

## Summary: Intervention & Options

<b>Department /Agency:</b>	<b>Title:</b>	
<b>Department of Environment, Food and Rural Affairs</b>	<b>Impact Assessment of measures to address obstructions to the free passage of migratory and freshwater fish</b>	
<b>Stage:</b> Consultation	<b>Version:</b> 1	<b>Date:</b> 15 January 2008
<b>Related Publications:</b> Salmon and Freshwater Fisheries Review, 2000; Government Response to the Review of Salmon and Freshwater Fisheries Review, 2001		

**Available to view or download at:**

<http://www.>

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### What is the problem under consideration? Why is government intervention necessary?

Migratory fish (including salmonids, eels and shad) need to move freely up and down rivers in order to access feeding, breeding or nursery grounds. Man-made obstructions are a significant barrier to this free movement, and have contributed to the decline of some species; further, lack of screening<sup>1</sup> means that the ingress<sup>2</sup> of fish is also a cause of high fish mortality. Current legislation only requires new obstructions and those undergoing significant modification to introduce a fish pass, and only for salmon and migratory trout.

New powers are therefore required in order to allow the Environment Agency to take effective action to ensure the free passage of all fish, extending the requirement to introduce fish passes to extant obstructions. This is required in order to meet EU obligations to achieve Good Ecological Status (GES) under the Water Framework Directive where lack of access to habitat has a significant impact on the conservation of migratory fish stocks and the ecological status or potential of the affected water bodies.

### What are the policy objectives and the intended effects?

The key objective is to sustain, protect and improve the natural productions of fish stocks, necessary to help meet the UK's objectives under the Water Framework Directive and the Eel Regulation. This will be achieved through the provision of the necessary legislation for the Environment Agency to tackle barriers to migration for fish species in England and Wales. This will assist in the restoration of fish stocks to parts of river systems from which they have been excluded, and in the development of sustainable recreational and commercial fisheries.

In addition, new legislation will provide for the screening of water-intakes to address the number of fish these can take and therefore reduce the impact these have on the conservation of fish stocks.

### What policy options have been considered? Please justify any preferred option.

- Three options have been considered;
- i. Do nothing;
  - ii. Implement measures in a prioritised, phased approach by 2015
  - iii. Implement measures in a prioritised, phased approach by 2027

Both the second and third options are considered necessary if the Government is to achieve a more flexible management regime that properly protects biodiversity and meet its objectives to reach GES under the Water Framework Directive.

<sup>1</sup> "Screening" includes a barrier, physical or otherwise (including sound or light) preventing or deterring the egress or ingress of fish into or from inland or relevant waters

<sup>2</sup> "ingress" and "egress" refer to a fish either entering or leaving a pump, turbine etc.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects? The Environment Agency will review costs and benefits five years after the implementation of these measures. The success of works carried out will be demonstrated by increases in fish stock levels. Stock assessments are carried out at regular intervals: the Agency already has baseline data and these assessments will provide further information.

**Ministerial Sign-off** For consultation stage Impact Assessments:

*I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.*

Signed by the responsible Minister:

.....Date:

## Summary: Analysis & Evidence

Policy Option: Option 1	Description: Do Nothing
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<b>COSTS</b>	<b>ANNUAL COSTS</b>		Description and scale of <b>key monetised costs</b> by 'main affected groups' Owners/operators of new obstructions incur annual costs of installing fish passes (£2.1m) and one-off cost for introducing screens (£15m over two years). <sup>3</sup>
	<b>One-off</b> (Transition)	<b>Yrs</b>	
	£ 15m	9-10	
	<b>Average Annual Cost</b> (excluding one-off)		
	£ 2.1m	18	
<b>Total Cost (PV)</b>			<b>£ 39.4m</b>
<p><b>Other key non-monetised costs</b> by 'main affected groups'</p> <p>All key costs for the introduction of fish passes have been identified at this stage have been monetised. The additional cost of failing to deliver the European Eel Regulation, i.e. the impact on industry and the Environment Agency, will be added to the baseline costs in the final IA.</p>			

<b>BENEFITS</b>	<b>ANNUAL BENEFITS</b>		Description and scale of <b>key monetised benefits</b> by 'main affected groups'  There are no monetised benefits for this option.
	<b>One-off</b>	<b>Yrs</b>	
	£ N/A		
	<b>Average Annual Benefit</b> (excluding one-off)		
	£ N/A	6	
<b>Total Benefit (PV)</b>			<b>£ N/A</b>
<p><b>Other key non-monetised benefits</b> by 'main affected groups' There are no benefits to stocks and thereby the owners of fisheries or the participants of those fisheries, and the UK will not meet its obligation under the Water Framework Directive or the Eel Regulation.</p>			

**Key Assumptions/Sensitivities/Risks** The Environment Agency will continue with the current undertaking, requesting that fish passes are introduced for all new obstructions. It is assumed that fish passes will be introduced at the same rate in the next 6 years, as has been done previously; with the one-off costs of £15m for the introduction of screens incurred in year 4 and 5.

The key risk is that the current restrictions on the ability of migrating fish to spawn will continue, contributing to further reduction of fish stocks and the UK will not meet its obligations under the Water Framework Directive.

Price Base Year	Time Period Years 6	<b>Net Benefit Range</b> (NPV) £ N/A	<b>NET BENEFIT</b> (NPV Best estimate) £ N/A
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What is the geographic coverage of the policy/option?	England and Wales
On what date will the policy be implemented?	N/A
Which organisation(s) will enforce the policy?	Environment Agency
What is the total annual cost of enforcement for these organisations?	£ N/A <sup>4</sup>
Does enforcement comply with Hampton principles?	Yes
Will implementation go beyond minimum EU requirements?	No
What is the value of the proposed offsetting measure per year?	N/A

<sup>3</sup> Administrative costs for the Environment Agency will be included in the final IA.

<sup>4</sup> Costs will be included in the final IA.

What is the value of changes in greenhouse gas emissions?				N/A	
Will the proposal have a significant impact on competition?				No	
Annual cost (£-£) per organisation (excluding one-off)	Micro	Small	Medium	Large	
Are any of these organisations exempt?	No	No	N/A	N/A	
<b>Impact on Admin Burdens Baseline</b> (2005 Prices)				(Increase - Decrease)	
Increase of £ 0	Decrease of £ 0		<b>Net Impact</b>	£ 18,400 <sup>5</sup>	

Key:

(Net)

<sup>5</sup> Cost given is the current administrative burden to industry, including monitoring, based on 130 obstructions; please refer to paragraph 44 and 45. Costs here have been adjusted to reflect 2005 prices.

## Summary: Analysis & Evidence

Policy Option: Option 2	Description: Implement measures in a prioritised, phased approach by 2015
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<b>COSTS</b>	<b>ANNUAL COSTS</b>		<p>Description and scale of <b>key monetised costs</b> by 'main affected groups' Owners/operators will incur annual costs of installing fish passes (£70m), eel passes (£0.9m), and screens (£17.88m), administrative burden (£0.078m) and monitoring (£0.83).</p> <p>The Environment Agency will incur additional annual administrative costs relating to fish pass approvals (£0.5m) and ensuring owners/operators meet the new screening requirements (£0.225m).</p>
	<b>One-off</b> (Transition)	<b>Yrs</b>	
	£ N/A		
	<b>Average Annual Cost</b> (excluding one-off)		
	£ 90.4m	6	<b>Total Cost (PV)</b> £ 498.56
<p><b>Other key non-monetised costs</b> by 'main affected groups'</p> <p>All key costs identified at this stage have been monetised.</p>			

<b>BENEFITS</b>	<b>ANNUAL BENEFITS</b>		<p>Description and scale of <b>key monetised benefits</b> by 'main affected groups'</p> <p>Benefits are non-monetised at this stage.</p>
	<b>One-off</b>	<b>Yrs</b>	
	£ N/A		
	<b>Average Annual Benefit</b> (excluding one-off)		
	£ N/A	6	<b>Total Benefit (PV)</b> £ N/A
<p><b>Other key non-monetised benefits</b> by 'main affected groups'</p> <p><b>Stocks:</b> The introduction of a fish passage for both new and extant obstructions and screens for all abstractions would ensure fish populations benefit from both a reverse in the decline of certain stocks and an improvement in others. This will see benefits to the ecology of the water environment, through the achievement of good ecological status, and enable the UK to meet its obligation under the WFD and Eel regulation.</p> <p><b>Fisheries:</b> Improving the ecological status will also have subsequent benefits for commercial fisheries and recreational anglers who rely on the health of these stocks. Where owners/operators have an interest in surrounding fisheries they will also benefit from an improvement in fish stocks. Further, there is evidence to suggest that the UK public value the conservation of freshwater fish, such as salmon<sup>6</sup>. Fish passes may not be necessary in all cases.</p>			

**Key Assumptions/Sensitivities/Risks** The Environment Agency would require significant additional resources to implement this proposal. The total costs provided are at the higher end of the estimation, assuming that there are more complex obstructions that will require a fish pass or screen. Within 2-3 years, following the introduction of a fish pass, it is also assumed that there will be a good indication that this pass is working effectively and that the spawning mass has increased. An increase in fish stock is likely to be seen 5-10 years following the removal of the obstruction.<sup>7</sup> A potential risk for owners of obstructions is the introduction of an unsuitable fish pass, which following an assessment will need to be removed and the correct type introduced.

Price Base Year	Time Period Years 6	<b>Net Benefit Range (NPV)</b> £ N/A	<b>NET BENEFIT (NPV Best estimate)</b> £ N/A
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<sup>6</sup> See paragraph 77.

<sup>7</sup> Fish Passes and Screens for Salmon (1997), Report of the Salmon Advisory Committee, MAFF Publications, London, 66pp.

What is the geographic coverage of the policy/option?		England and Wales	
On what date will the policy be implemented?		April 2009	
Which organisation(s) will enforce the policy?		Environment Agency	
What is the total annual cost of enforcement for these organisations?		£ N/A <sup>8</sup>	
Does enforcement comply with Hampton principles?		Yes	
Will implementation go beyond minimum EU requirements?		No	
What is the value of the proposed offsetting measure per year?		N/A	
What is the value of changes in greenhouse gas emissions?		N/A	
Will the proposal have a significant impact on competition?		No	
Annual cost (£-£) per organisation (excluding one-off)	Micro	Small	Medium      Large
Are any of these organisations exempt?	No	No	N/A      N/A
<b>Impact on Admin Burdens Baseline</b> (2005 Prices)		(Increase - Decrease)	
Increase of    £ 53,800	Decrease of    £ 0	<b>Net Impact</b>	£      53,800 <sup>9</sup>

Key:

(Net)

<sup>8</sup> Potential costs will be included in the final IA.

