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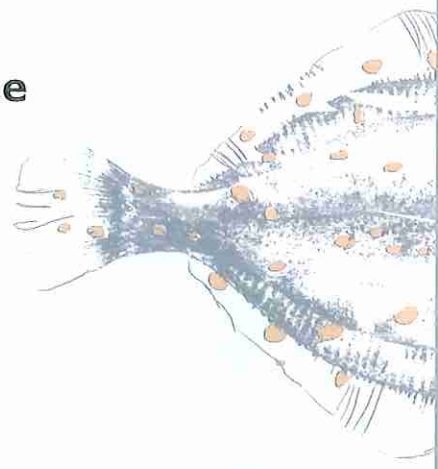
Report on the eel stock and fisheries in the Netherlands 2016/2017



O.G. Bos

CVO Report 18.005

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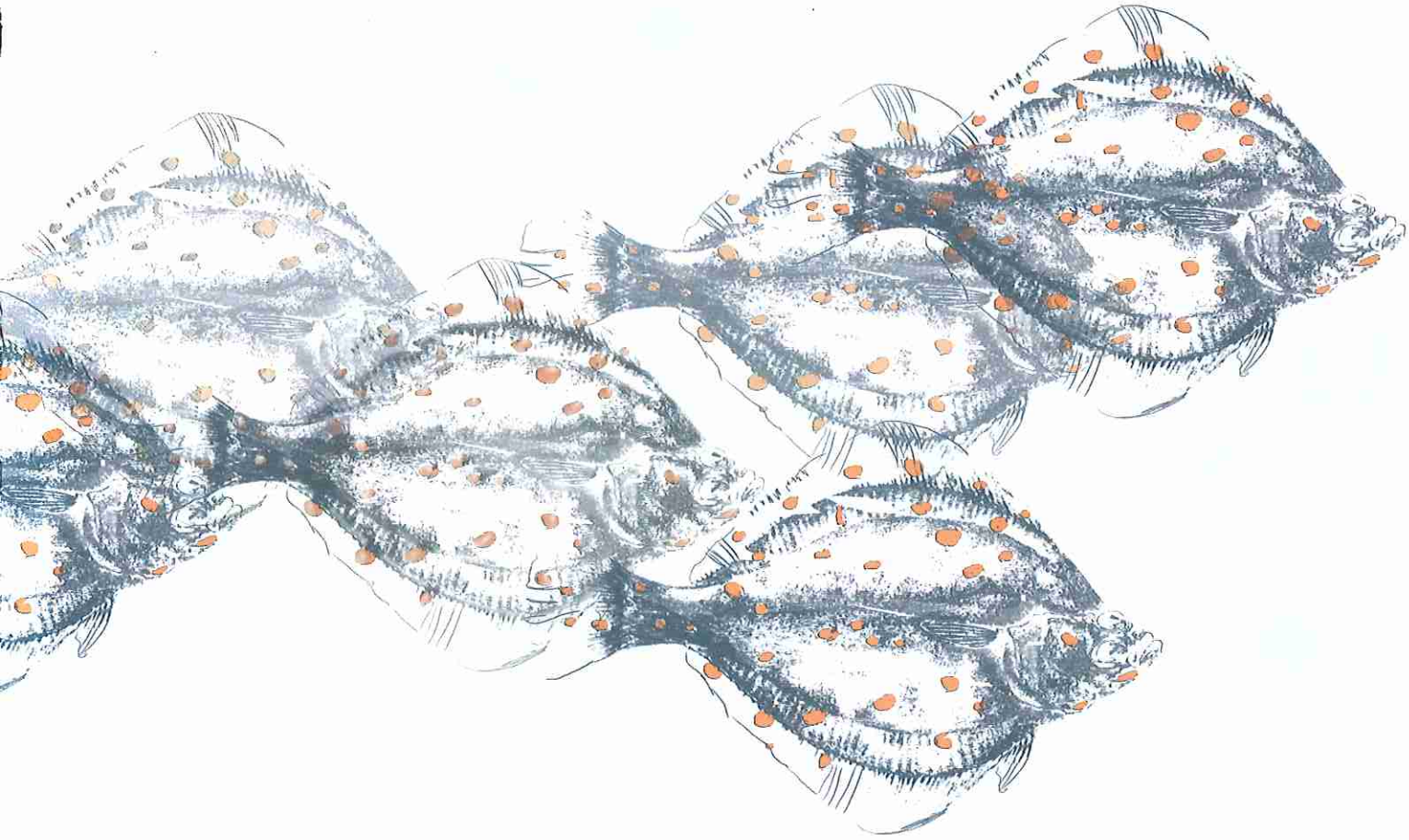

Centrum voor Visserijonderzoek (CVO)

WAGENINGEN
UNIVERSITY & RESEARCH

Stichting Wageningen Research
Centre for Fisheries Research (CVO)

Report on the eel stock and fisheries in the Netherlands 2016/2017

O.G. Bos

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1 Nederlandse Samenvatting

In Hoofdstuk 1 van dit rapport wordt een Nederlandse samenvatting gepresenteerd van de belangrijkste trends in de aalpopulatie in Nederland voor de periode 2016/2017. Het Engelse deel van het rapport (vanaf Hoofdstuk 2) is uitgebreider en is in september 2017 ingebracht bij de jaarlijkse aalwerkgroep (WGEEL) van ICES. Er is in 2017 geen verandering in de perceptie van de status van het bestand van de Europese aal.

Meer informatie:

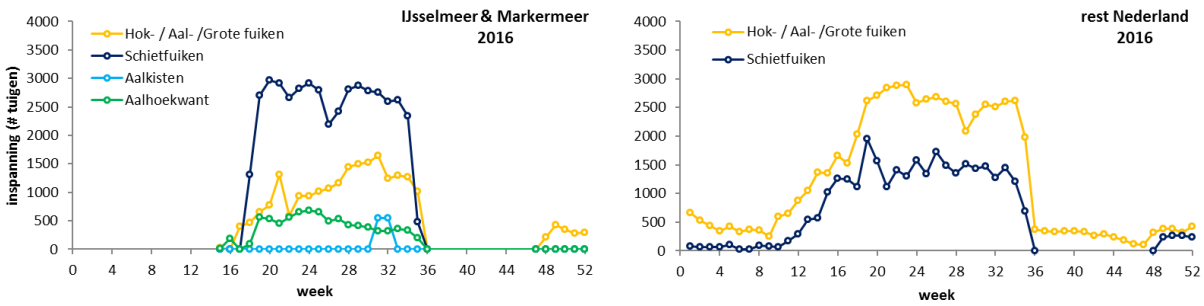
- Het Europese rapport over de stand van aal in Europa is te downloaden via: http://ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2017/WGEEL/wgeel_2017.pdf
- De Europese landenrapporten ('country reports'), inclusief het Nederlandse rapport, zijn te downloaden via: http://ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2017/WGEEL/WGEEL_CRs_2017.pdf

1.1 Menselijke invloed: visserij, uitzet en aquacultuur

1.1.1 Trend aalvangsten beroepsvisserij

De visserij op aal in Nederland vindt plaats in meren, rivieren, kanalen en kustwateren, met de grootste concentraties in de wateren in de lagere delen van ons land. De visserij op aal in Nederland wordt sinds de invoering van de Europese Aalverordening en het Nederlandse Aal Beheerplan beter gedocumenteerd. De eerste stap was de invoering van de verplichte vangstregistratie voor aalvissers per 1/1/2010 (data bij ministerie van LNV, Tabel 1). Een nadeel van deze registratie is dat rode aal en schieraal vangsten gecombineerd worden geregistreerd en dat vistuig en visserij-inspanning niet werden gedocumenteerd . Het Ministerie van LNV heeft per 1/1/2012 het vistuig en visserij-inspanning opgenomen in de verplichte digitale vangstregistratie.

