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Salmon Conservation Limits in England and Wales

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Setting Conservation Limits (CLs):

- CLs are defined from two relationships:

(i) A stock-recruitment (S-R) curve – relating egg deposition (the stock) to smolt output (the recruits).

(ii) A replacement line – relating smolt output to adult return (and eggs laid).

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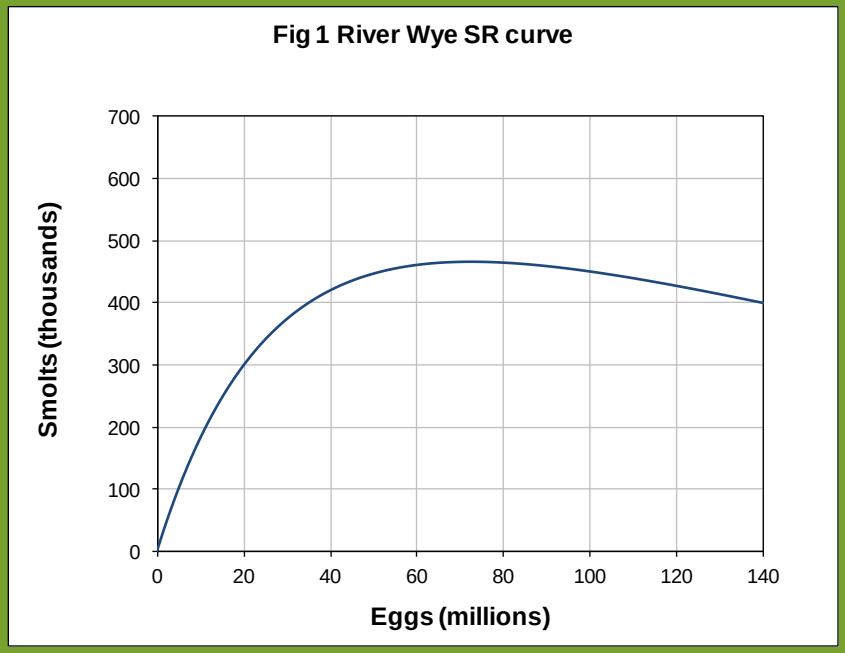
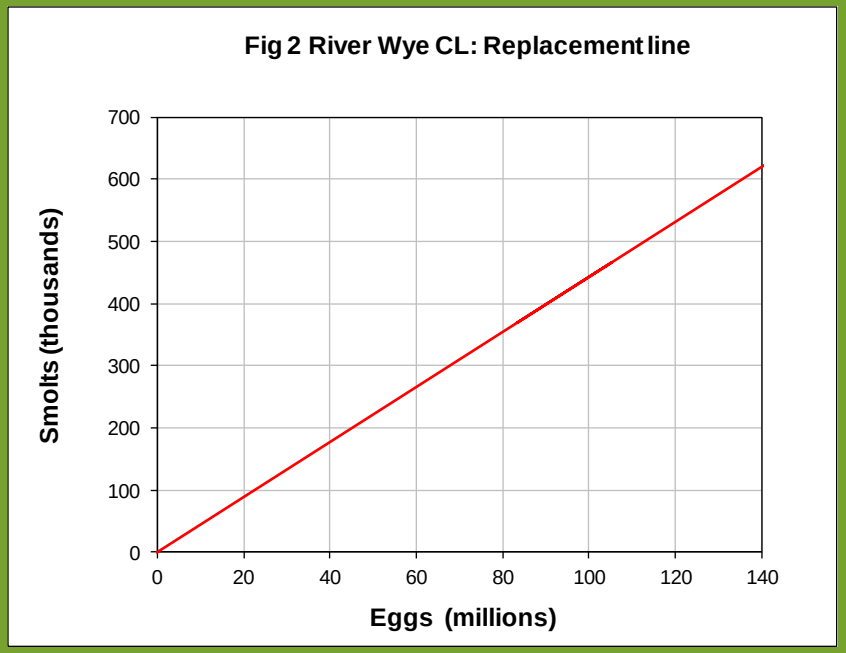
Setting Conservation Limits (CLs):





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Stock-Recruitment (SR) curve:

- Uses SR data from the River Bush, N. Ireland e.g. to set the initial gradient of the curve.
- Uses river specific map based info on stream length by altitude and stream order class to estimate juvenile production - defining the height of the SR curve under pristine environmental conditions.

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Replacement line:

- Uses info on marine survival from the River North Esk, Scotland to estimate the percentage smolts surviving to return as adults. *[Estimates are: 5% for multi-sea winter (MSW) salmon and 11% for grilse. These are combined to produce an overall survival rate that reflects the average sea age composition of each river stock.]*
- Uses river specific estimates of the % females (usually close to 50%) and their mean fecundity (based on the average size of fish) to convert returning adults into their likely egg contribution.

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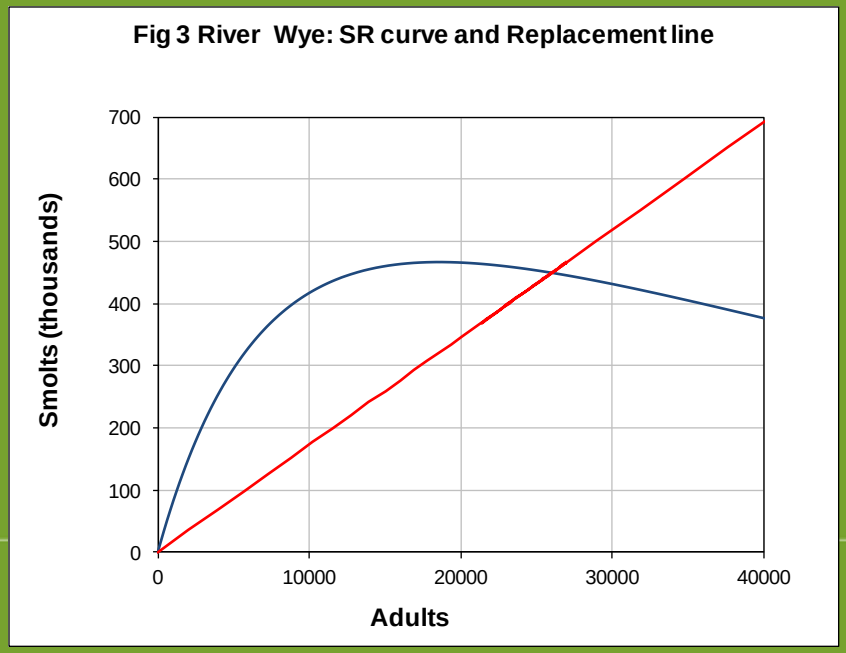
Conservation Limit (CL):

