

# Overview of Ireland's Scientific advice on Salmon

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**Baltic Salmon Seminar 8<sup>th</sup> & 9<sup>th</sup> Dec 2011**

## Scientific Advice – Three Stages

1. Assessing Salmon Habitat Quantity in Rivers
2. Setting Salmon Conservation Limits for Rivers
3. Assessing achievement of conservation limits and advising on salmon surplus annually

Standing Scientific Committee (SSC) of the Inland Fisheries Ireland 2010

Scientists from

Marine Institute

Inland Fisheries Ireland

Irish Sea Fisheries Board

Environmental Protection Agency

National Parks and Wildlife Service

The Loughs Agency

AFBI N. Ireland

Electricity Supply Board

## The Terms of Reference of the SSC:

- To develop age specific conservation limits for individual river stocks and estimate the overall abundance of salmon returning to rivers
- To carry out an assessment of salmon stocks using internationally accepted best scientific practice to demonstrate whether:
  - conservation limits are being attained on an individual river basis and
  - favourable conservation status is being attained within special areas of conservation (SACs) and nationally as required under the habitats directive
- To take account of mixed stock fishing on salmon stocks including the potential effects on freshwater salmon populations from rivers other than those targeted.
- In cases where stocks are determined to be below the conservation limits the SSC shall advise the level to which catches should be reduced or other measures adopted on a fishery basis to ensure a high degree of probability of meeting the conservation limits.

## **The Terms of Reference of the SSC continued:**

- The SSC shall provide IFI with an independent report on:
  - an annual overview of the status of Irish salmon stocks and catches on an individual river basis.
  - catch advice with an assessment of risks associated with the objective of meeting conservation limits
  - an evaluation of the effects on salmon stocks and fisheries of management measures or policies.
  - advice on significant developments and other relevant factors which might assist IFI in advising the Minister on methods to adopt for the management of salmon stocks.

# *Scientific Committee*

## *- International Obligations*

### **ICES/NASCO**

**Salmon Stocks should be maintained above Conservation Limits**

- **The only fisheries for salmon should be **on river stocks** that are shown to be above Conservation Limits**
- **For stocks below Conservation Limits catches should be reduced to increase the probability of meeting the CL.**
- **Due to the different status of individual stocks within the stock complex, **mixed stock fisheries** present particular threats to stock status.**

## *Scientific Committee*

### *- International Obligations*

**The Habitats Directive** (Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna).

*If a species is included under this Directive, it requires measures to be taken by individual member states to maintain or restore them to favorable conservation status in their natural range.*

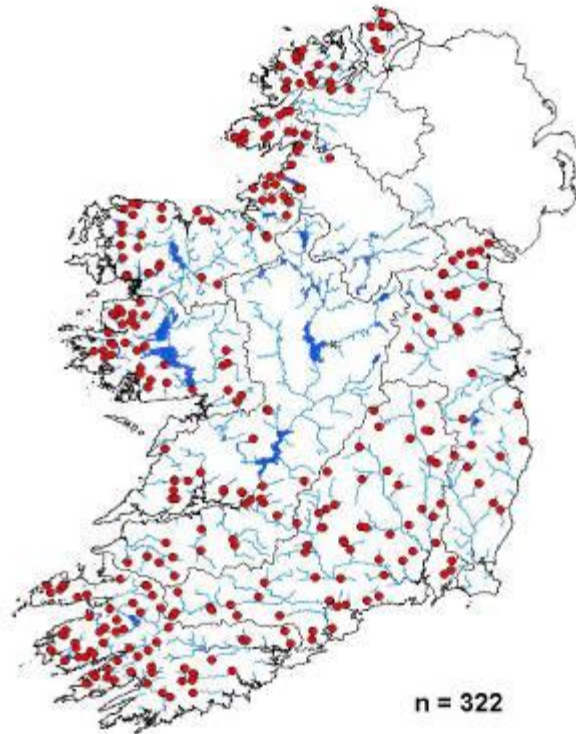
<b>District</b>	<b>River</b>	<b>Wetted area m<sup>2</sup></b>	<b>1SW CL</b>
Drogheda	Boyne	6,695,412	13,204
Wexford	Slaney	4,945,255	2,343
Waterford	Barrow	6,495,633	11,124
Waterford	Nore	6,796,230	11,061
Waterford	Suir	8,795,447	13,646
Lismore	Blackwater	7,701,703	11,128
Kerry	Blackwater	353,999	498
Kerry	Currane	266,976	352
Kerry	Laune	2,265,312	3,168
Kerry	Caragh	586,454	807
Shannon	Feale	2,019,244	2,990
Shannon	Mulkear	3,702,750	6180
Galway	Corrib	4,038,058	7,800
Connemara	Cashla	178,862	322
Connemara	Owenmore	524,049	1007
Ballinakill	Owenglin	186204	344
Ballinakill	Erriff	606,758	1,202
Bangor	Newport	493,143	1,037
Bangor	Srahmore	196,105	615
Bangor	Owenduff	645,812	1,374
Bangor	Glenamoy	260,000	583
Ballina	Moy	7,075,959	14,810
Sligo	Ballysadare	2,190,538	4,715
Sligo	Garvogue	1,376,884	3,111
Ballyshannon	Eske	431,848	1,050
Ballyshannon	Drowes	562,314	1,283
Letterkenny	Owenea	616,966	1,584
Letterkenny	Gweebarra	248,480	629
Letterkenny	Lackagh	375,778	1,002
Letterkenny	Leannan	1,167,125	3,347

30 Irish rivers designated as SAC's for salmon

In applying the Directive consideration must be given to the population across its natural range (141 rivers).

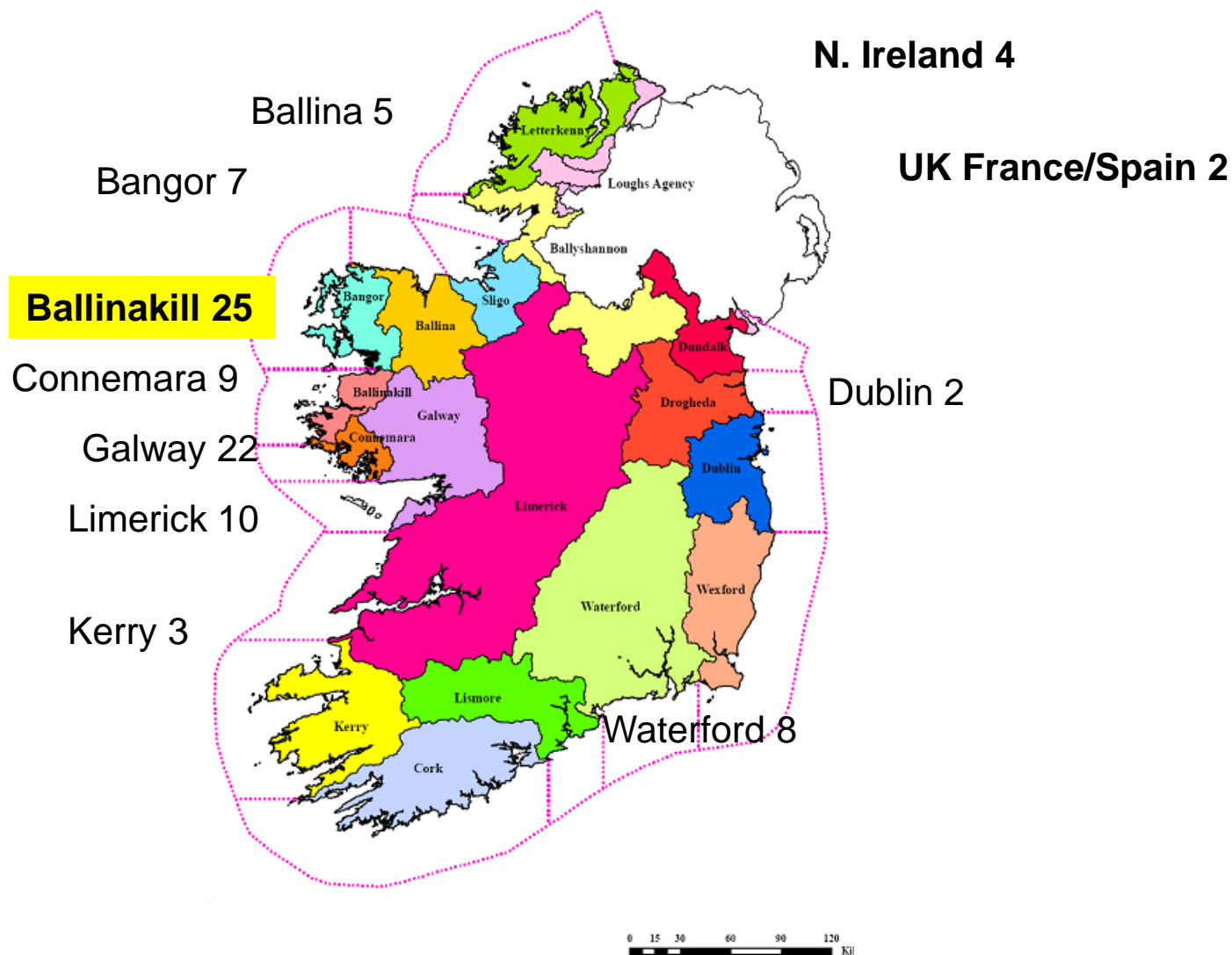
# Salmon Genetic Baseline established for 112 rivers (322 sites & 8,430 individual salmon) comprising 98% of salmon production in Ireland

