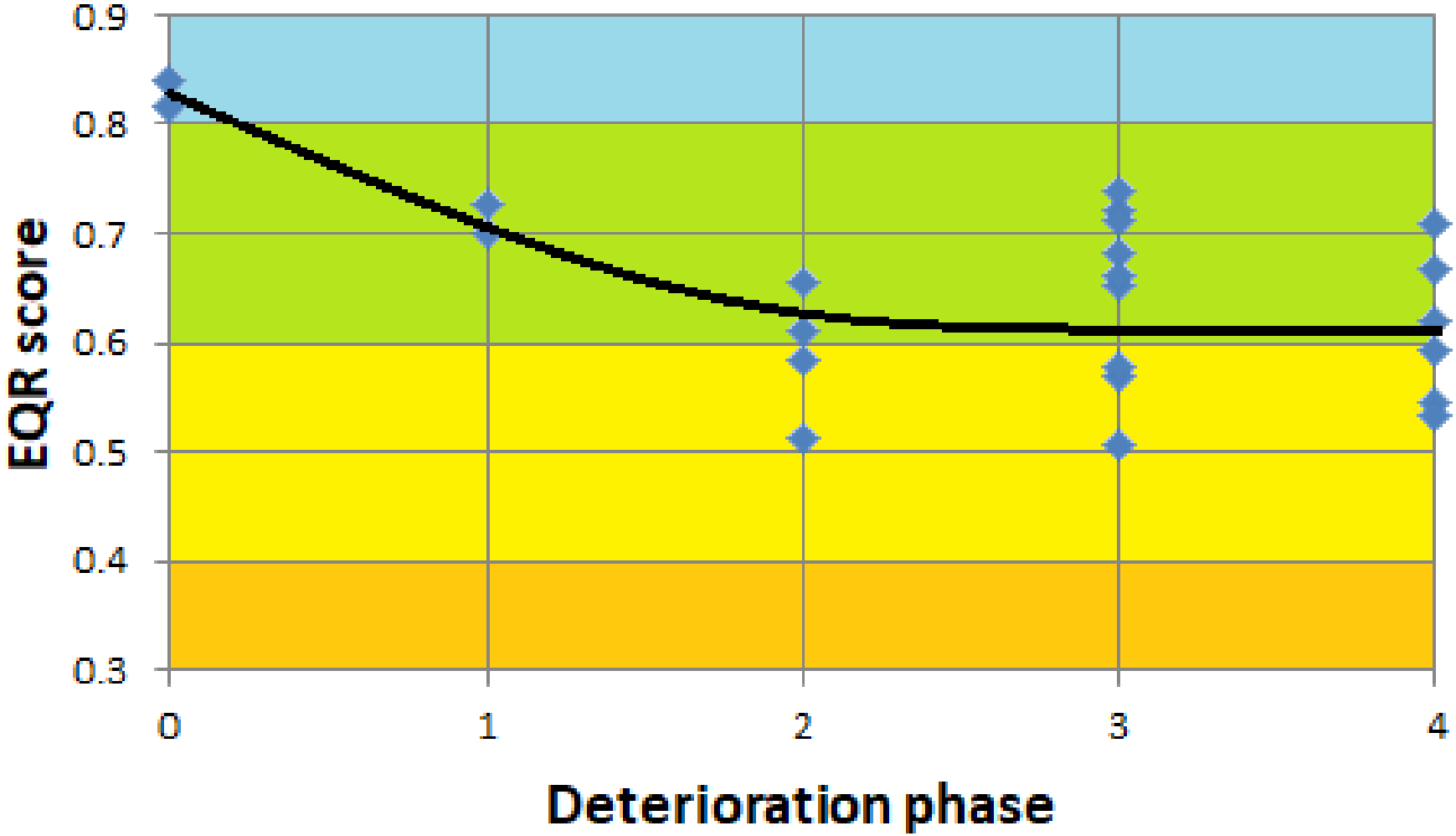

Total P (µg/l)
90
80
70
60
50
40
30
20
10
0
1988/89
2006
2014
2018
Knockballymore A
Knockballymore B
Knockballymore C
Dummy's
Kilroosky/Horseshoe
Burdautien
Summerhill
Annachullion
Drumacrittin