<sup>9</sup> Cost is based on 507 fish passes, including eel passes, and includes cost of those required to monitor; please refer to paragraph 65. Costs here have been adjusted to reflect 2005 prices.

## Summary: Analysis & Evidence

Policy Option: Option 3	Description: Implement measures in a prioritised, phased approach by 2027
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<b>COSTS</b>	<b>ANNUAL COSTS</b>	<p>Description and scale of <b>key monetised costs</b> by 'main affected groups' Owners/operators will incur annual costs of installing fish passes (£23.3m), eel passes (£0.3m), and screens (£5.96m), administrative burden (£0.026m) and monitoring (£0.278).</p> <p>The Environment Agency will incur additional annual administrative costs relating to fish pass approvals (£0.25m) and ensuring owners/operators meet the new screening requirements (£0.14m).</p>	
	<b>One-off</b> (Transition) <b>Yrs</b>		
	£ N/A		
	<b>Average Annual Cost</b> (excluding one-off)		
£ 30.26m	18	<b>Total Cost (PV)</b>	<b>£ 413.1m</b>
<p><b>Other key non-monetised costs</b> by 'main affected groups'</p> <p>All key costs identified at this stage have been monetised.</p>			

<b>BENEFITS</b>	<b>ANNUAL BENEFITS</b>	<p>Description and scale of <b>key monetised benefits</b> by 'main affected groups'</p> <p>Benefits are non-monetised at this stage.</p>	
	<b>One-off</b> <b>Yrs</b>		
	£ N/A		
	<b>Average Annual Benefit</b> (excluding one-off)		
£ N/A	18	<b>Total Benefit (PV)</b>	<b>£ N/A</b>
<p><b>Other key non-monetised benefits</b> by 'main affected groups'</p> <p>Stocks: Fish populations will benefit from both a reverse in the decline of certain stocks and an improvement in others. This will see benefits to the ecology of the water environment, through the achievement of good ecological status, and enable the UK to meet its obligation under the WFD and the Eel Regulation.</p> <p>Fisheries: Improving the ecological status will also have subsequent benefits for commercial fisheries and recreational anglers who rely on the health of these stocks. Where owners/operators have an interest in surrounding fisheries they will also benefit from an improvement in fish stocks. Further, there is evidence to suggest that the UK public value the conservation of freshwater fish, such as salmon<sup>10</sup>.</p>			

**Key Assumptions/Sensitivities/Risks** The Government successfully challenges for an extension of the deadline to meet Good Ecological Status to 2027, on the grounds of disproportionate costs. The total costs provided are at the higher end of the estimation, assuming that there are more complex obstructions that will require a fish pass or screen. Within 2-3 years, following the introduction of a fish pass, it is also assumed that there will be a good indication that this pass is working effectively and that the spawning mass has increased. An increase in fish stock is likely to be seen 5-10 years following the removal of the obstruction.<sup>11</sup>

A potential risk for owners of obstructions is the introduction of an unsuitable fish pass, which following an assessment will need to be removed and the correct type introduced.

Price Base Year	Time Period Years 6	<b>Net Benefit Range (NPV)</b> £ N/A	<b>NET BENEFIT (NPV Best estimate)</b> £ N/A
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What is the geographic coverage of the policy/option?	England and Wales
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<sup>10</sup> See paragraph 77.

<sup>11</sup> Fish Passes and Screens for Salmon (1997), Report of the Salmon Advisory Committee, MAFF Publications, London, 66pp.

On what date will the policy be implemented?		April 2009		
Which organisation(s) will enforce the policy?		Environment Agency		
What is the total annual cost of enforcement for these organisations?		£ N/A <sup>12</sup>		
Does enforcement comply with Hampton principles?		Yes		
Will implementation go beyond minimum EU requirements?		No		
What is the value of the proposed offsetting measure per year?		N/A		
What is the value of changes in greenhouse gas emissions?		N/A		
Will the proposal have a significant impact on competition?		No		
Annual cost (£-£) per organisation (excluding one-off)	Micro	Small	Medium	Large
Are any of these organisations exempt?	No	No	N/A	N/A
<b>Impact on Admin Burdens Baseline</b> (2005 Prices)		(Increase - Decrease)		
Increase of £ 5,700	Decrease of £ 0	<b>Net Impact</b>	£	5,700 <sup>13</sup>

Key:

(Net)

<sup>12</sup> Potential costs will be included in the final IA.

<sup>13</sup> Costs are based on 170 obstructions, including eel passes, per year; please refer to paragraphs 89. Costs here have been adjusted to reflect 2005 prices.

## Evidence Base (for summary sheets)

### SECTION 1: Introduction, background, and rationale for Government intervention

1. This Impact Assessment (IA) sets out the costs and benefits of the proposal for the passage of fish. This details new powers for the Environment Agency ('the Agency') to take action to enable the free passage of fish up and down rivers. It also provides powers for the Agency to ensure the screening of intakes and outflows to prevent the ingress of fish. These enforcement tools are in keeping with the principles as outlined in the Hampton Review<sup>14</sup>, in that the Environment Agency will be able to target the building of fish passes more effectively, and simplify its enforcement.
2. The IA should be referred to in conjunction with the accompanying Environment Agency Statement of Intent. It sets out the background to the proposals; the context with regards to requirements under the Water Framework Directive 2000/60/EC (the 'WFD')<sup>15</sup>; the Council Regulation No 1100/2007 establishing measures for the recovery of European Eel Stock ('the Eel Regulation')<sup>16</sup>; the sectors and groups affected by the proposals; the rationale for intervention; the Government aims and objectives; and detailed policy options for the implementation of the legislation. This has been mentioned in the Water Framework Directive IA<sup>17</sup>.
3. Three options have been set out in the IA;
  - (i) Do nothing
  - (ii) Implement measures in a prioritised, phased approach by 2015
  - (ii) Implement measures in a prioritised, phased approach by 2027
4. For each of the options a Costs and Benefits Analysis (CBA) has been undertaken as detailed below.

### Background

5. Many species of fish need to move freely between different parts of the river system or between the river and the sea in order to access breeding, nursery or feeding grounds. Obstructions to fish passage (such as weirs, dams or sluices) can greatly reduce or eliminate fish in upstream areas by limiting available habitat. Removing such obstructions or the provision of fish facilities, such as fish passes or easements<sup>18</sup> in order to make them passable, has been demonstrated to be an effective way of increasing the distribution and abundance of fish.<sup>19</sup>

<sup>14</sup> Philip Hampton: Reducing administrative burdens: effective inspection and enforcement, 2005.

<sup>15</sup> The Water Framework Directive 2000/60/EC establishes a framework for Community action in the field of water policy. This is available at [http://ec.europa.eu/environment/water/water-framework/index\\_en.html](http://ec.europa.eu/environment/water/water-framework/index_en.html).

<sup>16</sup> Council Regulation (EC) No 1100/2007 of 18 September 2007 establishing measures for the recovery of the stock of European Eel, available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:248:0017:0023:EN:PDF>

<sup>17</sup> UK Impact Assessment for the Water Framework Directive (2000/60/EC), adopted by the European Union Council and European Parliament on 22 December 2000; available at <http://www.defra.gov.uk/corporate/consult/river-basin/IA-river-basin-v2.pdf>.

<sup>18</sup> Fish passes are structures built on or around weirs and dams that allow fish to bypass the obstructions and continue their migration. Easements are where an obstruction is modified or partially or completely removed to allow fish to pass.

<sup>19</sup> Suggested references: C. Briand, D. Fatin, G. Fontenelle, E. Feunteun. (2005) Effect Of Re-Opening Of A Migratory Pathway For Eel (*Anguilla Anguilla*, L.) At A Watershed Scale *Bull. Fr. Pêche Piscic.* (2005) 378-379 : 67-86; From Sea to Source: Guidance for the restoration of fish migration in European Rivers, Environment Agency.

6. There are 37 species of freshwater and diadromous fish<sup>20</sup> generally regarded as native to Great Britain, and at least 17 introduced species. The latter species are mainly restricted to specific waters where they have been stocked, and their wider spread would be undesirable and potentially damaging. However, a number of the native species are in a seriously depleted condition, within inland waters in England and Wales. The decline is most dramatic for species, such as salmon and eels, which spend part of their lives in freshwater and part in the sea. In 2007, 33 of the 64 principle salmon rivers in England and Wales were below their conservation limit, with 17 achieving less than half this limit. Eel recruitment (the number of young eels entering rivers from the sea) has fallen by 95% in recent decades. More detail on the current status of fish stocks can be found at Annex 2.
7. The Salmon and Freshwater Fisheries Act 1975 sets certain requirements for allowing salmon and migratory trout free movement to access their feeding and breeding grounds. However, this legislation is not sufficient either for these species, nor for other migratory and freshwater species that need access to different parts of the aquatic environment. In particular, fish that migrate to and from the sea such as salmon and eels ('diadromous' fish) need free passage in order to complete their lifecycles. Whilst some freshwater fish move up and down the length of rivers ('potadromous' fish).
8. The deficiencies in the current legislation led to several key recommendations in the Salmon and Freshwater Fisheries Review 2000 which were, in part, accepted by Government (Recommendations 126-129).<sup>21</sup>
9. The overall objective of the WFD is to ensure better protection of the quality of water and ensure restoration of the ecology of the water environment. It requires Member States to make operational by 2012, a programme of measures to prevent deterioration in the status of all bodies of surface water and aim to achieve Good Ecological Status or Good Ecological Potential by 2015. The deadline can be extended to 2021 or 2027 if it is disproportionately expensive or technically infeasible to achieve Good Status by 2015. The assessment of the status of surface water bodies will include consideration of the status of fish fauna. Initial assessments, undertaken by the Environment Agency and Defra, suggest that many water bodies<sup>22</sup> are at risk of failing to achieve Good Status as a result of barriers to migration.<sup>23</sup>
10. In addition, the Eel Regulation No 1100/2007<sup>24</sup> requires Member States to develop management plans for each River Basin District; with the objective of "permit[ting] with high probability the escapement to the sea of at least 40% of the silver eel biomass relative to the best estimate of escapement that would have existed if no anthropogenic influences had impacted the stock". This includes anthropogenic influences such as barriers to migration and therefore requires, where necessary, Member States to take structural measures to make rivers passable for eels. Under this Regulation, Member States are required to implement the necessary measures by 1 July 2009.