The baseline can be used to determine the mixed stock nature of the offshore commercial fishery



# Mixed Stock Drift Net Fishery- Ballinakill 2006 (N=96)

Of 96 salmon captured in the Ballinakill offshore drift net fishery, only 25 were from rivers within that District



## ***The Standing Scientific Committee advised in 2006:***

- The overall exploitation should be immediately reduced, so that Conservation Limits can be consistently met.
- However, due to the different status of individual stocks, mixed stock fisheries present particular threats to the status of individual stocks.
- Thus, the most precautionary way to meet national and international objectives is to operate fisheries on individual river stocks which are exceeding their Conservation Limits.
- Fisheries operated in estuaries and rivers are more likely to fulfil these requirements.

# Ireland's Implementation of the Habitats Directive

- Salmon stocks need to be at favourable conservation status on a river by river basis
- This would not allow a mixed stock offshore salmon fishery
- Need to manage salmon rivers individually
  - Need to work out how many salmon are required to spawn in each river
  - Need to determine the number of salmon coming back, & are they above the spawning requirement?

To manage salmon rivers to ensure favorable conservation status a new strategy is required

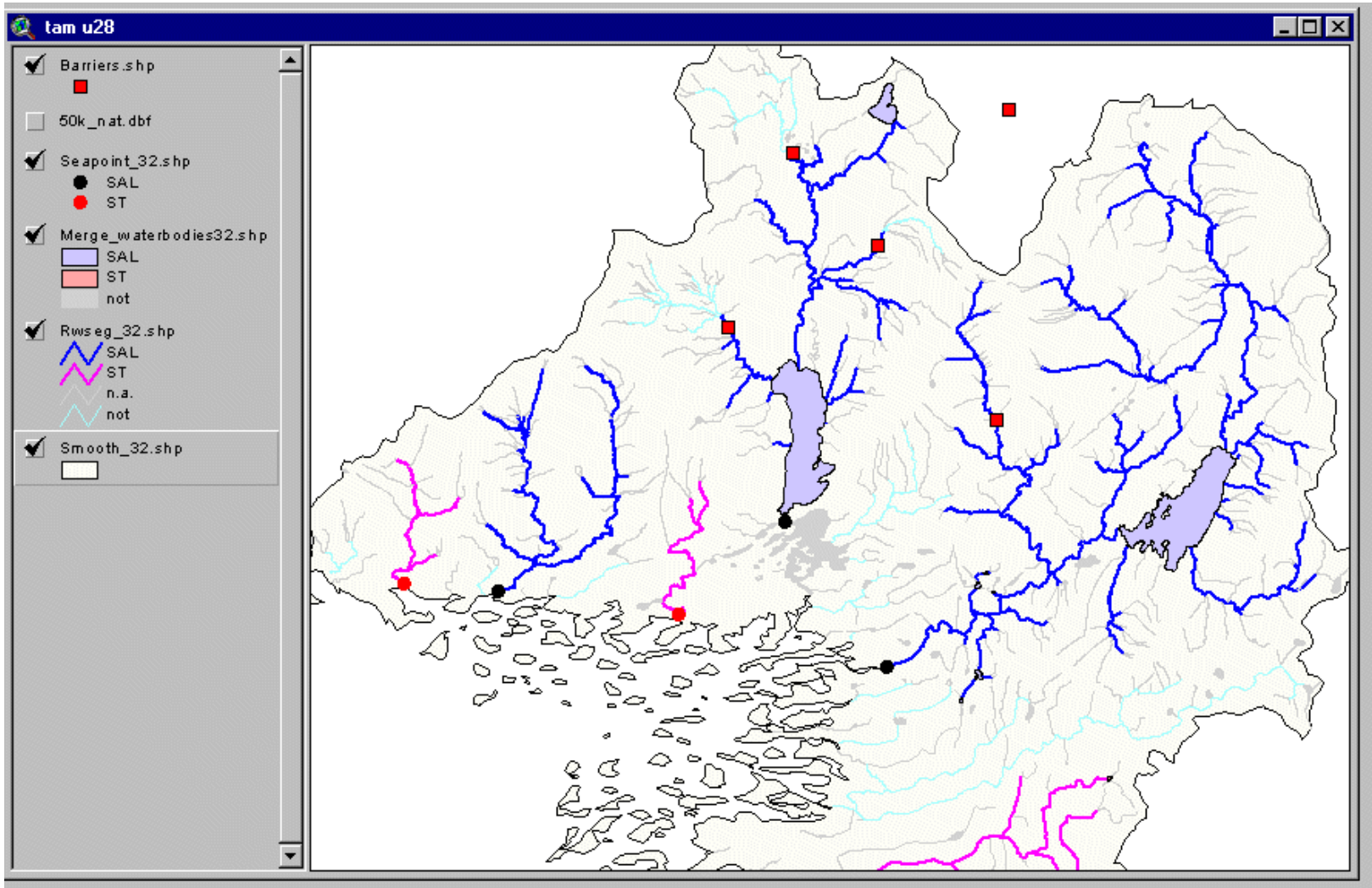
## Scientific Advice – Three Stages

1. Assessing Salmon Habitat Quantity in Rivers
2. Setting Salmon Conservation Limits for Rivers
3. Assessing achievement of conservation limits and advising on salmon surplus annually

# 1. Assessing Salmon Habitat Quantity in Rivers

- **Need to estimate Wetted Area of rivers (Report - 2003)**
  - **Identified 141 salmon rivers**
  - **Determine extent of salmon migration (Anadromy)**
  - **Area of usable habitat in these rivers calculated**