- To define the CL the SR curve and Replacement line are combined - effectively producing a whole lifecycle model. *[Note: in this example and the graphs that follow the X-axis is expressed as adult numbers not egg numbers.]*



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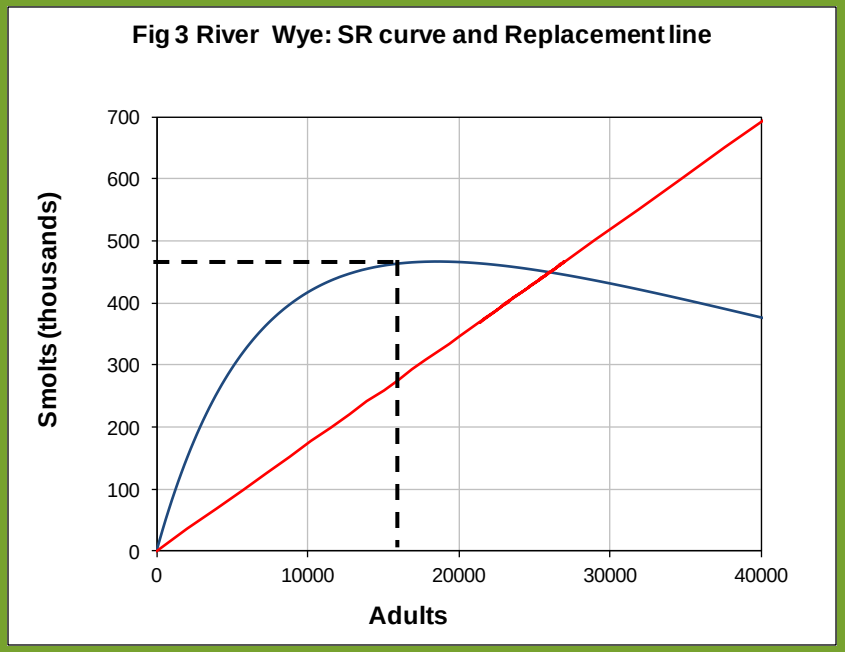
Conservation Limit (CL):

- The SR curve indicates maximum smolt production of around 460,000 fish arising from 18,500 spawning adults.



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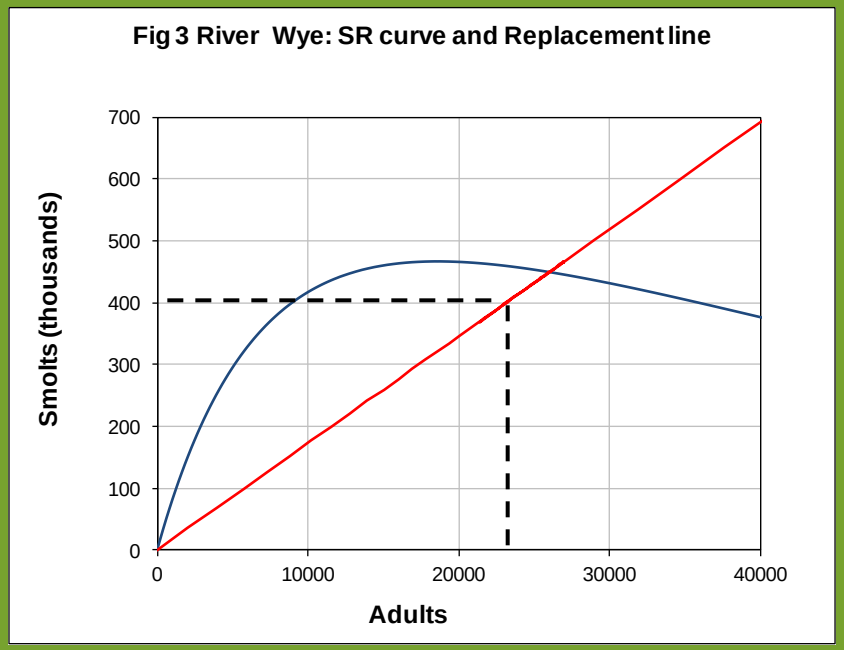
Conservation Limit (CL):

- The Replacement line indicates a smolt-to-adult marine survival rate of around 6% (e.g. 400,000 smolts produces 24,000 adults back to homewaters).