<sup>20</sup> Diadromous: species of fish that migrate between fresh and salt waters.

<sup>21</sup> The Salmon and Freshwater Fisheries Review was published in 2000, and the Government response to the recommendations in 2001. Both can be accessed at: <http://www.defra.gov.uk/fish/freshwater/pdf/sffrev.pdf>

<sup>22</sup> A water body, for the Water Framework Directive purposes, is a geographical unit of river, still or transitional water, of the same physico-chemical type, defined (and sub-divided) for management purposes.

<sup>23</sup> Further details on the risk assessment is provided in the preliminary Cost Effectiveness Analysis (pCEA) synthesis chapter on Morphological Change and Biodiversity Benefits; available [here](#).

<sup>24</sup> Council Regulation No 1100/2007, published in 2007, is available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:248:0017:0023:EN:PDF>

11. The Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora), meanwhile, lists lampreys, shad, grayling and salmon as species that are required to be subject to management measures. These and other migratory fish species are also listed in the UK's Biodiversity Action Plan. Physical barriers to migration are recognised as a known threat to these species.

## Dealing with Obstructions

### *Fish passes*

12. The Environment Agency has identified approximately 2,500 sites, many of which are already the responsibility of the Environment Agency, where fish passage needs to be improved by installing fish passes for all relevant species. Based on current WFD planning assumptions, it is estimated that fish passes will need to be installed at approximately 420 sites a year from 2009 – 2015 to meet WFD environmental objectives. Should the Government challenge for an extension to 2027, based on disproportionate costs, then fish passes will be installed at approximately 140 sites a year from 2009 – 2027. These sites would be prioritised according to a set of criteria that the Environment Agency have published alongside this IA in their Statement of Intent<sup>25</sup>. Currently, measures to address obstructions to migration have been dealt with in a piecemeal fashion, and legislation only applies in full to existing obstructions when these are undergoing substantial rebuilding, alteration or repair, and only in water frequented by salmon and migratory trout.
13. Passes may in some cases need to be species specific. It has been estimated that a number of eel passes will be additionally required specifically to address the passage of eel migration. Overall 540 eel passes will be required; 90 per annum over a 6 year period (2015) and 30 per annum over an 18 year period (2027).

### *Screens*

14. Screens are a means of preventing fish from entering an intake or outfall. Typically, they are physical (e.g. wire mesh) barriers, but can be acoustic or optical. The extension of screening requirements to all waters has the potential to impact on 10,277 licensed surface water abstractions (2008/09). For example, a large portable water abstraction may need screening with a wire mesh to prevent the ingress of fish; as well as the initial cost, the owner/operator will need to invest in maintenance (inspect, clean and repair) to ensure its continued effectiveness as a screen. The proportion of abstraction licenses by type are: public water supply 5%; private water supply 2%; electricity industry 2%; irrigation 71%; industry 10%; fish farms, cress beds and amenity 5%; and agriculture (non-spray) 5%.
15. The extent to which other sites would need to be screened would depend upon the type and size of abstraction, and any screening facilities already in place. Although a detailed assessment has not been carried out, it is likely that more than half of these remaining abstractions will be such that they do not impact significantly on fish stocks, and will therefore not require screening. It is thought, therefore, that approximately another 5,500 screens could be required.

## Sectors and groups affected

16. These provisions would have the potential to impact on owners of existing obstructions (including the Environment Agency, water companies, British Waterways, Network Rail, Highways Agency and local councils) and on developers of new obstructions such as property developers (it is now popular to convert mills

<sup>25</sup> Reference to the Environment Agency Statement of Intent.

into high-cost housing developments). Screening provisions would also affect some fish farms, and other businesses that abstract or discharge to watercourses. In particular the water supply and power generation industries will be affected.

## Rationale for Government Intervention

17. The current state of the fish stocks demonstrates that further Government intervention is required<sup>26</sup> if they are to be managed to their full potential<sup>27</sup>. Current legislation dates from an era when freshwater fish and eels were regarded as not being worthy of the level of protection afforded to salmonids, possibly even being seen as vermin where they were present in salmon or trout fisheries. Coarse fisheries<sup>28</sup> are now more valuable in both economic and social terms<sup>29</sup>. While eel stocks are in decline, the associated fisheries can be very valuable economically. Fish conservation has much higher status than it did in the 1970s, when current legislation was made. Particular weaknesses in the current legislation and management practices are outlined below:

- Other migratory species such as shad, while having a similar life cycle to salmon and despite their protected conservation status, fall outside any clear regulatory jurisdiction and therefore there is less effective protection.
- One of the critical challenges to the future management of freshwater and migratory fish is the impact of climate change. Current legislation does not offer the flexibility required to respond effectively to the increase in extreme events caused by climate change. Certain historic provisions constrain the ability to protect stocks under threat. Climate change will also have longer-term effects on freshwater ecosystems that may favour some species at the expense of others. In such circumstances there will be a need to ensure that management objectives are not inflexible, in order that decisions about the conservation and exploitation of particular species can be responsive to the change and not simply try to preserve the status quo.

18. Government intervention is necessary to implement the WFD, ensuring the requirement of good ecological status or potential is achieved.<sup>30</sup> As barriers to migration of fish species were identified as a pressure on the ecological status of water bodies in initial assessments, the Government needs to ensure that such pressures are addressed.

19. In order to deliver the requirements of the WFD, Member States are required to define the river basin districts, set appropriate objectives for each water body to achieve environmental requirements, and implement a programme of measures, within each river basin district, to achieve said objectives. This will be achieved through the development of a river basin planning system to improve the

<sup>26</sup> Currently, much of the agreements between the Environment Agency and the owners and operators of obstructions are voluntary, sometimes backed by discretionary payments. However, it is the case that many owners decline to give permission or to work with the Agency to provide free passage to fish.

<sup>27</sup> The Salmon and Freshwater Fisheries Review makes the case for Government intervention. It was published in 2000, and the Government response to the recommendations in 2001. Both can be accessed at: <http://www.defra.gov.uk/fish/freshwater/pdf/sffrev.pdf>.

<sup>28</sup> Coarse fisheries are for freshwater fish, fished usually by rod and line.

<sup>29</sup> Economic Evaluation of Inland Fisheries: Welfare benefits of inland fisheries in England and Wales. Lawrence K.S., Spurgeon, J. (2007) <http://publications.environment-agency.gov.uk/pdf/SCHO1207BNNV-e-e.pdf>.

<sup>30</sup> Overall Impact Assessment for the Water Framework Directive (2000/60/EC), adopted by the EU Council and Parliament on 22 December 2000; available at <http://www.defra.gov.uk/corporate/consult/river-basin/IA-river-basin-v2.pdf>.

management of the water environment, currently being developed under the WFD (please refer to the WFD IA for more information).

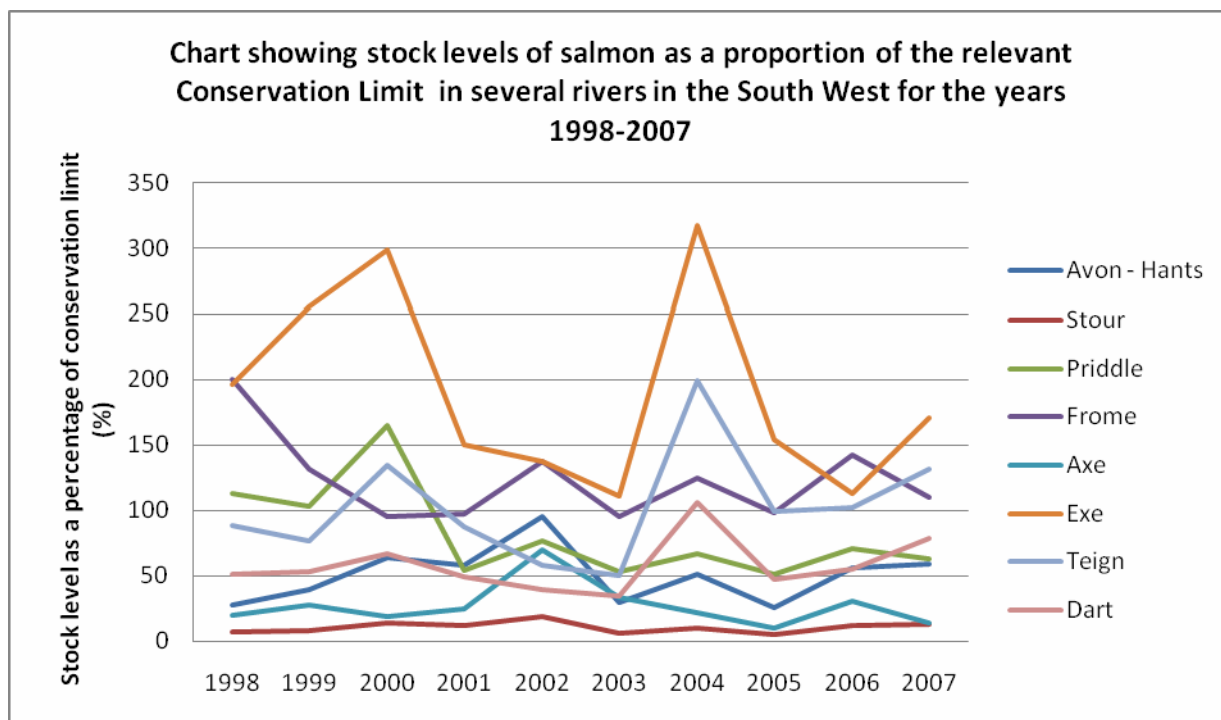
20. The measures assessed in this IA address the need to conserve, and where necessary restore, the abundance and diversity of freshwater and migratory fish through providing for access to suitable habitat. In particular the Government is seeking to improve the natural production of fish stocks by facilitating the free passage of fish to enable them to complete their life cycles through the provision of fish passes in obstructions in inland waters.
21. It is also looking to minimise the number of fish removed from inland waters, by various abstraction methods, by screening the intakes and outlets to prevent the ingress of fish during such operations.

