

The impact of a potential sales ban for eel on stock and sector



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Currently, there are a number of initiatives to promote recovery of the eel stock. This report analyses to which extent a sales ban for eel in the Netherlands might contribute to the restoration of the European eel stock. Four scenarios are analysed differentiating between partial and full closure of fisheries and aquaculture. The consequences for the economy of the sector as well as the fishing pressure of the stock are assessed.

Er zijn momenteel een aantal initiatieven om het herstel van de aalstand te bevorderen. In dit rapport is een analyse gedaan in welke mate een verkoopstop voor aal in Nederland zou kunnen bijdragen aan het herstel van het Europese bestand. Vier scenario's zijn geanalyseerd waarin onderscheid is gemaakt tussen gedeeltelijke of volledige sluiting van visserij en aquacultuur. Zowel de economische consequenties voor de sector als de visserijdruk op het bestand is in kaart gebracht.

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Preface

During the last decades the eel population in European waters has decreased and currently both the population and the eel sector are in a bad situation. Because of this, several measures have been proposed to promote recovery of the eel stock, from direct closure of the fisheries, to restocking programmes and market measures. In this context the Dutch branch of the World Wildlife Fund for Nature (WWF), WWF Netherlands, has asked LEI and IMARES to analyse to which extent a sales ban for eel in the Netherlands might contribute to the restoration of the European eel stock. Four scenarios are analysed differentiating between partial and full closure of fisheries and aquaculture, and the consequences for the economy of the sector and the fishing pressure of the stock are assessed. Unfortunately, the reporting of this project has taken quite some time and the situation has changed considerably since the study period. It should be noted, then, that the report describes the situation as it was in the spring of 2009 (1 April to 31 July). Because of this and the fact that WWF Netherlands felt that the research questions were not answered adequately, WWF Netherlands decided not to use this report in its activities. Because little information is available about the economics of the eel sector, the results from the desk study were validated in a workshop with stakeholders from both the fishing sector as well as the processing and retail sector in June 2009. I would like to thank those who attended this meeting for their contributions, which were of high value to the study.



Prof Dr R.B.M. Huirne
Managing Director LEI

Summary

The European eel *Anguilla anguilla* is found and exploited all over Europe, northern Africa and Mediterranean parts of Asia. It occurs in coastal areas, estuaries, lagoons, rivers, lakes, marshes and ditches. In the past six decades, fishing yield has gradually declined to below 20% of former levels; since 1980, recruitment has declined to <5%. The International Council for the Exploration of the Sea (ICES) has advised urgent protection and restoration of the stock, securing sufficient spawner production. To this end, the European Council of Ministers has adopted a protection and restoration programme, which sets a common objective all over Europe, and obliges Member States to develop and implement an Eel Management Plan for their rivers. The Netherlands has submitted an Eel Management Plan at the end of 2008 (revised on 1 April 2009), which now (July 2009) awaits endorsement by the European Commission.

WWF Netherlands asked Wageningen UR (LEI and IMARES) to analyse to which extent a sales ban for eel (full or partial, differentiating between fisheries and aquaculture or not) in the Netherlands might contribute to the restoration of the European eel stock. WWF Netherlands suggested four scenarios with different resulting effects on eel fisheries and aquaculture. The research was carried out in the period 1 April-31 July 2009 and the data used refer to the situation in 2009.

The scenarios proposed by WWF Netherlands make a differentiation between a ban on the sales of farmed eel in large supermarket chains versus a ban on wild caught eel which is primarily sold by small(er) retailers. The idea was that the first ban would put restrictions on eel farming and glass eel fisheries. The second was expected to affect the yellow and silver eel fishers most. Finally, there are two other scenarios which concern the 2008 situation with both fishing and farming continuing, and a situation where both fishing and farming completely or partly stop.

WWF Netherlands considered that a sales ban could start in two national supermarket chains Albert Heijn and Super-Unie but that the ban should ultimately cover all large retail chains. It was estimated that the sales of two groups mentioned represent 35% of the eel sales by Dutch supermarkets, 17% of the domestic eel consumption and 1% of the total European consumption. A ban by all large national retailers would cover 4% of the European consumption.

This report presents a review of the state of stock and fishery in mid-2009. An economic analysis shows the direct impact of a possible sales ban on the sector, and its effects on the stock. Indirect effects are known to occur, but these have not been considered in the present study, e.g. a mass-psychological effect that a limited sales ban is interpreted by consumers as a signal that eel consumption is 'not done'. Other anthropogenic impacts (among others migration barriers, pumps and sluices, cormorant protection and pollution) definitely may have an influence on the stock and thus might be relevant in management. However, quantification of these effects is generally poorly developed, hampering their inclusion in the current study. As a consequence, the current study focuses exclusively on possible sales bans, their effects on fishing and the stock, and the economic consequences for the industry and for stock restoration measures proposed to be funded by the industry (notably: restocking).

The results of the four scenarios are presented below.

Scenario 1a

No sales ban - Eel fishing and farming continue

This scenario describes more or less the situation in mid-2009, including a project proposed by the eel fishers (trap and transport of 157 tonnes of silver eels annually) which was part of the Netherlands' management plan from April 2009 as required by the EU. Also the impact of private restocking programmes are mentioned here.

Impact on stock restoration

Fisheries en farming will continue at the 2008 level. There is a potential impact of trap and transport of silver eel into coastal waters (i.e. a release of 157 tonnes of silver eel into the North sea) to restoration of the stock. Also properly applied restocking programmes for glass eel and bootlace, which allow silver eels to escape to the spawning area, can contribute to recovery of the stock. Restocking might be an option to contribute to stock restoration, but prices for seed material have been extremely high in the past decades. As a consequence, restocking is in general less cost-effective than reducing fisheries, since the cost per escaping silver eel is higher, and reducing fisheries avoids inherent risk of trap and transport. The Dutch Eel Management Plan (version July 2009) is based on restocking yielding an extra 100 tonnes of silver eel in the long run, approximately 10% of the effect of the total of all planned management measures.

The demand for glass eel by Dutch farms (5-15 tonnes/year) will not change in this scenario.

Economic impact

The present decline of catches continues. The main reason for this is the currently decreasing glass eel abundance which will affect stock and landings of yellow eel and silver eel in the next years (wild eel needs 5 years to grow from glass eel to the size of consumption eels and it may take decades to reach the silver eel stage). The costs of trapping and transporting of silver eels are estimated to be €1m. Other costs related to management of eels are not calculated. The costs of private restocking programmes are effectively paid for by the consumers. A levy of €1 per kg of smoked eel fillet would bring in respectively €165,000 (2 retail groups) and €500,000 (if all large retailers would participate). Dutch consumers would pay for the funding of the restocking programmes.

Scenario 1b

No sales ban for large supermarket chains (farmed eel) - Closure of (Dutch) yellow and silver eel fisheries

Impact on stock restoration

Escapement of silver eel increases by 10% (relative to the European landings) if only Dutch fisheries will be closed, while a Europe-wide ban for yellow and silver eel fisheries might reduce the impact of fishing to zero (except for the glass eel). What percentage increase in silver eel escapement this constitutes relative to the (current and potential) escapement is unknown. The conditional impact of private restocking programmes continues. As eel farming continues, the demand for glass eel might increase following from higher eel prices.

Economic impact

Total European supply of yellow and silver eels will be lower (Dutch ban 5%; Europe-wide ban 54%). Consequently, the prices are expected to increase substantially (4% with a Dutch ban and 75% with a Europe-wide ban). The loss of income (Dutch fishers, farmers, processors and retailers) will amount to €6m (Dutch ban). Under a Europe-wide ban the total income will not change because the losses of fishers and processors will be offset by additional income for eel farmers as result of the much higher prices. Yellow and silver eel fishers will get the burden of the restoration of the eel stock and completely loose their in-

come. Eel farmers will benefit from higher prices in particular in the case of a Europe-wide ban on (yellow and silver) eel fisheries. Processors and retailers will have to cope with reduced supply and higher prices. Consumers pay a levy for funding of restocking.

Scenario 2a

Sales ban of large supermarket chains (farmed eel) - small-scale yellow and silver eel fisheries continues as it is without additional restrictions

Impact on stock restoration

The sales ban may result in lower landings of glass eel and/or yellow and silver eel. However, the impact is ambiguous and depends on the response of fishers to the sales ban (see economic impact). The (potential) impact of private restocking programmes will disappear.

Economic impact

Except for the retail groups which support the ban (and on the short run also their supplying processors) the Dutch eel sector will be touched by the ban only marginally. In this scenario, retailers supporting the ban will pay the most. Retailers who do not support the ban will benefit from additional consumers and downward pressure on prices. Both fishers and eel farmers will have to cope with up to 1% lower prices if only two retail chains support the ban and 4% if all retailers are involved. The consumers will no longer be charged a levy for the funding of restocking.

Scenario 2b

Sales ban - Complete closure of (Dutch) eel fisheries industry

This scenario boils down to a complete closure/decommissioning of the Dutch (or European) eel sectors.

Impact on stock restoration

In this scenario the fishing effort by commercial fishing will be reduced to zero. This option leads to the highest restriction on fishing and the highest reduction in fishing mortality, though funding for restocking programmes might stop as well. Note that even with a complete fishery ban, stock restoration is still expected to take decades.

Economic impact

The annual loss of income related to eel (fishing, farming, processing and retailing) will be in the order of €34m for the Netherlands.

The main results of the scenarios have been summarised in the following table.

Scenario	Measures		Effects			Costs for NL sector (m €)
	Sales ban in supermarkets (farmed eel)	Stop of wild catch fisheries	Reduction in NL landings of yellow and silver eel (tonnes, %)	Reduction in EU landings of yellow and silver eel (%)	Reduction in glass eel demand (%)	
1a	No	No	0%	0	0	1 a) 0.4-1.0 b)
1b	No	Yes (in NL)	1,000 t 100%	10	0?	6
1b	No	Yes (in EU)	1,000 t 100%	100	0?	0
2a	Yes, two retailers	No	0-10 t 0-1%	0-1	0-1	1
2a	Yes, all large retailers	No	0-40 t 0-4%	0-4	0-4	3-4
2b	Yes	Yes (in NL)	1,000 t 100%	10	0-1	34
2b	Yes	Yes (in EU)	1,000 t 100%	100	100	34

a) Costs for trap and transport; b) Levy on consumer price for funding of restocking.
Source: LEI.

The effect of management, e.g. sales bans on the biological stock is hard to estimate, since the total stock is almost completely unquantified. Positive contributions to the protection of the stock might include restocking of glass eel purchased on the international market, and/or fishery buy-outs. Noting the extreme high prices paid for glass eel on the international markets and the low

efficiency of glass eel stocking into the wild (in comparison to raising in aquaculture), the fishery on the wild stock has little or no margin for protective measures in the situation like that of 2009. For aquaculture, minimal conditions for protective measures can be formulated, but ongoing projects so far did not consider these. In addition: it could be considered to raise funds for speeding up ongoing buy-out and restoration programmes. To be cost-effective such programmes would require minimum conditions to be formulated (avoiding funding of disinvestments which are already underway or disturbing the positive impact existing programmes, et cetera).

Estimating the European dimension of the impact of national management is further complicated by the approach taken by the EU Regulation which focuses on sharing tasks between the international and national levels. Each Member State (in each river basin) is obliged to implement a sustainable management regime. The stock in Dutch waters is far below the target level. Restricting wild-stock fishery (amongst others by a potential sales ban) will contribute to the national protection programme, but might easily lead to reduced protection efforts by others and no net change.

One of the main observations in this report is that the differentiation suggested by WWF Netherlands is only partly true. It is true that large retailers sell mostly farmed eel and wild eel is mostly sold in small shops. But all these markets are linked to each other. Following from the integration of European markets for captured and farmed eel, a sales ban for farmed eel in supermarkets would also affect the prices of wild captured eel and therefore the income and future landings of yellow and silver eel fishers. Turning it around, glass eel fishers and eel farmers would benefit from higher prices following from restrictions for yellow and silver eel fishers and may result in extension of glass eel fishing.

A sales ban is not equivalent to a ban on fishing or farming. The impact of a fishing ban is directly and unconditionally. In contrast, the impact of a sales ban is the result of a market process which is initiated in shops that might influence farmers and fishermen, which in turn influences the wild stock. In principle, a sales ban by retailers might reduce the number of eel consumers and shrink demand. Lower demand causes a downward pressure on eel prices and this might be reason for fishers or eel farmers to scale down their production. Given the usual time lags in restructuring decisions, down scaling of the sector might be slow and may just occur after many bad years for the eel sector.