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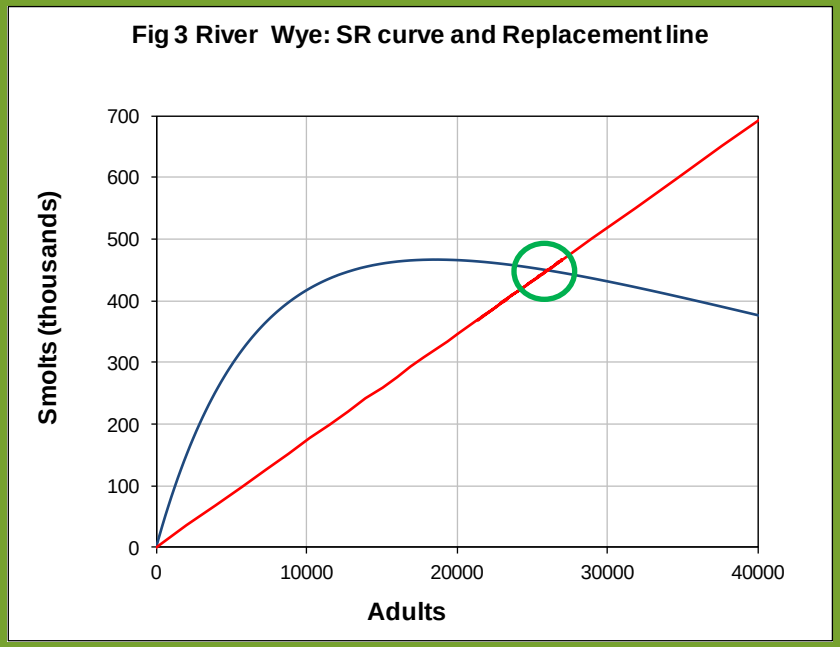
Conservation Limit (CL):

- In the absence of exploitation, the stock would stabilise around the ‘replacement point’.



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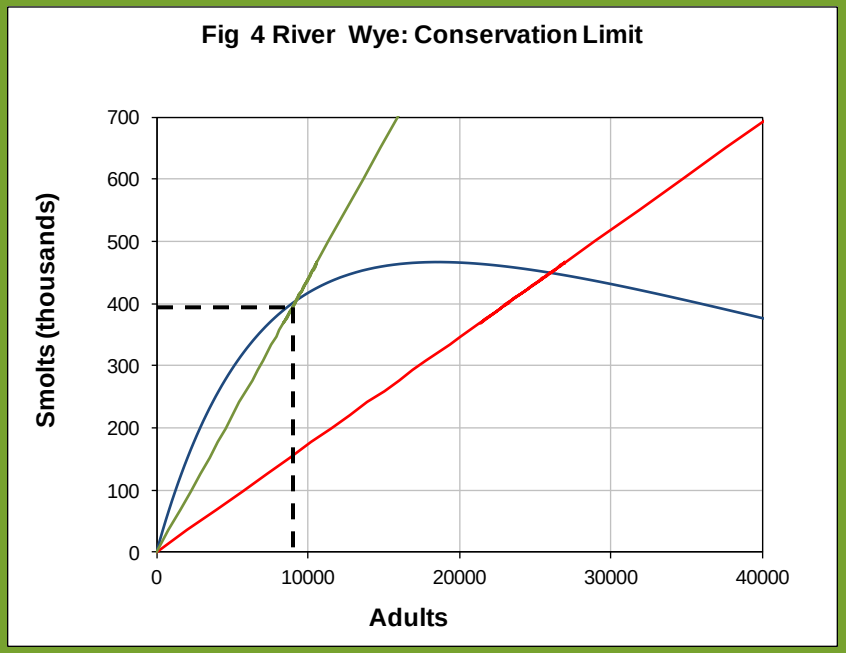
Conservation Limit (CL):

- The CL is set at the point of ‘Maximum Gain’ or the level of exploitation required to maximise the sustainable catch of fish returning to homewaters



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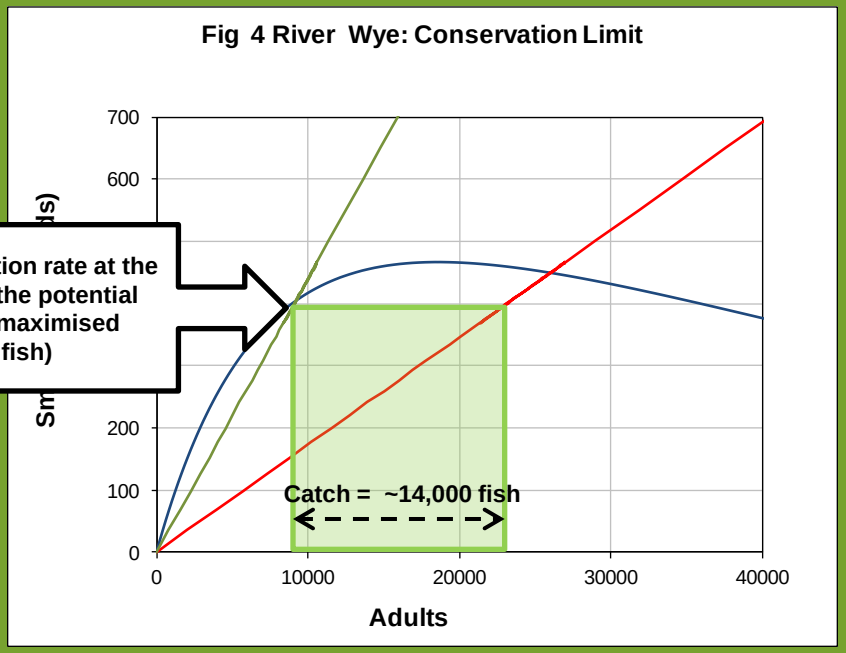