# Identify salmon rivers & map the extent of salmon anadromy



# Estimating the Quantity of Habitat

**Length X Width = Wetted Area**

**Length can be obtained from GIS**

**To derive width – necessary to measure the width of all 141 rivers at about 100M intervals, (78,000Km of rivers)**

**Instead, we measured 1,740 river widths in the field and used this as the basis of a model to predict river width**

**The two main predictive map derived variables (1:50,000 Discovery Series) were**

- catchment area and Shreve index value above any measured width**

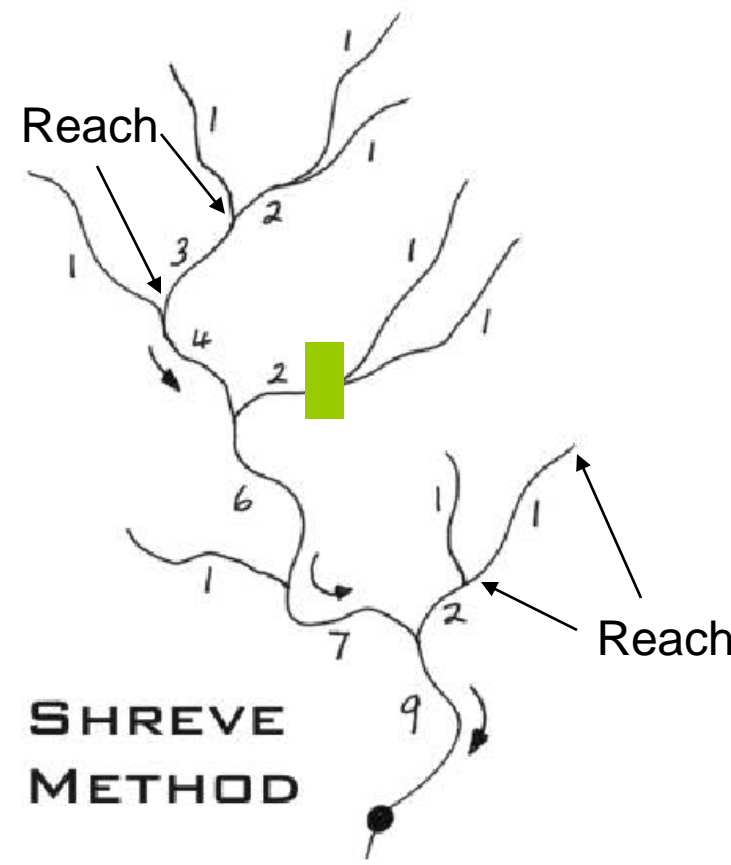
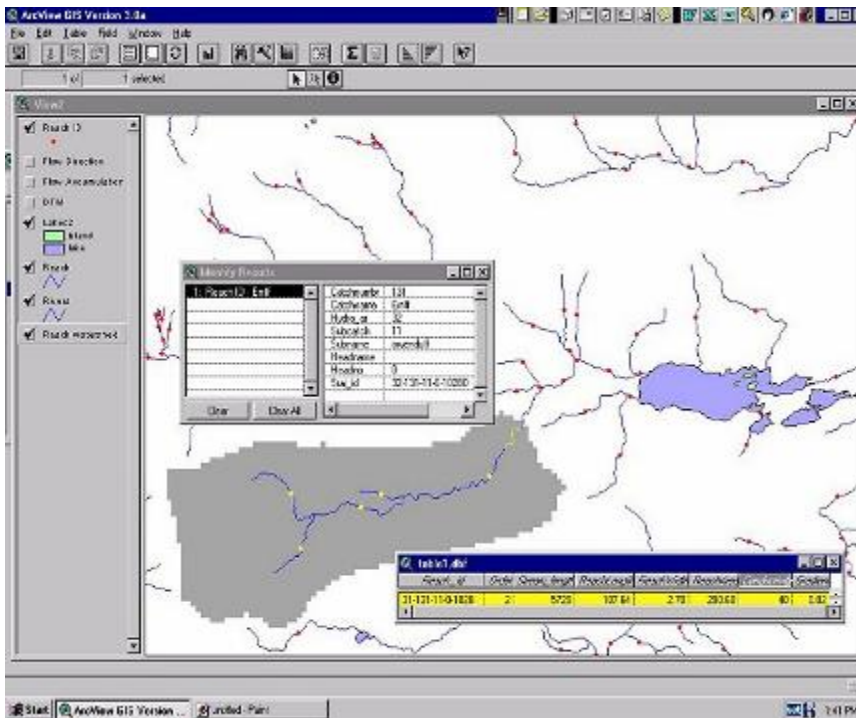
**Apply the model to all the river reaches in the country (n=90,000)**

**Use river width data X reach length = wetted area for each reach**

**All reaches added together = total wetted area for a river**



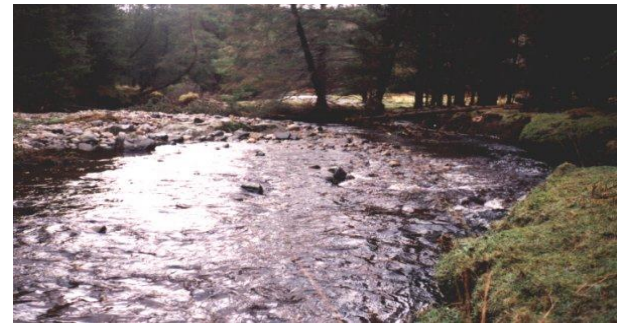
Catchment area and Shreve river reach from the 1:50,000 GIS Vector data allows a model to be developed to predict width



# Measuring stream width



River width measured by  
tape measure, range finder  
used on large rivers





## **A predictive model for estimating river habitat area using GIS-derived catchment and river variables**

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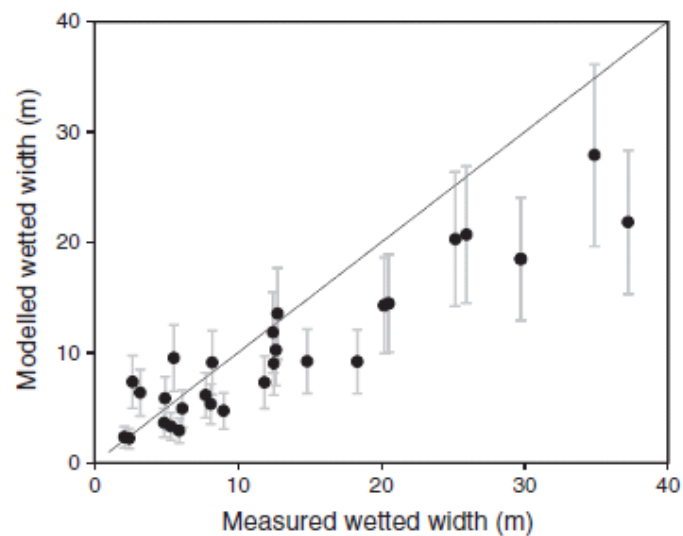
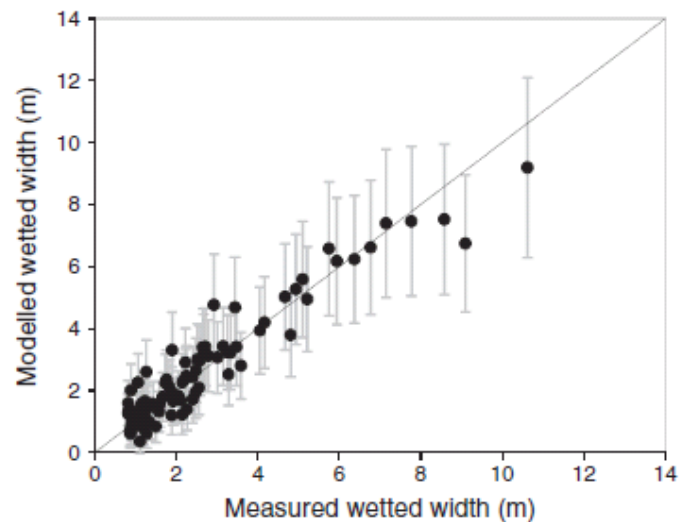
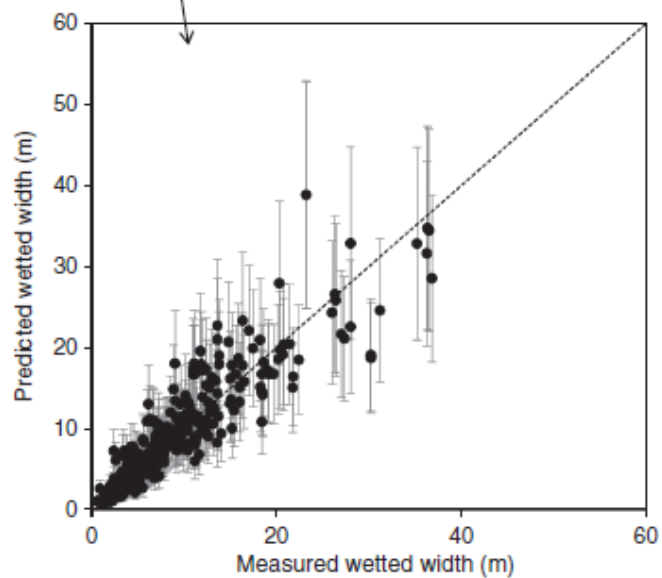
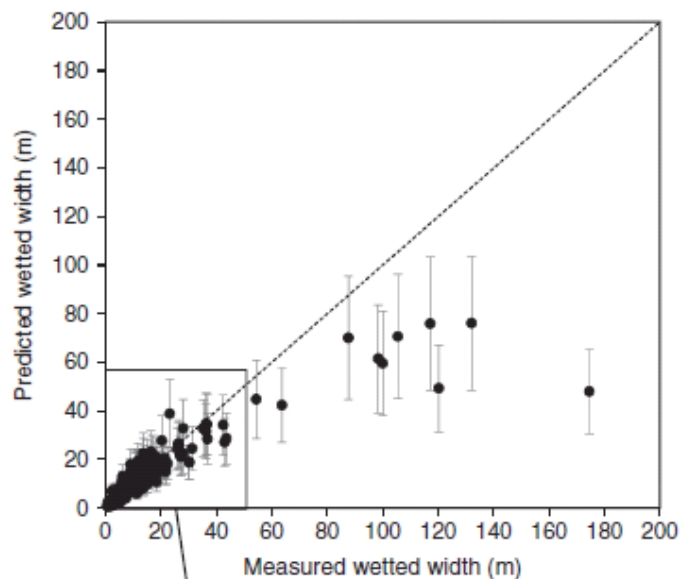
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**Figure 2.** Correlation between measured and modelled wet widths for the Burrishoole (top) and North Esk (bottom) catchments. The dashed line indicates a relationship with a Pearson product correlation coefficient.