The impact of a national sales ban should be assessed in the context of the common European market. A ban by one or two or even all national retailers will have a limited impact on the total European demand. The impact on national

and European prices is accordingly expected to be limited as well. The impact would evidently increase if more (national) retailers would support the ban. Furthermore, the pressure on price will affect all European producers and it will affect eel fisheries as well as eel farmers because their markets are presumably integrated.

It will be extremely difficult to implement a national sales ban for wild eel given the large number of small fish shops (1,500) and restaurants. Probably, landings of yellow and silver eel fisheries could therefore be restricted more effectively by direct fisheries management.

In conclusion

- A ban on farmed eel in (some) Dutch supermarkets will have some economic effect on eel markets and prices, but only a large scale, international ban will have a substantial and noticeable effect on the stock. Indirect effects are known to occur, but these have not been considered in the present study, e.g. a mass-psychological effect that a limited sales ban is interpreted by consumers as a signal that eel consumption is 'not done'.
- Cross-over effects between the market chains for farmed and wild eel are very likely. Restrictions for farmed eel will also hit yellow and silver eel fishers and vice versa.
- The present fund for restocking provides a potential annual budget of € 5,500,000 if all large retail groups would participate. That budget will do for restocking 1 tonne of glass eel at 2009 prices. Since this is below the 5-15 tonnes of glass eels actually used, this scheme does not fully compensate for the exploitation on which the funding is based.

Samenvatting

De Europese aal/paling *Anguilla anguilla* wordt gevangen in heel Europa, Noord-Afrika en de Mediterrane gebieden van Azië. Aal komt voor in kustgebieden, binnenzeeën, lagunes, rivieren, meren moerassen en vijvers. In de afgelopen 60 jaar is de vangst in Europa geleidelijk gedaald tot minder dan 20% van het vroegere niveau; sinds 1980 is de intrek van jonge aal (glasaal) uit zee gedaald tot 5%. De Internationale Raad voor het Zeeonderzoek (ICES) heeft dringend geadviseerd maatregelen te nemen tot bescherming en herstel van de aalstand en het veiligstellen van voldoende paaiende schieraal. Hiertoe heeft de Europese Raad van Ministers een bescherming- en herstelbeleid voor aal aangenomen waarin gemeenschappelijke Europese doelen zijn gesteld en de verplichting voor Lidstaten om een Aalbeheersplan op te stellen voor de rivieren in hun gebied. Nederland heeft eind 2008 een Beheersplan ingediend (herzien per 1 april 2009), dat nu (juli 2009) wacht op goedkeuring door de Europese Commissie.

Het Wereld Natuur Fonds (WNF) heeft Wageningen UR (LEI en IMARES) gevraagd te analyseren in welke mate een verkoopstop voor aal in Nederland (gedeeltelijk of volledig, met onderscheid naar wilde en gekweekte aal) zou kunnen bijdragen aan het herstel van het Europese bestand. WNF stelde vier scenario's voor met verschillend effect op de aalvisserij en -kwekerij. Het onderzoek is uitgevoerd in de periode van 1 april tot 31 juli 2009 en de gebruikte data verwijzen naar de situatie in 2009.

De scenario's die WNF heeft voorgesteld, maken onderscheid tussen een verkoopstop voor enerzijds aal in grote supermarktketens die voornamelijk afkomstig is van aalkwekers en anderzijds beperkingen voor wildgevangen aal die meest wordt verkocht door kleine detailhandelaren. De gedachte van het WNF was dat de eerstgenoemde verkoopstop vooral effecten zou hebben op de aalkweek, en het gebruik van glasaal ten behoeve van de aalkweek. En daarmee zou dit ook weer effecten kunnen hebben op de glasaalvisserij in andere landen. De tweede maatregel (wildgevangen aal van detailhandelaren) zou de visserij op rode en schieraal beperken. De beide overige scenario's beschrijven respectievelijk voortzetting van de visserij en kwekerij en een situatie waarin visserij en kwekerij volledig worden stilgelegd.

WNF overwoog dat een verkoopstop zou kunnen beginnen bij enkele grote supermarkten (Albert Heijn en Super-Unie), maar dat paling uiteindelijk in alle

grote Nederlandse supermarktketens uit het schap zou worden gehaald. Geschat is dat het marktaandeel van genoemde groepen ongeveer 35% beslaat van de omzet van aal via Nederlandse supermarkten, dit is 17% van de nationale en 1% van de Europese aalconsumptie. Een verkoopstop in alle Nederlandse supermarkten zou neerkomen op 4% van de totale Europese consumptie.

In dit rapport wordt een beeld gegeven van de toestand van het bestand en de visserij medio 2009, en worden economische berekeningen gemaakt over welk direct effect een eventuele verkoopstop zou kunnen hebben op de kweek of visserij, en op het bestand. Indirecte effecten zijn, hoewel bekend, niet in ogenschouw genomen in de huidige studie. Denk bij indirecte effecten bijvoorbeeld aan het massapsychologische effect dat een beperkte verkoopstop zou worden geïnterpreteerd bij consumenten als een signaal dat het 'not done' is om aal te kopen. Andere antropogene effecten (bijvoorbeeld migratiebarrières, pompen en sluizen, aalscholverbescherming, vervuiling, enzovoort) kunnen zeker het bestand beïnvloeden en daardoor relevant zijn voor het beheer. Kwantificering van deze effecten is echter in het algemeen nog slecht ontwikkeld, wat opname in de huidige studie in de weg staat. Daardoor richt de huidige studie zich alleen op mogelijke verkoopstoppen, hun effecten op de visserij en het bestand, en de economische consequenties voor de industrie en voor herstelmaatregelen die door de industrie worden gefinancierd (met name uitzetten).

Hieronder zijn de uitkomsten gepresenteerd van de vier scenario's.

Scenario 1a

Geen verkoopstop - Voortzetting van visserij en kwekerij

Dit scenario beschrijft min of meer de situatie medio 2009 met daarbij inbegrepen een actie als voorgesteld door de visserijsector ('over de dijk zetten' van 157 ton schieraal), dat onderdeel was van het door Nederland aan de EU voorgestelde Beheersplan van april 2009. Ook het uitzetten van glasaal (Foppenproject en andere) worden hier genoemd.

Effect op herstel van het bestand

Visserij en kweek zullen worden voortgezet op het niveau van 2008. Er is een potentieel effect van het 'over de dijk zetten' van schieraal (157 ton per jaar) dat kan bijdragen aan het herstel van het bestand. Ook de uitzet van glasaal, mits dit effectief wordt uitgevoerd en de uitgezette glasaal op kan groeien tot schieraal die de paaigronden terug weet te vinden, kan een bijdrage leveren. Uitzetprogramma's kunnen een optie zijn om bij te dragen aan bestandsherstel, maar de prijzen voor basismateriaal zijn in de laatste decennia extreem hoog.

Daardoor is uitzetten over het algemeen minder kostenefficiënt dan het reduceren van de visserij, omdat de kosten per ontsnapte schieraal hoger is, en een reductie van de visserij niet het inherente risico van het vangen en transporteren heeft. Het Nederlandse Aalherstelplan (versie juli 2009) was gebaseerd op uitzetprogramma's die resulteerden in 100 ton extra schieraal op de lange termijn, ongeveer 10% van het effect van het totaal van alle geplande beheermaatregelen.

De palingkwekerij en de vraag naar glasaal door Nederlandse kwekers (5-15 ton per jaar) zal in dit scenario niet veranderen.

Economisch effect

De huidige trend (dalende vangsten) zal in ieder geval in de komende jaren worden voortgezet. Belangrijkste reden hiervoor is de recente daling in glasaal, die nog jaren verder doorwerkt in lagere bestanden en vangsten van rode en schieraal (het duurt meer dan 5 jaar voordat glasaal een marktwaardige grootte bereikt, en de periode tussen glasaal en schieraal kan enkele tientallen jaren omvatten). De kosten van opvissen en weer uitzetten van de 157 ton schieraal worden geraamd op meer dan € 1 mln. Overige beheerskosten zijn daarbij niet meegerekend. De bijdrage voor uitzettingsprojecten wordt in feite betaald door de consument. Een heffing van € 1 per kg gerookte palingfilet zou circa € 165.000 per jaar in het fonds brengen als deze extra euro door 2 supermarktketens wordt geïnd en € 500.000 als alle grote Nederlandse ketens meedoen. De Nederlandse palingconsumenten betalen dan voor de uitzetprojecten.

Scenario 1b

Geen verkoopstop in supermarkten (kweekaal) - Sluiting van de (Nederlandse) rode en schieraalvisserij

Effect op herstel van het bestand

De Europese uittrek van schieraal neemt toe omdat de Europese aanvoer van rode en schieraal daalt met 10% als alleen de Nederlandse visserij wordt gesloten, terwijl een sluiting van de hele Europese visserij op rode en schieraal het effect van de visserij tot nul kan reduceren (met uitzondering van de glasaalvisserij). Welk percentage van de niet-gevangen aal als schieraal de zee weet te bereiken, en hoeveel de extra uittrek bijdraagt aan de totale uittrek is onbekend. Het mogelijke effect van de private uitzetprojecten wordt voortgezet.

De palingkweek en de glasaalvisserij worden mogelijk gestimuleerd door de prijsverhoging die kan ontstaan.

Economisch effect

Het totale Europese aanbod van rode en schieraal daalt (bij een vangstverbod in Nederland 5% en bij een Europa-breed vangstverbod 54%). Verwacht wordt dat de prijzen hierdoor zullen toenemen, met 4% bij een vangstverbod in Nederland en met 75% bij een Europa-breed vangstverbod. Het totale inkomensverlies in Nederlandse sector (vissers, kwekers, verwerking en handel) zal ongeveer € 6 mln. bedragen bij alleen een vangstverbod in Nederland. In geval van een Europees vangstverbod zal het inkomensverlies in Nederland mogelijk nihil zijn omdat de verliezen bij de visserij en de verwerking volledig worden gecompenseerd door extra inkomsten voor palingkwekers als gevolg van de veel hogere prijzen die bij dit scenario zijn te verwachten. Bij dit scenario zijn het de vissers die het herstel van het bestand betalen want ze verliezen hun volledige inkomen. Palingkwekers zullen profiteren van hogere prijzen, vooral in geval van een Europa-breed vangstverbod voor rode en schieraal. Verwerkers en retailers krijgen te kampen met een verlaagd Europees aanbod en hogere prijzen. De Nederlandse palingconsumenten betalen voor de uitzetprojecten.

Scenario 2a

Verkoopstop grote supermarkten - Geen beperking kleinschalige visserij

Effect op herstel van het bestand

De Europese vangst van rode en schieraal en/of glasaal zal marginaal kunnen dalen. Afhankelijk van waar de prijsverlaging het hardst aankomt, kan productiecapaciteit worden gesaneerd in de visserij of in de kweeksector. Dit zal dan ook een marginaal effect hebben op de uitstroom van schieraal en/of de vangst van glasaal. Het (mogelijke) effect van private uitzetprojecten vervalt.

Economisch effect

Behalve voor de supermarktketens die paling uit de verkoop nemen (en op korte termijn ook hun toeleveranciers) is het effect op de aalsector in Nederland beperkt. Supermarktketens die een verkoopstop hebben ingesteld zullen het grootste deel van de rekening betalen voor de inspanningen ten behoeve van herstel van de aalstand. Winkeliers die de verkoopstop niet steunen, krijgen meer consumenten in hun winkel en lagere prijzen. Palingrokers zullen op korte termijn te maken krijgen met de kosten voor aanpassing van hun klantenkring. De vissers en kwekers worden geconfronteerd met tot 1% lagere prijzen als

twee supermarktketens meedoen aan de verkoopstop en tot 4% als alle supermarktketens meedoen. De heffing voor de consument voor uitzetprogramma's komt te vervallen.

Scenario 2b

Verkoopstop - Volledige sluiting van de visserij

Dit scenario komt neer op een volledige sluiting/sanering van de Nederlandse (of Europese) palingsector.

Effect op herstel van het bestand

De visserijdruk vanuit de beroepsvisserij wordt tot nul gereduceerd. Deze optie leidt tot de grootste reductie in de visserij en de visserijmortaliteit, hoewel de financiering van de bestaande private uitzetprojecten ook mogelijk vervalt.

Maar ook bij sluiting van de complete visserij zal het herstel nog tientallen jaren duren.