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

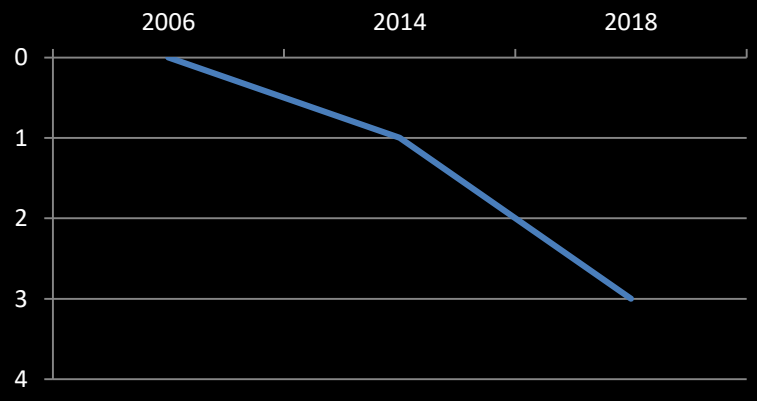
	Deterioration phase in 2018	EQR status
Knockballymore A	2	Good
Knockballymore B	3	Good
Knockballymore C	4	Moderate
Dummy's	4	Good
Kilroosky/ Horseshoe	3	Good
Little Kilroosky	4	Poor
Burdautien	4	Moderate
Summerhill	3	Moderate
Annachullion	4	Good
Drumacrittin	3	Good
Black	4	Moderate

