

UK approaches to urban lake restoration

Linda May, Bryan
Spears, Iain Gunn & Kate
Waters

Outline of talk

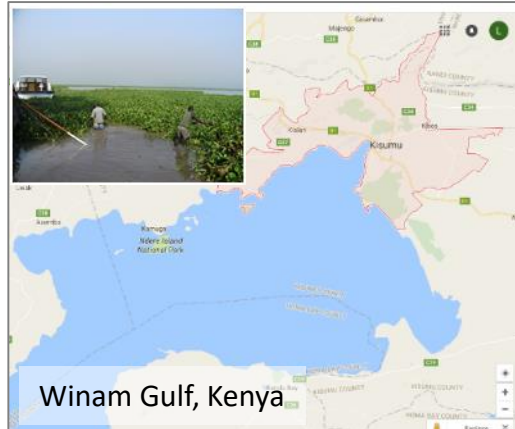
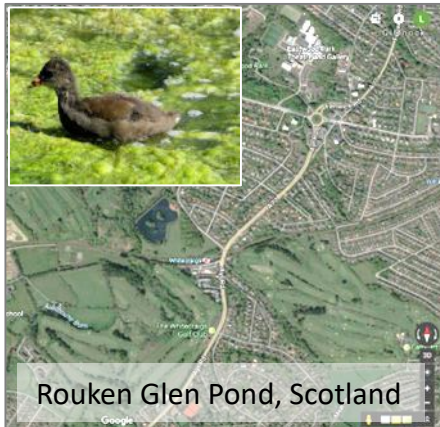
- Overview of 'urban' lakes and their problems (Linda May)
- Introduction to Linlithgow Loch and its management (Bryan Spears)
- Introduction to NERC/National Trust internship on freshwater assets (Kate Waters)

What is an urban lake?

- A lake that is in, or has in its catchment, a large area of dense population (≥ 30 people per km²)
- Within easy reach of an urban population for recreational use
- Has high amenity value for people, but likely to be adversely affected by people

Examples of 'urban' waterbodies

2.4ha.
???
people



1,350km²
0.5M
people

4,788km²
6.4M
people



41ha.
19,000
people

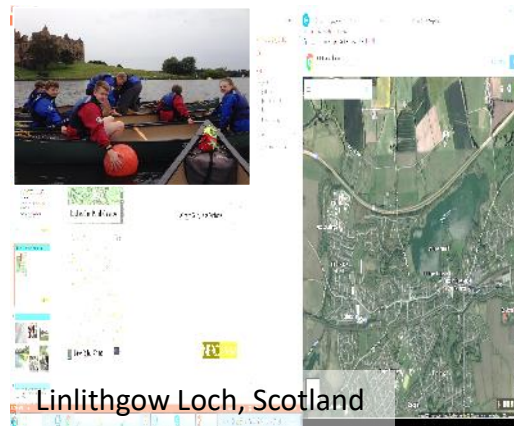
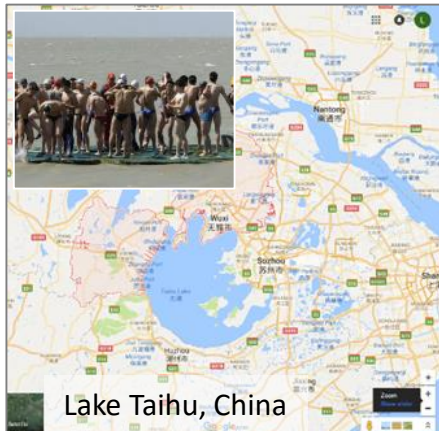
Examples of 'urban' waterbodies

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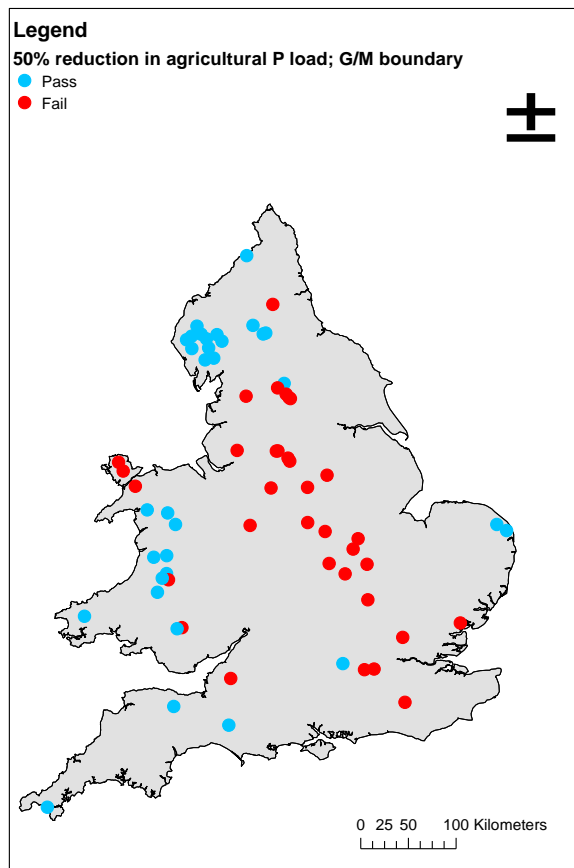
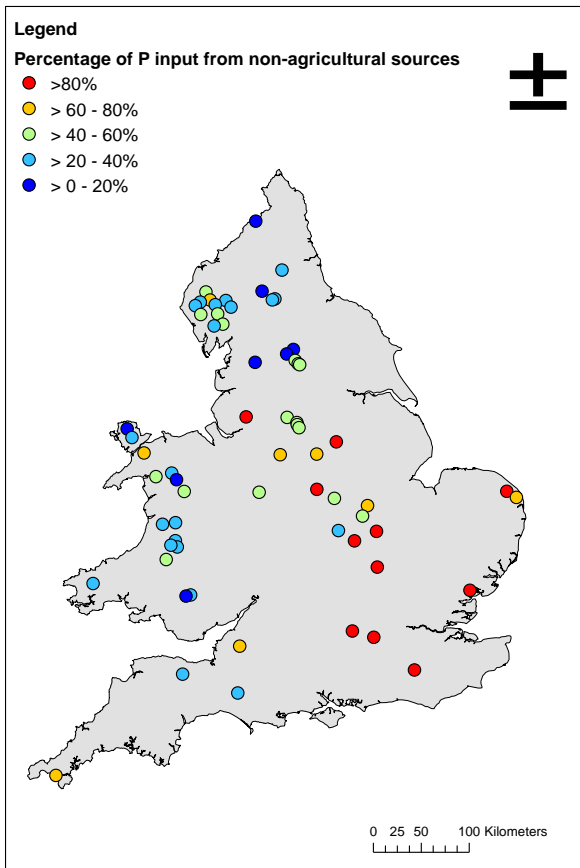
1,350km²
0.5M
people

4,788km²
6.4M
people



41ha.
19,000
people

Phosphorus inputs to WFD lakes (E&W)



Restoring impacted lakes

- Activities need to focus on addressing the cause of the problem
- Recovery can be accelerated by using in-lake approaches, eg:
 - Sediment removal
 - Biomanipulation
 - Geo-engineering
- But, sustainable recovery requires the drivers of bad water quality to be addressed