# New Model

- This simple predictive model provides a very useful tool for the quantification of the freshwater salmon habitat resource in Ireland and perhaps in other countries.
- A strong correlation between the predicted and map measured widths of the North Esk in Scotland
- Suggests that the model may be transferable to neighbouring geographic areas where high resolution habitat maps are not yet available, or where collection of field data over large geographical scales is not feasible

# Outcome of Wetted Area Estimates

	<b>Fishery System</b>	<b>District</b>	<b>Total Riverine Habitat</b>	<b>Accessible Riverine Habitat</b>	<b>% of National Accessible</b>
1	Suir (River)	Waterford	8911096	8795447	7.78
2	Blackwater (River)	Lismore	7728122	7701703	6.82
3	Moy (River)	Ballina	7495504	7075959	6.26
4	Nore (River)	Waterford	6796230	6796230	6.01
5	Boyne (River)	Drogheda	6695412	6695412	5.93
6	Barrow (River)	Waterford	6548527	6495633	5.75
7	Slaney (River)	Wexford	4945255	4945255	4.38
8	Corrib (River)	Galway	6719329	4038058	3.57
9	Shannon (River)	Limerick	35757947	3702750	3.28
10	Maigue (River)	Limerick	2437307	2437307	2.16
11	Liffey (River)	Dublin	3444930	2308361	2.04
12	Laune (River)	Kerry	2482704	2265312	2.00
13	Ballysadare (River)	Sligo	2301152	2190538	1.94
14	Feale (River)	Limerick	2020036	2019244	1.79
15	Bandon (River)	Cork	1663070	1652104	1.46
16	Avoca (River)	Wexford	1766724	1638135	1.45
17	Deel (River)	Limerick	1502689	1502689	1.33
18	Owenmore (River)	Bangor	1386308	1386308	1.23
19	Garvogue (River)	Sligo	1376884	1376884	1.22
20	Fergus (River)	Limerick	1270553	1270553	1.12

# Scientific Advice has Three Stages

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## 2. Setting Salmon Conservation Limits for Rivers

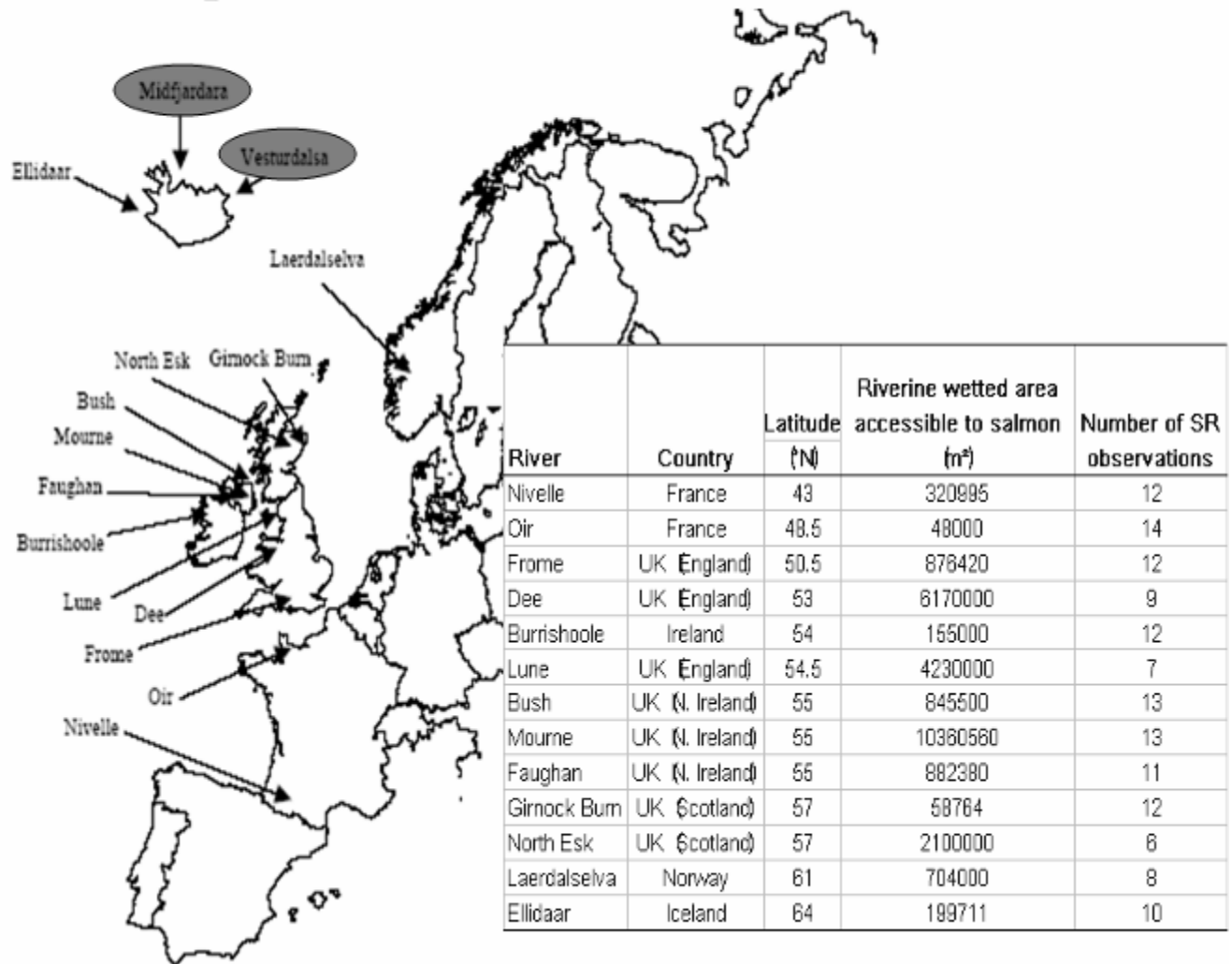
### Using Wetted Area to Calculate Spawning Requirement