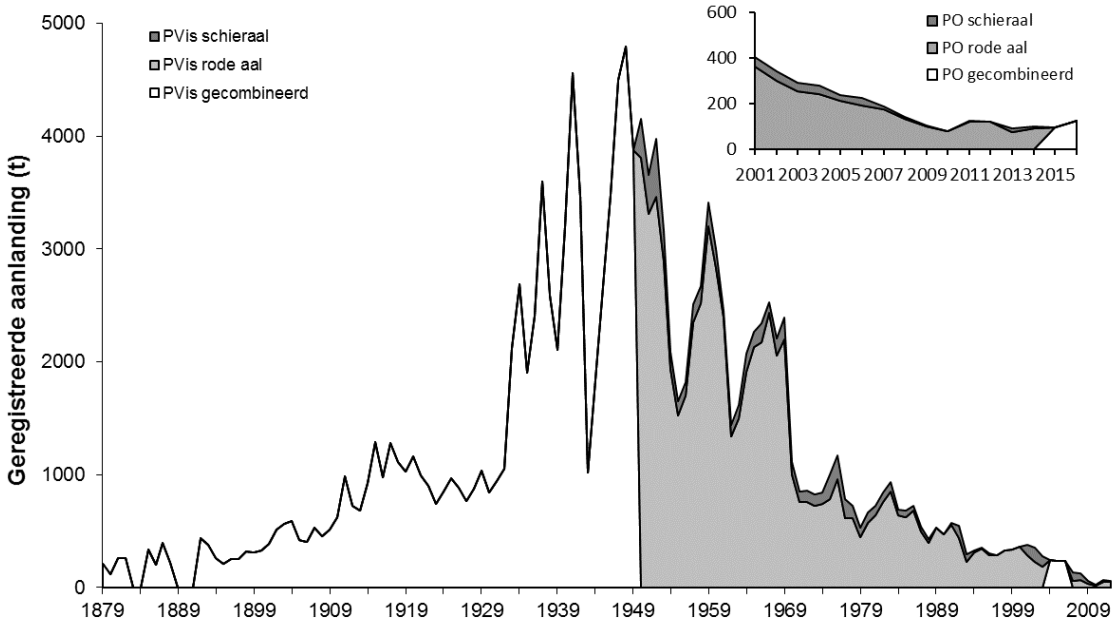
Een overzicht van de wekelijkse inspanning die wordt geleverd door beroepsvissers is te zien in Figuur 1.



Figuur 1. Overzicht van de wekelijkse inzet van verschillende vistuigen door beroepsvissers in 2016 in IJsselmeer en Markermeer (links) en rest van Nederland (rechts) (Bron: Min LNV).

Voor de Zuiderzee en later het IJsselmeer zijn gegevens beschikbaar over de aanvoer op de afslagen sinds 1880 (Figuur 2: data productschap vis en PO IJsselmeer). De aanlandingen van aal uit de Zuiderzee toonden in de periode 1880-1932 een stijging van 300 naar 1000 ton per jaar. Bij de afsluiting van het IJsselmeer (1932) namen de aanlandingen toe tot ca. 2500 ton per jaar, om daarna

verder te stijgen tot rond 3500 ton per jaar in de jaren 1940-1955. Sinds 1950 heeft de aanvoer sterk gefluctueerd, maar is wel een gestage daling opgetreden tot minder dan 400 ton per jaar sinds 2000. Sinds 2010 registreert LNV ook de aanlandingen. In 2016 zijn de gerapporteerde aanlandingen volgens LNV 174 ton en volgens de PO 126 ton (Tabel 1). Er zitten dus behoorlijke verschillen tussen de gegevens uit verschillende bronnen over de hoeveelheden aal die worden aangeland (Tabel 1). Hoe dit precies komt is nog niet vastgesteld. In het zoute water bedroegen de aanlandingen in Nederland in 2016 11 ton (zie Engelse deel van dit rapport).



Figuur 2. Trend in de geregistreerde aanlanding van aal op alle IJsselmeerafslagen (Bron PVIS) en trend in geregistreerde aanlandingen voor het IJsselmeer en Markermeer door de PO IJsselmeer (inzet). In 2009 was de aalvisserij gedurende oktober en november gesloten en vanaf 2010 is de visserij gesloten gedurende september, oktober en november. Voor de periode 2010-2016 zijn ook data van LNV beschikbaar (zie Tabel 1).

Tot 2010 waren er geen aanlandingsgegevens van de wateren buiten het IJsselmeer. Op 1 januari 2010 heeft het Ministerie van LNV een verplichte vangstregistratie ingevoerd voor alle aalvissers op de binnenwateren. De wekelijkse aalvangsten (rode aal en schieraal gecombineerd) worden per VBC-gebied opgenomen in de database van LNV (Tabel 1).

Tabel 1. Aanlanding van aal (ton) door de beroepsvisserij in Nederland 2010-2016 (Bron: PO en LNV).

	IJsselmeer/Markermeer		Andere gebieden	Totaal NL
Jaar	PO	LNV	LNV	LNV
2010	79	128	324	452
2011	124	179	188	367
2012	121	168	182	350
2013	90	144	171	316
2014	100	164	153	317
2015	93	141	157	298
2016	126	174	129	303

1.1.2 Trend aalvangsten recreatieve visserij

In 2009 is het Recreatieve Visserij onderzoeksproject van start gegaan. Er worden om het jaar ca 50.000 huishoudens benaderd om vast te stellen hoeveel recreatieve vissers er zijn in Nederland. Dit waren er naar schatting 1.7 miljoen in 2009, 1.4 in 2011, 1.3 in 2013 en 1.2 in 2015. Dit betreft zowel regelmatige als incidentele recreatieve vissers. Vanuit de groep benaderde huishoudens worden ca. 2500 recreatieve vissers (hengelaars) geselecteerd om deel te nemen aan een logboekprogramma voor een periode van 12 maanden om inzicht te krijgen in hoeveelheden gevangen aal en andere vissoorten. In 2012 en 2015 is het geschatte aantal onttrokken alen door hengelaars grofweg gelijk gebleven maar is het aantal gevangen en teruggezette alen toegenomen in vergelijking tot 2010 (Tabel 2).

*Tabel 2. Overzicht van de schatting van aalvangsten door recreatieve vissers in de Nederlandse binnenwateren en kustwateren (Van der Hammen & de Graaf 2017). Onttrokken = gevangen en niet terug gezet.*Data minder nauwkeurig.*

	Onttrokken				Teruggezet			
	Zoet		Zout		Zoet		Zout	
jaar	Hengel	Passieve tuigen	Hengel	Passieve tuigen	Hengel	Passieve tuigen	Hengel	Passieve tuigen
2010	341.000	Niet toegestaan	180.000	Onbekend	887.000	Niet toegestaan	117.000	Onbekend
2012	313.000	Niet toegestaan	91.000*	Onbekend	1.517.000	Niet toegestaan	67.000*	Onbekend
2014	220.000	Niet toegestaan	193.000	Onbekend	1.936.000	Niet toegestaan	247.000	Onbekend

* schatting met zeer hoge onzekerheid

1.1.3 Illegale visserij

In 2016 zijn er door de NVWA 80 gevallen geregistreerd van illegale visserij. De meeste overtredingen betreffen visserij met illegale tuigen in Zeeland. De omvang van de vangsten is niet bekend (Tabel 3).

Tabel 3. Overzicht van gevallen van illegale visserij in Nederland (2016). Aantal overtredingen per gebied. Vangstgewichten zijn niet bekend (bron: NVWA).

	IJsselmeer	Markermeer	IJssel/Zwarte Water	Friesland	Zeeland	Vinkeveense plassen	Totaal
1. Vissen buiten het seizoen						9	9
2. Vissen zonder vergunning							
3. Vissen met illegale tuigen	4	10	2	4	43		63
4. Ondermaatste vangsten							
5. Illegale verkoop van vangsten							
6. Vissen in gesloten gebieden	8						8
TOTAAL aantal incidenten							**80**

1.1.4 Trend uitzet glasaal en pootaal

Sinds de jaren 20 van de vorige eeuw is glasaal uit de omgeving van de Golf van Biskaje aangekocht en uitgezet in de Nederlandse binnenwateren (Figuur 11). De uitzet van glasaal heeft waarschijnlijk min of meer gelijke tred gehouden met de natuurlijke intrek, zoals te zien is aan de scherpe daling in de jaren 80 (vergelijk Figuur 4 met Figuur 8). In 2009 werd nog maar circa 0,3 miljoen glasalen

uitgezet, in 2015 waren dit er circa 3,3 miljoen. Daarnaast is pootaal uitgezet (0,6 miljoen stuks) (Tabel 5). Deze pootaal werd tot begin jaren ’80 voornamelijk gevangen in de Nederlandse kustzone en/of de benedenloop van de rivieren. In recente jaren heeft de uitzet van gekweekte aal (opgekweekt uit glasaal van Frankrijk en Engeland) de overhand (zie schema in Figuur 3). Sinds de opheffing van de OVB (Organisatie ter Verbetering van de Binnenvisserij) in 2005, wordt de aanvoer van glasaal en pootaal voor uitzet niet meer centraal geregistreerd. De latere cijfers zijn gebaseerd op opgave van de belangrijkste initiatiefnemers, maar mogelijk zijn kleinere partijen gemist.

Tussen 2010 en 2013 heeft het Productschap Vis (PVIS) de uitzet van de door het Ministerie van LNV aangekochte glasaal gecoördineerd ter bevordering van het herstel van de aalstand. Vanaf 2014 (opheffing PVIS) is dit overgenomen door de Stichting Duurzame Palingsector Nederland (DUPAN). Net als in voorgaande jaren is de door LNV aangekochte glasaal in 2016 vooral uitgezet in gebieden waar weliswaar vrije uittrek mogelijkheden zijn voor schieraal, maar waar ook de beroepsvisserij actief is. Er is (internationaal) verdeeldheid over het nut van de uitzet van geïmporteerde, in het wild gevangen, glasaal als maatregel voor het herstel van de aalstand. In het advies van ICES uit 2010 ten aanzien van het beheer van aal staat:

”Given the current record-low abundance of glass eels, ICES reiterates its concern that glass eel stocking programs are unlikely to contribute to the recovery of the European eel stock. This is because (a) there is no surplus anywhere of glass eel to be redistributed to other areas and (b) there is evidence that stocked/translocated eels experience impairment of their navigational abilities.”