## Implementation

22. The Environment Agency is in the process of developing River Basin management plans which are expected to be published for a 6 month consultation period in December 2008. Each plan will propose objectives following an assessment of the current status of water bodies within each river basin district, and set out a programme of measures that need to be taken, which might include addressing barriers to migration in some water bodies, in order to meet the environmental objectives. A cost effectiveness analysis will be carried out to assess the programme of measures for each district, ensuring these are appropriate to meet the identified objectives and are not disproportionate to the costs of introduction. If the measure is found to be disproportionately expensive when assessed using the economic tools developed for WFD implementation through collaborative research programme led by Defra, an alternative objective<sup>31</sup> or an extended deadline may be applied.
23. There are two tests for disproportionate costs: Economic Efficiency Analysis, which assesses whether total costs outweigh total benefits, and Distributional Analysis, which considers whether there are negative distributional impacts, such as adverse consequences for vulnerable or disadvantaged social groups and groups for which there are government objectives or concerns at a national or regional level.
24. The Environment Agency has identified a number of obstructions that need to be addressed. Average costs have been set out, though these can vary between sites, and, as the Agency will aim, where possible, to introduce fish passes at the same time as other works are being carried out, costs will decrease significantly.
25. Due to the numbers of impoundments, abstractions and discharges, the Agency has not yet identified all of the key sites where migration is being compromised; it is therefore difficult to assess the total cost associated with the proposed requirements, although average costs have been given.
26. Benefits are harder to estimate, as they both accrue from the increase in fish stocks and diversity of species present, and will be due to a range of measures the Government has taken to address poor water quality, low water flows, disease, habitat degradation and exploitation through fishing. Regulations to tackle obstructions to migrations is one part of this.

<sup>31</sup> Overall Impact Assessment for the Water Framework Directive (2000/60/EC), adopted by the EU Council and Parliament on 22 December 2000; available at <http://www.defra.gov.uk/corporate/consult/river-basin/IA-river-basin-v2.pdf>.

27. Stock assessments for salmonids and eels are carried out by the Environment Agency and Cefas (Centre for Environment, Fisheries and Aquaculture Science) on an annual basis. Assessments for coarse fish are carried out less often; the last was published in May 2004.<sup>32</sup> The chart below shows for each river, the proportion of its Conservation Limit<sup>33</sup> attained for each year between 1998 and 2007.<sup>34</sup> Increasing a river's stock level compared to its conservation limit will demonstrate the success of the measures taken.



28. Further assessments of all stocks will be carried out during the 6 or 18 year period, and particularly five years after implementation of these measures, to demonstrate the success of works, or otherwise, of fish passes and screens in enabling fish to access breeding, nursery and feeding grounds.

<sup>32</sup> Environment Agency (2004) Our Nations' Fisheries. The migratory and freshwater fisheries of England and Wales – a snapshot. Available at [http://www.environment-agency.gov.uk/commondata/acrobat/fisheries\\_eng\\_765655.pdf](http://www.environment-agency.gov.uk/commondata/acrobat/fisheries_eng_765655.pdf).

<sup>33</sup> The Conservation Limit for a species is the threshold level below which the spawning stock should not be permitted to fall. The use of conservation limits in England and Wales has developed in line with the requirement of ICES and NASCO to set criteria against which to give advice on stock status and the need to manage and conserve individual river stocks.

<sup>34</sup> Annual Assessment of Salmon Stocks and Fisheries in England and Wales 2007. CEFAS. Environment Agency. Published 2008.

## SECTION 2: OPTIONS

## OPTION 1: DO NOTHING

## Background

*Fish passes*

29. The current legislation recognises the need for salmon and sea trout to migrate upstream to spawn and for their young to migrate downstream to their marine feeding grounds. Owners of obstructions can be required to make fish passes if a new obstruction is constructed, an existing one is rebuilt, or re-instated to the extent of one-half of its original length, or altered to create an increased obstruction. Other migratory species (for example eels, shad and lamprey) are ignored (except insofar as eel nets may pose a threat to migrating salmonids), as is the fact that many exclusively freshwater species migrate considerable distances within rivers.
30. Eels ascend rivers from the sea as juveniles (elvers). There are a number of obstructions that prevent or reduce this upstream migration, constraining the colonisation of suitable habitat. Barriers are also preventing the downstream migration of adult eels, with resultant impact on subsequent spawning success of the stock. Given the recent documented decline in eel stocks<sup>35</sup>, it is important that eels are not prevented from completing their life cycle.
31. Lampreys and shad are listed in Annex IIa and Va of the Habitats Directive<sup>36</sup>. Therefore, if the Environment Agency is considering a permission (i.e. Land Drainage Consent) for a new structure within or adjacent to a Special Area of Conservation, it is possible to require the installation of fish passes and screens to protect these species, but it is not possible to require a fish pass where no permission is applied for.
32. Brown trout are the non-migratory form of sea trout (they are the same species). While the brown trout do not migrate to and from the sea, they do migrate within the river in order to find suitable spawning sites, generally in river headwaters. Barriers can threaten stock levels by interrupting spawning migrations and reducing potential spawning. However, no evidence has been gathered on the scale of the impact this might have on the populations.
33. It is now recognised that many coarse fish species show seasonal migrations within rivers in order to spawn or to feed. Many coarse fish migrate upstream to find suitable spawning sites. Some weirs and other obstructions impede this migration and hence reduce spawning success. A number of weirs that are passable by salmon or trout are impassable to coarse fish species because of their lower swimming speeds. For example, the installation of a flow gauging weir in 1978 on the River Nidd lead to reduced angling catches, because it impeded upstream migration. After the weir was removed and replaced with an ultrasonic gauge in 2000, anglers' catches recovered to pre-1978 levels<sup>37</sup>.

<sup>35</sup> Report of the 2007 Session of the Joint EIFAC/ICES Working Group on Eels, Bordeaux, 3<sup>rd</sup> - 7<sup>th</sup> September; available at <http://www.ices.dk/reports/ACOM/2007/WGEEL/2007%20EIFAC-ICES%20Report-Final-01-09-08.pdf>.

<sup>36</sup> Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, available at [http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index\\_en.htm](http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm)

<sup>37</sup> Environment Agency (2004) Our Nations' Fisheries. The migratory and freshwater fisheries of England and Wales – a snapshot. Available at [http://www.environment-agency.gov.uk/commondata/acrobat/fisheries\\_eng\\_765655.pdf](http://www.environment-agency.gov.uk/commondata/acrobat/fisheries_eng_765655.pdf).

34. Estuaries provide some of the most important strategic nursery grounds for marine fish species such as bass. The young of many species of marine and estuarine fish make extensive migrations through estuaries to reach nursery grounds. Recent work<sup>38</sup> has shown that the intertidal mudflats and saltmarshes are the optimum nurseries for these species. Fish passes can ease migration at estuarine and tidal obstructions and help secure Good Ecological Status for all species which migrate through these waters.
35. The current regulations on the closure of sluices are unnecessarily proscriptive, requiring the closure of sluices on Sundays. This reflects neither current working practices or the spawning times of migratory fish.
36. Improvements to fish passes are currently often made in partnership (between the local fisheries interests, River Trusts and /or conservation bodies and the owners/operators of weirs – with or without Environment Agency involvement), due to weaknesses in the Salmon and Freshwater Fisheries Act 1975, although the Environment Agency does use powers provided in other legislation to provide for sustainable fish stocks. For example, at Westwick Weir on the River Ouse in 2004, British Waterways re-constructed a very substantial part of the weir (30-40%) but less than 50% of it. Salmon and Freshwater Fisheries Act only allows the Environment Agency to insist that a fish pass be included in the overall programme of works if the extent of one half its length is rebuilt or reinstated. A fish pass was included because the Environment Agency were able to put together a collaborative project with British Waterways, who contributed about half of the costs whilst the rest was found from a Land Fill Tax source, the Environment Agency, and several small external funding sources. The pass specification was carried out by the Environment Agency, with British Waterways' engineers contributing the detailed engineering design. Without this major effort in a collaborative project, the pass would not have come about and a major opportunity on a large recovering river would have been lost.
37. Many fish passes will be built to a standard design and final approval will follow automatically. For others that are to a novel or non-standard design owners and/or occupiers of obstructions will be required to monitor and satisfy the Agency that the fish pass is functioning as specified. This can be achieved through the introduction of fish counters; these normally cost between £5,000 and £8,000 to purchase and install. Currently, final approvals are awarded a year following the introduction of a fish pass.

#### *Screens*

38. While screening of water intakes is required for migratory salmonids, all species can be adversely affected. On-river fish farms can draw in large numbers of coarse fish fry and juveniles, and other abstractors of water can have significant affects on fish populations.
39. Power stations can trap large numbers of coarse and estuarine fish in their intakes. The development of small-scale hydropower facilities has introduced the risk of fish, especially eels, being damaged in turbines or entrained in draw-off and discharge channels. For example, in 1989 one of Thames Water's intake stations was shown to have entrapped approximately 20,000 1+ year old (second year) coarse fish per annum, based on full licensed abstraction, and the equivalent of 10,500 adults from an assessment of entrapped 0+ (first year) coarse fish<sup>39</sup>.

<sup>38</sup> Colclough et al (2005). Fish utilisation of managed realignments. Fisheries Management and Ecology.

<sup>39</sup> Environmental Agency (2005). Screening intakes and outfalls - best practice guide. Environment Agency Science report.

40. In a two year study<sup>40</sup> at another Public Water Supply site on the Yorkshire Ouse in 1990/91, 14,246 river lampreys were entrained in the intake. The fitting of fine screens has since reduced entrainment significantly; from 16,000 a year to a few hundred per year.
41. Monitoring the cooling water intakes of a power station (situated on an east coast estuary) showed 47 and 36 tonnes of fish were impinged on the screens in 1999 and 2000, respectively.