Comparison of Ecological Quality Ratios and Deterioration phases

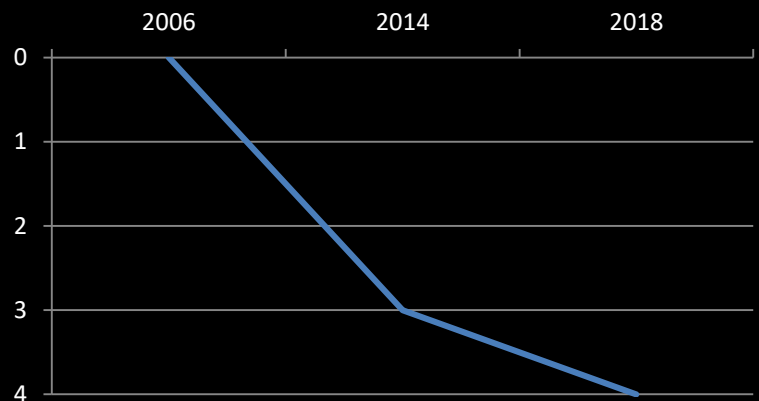


Based on all Leafpacs surveys in 2006, 2014 & 2018

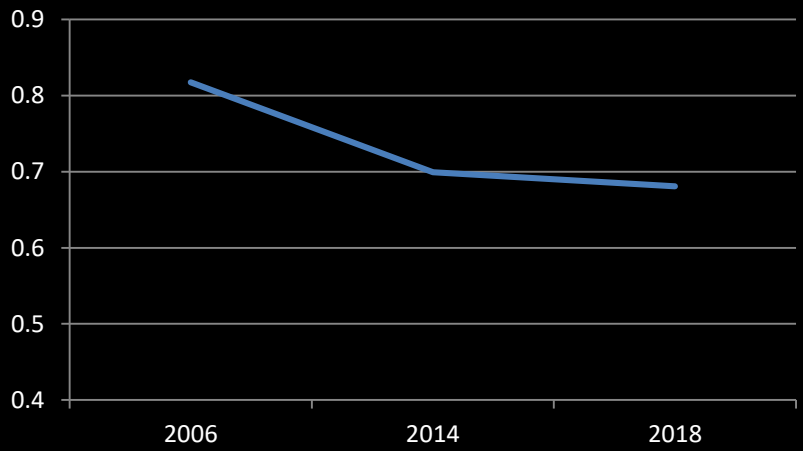
Kilroosky Lough Deterioration phases



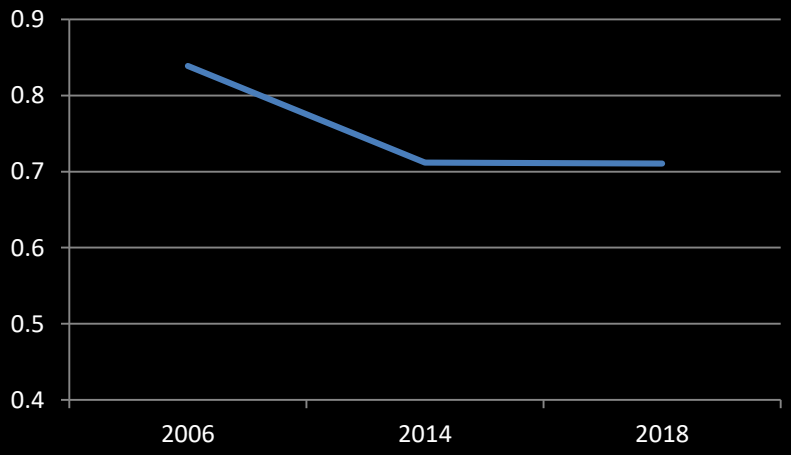
Annaghullion Lough Deterioration phases



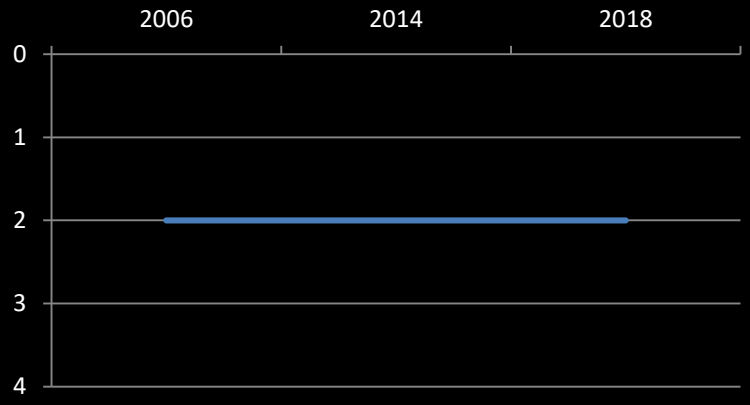
Kilroosky Lough EQR scores



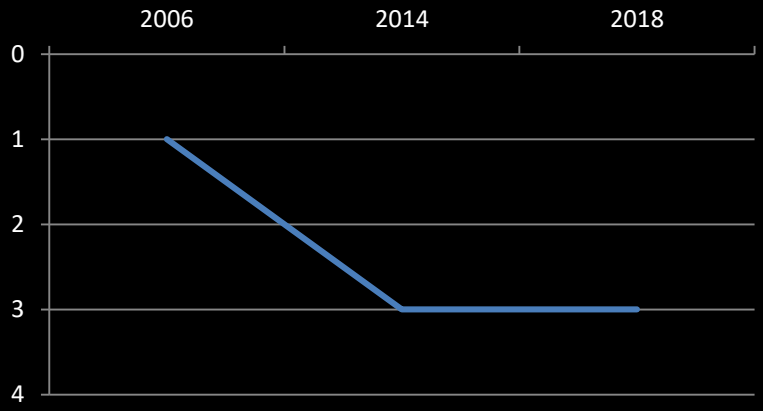
Annaghullion Lough EQR scores



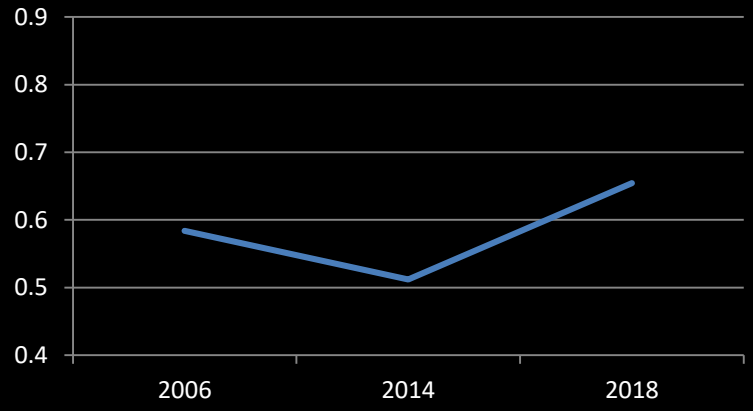
Knockballymore A Lough Deterioration phases