In het 2015 advies van ICES staat ten aanzien van het uitzetten van glasaal:

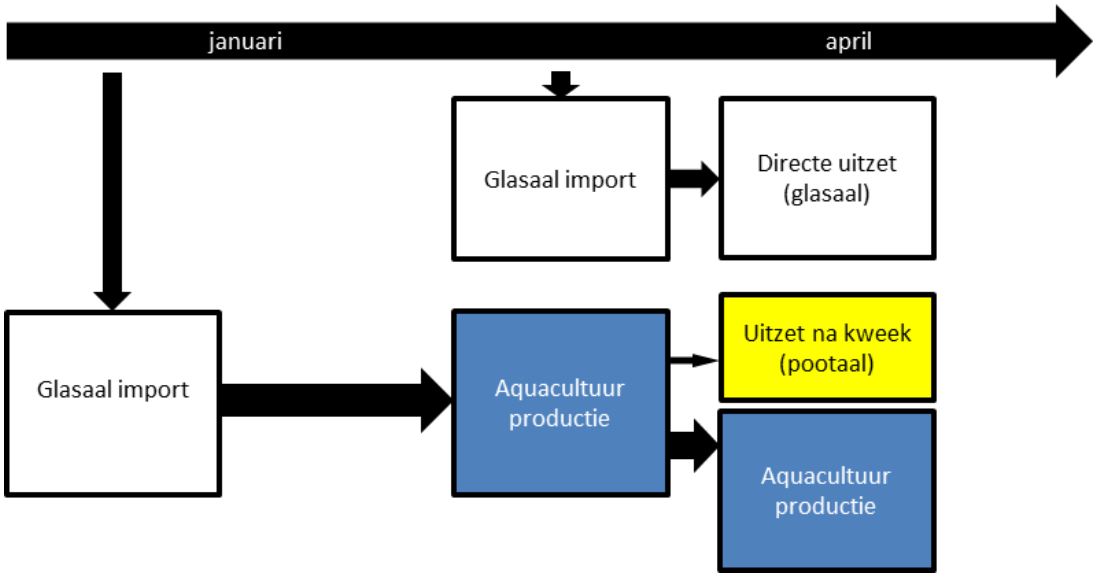
“There is evidence that translocated and stocked eel can contribute to yellow and silver eel production in recipient waters, but evidence of contribution to actual spawning is limited by the general lack of knowledge of the spawning of any eel. Internationally coordinated research is required to determine the net benefit of restocking on the overall population, including carrying capacity estimates of glass eel source estuaries as well as detailed mortality estimates at each step of the stocking process. When stocking to increase silver eel escapement and thus aid stock recovery, an estimation of the prospective net benefit should be made prior to any stocking activity. Where eel are translocated and stocked, measures should be taken to evaluate their fate and their contribution to silver eel escapement. Such measures could be batch marking of eel to distinguish groups recovered in later surveys (e.g. recent Swedish, French, and UK marking programmes), or implementing tracking studies of eel of known origin. Marking programmes should be regionally coordinated.”

Met andere woorden; het uitzetten van glasaal ten behoeve van het herstel van de aalstand heeft alleen nut als de productie schieraal per glasaal hoger is in het gebied van uitzet dan in het gebied van herkomst. Het is op dit moment onduidelijk of het uitzetten van glasaal in Nederland een netto positief effect heeft op de aalstand.

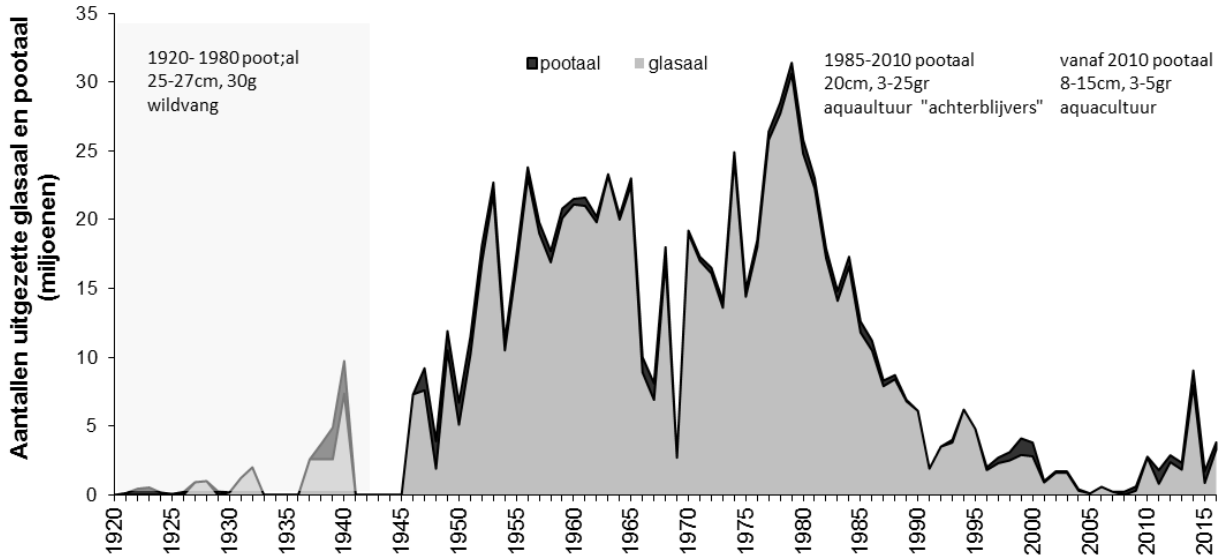
Het merken van alle uitgezette glasaal, zoals in sommige andere landen gebruikelijk is, is een goede manier om beter inzicht te krijgen in het lot van de uitgezette glasaal en om mogelijk beter inzicht te krijgen in de vraag of de huidige uitzet van glasaal een netto positieve of negatieve bijdrage levert aan het herstel van de Europese aalstand. Daarnaast geeft het mogelijk een indruk van de natuurlijke intrek van glasaal.

Tabel 4. Overzicht van het gebruik van geïmporteerde, in het wild gevangen glasaal (in kg per jaar) in Nederland

glasaal	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
Gevangen in commerciële visserij	0	0	0	0	0	0	0	0
Gebruikt voor uitzet	100	904	244	766	630	2.460	278	950
Gebruikt voor aquacultuur	?	?	6.750	6.775	6.700	4.900	5.200	5.500
Directe consumptie	0	0	0	0	0	0	0	0
Mortaliteit	?	?	?	?	?	?	?	?



Figuur 3. Schematisch overzicht van de bestemming van geïmporteerde glasaal. Glasaal geïmporteerd in de winter voor aquacultuur wordt gedeeltelijk als pootaal uitgezet. Glasaal geïmporteerd in het voorjaar wordt direct uitgezet.



Figuur 4. Overzicht van de Nederlandse uitzet van glasaal en pootaal in miljoenen stuks per jaar (1920-2016). De gegevens van voor 1940 zijn slechts een indicatie. Het gewicht van de gemiddelde uitgezette pootaal is afgenomen van 30 gram (1920) naar 15 gram (1985) tot 5 gram (2010).

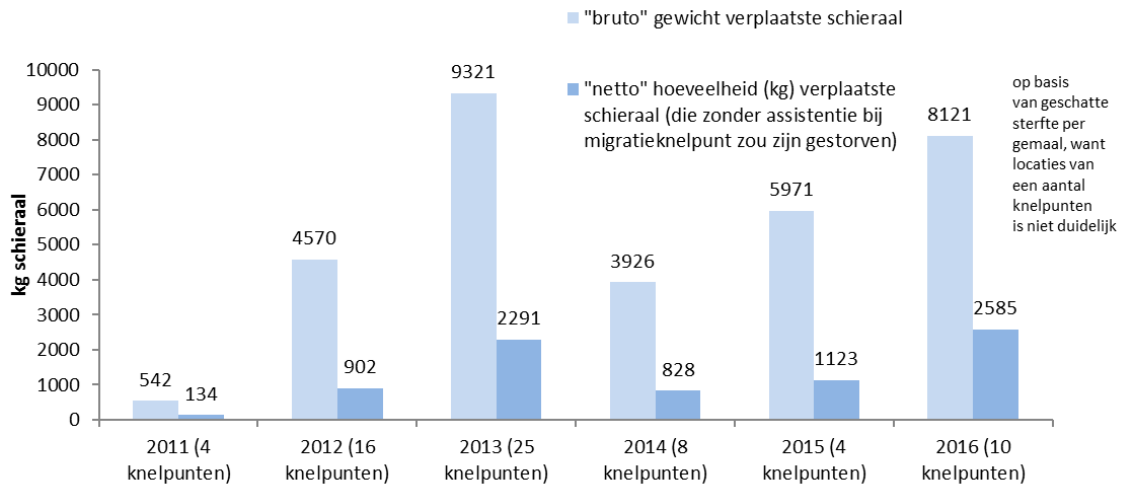
Tabel 5. Overzicht van de in 2017 in Nederland uitgezette glasaal en pootaal. Bron data: DUPAN (1, 2, 3, 4, 8, 9), Visnetwerk (5,6), NVWA (7): 72 kg glasaal werd onderschept op Schiphol in een koffer van twee Chinese smokkelaars, reizend van Spanje naar China.

