



Pike and Trout in lakes

An AFBI Ecological perspective

Presentation to IFI policy review, May 2017

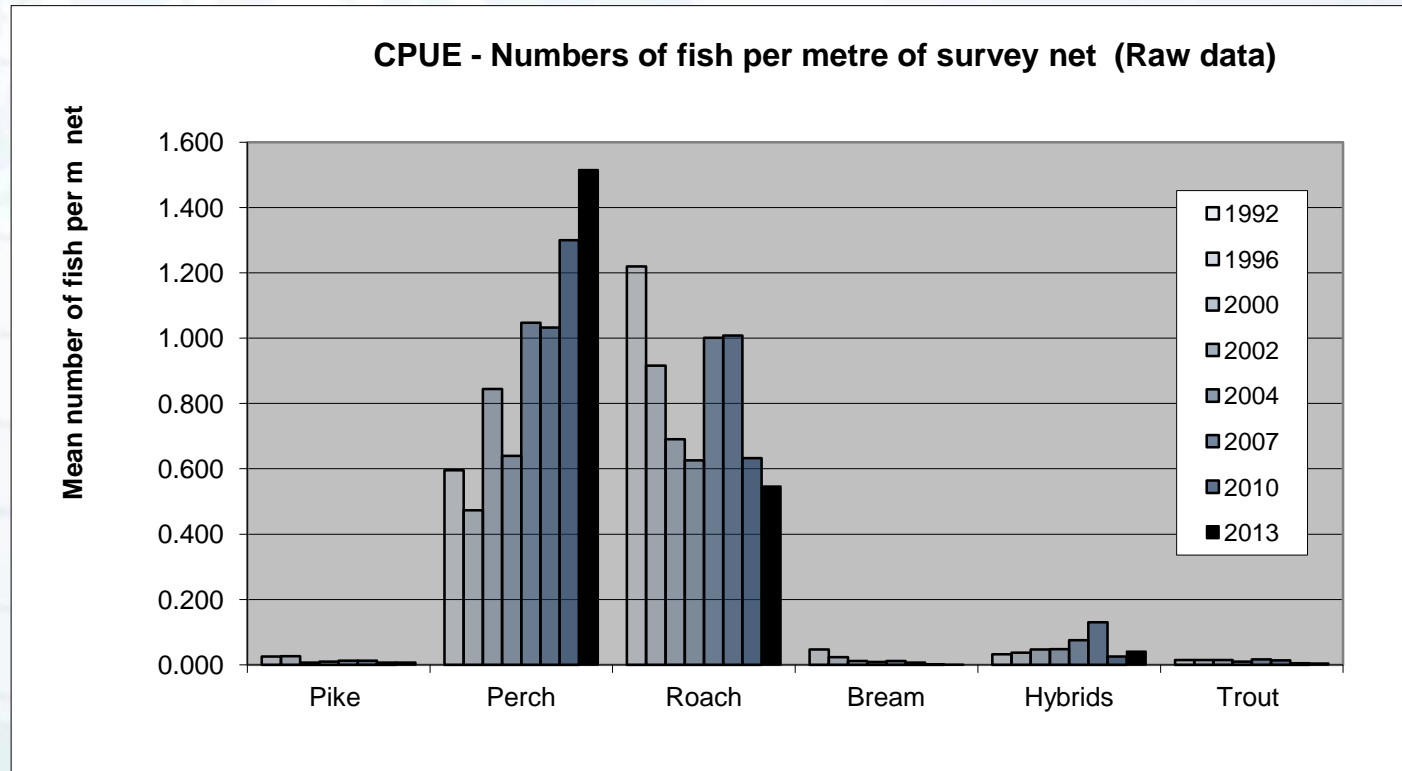
Dr Robert Rosell

Presentation to Cover:

- Data from general fish monitoring of Lower Lough Erne
- Pike specific studies/population assessments
- Pike Migration and Movements
- Predation /Feeding studies
- The history of commercial fishing for pike in the Erne system
- Current ongoing work yet to contribute to policy

Comment: AFBI and its predecessor in DARD science service have been monitoring mixed fish stocks for NI government departments since 1991, using a precursor to the current CENgill netting system for WFD.