Example: Restoration of Rouken Glen pond

Iain Gunn, Bryan Spears & Linda May

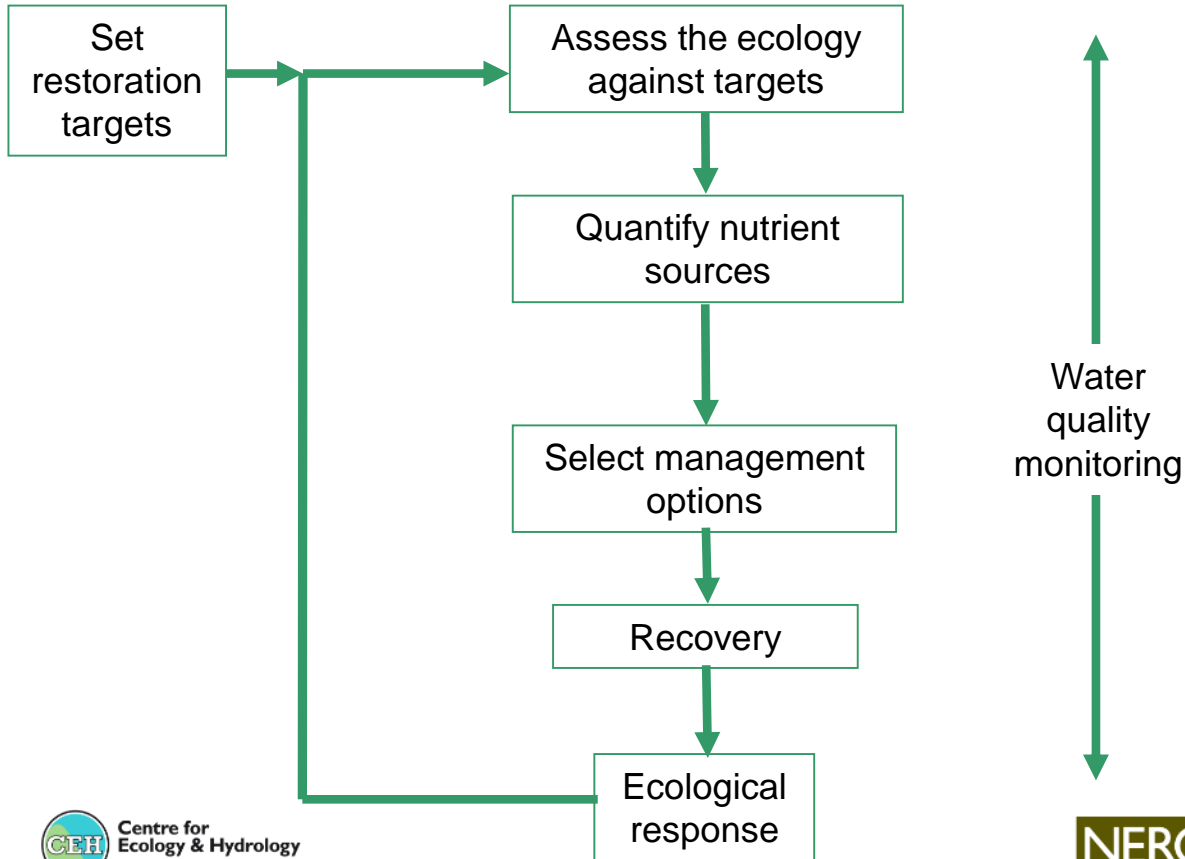


Background to the problem

- Perceived deterioration in water quality – possibly due to P pollution?
- Restrictions on public access - due to cyanobacterial blooms
- Sources of nutrients and ecological deterioration not fully understood



Restoration process (iterative)



Proposed water quality targets

Aims

- To improve water quality
- To reduce public health risk
- To increase biodiversity (& aesthetic value) of pond

Proposed targets based on previous research and pond characteristics (e.g. mean depth & alkalinity)

Determinand	Target	Standard
Total phosphorus (TP)	42 µg/L	Annual average – Site Specific Target
Chlorophylla	20 µg/L	Annual average – Site Specific Target
Cyanobacterial chlorophylla	• 10 µg/L (low risk threshold) • 50 µg/L (high risk threshold)	WHO
Aquatic plants	Relative frequency of less invasive, non-native species, e.g. <i>Elodea nuttallii</i> , <25%.	JNCC

Current status of pond

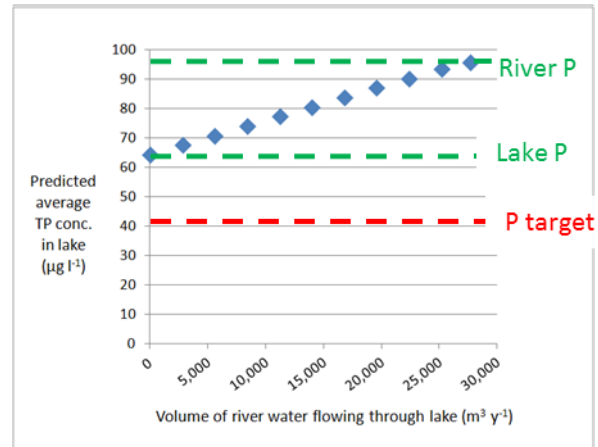
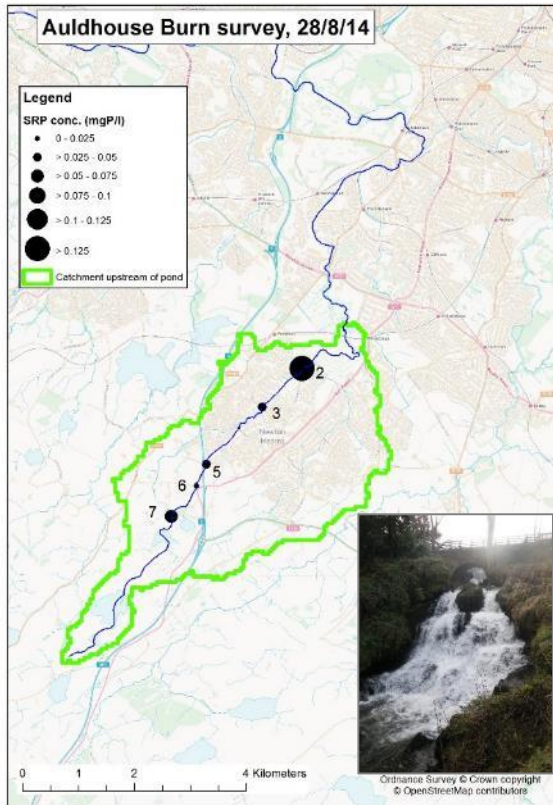
Determinand	Target	Fail/Pass
Total phosphorus	42 µg/L	Fail
Total chlorophylla	20 µg/L	Pass
Cyanobacterial chlorophylla	<ul style="list-style-type: none">• 10 µg/L (low risk threshold)• 50 µg/L (high risk threshold)	Pass
Aquatic plants	Relative frequency of less invasive, non-native species, e.g. <i>Elodea nuttallii</i> , <25%.	Fail

Based on 2013 data

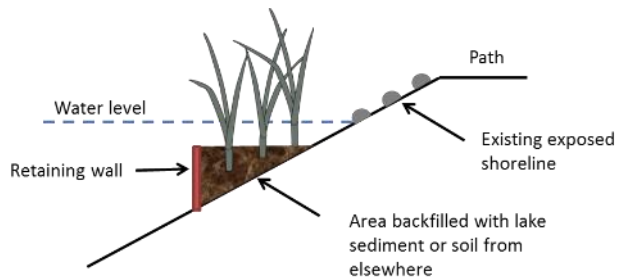
Management recommendations

1. Flush pond with water of low nutrient (P & N) content
2. Establish reed beds & other marginal vegetation to trap nutrients (*and improve aesthetics & biodiversity value of pond*)
3. Control *Elodea* (with removal of cut plants from pond)
4. Reduce in-lake P levels
5. Continue water quality monitoring to assess ecological response of pond

Action 1: Flush with low nutrient water



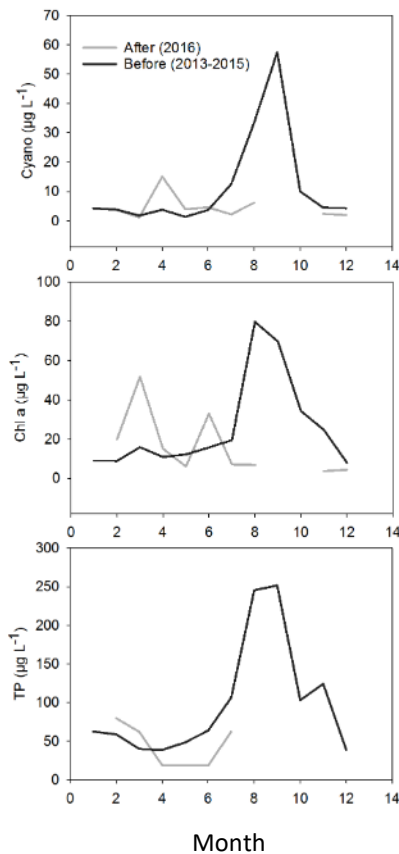
Actions 2 & 3: Plant macrophytes



Action 4: Reduce in-lake P levels



Action 5: Monitor to assess response



Outcome

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Rouken Glen Park recognised with top UK title

1 December 2016 Glasgow & West Scotland

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A Scottish park has been recognised with a top UK award.