	Datum	Uitzet locatie	Origine	kg	N	N/kg
N	GLASAAL					
1	10/03/2017	Veluwe Randmeren	Frankrijk	253	792.680	3133
2	10/03/2017	Zuidelijke Randmeren	Frankrijk	170	531.930	3129
3	10/03/2017	Markermeer	Frankrijk	150	469.650	3131
4	31/03/2017	Grevelingen	Frankrijk	341	1.250.100	3666
5	2017	Various locations	Frankrijk	33	107.738	3265*
6	07/04/2017	Kanaal van Steenenhoek	Frankrijk	10	35.000	3500
7	26/04/2017	Zeeuws-Vlaanderen	Spanje	72	235.064	3265*
	TOTAAL Glasaal			*1029*	*3.422.162*	
	POOTAAL					
8	6/05/2017	Gemeente Kampen: Ganzendiep en De Goot	Glasaal uit Frankrijk (aquacultuur in NL)		25.000	
9	24/05/2017	Friesland	Glasaal uit Frankrijk (aquacultuur in NL)		574.000	
	TOTAAL pootaal				*599.000*	
	TOTAAL glasaal+pootaal				*4.021.162*	

*N/kg geschat op basis van een gemiddelde van de DUPAN data (3265/kg)

1.1.5 Paling over de dijk

Sinds 2011 worden bij een aantal gemalen in Zeeland, Noord-Holland en Friesland schieralen geassisteerd bij het passeren van de migratieknelpunten (DUPAN "Paling over de dijk" initiatieven). In 2016 werd "bruto" 8 ton schieraal gevangen en vervolgens over de geselecteerde knelpunten gezet (Figuur 5). Echter een deel van de schieraal had mogelijk ook zonder assistentie het migratieknelpunt kunnen passeren (Winter *et al.* (2013)). Gebruikmakend van de verwachte sterfte (Bierman *et al.* 2012; Winter *et al.* 2013) tijdens het passeren van de geselecteerde migratieknelpunten kan een "netto" hoeveelheid verplaatste aal worden berekend. De geschatte sterfte voor aal ligt voor de verschillende gemalen tussen de 11% en 35%. Deze hoeveelheid extra schieraal die met succes heeft kunnen uittrekken als gevolg van de geleverde inspanning binnen "Paling over de dijk" initiatieven wordt daarom geschat op 2,6 ton in 2016 (Figuur 6).



Figuur 5. Overzicht van de "bruto" en "netto" hoeveelheden aal die in 2011-2015 bij diverse knelpunten "over de dijk" zijn gezet (geassisteerde migratie).

1.1.6 Trend aquacultuur

De grootste hoeveelheid aal (~90%) in Nederland voor consumptie wordt geproduceerd in intensieve kwekerijen. Hierin wordt in het wild gevangen glasaal geïmporteerd uit voornamelijk Frankrijk en Spanje (Tabel 4) en opgekweekt onder gecontroleerde omstandigheden.

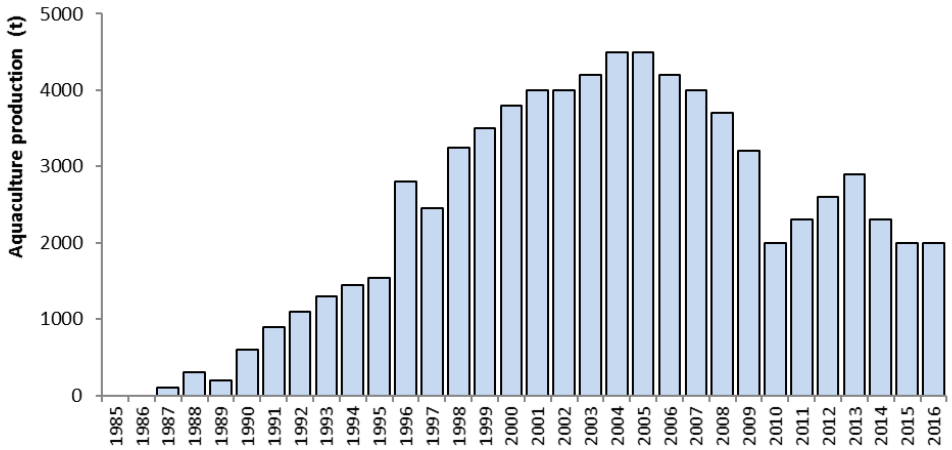
Tabel 6. Herkomst van de geïmporteerde, wild gevangen glasaal in de Nederlandse aquacultuur sector (Bron: DUPAN).

Seizoen	Frankrijk	Spanje	Engeland	Totaal (kg)
2010/2011	4725	1890	135	6750
2011/2012	5325	1350	100	6775
2012/2013	5500	650	550	6700
2013/2014	3400	250	1250	4900
2014/2015	4400	500	300	5200
2015/2016	5200	0	'Paar honderd kg'	5500*

*ervan uitgaande dat 'een paar honderd' ca 300 kg is.

De totale productie is sinds de start in 1985 gestegen tot meer dan 4000 ton in 2005. Tussen 2005 en 2010 is de productie gedaald tot 2000 ton en tussen 2010 en 2016 is de productie eerst gestegen en toen weer gedaald tot het niveau van 2010. In 2016 is ongeveer 2000 ton aal geproduceerd (Figuur 9). Kunstmatige voortplanting van de aal op commerciële schaal is tot op heden niet mogelijk, o.a.

doordat onbekend is wat larven eten. Wel is in 2016 aal in het laboratorium tot voorplanting gebracht bij het 'Eel Reproduction Innovation Centre' (EELRIC), een samenwerking tussen de WUR en DUPAN[1].



Figuur 6. Trend in de hoeveelheden aal die worden geproduceerd door de aquacultuur sector. In 2016 was de productie ongeveer 2000 ton (bron: DUPAN).

[1] http://www.wur.nl/nl/nieuws/Palingen-geboren-bij-Wageningen-UR.htm

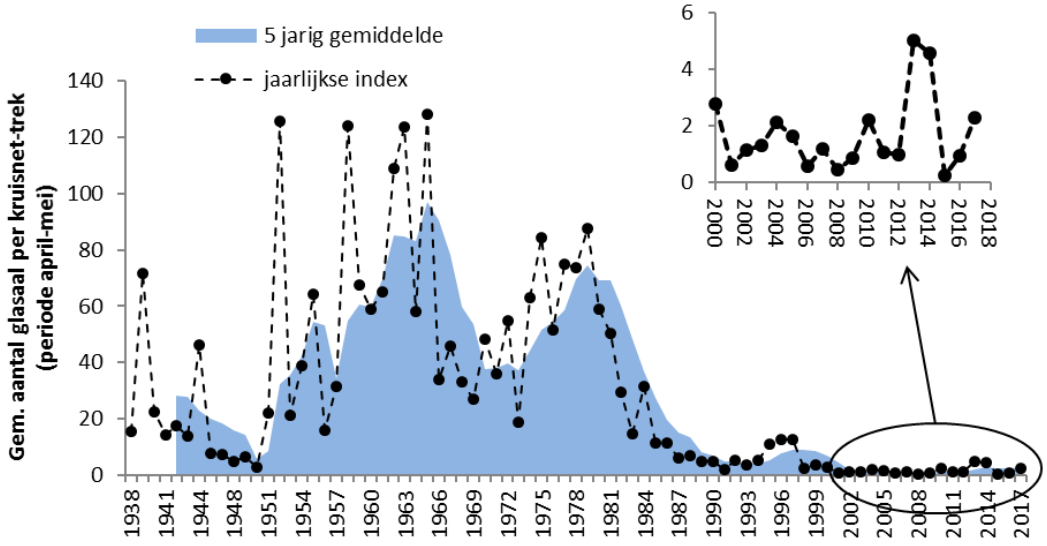
1.2 Onderzoek: glasaal, rode aal en schieraal

1.2.1 Trend glasaal

De intrek van jonge aal (glasaal) uit zee naar onze binnenwateren wordt – in principe - bemonsterd op 12 plaatsen langs de kust (Figuur 7). Niet alle locaties worden elk jaar bemonsterd. De meest intensieve bemonstering wordt sinds 1938 bij Den Oever uitgevoerd.