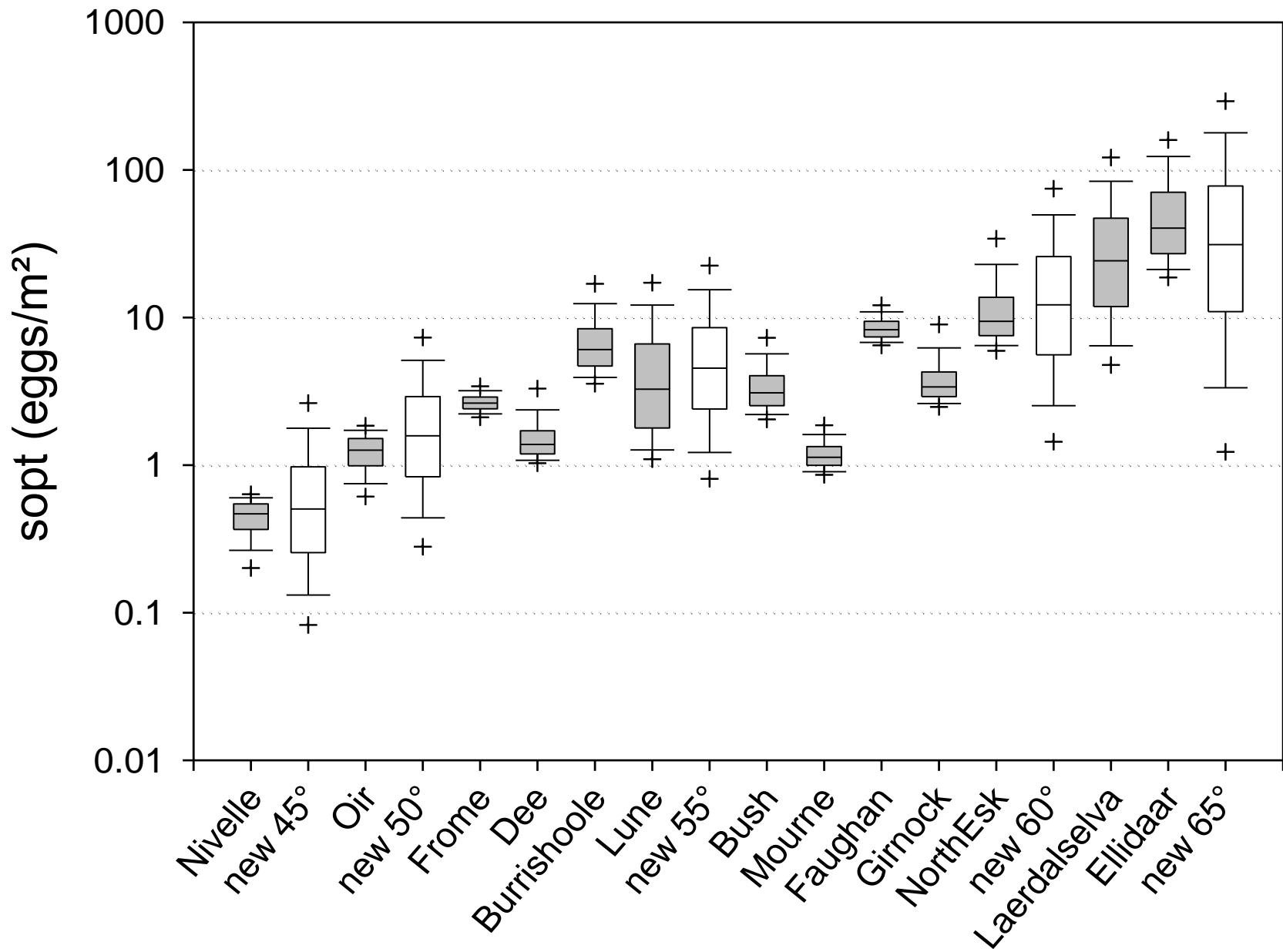
- Need to determine how many salmon (number of eggs) are needed to spawn the wetted area of individual rivers
- A Model (Bayesian) was developed using a set of 14 stock and recruitment data sets from monitored rivers in the north East Atlantic
- Using the two variables
  - 1) latitude
  - 2) accessible wetted area

s/r data can be transported from the data rich to the data poor rivers

- Provides the egg deposition rate /M<sup>2</sup> of wetted area of accessible salmon habitat
- Irish CL ranges from 3.5 – 7 eggs /M<sup>2</sup>

# European salmon rivers with SR data





## Conservation Limits

**“Conservation limits (CLs) for North Atlantic salmon stock have been defined by ICES as the level of stock (number of spawners) that will achieve long term average maximum sustainable yield (MSY)”**

WGNAS 2008

***Requires a time series of stock data and the corresponding subsequent recruitment e.g. smolt output to adult returns, adult spawners to subsequent adult returns etc.***

# Calculation of Conservation limit by River

	Male:Female	Av. Weight	No. of Eggs
One Sea Winter	60-40	2.5kg	3,400
Multi Sea Winter	15-85	4.5kg	8,000

River	Egg Requirement / (M <sup>2</sup> )	Wetted Area	Egg	Total Salmon	1 SW	MSW
	by latitude	Area (M <sup>2</sup> )	Requirement	Required		
Nore	4.4	6796230	30086910	11958	11061	897
Moy	5.7	7075959	40283435	16011	14810	1201

# To manage salmon two pieces of information required;

A

Estimation of Total Spawners by River

B

Estimation of Conservation Limits (CL) by River

If A is greater than B then there is a surplus

# Scientific Advice has three Stages

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### 3. Assessing achievement of conservation limits and advising on salmon surplus annually

**Requirement to assess if the Salmon Conservation Limit for each river is being met annually**

Scientific Assessment of Salmon Stocks for 2012	No.
Rivers assessed using with Counters	24
Rivers using rod catch & commercial catch	40
Rivers assessed using electro-fishing	32
Small rivers unassessed	45
Total	141

Fish Counters used on 24 rivers to assess salmon run annually



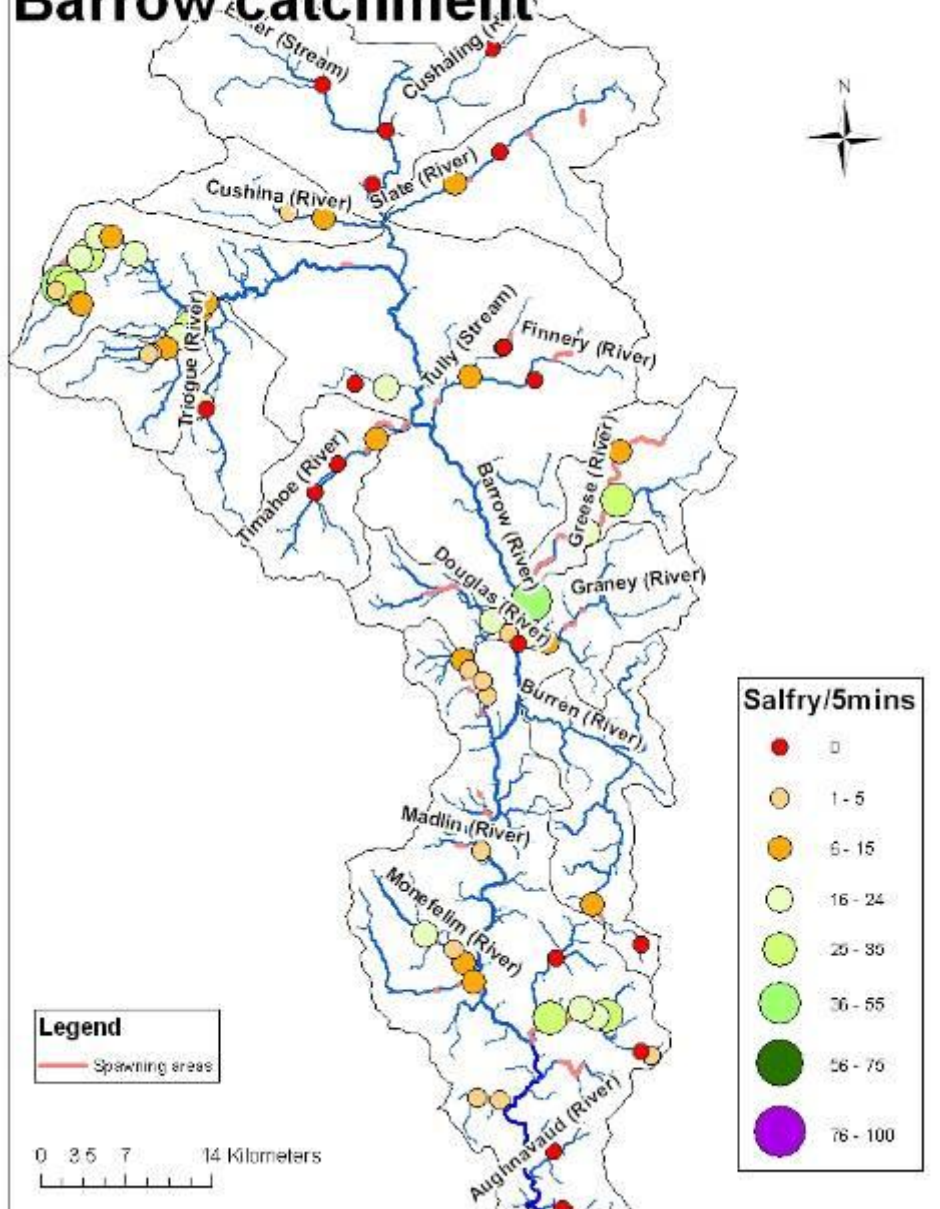
# 40 Rivers are assessed using recorded salmon rod catch