Rouken Glen Park in East Renfrewshire, which was originally gifted to the people of Glasgow in 1906, was named the UK's Best Park of 2016.

The shortlist for the Fields in Trust award included Castle Gardens in County Antrim, Pontypool Park in Torfaen, and Preston Park Rockery in East Sussex.

Top Stories

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The Labour leader says the general election is about "the establishment versus the people".
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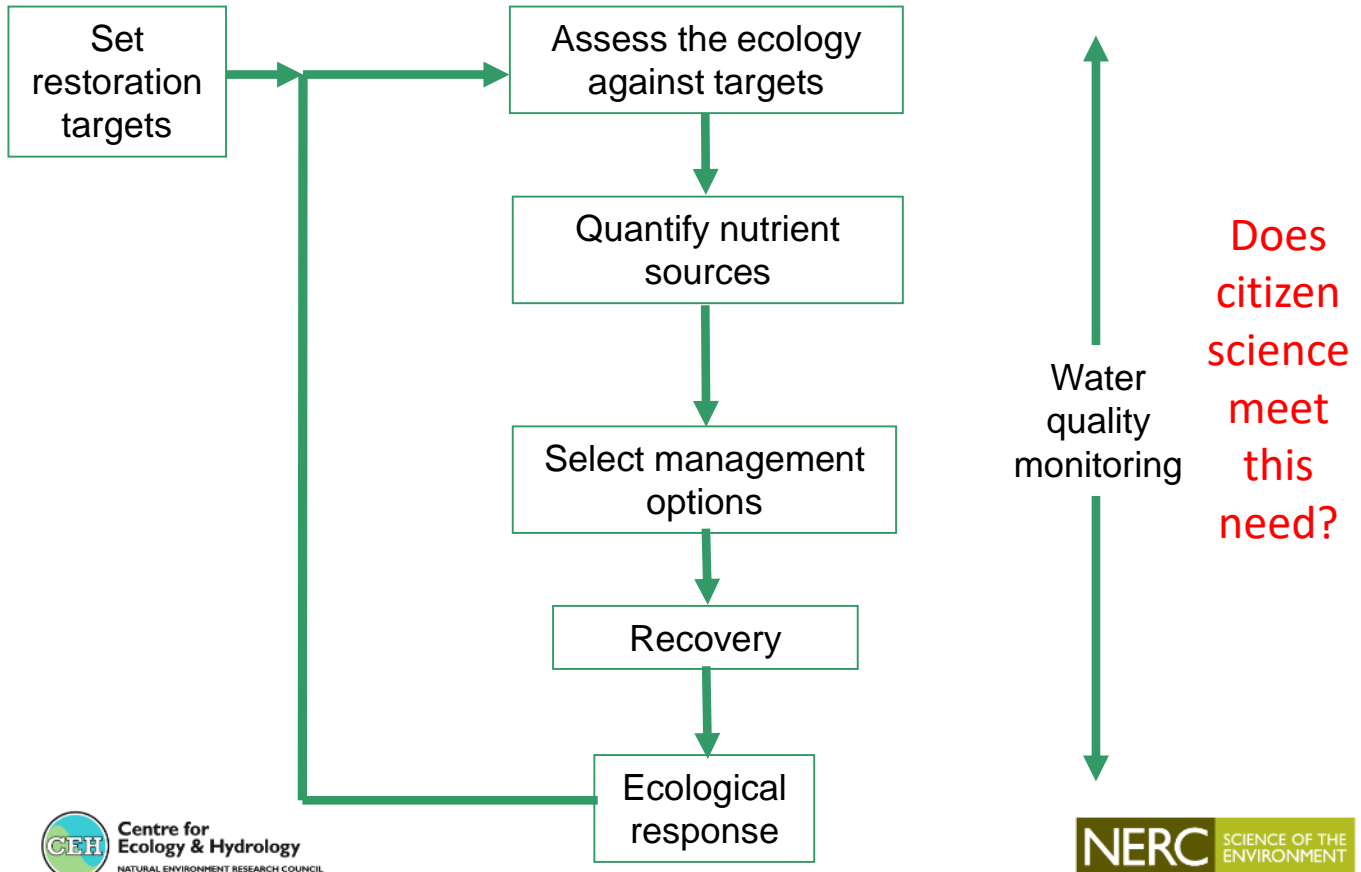
Features



The 13 MPs who opposed snap election



Restoration process (iterative)





Linlithgow Loch

Bryan Spears....*on behalf of many others*



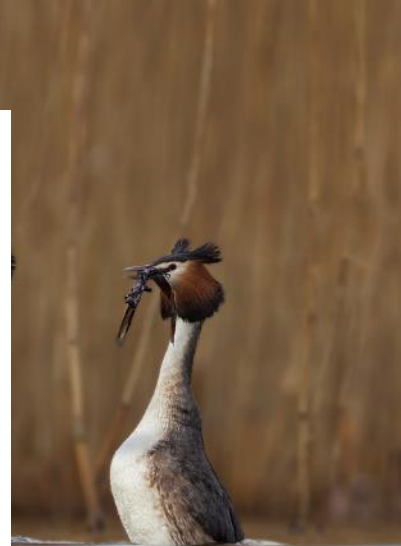
Introduction to Linlithgow Loch and Management Groups

Importance of Linlithgow Loch: work, live, play, learn



2016-17 financial year top ten staffed heritage attractions:

1. Edinburgh Castle – 1,647,351
2. Stirling Castle – 447,512
3. Urquhart Castle – 380,152
4. Skara Brae – 91,860
5. Doune Castle – 84,972
6. Linlithgow Palace – 68,958
7. Iona Abbey – 63,502
8. St Andrews Castle – 72,283
9. Fort George – 58,098
10. Melrose Abbey – 49,566



Linlithgow Loch is the largest natural freshwater loch in the Lothian area. It is designated as a SSSI for a good representation of eutrophic aquatic and emergent plant communities (SNH, 2008).

Importance of Linlithgow Loch: lake restoration platform

No council money to tackle Linlithgow Loch algae

Sponsored by LAIRDS Fine Foods

You are here: Home / Environment / Water / Linlithgow Loch

Home

- Environment
- Water
- Cyanobacteria (Blue-Green) Algae
- Water Supply
- Linlithgow Loch

Linlithgow Loch

Linlithgow Loch is one of the jewels in West Lothian's crown. Owned by Historic Scotland it provides opportunities for walking, fishing, and water sports. It supports a wide variety of wildlife.

Linlithgow Loch Summit

To bring together the various parties involved in Linlithgow Loch, a Loch Summit was organised by Historic Environment Scotland (HES). It took place at the Burgh Halls, Linlithgow on 24th November 2015 and was independently chaired.

Contacts

Environmental Health
Postal Address Only
West Lothian Civic Centre
Howden South Road
Livingston
West Lothian
EH54 6FP
Tel: 01506 280000
Fax: 01506 282488

Linlithgow GAZETTE

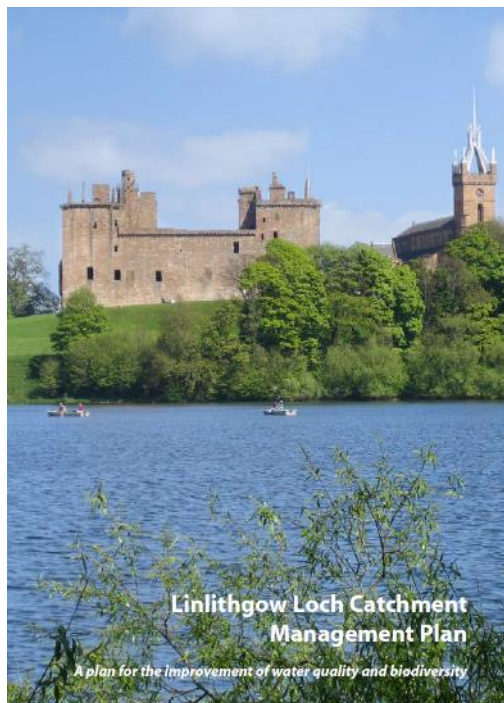
Health warning: Avoid Linlithgow Loch



The algae can cause liver failure in animals. Picture: Alan Murray



Linlithgow Loch CMG



Objectives of Catchment Management Group are to provide:

1. effective management advice in accordance with the responsibilities of the key stakeholders of Linlithgow Loch,
2. clean and safe water which is necessary to support tourism, recreation, education and local businesses, and,
3. high quality freshwater habitat which is required to sustain the loch's protected species and overall biodiversity.