Figuur 7. Locaties van de glasaalmonitoring in Nederland.

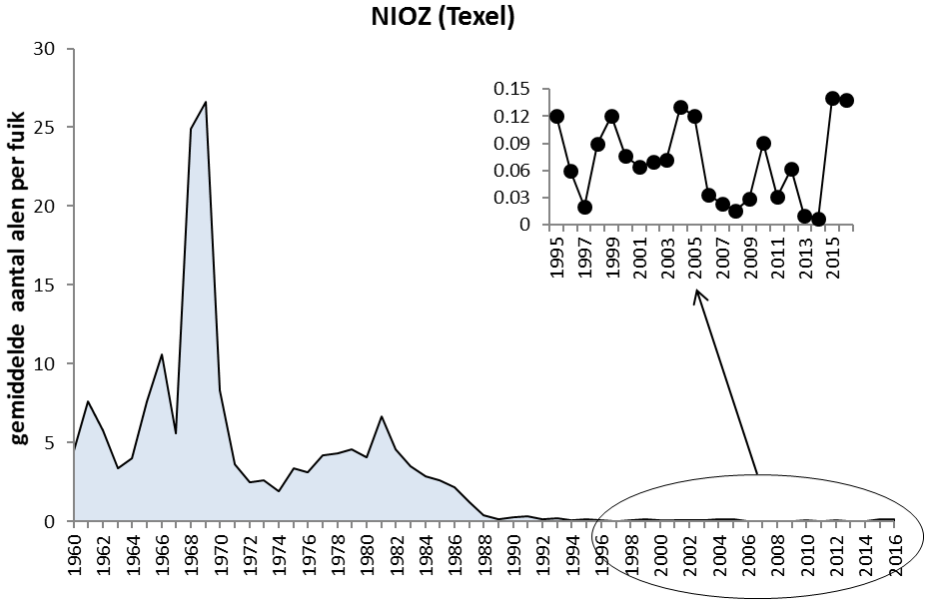
Het niveau van de intrek bij Den Oever in het voorjaar van 2017 (gemiddeld 2,3 glasalen per kruisnet-trek) is nog altijd laag in vergelijking met het vroegere niveau (van voor 1980) en is vergelijkbaar met het niveau van de intrek in de periode 1998-2000. In vergelijking met 2016 is in 2017 bij vijf van de acht locaties de intrek afgenomen. De resultaten van de langjarige intrekbemonstering bij Den Oever (locatie 'Spuisluis') tonen een sterk verlaagde intrek na 1985 (Figuur 8). Het gemiddelde niveau van de glasaalintrek in de laatste 15 jaar (2003-2017: gemiddeld 1,7 glasalen per kruisnet-trek, zie inzet in Figuur 8) is minder dan 5 % van het vroegere niveau (bv. in de periode 1960-1979: gemiddeld 64 per kruisnet-trek).



Figuur 8. Trend in de intrek van glasaal bij Den Oever (1938-2017).

1.2.2 Trend rode aal Waddenzee

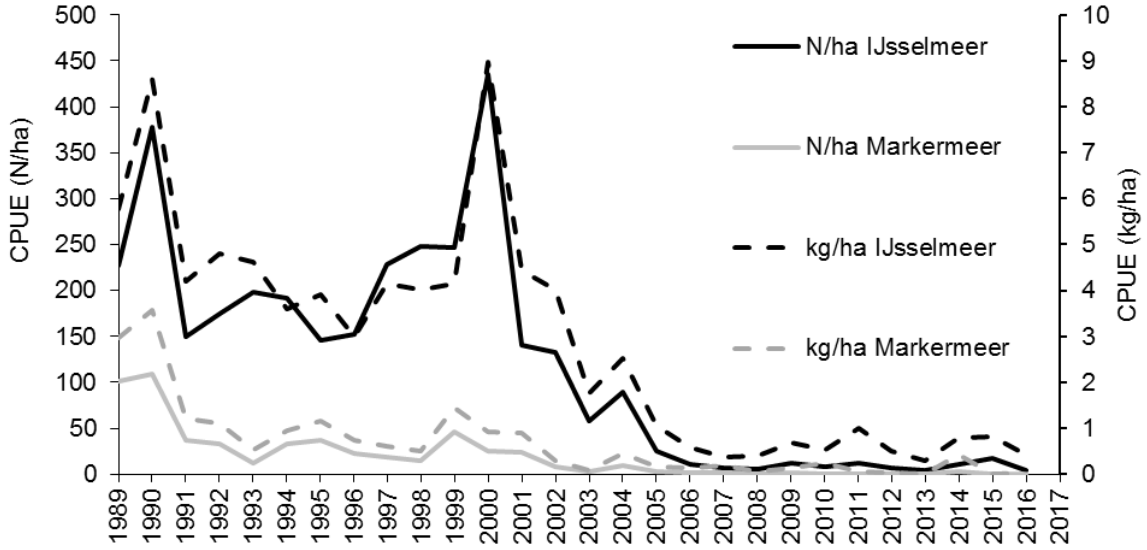
Sinds 1960 worden met een fuikbemonstering de vangsten rode aal in de haven bij de Mokbaai, 't Horntje (Texel) door medewerkers van het NIOZ nauwkeurig bijgehouden (Figuur 9). Deze dataset toont ook een duidelijk afname van de rode aal populatie sinds de jaren tachtig, vergelijkbaar met de drastische afname aan glasaal bij Den Oever. De index vertoont geen tekenen van herstel.



Figuur 9. Trend in de hoeveelheden rode aal in de NIOZ fuik per jaar (1960-2016) (Bron: Van der Meer et al., 2011, Van der Meer pers. com.).

1.2.3 Trend rode aal IJsselmeer/Markermeer

De bestandsopname met de electrostramienkor toont zowel in het IJsselmeer (sinds 2000) als het Markermeer (sinds 1990) een scherpe afname van rode aal (Figuur 10).



Figuur 10. Trend in de aantallen (linker-as, doorgetrokken lijnen) en gewicht (rechter-as, gestreepte lijnen) per ha rode aal in het IJsselmeer en Markermeer per jaar op basis van de vangst met de electrostramienkor. CPUE = catch per unit effort.

1.2.4 Trend zwemblaasparasiet (*Anguillicoloides crassus)*

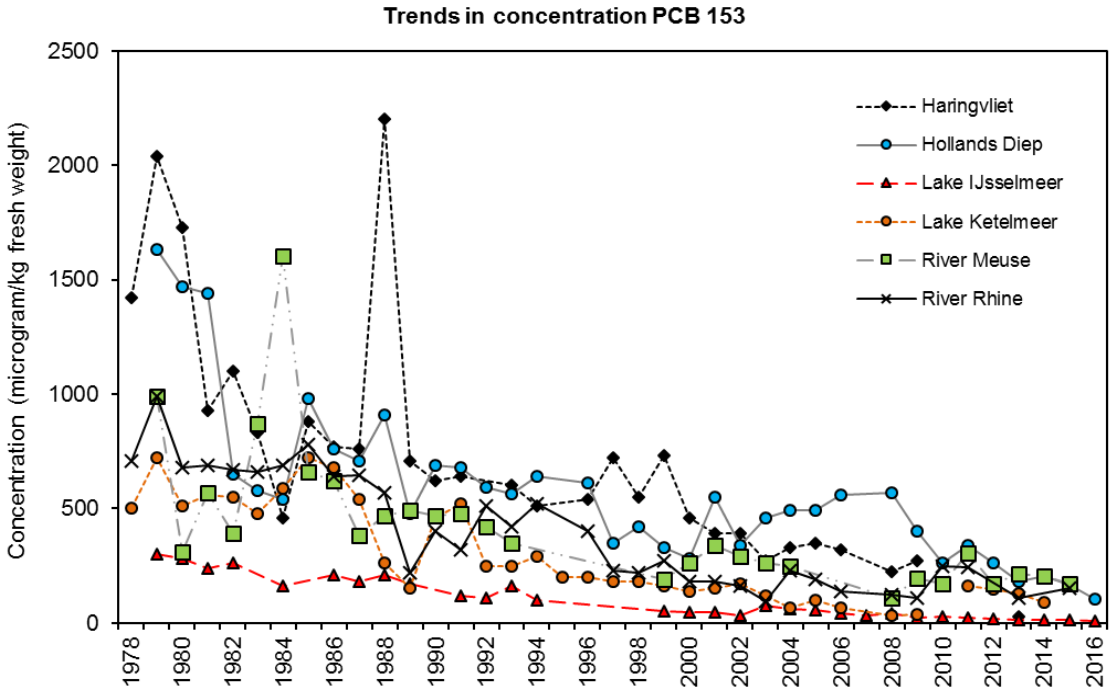
De zwemblaasparasiet *Anguillicoloides crassus* is afkomstig uit Zuidoost Azië en sinds begin jaren ’80 komt de parasiet voor in Nederlandse wilde aal. Bemonstering van aal laat zien dat het percentage geïnfecteerde aal in 2016 tussen circa 22-36% lag, afhankelijk van de locatie (Tabel 7). Het percentage geïnfecteerde aal lijkt stabiel te blijven sinds de jaren ’80 in alle onderzochte gebieden. In 2016 lijkt het percentage iets lager dan de jaren ervoor.