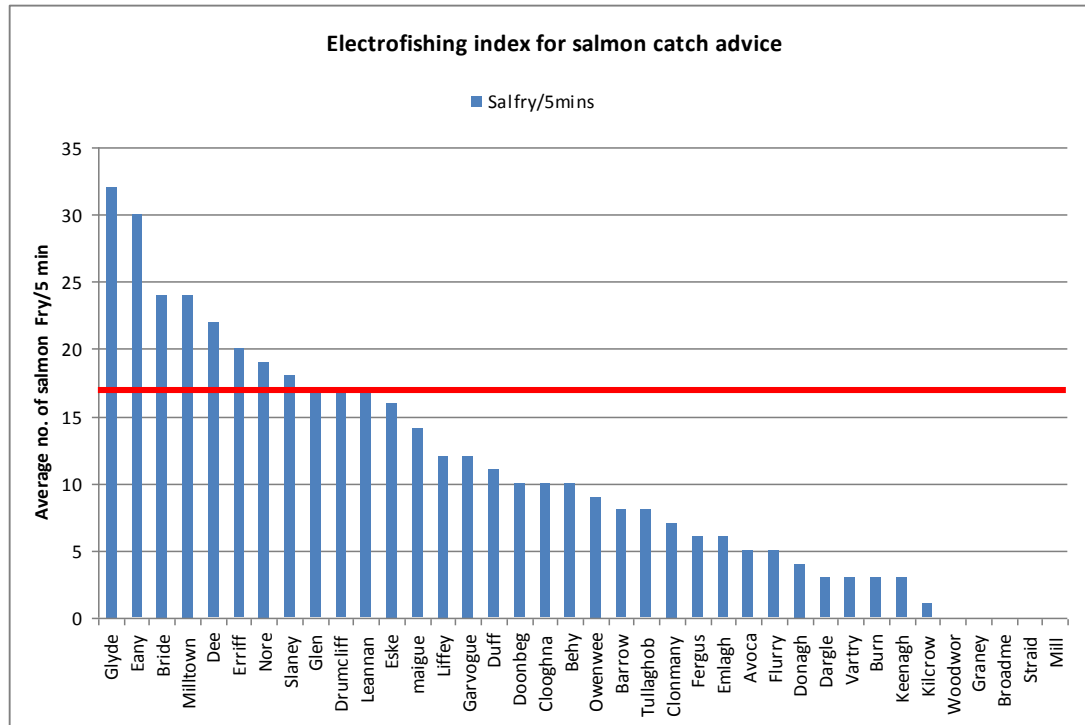
# Electro-fishing used as stock assessment on 32 rivers without counters or angling in 2011



# Barrow catchment



**Rivers which were predicted not to have surplus in 2010, but where the salmon fry index  $\geq 17$ . These rivers could be considered for Catch & Release**



# Providing Catch Advice Annually

- Gather all data on counters, salmon catches, commercial catches, electro-fishing
- Input data into a model which provides a forecast of the expected salmon return in the following year
- Assessment based on most recent five year time series
- Gives the available salmon surplus by river for the following year
- Conservation Limit does not change, only the surplus changes annually
- Surplus advised gives 75% chance CL will be met

## Salmon Rod Exploitation from Fish Counters

DISTRICT	RIVER	Average Rod Expl %	Minimum Rod Expl %	Maximum Rod Expl %	Average	Min	Max
Dublin	Liffey	1.7	0.9	2.5			
Connemara	Casla	4.6	3.1	6.2			
Bangor	Burrishoole	4.8	1.6	8.0	3.7	0.9	8.0
Ballyshannon	Eske	10.5	7.7	16.0			
Drogheda	Boyne	11.7	8.9	16.3			
Kerry	Kerry Blackwater	11.8	6.9	17.5			
Kerry	Waterville 1SW	11.8	6.1	32.8			
Shannon	Feale 1SW	13.5	3.1	25.0			
Lismore	Cork Blackwater 1SW	13.6	8.5	17.1			
Ballinakill	Erriff	14.0	7.3	18.8	12.4	3.1	32.8
Ballyshannon	Eanymore	22.3	13.5	33.9			
Bangor	Owenmore	23.0					
Wexford	Slaney 1SW	25.2	13.7	39.9	18.5	13.7	39.9
Dundalk	Dee	25.7	5.8	43.8			
Sligo	Ballysadare	27.6	11.8	37.6			
Cork	Bandon 1SW	28.1	13.0	45.8	27.1	5.8	45.8
	<b>1SW average</b>	<b>15</b>	<b>0.9</b>	<b>46</b>			
Kerry	Waterville 2SW	13.2	7.4	20.6			
Shannon	Feale 2SW	15.9	6.4	28.7			
Bangor	Muinhin 2SW	19.6	17.0	22.0	16.2	6.4	28.7
Wexford	Slaney 2SW	26.4	14.1	42.9			
Lismore	Cork Blackwater 2SW	28.6	21.9	36.1			
Cork	Bandon 2SW	32.3	24.9	49.7	29.1	14.1	49.7
	<b>2SW Average</b>	<b>23</b>	<b>6</b>	<b>50</b>			

# FORECASTING RETURNS


NORE 1SW		None
PERIOD	2007-2011	
<b>Rod catch by year</b>		
2011	150	
2010	574	
2009	88	
2008	0	
2007	0	
<b>Catch &amp; Release</b>		
2011	350	
2010	1210	
2009	1350	
2008	1833	
2007	2029	
<b>Total Rod Catch</b>		
2011	500	
2010	1784	
2009	1438	
2008	1833	
2007	2029	
Average	1517	
<b>Exploitation rates in the rod fisheries</b>		
Likely	10%	
Minimum	5%	
Maximum	15%	
<b>Estimated spawners</b>		
2011	4850	
2010	17266	
2009	14292	
2008	18330	
2007	20290	
Average	15006	
<b>Conservation limits</b>		
1SW CL	11061	
<b>Draft net</b>		
2011	1490	
2010	804	
2009	211	
2008	0	
2007	1220	
<b>Estimated potential recruitment</b>		
2011	6840	
2010	19854	
2009	15941	
2008	20163	
2007	23539	
Average	17267	
<b>Expected return to river in 2012</b>		17267