AFBI Fish monitoring - Erne System

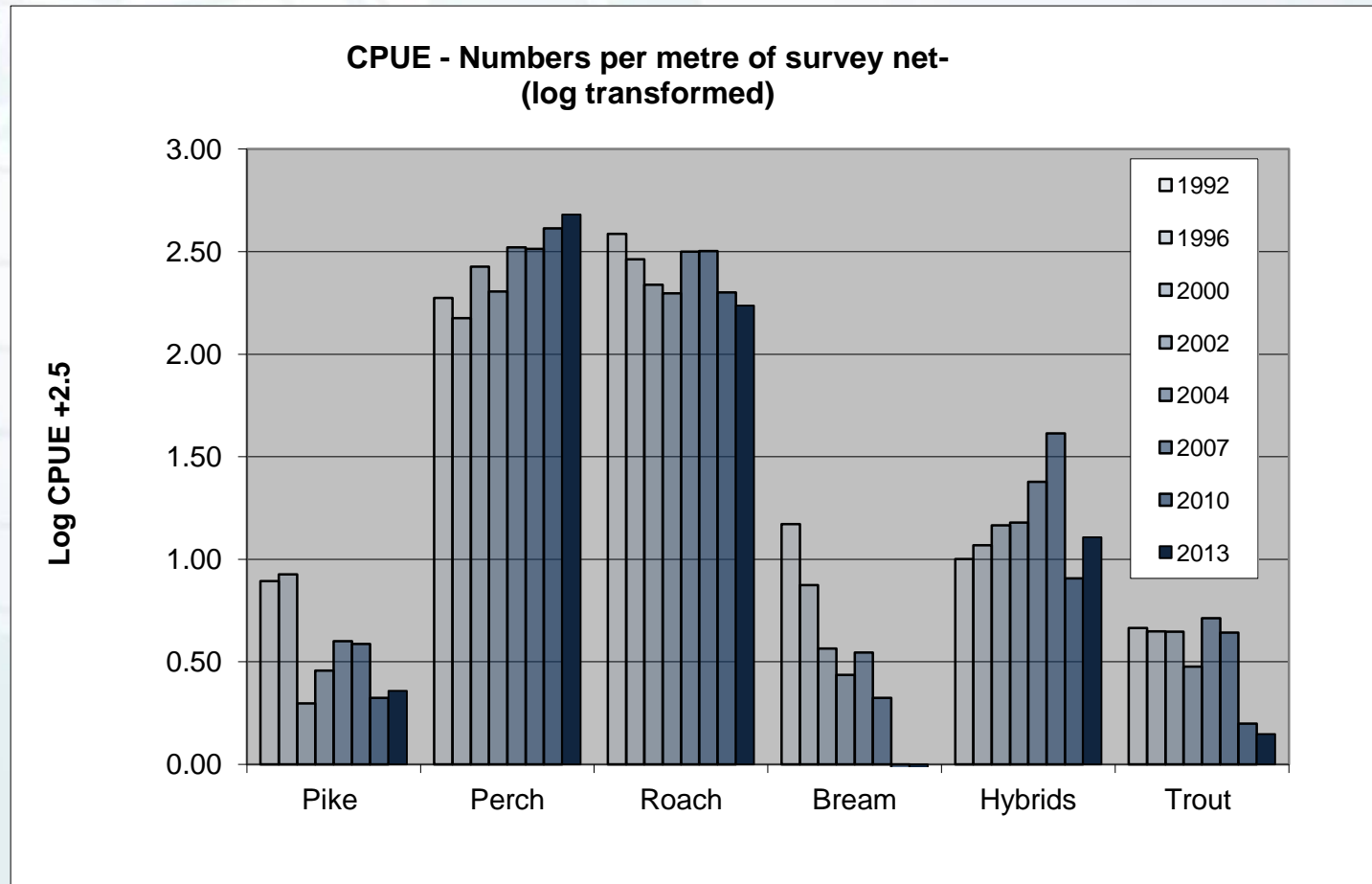


Data triennial since 1992

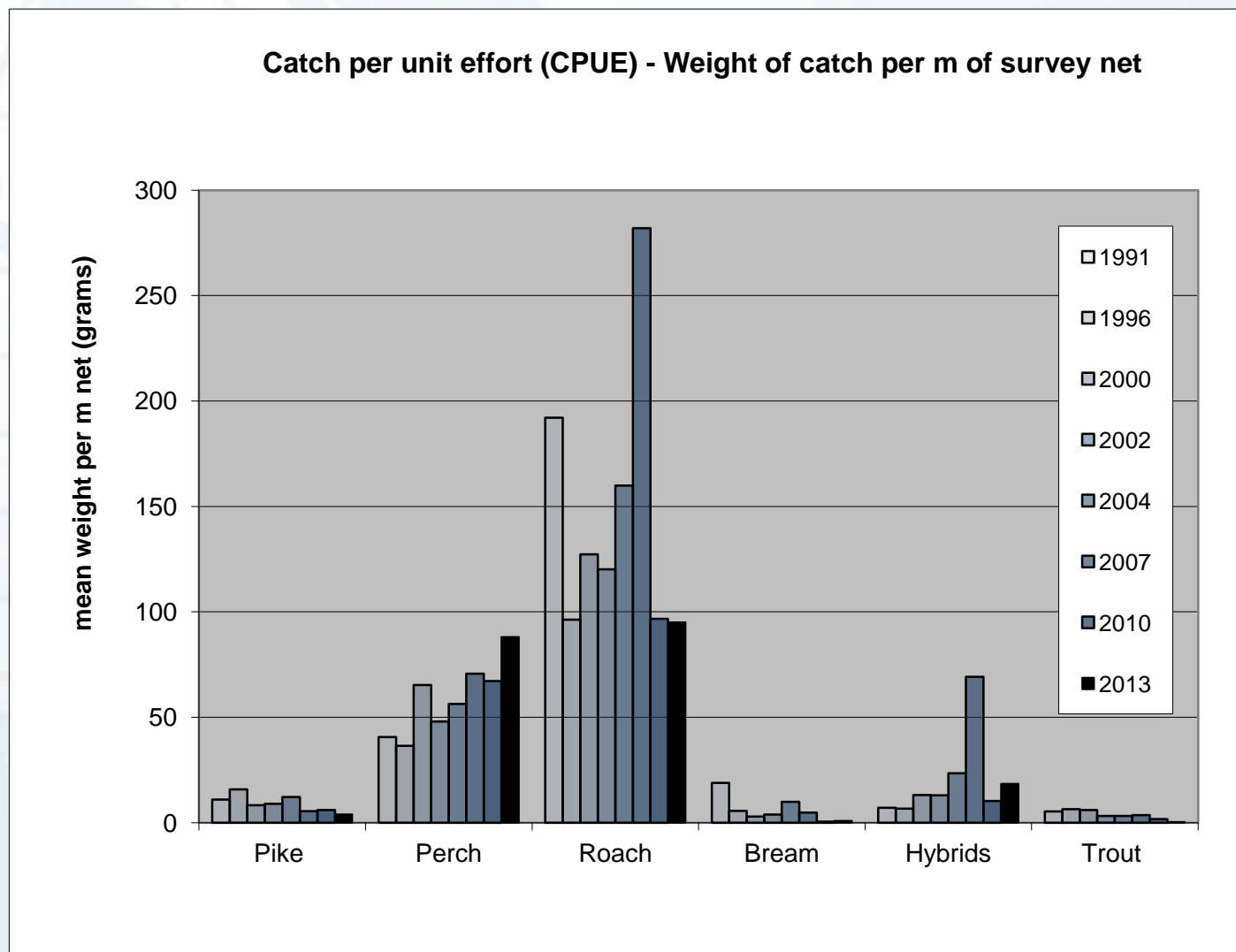
Spans a zebra mussel colonisation

Comment: This Log transformation is used to enable visualisation of trends in all fish stocks on the one view, in a way which is Not immediately visible when simple Number or Biomass CPUE data is presented without transformation

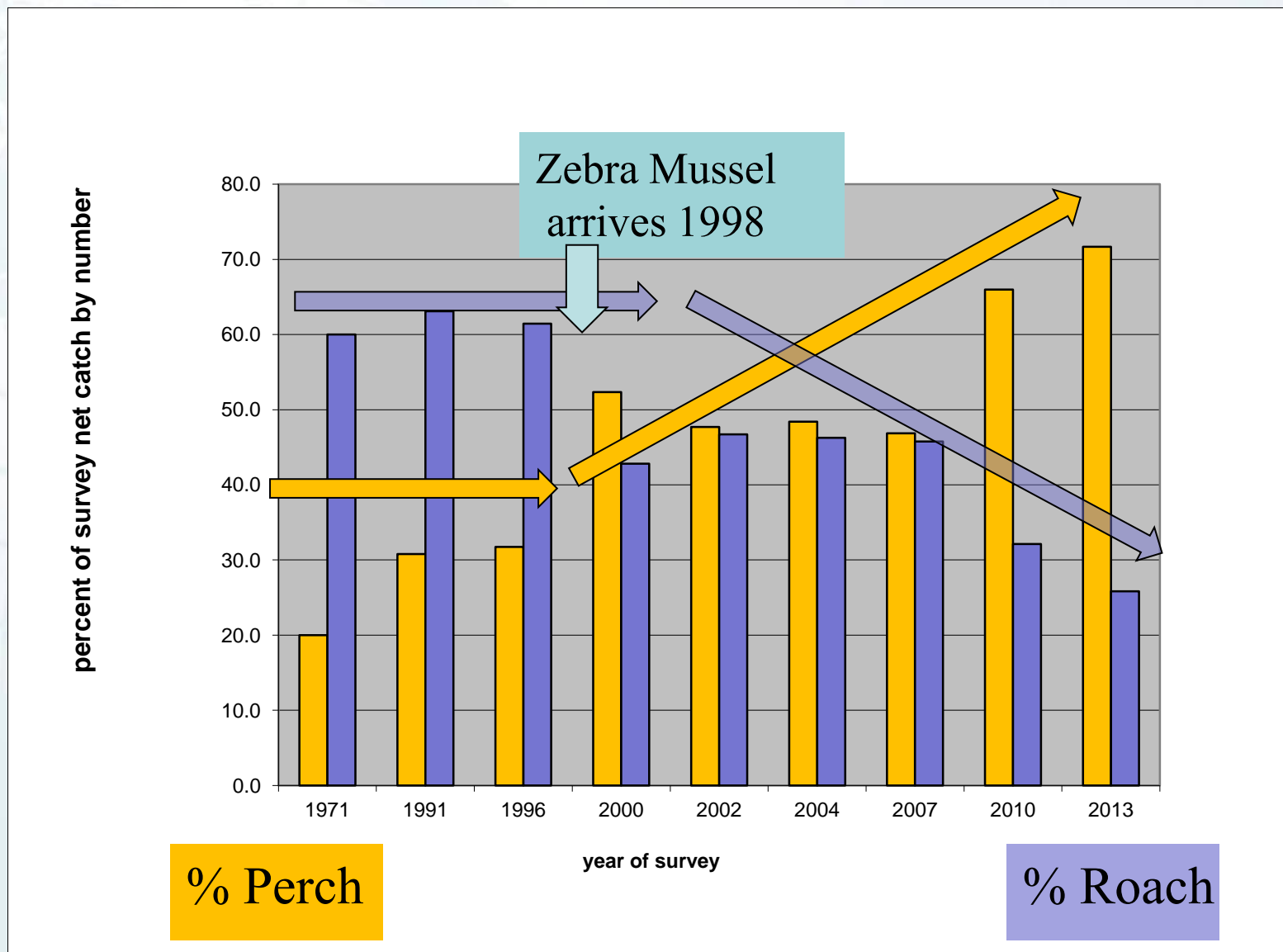
Erne transformed CPUE (for Visual impression)



Comment: Roach fluctuate dependent on year class strength and are still the most abundant species by weight in lower Lough Erne, although perch biomass has increased steadily over the time series, particularly post arrival of zebra mussel and now almost equals roach