Economisch effect

Het jaarlijkse verlies aan inkomen dat gerelateerd is aan productie, verwerking en distributie wordt voor de Nederlandse sector geschat in de orde van € 34 mln. De heffing voor de consument komt te vervallen.

De belangrijkste resultaten per scenario zijn samengevat in de volgende tabel.

Scenario	Maatregel		Effecten			Kosten NL-sector (mln. €)
	Verkoopstop in supermarkten (kweekaal)	Stoppen visserij rode en schieraal	Reductie in NL vangst van rode en schieraal (ton, %)	Reductie in EU vangst van rode en schieraal (%)	Reductie in vraag glasaal (%)	
1a	Nee	Nee	0%	0	0	1 a) 0,4-1,0 b)
1b	Nee	Ja (in NL)	1000 t 100%	10	0?	6
1b	Nee	Ja (in EU)	1000 t 100%	100	0?	0
2a	Ja, twee retailers	Nee	0-10 t 0-1%	0-1	0-1	1
2a	Ja, alle retailers	Nee	0-40 t 0-4%	0-4	0-4	3-4
2b	Ja	Ja (in NL)	1000 t 100%	10	0-1	34
2b	Ja	Ja (in EU)	1000 t 100%	100	100	34

a) Kosten voor vangst en transport; b) heffing op de consumentenprijs voor financiering van uitzet.
Bron: LEI.

Het effect van beheer, waaronder een verkoopstop, op het biologische bestand is moeilijk te schatten, omdat het totale bestand bijna volledig niet gequantificeerd is. Positieve bijdragen aan de bescherming van het bestand kunnen bijvoorbeeld worden verwacht van uitzetprojecten van glasaal, die anders een niet-duurzame bestemming zou hebben op de internationale markt, en van uitkoopregelingen. Gezien de extreem hoge prijs die wordt betaald voor glasaal en het lage rendement van het uitzetten van glasaal in de natuur (in vergelijking met aquacultuur) en de smalle marges in de visserij, is uitzetten geen haalbare optie voor vissers bij de hoge glasaalprijzen als in 2009. Voor uitzetten van glasaal door aalkwekers zouden minimale voorwaarden kunnen worden geformuleerd (voorkomen van concurrentie tussen herstelprojecten, minimale hoeveelheden, enzovoort). Bij de lopende projecten is dit nog niet bekeken. Daarnaast zou geld kunnen worden gegenereerd, om lopende sanerings-

en herstelprojecten te versnellen. Om kosten effectief te zijn zouden bij deze programma's weer minimale voorwaarden kunnen worden geformuleerd (niet betalen voor wat toch al zou gebeuren; het herstel niet weer teniet doen door afzwakking van andere bestaande projecten, enzovoort).

Het schatten van het effect van maatregelen op Europese schaal wordt verder gecompliceerd door de benadering die is gekozen in de Europese Verordening die focust op het verdelen van de taken tussen communautaire en nationale overheden. Iedere lidstaat (in elke riviergebied) is gehouden een duurzaam beleid uit te voeren. Het bestand in de Nederlandse wateren is ver beneden de gestelde doelen. Beperking van de visserij (onder andere door een potentiële verkoopstop) zal bijdragen aan het nationale programma, maar zal gemakkelijk kunnen leiden tot verminderde inspanning door anderen en per saldo geen verbetering.

Een van de belangrijkste conclusies van dit rapport is dat het onderscheid dat WNF wenste te maken tussen visserij en kweek maar ten dele bestaat. Het is juist dat de grote retailers meest kweekaal verkopen en dat wildgevangen aal meest in kleine winkels terechtkomt. Maar al deze markten zijn gekoppeld. Als gevolg van de integratie van de markten voor wildgevangen en gekweekte aal, zal een verkoopstop voor gekweekte aal door supermarkten ook effect hebben op de prijs van wilde aal en op het inkomen van aalvissers. Omgekeerd zullen vissers van glasaal en aalkwekers profiteren van de hogere prijs die zal volgen op beperkingen opgelegd aan de visserij op rode en schieraal.

Een verkoopstop is niet gelijkwaardig aan het direct stilleggen van visserij of kwekerij. Het effect van het sluiten van de visserij is onmiddellijk en onvoorwaardelijk. Het effect van een verkoopstop is afhankelijk van de marktwerking die ze heeft op de primaire productiesectoren (en uiteindelijk op de visstand). In principe kan een verkoopstop door winkeliers resulteren in minder consumptie en verkleining van de vraag. Minder vraag veroorzaakt een neerwaartse druk op de prijs en dit zou reden kunnen zijn voor vissers en/of kwekers om hun productie te verlagen. Omdat het saneren van productiecapaciteit vaak een langdurig proces is, zal sanering van de sector mogelijk pas tot stand komen na een reeks van jaren met slechte economische resultaten.

De gevolgen van een nationale verkoopstop van paling kunnen alleen worden beoordeeld in het licht van de gemeenschappelijke Europese markt. Een verkoopstop door een of twee supermarktketens van nationale betekenis zal relatief weinig invloed hebben op de totale Europese vraag. Het effect op de prijs in Europa en Nederland zal daardoor ook beperkt zijn. Het effect zou uiteraard toenemen naar mate meer (Nederlandse) supermarktketens paling uit het schap

halen. Daarbij moet wel worden opgemerkt dat de iets lagere prijs zal gelden voor alle Europese producenten. En de lagere prijs raakt zowel vissers als kwekers omdat verondersteld is dat beide markten volledig geïntegreerd zijn.

Het zal zeer lastig zijn een nationale verkoopstop in te voeren voor wildgevangen aal, gegeven het grote aantal kleine viswinkels (1.500) in Nederland. Maatregelen om de vangst van rode en schieraal te beperken zullen daarom in de praktijk vooral neerkomen op direct visserijbeheer.

Conclusies

- Een verkoopstop voor gekweekte aal in (een aantal) Nederlandse supermarkten zal enig effect hebben op markt en prijzen, maar alleen een groot-schalige international opgezette verkoopstop zal aanzienlijke en merkbare effect hebben op het bestand. Indirecte effecten zijn bekend, maar deze zijn niet meegenomen in deze studie, bijvoorbeeld het massapsychologisch effect dat een beperkte verkoopstop door de consumenten geïnterpreteerd zal worden als signaal dat het eten van paling 'not done' is.
- Wisselwerking tussen de markten voor kweekaal en rode en schieraal zijn zeer waarschijnlijk. Beperkingen voor gekweekte aal zullen ook van invloed zijn op de visserij op rode en schieraal en omgekeerd.
- Het bestaande private fonds voor de uitzet van aal heeft een potentieel budget van € 500.000 als alle supermarkketens meedoen. Dit budget zou, met de glasaalprijzen van 2009, volstaan voor het uitzetten van 1 ton glasaal. Dat is minder dan de 5-15 ton glasaal, die is gebruikt voor de productie waarop het private fonds is gebaseerd. In deze opzet wordt de exploitatie dus niet volledig gecompenseerd.

1 Introduction

1.1 Background

The stock and fishery of the European eel *Anguilla anguilla* (L.) are in decline (Moriarty and Dekker, 1997; Dekker, 2004a). Total fishing yield declined since the mid-1960s to less than 20% of former values (Dekker, 2003). Since 1980, recruitment of glass eel from the Ocean dropped to less than 5% (Moriarty, 1986; Dekker, 2000; ICES, 2008). The stock is considered outside safe biological limits (ICES, 1999), and urgent protective measures have been advised over many years.

Measures for the restoration of the eel stock were established in September 2007 through an EU Regulation (EU, 2007). The objective of this Regulation is the protection and sustainable use of the stock of European Eel. To achieve this, member states will develop eel management plans for their river basin districts, designed to reduce anthropogenic mortalities. The eel management plans shall allow an escapement to sea of at least 40% of the biomass of silver eel, defined as the best estimate of the theoretical escapement if the stock had been completely free of anthropogenic influences.

In December 2008, the Dutch Minister of Agriculture, Nature and Food Quality submitted a national management plan which includes a closed season for all eel fisheries from 1 September until 31 October. Following political discussions, the Minister allowed the sector to present alternative solutions, in the form of releasing 157 tonnes of silver eels, with which the closed season was abolished.

WWF Netherlands considers options that would positively affect restoration of the eel stock by influencing the market. WWF Netherlands asked Wageningen University (LEI and IMARES) to examine scenarios which include a sales ban for eel for large supermarket chains which primarily use farmed eel, or a stop of the small-scale fishery on yellow and silver eel from the Dutch waters

1.2 Objective of this study

The objective of this study is to compare the possible contribution of two scenarios to suspend sales (and consumption) of farmed eel sold by supermarket chains and yellow and silver eel caught from the wild in the Netherlands to the recovery of the European eel stock and to quantify the economic consequences for the eel sector.

1.3 Terms of Reference

These ToR is a direct translation of the questions formulated by WWF Netherlands in Dutch. WWF Netherlands added further observations to each of the scenario, which have been presented in Chapter 4 (Results).

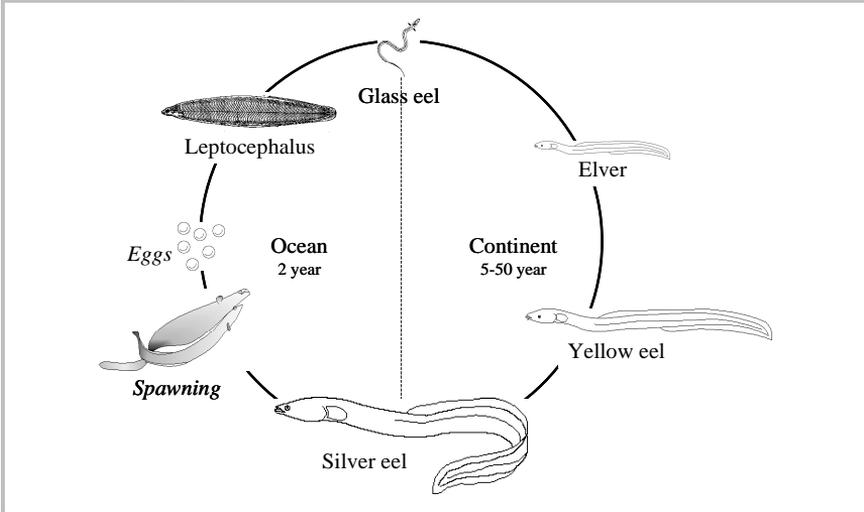
- *Scenario 1a*
(Farmed) eel remains in the counter of retailers and (Dutch) eel fisheries continue (except in areas where eel shows a high dioxin/PCB content)
- *Scenario 1b*
(Farmed) eel remains in the counters of retailers and eel fishery is closed
- *Scenario 2a*
(Farmed) eel is taken out of the counter of large retailers, but local eel fisheries continue and small scale retail outlets continue
- *Scenario 2b*
Eel is taken out of the counter of retailers and the eel fishery will entirely been closed

1.4 Glossary

Eels are quite unlike other fish. Consequently, eel fisheries and eel biology come with a specialised jargon. This section provides a quick introduction for outside readers. It is by no means intended to be exhaustive.

Figure 1.1

The life cycle of the European eel. The names of the major life stages are indicated. Spawning and eggs have never been observed in the wild



Glass eel	Young, unpigmented eel, recruiting from the sea into continental waters.
Elver	Young eel, in its 1st year following recruitment from the ocean. The elver stage is sometimes considered to exclude the glass eel stage, but not by everyone. Consequently, the term is confusing.
Bootlace, Fingerling	Intermediate sized eels, approximately 10-25 cm in length. These terms are most often used in relation to stocking. The exact size of the eels may vary considerably. Consequently, the term is confusing.
Yellow eel (Browneel)	Life stage resident in continental waters. Often defined as a sedentary phase, but migration within and between rivers, and to and from coastal waters occurs. This phase encompasses the elver and bootlace stages.
Silver eel	Migratory phase following the yellow eel phase. Eel characterised by darkened back, silvery belly with a clearly contrasting black lateral line, enlarged eyes. Downstream migration towards the sea, and subsequently westwards. This phase mainly occurs in the second half of calendar years, though some are observed throughout winter and following spring.