<http://www.westlothian.gov.uk/article/5860/Linlithgow-Loch>

LINLITHGOW LOCH GOVERNANCE STRUCTURE

LEAD: Strategy, Direction,
Resources & Comms

STRATEGIC MANAGEMENT GROUP

MANAGE: Action Plans,
Liaison & Co-ordination

LOCH CATCHMENT MANAGEMENT GROUP

3 meetings / year

DELIVER: Action, projects,
resource allocation

WORKING SUB GROUPS

X4

HES (Chair)	David Mitchell	Director of Conservation
HES	Joann Russell	Head of Estates
HES	Martin Gray	Ranger Manager
SNH	Katherine Keys	Operations Manager
SEPA	Ian Buchanan	Head of Regulatory Services
SEPA	Andy Hemmingway	Water specialist
SW	Mark Williams	Head of Env Science & Regulation
SG	Joyce Carr	Environmental Quality Division
CEH	Dr Bryan Spears, Dr Linda May	
WLC	Jim Jack	Head of Operation Services
LINLITHGOW HERITAGE TRUST	Martyn Wade	
COMMUNITY	Martin Crook	Community Council Chair

WLC (Chair)	Graeme Hedger	Flood Risk Management
WLC (Secretary)	Chris Alcorn	Planning Officer
HES	Martin Gray	Ranger Manager
	Peter Ranson	District Architect
SNH	Malcolm Fraser	Area Officer
SEPA	Ian Buchanan	Head of Regulatory Services
SW	June Guthrie	Ops Manager
CEH	Dr Bryan Spears, Dr Linda May	
SAC	Mary-Jane Stewart	Agri Consultant
FAFA	Andy McAlpine	President
Linlithgow Angling Club	Harry Miller	

FUNDING

WLC
COMMUNITY
HES
+Others as projects dev

WATER QUALITY

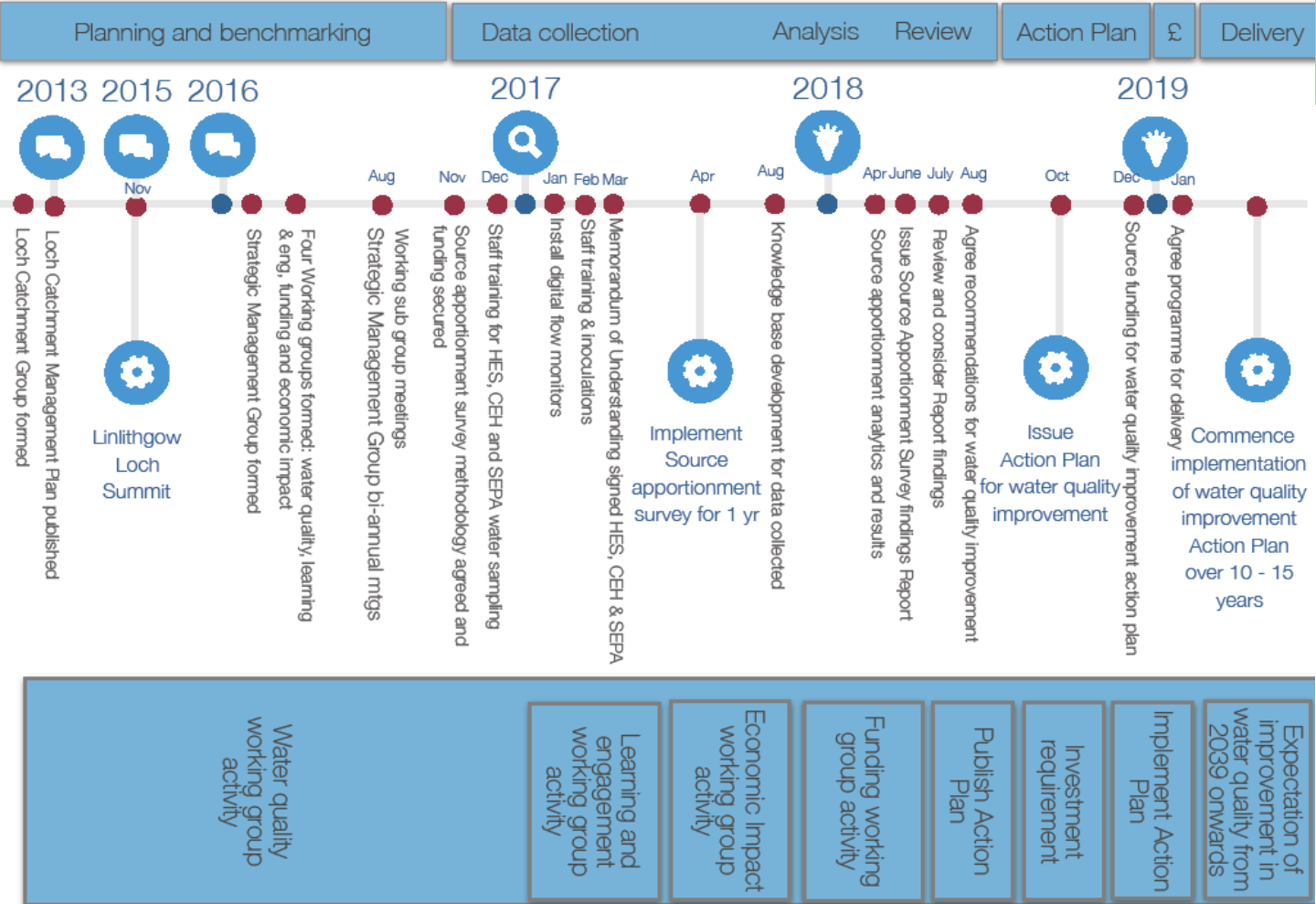
WLC	Graeme Hedger
HES	M Gray P Ranson
	E Hyslop
CEH	B Spears L May
SEPA	IBuchannan A Hemmingway

LEARNING & ENGAGEMENT

WLC	Graeme Hedger
HES	Martin Gray
HES	Alan Bannon
LHG	Martyn Wade
LAG	Harry Miller
+Others as projects dev	