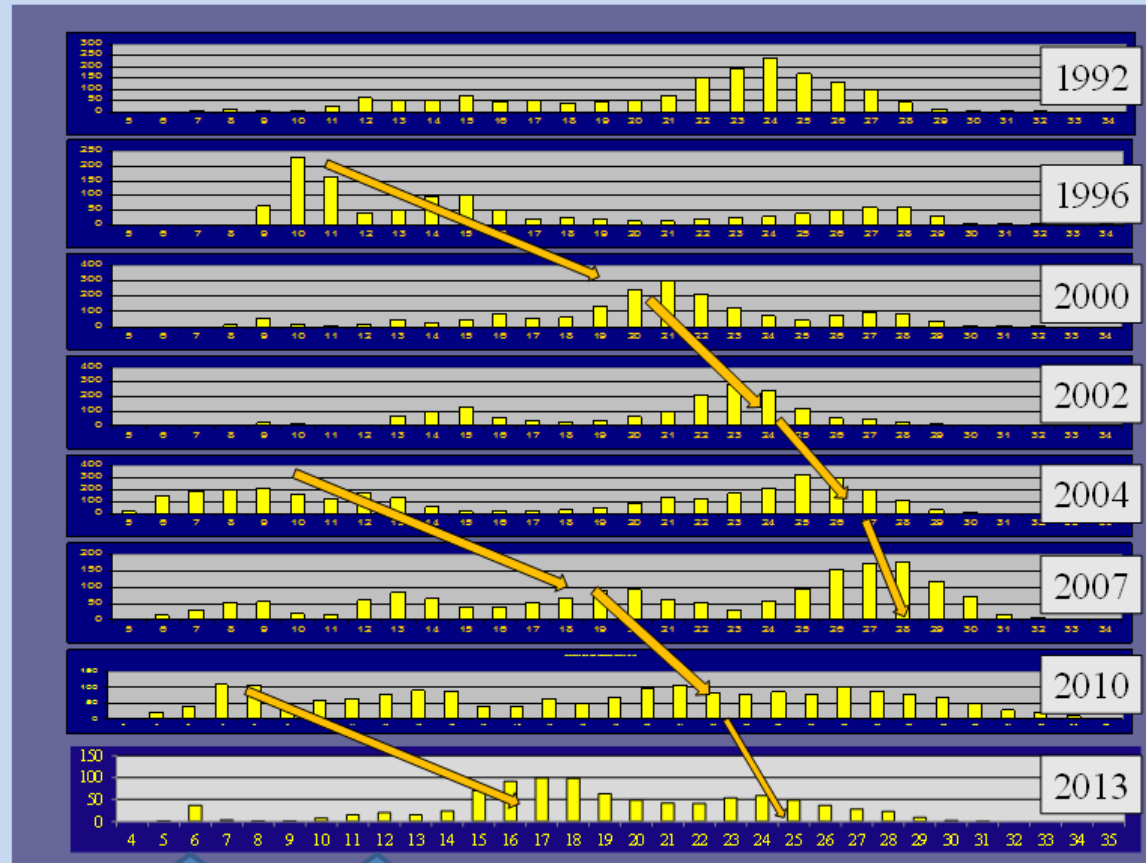
Lough Erne - Perch increase, Roach decrease, after zebra mussel



Comment: Relative Perch numbers (catch per unit effort) have increased dramatically since zebra mussel – now the most abundant species outnumbering roach by 2.5:1, When records began Roach outnumbered perch by a similar figure. This is in all likelihood a zebra mussel driven change: theory is perch have an ecological advantage in clear water systems and are less dependent than roach on plankton in the early years of life

Lower Lough Erne - Total fish biomass driven by Roach

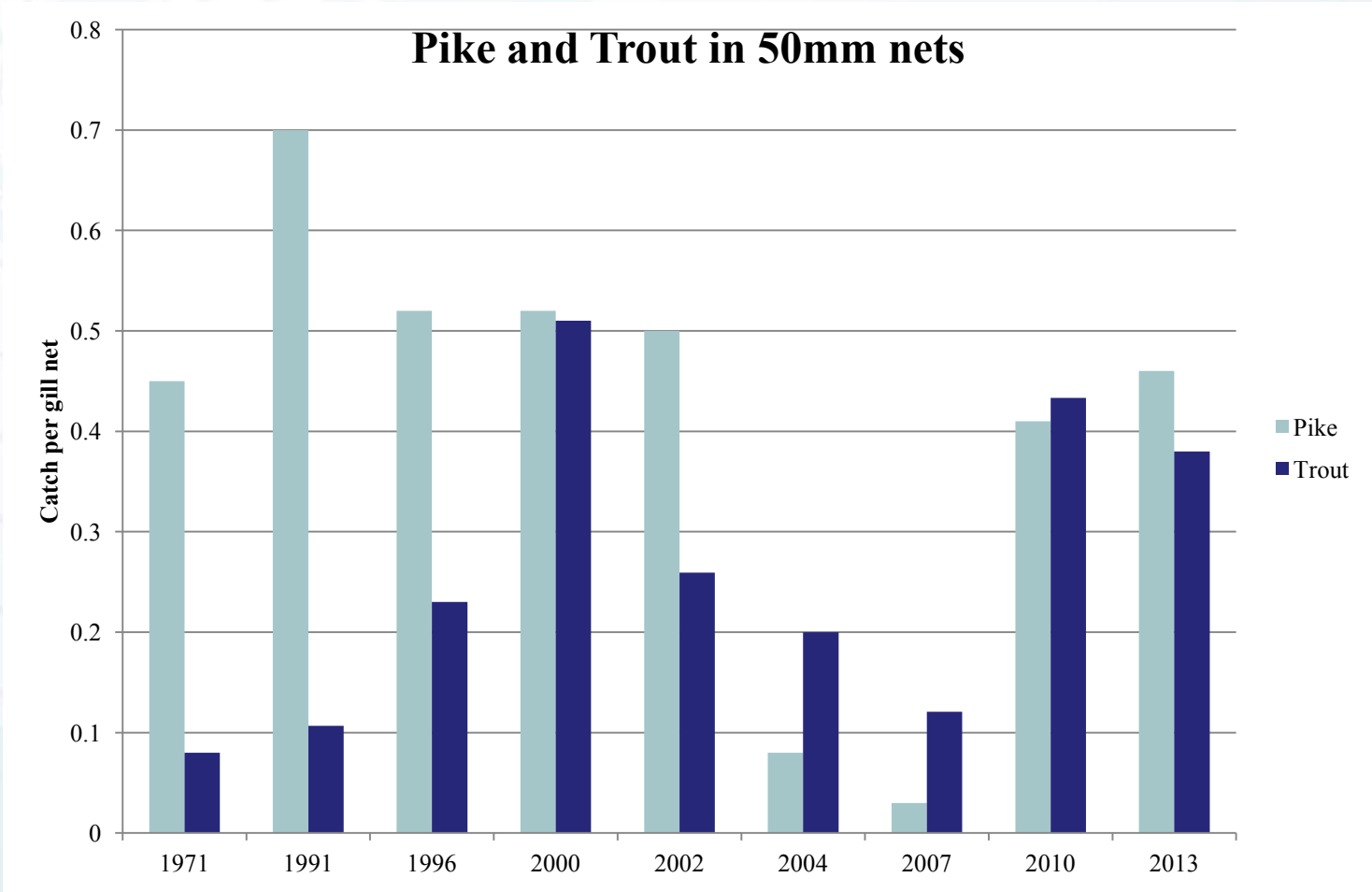
Roach tracking through .. Strong and weak year classes



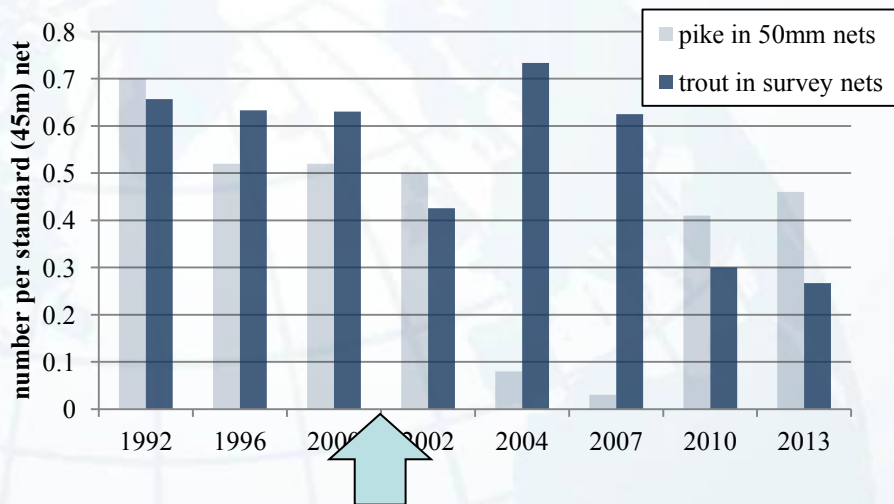
Weak year classes from 2011 and 2012:

Comment: The fluctuation in roach numbers and biomass is due to variable recruitment. Once year classes reach 2+ they appear to lock down as strong year classes for 13 year life. This is likely to be important in driving predatory fish numbers

Comment: Looking for interaction between pike and trout, the first look was at numbers of mature pike (>55cm) and larger trout (>40cm) in data from 2" net series. Both fell for a while at the peak of the Zebra mussel effects, but there is no clear long term relationship. Note these are from low sample sizes so care should be taken not to over-analyse the data.