Eel River Basin	'Member States shall identify and define the individual river basins lying within their national territory that constitute natural habitats for the European eel (eel river basins) which may include maritime waters. If appropriate justification is provided, a Member State may designate the whole of its national territory or an existing regional administrative unit as one eel river basin. In defining eel river basins, Member States shall have the maximum possible regard for the administrative arrangements referred to in Article 3 of Directive 2000/60/EC [i.e. River Basin Districts of the Water Framework Directive].'
River Basin District	The area of land and sea, made up of one or more neighbouring river basins together with their associated surface and groundwaters, transitional and coastal waters, which is identified under Article 3(1) of the Water Framework Directive as the main unit for management of river basins. Term used in relation to the EU Water Framework Directive.
Stocking	Stocking is the practice of adding fish [eels] to a waterbody from another source, to supplement existing populations or to create a population where none exists.
Protection	Activity to avoid a further decline.
Recovery	Return to an original state, no reference to the action required.
Restoration	Activity in order to recover, so both action and result. EU talks about protection and restoration.
Eel sector	Cluster of all eel activities (fishing, farming, smoking/processing, retailing).
Eel production	The sum of wild catch and farmed eel.

1.5 Reader

In Chapter 2 the status of the stock and the eel management will be discussed until 2009. Chapter 3 outlines the data, methods and assumptions used in the analysis of the effects of the different scenarios for both the economic and biological effects. In Chapter 4 the results are presented and Chapter 5 gives a short discussion.

2 Status of stock and management

2.1 Biology and exploitation

Biology

The European eel¹ *Anguilla anguilla* L. is a weird animal. Although its life cycle is incompletely known, reproduction must take place somewhere in the Atlantic Ocean, presumably in the Sargasso Sea area where the smallest larvae have been found. Eels grow and mature in 5-50 years (average 20, max. 84). Females become about twice the age and size of males. No-one has ever observed spawning adults or eggs in the wild. Aquaculture is exclusively based on rearing of wild caught (glass) eels.

Distribution

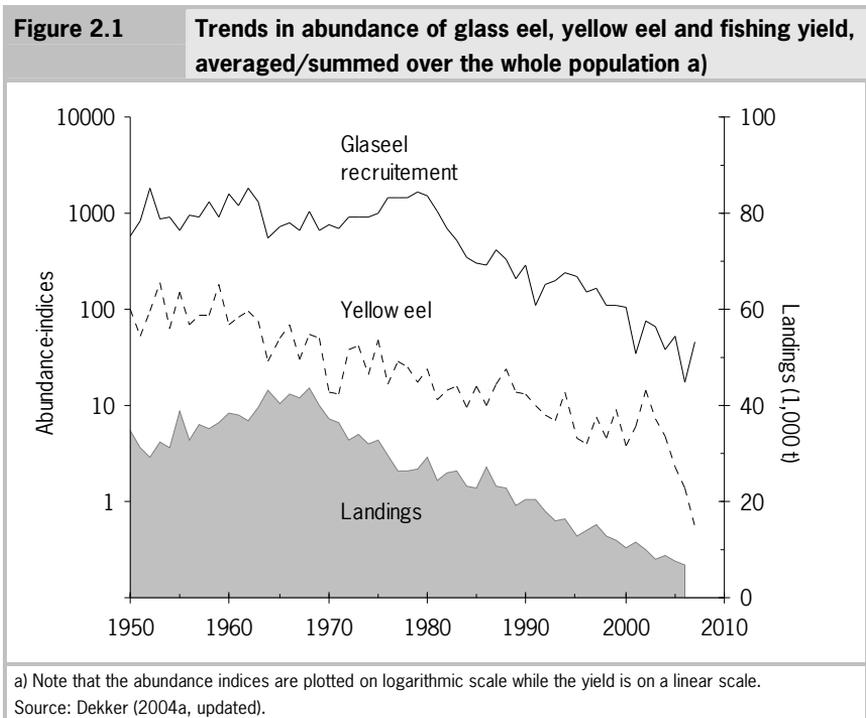
The European eel constitutes one (probably) panmictic stock found all over Europe, northern Africa and the Mediterranean parts of Asia. This wide distribution area, however, is effectively fragmented over thousands of river catchments, with little or no natural interaction in-between. The Bay of Biscay area receives approximately 90% of all glass eel recruitment; yellow and silver eel are more evenly spread over the wide distribution area. They occur in coastal areas, estuaries, lagoons, rivers, lakes, marshes and ditches, and migrate in-between throughout their life time. They can survive a wide range of environmental conditions (temperature, salinity, depth, trophic status, et cetera). Active transport by man (mostly transporting glass eels) has influenced the distribution considerably, both within rivers and over the continents.

Trends

Recruitment of glass eels from the Ocean fell in the 1980s to about 10% of former levels, followed by a further decline since 2000, to 1-5% of the historical level. Most recent information (2009) indicates a continuation of the decline (approximately 15% down per year, an order of magnitude per generation). Catches have gradually declined over the second half of the 20th century, down to approximately 15% of the historical level. These trends have occurred over

¹ Names: eel, ål, anguille, aal, angula, pibale. In Dutch, paling and aal are nearly synonyms.

almost the whole distribution area. In the British Isles, the glass eel declined to 30%, while in Scandinavia, the yellow eel stock declined earlier. There are indications that other *Anguilla* species (American, Japanese, and both New Zealand eels) experience a comparable, and possibly synchronous decline. Causes of the stock decline are not well known, but might include pollution, habitat loss, overexploitation, transfer of diseases, ocean climate change. Though a synergistic effect is probable, the single breakpoint in glass eel recruitment (1980) throughout Europe suggests that the whole stock is affected by and part of one single process.



Exploitation

Exploitation takes place all over the distribution area, and is generally organised in small scale, rural enterprises. All continental life stages are targeted, though emphasis varies between countries. In the area around the Bay of Biscay, glass eel is exploited for:

- a. export to Eastern Asia, Netherlands, Denmark, Italy and others for aquaculture;
- b. export to Spain for human consumption; and
- c. export to northern and eastern Europe for restocking inland waters.

Yellow and silver eel are exploited throughout the distribution area, though silver eel dominates more in northern regions.

Glass eel landings are in the order of less than 100 tonnes recently, yellow and silver eel (combined) landings are now below 10,000 tonnes. Aquaculture production of European eel amounts to 10,000 tonnes in Europe, and 10,000 tonnes in Asia. Fishing yield of other eel species is an order of magnitude lower than that for European eel, but total aquaculture in Asia is over 100,000 tonnes.

Monitoring and assessment

There is a general lack of accurate data, both on the wild stock and on fishing practices. This is largely due to the scattered, unregistered nature of the fisheries. It is likely that true yields are twice as high as reported (officially, and in the text above). Time trends are derived from local data series. Since (almost) all data series agree, the observed trends must be real. There is no international assessment of the stock and fisheries (disregarding a Procrustean attempt, now outdated), and assessments of local stocks are few and incomplete. Scientific advice to protect and restore the stock reflects the Precautionary Approach, based on the observed abundance trends.

2.2 Protection and restoration

International management

Eel fisheries and their ecosystems have traditionally been managed only on a small local scale, and as far as the ecosystem is concerned, have addressed the eel most often only implicitly. Without authoritative international legislation, governments have not been inclined to manage or protect effectively. Local management can be effective in setting and controlling at the local level where eel fisheries actually occur, but cannot control or influence the long-term, continent-wide status of the stock. Eel specific management structures are now (2007-2009) being developed on the international level (EU Regulation 1100/2007, CITES listing Annex II), which will set a common objective, improve

the documentation of the status, and should bring the existing, local management structures within a common framework (see below, structure).

EU protection plan

Objectives of the EU Regulation on eel are to protect and restore the stock. The Regulation sets a common target for the escapement of (maturing) silver eels, at 40% of the natural escapement (that is: in the absence of any anthropogenic impacts). Since current glass eel recruitment is far below historical levels (and implicitly assumed to be so due to anthropogenic impacts), return to this target level is not expected within 3-4 generations of eel (60-80 years), or much longer (up to 200 years or more) even if all anthropogenic impacts are abolished or stopped.

A decision on an acceptable time frame is left to the individual Member States. Since time frame and protection level are two sides of the same coin, the chosen time frame effectively compromises the common target for many decades. In practice, however, Member States tend to homogenise their ambition levels, the regulations that impact the fisheries and time schedules. According to the EU Regulation, national management plans had to be accepted and implemented mid 2009, and post-evaluation is planned every third year (first in 2012; from 2021 onwards, every sixth year).

Protection and restoration of the eel will require action in the field of fisheries, of habitat restoration, of (restricting) hydropower generation, of nature conservation, etc. The EU Regulation on eel acknowledges that many anthropogenic factors impact the stock, but focuses on fisheries (and mortality induced by hydropower generation); for other factors, one relies upon various other regulations already in place (Water Framework Directive, Flora and Fauna Directive, Common Fishery Policy). It is implicitly assumed, that these other regulations contribute adequately to the restoration process, and achieve the maximum feasible effort.

Aims, Efforts and Achievements

The traditional management structure in local/regional/national units, implementing an uncoordinated and spatially varying management regime, has proven to be unsuccessful in protecting the stock. Central coordination and/or central planning are mandatory to achieve recovery of the eel stock and sustainable management. Political discussions during the final preparation of the EU protection plan have focused on the role of the central organisation (that is: the EU Commission). Would coordination between countries suffice (which would

imply a Directive), or would a central authority be required (implying a Regulation)? Noting the deplorable state of the stock, and the low ambition of Member States so far, a deliberate choice was made for central planning/coordination/evaluation. The objective of the restoration process, and the post-evaluation of achievements are decided upon and executed at the central level (by the EU Commission), while the elaboration and implementation of protective measures are delegated to the Member States. Moreover, the responsibility that the Member States have is set in terms of achieved results, rather than required effort levels,¹ and Member States are obliged to monitor their own achievements. External perturbations and poor implementation might jeopardise adequate recovery and protection, but will not be acceptable as an excuse for lack of results.

Member States are supposed to adjust their management regime, in order to bring the results up to the target. Note, however, that after the objectives have been met and the stock is (on its way to) recovering, this set-up also allows Member States to compensate for unforeseen positive external impacts. In particular, voluntary contributions by third parties (be it restrictions on impacts or positive contributions such as restockings) may be counterbalanced by lower efforts made by the Member State's government. The final achievement is the individual responsibility of the government, while all parties involved might influence the process. In practice, Member State governments tend to integrate third party contributions into their own management plans; e.g. the voluntary ban on sports fishing landings in the Netherlands (approximately 200 t) that is now included in the national Eel Management Plan.

CITES

Eels are tough and can easily survive prolonged live storage and transport. Over 50% of the international trade in unprocessed products concerns live eels. International trading and processing has been reported from medieval times onwards, while local processing and consumption in rural communities is a common situation even today. International trade statistics are far from complete; available information indicates the following: For glass eel, export to

¹ In Dutch, this is known as a 'resultaatverplichting', in contrast to an 'inspanningsverplichting'. In the draft state of the EU plan for the eel, a continent-wide fortnightly closure of all fishing has been considered, which would have resulted in equal efforts in protection, rather than equal outcomes. But this line has not been pursued any further in the final Regulation.

Eastern Asia amounted more than 50% of the total catch in recent years, while for yellow and silver eel, Europe is a net importer. However, live eels of all *Anguilla* species, and all life stages are often imported, mixed and re-exported all over the world beyond traceability. In 2007, CITES included the European eel in Appendix II of this convention. From March 2009 onwards, export of live eels and all eel products over the outer borders of the European Union is only allowed with a Non Detriment Finding, a certificate ensuring that the export (and thus the exploitation) is non-detrimental to the stock. CITES implements a phasing-out of the existing glass eel exports (by annual quota) over a period of three years (2011/2012 no export). Since Europe is a net-importer of grown eel, this mainly concerns the export of life glass eel to eastern Asia, for aquaculture. The CITES implementation and the development of the EU protection plan are effectively overlapping each other.

3 Assessing the impact of a sales ban

3.1 Economic model

To our knowledge, there is no experience with explicit sales bans for eel, from which we could learn how the market and all chain partners will respond to a sales ban. However, the situation looks very much like the recent policy applied by some retailers to select only MSC certified species. The impact of such MSC driven sales bans are not yet fully clear.

The economic impact of the scenarios in this study has been explored using a simple economic model. The basis of the model is a quantitative overview of production (wild catch and farmed) and consumption of eel in the Netherlands and Europe in 2009 as presented in the Table 3.1 below. The sources of the data have been set out in Appendix 1.

Running the model under sales ban conditions as proposed in each of the scenarios allows estimation of the impact this might have on the economic performance of each partner in the eel chain. The results of such calculations depend on a number of assumptions which will be explained in the paragraphs below.