ECONOMIC IMPACT

WLC	tbc
LHG	Martyn Wade
HES	Russell Whyte
	Jane Rahil
CEH	Dr J Dick & Dr LMav

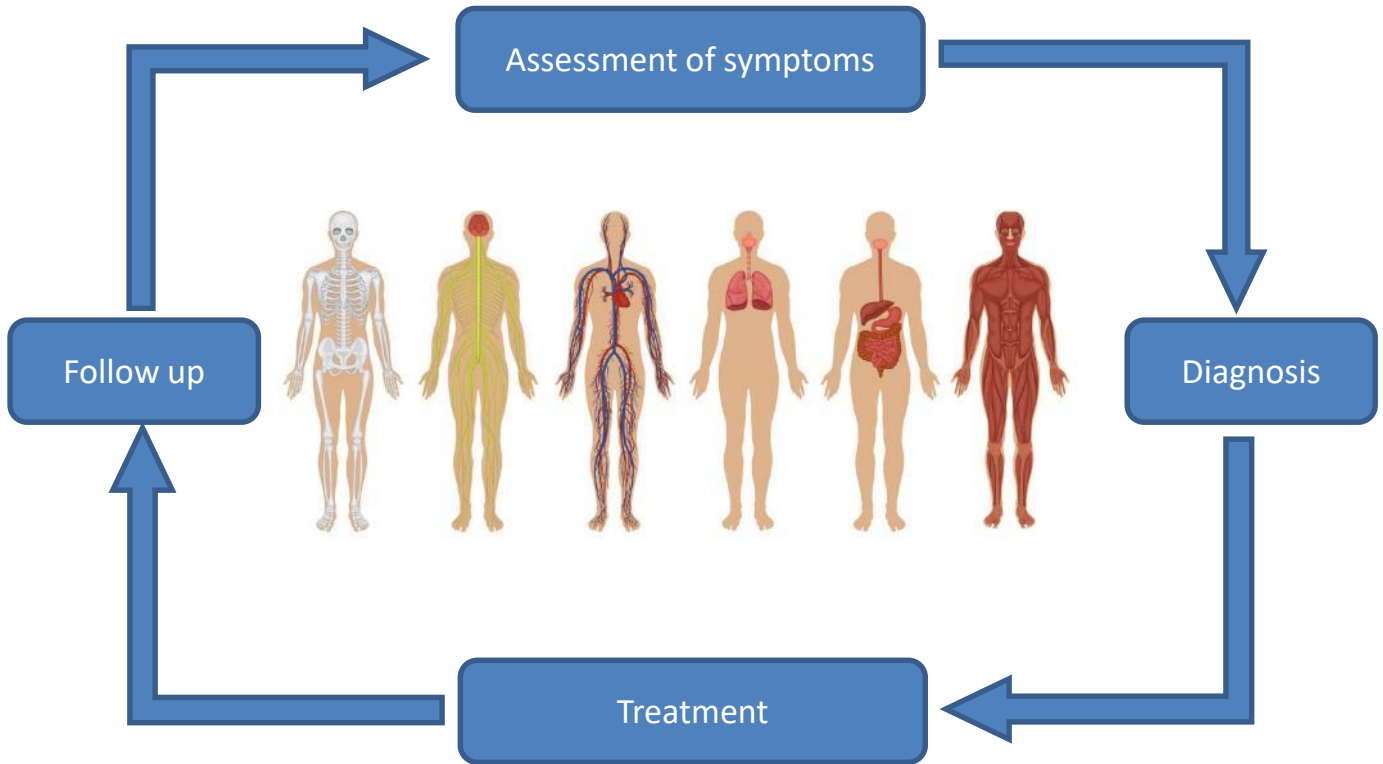


Linlithgow Loch water quality improvement timeline

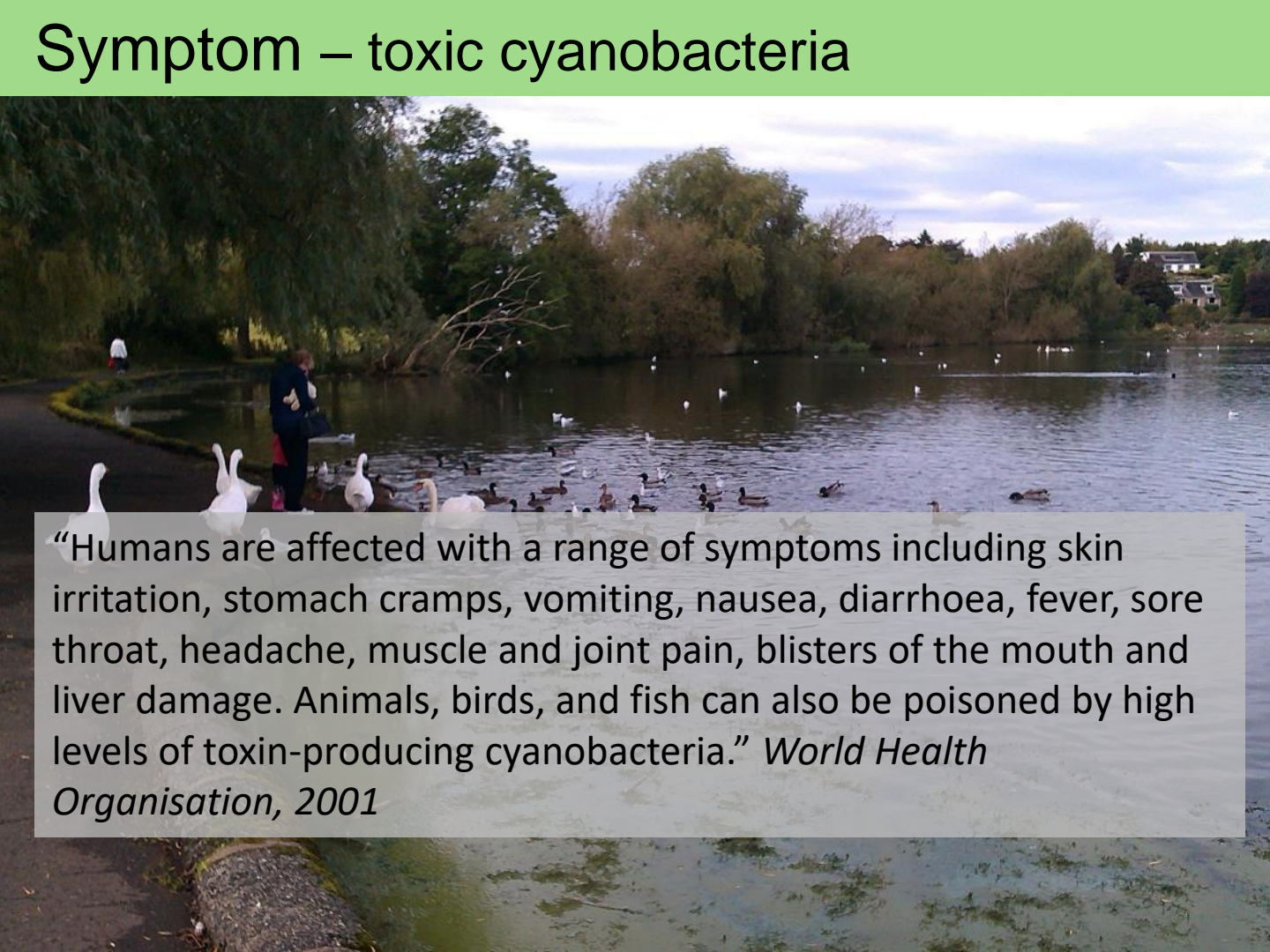


Progress with addressing causes of poor water quality in Linlithgow Loch

Linlithgow Loch – health check



Symptom – toxic cyanobacteria

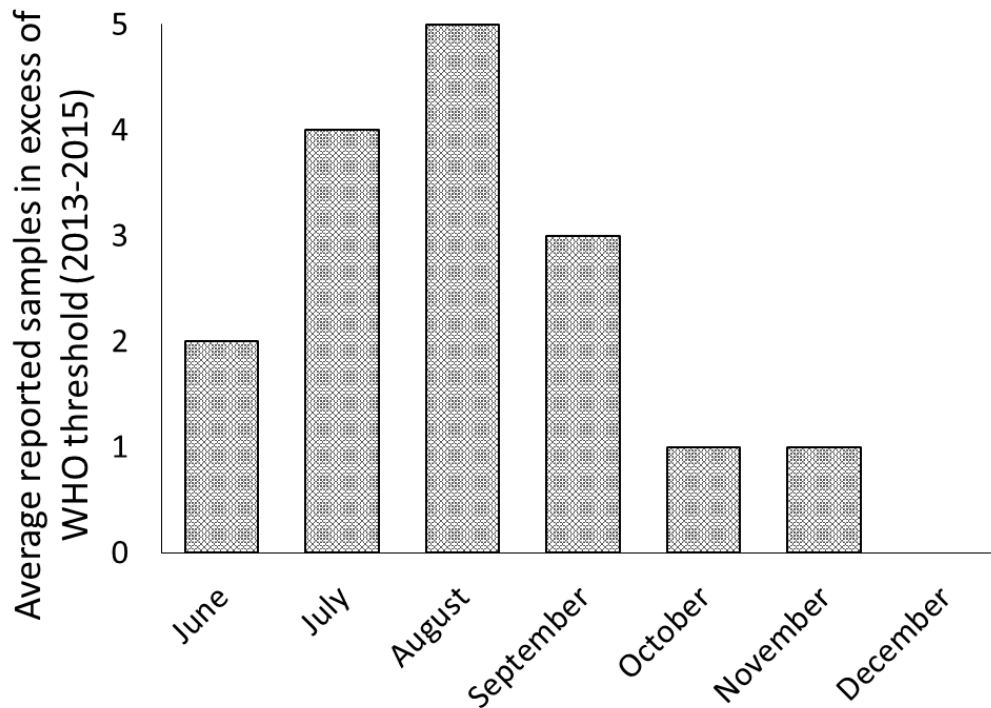


“Humans are affected with a range of symptoms including skin irritation, stomach cramps, vomiting, nausea, diarrhoea, fever, sore throat, headache, muscle and joint pain, blisters of the mouth and liver damage. Animals, birds, and fish can also be poisoned by high levels of toxin-producing cyanobacteria.” *World Health Organisation, 2001*