Rod harvest or count 

Rod C&R 


Total rod catch 

Exploitation rate 

Estimation of spawning stock 

Conservation Limit 

Draft nets catch 

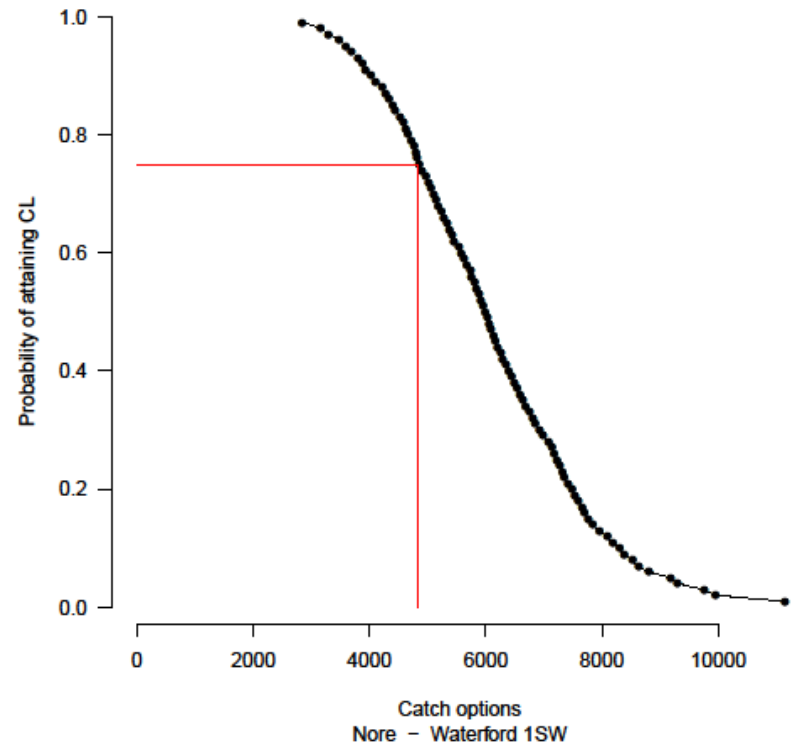
Expected return in model 

Expected return 

# Risk Analysis for R. Nore

Risk Plot of the probability of meeting spawning requirements versus various catch options with the catch option providing at least a 75% probability of meeting the Conservation Limit

	Nore		
Percentiles	Predicted Recruits	Cons Limit	Surplus
100%	13347	11958	1389
90%	15894	11958	3936
75%	16751	11958	4793
50%	17267	11958	5309
25%	19093	11958	7135
10%	20267	11958	8309
0%	25633	11958	13675



# The Standing Scientific Committee advises:

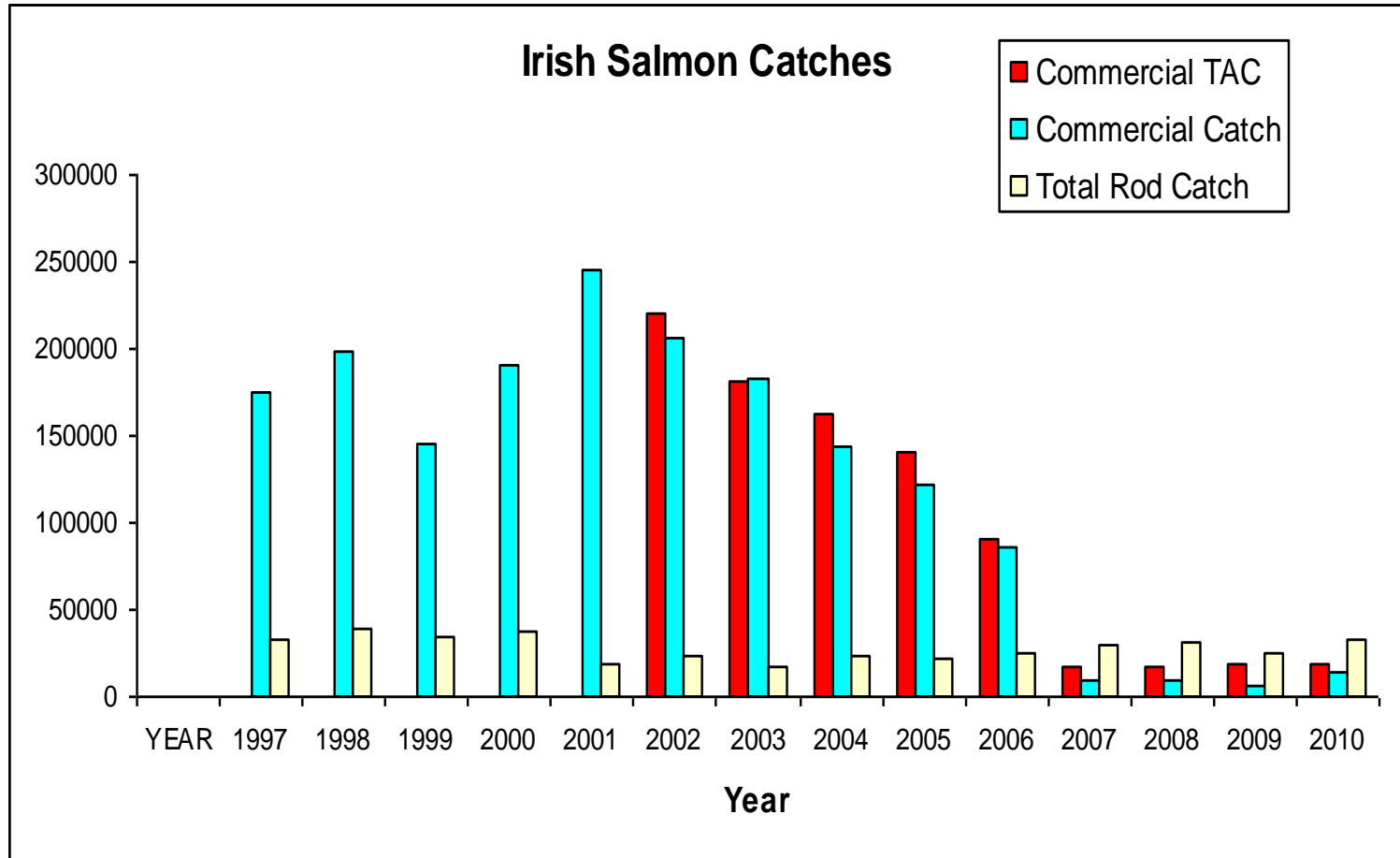
- Harvest of salmon should only be allowed in rivers where there is a surplus above the Conservation Limit identified and that no more than this surplus should be harvested.
- Harvest fisheries should not take place in rivers without an identifiable surplus above the Conservation Limit and further efforts are made to rebuild these stocks.
- No salmon harvest should take place in small rivers (45 rivers) with an average rod catch <10 salmon annually until additional information is available to assess the status of these stocks