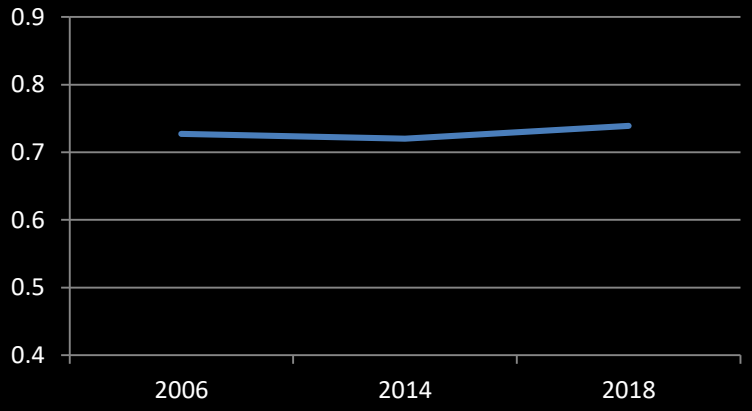
Drumacrittin Lough Deterioration phases



Knockballymore A Lough EQR scores

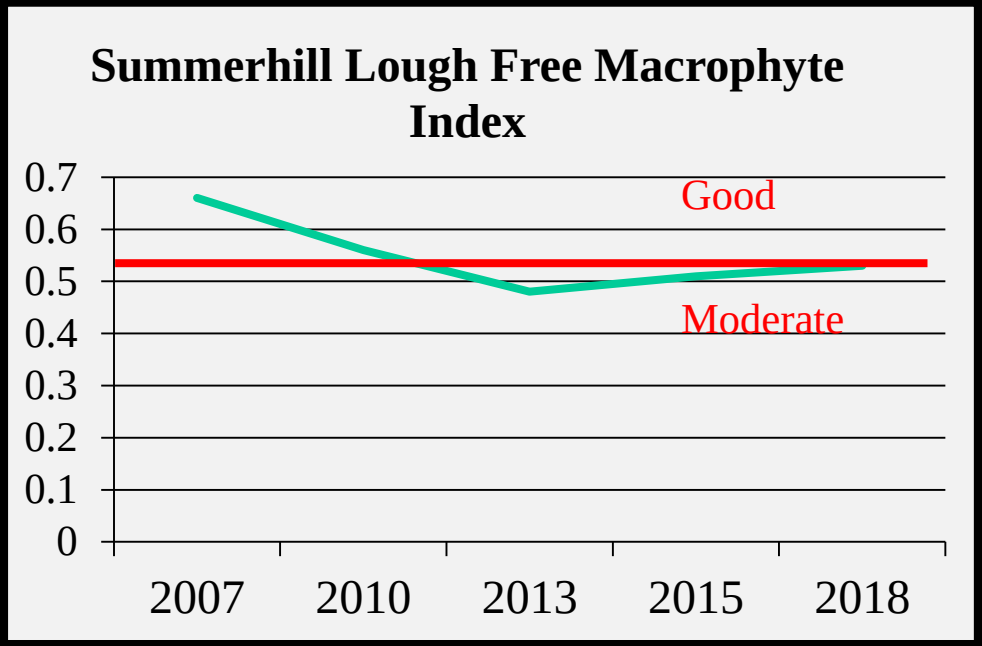


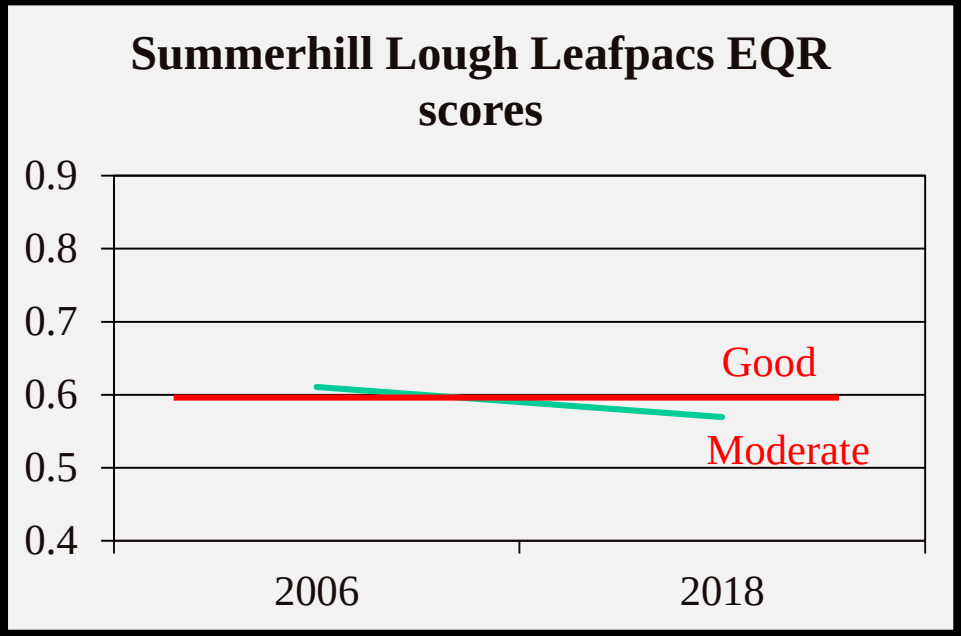
Drumacrittin Lough EQR scores



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


Summerhill Lough Free Macrophyte Index
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Good
Moderate
2007
2010
2013
2015
2018


Summerhill Lough Leafpacs EQR scores
0.9
0.8
0.7
0.6
0.5
0.4
Good
Moderate
2006
2018


nfstewart@freeuk.com