## Costs

42. Approximately 80 complex river passes have been constructed in the last 10 years (1997-2007) together with 50 smaller, cheaper constructions. The latter have depended upon joint action between organisations such as the River Trusts and the Environment Agency. The costs for complex fish pass facilities can amount to £250,000 each, £2m each year for 8 passes. Smaller constructions can cost up to £20,000 each; £100,000 each year based on 5 constructions.
43. Current administrative burden cost for owners or developers of obstructions is estimated at £144<sup>41</sup>; a total of £18,700 for 130 obstructions that were required to introduce a fish pass.
44. Following the introduction of a fish pass, owners and developers will be required to carry out monitoring work if the fish pass introduced is of a novel design, or if the obstruction is of a complex nature. Owners will need to use basic video or sonar equipment for monitoring; this is expected to cost an additional £5,000-8,000. The estimated total administrative burden cost to owners is £36 per obstruction;<sup>42</sup> total cost of £1,188. It should be noted that owners that introduce fish passes that are of a standard design, will not be required to undertake any monitoring; estimated for 75% of cases.
45. Over a two year period, between 2002-04, the Environment Agency required the screening of approximately 400-500 licensed abstractions from migratory salmonid rivers and estuaries. Using an average cost of £30,000 for each screen, the total cost of installing a screen to these licensed abstractions was approximately £15m. In the short term, doing nothing will present no additional effect on costs to land owners or those who extract water from water courses.
46. It is assumed that the current costs will remain the same over the next 18 years, remaining consist with the third option.
47. It is the intention of the Environment Agency, even through a change in current legislation, to work with obstruction owners to ensure the free passage of fish to complete their life cycles.<sup>43</sup>

<sup>40</sup> National Rivers Authority (1991). Impingement and mortality of fish associate with the River Ouse abstraction scheme. Internal NRA report.

<sup>41</sup> An EA estimate. For each obstruction the assessment is based on: 1 person; spending 4 hours in total filling necessary forms, including an application for a land drainage licence; with a salary of £36 an hour (includes overheads) at the initial outset of designing and introducing a fish pass for an obstruction.

<sup>42</sup> An EA estimate. Subsequent to introducing a fish pass, owners/developers will be required to undertake monitoring in 25% of cases, ensuring that the pass is fit-for purpose. This will take 1 person, spending 1 hour (filling out the necessary form and covering letter to the report), with the same salary of £36.

<sup>43</sup> Currently, owners and/or developers of new obstructions who seek licences, such as those for planning or impoundment, will then be notified by the Agency to introduce a fish pass. Administrative costs for the Agency will be included in the final IA.

48. Current legislation provides for the adequate passage of migratory salmonids through existing obstructions under certain, but restricted circumstances. Other species, e.g. eels, only benefit from any fish passes in existence for the passage of salmonids that are incidentally conducive for their own migratory habits. For example, larger eels can only use certain types of passes and silver eels are especially vulnerable to hydropower turbines when moving downstream. Without legislation to provide for non-salmonid species there is a risk of significant reductions in fish stocks continuing.
49. The objective of the Council Eel Regulation is to ensure the escapement to the sea of at least 40% of the silver eel biomass, relative to the best estimate of escapement that would exist if no anthropogenic influences had impacted the stock. Such measures, as set out in individual management plans, based on the river basin districts, will need to be implemented by 1 July 2009. If Member States fail to deliver by the specified deadline, then they will be required to reduce fishing effort by 50% (relative to the effort deployed between 2004-2006) or ensure a reduction of eel catches by 50% (relative to the average eel catch between 2004-2006). This reduction in fishing effort and catches will have a significant impact on UK fisheries; the potential costs to fisheries and to the Environment Agency will be explored and estimated and provided in a separate IA, specific to meet the requirements of the Regulation.

### Benefits

50. In conclusion, the “Do nothing” option will allow the current restrictions on the ability of migrating stocks to spawn to continue, and therefore does not present any benefits. This will inevitably contribute to further reductions in stock, and species will not be able to exploit recent, and potential future, improvements in water quality. The UK will therefore not meet its obligations under the WFD, the Eel Regulation nor the Habitats Directive.

## OPTION 2: IMPLEMENT MEASURES IN A PRIORITISED, PHASED APPROACH BY 2015

### *Fish Passes*

51. Provisions on obstructions need to cover all forms of obstructions, both natural (but only those of a temporal nature) and man-made so far as they impede the passage of migratory, freshwater, estuarine and marine fish to or from their spawning and feeding areas. Further, the Environment Agency needs to be able to require the provision of passes in both new and extant obstructions, and to require the maintenance of all passes. Although many fish passes are currently constructed in obstructions through voluntary agreements with the Environment Agency, it is also the case that many owners decline to give permission, or work with the Agency, to ensure the effective passage of fish.
52. It is proposed to widen Environment Agency powers in respect of obstructions to the upstream or downstream passage of these fish. There would be powers to require owners to provide or repair fish passes if it was determined that the environmental benefits would be sufficient and the obligation proportionate.
53. The Environment Agency would be able to require a fish pass to be put in place, and subsequently maintained, where a structure has *become* an obstruction to passage (e.g. through alterations to its structure owing to design or decay). Current legislation

refers to the situation where “any other obstruction to the passage of salmon or migratory trout is *created*” (e.g. through a man-made structure). Primary legislation would also introduce a general obligation on the owner or occupier of a dam or obstruction with a fish pass to maintain it. In the current legislation there is only an obligation to maintain a new fish pass. If it is not feasible to establish who owns an obstruction, the Environment Agency would have the power to reduce or remove barriers to the passage of fish. However, it must be clear that account must be taken of the needs of other users and the wider environment.

54. All owners of obstructions will be liable to put in fish passes where it can be shown that the obstruction hinders the access of fish to their feeding or breeding grounds. It is recognised that this is a significant financial burden, however at present this is being met to some degree from public funding, and it is not reasonable to expect this contribution to increase where the owner derives the benefit from the obstruction. It is not the intention that all owners will be required to carry out modifications on their obstructions; the Environment Agency will prioritise the most critical barriers to fish migration, and this is currently estimated at 420 significant obstructions a year to 2015.

#### *Screens*

55. At the moment screens are only required for mills or fish farms and only for waters frequented by salmon or trout, and there is an exemption for channels (linked to mills) built before 18 July 1923. The new provisions would require owners or occupiers of artificial channels that either take water out of or feed water into rivers or canals, to put in place and maintain screens to prevent movements of fish in inland waters into or out of the river or canal. Some owners whose abstraction or discharge is less than 20m<sup>3</sup> may not be required to introduce a screen<sup>44</sup>; there are likely to be few such owners. Primary legislation would also empower the Agency to install and maintain screens, and to modify channels in which screens are located, in all rivers as above.

#### *Fisheries Classification Scheme*

56. In order for the UK to achieve its obligation under the WFD, of achieving good ecological status by 2015, the Environment Agency will develop a framework to assess the status of the water bodies<sup>45</sup> in accordance with the requirements of the WFD, identify where pressures are impacting the ecological status and thereby what management solutions are required if the classification is less than ‘good’. The abundance of fish species using a measure of the observed population in relation to the expected one in a similar river type under different conditions<sup>46</sup> forms part of this classification. When faced with a water body that is at less than ‘good’ status, and with a certainty of greater than 95% that this is the correct status, the Agency will consider the most appropriate measures and their impact before taking any action. If the Agency is less than 95% confident that the status of the water body is less than ‘good’, then further information will be sought to confirm status. The EA will carry out reviews every six years; the costs associated with this scheme fall under the WFD IA.
57. Table 3 below provides some insight as to how the classification data could be developed and used to identify the most appropriate measure to help achieve a good status. Examples of how this process may operate are outlined below:
- a. A water body upstream of an obstruction has been classified as ‘poor’, with a confidence of greater than 95%, i.e. the Agency is confident that the fish

<sup>44</sup> Abstractions below 20m<sup>3</sup> do not require an abstraction licence from the Environment Agency, and are therefore exempt from requiring a screen.

<sup>45</sup> Water bodies will be individually classified into one of five status classes: high, good, moderate, poor or bad.

<sup>46</sup> Data used to predict the expected population level is based on quantitative and semi-quantitative data from over 6000 sites across England and Wales, surveyed between 2001 and 2005.

population has been impacted, and that the barrier is the cause. In this case, the Agency would pursue the most cost effective appropriate measure of removing the barrier or introducing a fish pass, provided the cost is proportionate to the benefits.

- b. A water body has been classified as less than 'good', with a confidence of less than 95%, e.g. 60%. In this case, the Agency will consider why the confidence in the assessment is low, before identifying appropriate measures. If it is considered that this low confidence is due to limited available samples, then additional information, e.g. through surveys, will be sought before any measures are suggested.
- c. A water body has been classified as less than 'good', with confidence at greater than 95%, but it is not clear what the pressures are and therefore what the most appropriate measures are. Here the Agency would undertake further monitoring of the water body to understand the cause of the impact before any action is taken.

**Table 1: An example of how classification data could be used to help identify where measures are required**

		<b>Confidence that status is less than good (where status is less than good)</b>		
		High	Medium	Low
<b>Certainty of cause of impact (pressure)</b>	Certain of cause of impact	Work with appropriate pressure manager to identify measures options	Look for supporting evidence that impact is genuine	Review classification to determine why confidence is low
	Suspect of cause of impact	Work with appropriate pressure manager to identify measures options. Look for supporting evidence to confirm nature of pressure causing impact	Look for supporting evidence that impact is genuine and look for supporting evidence to confirm nature of pressure causing impact	Review classification to determine why confidence is low
	Don't know cause of impact	Investigative monitoring required to determine cause of impact	Look for supporting evidence that impact is genuine. Consider investigative monitoring to determine cause of impact	Review classification to determine why confidence is low

58. The Environment Agency will continue to carry out surveys and gather information to better inform the fisheries classification model to aid in the assessment of the ecological status of the water system. The Agency will also continue to develop a prioritisation scheme to enable better targeting of critical obstructions, using criteria as set out in the Statement of Intent, thereby reducing the potential burden to owners and developers of obstructions, as not all will require a fish pass.