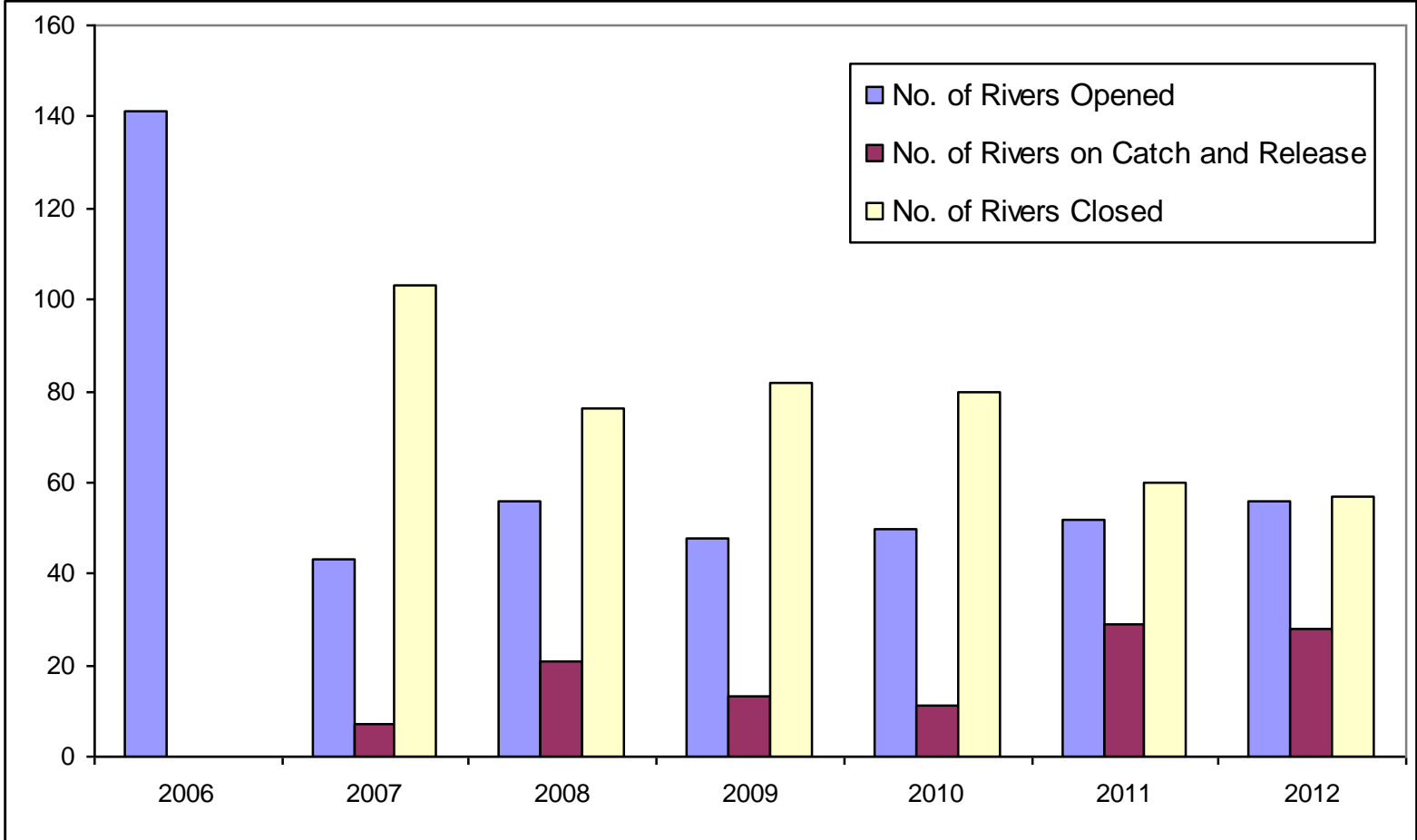
# Status of Rivers:

Example of river status based on form of stock assessment

River	CL	Deficit/ Surplus 2011	Deficit/ Surplus 2012	<i>Prop of CL</i>	Status 2012
Boyne counter	13831	<b>-6328</b>	<b>-8284</b>	<i>0.40</i>	Catch & Release (Electro-fishing)
Corock R	734	<b>-406</b>	<b>-406</b>	<i>0.45</i>	Closed
Barrow	12117	<b>-7324</b>	<b>-7135</b>	<i>0.41</i>	Closed
Nore	11958	<b>3500</b>	<b>4816</b>	<i>1.40</i>	Open to angling & snap nets
Colligan	338	<b>-8</b>	<b>118</b>	<i>1.35</i>	Open to angling
Blackwater	12103	<b>4668</b>	<b>3114</b>	<i>1.26</i>	Open to angling & draft nets
Maine	1487	<b>-475</b>	<b>1510</b>	<i>2.01</i>	Open to angling
Owenascaul	193	<b>-83</b>	<b>-82</b>	<i>0.58</i>	Catch & Release (Electro-fishing)
Corrib counter	7589	<b>5173</b>	<b>4371</b>	<i>1.58</i>	Open to angling
Bunowen	619	<b>-79</b>	<b>-128</b>	<i>0.79</i>	Catch & Release (Meeting >65% CL)
Moy	16974	<b>25020</b>	<b>25397</b>	<i>2.50</i>	Open to angling
Glenna	207	<b>-86</b>	<b>-86</b>	<i>0.59</i>	Closed
Oily	549	<b>-153</b>	<b>-114</b>	<i>0.79</i>	Catch & Release (Meeting >65% CL)

# Salmon catches since change in fishery in 2006





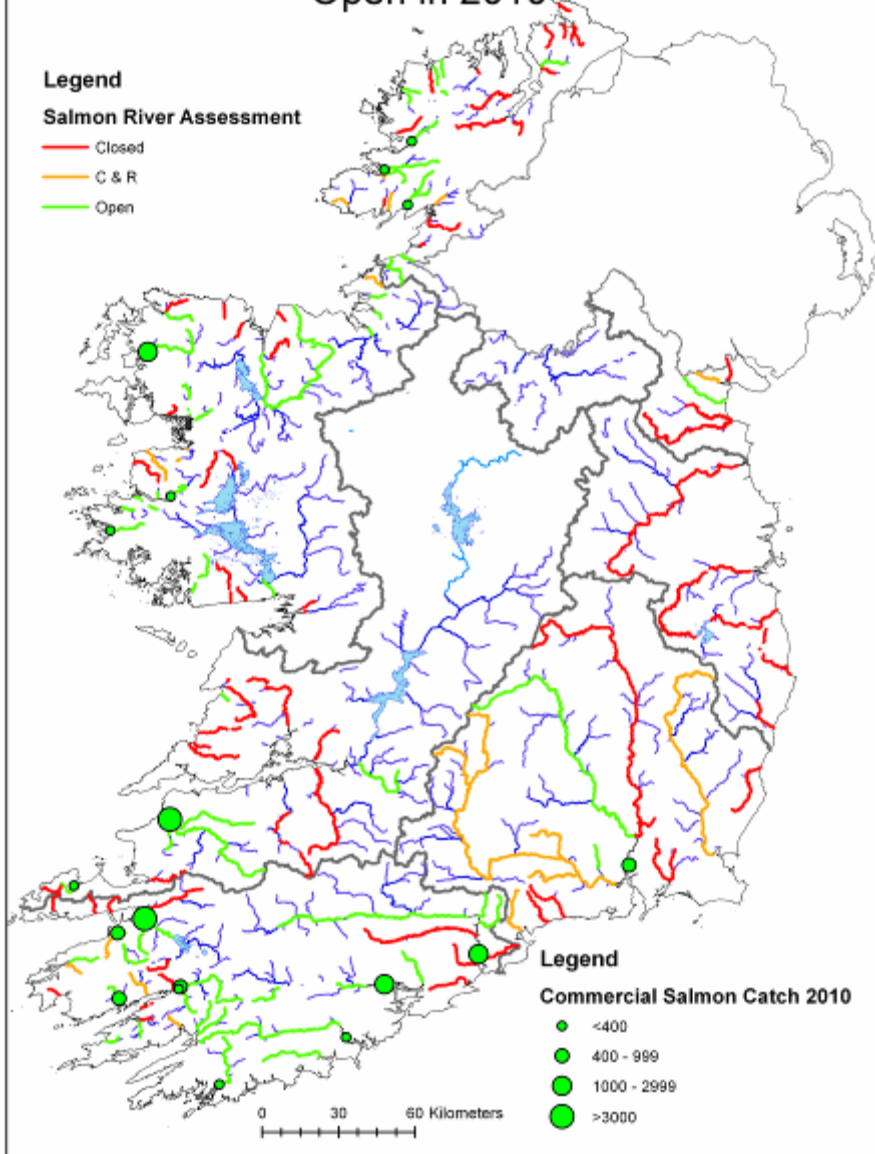
# Location of Net & Rod Fisheries Open in 2010



## Legend

### Salmon River Assessment

- Closed
- C & R
- Open



## Legend

### Commercial Salmon Catch 2010

- <400
- 400 - 999
- 1000 - 2999
- >3000