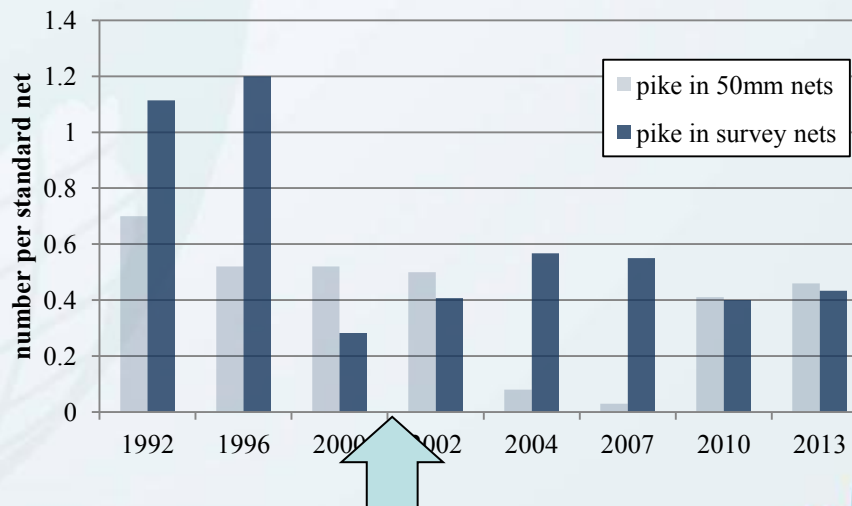


CPUE of Pike in 50mm nets versus trout in "Survey" nets, Lower Lough Erne series



Comment: These data series: above, (showing larger pike in 2" Versus juvenile trout in the margins) and right , showing Larger pike versus numbers of smaller pike In the margins, when taken in the context of post zebra Mussel invasion water clarity, suggest inverse relationship between mature pike and their two favourite prey (See later) which does not show before ZM water Clarification impact takes full effect 2000

CPUE of pike in 50mm nets versus pike in "Survey" nets, Lower Lough Erne Series





Pike Specific surveys

Pike migration and Movement in Lough Erne (1990's)

(Rosell, R.S and MacOscar, 2000 - Movements of pike *Esox lucius* L. in Lower Lough Erne, determined by mark -recapture, 1994 to 2000. Fisheries management and Ecology (Used Floy tags, commercial and angler recaptures)

Concluded that:

- Pike make annual migrations to spawning grounds, with some spawning site fidelity year on year.
- Spawning is in shallow weeded bays in sheltered areas
- Outside the spawning season, (March-April) pike moved widely into medium-deep areas of the Lough, with summer recaptures up to 13km from spawning grounds.

Currently active Acoustic tagging is reinforcing these results

“pairing” in mark-recapture data –
 Suggestion of some longer term group fidelity in migrations
 (Similar data exists from Windermere, England)

Date of multiple recapture	Number of tagged pike recaptured at particular location	Available pool of tagged fish at large	Recaptures “paired” from any one release batch	Batches at large in lake originating from individual release events (assume zero mortality)	Probability of capturing any “pair” in the multiple recapture
24/12/95	2	144	No	34,17,24,16,15,15,12,7,2,2	0.135
6/2/96	2	135	Yes	33,15,21,15,14,14,12,7,2,2	0.135
7/2/96	2	133	No	33,15,20,15,14,13,12,7,2,2	0.135
17/8/96	2	226	Yes	29,15,18,15,13,9,11,9,6,21,17,20,26	0.077
31/8/96	3	223	No	29,15,16,15,13,9,11,9,6,20,17,20,26	0.211
13/12/96	2	221	Yes	29,15,16,14,12,9,11,9,6,20,17,20,26	0.077
Number of “pairs”			3		
Probability of recapturing any three or more “pairs” in these 6 events					0.0296

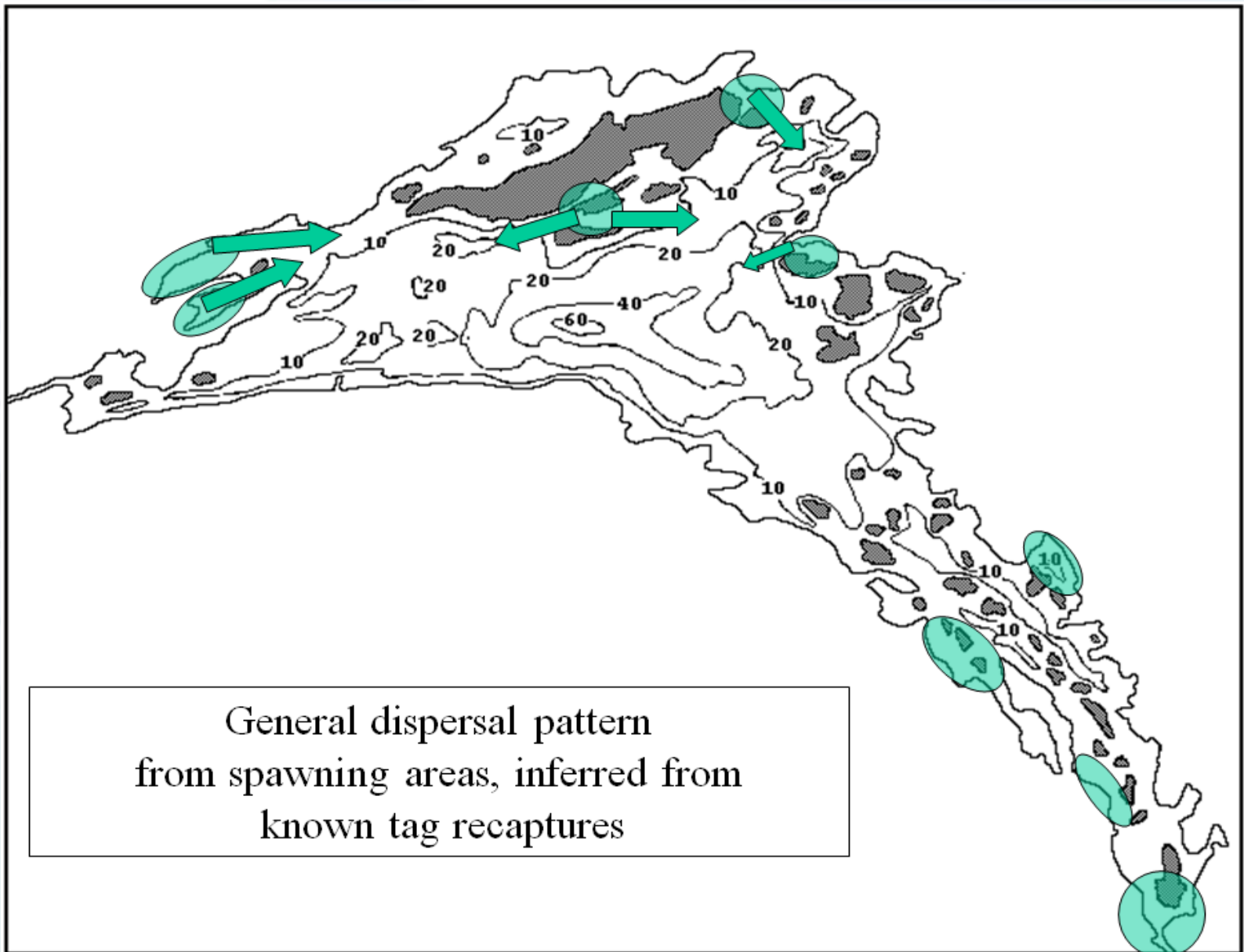
Pike targeted Census work (every three years)