## Costs

### *Fish passes*

59. Costs for fish facilities can vary greatly; from easements which can cost no more than £5,000 to large, complex fish passes which can cost up amount to £250,000<sup>47</sup>. However, where other substantial works are ongoing at the same time, the additional cost of building a fish pass or other easement can be much reduced and could become effectively marginal. Initial work by the Environment Agency suggests that approximately two-thirds of the obstructions identified as needing fish passage facilities will be at the higher end of this range (at around £200,000), with the remainder costing approximately £100,000. Based on current planning assumptions (the Environment Agency will consult on draft River Basin Management Plans and programmes of measures for six months from December 2008) the Environment Agency estimates that up to 420 obstructions per year will need to be removed or made passable in order to meet WFD environmental objectives. The total cost of this will be approximately £420m over a 6 year period, with an average of £70m per annum. The cost implications on small business are currently being explored; a list of the sectors who we believe will be affected are listed in Annex 1 of this IA, under the 'Small Firms Impact Test'.
60. The Environment Agency will target effort to areas of need or where opportunities arise. It is the Environment Agency's intention to work collaboratively with the owners of existing obstructions. The owners of new obstructions will incur reduced costs, as the construction of fish passes is less costly where this is part of a larger overall design and build project. Similarly, fish pass costs can be reduced where installation is carried out as part of repair or reconstruction of an existing obstruction. These same principles will apply to sites where screens to protect fish are required.
61. In addition to the 420 most significant obstructions to be targeted, the Agency estimates that approximately 90 eel passes will be required per year, to specifically address the passage of eel migration. Eel passes generally cost significantly less and can be in the order of £10,000. Again, where these are part of other substantial works costs would be significantly less. Therefore, the total cost of this will be approximately £5.4m over a 6 year period, with an average of £900,000 per annum.
62. Where the person responsible for the obstruction is also the fishery owner of an adjacent reach, the cost would be offset over time by the benefits to improved fish stocks and increased value to the fishery.
63. Some powers to require the construction or alteration of a fish pass already exist in relation to migratory salmonids. However, in practice, these powers are rarely used to force owners to install or repair a fish pass at their own expense, and it is envisaged that a partnership approach would be extended to fish passes required for other migrating fish. In addition the Environment Agency would be able to exempt some obstructions from requiring fish passes where they are not necessary. For those sites that are the responsibility of the Environment Agency, work would depend on resource availability and an assessment of the costs and benefits of each project.

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<sup>47</sup> Environment Agency estimate.

64. The administrative costs linked to each fish pass that is introduced remains unchanged from the current rate (please see paragraph 44). However, as there will be an increase in the number of fish passes that are required, this will lead to an increase in the administrative burden. This is estimated at a total of £78,000<sup>48</sup> annually for 510 fish passes, which includes the 90 eel passes required each year; the total cost over the 6 year period is £468,000.

65. In 25% of cases, owners or developers of obstructions that use novel or complex fish passes will require to undertake monitoring and surveillance assessment, necessary to ensure the accessibility of the fish pass that has been introduced. Such circumstances include owners of obstructions introducing novel fish passage designs, and therefore are considered as high risk facilities. In these circumstances owners are likely to sub-contract the monitoring assessment, at a cost of £5,000-8,000; which includes a basic video or sonar assessment, monitoring throughout the year, and producing a report for the owner to submit to the Agency. This is a total cost of £5m for the total number of obstructions (2,500). Under this option, the cost for monitoring is approximately £833,000 per annum. It should be noted that fish passes that follow the Environment Agency's standard designs will not be required to monitor.

#### *Maintenance costs*

66. New or extant obstructions or alterations to existing obstructions owners/occupiers will be required to take on the cost of maintenance of the fish pass. These costs will vary from site to site and there is little evidence to give clear indications of their levels. Maintenance costs (for constructions outwith this context, e.g. engineering works such as bridges), are commonly assumed to be around 2% of capital investment costs, which would imply costs of the order of £4,000 per annum (per fish pass) and £200 per annum (per eel pass), a total of £76,000 over 6 years, but there is no evidence to support these figures in this context.

#### *Costs to the Environment Agency*

67. The Agency will incur increased costs of overseeing the proper authorisation and then operation of fish passes by owners. This cost is estimated to be £500,000 annually, which will be absorbed from the project costs, as part of our delivery of WFD requirements.<sup>49</sup>

#### *Screens*

68. The cost of installing a screen includes: capital costs; installation costs (associated planning & design); site investigations; preparation; consultancy; installation; testing and commissioning. The cost of a screen is highly dependent on the site, but ranges from £5,000 to £250,000 (including installation costs). The total cost of this will be approximately £107.3m, please see Table 1 below for the breakdown of costs. The cost implications on small business are currently being explored; a list of the sectors who we believe will be affected are listed in Annex 1 of this IA, under the 'Small Firms Impact Test'.

<sup>48</sup> Costs includes the administrative burden on 25% of owners that will be required to undergo monitoring and surveillance, to ensure that the fish pass is fit-for-purpose. Please see paragraph 44 and 45.

<sup>49</sup> An EA estimate, based on 0.5 to 1 FTEs per operational area.

**Table 2: Total cost of installing screens across the differing types of licensed abstractions over the 6 year period**

	% of abstraction licence types *	No of licences	Probable cost of screen (£'000) (assumed)	Total cost (£'m)
Public supply	5%	285	100	28.5
private supply	2%	102	50	5.1
electricity industry	2%	131	250	32.8
irrigation	71%	3895	3	11.7
industry	10%	527	50	26.4
fish farms, cress beds and amenity	5%	278	5	1.4
Agriculture (non-spray)	5%	282	5	1.4
<b>TOTAL</b>		<b>5,500<sup>50</sup></b>		<b>107.3</b>

\* Percentages are rounded to the nearest whole number

69. However, the requirement to fit a screen would be prioritised in the same way as for fish passes. The Environment Agency would develop criteria, outlined in the Statement of Intent<sup>51</sup>, and guidance to which the new powers would be applied. It is therefore difficult to estimate the total cost of this requirement.

70. There would also be additional costs to the Agency to ensure operators meet the new screening requirements. These are estimated at an initial £250,000 annually for 5 years as the phased implementation envisaged takes place, reducing to £100,000 for the final year for ongoing enforcement and consenting work.<sup>52</sup> This is estimated as a total cost of £1.35m over the 6 year period, averaging out to an annual cost of £225,000. This again will be absorbed from the current staffing levels, as part of our delivery of WFD requirements.

<sup>50</sup> An additional 5,500 licensed water abstractions could require screening over the 6 year period; refer to paragraph 15 of this impact assessment.

<sup>51</sup> Reference to the Environment Agency Statement of Intent

<sup>52</sup> An EA estimate, based on 0.25 to 0.5 FTEs (reducing to approx 0.1 FTEs) per operational area.

**Table 3: Total costs to industry and the Environment Agency to 2015**

	<b>Total cost (£m)</b>	<b>Cost per annum until 2015 (£m)</b>
<b>Cost to Industry</b>		
Fish passes	420	70
Eel passes	5.4	0.9
Monitoring	5	0.833
Screens	107.3	17.88
Administration burden	0.468	0.078
Maintenance costs (for both fish and eel passes)	0.076	0.013 (average)
<b>Cost to the Environment Agency</b>		
Administrative – approval of fish passes	3	0.5
Screening	1.35	0.225 (average)
<b>Total</b>	<b>542.6</b>	<b>90.4</b>
<b>Total discounted cost over 18 years (at 3.5%)</b>	<b>498.6</b>	

## Benefits

71. In order to meet the EU biodiversity obligations to achieve Good Ecological Status, as set out under the WFD, the Government considers that this is the most appropriate option; it ensures the free passage of migratory fish species where these are necessary, thus enabling these species to complete their life-cycles and so increase fish stocks.
72. In areas where the installation of fish passes are critical to fish migration, there will be significant benefits to the fish stocks of that migratory species. For example, fish passes at Naburn, Linton and Westwick have all contributed to improved salmon stocks in the River Ouse. There are many rivers, particularly in the North East and North West, where other constraints on fish populations have been removed, but obstructions remain. Where fish cannot easily move about, particularly upstream to colonise, populations are often only maintained by stocking.<sup>53</sup> Without the introduction of fish passes to provide connectivity, fish stocks could fall unless stocking is maintained. It is also the case that many migratory and coarse fish stocks will make slower recoveries, or may not recover at all, if passes are not provided.
73. As a way to value this, some of the investment into the free passage of freshwater fish to reverse the decline in certain fish populations, particularly eels, will benefit both commercial and recreational fishing interests.
74. In areas where fish passes are critical to sustainable fish stocks, there will be added benefits to recreational anglers through a better quality of angling experience, and to commercial fishers through an increase in the abundance of fish stocks.

<sup>53</sup> Stocking is the act of introducing reared (or trans-located) fish to supplement existing stocks to support a fishery or maintain a depleted fish population.

75. The burden on owners or occupiers of relevant sites may be offset where they also have an interest in the surrounding fisheries, which is frequently the case, and the value of those fisheries gains from the better protection to stocks delivered by new fish pass or screening arrangements.
76. Research commissioned jointly by the Environment Agency and Defra into the economic value of inland fisheries<sup>54</sup>, has looked at economic aspects of fish and fishing in freshwaters. Expenditure by freshwater anglers in England and Wales supports about a billion pounds of household income, equating to 37,000 full-time jobs. A separate study assessed the total economic value of salmon. It concluded that, on average, the public would be willing to pay £15.80 per household per year to prevent “a severe decline in salmon populations across [England and Wales], with 95 percent of salmon being lost for at least 25 years”. Aggregated across all households in England and Wales, this amounts to a value of around £350 million per year<sup>55</sup>.
77. Using a conservative first sale value, the total reported salmon catch by nets and traps in 2006 would be worth over £670,000<sup>56</sup>. The gross, first sale value of the sea trout catch is estimated at about £312,000. An estimate of the total value of commercial eel fisheries (glass, yellow and silver eels) is in the order of £1.6m annum; though this varies widely from year to year. Other, commercially valuable net and trap fisheries include for lampreys (estimated at £125,000) and smelt (£100,000).
78. The total capital value of salmon fisheries in England and Wales (i.e. the value if they were sold on the open market) was estimated at £127.6m<sup>57</sup>. In this study, it was estimated that for each additional rod caught salmon, with the five-year annual rod catch, the capital value of a river fishery increases by £8,000 (estimation, £9,000 for 2007 prices).
79. The analysis outlined in the paragraphs above provides an indication of the economic value and, thereby, the importance of fishing in freshwater and indicates the importance of regulation and protection of the natural environment to increase fish stocks. A complete quantification of the benefits of this option is not possible due to the difficulty in valuing conservation measures.