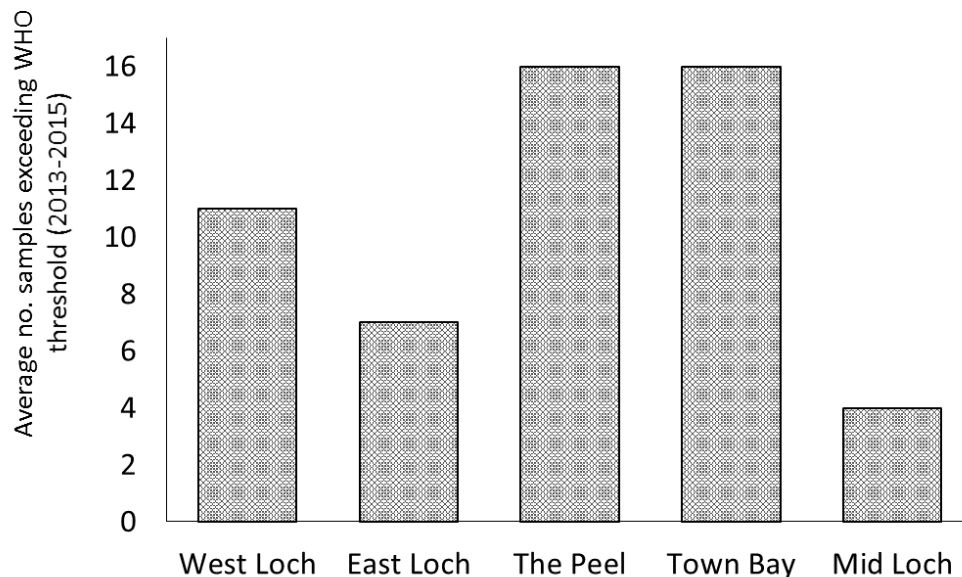
Cyanobacteria species - *Anabaena* sp.



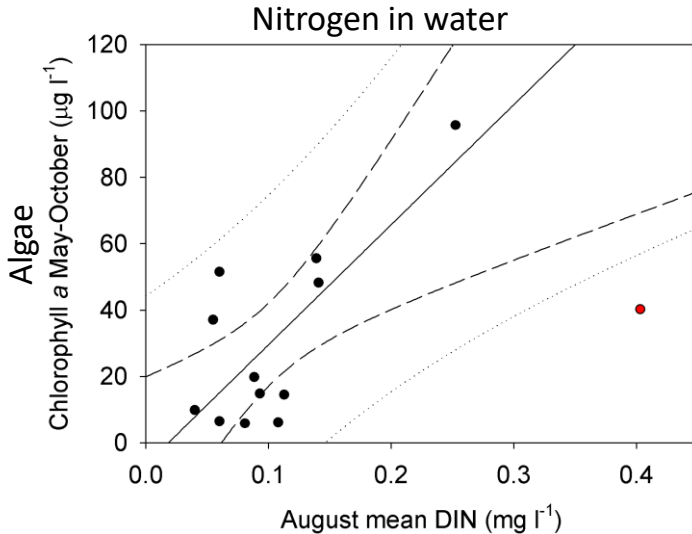
Symptom – Toxic cyanobacteria in Linlithgow Loch



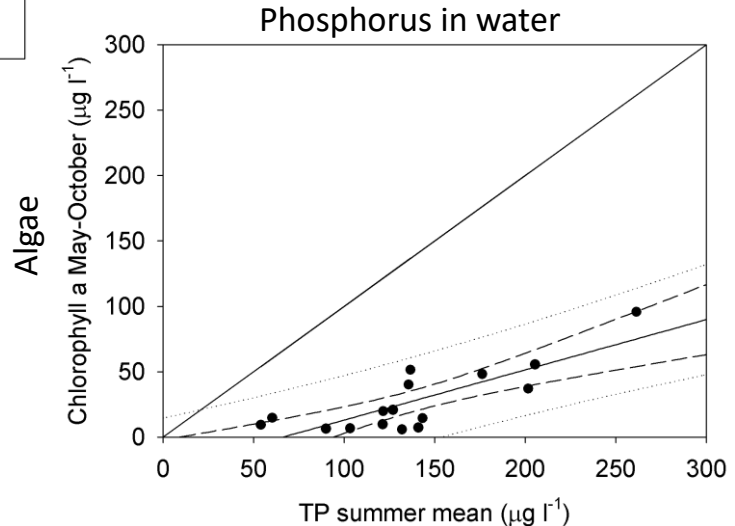
Symptom – Toxic cyanobacteria in Linlithgow Loch



Diagnosis – N and P are main causes



Algae require a supply of nitrogen and phosphorus to grow well



Treatment – reduce pollution entering lakes

Loch is contaminated by raw sewage — again

RAW sewage contaminated Linlithgow Loch last week, for the third time in nearly two months.

Human waste, plus other materials, seeped into the loch — habitat of many types of bird, fish and plant life — following heavy bouts of rain.

This week it emerged a blocked drain was to blame, and pledges have been made that a close eye will be kept on the situation.

The alarm was raised by the Forth Federation of Anglers, which has a club hut on the edge of the loch.

Member Joe Lidster said: "Our jetty formed a natural barrier. You should have seen the things that were floating about in the water — it was raw sewage, basically. The smell was terrible."

He said debris had included waste, sanitary towels and toilet paper.

Added Joe: "This was the third time in the last five or six weeks that this had happened. It always seemed to follow a shower of heavy rain."

Joe, who complained to West Lothian Council's environmental health department, said that attempts had been made to clear up the mess, but last Thursday waste items were still clearly evident on the surface of the water.

SNP councillor Jimmy McGinley (St Ninian's) said this week: "Our environmental health officers got in touch with East of Scotland Water.

"They sent out two men with fine mesh nets to remove any solid debris from the water."

Councillor McGinley added: "They've traced the problem to a choked drain in the Vennel area, which was blocked with a build-up of grease.

"A build-up of sludge like this can lead to a sewage overflow, especially when there's heavy rain, and that's what seems to have happened here.

"That drain has now been cleared, and East of Scotland Water say they will keep an eye on the situation."

He added: "While this had occurred three times in the last five or six weeks, thankfully it's not something that generally happens on a regular basis, although I do recall a similar incident at Preston Road some time ago."

attention of the Board has been called to the serious pollution of Linlithgow Loch. From enquiries, which they have caused to be made it appears that the Loch is polluted from the following sources:—

SOURCES IN COUNTY OUTSIDE BURGH

1. Bell's Burn, which discharges into the Loch, conveys the sewage from the Poor-

FOOD for
THOU

JOURNAL & GAZETTE
Guide to The Best
Food Around

YUK FUNG 玉鳳

CHINESE RESTAURANT AND TAKE AWAY

SUNDAYS-THURSDAYS 4.30-11.30 p.m.
FRIDAYS and SATURDAYS 4.30 p.m.-12 midnight



JIMMY MCGINLEY

Panel is on the

Thomas, Bailie Dymock, Dean of Guild Nimmo, Treasurer; Dymock, Councillors W. Braithwaite, G. Davie, J. Hebeon, A. Kerr, J. F. Macdonald, N. S. Main, and J. McKay, with the Clerk (Mr Thom), Mr A. H. Swatson, Burgh Surveyor, and Mr Jas. Bambrerry, Sanitary Inspector.