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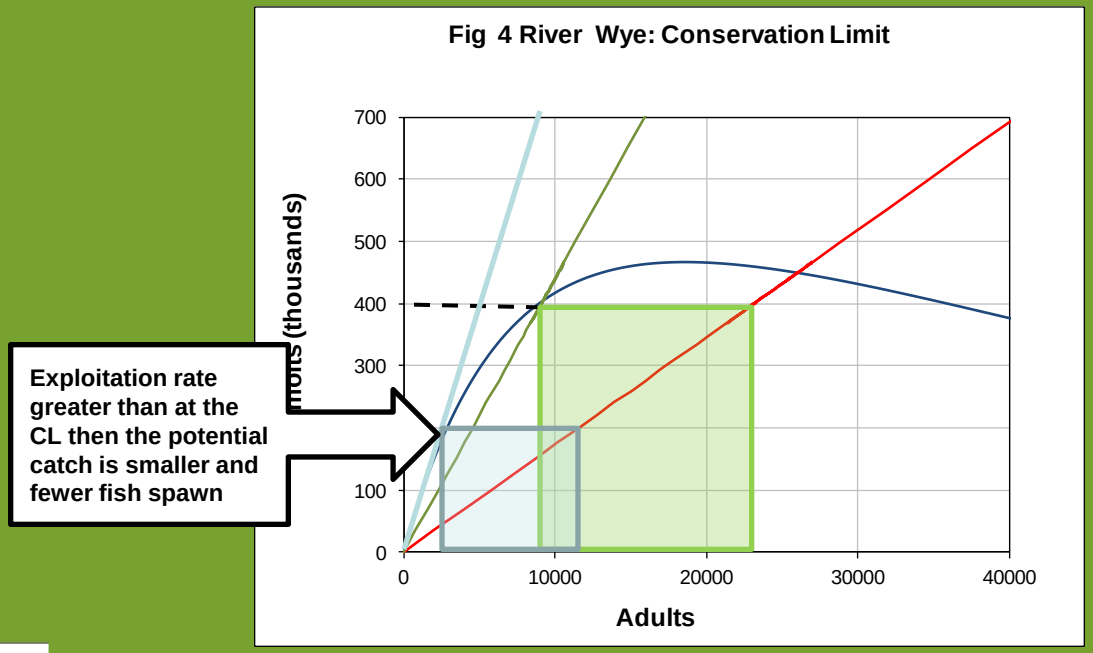

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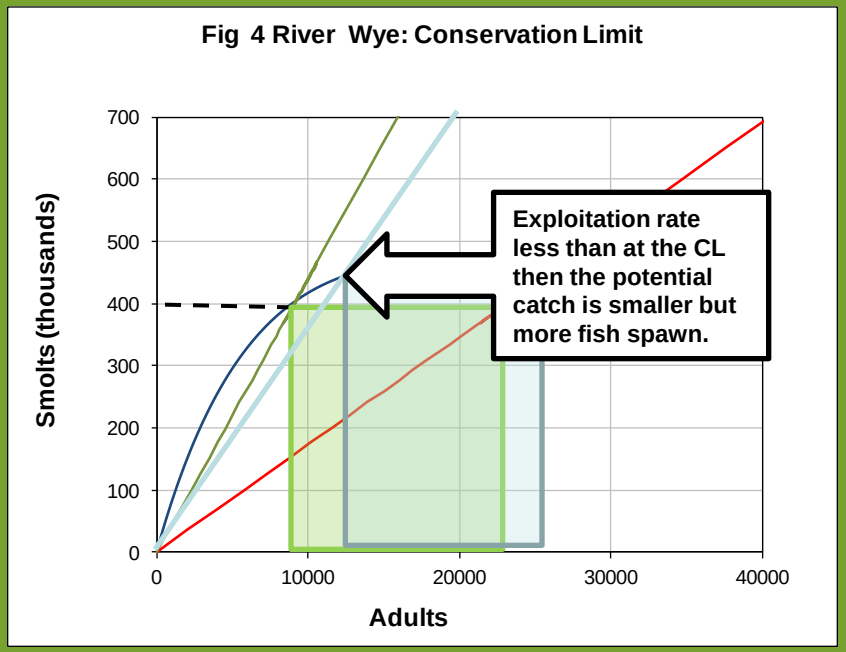

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Conservation Limit (CL):

- However, compliance procedures build in additional protection for the stock.
- This is expressed in the ‘Management Objective’ which requires spawning levels to be at or above the CL four years out of five, in the long run, in order for a river to formally ‘pass’ its CL.

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Conservation Limit (CL):

- Accordingly, on a river which is achieving ‘pass’ status, average spawning levels will be someway above the CL – at least 10,500 fish for the Wye (this is equal to the ‘Management Target’ or MT) c.f. ~9,000 fish at the CL.

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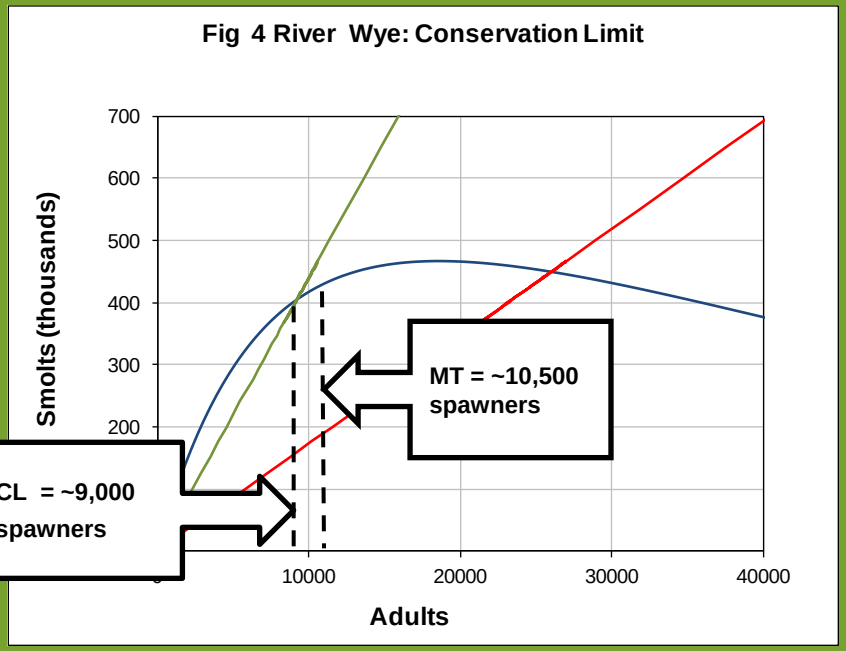
Conservation Limit (CL):