Tabel 7. Overzicht van de aanwezigheid van zwemblaasparasiet (Anguillicoloides crassus) in aal.

	Friesland		Ijsselmeer		Markermeer		Rest NL	
	N aal	% geïnfecteerd	N aal	% geïnfecteerd	N aal	% geïnfecteerd	N aal	% geïnfecteerd
2010	534	243(46%)	390	190(49%)	225	107(48%)	511	258(50%)
2011	107	40(37%)	293	127(43%)	104	35(34%)	583	231(40%)
2012	133	44(33%)	320	167(52%)	253	95(38%)	529	185(35%)
2013	17	8(47%)	14	7(50%)	93	40(43%)	283	106(37%)
2014	49	31(63%)	202	100(50%)	46	12(26%)	321	127(40%)
2015	61	24(39%)	267	110(41%)	nc	nc	297	112(38%)
2016	65	14(22%)	260	89(34%)	78	28(36%)	258	79(31%)

1.2.5 Trend vervuiling

In het kader van de monitoring van voedselkwaliteit, zijn sinds eind jaren 1970 de gehaltes van vervuilende stoffen (PCB's en dioxines) in aal bepaald. Na de sterke vervuiling in de jaren voor 1970, is een gestage daling in de gehaltes van PCB's en dioxines in aal waargenomen. In Figuur 11 wordt de trend in PCB 153 getoond; PCB 153 is een goede indicator voor de andere PCB's.



Figuur 11. Trends in PCB 153 in rode aal (1978-2016). Elk punt is de gemiddelde concentratie van PCB 153 van 25 alen van 20 tot 30 cm, of minder alen dan 25 stuks als er minder aal beschikbaar was op die locatie.

2 ICES country report The Netherlands

The following chapter form the country report for the Netherlands that was submitted to the ICES WGEEL meeting in September 2017.

More information:

- *The ICES report on the status of eel in Europe can be downloaded from: http://ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2017/WGEEL/wgeel_2017.pdf*
- *The country reports, including the Dutch report can be downloaded via: http://ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2017/WGEEL/WGEEL_CRs_2017.pdf*

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Reporting Period: This report was completed for the ICES working group on Eel (ICES WGEEL) in September 2017, and contains data up to 2016 and some provisional data for 2017.

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Codes used for circumstances of Nil Return in tables:

0: Measured data point with an actual zero value (for example when the catch is zero but the effort is >zero).

NP: "Not Pertinent", where the question asked does not apply to the individual case (for example where catch data are absent as there is no fishery or where a habitat type does not exist in an EMU).

NR: "Not Reported", data or activity exist but numbers are not reported to authorities (for example for commercial confidentiality reasons).

NC: "Not Collected", activity / habitat exists but are not collected by authorities (for example where a fishery exists but the catch data are not collected at the relevant level or at all).

ND: "No Data", where there are insufficient data to estimate a derived parameter (for example where there are insufficient data to estimate the stock indicators (biomass and/or mortality).

Table 1. Units and number of decimal places

PARAMETER	UNIT	DECIMAL PLACES (MINIMUM)
Length of glass eel	mm	0
Length of yellow/silver eel	mm	0
Age yellow or silver eel	year	0
Age glass eel/on grown	days	0
Area (EMU scale)	ha	0
Area (Sub EMU scale)	ha	0
Weight (individual Glass eel)	g	2
Weight (Yellow or silver eel)	g	0
Weight (Catch level) GE	kg	0
Weight (Catch level) Other	kg	0
Site/position	Lat Long units (WGS84)	Deg + decimal Min (2)
Biomass (B0, Bbest, Bcurrent, etc)	kg	0
Mortality rate	ΣF, ΣH, ΣA per year	2
Effort	Gear days, gear hours	0
Language	English	
Price	Euros	0
Distance	Km	0
Season	Clearly define season	

NOTE: Where no data exists for a section, the section is not removed, but it is stated that no data is available.

3 Stock status summary

3.1 EMP Progress Report summary table

3.1.1 Estimate of B_0

Table NL. A. Reference period for B0 (Van de Wolfshaar et al. 2015, p.72).

EMU_code	B_0 (kg/ha)	Reference time period	Whether or not changed from value reported last year (Y/N)
NL_Neth	10.400	2011	N

3.2 Stock indicators and Targets

Table NL. B. Stock indicators and Target derived from: Van de Wolfshaar et al. 2015, p.72.

EMUcode	Indicator	biomass (T)		Mortality (rate)			Target		
	B_0	B_{best}	B_{curr}	∑A	∑F	∑H	Source	Biomass (t)	∑A (rate)
NL_Neth	10400	1697	1057	0.47	0.35	0.12	EMP		
							EU Reg	4160	
							WGEEL		0.106

Key:

EMU_code = Eel Management Unit code (see sheet 'EMU names and codes' for list of codes)

B0 = the amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the stock (kg).

Bcurr = The amount of silver eel biomass that currently escapes to the sea to spawn (in the assessment year) (kg).

Bbest = The amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the current stock (kg).

∑F=mortality due to fishing, summed over the age groups in the stock (rate)

∑H=anthropogenic mortality excluding the fishery, summed over the age groups in the stock (rate)

∑A=all anthropogenic mortality summed over the age groups in the stock (rate)

3.2.1 Habitat coverage

Table NL. C. Habitat coverage derived from Van de Wolfshaar et al. 2015.

EMU code	River		Lake		Estuary		Lagoon		Coastal	
	Area (ha)	A'd (Y/N)	Area (ha)	A'd (Y/N)	Area (ha)	A'd (Y/N)	Area (ha)	A'd (Y/N)	Area (ha)	A'd (Y/N)
NL_Neth	88,391	Y	232,758	Y	NP	NP	NP	NP	358,802	N

3.3 Precautionary diagram

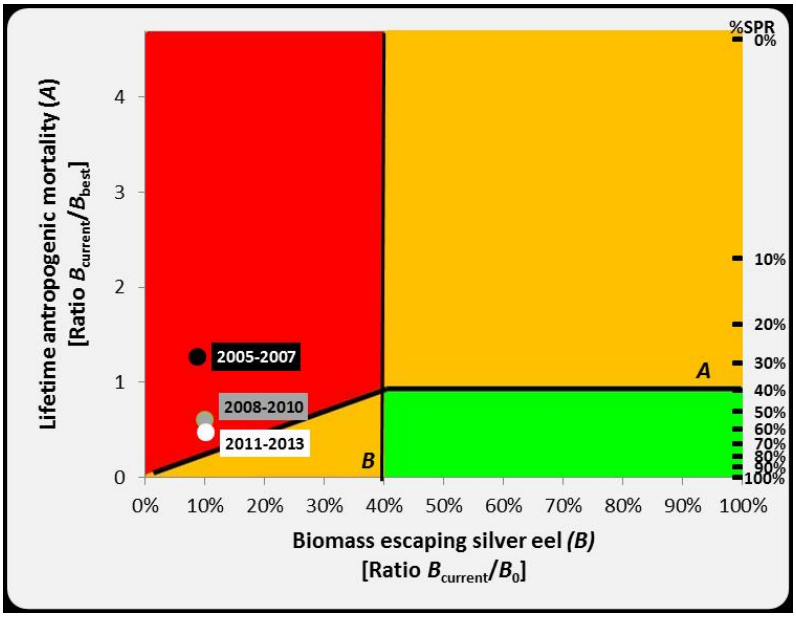

Figure NL. 1. Modified precautionary diagram for the Netherlands EMU (Van de Wolfshaar et al. 2015 after WGEEL 2012), see section 1.3.2 of ICES (2013) for more information.

4 Overview of the stock and its management

4.1 Describe the eel stock and its management

4.1.1 Eel Management Units and Eel Management Plans

The Netherlands consists of 1 EMU coded 'NL_Neth' and there is one Eel Management Plan (EMP)[2] that was implemented in July 2009 and revised in 2011.

4.1.2 Management authorities

The Dutch Ministry of Agriculture, Nature and Food Quality (PO Box 20401, 2500 EK Den Haag, The Netherlands) is responsible for the conservation of stocks and for the management of all anthropogenic impacts, as well as for the delivery of the Eel Management Plan (EMP).

4.2 Regulations

4.2.1 Fisheries

Fisheries on eel in the Netherlands is regulated by the Dutch Fisheries Act, while protection of eel is regulated under the Dutch Flora and Fauna Act. In summary, the following regulations apply: the minimum catch size is 28 cm, a number of fisheries is closed in the period 1 Sept-30 Nov, all eel caught in 1 Sept-30 Nov have to be released, and since 2011 a number of areas is closed for fisheries due to pollution (dioxins)[3] (Figure NL 1).

