Summary: Intervention & Options

Department /Agency:	Title:	
Defra	**Impact Assessment of modernising the aquatic animal health regime**	
Stage: Implementation stage	**Version:** 2	**Date:** August 2008
Related Publications: Directive 2006/88/EC		

Available to view or download at:

http://www. defra.gov.uk/corporate/consult/aquatic-ah/

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

In the absence of government intervention, individual producers in the aquaculture industry are likely to under-allocate resources to preventing/controlling disease, as they have no incentive to consider the impact of disease spread to other farmed fish populations or to the wild environment.

This assessment relates to transposition of an updated European aquatic animal health regime into national law in England and Wales (Directive 2006/88/EC available at: http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_328/l_32820061124en00140056.pdf)

What are the policy objectives and the intended effects?

The aim of the new Directive is to act as a framework, within which, standards in aquaculture can be raised across the Community.

Specifically, this means tighter supervision of aquaculture producers and a flexible approach to disease surveillance and control.

Implementation is intended to reduce the risk of a serious outbreak of disease, while minimising the burden of the new regime.

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

There is an existing policy regime for aquatic health that applies to fish and mollusc farms. The new regime has a wider scope that includes recreational fisheries, ornamental and wild fish.

Due to the framework nature of the new regime, there are different levels of intervention for different elements. Different options, for surveillance and processors are examined in the relevant analysis and evidence pages.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects?

The official control element of enforcement will be reviewed annually under Regulation 882/2004.

Ministerial Sign-off For SELECT 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: Final	Description:

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups'
One-off (Transition)	**Yrs**	Cost of admin burden to industry - £872k (pg. 17)
£125k	10	Cost of compliance with directive to industry - £977k (pg. 17)
Average Annual Cost (excluding one-off)		Cost to processing plants for compliance with authorisation requirements: £148k (pg. 19)
£231k	10	**Total Cost** (PV) **£2m**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups'
One-off	**Yrs**	(i) Benefit to aquaculture industry from reduction in fish disease outbreaks - £2.81m (pg. 14)
£0	10	(ii) Benefit to govt from reduced costs of dealing with fish disease outbreaks - £2.15m (pg. 14)
		(iii) Benefit to recreational anglers from avoided loss of angling days - £63k (pg. 14) (pg. 14)
Average Annual Benefit (excluding one-off)		(iv) Benefit of processing plant authorisation. Govt :£105k Industry: £51k (pg. 20)
£518k	10	**Total Benefit** (PV) **£5.02 m**

Other **key non-monetised benefits** by 'main affected groups'

Benefits to aquaculture industry and to govt from reduced scale of shellfish outbreaks.

Key Assumptions/Sensitivities/Risks

(i) Trout and carp the only species considered, and only main disease risks to these species considered.

(ii) Assumed that the majority (87%) of recreational anglers at an affected fishery can switch to other fisheries.

(iii) Negligible risk of transmission to wild fish populations.

Price Base Year 2008	Time Period Years 10	**Net Benefit Range** (NPV) **£ -1.39m to 21.88m**	**NET BENEFIT** (NPV Best estimate) **£ 3.02m**

What is the geographic coverage of the policy/option?				England	
On what date will the policy be implemented?					
Which organisation(s) will enforce the policy?				FHI	
What is the total annual cost of enforcement for these organisations?				£Nil	
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?				£Nil	
What is the value of changes in greenhouse gas emissions?				£Nil	
Will the proposal have a significant impact on competition?				No	
Annual cost (£-£) per organisation (excluding one-off)	Micro **N/A**	Small **£482**	Medium **£1446**	Large **£2892**	
Are any of these organisations exempt?	No	No	N/A	N/A	

Impact on Admin Burdens Baseline (2005 Prices) (Increase - Decrease)

Increase of £ £98.5k Decrease of £ Nil **Net Impact** £ + £98.5k

Key: **Annual costs and benefits: Constant Prices** **(Net) Present Value**

[Use this space (with a recommended maximum of 30 pages) to set out the evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Ensure that the information is organised in such a way as to explain clearly the summary information on the preceding pages of this form.]

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BENEFITS OF THE AQUATIC ANIMAL HEALTH DIRECTIVE

1. Impact of the Directive

The minimum implementation of the Directive requires authorisation of aquaculture production businesses, including fish, shellfish and crustacean farms, depuration centres that purify shellfish prior to human consumption, and cropping agents that supply fish to commercial fisheries. Authorisation requires record-keeping, use of certain biosecurity measures, and participation in disease surveillance. Stocked fisheries are required to be registered.

The measures set out above are not expected to reduce the risk of introduction of a fish or shellfish disease. However, they can be expected to reduce the scale of outbreaks, as the authorisation of fish farms, traders and dealers and the registration of stocked fisheries will enable quicker backward and forward tracing. This means that effective movement controls can be quickly imposed, so that the spread of disease is limited to fewer farms.

Therefore, the potential benefits of the Directive were estimated in terms of the avoided costs of larger fish disease outbreaks, that would occur if the Directive was not implemented.

2. Scope

In order to quantify the potential benefits, it was decided to limit the scope of the analysis to the main finfish species in England and Wales, and the main disease threats affecting them. Although the shellfish industry is of commercial importance in England and Wales (with oysters and mussels being the most important species), shellfish were excluded as scientific opinion was that the potential impact of the Directive on the introduction and scale of shellfish disease outbreaks is somewhat speculative and would be very difficult to quantify. Crustacean diseases were also ignored as crustacean farming is very small scale in England and Wales, with only a few farms engaged in it.