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Deriving Conservation Limits:

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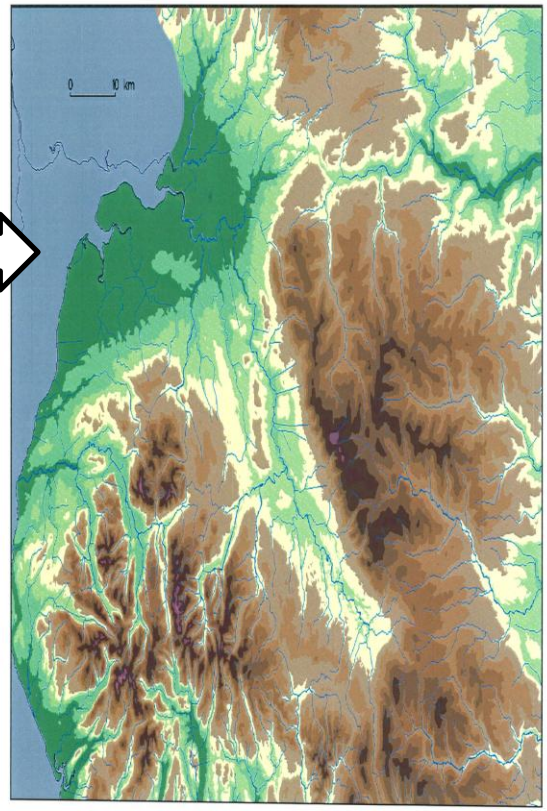
Example 1:250,000 catchment map (for the River Eden) showing detail of the drainage network used to define reaches accessible to salmon.



River Eden

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APPENDIX VII.1: GIS DERIVED RIVER LENGTHS (M) BY ALTITUDE/ STREAM ORDER CLASS FOR 76 SALMON RIVERS IN ENGLAND AND WALES

Map derived steam length measurements (by altitude and stream order class) obtained for all principal salmon rivers in E&W. Measurements amended locally to include only accessible reaches in CL calculations.

		Stream order (after Strahler)					
River	Alt. range (m)	1	2	3	4	5	6
River Aeron	0-49	0	1246	5975	0	0	0
River Aeron	50-99	8289	6005	12448	0	0	0
River Aeron	100-149	11332	7270	0	0	0	0
River Aeron	150-199	8713	2518	0	0	0	0
River Aeron	200-299	16437	1248	0	0	0	0
River Aeron	300-399	1175	0	0	0	0	0
River Afan	0-49	0	0	5633	0	0	0
River Afan	50-99	0	6031	1245	0	0	0
River Afan	100-149	3192	3594	0	0	0	0
River Afan	150-199	6983	1156	0	0	0	0
River Afan	200-299	10228	0	0	0	0	0
River Afan	300-399	2350	0	0	0	0	0
River Afan	400-499	2098	0	0	0	0	0
River Afan	500-599	399	0	0	0	0	0
River Artro	0-49	189	3511	0	0	0	0
River Artro	50-99	999	3047	0	0	0	0
River Artro	100-149	2879	2375	0	0	0	0
River Artro	150-199	3660	505	0	0	0	0
River Artro	200-299	2873	505	0	0	0	0
River Artro	300-399	4573	0	0	0	0	0
River Artro	400-499	225	0	0	0	0	0

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APPENDIX VII.3 MEAN SALMON FRY AND PARR DENSITIES (100M2) BY ALTITUDE/STREAM ORDER CLASS FOR RIVERS IN ENGLAND AND WALES

Default fry and parr density estimates (by altitude and stream order class) used in calculating the CL.

Class	Altitude class (m)	Stream Order:							
		1		2		3		4	
		Fry	Parr	Fry	Parr	Fry	Parr	Fry	Parr
A	0-49	9.65	1.87	14.11	3.49	18.73	3.93	22.58	2.66
B	50-99	4.79	3.33	12.06	5.33	19.62	6.39	20.62	5.73
C	100-149	5.09	6.39	17.04	7.27	34.15	7.70	40.94	7.59
D	150-199	8.77	11.51	27.27	8.87	50.20	7.93	54.68	8.21
E	200-299	26.38	18.06	30.34	9.70	14.83	8.39	3.08	11.68
F	300-399	44.64	7.02	1.56	7.40	-	-	-	-

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APPENDIX VII.2 DEFAULT RIVER WIDTHS (M) BY ALTITUDE/STREAM ORDER CLASS FOR RIVERS IN ENGLAND AND WALES

Default stream width estimates (by altitude and stream order class). Local measurements, where available, used in calculating the CL.

Class	Altitude class (m)	Stream Order:			
		1	2	3	4
A	0-49	3.29	4.17	7.03	15.72
B	50-99	3.22	4.17	6.89	14.56
C	100-149	3.16	4.17	6.76	13.49
D	150-199	3.10	4.17	6.64	12.49
E	200-299	3.01	4.17	6.45	11.14
F	300-399	2.89	-	-	-

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Assessing compliance with Conservation Limits (CLs):

- A two stage process :

(i) Provision of annual egg deposition estimates.

(ii) Statistical assessment of compliance with the CL ('@ risk' status).