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<sup>54</sup> Economic Evaluation of Inland Fisheries: Welfare benefits of inland fisheries in England and Wales. Lawrence K.S., Spurgeon, J. (2007) <http://publications.environment-agency.gov.uk/pdf/SCHO1207BNNV-e-e.pdf> and Economic Evaluation of Inland Fisheries: The economic impact of freshwater angling in England and Wales. Radford A., Riddington G., Gibson H. (2007) <http://publications.environment-agency.gov.uk/pdf/SCHO1207BNNW-e-e.pdf>

<sup>55</sup> Economic Evaluation of inland fisheries: Welfare benefits of inland fisheries in England and Wales. Lawrence, K.S., Spurgeon, J. (2007) <http://publications.environment-agency.gov.uk/pdf/SCHO1207BNNV-e-e.pdf> and Economic Evaluation of Inland Fisheries: The economic impact of freshwater angling in England and Wales. Radford A., Riddington G., Gibson H. (2007) <http://publications.environment-agency.gov.uk/pdf/SCHO1207BNNW-e-e.pdf>

<sup>56</sup> Operating costs need to be taken into account in assessing the value of net fisheries. In the Northeast these have been estimated at between 10-20% of the value of fish sold whilst in other fisheries higher figures have been quoted.

<sup>57</sup> Economic evaluation of inland fisheries: Module A (W2-039/PR/1) – economic evaluation of fishing rights. Environment Agency, 2001 <http://publications.environment-agency.gov.uk/pdf/SW2-039-PR-1-e-e.pdf>

### OPTION 3: IMPLEMENT MEASURES IN A PRIORITISED, PHASED APPROACH BY 2027

80. Current provisions on the passage of fish in the current Salmon and Freshwater Fisheries Act (1975) are aimed at salmon and migratory trout only, and are limited in their extent. Strengthening the powers for the Environment Agency to require the provision of fish facilities or screens for salmon and migratory trout, as well as extending the requirements to all migratory and freshwater species, would ensure improved access to spawning grounds in all rivers in England and Wales.
81. Under the WFD, a programme of measures will be implemented with the aim of achieving Good Ecological Status or Good Ecological Potential by 2015. The deadline can be extended to 2027 if it is disproportionately expensive or technically infeasible to achieve Good Status by 2015. Under this option, we have presented the costs of meeting Good Status by 2027, implementing the measures in a phased and prioritised approach.

#### *Fish passes*

82. As outlined under option 2, the Environment Agency will prioritise the most critical barriers to fish migration in water bodies, and this is estimated at 140 significant obstructions a year; a total of 2,500 obstructions.
83. In addition to these targeted obstructions, the Agency will also address barriers to the free passage of eel migration. It is estimated that approximately 30 eel passes a year will be required to be installed.

#### *Screens*

84. Again, as outlined under option 2, the Agency estimates that approximately another 5,500 obstructions, which have a significant impact on fish stocks, will require screening.

### Costs

#### *Fish passes*

85. As outlined under in option 2 (paragraph 60), the cost of introducing complex fish passes can amount to £250,000.<sup>58</sup> Based on the assumption of the achievement for an extension to the deadline of meeting Good Ecological Status to 2027, the Agency estimates that up to 140 obstructions per year will need to be removed or made passable. The total cost of this will be approximately £420m over an 18 year period, with an average of £23.3m per annum.
86. In addition to these significant obstructions to be targeted, the Environment Agency estimates that approximately 30 eel passes will be required per year. The total cost of introducing eel passes over the 18 year period is approximately £5.4m, with an average of £300,000 per annum.
87. The administrative costs, linked to the fish passes introduced, remains unchanged from the current baseline costs (please see paragraph 44 and 45). However, due to the increase in the number of fish passes required, it is estimated that a total of £26,050<sup>59</sup> for 170 fish passes, which includes the 30 eel passes required, for each year; this is a total of £469,000 over the 18 year period.

<sup>58</sup> Environment Agency estimate.

<sup>59</sup> Costs includes the administrative burden on 25% of owners that will be required to undergo monitoring and surveillance, to ensure that the fish pass is fit-for-purpose. Please see paragraph 44 and 45.

88. Again, 25% of owners or developers of obstructions who use novel or complex fish passes will be required to undertake monitoring and surveillance assessments.<sup>60</sup>

#### *Maintenance costs*

89. The maintenance cost remains the same as that outlined under option 2 (paragraph 67) as the number of required fish and eel passes remains the same; i.e. in the order of £4,000 per annum (per fish pass) and £200 per annum, a total of £76,000 over 18 years, but there is no evidence to support these figures in this context.

#### *Costs to the Environment Agency*

90. Again, as outlined in option 2 (paragraph 68), the Agency will incur increased costs of overseeing the proper authorisation and then operation of fish passes by owners. This is estimated at £250,000<sup>61</sup> annually, absorbed from project costs.

#### *Screens*

91. The costs of installing screens remains the same as that outlined in option 2 (paragraph 69 and table 2) i.e. a total cost of approximately £107.3m.

92. There will also be additional costs to the Agency to ensure operators meet new screening requirements (paragraph 71). These are estimated at an initial £250,000 annually for 5 years as the phased implementation envisaged takes place, reducing to £100,000 annually thereafter for ongoing enforcement and consenting work.<sup>62</sup> This is estimated as a total cost of £2.6m over the 18 year period, averaging out to an annual cost of £140,000. This again will be absorbed from the current staffing levels, as part of our delivery of WFD requirements.

**Table 4: Total costs to industry and the Environment Agency by 2027**

	<b>Total cost (£m)</b>	<b>Cost per annum until 2027 (£m)</b>
<b>Cost to Industry</b>		
Fish passes	420	23.3
Eel passes	5.4	0.3
Monitoring	5	0.278
Screens	107.3	5.96
Administration burden	0.469	0.026
Maintenance costs (for both fish and eel passes)	0.076	0.004
<b>Cost to the Environment Agency</b>		
Administrative – approval of fish passes	4.5	0.25
Screening	2.6	0.14 (average)
<b>Total</b>	<b>545.35</b>	<b>30.26</b>
<b>Total discounted cost over 18 years (at 3.5%)</b>	<b>413.1</b>	

<sup>60</sup> Please refer to paragraph 66.

<sup>61</sup> An EA estimate, based on 0.25 to 0.5 FTEs per operational area.

<sup>62</sup> An EA estimate, based on 0.25 to 0.5 FTEs (reducing to approx 0.1 FTEs) per operational area.

## Benefits

93. As outlined under option 2 (paragraph 72), benefits of improved passage for migratory and freshwater fish would be realised; this would have significant impact on the stocks of those fish that are particularly hindered by lack of access to habitats, improving their conservation status and potentially allowing for greater realisation from fisheries. It would benefit eels and allow the UK to meet its obligations under the EC Eel Regulation of ensuring the recovery and protection of the European Eel stock and would also improve the status of those stocks that are listed under the Habitats Directive.
94. With regards to the WFD, it would allow the UK to meet its requirements to improve habitat access for fish stocks significantly by 2027, and therefore contribute to the attainment of Good Ecological Status.

## Sanctions / review / enforcement

95. There will be fines for non-compliance for failure to provide a fish pass when so required, but the EA will also have the powers to build a fish pass or insert a screen and recover the costs from the owner/occupier via the courts. Owners/occupiers will be required to insert fish counters in passes to confirm their efficacy. The EA will have the power to require modifications to the fish pass if necessary. Stock assessments are carried out annually; this will enable the EA to evaluate increases in stocks of migratory and freshwater fish.

## Conclusion

96. The free passage of fish has been identified as one of the measures necessary for the UK to meet its obligation under the WFD, of achieving Good Ecological Status or Potential by 2015<sup>63</sup>. The assessment of the status fish fauna will be included in the overall assessment of the status of the water bodies; good fish fauna status can be achieved by providing access for fish enabling them to migrate both up- and downstream.
97. It has not been possible to provide monetised benefits for the conservation of fish stocks, and thereby the benefits to the public and fishers.
98. Over the consultation period, the Government will consider both options 2 and 3 as potentially effective solutions to sustain and help better protect and improve the natural production of fish stocks; facilitating free passage to feeding, breeding and nursery sites. In both options, the Environment Agency will be able to prioritise and address the most critical barriers to fish migration and reduce the overall cost, spreading it either over a 6 or 18 year period. The decision to opt for either option 2 or 3 will depend on whether sufficient evidence can be gathered and grounds made to request for an extension of the deadline to meet Good Ecological Status or Good Ecological Potential from 2015 to 2027. This further evidence will be gathered during the consultation process.

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<sup>63</sup> Overall Impact Assessment for the Water Framework Directive (2000/60/EC), adopted by the EU Council and Parliament on 22 December 2000; available at <http://www.defra.gov.uk/corporate/consult/river-basin/IA-river-basin-v2.pdf>.

## Specific Impact Tests: Checklist

Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

**Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.**

Type of testing undertaken	<i>Results in Evidence Base?</i>	<i>Results annexed?</i>
Competition Assessment	No	Yes
Small Firms Impact Test	No	Yes
Legal Aid	No	Yes
Sustainable Development	No	Yes
Carbon Assessment	No	Yes
Other Environment	No	Yes
Health Impact Assessment	No	Yes
Race Equality	No	Yes
Disability Equality	No	Yes
Gender Equality	No	Yes
Human Rights	No	Yes
Rural Proofing	No	Yes

## Annexes

### **Annex I: Outcome of Impact Tests not referred to in the Evidence Base**

#### Small Firms Impact Test

These provisions could potentially affect small/medium sized property development companies. These include: owners or occupiers of converted mills and other riparian buildings with attached structures; developers/renovators of such obstructions and of low head hydropower schemes on weirs and barrages; farms that own structures to manage drainage or maintain water levels to support abstraction; fish farms that either maintain levels for fish productions or to support an abstraction; small industries who own/operate structures to maintain abstractions; other land holdings, e.g. estates where water is diverted for ornamental purposes; and fisheries.

Screening requirements will affect any firm abstracting water/discharging effluent, including: small scale industries; farmer or irrigators; fish farmers; and fisheries. It should be noted that if the majority of abstractions below 20m<sup>3</sup> are exempted, this would include many of the industries cited above.

These provisions are likely to have a positive impact on environmental consultant businesses, who advise on fish pass and screening schemes, and developers of such schemes.

Further information will be gathered for the small firms impact test prior to producing the final IA.

#### Competition Assessment

The majority of firms affected by this set of provisions are likely to be public organisations or state-regulated monopolistic utility companies which by definition do not operate in open markets. Companies who do operate in an open market and who may be affected by the provisions, such as property developers, will all be affected in a similar way and there will therefore be no effects on competition.

#### Legal Aid

The proposal does not create any new criminal sanctions or civil penalties aside from those referenced in the evidence base where relevant.

#### Sustainable Development

The proposal complies with sustainable development principles in that the primary aim of legislative changes are in order to allow the Environment Agency to effectively conserve the fish stocks for future benefit and control exploitation at sustainable levels.