3.2 Eel production and trade

The economic analysis is based on the following details of the market chains for eel in the Netherlands.

Table 3.1 Production, prices and price flexibility of eel in the Netherlands and in Europe in 2009			
	Number	Volume (tonnes)	Value (m €)
Netherlands			
<i>Fishers</i>	280		
Catches yellow and silver eel		1,000	8.0
Estimated income			3.2
<i>Farmers</i>			
Use of glass eel		5-15	2-6.5
Production		3,500	31.5
Estimated income			12.6
<i>Smokers/processors</i>			
Estimated income			11.0
<i>Large retail groups</i>			
	5		
Domestic market share	50%		
<i>Small retailers</i>			
	1,500		
Domestic market share	11%		
<i>Consumption</i>		2,000	79.9
EU			
Catches yellow and silver eel		10,500	
landings glass eel		85	
Production farmed eel		9,000	
Consumption wild and farmed eel		24,458	
Landing price alive eel			8.00
Price farmed eel			9.00
Price flexibility			-1.0
Price glass eel			300-500
Source: See appendix 1.			

The eel market is an international market. The trade between EU countries amounts to about 9,000 tonnes and import from outside Europe is about 4,000 tonnes, including 2,500 tonnes from China. Exports outside the EU are small. For the Netherlands, trade within the European Union dominates (Table 3.2).

Table 3.2		Overview of European trade in eel products (alive, frozen, smoked eel, in 1,000 tonnes)									
Exporting countries	Importing countries										
	Belgium	Netherlands	Germany	Italy	Denmark	Poland	Other EU	Total EU	Outside EU	Total exports	
France	0.1	0.1	0.0	0.2	0.0		0.2	0.5		0.5	
Belgium		0.4	0.0	0.0	0.0		0.1	0.5		0.5	
Netherlands			1.6	0.1	0.1	0.1	0.8	2.7		2.7	
Germany	0.0	0.4		0.0	0.1	0.3	0.1	0.9		0.9	
UK		0.4	0.0		0.1		0.0	0.5		0.5	
Denmark	0.0	1.2	0.5	0.2		0.0	0.2	2.1		2.1	
Greece		0.3	0.0	0.2			0.0	0.6		0.6	
Spain	0.0	0.0	0.0	0.0			0.1	0.2		0.2	
Sweden	0.0	0.1	0.2	0.0	0.1		0.0	0.5		0.5	
Poland					0.1		0.1	0.2		0.2	
Other EU	0.0	0.3	0.0	0.0	0.0		0.1	0.4		0.4	
Total EU	0.2	3.2	2.3	0.8	0.6	0.4	1.8	9.1	0.3	9.4	
Outside EU	1.0	0.5	1.1	0.2	0.4	1.2	0.7	4.1			
Total imports	1.2	3.6	3.4	1.0	1.1	1.5	2.5	13.2			

Source: Eurostat - Comext.

3.3 Assumptions

Market process

When proposing a sales ban, the underlying assumption is that lower sales will result in less eel fishing or farming and that this will ultimately contribute to recovery of the eel stock. It is questionable whether this expectation is justified in the case of a partial sales ban as proposed in most of the scenarios. Consumers and market partners will try to avoid or compensate the effect of a sales ban, at least partially. And in doing so, they will reduce the effect of the ban.

Under free market conditions the following processes can be expected:

- Consumers finding out that eel has been taken out of the counter in their regular supermarket may accept the ban and stop being an eel consumer,

or may buy eel in other supermarkets if not all chains will support the ban, from fishmongers or directly from an eel processor or even from fishers. Data on fish consumption in the Netherlands (GfK, 2007) indicate that consumers who regularly buy fish in supermarkets also spend 35% of their fish Euros in fish shops. That means that they can easily switch a larger share of their fish budget to the fish shop, if supply in supermarkets changes. Retail outlets not supporting the ban can benefit from additional sales and possibly a few new clients. The success of a sales ban depends above all on the number of consumers who permanently stop buying and eating eel. If the consumer preference for eel appears to be very strong and pertinent, only a general sales ban will be effective.

- Eel processors delivering to the retailers who support the ban will directly been hit by a sales ban. However, under free market conditions they will try to find other customers in order to maintain their production lines. If directly involved processors will not successfully re-arrange their network of customers, others will take over their production.
- It might be expected that eel fishers and farmers will deliver to others if their present buyers/processors will be hit by sales bans. If large groups of consumers stop eating eel and demand for eel declines, it is likely that all (European) fishers and eel farmers might experience lower prices. However, as long as eel prices remain above the variable production cost, lower prices are no reason for reducing eel production immediately. Even if eel prices will fall below critical limits, the decision to structurally reduce the production capacity will probably been taken only after considerable time lag, especially if fishers or eel farmers have invested in their eel activities recently. Ending a (eel) fishing business is a complex decision which depends also on availability of satisfactory alternatives (inside and outside fishing), the age of the owner and the availability of a successor. The production planning of eel farmers will also depend on the price of glass eels and the opportunities to change to other species. The limitation of glass eel exports following from the CITES agreement interferes with a sales ban.

Eel fishers and eel farmers will only reduce production if the sales ban will drive prices structurally below critical levels.

In conclusion, the final reduction in eel fishing and aquaculture achieved in the field will probably be smaller than the volume of sales being banned in the market.

Common European market

The impact of market changes can only properly be assessed in a European context, even if the cause of the changes is national or local. This implies e.g. that a sales ban by one or two players of national relevancy dissipates largely to the European market. When assessing the total European supply, also imports into the EU have been included. Imports from China increased recently.

It is assumed that the eel market is geographically limited to Europe. European eel is practically only sold inside Europe since extra EU exports of eel are negligible.

Single eel market

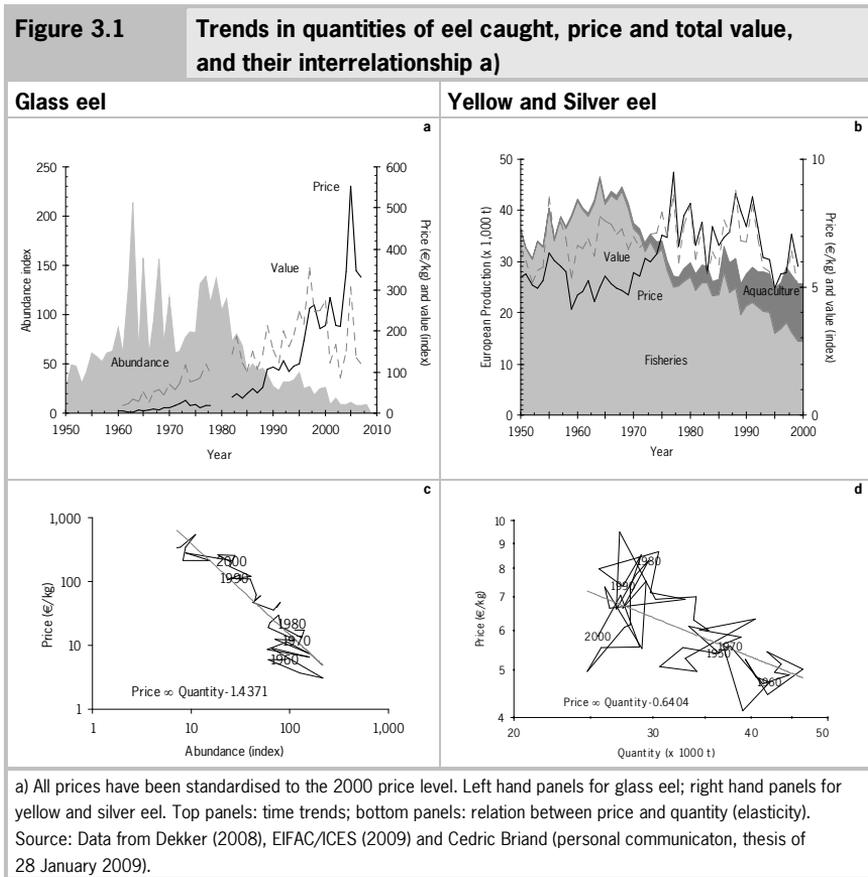
It is assumed that markets for wild captured eel and farmed eel are integrated and belong to one market (silver eel and yellow eel). This does not mean that all eel are equal (in quality and price) but that prices of different eel categories follow each other over time; if the price of one category changes markedly, the others will follow.

Next to the market for yellow and silver eel it is assumed that there is a European market for glass eel. Both markets are indirectly linked by the eel farming sector.

Eel price formation

Price changes are crucial when assessing the impact of sales bans. Quantities produced, consumed and prices paid have a mutual influence on each other, where price paid might set the willingness to produce/consume, while the decline of the stock in the past and coming decades will lower production, which in turn might increase prices being paid. In the case of fisheries, the relationship between volumes and prices is generally expressed in terms of price flexibility, i.e. the % price change when volumes change 1%. To our knowledge, these relationships have only been analysed for eel by Frost et al. (2001), Dekker (2004a, 2008) and Briand (personal communication, in his thesis of 29 January 2009) and none of these authors gave a comprehensive analysis. Data are presented in Figure 3.1 at face value. For the European fisheries on yellow and silver eel fisheries scattered across Europe, catch volumes gradually declined since 1960, though rising aquaculture production since the early 1980s did increase the total quantity of eel on the market. Prices rose during the period of decline, but lowered due to the introduction of aquaculture products on the market. In most recent years, a substantial reduction in price was observed, which might be related to more frequent re-imports of European eel from China

on the European market. The price flexibility is found to be in the order of -0.64, indicating that a 1% decline in yield comes with a 0.64% rise in price, and a 0.36% decline in total market value. Nielsen (2009) estimated a flexibility of all European fresh fish prices for changes of total European supply in the magnitude of -1.2. In our calculations below, the price flexibility was assumed to be -1.0, indicating that all changes in landings will be offset by equal price changes. Prices changes are first estimated for first-hand markets for live eel, i.e. prices received by fishers and eel farmers.



For the glass eel fisheries around the Bay of Biscay, catch volumes declined since 1980, prices rose almost consistently during the whole study period

(1960-present), and total market value rose from 1960-1990, but stabilised thereafter. The price flexibility estimated from these historical data comes at a value of -1.44, which is in reasonable agreement with Frost et al. (2001), finding a value of -1.59 using ten years of Japanese glass eel prices. This number means that an increase in glass eel abundance by 1% will decrease the price paid by 1.44%, lowering total revenue by 0.44%. However, these estimates are based on the whole range of data years (1961-present), and most recent data (1980-present) indicate a much lower flexibility of -0.99. In our calculations, the price flexibility for glass eel was also assumed to be -1.0.

It is assumed that a reduction in demand will have the same effect as an increase in supply.

Constant Gross margin

The economic model applies a simple approach to estimate margins and income for each party in the eel chain after primary production. It is assumed that gross distribution margins are constant. This implies that price changes estimated for the first-hand markets will be transmitted to downstream parties maintaining a constant margin for the value added (for processing, distribution, profit, et cetera) delivered by each party in the eel chain.

Further details and references for the parameters used in the model have been set out in Appendix 1.

3.4 Biological effect of reduced sales

If a sales ban leads to lower demand and reduced exploitation, this will have a positive effect on the wild stock. For aquaculture, this will primarily affect the source areas of the glass eel (France, England, Spain, Portugal), while for the Dutch fisheries, the effect is expected within the Netherlands.

For the Dutch fisheries, any reduction in quantities being caught nearly translates proportionally into an increase in the production of silver eels. Dutch fishing legislation (e.g. minimum legal size) has been set up with a view to optimise the yield per glass eel, by targeting yellow eels close to the silver eel stage. Any protected yellow eel might gain some weight while growing to the silver eel stage, but this gain is offset by additional natural mortality, making the net gain negligibly small. In the silver eel stage, any reduction in silver eel catch directly translates into an increased production of silver eels.

In the yellow eel stage, an increased density of the yellow eel stock might in principle lead to reduced productivity, through density-dependent processes (density-dependent growth, mortality, sex determination or migration). Though density dependence is known to exist in eel (see ICES 2003 for an overview), it is extremely unlikely that this will actually occur within the foreseeable future (Dekker, 2008). Current stock densities are far below historical levels (glass eel: <5%, yellow and silver eel: <20%). There have been fierce political debates, whether the current ecosystems within the Netherlands still could sustain eel stocks at densities as high as in historical times. However, noting the current low density and the extremely low rate of recovery (decadal or centennial, anticipated even if fisheries and other anthropogenic mortalities would be reduced to zero), the issue of potential density-dependence is not relevant for the current discussion. For a period of decades, a reduction in exploitation will result in a direct increase of the quantity of silver eels being produced.