The finfish sector is subdivided into fish farmed exclusively for human consumption and fish produced for use in recreational fisheries. The main species farmed for human consumption in England and Wales is trout (rainbow trout and brown trout). By far the main species produced for use in recreational fisheries is carp. While common carp is produced for recreational fisheries, ornamental/koi carp is produced for use in ornamental ponds.

3. Disease risks

3.1 Trout diseases

The main disease risks to trout in England and Wales at the present time have been identified as viral haemorrhagic septicaemia (VHS), infectious haemotopoietic necrosis (IHN) and epizootic haematopoietic necrosis (EHN). VHS and IHN are non-exotic diseases, i.e. already present in Europe, while EHN is an exotic disease. VHS was first detected in freshwater in England and Wales in 2006. Only one farm was affected in that outbreak. The most likely route of introduction was probably the importation of rainbow trout carcasses from Europe by a fish processor upstream of the farm. So far, there has been no outbreak

of IHN in England and Wales, but it remains a significant disease risk. These diseases primarily affect farmed fish; there is no significant risk of transmission to wild fish.

3.2 Carp diseases

The main disease risks affecting carp are spring viraemia of carp (SVC) and koi herpes virus (KHV). SVC was first detected in England and Wales in 1977 and since then sporadic outbreaks have occurred in most years. Because SVC does not tend to recur at the same site in consecutive years, it is thought that it is not endemic to carp in the UK. The disease has not been reported in wild riverine carp populations. It is mainly confined to carp in managed fisheries, although in some instances farms, wholesale dealers, coarse fish dealers and retailers have also been affected.

The first case of KHV in the UK occurred in 2003, and it was made a notifiable disease in 2007. Outbreaks have tended to occur every year, mostly in fisheries and garden ponds. The virus has also been detected in consignments of imported carp. No outbreaks have been recorded in farmed carp populations or wild riverine carp.

3.3 Other disease risks

One disease that is of great potential significance but is not being considered here is Gyrodactylus salaries (Gs). Although this disease does not affect trout per se, it is carried by rainbow trout and has the potential to decimate wild salmon populations if transmitted to the wild, not least because of the lack of environmentally acceptable methods of controlling the disease in the natural environment. Gs is not considered in this analysis as it is not listed under the proposed Directive (it is currently covered by other EC regulation). Moreover, it is not likely that the measures proposed under the minimum implementation of the Directive will impact the risk of spread of Gs if it were to be introduced in England and Wales. This is because Gs does not result in any clinical signs in rainbow trout, hence better on-farm detection would be difficult. Although the registration of fisheries may improve the efficiency of contact tracing in the event of an outbreak, it was concluded that, overall, the proposed policy would have little impact on the control of Gs in England and Wales.

4. Impact of the Directive on trout disease outbreaks

4.1 Baseline probability of occurrence

As stated above, the Directive is not expected to lead to a reduction in the risk of introduction of fish disease outbreaks. The main route for the introduction of notifiable diseases is the movement of live fish. Other routes include importation and processing of fish and fish products. Some notifiable diseases such as VHS and infectious salmon anaemia have reservoirs in wild marine populations. Transmission of these pathogens through wild fish migrations or other routes is possible.

It is very difficult to estimate the probability of occurrence of a fish disease outbreak. Disease outbreaks are stochastic in nature, that is to say they are random events largely influenced by chance. Thus they are not deterministic and cannot be predicted by existing circumstances.

Clearly this means that forecasting the frequency of future disease outbreaks is extremely problematic. However, for the purposes of this analysis, it was assumed that a frequency of one outbreak every ten years for a major salmonid disease affecting trout (i.e. VHS, IHN or EHN) is reasonable. Unless stated otherwise the probability is constant across the scenarios. Therefore, one trout disease outbreak could be expected to occur over the ten-year time horizon considered in this analysis.

4.2 Baseline cost of trout disease outbreaks

Disease outbreak scenarios for a salmonid disease affecting trout were developed by Cefas, and the costs of each outbreak estimated. Four outbreak scenarios were developed based on both known information such as average number of farms in a catchment and assumptions such as the likely size of outbreaks.

Total outbreak costs included costs to industry as well as to government. Costs to industry result from destocking and disinfection of infected farms, and movement restrictions imposed on farms suspected of being infected (or located in the same catchment as infected farms). The total cost to industry was calculated by multiplying the cost per farm by the total number of affected farms. Costs to government consisted of the costs of testing and surveillance, and were based on the 2006 VHS outbreak. It was assumed that there was a fixed cost irrespective of the size of the outbreak, and additional costs for each catchment affected.

The four outbreaks are described and the estimated costs summarised below.

Table 1. Scenario 1 – Isolated outbreak

One infected farm only. The disease is detected at the original farm and has not spread to any other sites. A number of forward and backward contacts (those farms supplying or being supplied by the infected farm) are initially placed under controls on suspicion but released when they prove negative for the disease. The infected site is destocked, disinfected and left fallow for an appropriate period. There is another farm on the same river catchment as the infected farm.

Situation	Number	Consequence/ activity	Cost
Infected farms	**1**	**Farm destocked and disinfected. Controls in place for 8 months**	**£168,500**
Farms under suspicion	**4**	**Movement controls for one month, while tests carried out**	**£0**[1]
Uninfected farms in same catchment	**1**	**Movement controls for 8 months**	**£0**[2]
Government costs		**Testing and surveillance**	**£800,000**
		Total	**£968,500**

[1] Costs to farms, caused by movement restrictions while under suspicion, depend very much on the business model of the farm and the time of the movement restrictions. Suspension of trade in live fish for 30 days in spring or summer will have severe impact on restocking farms.