#### Carbon Assessment

The proposal will have no significant effect on carbon emissions. Levels of fishing activity and associated services are likely to remain the same.

#### Other Environment

The proposals are designed to allow flexibility towards future challenges that face sustainable fisheries in the future. In that respect, they will allow for a greater capacity

for adaptation to the effect of climate change and associated freshwater temperature rises. Implicit in the proposals are measures to maintain and where necessary improve fish stocks, thereby preserving and enhancing the biodiversity in England and Wales.

#### Health Impact Assessment

The proposal will have no significant impact on health, well-being or health inequalities. Studies have shown that fishing has a social benefit contributing to societies overall well-being; in the respect the proposals will have a positive impact as the measures proposed are designed to enhance benefit over the long term.

#### Race/ Disability/Gender Equality

None of the proposals discriminate against either race, disability or gender. The proposals do not impose any restriction or involve any requirement which a person of a particular racial background, disability or gender would find difficult to comply with. Conditions apply equally to all individuals and businesses involved in the activities covered by the proposal.

#### Human Rights

The proposal is consistent with the Human Rights Act 1998.

#### Rural Proofing

The majority of financial benefits that arise from angling and fishing contribute to local communities. As such, the proposals are designed to enhance these benefits and the value of the fisheries to local communities over the long term.

## Annex 2: Background

### Current levels of stocks

99. There are 37 species of freshwater and diadromous fish generally regarded as native to Great Britain and at least 17 introduced species. These latter are mainly restricted to specific waters where they have been stocked and their wider spread would be undesirable and potentially damaging. A number of the native species are in a seriously depleted condition within inland waters in England and Wales. The decline is most dramatic for species, such as salmon and eels, which spend part of their lives in freshwater and part in the sea. Whitefish (coregonids) and char that are already restricted in their distribution have also declined. The status of other migratory species such as shad, lampreys and smelt is not well known although their distribution is thought to be significantly reduced from historic patterns. Protection of freshwater and migratory stocks already involves significant management intervention through such actions as fishery restrictions, habitat improvement and stocking, but there is a serious risk that populations could continue to decline to very low biological levels from which they may not be able to recover to a sustainable level.

100. Atlantic salmon spawn in most rivers in England and Wales apart from most of those entering the sea along the east and south coasts between the Humber and the Solent. Conservation limits are set for 67 principal river stocks. The conservation limit for salmon is the level assessed as ensuring the biological sustainability of the stock whilst allowing for appropriate exploitation. The health of salmon stocks varies and on some rivers is giving serious cause for concern. Whilst some rivers are reaching satisfactory levels and an analysis of trends suggest some improvement by 2008, the majority are in a depleted state.

101. In 2005 the North Atlantic Salmon Conservation Organisation (NASCO), responding to advice from the International Council for the Exploration of the Seas (ICES), sounded the alarm for salmon stocks across the North East Atlantic, including those returning to UK rivers<sup>64</sup>. The current estimate of the total number of adult salmon returning to all of the rivers in England and Wales on their spawning migration is only about 100,000. NASCO believes salmon stocks have declined to levels that make individual river stocks and the overall population vulnerable and want to see reductions in exploitation for as many stocks as possible. Their scientific advisers ICES argue that fisheries should only be allowed where salmon stocks are at safe levels, expressing particular concern about the reduced survival of salmon during the marine phase of their life-cycle. However, many of the human activities impinging directly upon salmon occur in freshwater, and it is essential that powers are available to control these activities if stocks are to be protected.

102. Despite the poor state of many stocks, salmon distribution has been increasing in recent years. Salmon are returning to rivers recovering from pollution and neglect. For example, salmon are now breeding for first time in decades in the Mersey and rivers draining into the Humber estuary. The recovery of stocks in these large river systems will lead to demands for their effective protection.

103. Trout are widely distributed in England and Wales, occurring in most rivers, except for some on the east coast, and many still waters. However, management of trout is complicated by the presence of two forms, the 'brown trout' which remains resident

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<sup>64</sup> NASCO: Report of the twenty-second annual meetings of the Commission, 2005. Available at <http://www.nasco.int/pdf/2005%20Commission%20Report.pdf>.

in freshwater through its life and the 'sea trout' which undertakes marine migrations similar to the salmon. The rainbow trout is an introduced species that is sustained almost entirely by stocking, mainly into lakes and reservoirs.

104. Sea trout are exploited by both net and rod fisheries, and are frequently managed in conjunction with salmon. They are present in 26% of all rivers in England and Wales. A method for setting similar measures (conservation limits) for sea trout as for salmon has not yet been developed and the status of these stocks is assessed using estimates of the numbers of juvenile fish in the river, derived from river surveys, and information on catches. Most stocks showed an increase in rod catches over the last 30 years although catches in some areas have declined in the last five years. This suggests that stocks of sea trout have, until recently at least, been in a relatively good condition, although contributors to the First International Sea Trout Symposium (July 2004) recommended measures to more effectively control exploitation and conserve their environment. Measures controlling exploitation often address both salmon and sea trout and it is important that regulations do not expose enforcement loop-holes.

105. The health of Brown trout stocks depends on a high quality environment. Similar environmental pressures bear upon trout as on salmon (see above) and in some rivers stocks are threatened. Brown trout are only caught by rod, and many trout fisheries are supported by the introduction of hatchery-reared fish. Localised stocks also exist that represent self-sustaining 'wild' strains that are of significant conservation value.

106. Grayling is a member of the salmon family that remains in fresh-water throughout its life cycle. Similar environmental pressures bear upon grayling as upon trout and salmon (see above) and, in some rivers where the environment is not of high quality, stocks are threatened. Grayling are only caught by rod and, whilst there has been some stocking, most grayling fisheries are supported by self-sustaining stocks that are of significant conservation value.

107. The European eel is one of the most widespread fish species in European waters, and it is thought to comprise a single reproductive stock. Eel recruitment in Europe as a whole reached a historical minimum in 2001 of 1-2% of the pre-1980 level and has not improved since then<sup>65</sup>. Owing to the uncertainty concerning the eel lifecycle it is not known what brought about this decline. However, factors including poor water quality, loss of habitat, obstructions to both upwards and downwards migration, parasitic diseases, overexploitation and poor marine survival are all thought to play a part. These factors cannot be addressed under the present legislative framework and will therefore continue to contribute to the decline of eel stocks. Eels are exploited commercially by net fishing, both as adults and as juveniles (elvers).

108. The other migratory species include two species of shad, the two anadromous species of lamprey and the smelt. The distribution and status of lamprey and smelt stocks is not well documented. The twaite and allis shad occur in coastal waters, but only the twaite shad is known to breed regularly in British rivers and then only at a few locations. Estuarial pollution and man-made barriers in the lower reaches of rivers are thought to have been responsible for the loss of these fish from many areas. The river lamprey and the sea lamprey are fairly widespread in England and Wales but are under threat from pollution, river engineering affecting habitat quality and impassable barriers. In other parts of Europe, lampreys are caught

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<sup>65</sup> Latest ICES advice, May 2005. Available at <http://www.ices.dk/committe/acom/comwork/report/2005/may/wgeel.pdf>

commercially, and the juveniles that live in silt on river beds may be caught for use as angling bait. The full distribution of the smelt in England and Wales is also poorly documented, but it is thought to have been lost from about 25% of estuaries and rivers from which it had been recorded historically, with losses probably being due to poor water quality.

109. There are 27 species of coarse fish native or naturalised to England and Wales. Most of these are relatively widespread although their abundance can fluctuate significantly between years and will be affected by local factors. Coarse fish inhabit a wide range of waters, although they are absent from steeper salmonid-dominated upper reaches of rivers in Wales and in the south west and north of England. River surveys have shown that coarse fish populations are improving in many rivers, although some stakeholders' experience is to the contrary. In a recent survey<sup>66</sup>, fish were present at over 98 per cent of sites, and 50 per cent of sites contained eight or more species. There is evidence of improved catches over the past two decades. The chemical quality of freshwater is a key determinant of fish stocks and the changing environment resulting from reduced and cleaner discharges is leading to changes in fish populations and changes in the angling experience for those fishing these waters. A number of species, including minnow, roach, bream, barbel, chub and dace, undergo seasonal migrations within the river, and can therefore be adversely affected by river obstructions.
110. Four species of fish currently occurring in freshwater are classed as rare in England and Wales. Three of these, the vendace, schelly and Arctic char, are generally anadromous where they occur elsewhere in Northern Europe but exist only as isolated landlocked populations in northern and upland still-waters in England and Wales. Some of these populations are in a tenuous state.
111. The decline of the vendace in Bassenthwaite Lake in Cumbria in the past 40 years, and particularly in the past 20 years, shows the pressures to which such fish are subjected, including increased nutrient levels from various discharges, siltation due to agricultural practices, competition for habitat from native species as well as from uncontrolled introductions of non-indigenous fish and climate change. The final rare species, the spined loach, has a very restricted distribution, primarily in central England and often in gravel-pit habitats.
112. Native fresh-water crayfish have been lost to many previously well-populated rivers and streams. Primarily this is owing to competition and disease arising from illegally introduced and escaped non-native crayfish (principally signal crayfish). Habitat destruction and pollution have also played a part in the decline of native crayfish. In contrast, the spread of non-native crayfish has encouraged, and may in turn be encouraged by, the establishment of fisheries for them.

### **Impacts on Fish Stocks – environmental**

113. Both the diadromous species, which migrate between freshwater and the sea, and potadromous species that migrate within rivers, can be severely affected by obstructions which limit their movements. This may prevent fish finding suitable habitat at particular stages in their lives and thus limit the optimal utilisation of freshwater habitats.

<sup>66</sup> Environment Agency (2004) Our Nations' Fisheries. The migratory and freshwater fisheries of England and Wales – a snapshot. Available at [http://www.environment-agency.gov.uk/commondata/acrobat/fisheries\\_eng\\_765655.pdf](http://www.environment-agency.gov.uk/commondata/acrobat/fisheries_eng_765655.pdf).

114. It should also be noted that loss of fish can radically change the ecology of a water body. Fish contribute across the full ecological range, providing food for predatory species while at the same time feeding on, and thus controlling, other species such as aquatic insects and plants. Permitting the further decline of fish species could therefore have a serious impact on the freshwater ecosystems and those reliant on them, and contribute to water bodies failing to meet Good Ecological Status or Good Ecological Potential.