Silver eels produced in inland waters return to the ocean. On their way out, they experience mortality, due to fishing, hydropower generation and water pumps, cormorants, etc. Extra quantities of silver eel produced due to a sales ban thus will be reduced by mortality in the silver eel stage. Consequently, only part of the quantities actually contribute to the ocean stock. Current mortality in the silver eel stage is estimated at an order of magnitude of 60-70% of the silver eel run (of which 10-25% by unknown causes), and 20-25% mortality is caused by fisheries. Consequently, marginal restrictions in fishing pressure are expected to result in an increase in silver eel escapement of only 30-40% of the quantity saved from fishing. The extra mortality in the silver eel stage is an argument for more intense restrictions on fishing. Contemporary other management measures might reduce the extra mortality in the silver eel stage.

For the glass eel, the effect of a reduced demand (for aquaculture) on the stock is hard to predict. Until 2009, the international market has been dominated by Asian demand, but the implementation of the CITES listing is likely to reduce this export within a couple of years. Alternative demand exists for direct consumption (mainly in Spain) and for restocking in the Netherlands and other European countries. Finally, a reduced demand might result in a smaller quantity being caught. At the same time, however, the stock is quite likely to experience a continuation of the past downward trend, and implementation of Eel Management Plans will further reduce the quantities being caught - i.e. supply is likely to be reduced anyhow. Consequently, it is not very likely that demand will limit supply in many years to come. Noting that many EU countries intend to increase restocking within the framework of their national Eel Management Plans, a shift

from aquaculture to restocking seems most likely, i.e. the glass eel will become available for the wild stock. However, by restocking, glass eels are effectively transplanted over large areas, and there is no direct proof of (the lack of) potential detrimental effects of long distance transplantations. Though ICES (1998-2006) advised against reliance on restocking, the EU Regulation fully accepts restocking as a restoration measure.

3.5 Indirect effect of reduced sales

Effect of sector funding on restoration projects

Exploitation of eels might also generate a budget for management, protection and restoration. Several parties in the Netherlands have argued that reducing or closing their business would result in loss of funding for restoration projects. Amongst others, Foppen Paling en Zalm in Harderwijk, and Nijvis in Nijmegen, are currently (2009) involved in restoration projects, and the recently established Future For Eel Foundation has planned to do so. In this section, the rationale for this will be analysed.

Available funding

Current discussions focus on funding the restocking of glass eel (and 'pre-grown' yellow eel). For the fisheries on yellow and silver eel, Frost et al. (2001) calculated a potential yield of 96 kg (at an average size of 40-65 cm, 100-500 gr) for each kg of glass eels being stocked; assuming a price of €185 for the glass eel and €3.50-€4.50 for yellow and silver eel, final turn-over comes at nearly €400, *exceeding the costs* of the glass eel by a factor of approximately 2. Klein Breteler (2009) calculated a potential yield of 27 kg (at an average size of 40 cm, 100 gr) for each kg of glass eels being stocked; assuming a price of €750 for the glass eel (in hindsight, this is the exceptionally high price paid in 2005 only; see Briand op.cit.) and €8.50 for yellow and silver eel, final turn-over comes at just over €225 which is a factor 2 *below the costs* of the glass eel. However, both authors compare the costs of stocking to the final turn-over, without subtracting the costs of fishing. It seems reasonable to assume that the costs of fishing (including material as well as labour costs) are close to the price being paid for yellow and silver eel, i.e. profit margins are small. Consequently, restocking of glass eel into outdoor waters is not a viable economic option anymore; substantial restocking programmes in 1950-1980 have indeed been discontinued for economical reasons. Fisheries based on

stocked glass eel are currently not sustainable, and no financial margin will exist to contribute to stock protection and restoration.

For eel aquaculture in intensive recirculation systems, Frost et al. (2001) calculated a potential yield of nearly 400 kg per kg of glass eel used. Since 2001, the efficiency of aquaculture facilities will have improved further. Assuming an up-to-date selling price of €9.00 per kg of grown eel (Appendix 1), final turn-over comes at €3,600 per kg of glass eel. This covers the cost of the glass eel seeding the aquaculture, as well as all other production costs and a profit margin. The use of glass eels for aquaculture has indeed increased since 1980. Any increase in sale price thus creates an additional profit margin that can be used to contribute to stock protection and restoration measures.

The high efficiency of production in aquaculture has been used as an argument in favour of stocking of cultured ('pre-grown') eel, in contrast to the stocking of glass eel into the wild. However, cultured eels might be ill-adapted for survival in the wild; quantitative information on survival and production of cultured eels after release into the wild is missing. Foppen Paling en Zalm is currently (2009) executing a full-scale experiment in de Randmeren (parts of the former IJsselmeer near Harderwijk, the Netherlands) to fill this knowledge gap. These experiments are financed from an extra profit margin paid by Foppen Paling en Zalm, and their customers. The final aim of this experiment is to compare the pros of efficient aquaculture to the cons of potentially ill-adapted animals, which might result in a net effect that can be positive or negative.

In principle, additional budget for protection might compensate completely for the exploitation on which the additional budget is based. If this is intended, however, the positive impact of the protection programme should exceed the negative impact of exploitation. For fisheries on yellow and silver eel, this is no option for economic reasons (as worked out in the paragraph above). For aquaculture, the extra profit margin should suffice to take at least one extra kg of glass eels out of the market; at current prices (2009) this boils down to an extra margin of approximately 10% on the price (€300-€500 for the extra kg of glass eel, in comparison to €3,600 for the 400 kg of grown eel produced). However, double-counting should be avoided: the protective effect paid for by the additional budget should be attributed to the management of either the glass eel source area, or the glass eel restocking area, but not to both. Additionally, the extra glass eel should be purchased from a source that would otherwise not have protected them, i.e. a shift from one protection programme to another does not make sense.

Compensating impacts by restocking

Elaborating the option to purchase glass eel for restocking on the basis of an extra margin on the selling price, both the source and the destination of these glass eels need careful consideration.

In the current initiatives, the extra glass eel has been obtained from the international market at commercial prices, competing with the use of glass eel for aquaculture and export. This has effectively shifted some glass eel back into the wild. Implementation of the EU Regulation later this year (2009) will change this situation completely. Under the EU Regulation, a fixed percentage of the total glass eel catch (increasing stepwise from 35% in 2009/2010 to 60% in 2014/2015) is to be reserved for restocking. Member States are obliged to ensure that the adequate percentage is indeed restocked, within their own territory or abroad. Since there is an obligation to sell glass eel for restocking but no obligation to buy, prices will adjust downwards until there is a demand for the total quantity (though the currently proposed Eel Management Plans apparently shy away from extensive restocking, because of the historical prices). Initiatives for extra restocking might purchase glass eel from this quantity, in which case prices will rise, but the quantity will not change. Purchase outside this quantity will increase the pressure on the free part of the glass eel market, which in turn will increase the price. (Note that the protection initiatives thus compete with the aquaculture industry on which they are based. And note that the extremely high prices will affect the political evaluation of glass eel prices foreseen by the EU Regulation in 2011). At the bottom line, protection initiatives consequently need to document their glass eel resources, and need to ensure that these glass eels are not making part of the restocking percentages of the EU Regulation. To our knowledge, none of the ongoing protection initiatives has done so yet.

On the receiving side, the waters being restocked must be adequately managed too. The EU Regulation sets a restoration target in terms of the biomass of escaping silver eels, but the current stocks are generally far below that level. Restoration towards the target depends on the (anthropogenic) mortality exerted on the stock. In areas managed by biomass targets (i.e. sharp reductions in mortalities for as long as biomass is below the target), restocking will not contribute to the restoration when the target has been met. Extra glass eel will increase the opportunity for exploitation, but will not raise the escaping biomass above the target level. In areas managed on the basis of mortality levels (that is the relevant target for the Netherlands in the coming decades; Dekker et al., 2007), the extra glass eel will result in increased escapement only in as far as they are not exploited. The net effect of restoration initiatives hence depends

crucially on the details of the local Eel Management Plan. Care should be taken that the positive effect of restoration initiatives is not buffered by a reduced protection effort in the remainder of the EMP. To our knowledge, none of the ongoing protection initiatives is currently embedded in the relevant EMP, i.e. restocking is already included as a stock restoration measure under the EU Regulation, while ongoing mortalities have not been compensated for.

Compensating impacts by a buy-out of the fishery

As an alternative to compensation measures (positive measures off-setting the negative impact of exploitation), one might also consider compensating negative impacts by reducing other negative impacts. Funds available on the basis of exploitation (fishery or aquaculture) could in principle be used to reduce or stop other impacts. Klein Breteler (2008, Table 4.9) calculated costs and benefits of various management measures, and concluded that a buy-out of the wild fishery is having by far the most cost-effective result in the long run.

A precedent for a buy-out has been set by the North Atlantic Salmon Fund (www.NASFworldwide.com), which reduced fishing on wild salmon by a fisher buy-out since the early 1990s. Unlike the salmon case, the current suggestion of a compensatory buy-out for eel requires that the restrictions on fishing are not buffered by a reduced protection effort in the remainder of the relevant EMP, and that positive effects are not annihilated by unmanaged impacts following.

Cultural aspects

Eel fisheries contribute to the small-scaled, rural economies found in almost all European coastal states (Dekker, 2004a). In the early 1990s, the number of fishers for which the eel constituted an essential part of their income was estimated at 25,000 for all of Europe (Moriarty and Dekker, 1997). Loss of opportunities for eel fishing will negatively impact the rural communities. We know of only one case (Boude et al., 2007) in which the direct and indirect profits of eel fishing to the local communities has been quantified, including the indirect profits due to the cultural value of the rural communities. Currently available information does not suffice to judge this analysis, or to develop a parallel in other areas. In the Netherlands, examples are known from Volendam and other ports along the IJsselmeer coast. However, it can be argued that the indirect profits and the cultural value of eel fishing should not be discounted as long as eel fisheries are not completely closed.

Existing eel fisheries in the Netherlands generate a direct income from fishing and selling eel, and an indirect income from by-catches, cultural values (tourism), and additional incomes. The depleted state of the stock necessitates restrictive measures, which will affect the fishery particularly in its direct income. The indirect income and cultural aspects, however, do not require a maximisation of the catch. A major shift in focus from maximising the catch and direct income, to minimising the catch while serving other goals, will be required. It should be recognised that such cultural aspects, even where they are very important for a local economy, may not offer a sound economic basis for all existing eel fishers.

4 Results

4.1 Scenario 1a: No sales ban - Eel fisheries and farming continue where possible

Explanation by WWF Netherlands in the ToR

'This scenario was advocated by the Dutch eel sector. The sector stresses the importance of co-management and initiatives of the sector in the form of restocking of glass eels, research, combating illegal landings and lobbying for restoration of migration routes.

The sector also proposed to increase the number of fertile silver eels by restocking of young eel from high dioxin areas to 'clean' waters. In theory, this could have a positive impact on the European eel stock though there is no evidence that such restocking will have a positive impact on eel migration and reproduction.'

General observations

This scenario describes an unchanged situation of the Dutch eel fishing and farming sector including trap and transport of 157 tonnes of silver eels annually which is currently part of the Netherlands' management plan as required by the EU. Also the impact of private restocking programmes should be mentioned here.

Impact on stock restoration

The present negative trends in yellow and silver eel catches are likely to continue for at least a couple of years. The potential effect of trap and transport of silver eel into coastal waters is uncertain and unquantified, i.e. a release of 157 tonnes of silver eel into the North sea and of the restocking programmes. Trapping and transporting of silver eel from inland areas to coastal waters is a way to avoid mortality in hydropower plants and polder pumps, but release of fresh water eels into marine waters might result in adaptation problems.

The contribution of private restocking programmes is limited (see section 3.4). About 1 tonne of glass eel could be bought for restocking if all large retailers would participate. The present fund for restocking provides a potential annual budget of €500,000 if all large retail groups would participate. That budget will do for restocking of 1 tonne of glass eel at 2009 prices. Since this

is below the 5-15 tonnes of glass eels actually used, this scheme does not fully compensate for the exploitation on which the funding is based.

Economic impact

The present fishing and farming activities will continue. Current annual income (labour costs + profits) in the Netherlands by fishing, farming, processing and trading eel is estimated at about €40m.