[2] Farms producing for human consumption should be relatively unaffected by long term movement controls. Later scenarios predict that more restocking farms will be affected by long term restrictions.

Table 2. Scenario 2 – Contained outbreak

Two infected farms, but in the same catchment (local spread only). The disease has spread to other farms within the same catchment, but not to forward and backward contacts. Despite only one additional infected farm, the numbers of contacts increases significantly.

Situation	Number	Consequence/ activity	Cost
Infected farms	**2**	**Farm destocked and disinfected. Controls in place for 8 months**	**£432,000**
Farms under suspicion	**18**	**Movement controls for one month, while tests carried out**	**£0**
Uninfected farms in same catchment	**1**	**Movement controls for 8 months**	**£0**
Government costs		**Testing and surveillance**	**£800,000**
		Total	**£1,232,000**

Table 3. Scenario 3 – Limited outbreak

9 infected farms in 9 catchments. The disease has spread to other farms on the same catchment and farms on different rivers through the trade in live fish. Nine farms become infected. Farms under suspicion and those placed under long-term controls again increases significantly, as does Government costs, due to controls having to be placed on a number of river catchments.

Situation	Number	Consequence/ activity	Cost
Infected farms	**9**	**Farm destocked and disinfected. Controls in place for 8 months**	**£1,896,500**
Farms under suspicion	**11**	**Movement controls for one month, while tests carried out**	**£0**
Uninfected farms in same catchment	**16**	**Movement controls for 8 months**	**£699,000**
Government costs		**Testing and surveillance**	**£3,200,000**
		Total	**£5,795,500**

Table 4. Scenario 4 – National outbreak

63 infected farms in 35 catchments. The disease has been spread nationwide before detection and controls, preventing further spread, are put in place. The spread has been caused largely by the trade in live fish prior to detection.

Situation	Number	Consequence/ activity	Cost
Infected farms	**63**	**Farm destocked and disinfected. Controls in place for 8 months**	**£12,990,500**
Farms under suspicion	**23**	**Movement controls for one month, while tests carried out**	**£0**
Uninfected farms in same catchment	**69**	**Movement controls for 8 months**	**£3,262,000**
Government costs		**Testing and surveillance**	**£11,000,000**
		Total	**£27,252,500**

4.3 Benefit estimation

The implementation of the Directive can be expected to reduce the scale of any tour disease outbreak that does occur. Table 5 shows the potential benefit associated with reducing the scale of different types of outbreaks that might occur under baseline conditions.

Table 5. Potential undiscounted benefit of reducing scale of trout disease outbreak (£)

Estimate	Baseline scenario	Cost of baseline scenario (1)	Alternative scenario	Cost of alternative scenario (2)	Potential benefit (1-2)
Low	**Contained outbreak**	**1,232,000**	**Isolated outbreak**	**968,500**	**263,500**
Medium	**Limited outbreak**	**5,795,500**	**Contained outbreak**	**1,232,000**	**4,563,500**
High	**National outbreak**	**27,252,500**	**Limited outbreak**	**5,795,500**	**21,457,000**

The benefits estimates in table 5 are undiscounted. For discounting purposes, it was assumed that the outbreak would occur at the mid-point of the ten year time horizon, i.e. in five years' time. A discount rate of 3.5 % was used.

5. Impact of the Directive on carp disease outbreaks – SVC

5.1 Baseline probability of occurrence

The years in which SCV outbreaks have occurred in England and Wales, and the number of fisheries affected in each year, are shown in table 6. SVC outbreaks have occurred in 14 out of the 22 years since 1986.

For the purposes of this analysis, it was important to predict the frequency of *large* SVC outbreaks. Table 6 shows that large outbreaks (>10 affected fisheries) occurred in two years since 1986, i.e. in 1988 and 1995. It was therefore estimated that large SVC outbreaks may occur approximately once every 10-15 years. Taking a conservative approach, it was therefore assumed that, under baseline conditions, a large SVC outbreak will occur once in 15 years. This implies that the baseline probability of a large SVC outbreak occurring in the next 10 years (the time horizon) is 67%.

Table 6. Number of fisheries affected by SVC and KHV outbreaks in England and Wales

Year	SVC	KHV
1986	1	
1987	0	
1988	23	
1989	2	
1990	0	
1991	2	
1992	0	
1993	0	
1994	6	
1995	12	
1996	4	
1997	5	
1998	0	
1999	1	
2000	0	
2001	0	
2002	3	
2003	2	6
2004	2	4
2005	1	6
2006	0	23
2007	1	10

5.2 Baseline cost of SVC disease outbreaks

5.2.1 Number of affected fisheries

Registration of fisheries and the authorisation of cropping waters will improve Cefas' capacity to track the origin of carp disease outbreaks such as SVC and KHV and the speed of detection of new infected waters. Therefore, it is expected that the regulations may reduce the size of large outbreaks.

Table 6 shows that 23 fisheries were affected in the 1988 SVC outbreak and 12 fisheries were affected in the 1995 outbreak, yielding an average of about 18 affected fisheries. It was therefore assumed that, under baseline conditions, 18 fisheries would be affected in a large SVC outbreak.

Because costs vary depending on whether the affected fishery is a match or a specimen fishery, it was necessary to estimate the numbers of each that would be affected in a disease outbreak. It is known that there are about ten match fisheries to one specimen fishery in England and Wales. Using this ratio, it was estimated that, under baseline conditions, 16 match fisheries and 2 specimen fisheries would be affected (total 18).