Uses 50mm Gill nets , set overnight,

In cold weather leading up to Spawning time

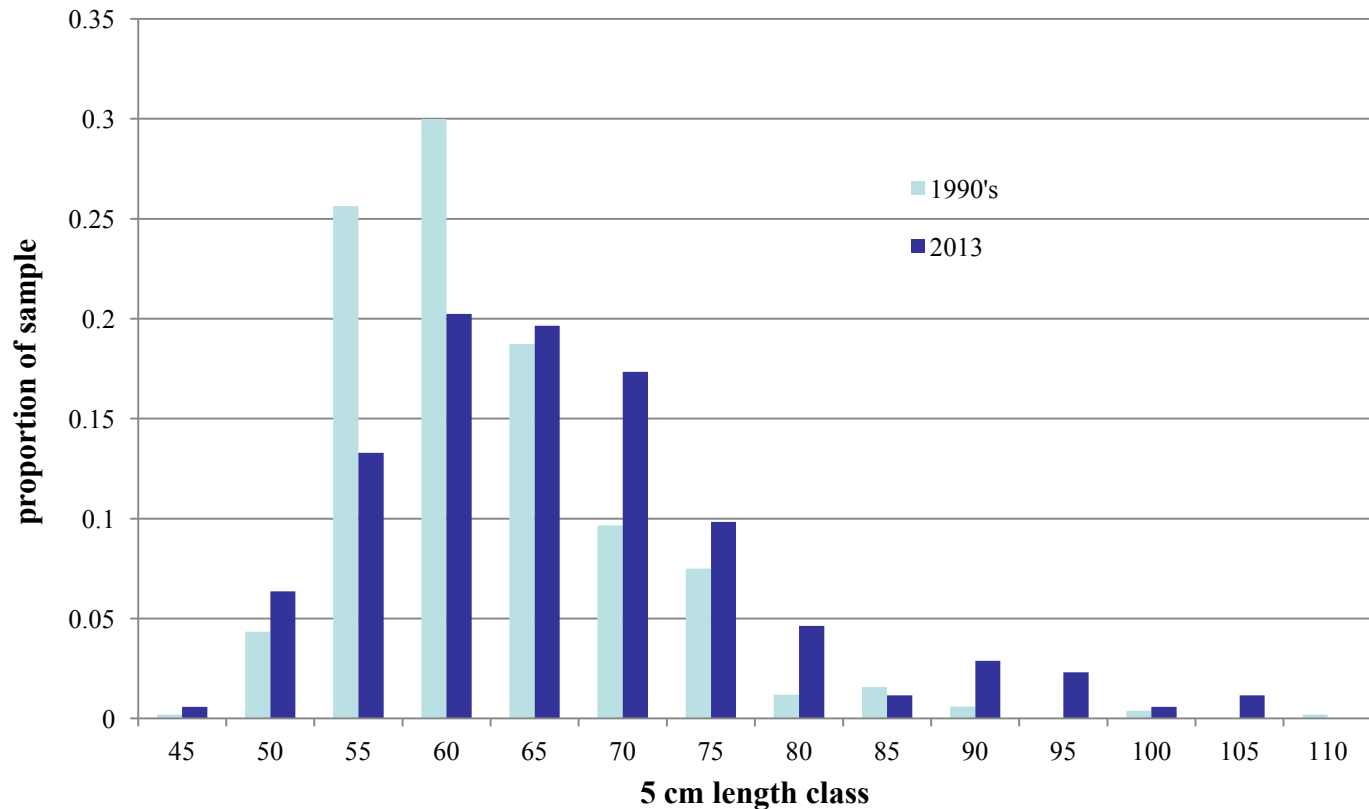
Very low mortality (2-3%)

Targets the spawning stock



Comment: Pike have known concentration spawning areas in shallow margins and weedy bays. Fish widely from these after spawning in March. (at circa 8 degrees c water temp) . Individual Pike tend to return to spawn in the areas they used in previous years

Length frequency of Lower Lough Erne Pike, 2013 (n=173) and 1994-1997 (n=507)

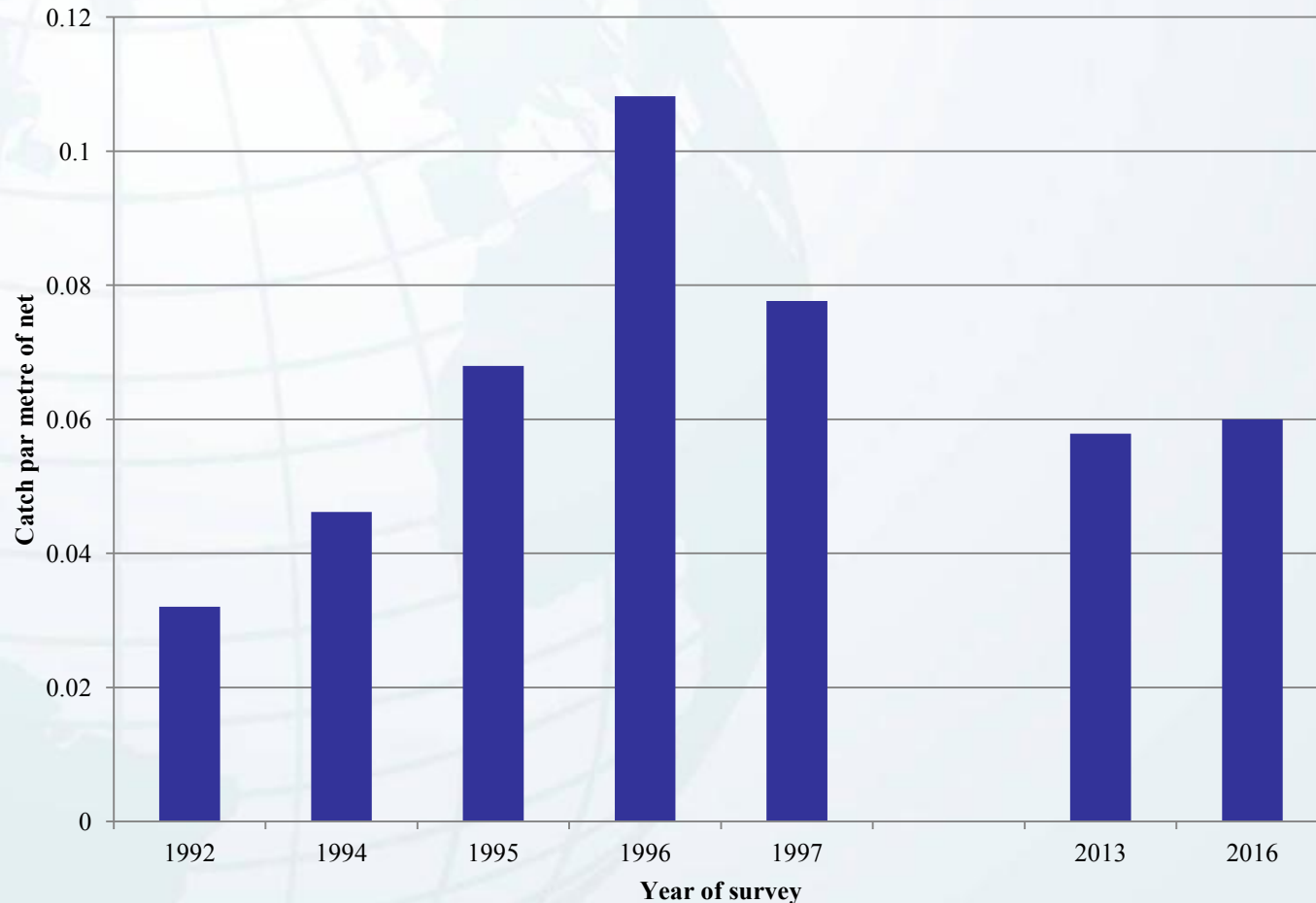


Comment: Data from 2013 vs 1990s show the impact of reduced commercial exploitation in Lough Erne pike “Filling in”
The length frequency graph of over 65 cm, Size selection of commercial 2.5” net is designed to match the 60 cm MLS

Spring (spawning season) – pike targeted surveys

(give a far better picture of adult pike stocks than CEN WFD type surveys)

Lower I Erne : Pike catch (number) per metre of net, 2013 vs 1990's



Comment: Current pike CPUEs in AFBI surveys are about middle of the 1990s ranges,
Bear in mind changes due to zebra mussel affecting (reducing) total all species fish biomass
Interestingly, there is no abundance difference in protected vs commercially fished areas, potentially suggesting
mobility of the larger pike and reduced exploitation

Mean weight of pike



Comment: Pike are on average larger now than in the 1990s. (see length frequency graph earlier slide)

Pike survey: Results 2013 – Summary

- 177 pike in 87 set nets
- Only 4 mortalities
- No significant difference between protected and commercially fished areas
- Catch per unit effort within the range of 1992-1997 data, (previous sample)
- 2013 Higher average length and weight than 1990s
- More even distribution of sizes:
(less evidence of commercial exploitation than 1990s)

2013-4: opportunity taken to examine commercial fishery pike stomach contents and examine prey item selectivity



Pike Feeding studies

Pike stomachs bought from 2013-4 winter commercial fishery and Analysed freshwater fish Lab AFBI Newforge

Species	No. Of Fish	% of Total No.
Pike	6	2.1
Perch	147	50.9
Roach	83	28.7
Hybrid	3	1.0
Bream	1	0.3
Gudgeon	1	0.3
?Cyprinid	8	2.8
Cyprinids	96	33.2
Trout	38	13.1
Eel	3	1.0
Pollan	1	0.3
S'back	1	0.3
Total	289	

No. of stomachs containing other items		
Vegetation		19
Fishing Traces		2
Bird/mammal bones		1
Invertebrates		10