THE WATER SUPPLY

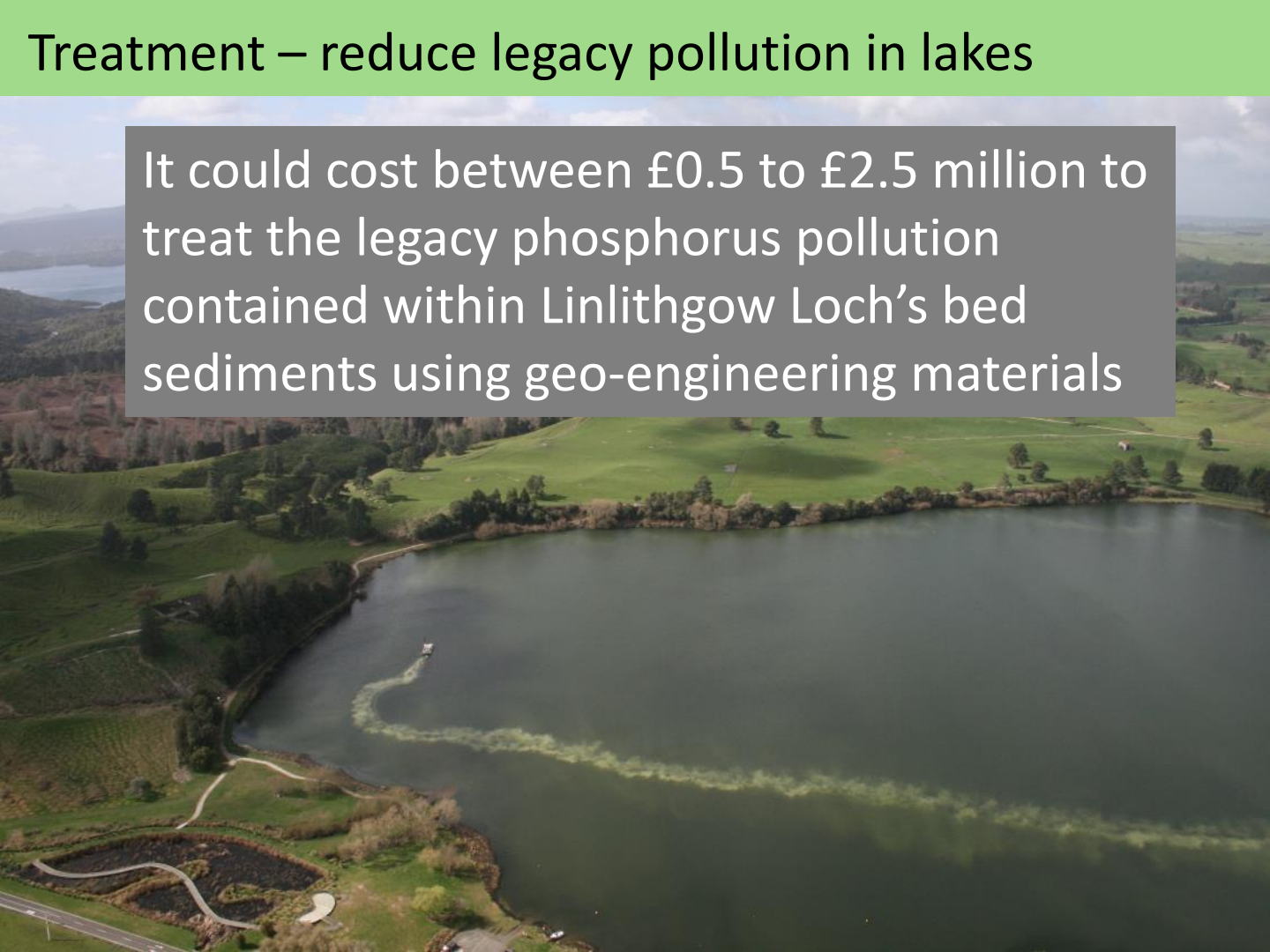
The Clerk read the following list of



DEGATTA.—The a
Saturday under-
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of the first round of the course
the small number of entrants
the events was rather disappoint
the races were keenly conteste
fortunately owing to the lateness of
and the fact that other importa
events were held on the same
neighbourhood competitors who w
vice have entered were prevented
so, and the committee have statu

Treatment – reduce legacy pollution in lakes

It could cost between £0.5 to £2.5 million to treat the legacy phosphorus pollution contained within Linlithgow Loch's bed sediments using geo-engineering materials



Water quality working group - MOU

OUR SCIENCE DATA SERVICES STAFF NEWS & MEDIA GET INVOLVED



CEH scientists to work on water quality challenges at Linlithgow Loch

Home » News & Media » News

Submitted by on Wed, 07/09/2016 - 11:29

Scientists from the Centre for Ecology & Hydrology (CEH) are part of a new group charged with tackling the challenges, including water quality issues, at Linlithgow Loch in Scotland.

Key partners including CEH, Historic Environment Scotland, Scottish Water, Scottish Environment Protection Agency, Scottish Natural Heritage, West Lothian Council, Scottish Government and local community representatives have come together to set out a clear action plan for working together on a long-term joint-management plan to improve water quality and biodiversity in the loch.

The group's first priority is to understand where and how the nutrients, which cause algal blooms, enter the loch and to what extent these nutrients have been stock-piled in the lake bed sediments, representing a legacy pollution risk. To achieve this, a 'source apportionment' study will begin at the start of January 2017 and take place over the course of one year. The study, which will be resourced by Historic Environment Scotland, with scientific guidance from the Centre for Ecology & Hydrology and Scottish Environment Protection Agency, will involve water sampling from a number of different locations within the catchment and loch. The information gathered through this process will help inform sources and solutions for managing nutrient pollution.



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Metal speciation from stream to open ocean: modelling v. measurement

Long-term nitrogen and phosphorus enrichment alters vegetation species composition and reduces carbon storage in upland soil

The relative risk and its distribution of endocrine disrupting chemicals, pharmaceuticals and personal care products to freshwater organisms in the Bohai Rim, China

Events



European Climate Change Adaptation Conference, 5-9 June 2017

2017-06-05

The theme of ECCA 2017 is 'Our Climate Ready Future'. Our vision

Water quality working group – nutrient loading assessment

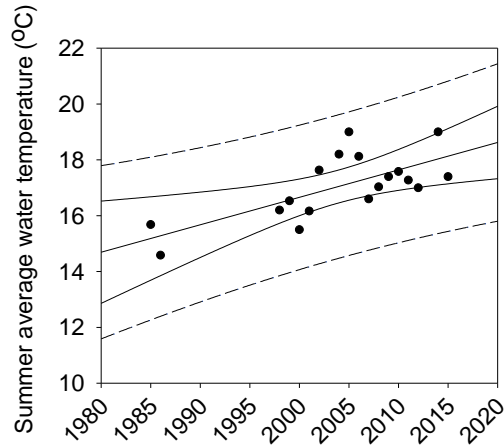


- Catchment walks completed
- Plan for gauging inflows completed and in progress
- Plan for collection of samples prepared
- Training of staff conducted
- Modelling estimates of nutrient load in progress

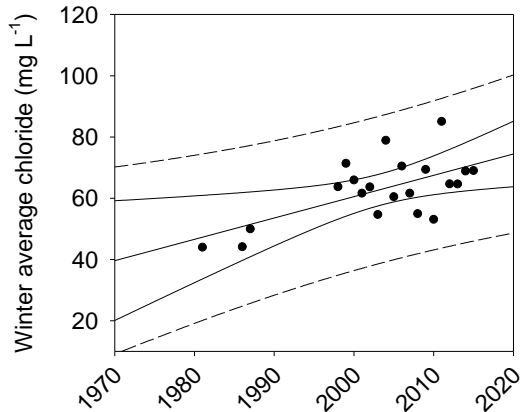


Assessing factors that may confound management measures in the long-term

Potentially complicating factors (temperature and salt)

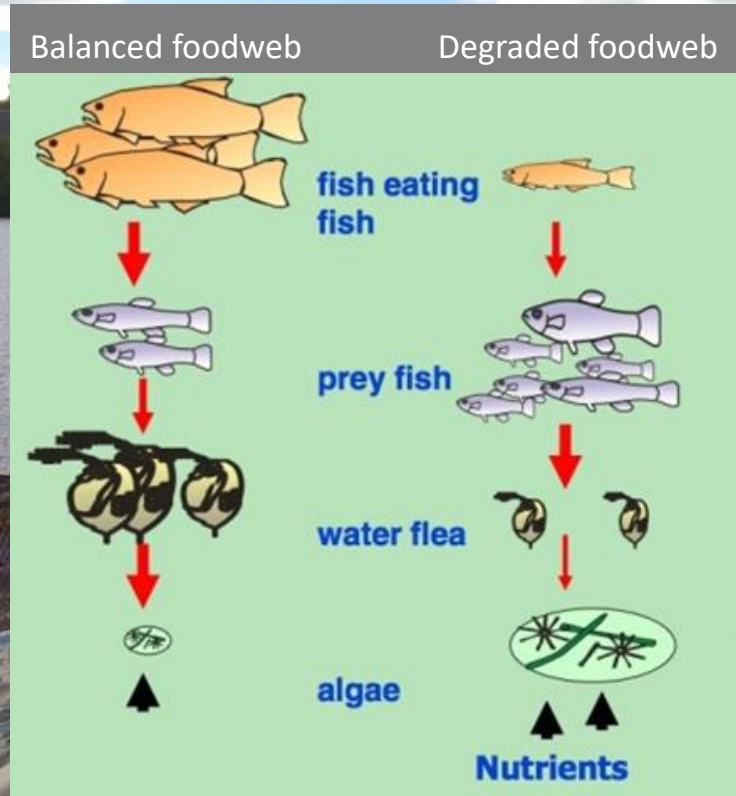


Linlithgow Loch is getting warmer, a condition known to increase algal yield in other lakes