5.2.2 Cost to affected fisheries

The cost of a carp disease outbreak to an affected fishery varies according to whether the fishery is a match or a specimen fishery. Match fisheries are generally heavily stocked with smaller fish (<3 kg), and anglers fish in close proximity to one another. Specimen fisheries are less heavily stocked with larger, and therefore more valuable, fish. Considerably fewer day licenses are sold, at higher cost, compared with a match fishery of a similar size.

The main costs to a fishery from a carp disease outbreak are (i) the loss of fish, and (ii) decreased revenue from loss of day ticket sales. In the event of a SVC outbreak, no restocking of any fish is allowed for a period of 12 months. The impact on ticket sales can be significant. Specimen carp waters may be hardest hit since their clients are not interested in fishing for other species, and because large carp may not be easily available once the 12 month moratorium on restocking ends.

The cost of a 'typical' SVC outbreak to an affected fishery was calculated using the following parameters:

1. number of fish by weight category
2. mortality by weight category
3. value of the fish by weight category (based on available price lists)
4. cost of a day ticket
5. decrease in ticket sales by week following an outbreak

and using a range of values for each parameter. Results are shown in table 7.

Table 7. Financial cost of a SVC outbreak on a carp fishery (£)

Fishery type		Low	Most likely	High
Match	Lost stock	1,312	21,750	117,000
	Lost ticket sales	1,440	25,785	156,000
	Total	2,752	47,535	273,000
Specimen	Lost stock	4,910	129,375	558,500
	Lost ticket sales	9,263	39,450	156,000
	Total	14,173	168,825	714,500

It must be noted that, although the loss of revenue from ticket sales is a cost for an affected fishery, to the extent that anglers can switch to alternative fisheries, there would simply be a transfer of revenue from affected to unaffected fisheries. Therefore the loss to the aquaculture industry as a whole would be lower than the loss to the particular fisheries affected by disease. This was taken into account in the estimation of disease costs by assuming that only 13% of the reduction in day tickets represented the actual loss to the industry (see section 5.2.4 for an explanation of the 13% estimate).

5.2.3 Cost to government

The cost to government of dealing with a SCV outbreak was estimated to be about £4,200 per affected fishery, and comprised the costs of staff time for investigation, travel and subsistence, and diagnostic testing.

5.2.4 Cost to recreational anglers

Angling is a popular form of recreation in England and Wales, and coarse angling (in which carp is the dominant species) is particularly important. Radford et al (2007) have estimated that coarse angling accounted for 83% of the total angling expenditure in England and Wales in 2005. 26.4 m angler days were spent on coarse angling in 2005, with an associated expenditure of £689.4 m, i.e. expenditure of about £26 per angler day. The importance of carp as a coarse angling species implies that the economic impact of a carp disease outbreak on recreational anglers must be considered in the estimation of costs and benefits. In the event of a SVC outbreak, no restocking of any fish is allowed for a period of 12 months.

The economic benefit associated with recreational angling can be measured using the concept of consumer surplus, which is the excess of what the angler is willing to pay for the angling experience, over and above the amount that he actually pays. Since, in practice, all that is observed is the amount that anglers actually pay for the experience (for instance through the purchase of fishing tickets), economists use special valuation techniques in order to estimate the consumer surplus. These valuation techniques usually take one of two forms: (i) the travel cost approach, in which the travel and time costs of individuals are used to infer their willingness to pay for the angling experience, and (ii) the contingent valuation approach, which is a direct questioning technique intended to elicit estimates of the willingness to pay for the experience.

Various consumer surplus estimates for coarse angling obtained using these techniques have been reported in Turner and Postle (1994) and Pretty et al (2002). These are summarised in table 8.

Table 8. Consumer surplus estimates for coarse angling in the UK

Estimate (£)	Price year	Estimate in 2008 prices (£)	Authors
4.65	1994	6.4	Stabler and Ash (1977, 1978) *[reported in Turner and Postle]*
5-8.8	1994	6.9-12.2	Middlesex University (1994) *[reported in Turner and Postle]*
4.5-8	1999	5.6-10	Stabler and Ash (1997), Willis and Garrod (1990), NRA (1995) *[reported in Pretty et al]*

The average of the estimates presented in the table is £7.9. This was used to value the impact of a carp disease outbreak on recreational angling.

In order to estimate the total loss of value to recreational anglers as a result of a disease outbreak, it is also necessary to estimate the number of angling days that would be lost as a result of the outbreak. This is difficult as it would depend, among other factors, on the location of the affected fishery and availability of substitute fisheries in the area. On this issue, a national angler survey conducted by Spurgeon et al (2001) found that 87% of coarse anglers perceived that there are at least a few substitutes within the same distance as their regular fishing site. It was therefore assumed in the analysis that only 13% of the reduction in day ticket sales represented an actual loss of angling days, as the remaining anglers would simply switch to substitute sites. Note that this is a conservative assumption; a higher proportion of anglers would be affected if the disease outbreak affected several fisheries in the same geographical area.

5.3 Benefit estimation

Scientific opinion is that the Directive may reduce the size of a large SVC outbreak by 30-60%. This means that the size of a future large outbreak will be reduced from 18 affected fisheries to between 7-12 affected fisheries. It is assumed that 6 match fisheries and 1 specimen fishery (total 7) would be affected in the high impact scenario, while 11 match fisheries and 1 specimen fishery (total 12) would be affected in the low impact scenario.