No. of empty stomachs : 172

No. Of female pike : 329

No. Of male pike : 118

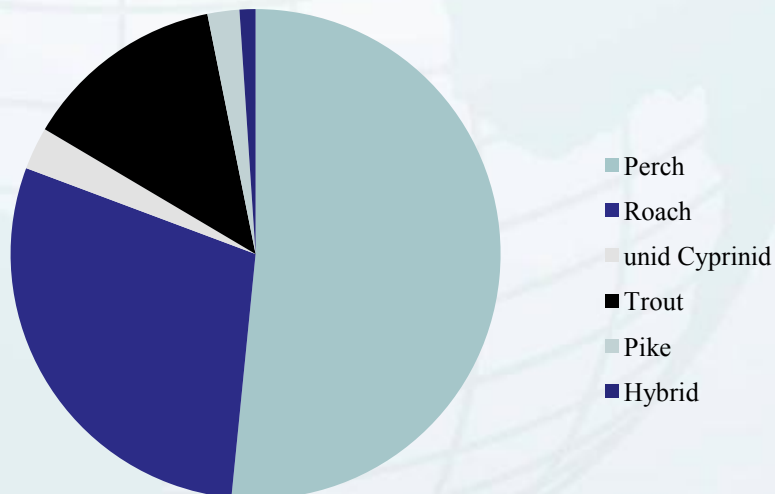
No. Of females with empty stomachs : 66

No. Of males with empty stomachs : 106

Percentage of fish species by number in 2013 general population sample



Percentage of fish species by number in 2013-4 winter pike stomachs



Species	Selection factor by pike (proportion by number in prey sample divided by proportion available in general surrounding environment) (Note these are large pike, winter/spring sample)
Pike	6.17
Perch	0.72
Roach	1.13
Hybrids	0.55
Trout	63.5

Comment:

**These large pike were clearly
Selectively taking trout
and to a lesser extent, also
smaller pike**

**And
Selecting larger prey items**

A case of selective predation



Comment: A prey population – mix of different species

POPULATION IN LAKE



PERCH



ROACH



HYBRIDS



PIKE



TROUT



BREAM

Comment: Visualised abundance by number in lake

PIKE- 300 WINTER STOMACH SAMPLES



PERCH



ROACH



HYBRIDS



PIKE

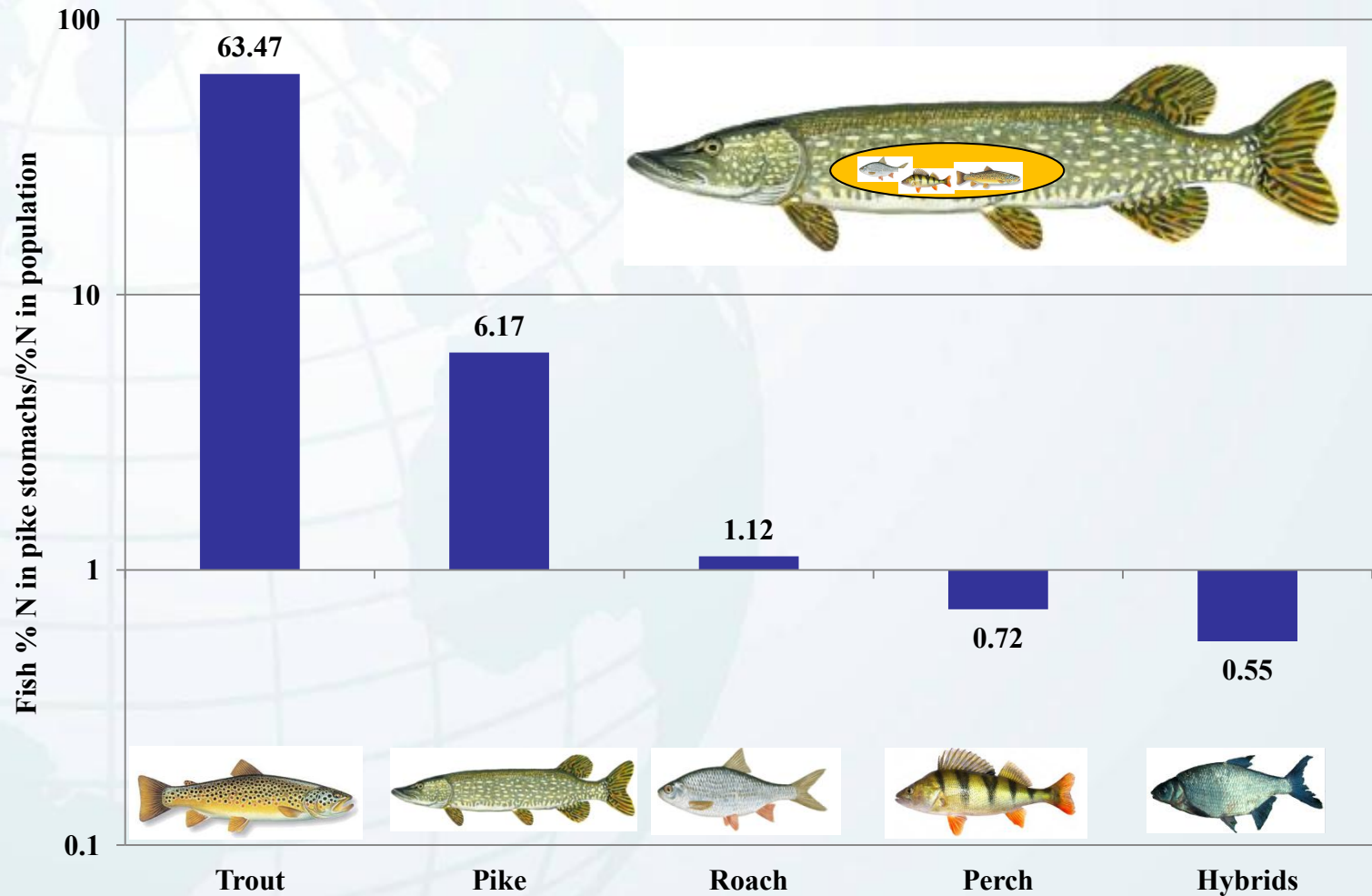


TROUT

BREAM

Comment: Visualised abundance by number in pike stomachs

Lough Erne: Pike prey selection factors (2013/4):



Erne Salmon Management Programme, 1999 and 2000

Crowley, Mathers and O'Teangana

Found Selective feeding by pike on salmonids in Lough Erne at timing of smolt runs, April to May samples

Fish Species	Proportion in net sample	Proportion in pike diet	Prey selection index (-1 is total avoidance) (+1 is total selection)
Roach	0.505	0.249	-0.511
Perch	0.441	0.559	0.233
Bream	0.005	0.006	0.085
Hybrids	0.032	0.021	-0.227
Salmon	0.003	0.065	0.904
Trout	0.008	0.018	0.357
Pike	0.004	0	-1
Eel	0	0.009	1

Eel and pike samples in diet or survey were too low to be meaningful

Monitoring Impact of selective predation – Lough Erne

Clearly, If prey availability plays a part in determining pike stocks. It is their bread-and-butter diet of Roach and Perch which is most Likely to drive total numbers of pike. Pike stocks are best surveyed in Spring on spawning grounds

So we need to be aware of changes in these –
(CEN surveys work well)