In addition, the costs of trapping and transporting of silver eels are estimated to be €1m. We assumed that costs for trap and transport are based on the volume and relatively low prices, thus ignoring the costs of transport and release. The eel fishers assumed a price of €5 per kg for the initially proposed 50 tonnes of eel to be released, which totals €250,000 (CVB, 2009). Given the much larger quantity now proposed, i.e. 157 tonnes, an average price of €6.50 has been applied in the calculations. The costs for trap and transport of 157 tonnes of silver eel then will exceed €1m, while the Minister provides compensation of €700,000 only. We do not consider additional costs for compliance monitoring and control of the trap and transport operations, as well as the costs for quality assessment of the silver eels being released, though these costs will in reality be made.

The fund raising for private restocking programmes is effectively paid by the consumers. A levy of €1 per kg smoked eel fillet would bring in €165,000 (2 retail groups), respectively €500,000 (if all large retailers would participate).

4.2 Scenario 1b: No sales ban for large retailers and consequently for the fish farmers - Closure of (Dutch) wild caught eel fisheries

Explanation by WWF Netherlands in the ToR

'Fishing eel has a negative impact on the eel stock because this fish has not yet reproduced itself. This might lead to the assumption that wild catch causes more damage to the eel stock than eel farming. Moreover, the income of eel fishers declined as has the number of eel fishers. This raised the question whether, under the EU management plan, the costs of managing eel fisheries will not exceed its earnings.

An additional question is to which extent fishers could be charged with restocking programmes and how large the annual costs of such operations will be.

General observations

This scenario envisages a situation where the fishery on yellow and silver eel comes to an end, which is presumed to have a large effect on the small(er) retailers and some processors, but not on the eel farms. Hence, sales through the large retail chains continue. In the following sections, two options have been analysed: a ban only for Dutch fishermen and an EU-wide ban.

Impact on stock restoration - Dutch ban

When only the Dutch fisheries would be banned, the landings of yellow and silver eel in the Netherlands will be zero, allowing the adult eels to move to the sea and hopefully procreate. At European level, the escapement of silver eel is expected to increase, by an unknown percentage of current escapements.

On the other hand, the catches and import of glass eel remains the same or might even increase following from much higher eel prices. So there is still an impact on the overall eel stock.

Economic impact - Dutch ban

Table 4.1 presents the economic effects of a sales ban of yellow and silver eel. In case of a ban on Dutch fisheries, the total European landings of yellow and silver eel will decrease by 10%, whereas glass eel landings for aquaculture will remain the same. This will lead to a small decrease of the total supply of eel on the European market, inducing a limited price increase (4%). The income in the Dutch eel sector will decrease, mainly due to a loss in income in the fishery, but also due to a decrease in the processing sector involved in processing of wild caught eel. Retailers will suffer a small loss because they will have to cope with reduced supply and higher prices. The aquaculture will benefit from the higher prices and in a later stage the higher eel prices might boost eel farming in Europe.

Table 4.1		Economic impact of a closure of the fisheries for yellow and silver eel in the Netherlands and in the EU a)		
		Ref	NL ban	EU ban
Income	(m €)	34	28	34
Income change	(m €)		-6	0
Income change	(%)		-17%	0%
- NL fishermen		3.2	-100%	-100%
- NL eel farmers		12.6	4%	75%
- NL processors		11.0	-27%	-27%
- Retail ban		3.3	-4%	-45%
- Retail other		4	-4%	-45%
Production change				
- Wild catch		10,500	-10%	-100%
- Farmed		9,000	0%	0%
- Total		19,500	-5%	-54%

a) Percentages are expressed relative to the 2008 landings.
Source: LEI.

Impacts on the stock - EU-wide ban

The last column of Table 4.1 presents the impact of a European ban on yellow and silver eel fishing, with the exception of the glass eel fisheries in order to provide the aquaculture sector with seed stock. In case of an EU-wide ban, landings of yellow and silver eel will be zero all over Europe, allowing the adult eels to move to the sea and hopefully procreate. In the case of a Europe-wide ban the escapement of silver eel is expected to increase by an amount (nearly) equal to the existing landings. Since current escapement is virtually unknown, the contribution to the escapement cannot be quantified.

On the other hand, the catches and import of glass eel remains the same or might even increase following from much higher eel prices. So there is still an impact on the overall eel stock.

Economic impact - EU-wide ban

A European ban on fisheries for yellow and silver eel will cause a major reduction in the supply of yellow and silver eel (54%) and therefore boost eel prices by 75%. This will obviously be much to the benefit of eel farmers and glass eel fishers. There will be no direct impact on the glass eel fisheries for aquaculture. Retailers will be faced with much higher prices following from tight European

supply. This will also hold for retailers only selling farmed eel since markets for wild captured and farmed eel are presumed to be fully integrated. The loss to the processing sector, in particular to those who process wild catch will also be considerable. However, the gain in income for eel farmers (higher prices) will compensate for the losses in the other sub-sectors so that the overall economic effect of an EU-wide ban on the Dutch sector will be negligible.

4.3 Scenario 2a: Sales ban for large retailers (and consequently for aquaculture) - Wild catch fisheries continue

Explanation by WWF Netherlands in the ToR

In this scenario it is assumed that by ending the bulk of eel production and sales, the sector will be forced to restructure. A sales ban will particularly affect eel farming and landings of glass eel. At the same time no (costly) actions are taken to restrict local small scale fisheries. Instead, the saved money might be used for restocking programmes. Eel will be a delicacy. Historic and cultural values dedicated to eel will be safeguarded. Eel fishery is restricted to small scale businesses.

General observations

This scenario describes a combination of a ban on farmed eel which supplies the large supermarket chains, while the eel fisheries and sales by the typical small scale retailers at the current level continues.

However, the expectation that only the farmed eel chain will be hit by a sales ban for large retailers is only partly true. It is true that large retailers sell mostly farmed eel and wild eel is mostly sold in small shops. But all these markets are linked. Following from the integration of European markets for captured and farmed eel, a sales ban for farmed eel in supermarkets would affect also the prices of wild captured eel and therefore the income and future landings of yellow and silver eel fishers.

Impact on stock restoration

The sales ban may result in lower landings of glass eel and/or yellow and silver eel. However, the impact is ambiguous. Aquaculture is based on (wild-caught) glass eel obtained on the international market. If a sales ban for cultured eels results in a lowering demand, these glass eels might become available for re-

stocking, but international glass eel quotas (for export and restocking), and the potential (lack of) willingness to invest in restocking, complicate the prediction of effects.

Economic impact

Three extreme situations have been analysed in order to explore the limits of the results which might be expected from a sales ban:

A. *Dynamic consumer - constant eel supply*

Consumers faced with empty counters go to other (smaller) shops and trade channels reorganise accordingly. Therefore total EU demand and supply of eel remain the same.

B. *Fewer consumers - constant supply*

Consumers faced with empty counters support the trade ban and give up buying eel. Assuming that eel fishers/farmers maintain the same production, prices will drop. Market chains will have to be reorganised accordingly and the same amount of eels will now be sold to fewer consumers at the remaining retail outlets in Europe.

C. *Fewer consumers - lower supply*

Consumers faced with empty counters will support the trade ban and give up buying eel. Producers faced with lower prices will reduce production and prices recover. As a result both demand and supply will be lower.

As argued above, results between situations A en B are most likely, in particular on the short term. Situation C indicates the maximum impact of a trade ban which will only be achieved if the trade ban will cause critical and long-lasting price reductions which will result in restructuring of eel production.

The extreme situation C will occur only in case the estimated price fall will result in scaling down the eel fishery or the eel farm sector. Restructuring of production will push supply, demand and prices into a new equilibrium. In this exceptional case, the volumes covered by the trade ban will equal the restructuring of production and prices will recover to the old level.

Two options have been analysed: a sales ban by two large national retailers and a ban by all national large retail groups (see also the Tables 4.2 and 4.3).

If retail groups support the sales ban, this will diminish their income from eel sales. The effects on other actors in the eel chain are not this clear and depend largely on the consumer behaviour. In general, the effect of the ban will be zero, if consumers simply switch to other shops and keep on buying the same amount of eel. If they give up buying eel, this will lead to lower consumption and lower

prices (situation B) or, ultimately, lower production (situation C). In case of a ban by two retail groups the maximum effect on the total EU eel landings will be a reduction of 1%. The sales ban might also cause a reduction of glass eel catches for aquaculture of 1% and also processors will experience the same reduction in income. The main loss to the Dutch eel sector will be paid by the retailers supporting the ban. In case all large Dutch retailers support the ban, the effects on landings and income will be larger; up to 4%. This will result in a total loss for the Dutch eel sector of €3 to €4m, paid mainly by the retailers.

Table 4.2		Economic impact of a sales ban for eel by two large Dutch retail groups a)			
		Ref	Result A	Result B	Result C
Income	(m €)	34	31	30	30
Income change	(m €)		-3	-4	-4
Income change	(%)		-9	-12	-13
- NL fishermen		3.2	0%	-4%	-4%
- NL eel farmers		12.6	0%	-4%	-4%
- NL processors		11.0	0%	0%	-4%
- Retailers ban		3.3	-100%	-100%	-100%
- Retailers other		4	4%	0%	0%
Production change					
- Wild catch		10,500	0%	0%	-4%
- Farmed		9,000	0%	0%	-4%
- Total		19,500	0%	0%	-4%
a) Percentages are expressed relative to the 2008 landings. Source: LEI.					

Table 4.3 Economic impact of a sales ban for eel by all large Dutch retail groups a)

	Ref	Result A	Result B	Result C
Income (m €)	34	31	30	30
Income change (m €)		-3	-4	-4
Income change (%)		-9	-12	-13
- NL fishermen	3.2	0%	-4%	-4%
- NL eel farmers	12.6	0%	-4%	-4%
- NL processors	11.0	0%	0%	-4%
- Retailers ban	3.3	-100%	-100%	-100%
- Retailers other	4	4%	0%	0%
Production change				
- Wild catch	10,500	0%	0%	-4%
- Farmed	9,000	0%	0%	-4%
- Total	19,500	0%	0%	-4%

a) Percentages are expressed relative to the 2008 landings.

Source: LEI.

It can be concluded that the total European demand/supply will fall marginally (1% if only 2 retail groups and 4% if all national retailers would support the ban). This will result in slightly lower prices for eel farmers and both glass eel and yellow and silver eel-fishers. Due to the lower prices, some glass eel fishers may stop. However, it is more realistic to expect that yellow and silver eel fishers will stop first, given their poor economic performance in 2009.

The Dutch eel sector will structurally lose income in the order of €1m if only 2 retail groups support the ban and €4m if all national retailers would get involved. Retailers supporting the ban pay the largest part of the bill. Retailers not supporting the ban might benefit from additional consumers. In the short run, the eel processing industry will face additional costs for restructuring their network of customers.

4.4 Scenario 2b: Complete sales ban - Closure of fisheries and farming

Explanation by WWF Netherlands in the ToR

It is assumed that a complete sales ban will reduce both demand and supply to zero. This follows the biological advice, that stated: 'all anthropogenic impacts on production and escapement of eels should be reduced to as close to zero as possible until stock recovery is achieved'.¹ Large retailers will first be asked to ban the eel which will force the eel sector to reorganise itself. Small scale retailers will possibly follow. It is assumed that this scenario will be the fastest way to recover the eel stock. However, recovery will only work out if other EU member states will follow, if there will come solutions for other barriers caused by e.g. pumping-stations and power stations and if there will be funding for restocking programmes. This scenario will have a number of implications: without a fishing sector the interest to participate in research and restoration programmes will also disappear. Depending on developing of the CITES agreement, supply might continue via China.

General observations

This scenario boils down to a complete closure/decommissioning of the Dutch (or European) eel sectors.

Impact on stock restoration

This scenario achieves the maximum reduction in fishing effort. In practice, a complete sales ban and a total closure would make all eel activities illegal. Fisheries-dependant information on the stock will be lost.

In the case of national bans for yellow and silver eel fishing and sales by large retailers, it is expected that escapement of adult silver eels will be increased by 10% (of landings) and demand of glass eel for European aquaculture would reduce by 40%.

Economic impact

This scenario comes down to a complete closure/decommissioning of the Dutch (or European) eel sector. The annual loss of income will in the case of the Netherlands be in the order of €35m.

5 Discussion

Data on the Dutch and European eel sector are sparse and incomplete. The data available allow only drawing the outlines of the economy of this sector. Some of the figures and parameters used in this study had to be estimated from indirect indicators. The results of this study should be judged accordingly.