The potential benefit of the Directive therefore consists of the avoided cost of a larger disease outbreak, multiplied by the probability that a disease outbreak occurs within the ten year time period (67%). Estimates of the potential benefit are shown in table 9.

Table 9. Potential undiscounted benefit of reducing scale of SVC outbreaks (£)

Estimate	Low	Most likely	High
30% reduction in scale of outbreak			
Benefit to fisheries	**9,000**	**174,000**	**848,000**
Benefit to government	**17,000**	**17,000**	**17,000**
Benefit to recreational anglers	**4,000**	**26,000**	**86,000**
Total benefit	**30,000**	**217,000**	**951,000**
60% reduction in scale of outbreak			
Benefit to fisheries	**14,000**	**258,000**	**1,308,000**
Benefit to government	**31,000**	**31,000**	**31,000**
Benefit to recreational anglers	**7,000**	**48,000**	**157,000**
Total benefit	**52,000**	**337,000**	**1,496,000**

These benefits are undiscounted. In order to obtain the present value, it was assumed that the SVC outbreak would occur at the mid-point of the time period, i.e. in five years' time.

6. Impact of the Directive on carp disease outbreaks – KHV

6.1 Baseline probability of occurrence

KHV has only been observed in the UK since 2003. Table 6 shows that since 2003, there have been outbreaks every year, with large outbreaks (>10 affected fisheries) occurring in 2006 and 2007. Thus one large KHV outbreak every 2-5 years could be predicted. Taking a conservative approach, it was assumed that, under baseline conditions, a large KHV outbreak will occur once every five years. This implies that two large KHV outbreaks could be expected to occur over the 10-year time horizon.

6.2 Baseline cost of SVC disease outbreaks

6.2.1 Number of affected fisheries

23 fisheries were affected in the 2006 outbreak and 10 fisheries were affected in the 2007 outbreak, yielding an average of about 17 fisheries. It was therefore assumed that, under baseline conditions, 17 fisheries would be affected in a large KHV outbreak. As in the case of SVC, affected fisheries were designated as match or specimen fisheries using the 10:1 ratio. It was therefore estimated that, under baseline conditions, 15 match fisheries and 2 specimen fisheries would be affected (total 17).

6.2.2 Cost to affected fisheries

Following a similar approach as in the case of SVC, the cost of a 'typical' KHV outbreak on an affected fishery was calculated and is shown in table 10.

Table 10. Financial cost of a KHV outbreak on a carp fishery (£)

Fishery type		Low	Most likely	High
Match	Lost stock	3,280	32,625	130,000
	Lost ticket sales	1,440	6,615	28,350
	Total	4,720	39,240	158,350
Specimen	Lost stock	9,820	207,000	837,750
	Lost ticket sales	9,263	25,050	85,800
	Total	19,083	232,050	923,550

6.2.3 Cost to government

The cost to government of dealing with a KHV outbreak was estimated to be about £2,950 per affected fishery.

6.2.4 Cost to recreational anglers

In the event of a KHV outbreak, no carp may be restocked into the affected fishery for a period of 12 months, but other species may be introduced. Therefore, match fisheries affected by KHV can switch to keeping other fish such as silver fish, and are therefore very little affected by the outbreak. The impact on specimen fisheries is greater as their clients are usually not interested in fishing for other species, and once the 12 month moratorium on restocking ends, large carp may not be easily available.

The loss of recreational angling days was calculated using a similar approach as in the case of SVC.

6.3 Benefit estimation

Assuming that the Directive would reduce the size of a KHV outbreak by 30-60%, the size of the outbreak would be reduced from 17 affected fisheries to 7-12 affected fisheries. It was assumed that 6 match fisheries and 1 specimen fishery (total 7) would be affected in the low-impact scenario, while 11 match fisheries and 1 specimen fishery (total 12) would be affected in the hi-impact scenario.

The potential benefit of the Directive consists of the avoided cost of a larger KHV outbreak, multiplied by the frequency of occurrence of an outbreak (twice in the ten year time horizon). Estimates of the total potential undiscounted benefit are shown in table 11.

Table 11. Potential undiscounted benefit of reducing scale of KHV outbreaks (£)

Estimate	Low	Most likely	High
30% reduction in scale of outbreak			
Benefit to fisheries	**50,000**	**688,500**	**2,767,000**
Benefit to government	**29,500**	**29,500**	**29,500**
Benefit to recreational anglers	**10,000**	**24,000**	**58,500**
Total benefit	**89,500**	**742,000**	**2,855,000**
60% reduction in scale of outbreak			
Benefit to fisheries	**85,000**	**1,023,500**	**4,104,000**
Benefit to government	**59,000**	**59,000**	**59,000**
Benefit to recreational anglers	**20,000**	**48,500**	**117,000**
Total benefit	**164,000**	**1,131,000**	**4,280,000**

For discounting purposes, it was assumed that the outbreaks would occur in the third and eighth years of the time period.

7. Total benefits

Total discounted benefit of the policy ranges from £374,000 to £23 m. A mid-range estimate was calculated by using the 'medium' estimate for trout disease outbreaks and an average of the benefits from 30% and 60% reductions in the scale of SVC and KHV outbreaks using the 'most likely' parameter estimates. For KHV the average benefits have been halved to make the figures more conservative due to expert opinion indicating a large degree of uncertainty around the estimates. These values are presented in the table in section 8 below. The mid-range estimate was estimated to be about £5 m.