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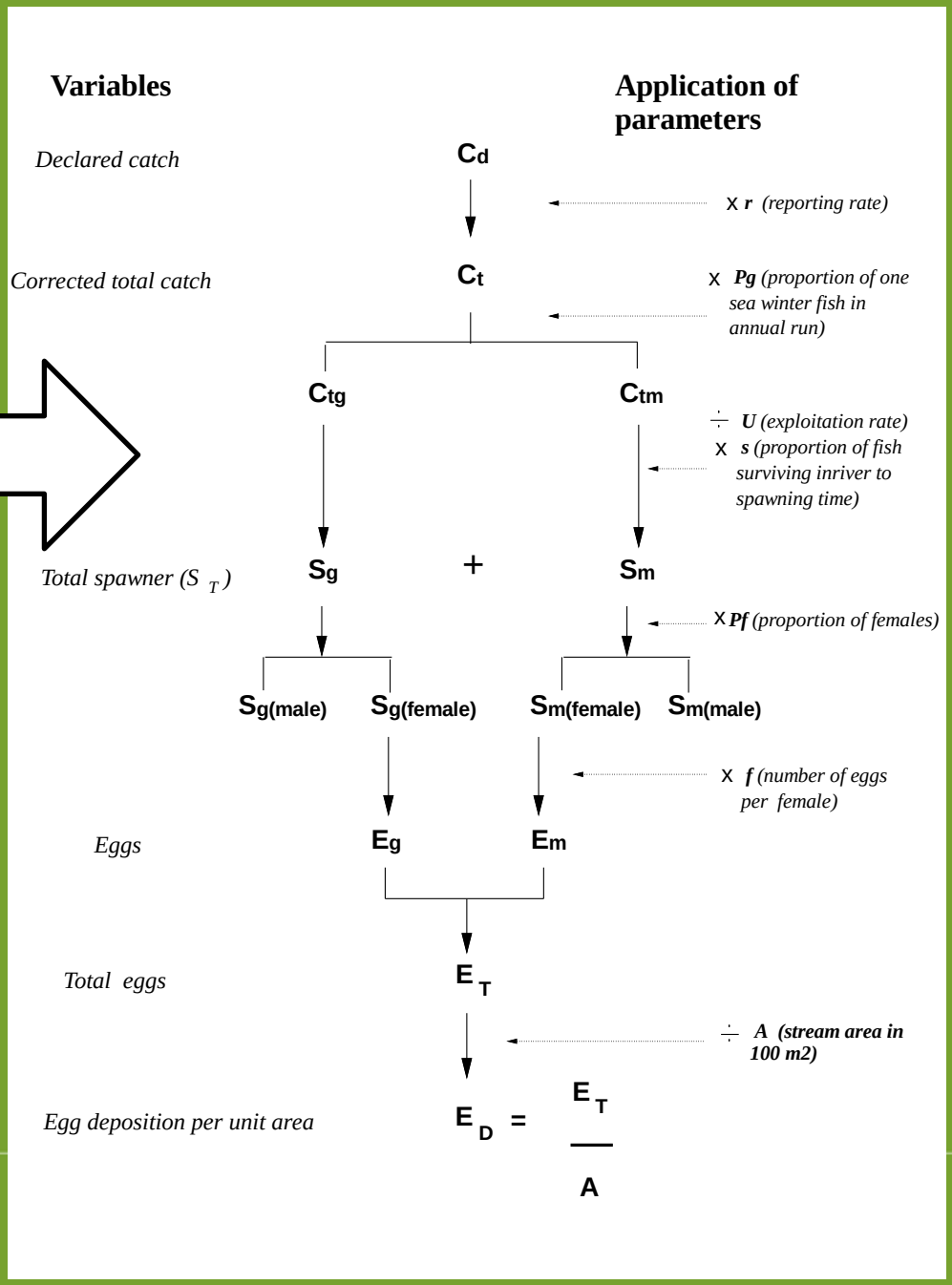
Summary of procedures to estimate grilse and MSW spawner numbers (Sg and Sm) and their egg contribution (Eg and Em) from rod catches (C) and assumed exploitation rates (i.e. the proportion of the annual run caught by angling). Additional procedures, not shown here, are used to estimate the egg contribution of rod-released fish.