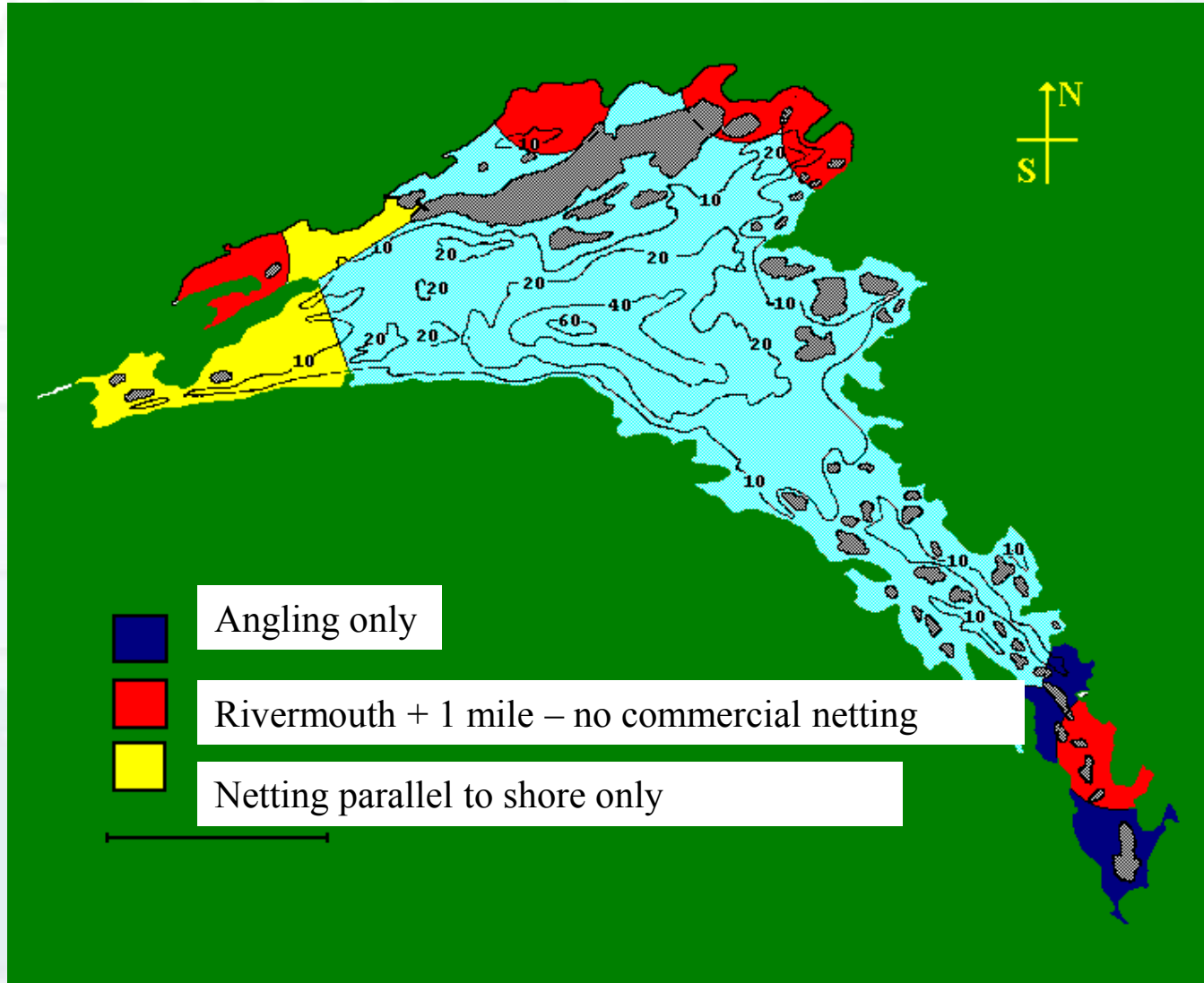
And..

If the pike stock is maintained at a high level, the impact on Trout (and salmon through predation on smolts) has the potential to be disproportionate to the salmonid population (which is low relative to the coarse fish numbers)

Commercial pike fishery Lower Lough Erne

- Traditional activity, Licensed since 1950s..
- Seen as a way of maintaining control of pike numbers to reduce predation on trout
- In 1970-1990 captured circa 20-30 tonnes per year of pike
- Effort has fallen to a max catch about 6 tonnes recent years
- Fishery Has controls:
 - MLS of 60cm, with matching min gillnet size (62.5mm)
 - Short season (Start December-End February)
 - Prohibited Zones including some major pike spawning grounds
 - Current proposal of a cap at 10 tonnes per year.

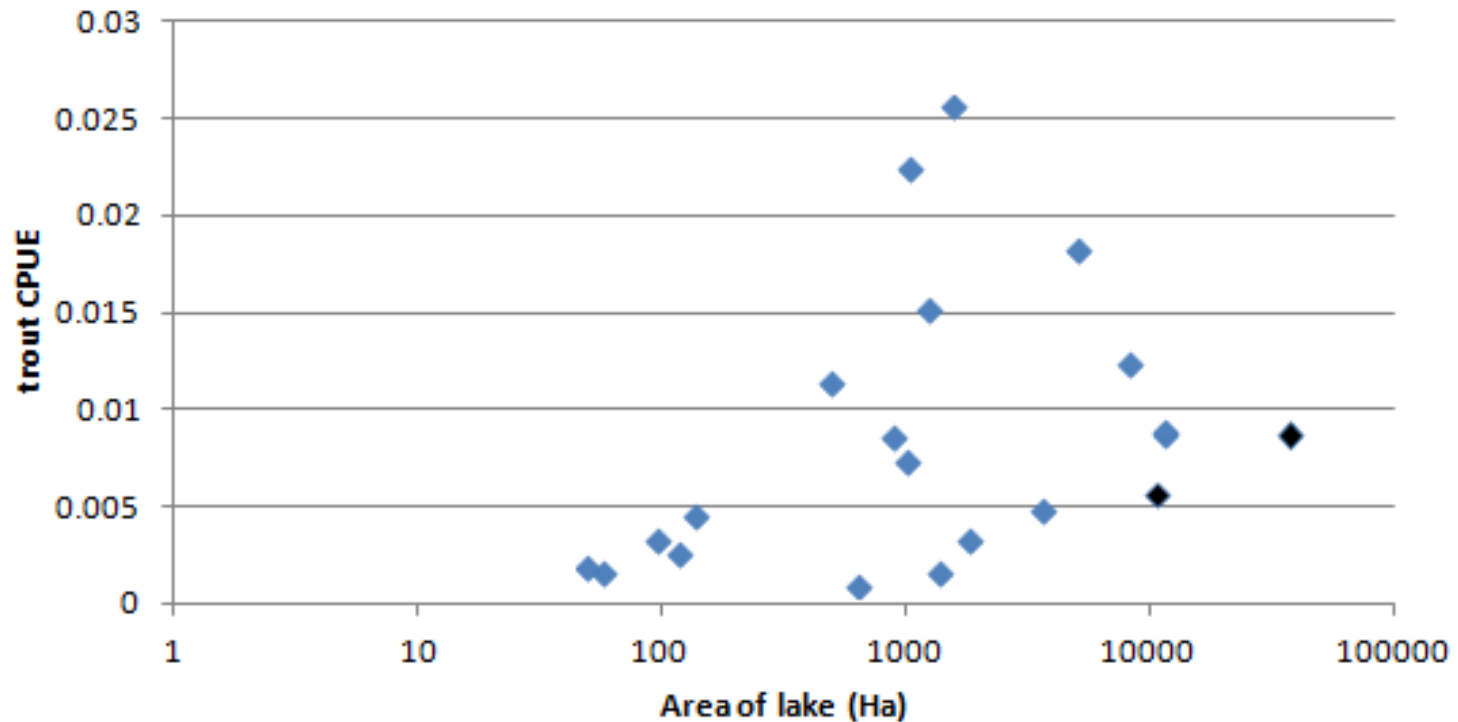
Zoning and current commercial pike fishery in Lower Lough Erne





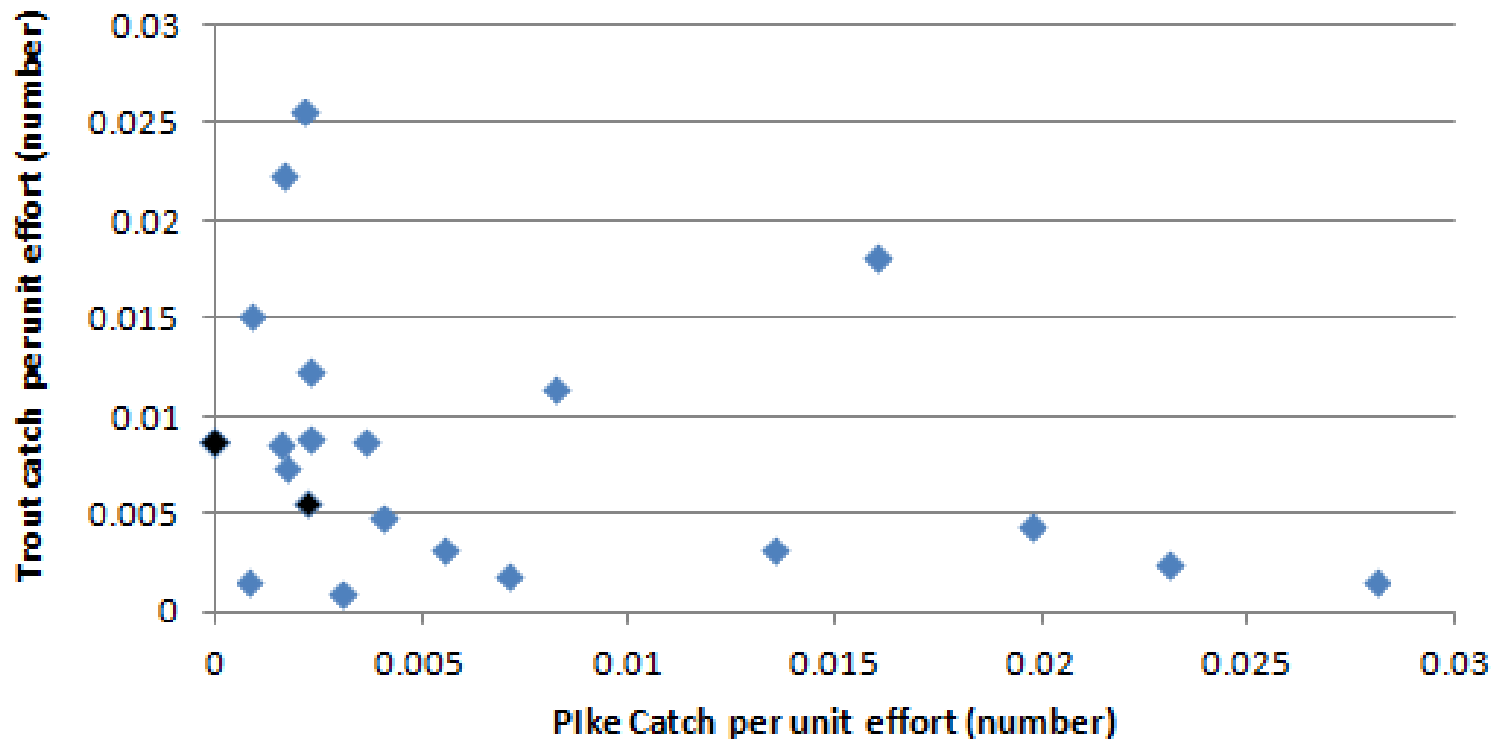
Pike-Trout interactions on a larger scale