8. Summary of Benefits by Disease Type and Main Affected Groups

Undiscounted Benefits

	Benefit to industry	Benefit to govt	Benefit to anglers	Source
trout	£2,163,500	£2,400,000	£0	Table 5
Carp SVC	£216,000	£24,000	£37,000	Table 9
Carp KHV	£428,000	£22,125	£18,125	Table 11

Discounted Benefits

		Benefit to industry - discounted				Benefit to govt - discounted				Benefit to anglers - discounted			
Year	**Discount factor**	**Trout**	**SVC**	**KHV**	**Total**	**Trout**	**SVC**	**KHV**	**Total**	**Trout**	**SVC**	**KHV**	**Total**
2009	1.0000	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0
2010	0.9662	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0
2011	0.9335	£0	£0	£399,543	£399,543	£0	£0	£20,654	£20,654	£0	£0	£16,920	£16,920
2012	0.9019	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0
2013	0.8714	£1,885,365	£188,232	£0	£2,073,597	£2,091,461	£20,915	£0	£2,112,376	£0	£32,243	£0	£32,243
2014	0.8420	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0
2015	0.8135	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0
2016	0.7860	£0	£0	£336,404	£336,404	£0	£0	£17,390	£17,390	£0	£0	£14,246	£14,246
2017	0.7594	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0
2018	0.7337	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0
				Total	£2,809,543			**Total**	£2,150,420			**Total**	£63,405

Grand Total £5,023,373

6. COSTS OF THE AQUATIC ANIMAL HEALTH DIRECTIVE

6.1 Cost of Administrative Burden and Compliance

The cost of the Directive falls into two main areas. The first being the administrative costs associated with record keeping, compliance with inspections and applications for authorisation. The second area being the cost of complying with the good hygiene practices and certification requirements of the Directive. Other costs falling on processor plants are considered later.

Administrative burdens result from the additional information obligations which the Directive places on businesses. The main information obligation of the Directive have been identified as follows.

Activities	
Application for authorisation	**Familiarisation with obligations, assessment of business premises and practices. Providing information to inspectorate staff.**
Keeping of mortality records	**Recording mortalities for each epidemiological unit, as practical for each production type. Records will have to be kept in a standard format.**
Completion of movement records	**Farms and croppers will need to record all movements on and off business premises. Processing plants and depuration centres will need to record inward movements. The records are required in a standard format.**
Cooperation with inspections and surveillance	**Inspection visits for surveillance and to ensure authorisation conditions are being met are required. Such visits will have to be supervised by the business owner**
Record keeping during transport	**When aquaculture animals are transported, the transporter must keep records of farms, mollusc farming areas or processing establishments visited, mortality levels, as practical for the type of transport, and any water exchange.**

The following non-admin compliance costs have been identified.

Activities	
Good hygiene practice activities	**Good hygiene practice will consist of a number of activities, specific to the type of production, designed to reduce the introduction or spread of disease. These could include disinfection activities**
Animal health certification	**When exporting to third countries or trading with areas of the Community with a high health status, animal health certification needs to be completed. This requires that an inspector examines stock before despatch.**
Biosecurity measures for specialist transporters	**A number of measures will be required, principally disinfection of vehicles and equipment prior to loading.**

6.1.1 Administrative Burden

We have estimated the additional administrative burden imposed by the Directive below. This is done by estimating the time taken to fulfil the information obligation; how often it has to be performed and the wage costs per hour of having staff perform the task.

Table 12. Undiscounted Estimate of Admin Burden Imposed by the Directive

	Price		Quantity			Annual cost/burden		
Activities	**Time (Hours)**	**Tariff**	**Population**		**Frequency**	**Activity Cost**	**% of cost to burden**	**Admin burden**
Application for authorisation	**2.5**	**£16.24**	**Fish farms**	**379**	**One off**	**£24.5k**	**100**	**£24.5k**
			Mollusc farms	**132**				
			Crustacean farms	**3**				
			Depuration centres	**42**				
			Cropping Agents	**48**				
Keeping of mortality records	**0.17**	**£16.24**	**Fish farms**	**379**	**Weekly**	**£61.5k**	**25**	**£15.5k**
			Mollusc farms	**0**[3]				
			Crustacean farms	**3**				
			Cropping Agents	**48**				
Completion of movement records[4]	**0.02**	**£16.24**	**Farm to farm**[5]		**6000**	**£4.5k**	**25**	**£1k**
			Fish farm to processor		**1500**			
			Mollusc farm to Depuration centre[6]		**0**			
			Movements to stocked fisheries[7]		**6500**			
Cooperation with inspections and surveillance	**8**	**£16.24**	**Fish farms**	**379**	**Once per year**[8]	**£78.5k**	**100**	**£78.5k**
			Mollusc farms	**132**				
			Crustacean farms	**3**				
			Depuration centres	**42**				
			Cropping Agents	**48**				
Record keeping during transport	**0.02**	**£16.24**	**11,000 movements per year**			**£3.5k**	**100**[9]	**£3.5k**
Total (excluding one off costs)							**£98.5k**	

The one-off cost to industry is estimated to be **£24.5k**

[3] It will not be practical, in most circumstances, to record the mortality at mollusc farms.
[4] Average number of known movements, from farms and by cropping agents, in a year (based on Live fish movement database and Environment Agency information)
[5] Will require 2 records, one for movement off site another for introduction to the new site. This also applies to mollusc farm to mollusc farm movements.
[6] Depuration centres are already obliged to keep these records under food hygiene rules.
[7] Environment Agency consented movements.
[8] For minimum application, one visit per year, for a combined surveillance and supervision inspection is expected. The cost of different surveillance options is discussed in the benefits section.
[9] Documentation is already required, for journeys over 65 km, under welfare in transport legislation.