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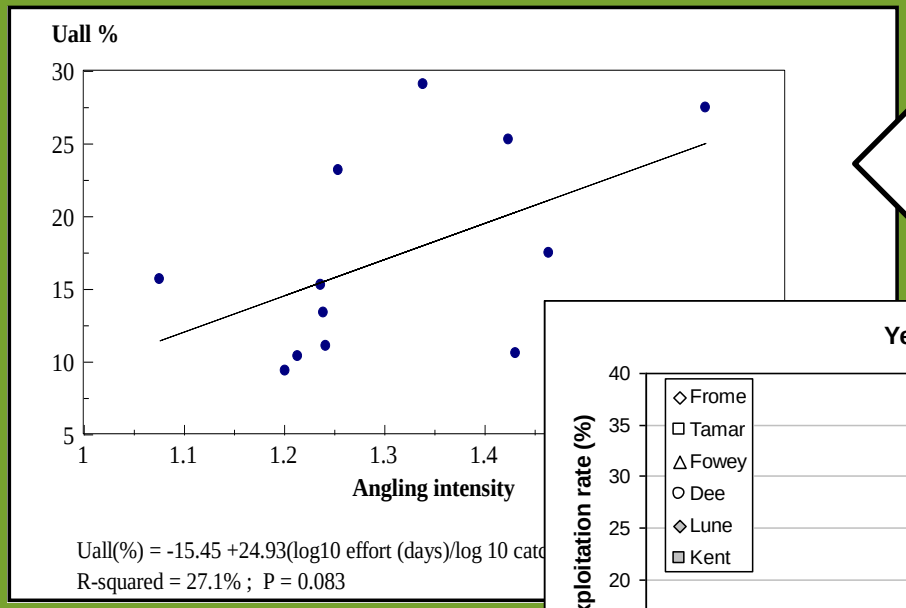
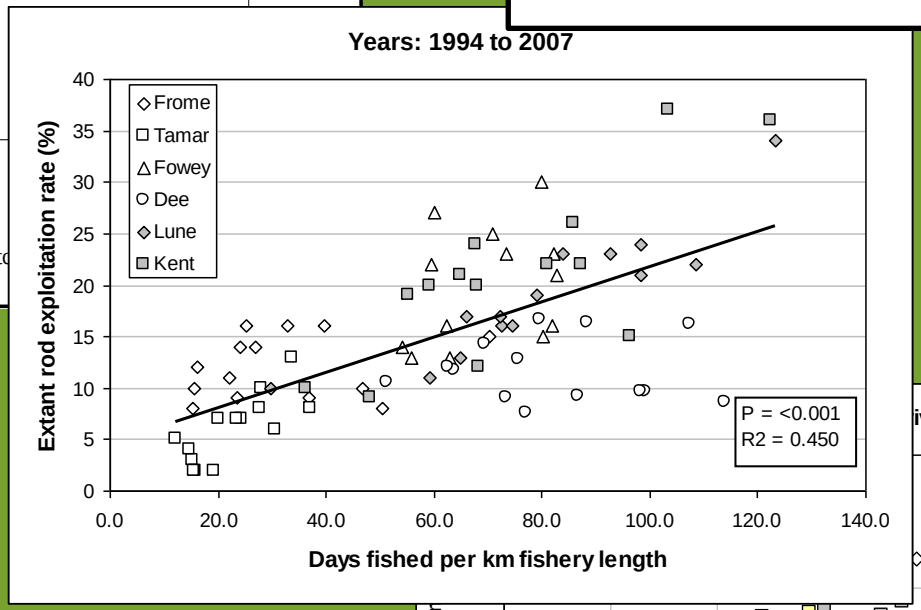
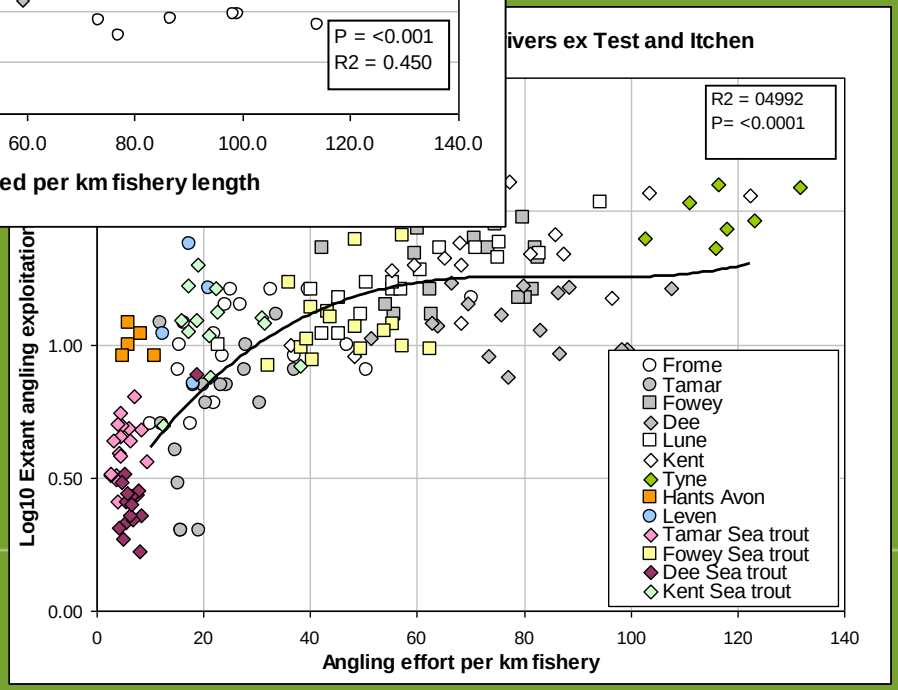


Default relationship used to predict angling exploitation rate (Uall%) from 'angling intensity' (fishing effort per unit catchment area).

Work to refine this relationship is ongoing (e.g. Model A and B, below) .

On the Wye and Usk, exploitation rate estimates are based on the rolling 5-year mean recorded on the Welsh Dee.