The exploitation of the European eel is organised in small-scale rural enterprises, fishing for eel often in a traditional manner (Dekker, 2000; 2008). Trade and processing, however, are partly organised on larger scales, often crossing national boundaries. The strong relation between international supply and market prices indicates that there is essentially one world market for eel (Dekker, 2008). The export of glass eel towards eastern Asia in the past decades (and the related extreme rise in price) definitely has made glass eel an international commodity.

The request by WWF Netherlands to analyse potential effects of a sales ban for eel, as discussed in this report, focuses primarily on the production (fisheries and aquaculture), trade and consumption in the Netherlands, at a national scale. Our analysis of the markets for fresh and processed eel, however, indicates tentatively that market resilience is such that a restricted sales ban (partial or full), on the national scale only, will effect the landings of yellow and silver eel and of glass eel just marginally. Only larger bans organised at the international scale are expected to have a noticeable effect on the biological stock. This international scale fits in with the scale for management of the stock, where only the international level can set objectives, and can influence the overall state of the stock, though protective measures must be implemented on a national or lower level (Dekker, 2000; 2004; 2008).

In addition to the economic effects analysed in this report, the potential institution of a sales ban by prominent retailers may have a psychological effect on decision makers and consumers. In fact, even discussing a sales ban already has had that effect. Though we acknowledge the psychological effect, we saw no way to quantify its effect on sales and stock exploitation, and therefore excluded it from our analysis. Moreover, the psychological effect might well be restricted to a strengthening/advancing of the motivation to take required protective measures, and the psychological effect might wear off quickly.

It has taken considerable time to compile an international management plan for the eel, because of the complicated character of the problem

(Dekker, 2008). Following the presentation of a first proposal (2005), international discussions have focused on conflicts of interests between fishers of different nations, with national governments taking stand for their fishers.

However, discussions between types of stakeholders (e.g. between nature conservationists and fishers) were absent (Dekker, 2008). It is only during the compilation of the national Eel Management Plans that discussions between the different parties and stakeholders started in several countries in parallel. Apparently, this late start of the inter-stakeholder discussions has set the geographical focus of the discussion, which now results in ineffective proposals for a sales ban on the national level.

Even at national level, it is uncertain how many retail groups would support a sales ban. The umbrella organisation CBL announced that all its members will only supply sustainably produced fish that meets criteria set by MSC (Marine Stewardship Council) by 2011. It is uncertain whether this target will be met that soon also for products having a substantial sales value, like eel. Because of this scale problem, we have tentatively analysed the effects of a potential sales ban by 2 national retail chains versus a ban by all large retailers. If our line of reasoning is followed and if a(n) (inter)national sales ban can be achieved, the lack of organisation of all types of stakeholders at the international level will have to be addressed.

The European eel stock has experienced a prolonged decline, and the remaining stock constitutes a small percentage of the historical density. Due to the deep decline and the slow growth of the eel, restoration of the stock will take decades or centuries (Åström and Dekker, 2007), for which major reductions in anthropogenic impacts (fishery and other mortalities) are required. Temporary upward trends in stock abundance indicators might give a false impression of restoration, because of the high variation in monitoring data (Dekker, 2004), and transient periods of increase in an overall downward trend (Åström and Dekker, 2007).

A (partial) national sales ban, as suggested as one of the options by WWF Netherlands, will undoubtedly contribute to the protection of the eel, but since the impact of these measures is limited, it is doubtful if any effect on the overall eel stock might ever be detected.

Because of the downward trend observed in glass eel recruitment in the past decade, a major downward drift is expected in yellow and silver eel fishing yield, which will have a considerable negative (economical) impact on the fishing sector in the near future and in addition to the effect of a potential sales ban. Moreover, the Dutch Eel Management Plan submitted to the European Commis-

sion accepts a prolonged recovery period and enforces moderate restrictions to anthropogenic impacts. Potential beneficial effects of a (partial) national sales ban emerge during the range of years in which the effects of the national Eel Management Plan might also become visible. It is likely then, that the impact of the Management Plan will overshadow the sales ban. Adjustment and fine-tuning of the national Eel Management Plan will therefore add to the net effect of a (partial) national sales ban, i.e. the effect of the sales ban will be absorbed by the national Eel Management Plan, and the efforts of the national Eel Management Plan will probably be reduced accordingly.

A sales ban at the international level, however, may have a larger effect, that might be detectable in future monitoring data. However, a full sales ban will effectively result in a closure of both the fisheries and aquaculture. If achievable, the effect may go far beyond the European restoration plan that has been accepted by the Council of Ministers in 2007. Whether a full international sales ban would be achievable or not, goes beyond the scope of this report.

Effective management of the eel depends much on enforcement. All eel fisheries in Europe are basically small scale businesses with a large number of fishers involved. Monitoring such small scale sectors is a time-consuming challenge and the costs are therefore high. Also eel farms are generally small or medium scale but their number is limited and they might be easier to monitor.

In its ToR, WWF Netherlands raises the question whether the earnings of eel fishing justify the high costs of monitoring to comply with the EU Regulation. However, the costs of control and enforcement will not disappear with a closure of the professional eel fishery. Having a potential consumer value in the order of €20m, the eel will need protection by inspection authorities against poaching. This problem will get even more prominent in case of a sales ban and the assumed increase in prices. Undoubtedly, a full closure will be easier to monitor than a controlled fishery, but the difference in costs of monitoring is very hard to estimate at forehand.

In its ToR, WWF Netherlands suggests that when reserved for small scale fisheries, eel could be a delicacy and presumably have a corresponding high price. It should be stressed that this would only happen if a ban on eel farming were in place. Otherwise the prices received by the small scale fishery will also depend on the developments in eel farming, given the integration of markets for wild and farmed eel.

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Appendix 1

Parameters economic model

Dutch and European production statistics are derived from earlier studies (ICES, 2008; IMARES, 2008) and various statistics. For its calculations, the model uses the following figures: 1,000 tonnes of wild catch and 3,500 tonnes of farmed eels in the Netherlands (Productschap Vis, 2009); 10,500 tonnes of wild catch and 9,000 tonnes of farmed eel in Europe (FEAP).

Dutch consumption has been estimated along two lines. First, consumption has been calculated from the balance of production + imports minus exports (Eurostat-Comext). The weight of the trade flows has been converted to live weight by a factor 0.7 (smoked eels) for imports and 0.5 (FAO/SIFAR, 2001) for exports (smoked fillets). This calculation suggests 5,200 tonnes for domestic annual consumption. However, earlier analyses indicated that intra EU trade statistics are generally not complete.

Domestic eel consumption in the Netherlands was also derived from consumer panel data (GfK panelservices Benelux 2008). Panel data show 1,100 tonnes for home consumption. Earlier consumer panels (VCP, 1998) indicated that home consumption covers 60% of total domestic consumption, which should consequently amount to 1,800 tonnes per year.

Based on these two indications it is assumed that the annual Dutch domestic consumption amounts to 2,000 tonnes of live weight.

The market share covered by a sales ban was estimated by applying the following assumptions:

- Home consumption covers 60% of domestic consumption (GfK, 1998).
- Multiples have 80% market share of home consumption (GfK, 2007).
- WWF suggests that AH and Superunie consider a sales ban. The overall market shares of AH and Superunie are 31% and 34.8%. However, their market share for eel is expected to be lower, given a relative large eel market share of the discounters Aldi and Lidl. Therefore the eel market shares of AH and Superunie are assumed to be in the order of 25%. Superunie is in effect not a retail chain itself but a buyers' combine. If it is assumed that 25% of the multiples in the Superunie would support the ban, about 33% of the sales by multiple stores would be covered by the ban.

- It is assumed that all eels produced in the Netherlands are processed in the Netherlands.
- It is assumed that multiple stores only supply farmed eel. A diverse group of other retail outlets (fish mongers, catering services, restaurants), offer both eel from wild catch and farmed eel.

The price of live eel is assumed to be €8.00 per kg for wild catch and €9.00 per kg for farmed eel. The price of silver eel for trap and transport is assumed to be €6.50 per kg. Consumer prices are €40 per kg.

The trade margins in the eel chain are estimated as follows:

- The income (labour costs + profits/losses + interest for invested capital) of Dutch fishers are assumed to be 40% of their Gross Earnings. The income of eel farmers is supposed to be 5% of their Sales Value.
- The gross margin of eel processors is assumed to be 30%-35% of their sales value. Their income is supposed to be 70% of their gross margin. These assumptions are based on data from processing businesses as submitted to the Chamber of Commerce.
- The gross margin by multiple stores is estimated to be 30% and the corresponding income is supposed to be 50% of the gross margin. It is assumed that the gross margin by other retail outlets amounts to 35% and their income to 70% of their gross margin.

Appendix 2

Comments by stakeholders

A first draft of the report was presented to a group of stakeholders. The group included the following participants:

Krijn Poppe	LEI chair
Alex Koelewijn	Spakenburg Paling BV
Arjan Heinen	Combinatie van Beroepsvissers
William Swinkels	Nijvis BV
Bart Kraan	Gebr. Kraan Palingrokerij BV
Bertus van Panhuis	Foppen Paling en Zalm
Jac Tijsen	Klooster Paling
John Oosterhuis	Foppen Paling en Zalm
Ruben Hurkens	Albert Hein – Ahold
Maarten Mens	Productschap Vis
Wim van Eijck	Productschap Vis
Willem Dekker	IMARES
Hans van Oostenbrugge	LEI
Jos Smit	LEI

1. The workshop was in particular organised in order to check the assumptions and methods used in this report. The following comments have been made to the methodology and the assumptions applied in the report:

A number of comments and questions focused on the impact of measures on the eel stock. It was commented that the Dutch eel sector decided to a trap and transport strategy and that WWF Netherlands should have asked for an analysis of the impact of this strategy. It was stated that even the impact on the stock of a complete ban on fisheries is questionable. Others would have liked an explicit estimation of the impact of a sales ban (and marginally lower production) on the stock.

The group confirmed the assumption that the European market for captured and farmed eel are fully integrated and that the impact of national measures should be considered in an international scope. It was also argued

that the impact of any measures in the Netherlands will largely depend on measures taken elsewhere in the EU. The following examples have been mentioned. The CITES-regulation is considered to be very important but will take time. The EU protection plan includes escape clauses in case of price disruptions. The EU Regulation states that 40% of glass eel landings should be allocated for aquaculture. This would imply that quantities of glass eel available will fluctuate with the glass eel landings. National restoration plans may differ by Member State, e.g. a national ban on eel fisheries is currently applied by Ireland.

Several comments confirmed the uncertainty, as stated in the report, whether a sales ban would result in declining of demand for eel and consequently in reduction of (glass) eel catches:

- consumers may go to other retailers. Examples are the response of consumers to price promotions by discounters;
- suppliers to retailers in question confirmed that they would try to find other customers;
- a sales ban in the Netherlands might encourage (organisations of) glass eel fishers to develop markets for glass eel elsewhere inside or outside the EU.

The group claimed that only direct income of the eel sector has been considered. Eel and eel fishing are major drivers for cultural events and a touristic attraction of specific local communities. E.g. millions of Euros are spent at 'Aaltjes dagen' at the port of Harderwijk (see comments on this issue in Chapter 3).

The economic parameters presented in Appendix 1 were generally endorsed except the following amendments:

- the eel market share of the candidate sales ban retailers is lower than their overall market share (40%), due to a large eel market share of discounters. Consequently their eel market share has been adjusted to 33%;
- consumer prices should be lower (than €42.50 till €45.00) and have been adjusted to €40 per kg smoked eel fillets;
- the gross margins of retailers are higher than (30-35%) and have been adjusted to 35%. Consequently the gross margin of processors has been adjusted to 30%.

2. The following general comments have been made:

The eel sector opposes this initiative by WWF Netherlands. A sales ban would put a pressure on the sector but it would not start a discussion on steps forward. The sector invites WWF Netherlands to participate in such debates and to support the initiatives already started by the sector.

The sector fears that a sales ban would destroy the sector structure and the exchange of information which has been established in the market chain for farmed eel and which is coming into being for the fisheries sector. In a concerted action, a processor and a retailer raised a fund for eel restoration projects by means of a levy on eel products, €400,000 have been collected in this fund which is currently being used for restocking experiments. A sales ban would interrupt this and other restoration projects being financed by the eel sector. A ban would push the eel farming sector back into gray markets. It would be a step back for the further development of a professional and responsible eel chain and it would further complicate tracing of (glass) eel trade in the future.

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