The on-going admin costs is estimated to be **£98.5k per year**

Total NPV (10 years) Cost to Industry is **£872k**

Average Annual Cost (NPV) to Industry is **£85k per year**

6.1.2 Compliance

The cost of compliance with the requirements of the Directive has been estimated in the same way as above but looking at the time taken to comply with the other requirements rather than the information obligation

Table 13. Undiscounted Estimate of Compliance Costs Imposed by the Directive

	Price		Quantity			Annual cost		
Activities	**Time (hours)**	**Tariff**	**Population**		**Frequency**	**Activity cost**	**% of industry**	**Industry cost**
Good hygiene practice activities	**2**	**£16.24**	**Fish farms**	**379**	**Weekly**	**£102k**	**10**	**£102k**
			Mollusc farms	**132**				
			Crustacean farms	**3**				
			Depuration centres	**42**				
			Cropping agents	**48**				
Animal health certification	**1**	**£16.24**	**150 certificated movements per year**			**£2.5k**	**100**	**£2.5k**
Biosecurity for transporters	**1**	**£16.24**	**11,000 movements per year**			**£179k**	**5**	**£9k**
Total						**£113.5k**		

The on-going compliance cost is estimated to be **£113.5k per year**

Total NPV (10 years) Cost to Industry is **£977k**

Average Annual Cost (NPV) to Industry is **£98k per year**

7. Costs and Benefits of Authorisation Requirements for Processing Plants

Processing plants will be required to be authorised if they wish to treat fish from infected areas. To gain authorisation they will need to show that potentially infected effluent from the processing operations is not entering the water system where it could cause disease outbreaks. This means that effluent will need to be discharged into the sewerage system or if this is not the case, undergo treatment.

For processing plants already on the sewer system compliance with this requirement will not cost anything, apart from the application for authorisation which is dealt with above. For processors not on the sewerage system, effluent treatment will involve the installation of equipment which will incur a one-off capital cost and on-going running costs.

These measures aimed at reducing the risk of disease outbreaks can be financially justified by estimating the economic benefit of the expected reduction in the likelihood of an outbreak. Effluent treatment on processing plants will reduce the likelihood that processing infected fish results in the establishment of exotic pathogens. However, each outbreak is one-off and thus the level of costs will vary greatly between outbreaks. Secondly, the impact of risk mitigation (in terms of reduced risk of disease establishment) is not well established. One approach to cope with these unknowns is through sensitivity analysis which is performed in this section.

7.1 Estimating Benefits

In order to quantify the potential benefits of the authorisation requirements for processing plants the same disease outbreak scenarios and related cost of these scenarios as used earlier in section 4.2 are adopted here. We assume that currently an outbreak will occur once every 10 years. We can then reduce this probability by a range of values and recalculate the cost. The difference in cost between the two probabilities is the benefit of the associated reduction in the likelihood of an outbreak.

The benefit of the processor authorisation requirements is to reduce these costs through a reduction in the risk of outbreaks. The benefit will be dependant on the size of the outbreak that would have occurred and the degree to which the likelihood of an outbreak occurring is reduced. Due to uncertainty surrounding these we have analysed the expected benefit by looking at the range of reductions in risk for the different outbreak scenarios.

7.2 Estimating Costs

The cost arises from the need to install effluent treatment equipment. Ninety percent of trout produced in E&W are processed at 4 sites. We have considered two different scenarios.

1) no processors install effluent treatment as an adequate number are located on the sewer system where effluent can be discharged without treatment. **This scenario would incur no cost**;

2) installation of disinfection equipment on 2 sites. The capital cost of equipment was estimated at £100,000 per site and annual running costs at £10,000 per site. **The present value costs for the two sites over 10 years would be £295k.**

7.3 Analysis

It was assumed that an exotic salmonid disease outbreak occurs every 10 years in the absence of effluent treatment. The benefits of processor authorisation are achieved by reducing the likelihood of a disease outbreak, for which a range of values were used (-5% to -35%). The cost of an outbreak will depend on its size, and costs were calculated for the 4 outbreak scenarios.

The future costs of effluent treatment (i.e. the running costs) were discounted (using a discount rate of 3.5%) to generate a net present value (NPV) of the costs. Similarly the benefits were expected to be realised, on average at year 5, and were similarly discounted to produce a NPV.

7.4 Results

Tables 1 and 2 summarise the benefit minus any cost values (where relevant) for the 4 outbreak scenarios and a range of values for the reduction in likelihood of an outbreak, for the two effluent treatment scenarios, respectively. This allows us to see under what circumstances the authorisation requirements for processors would break even.

Table 14. Net benefits (£) of scenario 1 (no effluent treatment installed)

outbreak scenario	percentage reduction in likelihood of that an outbreak occurs						
	5	10	15	20	25	30	35
1	40,773	81,545	122,318	163,090	203,863	244,635	285,408
2	51,866	103,731	155,597	207,462	259,328	311,193	363,059
3	243,983	487,966	731,948	975,931	1,219,914	1,463,897	1,707,879
4	1,147,294	2,294,587	3,441,881	4,589,175	5,736,468	6,883,762	8,031,056

Table 15. Net benefits (£) of scenario 2 (2 plants install effluent treatment)

outbreak scenario	percentage reduction in likelihood of that an outbreak occurs						
	5	10	15	20	25	30	35
1	-255,005	-214,232	-173,460	-132,687	-91,915	-51,142	-10,370
2	-243,912	-192,046	-140,181	-88,315	-36,450	15,416	67,281
3	-51,795	192,188	436,171	680,154	924,136	1,168,119	1,412,102
4	851,516	1,998,810	3,146,103	4,293,397	5,440,691	6,587,985	7,735,278

Shaded area indicated loss

For scenario 1, due to the absence of any costs the requirements for authorisation would have a positive NPV benefit in all circumstances

In scenario 2 the outcome of the requirements is less clear with a negative NPV of benefits in nearly half of the circumstances analysed.