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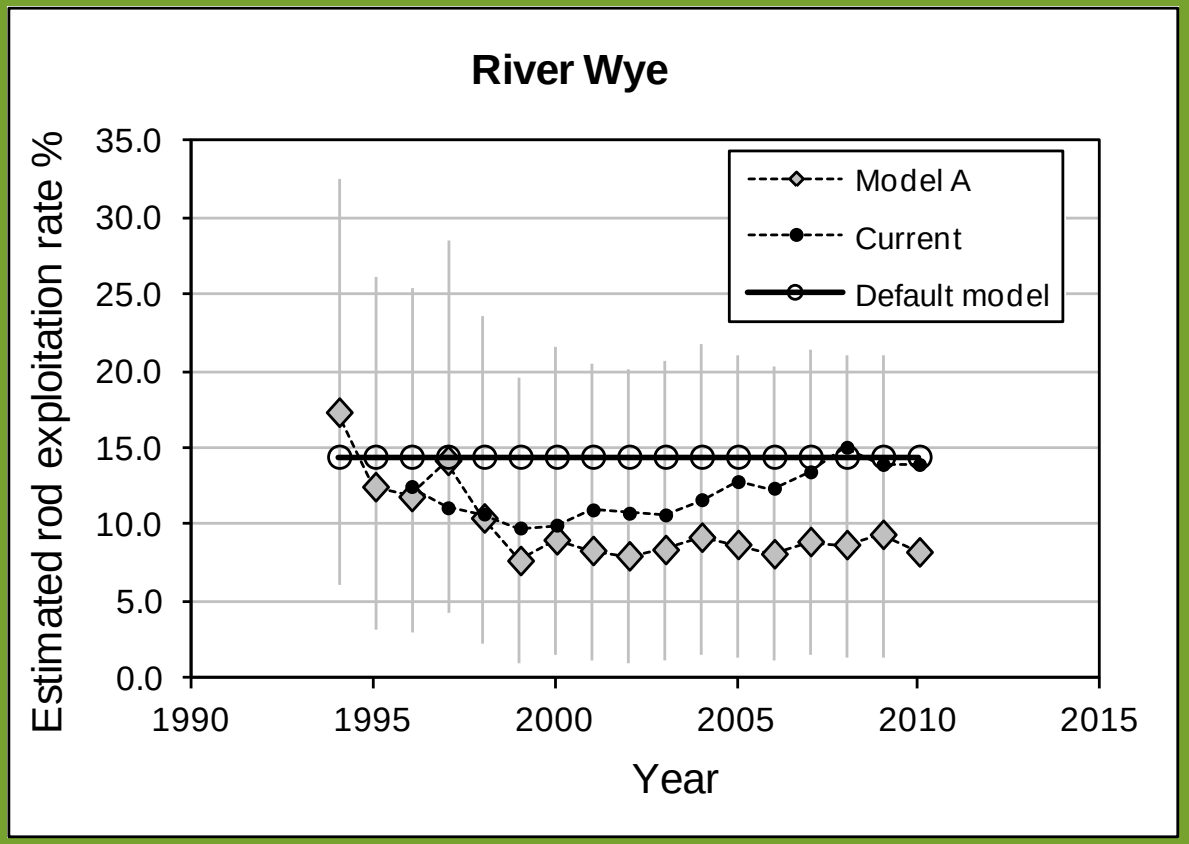

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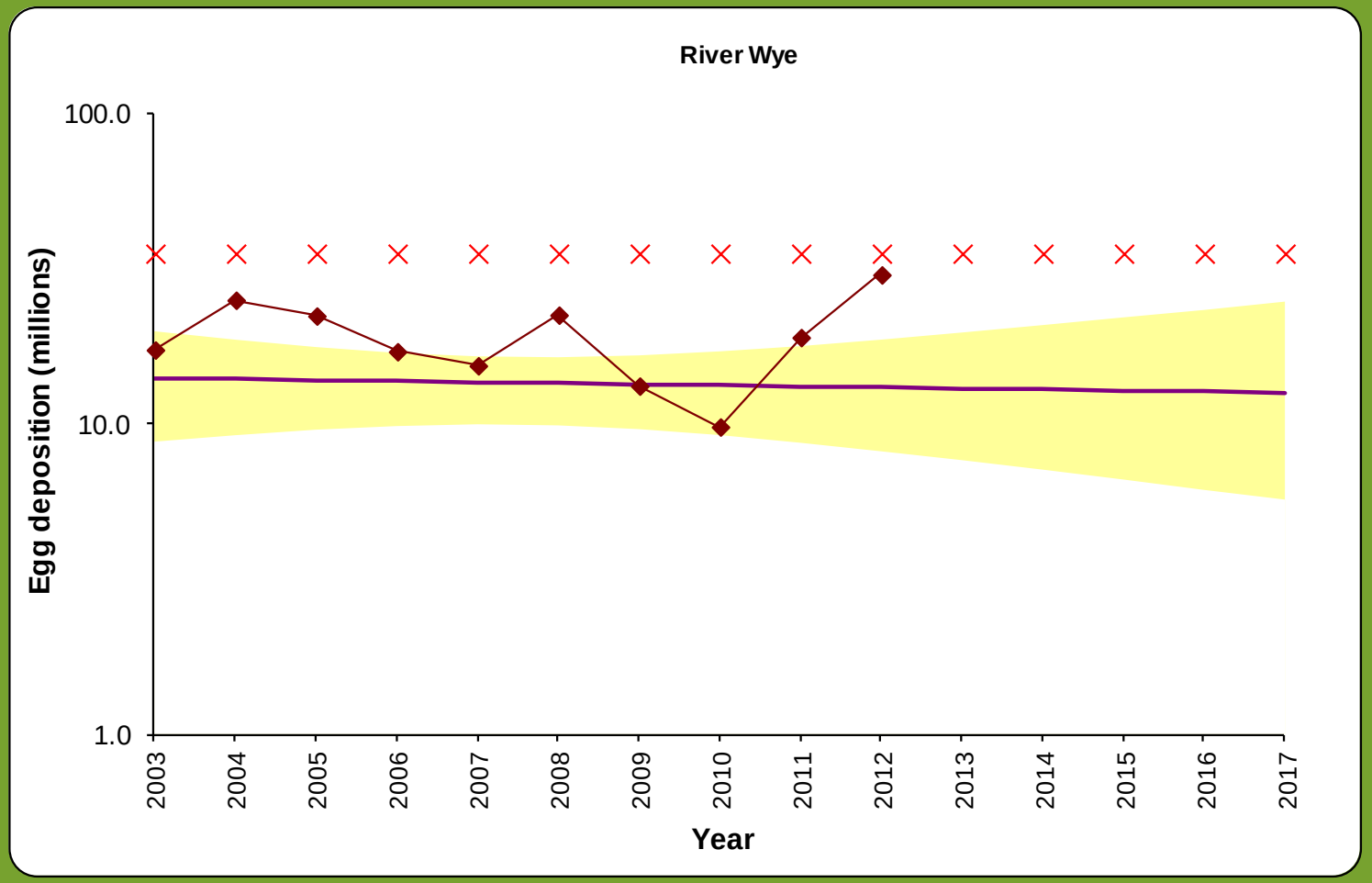

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