Figure NL 1. Overview of the areas closed for eel and Chinese mitten crab fishery as of 1 April 2011 (Source: Ministry of Agriculture, Nature and Food Quality).

2 https://www.rijksoverheid.nl/documenten/rapporten/2009/11/27/aalbeheerplan
3 http://www.sportvisserijnederland.nl/vispas/visserijwet-en-regels/binnenwater/paling.html

4.3 Management actions

The management measures taken in the Netherlands in the framework of the Eel Management Plan (EMP) are listed in Table NL B.

Table NL A. Overview of all the (un)foreseen measures described in the Dutch Eel Management Plan to be implement to reach the 40% escapement objective (source: Van de Wolfshaar et al., 2015).

No	Foreseen Measure	Planned implementation	Realised implementation
1	Reduction of eel mortality at pumping stations and other water works; of the 1800 most important migration barriers 900 will be solved by 2015 and the remaining 900 by 2027	2015-2027	2015-2027[a]
2	Reduction of eel mortality at hydro-electric stations with at least 35%	2009	November 2011[b]
3	The establishment of fishery-free zones in areas that are important for eel migration	2010	1 April 2011[c]
4	Release of eel caught (a) at sea and (b) at inland waters by anglers	2009	1 October 2009
5	Ban on recreational fishery in coastal areas using professional gear	2011	1 January 2011[d]
6	Annual closed season from 1 September to 1 December	2009	1 October 2009
7	Stop the issue of licences for eel snigglers by the minister of LNV in state owned waters	2009	1 May 2009
8	Restocking of glass eel and pre-grown eel from aquaculture	2009	Early 2010
9	Research into the artificial propagation of eel	ongoing	EU-project started
			Unforeseen Measure
10	Closure eel fishery in contaminated (PCBs, dioxins) areas		1 April 2011[e]

a In agreement with the European Commission changes have been made to the original schedule of solving migration barriers.

b Due to technical difficulties the maximum achievable reduction in mortality by adjusted turbine management is 24%.

c The vast majority of the contaminated areas that were closed for commercial fisheries on 1/4/2011 are the main rivers. These rivers are the most important "high ways" for diadromous species like salmon and eel.

d The use of fykes and long-lines by recreational fishers has been banned in nearly all marine and inland waters waters. The use of gillnets, however, by recreational fishers is still allowed in a few marine waters.

e On 1 January 2015 the area closed for eel fishery due to contaminants (PCBs, dioxins) was extended.

Table NL B. Proposed and implemented management measures. Com fish = commercial fisheries; Rec fish = recreational fisheries; 'Hydropower & Pumps' includes obstacles; 'Other' refers to indirect measures (e.g. implementing data collection and conducting studies).

EMU code	Action Type	Action	Life Stage	Planned	Outcome
NL_Neth	Com Fish	Closing fishing season	M	EMP	Fulfilled
NL_Neth	Com Fish	Introducing fishery-free zones	M	EMP	Fulfilled
NL_Neth	Com Fish	Closure of fishery in contaminated areas	M	After EMP	Fulfilled
NL_Neth	Com Fish	Sniggling Ban	M	EMP	Fulfilled
NL_Neth	Rec Fish	Eel releasing by anglers	M	EMP	Fulfilled
NL_Neth	Rec Fish	Ban on recreational fishery using professional gears	M	EMP	Fulfilled
NL_Neth	Rec Fish	Closing fishing season	M	EMP	Fulfilled
NL_Neth	Rec Fish	Sniggling ban	M	EMP	Fulfilled
NL_Neth	Hydropower & Pumps	Barriers reduction from 2015	M	EMP	Partially
NL_Neth	Hydropower & Pumps	Hydroelectric stations barriers reduction	M	EMP	Partially
NL_Neth	Restocking	Stocking with glass eels	M	EMP	Fulfilled

4.4 Significant changes since last report

There have not been significant changes in the status of the eel across The Netherlands since the Country Report of 2016 (De Graaf & Bos, 2017).

5 Impacts on the stock

Table NL C. Overview of the assessed impacts per habitat type or for 'All' habitats where the assessment is applied across all relevant habitats. Barriers include habitat loss; indirect impacts are anthropogenic impacts on the ecosystem, but only indirectly on eel (e.g. eutrophication). A = assessed, MI = not assessed, minor, MA = not assessed major, AB = impact absent (Bierman et al. 2012).

EMU CODE	HABITAT	FISH COM	FISH REC	HYDRO & PUMPS	BARRIERS	RESTOCKING	PREDATORS	INDIRECT IMPACTS
NL_Neth	Riv	A	A	A	A	MI/MA	MI/MA	MI/MA
	Lak	A	A	A	A	MI/MA	MI/MA	MI/MA
	Est	NP	NP	NP	NP	NP	NP	NP
	Lag	NP	NP	NP	NP	NP	NP	NP
	Coa	MI	A	AB	AB	AB	AB	MI
	All							

Table NL D. Loss of eel (kg) for each impact per developmental stage. MI = not assessed, minor; MA = not assessed major; AB = impact absent. [1]All eel caught recreationally were assumed to be yellow eel. [2]Including 6 t mortality of GER/BE silver eel (Bierman et al. 2012).

EMU CODE	STAGE	FISH COM	FISH REC	HYDRO & PUMPS	BARRIERS	RESTOCKING	PREDATORS	INDIRECT IMPACTS
NL_Neth	Glass	AB	AB	MI/MA	MI/MA	MI	MI/MA	MI/MA
NL_Neth	Yellow	290	100	MI/MA	MI/MA	AB	MI/MA	MI/MA
NL_Neth	Silver	77	AB[1]	76[2]	MI/MA	AB	MI/MA	MI/MA
NL_Neth	Silver EQ							

[1]All eel caught recreationally were assumed to be yellow eel.

[2]Including 6 t mortality of GER/BE silver eel.

5.1 Fisheries

5.1.1 General information

Eel fisheries in the Netherlands occur in coastal waters, estuaries, larger and smaller lakes, rivers, polders, etc. Management of eel stock and fisheries has been an integral part of the long tradition in manipulating water courses (polder construction, river straightening, ditches and canals, etc.). Governmental control of the fishery is restricted to on the one hand a set of general rules (gear restrictions, size restrictions, for course fish: closed seasons), and on the other hand site-specific licensing. Since 1/1/2010 there is a general registration of landings, whereas a general registration of fishing efforts has not yet been implemented. In recent years, licensees in state-owned waters are obliged to participate in so-called Fish Stock Management Committees ['Visstand Beheer Commissies' VBC][4], in which commercial fisheries, sports fisheries and water managers are represented. The VBC is responsible for the development of a regional Fish Stock Management Plan. The Management Plans are currently not subject to general objectives or quality criteria. The future of VBC and their role in fish stock management is under debate.
Until April 2011 the total Dutch fresh water fishery on eel involved approx. 200 companies, with an estimated total catch of nearly 442 tonnes of eel in 2010. However, on 1 April 2011 a large part of the fishery was closed due to high PCB-levels in the eel (Fig. NL.1). This closure has affected about 50 fishing companies catching 170 tonnes of eel in 2010, roughly a third of the annual landings of inland waters in the Netherlands.

[4] http://www.visstandbeheercommissie.nl/

5.1.2 Spatial subdivision of the territory

The fishing areas in the Netherlands can be categorised into five groups:

1. The Wadden Sea; 53ºN 5ºE; 2,591 km^2. This is an estuarine-like area, shielded from the North Sea by a series of islands. The inflow of sea water at the western side mainly consists of the outflow of the river Rhine, which explains the estuarine character of the Wadden Sea. The fishery in the Wadden Sea is permitted to license holders and assigns specific fishing sites to individual licensees. Fishing gears include fyke nets and pound nets; the traditional use of eel pots is in rapid decline. The fishery in the Wadden Sea is obliged to apply standard EU fishing logbooks. Landings statistics are therefore available from 1995 onwards; 11 tons in 2016 (Table NL G). In 2009 there were 21 companies having a commercial license for fishing eel, and the total number of fyke nets was estimated at 400.

2. Lake IJsselmeer; 52º40'N 5º25'E; now 1820 km^2. Lake IJsselmeer is a shallow, eutrophic freshwater lake, which was reclaimed from the Wadden Sea in 1932 by a dike (Afsluitdijk), substituting the estuarine area known before as the Zuiderzee. The surface of the lake was reduced stepwise by land reclamation, from an original 3,470 km^2 in 1932, to 1,820 km^2 since 1967. In preparation for further land reclamation, a dam was built in 1976, dividing the lake into two compartments of 1,200 and 620 km^2, respectively, but no further reclamation has actually taken place. In managing the fisheries, the two lake compartments have been treated as a single management unit. The discharge of the river IJssel into the larger compartment (at 52º35'N 5º50'E, average 7 km^3 per annum, coming from the River Rhine) is sluiced through the Afsluitdijk into the Wadden Sea at low tide, by passive fall. Fishing gears include standard and summer fyke nets, eel boxes and long lines; trawling was banned in 1970. Licensed fishermen are not spatially restricted within the lake, but the number of gears is controlled by a gear-tagging system. The registered landings at the auctions are assumed to cover some the actual total. There are, however, differences in estimated landings reported by the fisheries organisation (PO IJsselmeer), the Fish Board (PVIS) and catch registration system of the Ministry of Agriculture, Nature and Food quality (Ministerie van LNV).