NS-Share data set (2010) lakes with both pike and trout - trout catch per unit effort (CEN nets)



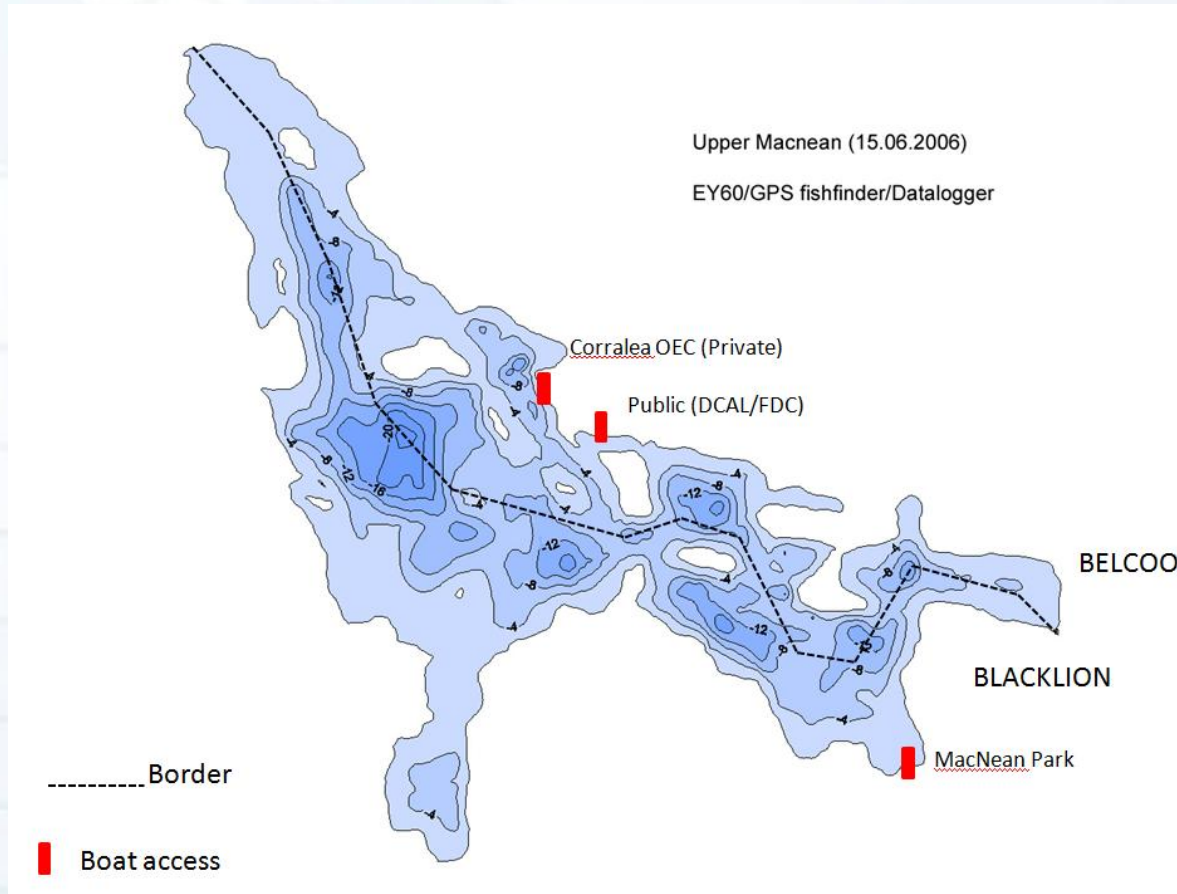
Comment, NI interest is in Loughs Neagh and Erne (Black diamonds) . The Overall data suggests
A cut-off of lake size below which pike and trout do not co-exist

trout cpue in lakes with pike (NS-Share dataset)



Comment, NI interest is in Loughs Neagh and Erne (Black diamonds) . The Overall data suggests
A trend for lower trout numbers in lakes where pike are more abundant

Conformity Example – Upper Macean a lake where pike may have high influence on trout stocks

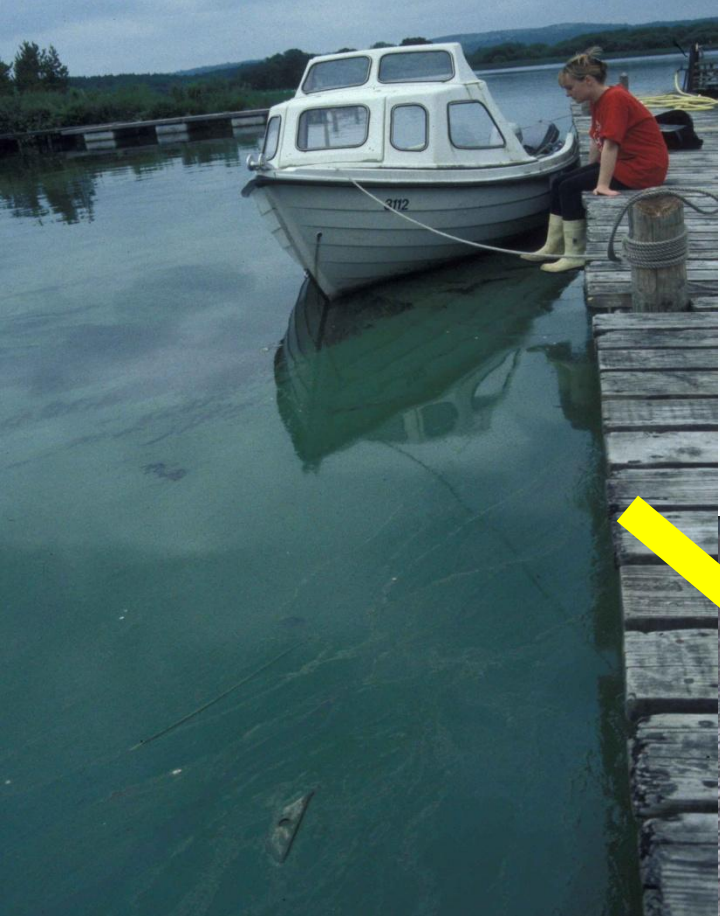


Comment, Lough MacNean is a large lake, perch dominated with trout in afferent streams but very low lake trout stocks. Suggesting that lake structure without a large deep basin prevents separation of the species (Pike range down to 15m) creates proximity and potential high selective predation

Note : Just 10 Km away is Lough Melvin, A noted trout fishery with similar water quality, different structure – a deep open basin, no pike, and abundant trout Stocks. There is one isolated record of a single pike in a feeder Lake to Lough Melvin, in 2005, with no subsequent or prior records.

The impact of zebra mussel

- Almost all large lake studies on pike have their basis before Zebra Mussels
- ZM have had varying impacts in different lakes, but generally:
 - Plankton crop reduction
 - Shift of production to the benthos
 - Increasing water clarity leading to more weed growth
 - All of these benefit sight feeding predators, of which perch have been the biggest winner
- Management policies need a continued or renewed scientific survey base in this new ecological state.



Lower lough Erne , AFBI boat mooring. ZM changed the lake from low transparency with regular algal blooms and no emergent weed to high Transparency and emergent weed growth in sheltered bay.



It is inconceivable that the ZM induced changes – transparency, weed growth, lower plankton numbers, higher perch and lower roach numbers, and more... have not affected the fish behaviour, distribution, and Predator-prey relationships

In Conclusion:

List of factors to consider in dealing with pike-trout interactions in lakes

Overall fish species mix

Lake Trophic status

Water Clarity

Lake size, depth

Lake Conformity

Spawning and juvenile areas available to both species

Level - Changes or stability

Zebra Mussel influence

And probably more.....