8. Summary

This analysis is now simplified in order to present a low, medium and high estimate of the costs and benefits we might expect from the authorisation requirements. The two scenarios for effluent treatment have been combined to find a medium estimate of what we might expect. These are the NPV over 10 years.

For costs, we have assumed that scenario 1 represents the low value and scenario 2 the high value. The average of these two is taken for the medium value.

Table 16. Summary of Costs

	Costs (Ongoing and One-Off)		
	Low	**Medium**	**High**
Industry One-off	**£0**	**£100k**	**£200k**
Industry Ongoing – NPV (10 Years)	**£0**	**£48k**	**£95k**
Industry Total – NPV (10 Years)	**£0**	**£148**	**£295**
Average Annual	**£0**	**£4.8k**	**£9.5k**

Highlighted figure used on summary sheet

It is difficult to estimate where the benefits might lie in this analysis as there is a lack of strong scientific evidence making it difficult for a considered expert opinion to be formed. However, for the purpose of this IA we have taken a range of benefits which seek to be conservative due to the uncertainty surrounding them. The range of values we have taken is highlighted in table 14 above.

Table 17. Summary of Benefits

	Benefits (Ongoing)		
	Low	**Medium**	**High**
Govt – NPV (10 Years)	**£70k**	**£105k**	**£556k**
Industry – NPV (10 Years)	**£12k**	**£51k**	**£420k**
Total – NPV (10 Years)	**£82k**	**£156k**	**£976k**
Average Annual	**£8.2k**	**£15.6k**	**£9.76k**

Highlighted figures used on summary sheet

9. Small Firms Impact Assessment

The costs of this Directive are generally proportional to the size of the business. To consider the effect of this we have focussed on fish farms which are the largest effected sector in the industry.

Generally the differences between small, medium and large businesses will be the number of individual farming sites owned by the firm. Here we have assumed a small firm will own 1 site; a medium firm 3 and a large firm 6.

Due to the nature of the Directive each site will have to comply individually with the requirements such as record keeping, inspections and bio-security etc. This means that there is very little if any economies of scale to be gained by larger firms with more sites. Therefore, this Directive is unlikely to place disproportionately large burdens on smaller firms.

To look at the impact on the different firms in money terms we have first estimated the annual cost for one farm site.

Average cost to a fish farming business

	Time	**Tariff**	**Frequency/year**	**Cost to business**
Keeping mortality records	0.17	16.24	52	£ 143.56
coop with inspections	8	16.24	1	£ 129.92
Completion of movement records	0.02	16.24	16	£ 5.20
Movement records during transport	0.02	16.24	16	£ 5.20
Animal health certification	1	16.24	1	£ 16.24
Good hygiene	2	16.24	52	£ 168.90
Biosecurity in transport	1	16.24	16	£ 12.99
			Total Cost	**£ 482.00**

Therefore using our definition above for the different size of firms the cost for different firms are:

- small - £482;
- medium - £1446;
- large - £2892.

10. Competition Assessment

This Directive increases the cost of entry into the market for new firm by introducing a type of licensing system in the form authorisation. However, this cost is one-off and also applicable to existing firms as they will have to apply for authorisation when the Directive comes into force, therefore limiting any negative affect on competition.

If the cost of authorisation is prohibitive then this might have an adverse effect on competition, existing firms may choose to leave the market and new firms may be deterred from entering. The cost of authorisation for different types of firms covered by the Directive are listed below.

Type of Firm	**One-Off Cost of Applying for Authorisation**
Fish farms	**£40.60**
Mollusc farms	**£40.60**
Crustacean farms	**£40.60**
Depuration centres	**£40.60**
Cropping Agents	**£40.60**

The table shows that this cost is minimal and is therefore unlikely to have a significant impact on competition. Other costs such as admin burdens and compliance costs apply to all firms and are therefore unlikely indirectly limit the number and range of suppliers.

The Directive does have the potential to limit suppliers ability to compete by possibly limiting the number of sales channels. In the event of an outbreak, farms will only to able to process their fish at authorised processing centres. If an adequate number of these are not authorised then certain farms (for example, those which are not already using processing centres which are authorised) might find it more difficult to have their fish processed. It is difficult to understand what the impact of this will be as it is not yet clear how many processors would seek authorisation and how the market would function during an outbreak. However, as a number of processors can seek can seek authorisation for a very low cost, as they are on the sewer system and do not require effluent treatment, and the effect and competition would be restricted to when disease outbreaks are occurring, we do not believe that the overall impact on competition would be large.

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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	*Results in Evidence Base?*	*Results annexed?*
Competition Assessment	Yes	No
Small Firms Impact Test	Yes	No
Legal Aid		
Sustainable Development		
Carbon Assessment		
Other Environment		
Health Impact Assessment		
Race Equality		
Disability Equality		
Gender Equality		
Human Rights		
Rural Proofing		

Annexes

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