Linlithgow Loch is getting saltier, a condition known to increase cyanobacteria dominance in other lakes

Potentially complicating factors – fish stocking



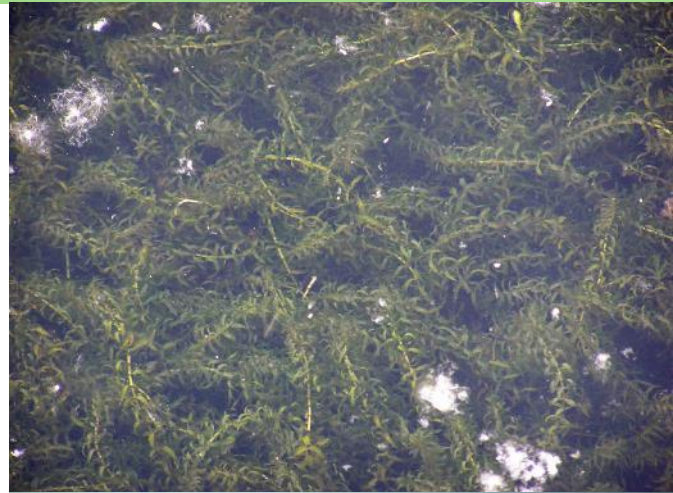
Secondary symptom – suppressed aquatic plant diversity



Linlithgow Loch is the largest natural freshwater loch in the Lothian area. It is designated as a SSSI for a good representation of eutrophic aquatic and emergent plant communities (SNH, 2008).

Complicating factor – non-native invasive species

In the late 1970s, native pondweeds began to decrease in Linlithgow Loch and the first non-native species of pondweed (Canadian pondweed) took hold in 1980, with Nuttall's pondweed being recorded for the first time in 2004.



In this section

Be plant wise

- ▶ How easy is it to tell?
- ▶ Are you a gardener/pond owner?
- ▶ Know what you have
- ▶ Stop the spread
- ▶ Compost with care

Quick links

Non-native species information portal



Gallery



Don't forget about us.....

COOT

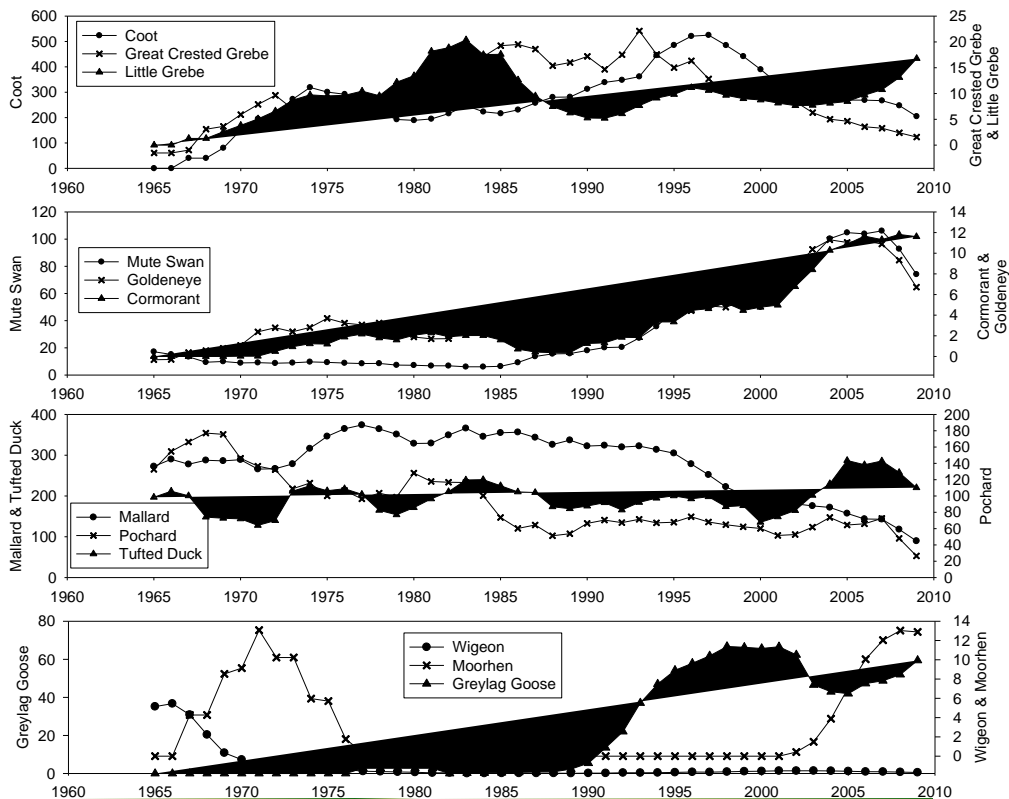


J. SQUIRE - SNH

MUTE SWAN



D. CARSS CEH



Habitat quality – aquatic plants

Gandalf strikes again....

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Spacious family rooms
where kids stay free

Doesn't he know it's swan way? Dozy bird brings motorway traffic to a standstill for 30 minutes after getting



© Gordon Jack/ScotImage.com

Safe and sound: The woman who reported the swan on the motorway cried with relief upon learning it had been rescued



© Gordon Jack/ScotImage.com

In a bit of a jam: The confused swan waddled down the middle of the M9 motorway during the morning rush hour today after losing its way in thick fog



© Gordon Jack/ScotImage.com

Bizarre scene: Cars were left queuing up behind the swan, which wandered around the carriageway for around 30 minutes before it was eventually rescued



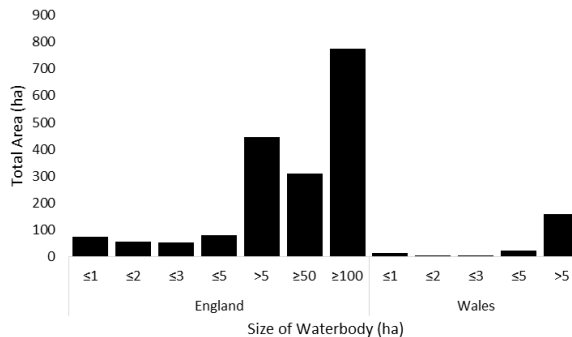
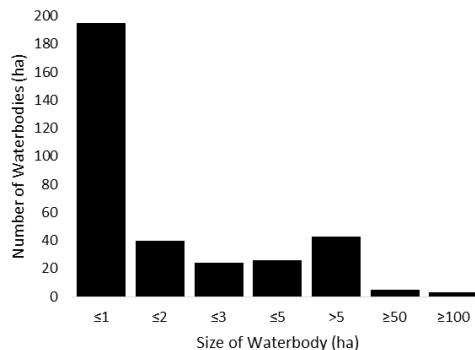


NERC Innovation Internship with The National Trust

Aims to:

- Get a better understanding where National Trust owned waterbodies are
- Review and update existing National Trust management guidance
- Raise awareness and promote better lake/pond management

National Trust project



- 336 waterbodies in National Trust ownership in England and Wales
- 89 waterbodies next to or near National Trust owned land in England and Wales
- Nearly 2000 ha of freshwater in Trust ownership in England and Wales

National Trust project

- Few waterbodies under The National Trust's ownership are classed as 'urban'
- Large numbers are ornamental ponds and parkland lakes, but they still suffer from many of the issues that can blight urban lakes and ponds
- There is a need to balance ecology and amenity
- **Next steps**
 - Gather National Trust economic data and link it to existing WQ and ecological data
 - Provide lake management decision support tools to aid better management



Thank you

Any questions?