3. Main rivers; 180 km^2 of water surface. The Rivers Rhine and Meuse flow from Germany and Belgium respectively, and in the Netherlands constitute a network of dividing and joining river branches. Traditional eel fisheries in the rivers have declined tremendously during the 20th century, but following water rehabilitation measures in the last decades, is now slowly increasing. The traditional fishery used stow nets for silver eel, but fyke net fisheries for yellow and silver eel now dominates. Individual fishermen are licensed for specific river stretches, where they execute the sole fishing right. No registration of effort is required. In 2009 there were 28 fishing companies, using an estimated number of 318 fixed fykes, 2433 train fykes, 551 eel boxes, and unknown quantities of other gears (electric dipnet, longlines, etc). Since 1 April 2011 the eel fishery on the main rivers has been closed due to high levels of pollutants in eel.

4. Zeeland; 965 km^2. In the Southwest, the Rivers Rhine, Meuse and Scheldt (Belgium) discharge into the North Sea in a complicated network of river branches, lagoon-like waters and estuaries. Following a major storm catastrophe in 1953, most of these waters have been (partially) closed off from the North Sea, sometimes turning them into fresh water bodies. Fishing is licensed to individual fishermen, mostly spatially restricted. Fishing gears are dominated by fyke nets. Management is partially based on marine, partly on fresh water legislation. In 2009 there are 27 companies, using an estimated number of 174 fixed fykes, 233 train fykes, and unknown numbers of eel pots. This area has also been affected by the ban on eel and Chinese mitten crab fishery due to high pollution levels.

5. Remaining waters; inland 1,340 km^2. This comprises 636 km^2 of lakes (average surface: 12.5 km^2); 386 km^2 of canals (> 6 m wide, 27,590 km total length); 289 km^2 of ditches (< 6 m wide, 144,605 km total length); and 28 km^2 of smaller rivers (all estimates based on areas less than 1 m above sea level, 55% of the total surface; see Tien and Dekker 2004 for details). Traditional fisheries are based on fyke netting and hook and line. Individual licenses permit

fisheries in spatially restricted areas, usually comprising a few lakes or canal sections, and the joining ditches. Only the spatial limitation is registered. Eight small companies operating scattered along the North Sea coast have been added to this category. In 2009 there were about 100 companies, using unknown quantities of gears of all types.

The Water Framework Directive subdivides the Netherlands into four separate River Basin District (RBD), all of which extend beyond our borders. These are:

1. the River Ems (Eems), 53º20'N 7º10'E (=river mouth), shared with Germany. This RBD includes the north-eastern Province Groningen, and the eastern part of Province Drenthe. Drainage area: 18,000 km^2, of which 2,400 km^2 in the Netherlands.
2. the River Rhine (Rijn), 52º00'N 4º10'E, shared with Germany, Luxemburg, France, Switzerland, Austria, Liechtenstein. Drainage area: 185,000 km^2, of which 25,000 km^2 in the Netherlands, which is the major part of the country.
3. the River Meuse (Maas), 51º55'N 4º00'E, shared with Belgium, Luxemburg, France and Germany. Drainage area: 35,000 km^2 , of which 8,000 km^2 in the Netherlands.
4. the River Scheldt (Schelde), 51º30'N 3º25'E, shared with Belgium and France. Most of the south-western Province Zeeland used to belong to this RBD, but water reclamation has changed the situation dramatically. Drainage area: 22,000 km^2, of which 1,860 km^2 in the Netherlands.

Within the Netherlands, all rivers tend to intertwine and confluent. Rivers Rhine and Meuse have a complete anastomosis at several places, whereas a large part of the outflow of the River Meuse is now redirected through former outlets of the River Scheldt. Additionally, the coastal areas in front of the different RBDs constitute a confluent zone. Consequently, sharp boundaries between the RBDs cannot be made – neither on a practical nor on a juridical basis. This report will subdivide the national data on a pragmatic basis.
In this report, we will subdivide the national data on eel stock and fisheries by drainage area on a preliminary assumption that water surfaces and fishing companies are approximately equally distributed over the total surface, and thus, totals can be split up over RBDs proportionally to surface areas.

5.1.3 Fishing capacity

Capacity is defined as the potential fishery usage (i.e. number of licences issued). For marine waters and Lake IJsselmeer a register of ships is kept, but for the other waters no central registration of the ships being used is available. Registration of the number of gears owned or employed was lacking until recently.
For Lake IJsselmeer/Markermeer, an estimate of the number of gears actually used is available for the years 1970-1988 (Dekker 1991). In the mid-1980s, the number of fyke nets was capped, and reduced by 40 % in 1989. In 1992 the number of eel boxes was counted, and capped. Subsequently, the caps have been lowered further in several steps, the latest being a buy-out in 2006. Since the number of companies has reduced at the same time, the nominal fishing effort per company has not reduced at the same rate, and underutilisation of the nominal effort probably still exists. The effort in the longline fishery is not restricted, other than by the number of licenses.
The ministry (LNV-RVO) provides permits that give the right to fish with certain gears. The numbers of gears and rights differ per permit holder. Insight in the use of the permits is provided by the weekly catch reports that fishermen are obliged to hand in. When fishermen fish with a certain gear, they have to mark it with a label ('merkje'). Permits can also be reserved temporarily, e.g. when there is no vessel to fish with. In that case, there are no rights to fish (source: pers. com. RVO, Ministry of Agriculture, Nature and Food quality, 2017). In 2017, the total number of gears allowed was 1579 fixed fykes, 3193 train fykes (1 fyke = 2 eel units), 7415 eel boxes.

5.1.4 Glass eel fisheries

There is no fishing on glass eel.

5.1.5 Yellow eel fisheries

5.1.5.1 *Commercial*

No reliable long term time series of yellow eel landing exist; total landings of yellow and silver eel combined have been reported.

Statistics from the auctions around Lake IJsselmeer were kept by the Ministry of LNV until 1994; since then and until 2012 statistics were kept by the Fish Board (PVis; Table NL. D; Figure NL 2, main graph). These statistics are broken down by species, month, harbour and main fishing gear. The quality of this information deteriorated considerably over the past decades, due to misclassification of gears, and the trading of eel from areas other than Lake IJsselmeer and Laker Markermeer at the IJsselmeer auctions. In the data from auctions around Lake IJsselmeer yellow and silver eel were reported separately, but data from recent decades (from early 1990s onwards) is unreliable: yellow eel from eel boxes and silver eel from all gears have been combined.
In addition, the fishers organisation (PO IJsselmeer) has kept records of the catches of their associated fishers (>90% of the fishers active in the IJsselmeer area) from 2001 onwards (Figure NL 2, inserted graph).

An obligatory catch registration system was introduced in the Netherlands in January 2010 by the Ministry of Agriculture, Nature and Food quality (Ministry of LNV). Weekly catches of eel have been reported, but yellow eel and silver eel catches are combined in this program and no information on effort and gears have been reported.

Table NL. D. Landings of yellow eel and silver eel combined in tons by year, from the auctions around Lake IJsselmeer, Rhine RBD. Only landings recorded at the auctions are included; other landings are assumed to represent a minor and constant fraction. Figures in italics (since 1995) are suspect, due to misclassification of catches and trade from areas outside Lake IJsselmeer at the IJsselmeer auctions. Source Ministry of Agriculture, Nature and Food quality (LNV; 1900-1994), Productschap Vis (PVIS; 1995-2012); PO IJsselmeer (in brackets; 2001-current).

DECADE	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010
YEAR												
0	324	620	1157	838	3205	4152	2999	1112	641	472	*368*	*21*(79)
1	387	988	989	941	4563	3661	2460	853	701	573	*381* (405)	*62*(124)
2	514	720	900	1048	3464	3979	1443	857	820	548	*353* (343)	*59*(121)
3	564	679	742	2125	1021	3107	1618	823	914	293	*279* (293)	NC(90)
4	586	921	846	2688	1845	2085	2068	841	681	330	*245* (280)	NC(100)
5	415	1285	965	1907	2668	1651	2309	1000	666	*354*	*234* (238)	NC(93)
6	406	973	879	2405	3492	1817	2339	1172	729	*301*	*230* (224)	NC(126)
7	526	1280	763	3595	4502	2510	2484	783	512	*285*	*130* (188)	
8	453	1111	877	2588	4750	2677	2222	719	437	*323*	*122* (141)	
9	516	1026	1033	2108	3873	3412	2241	510	525	*332*	*58* (105)	

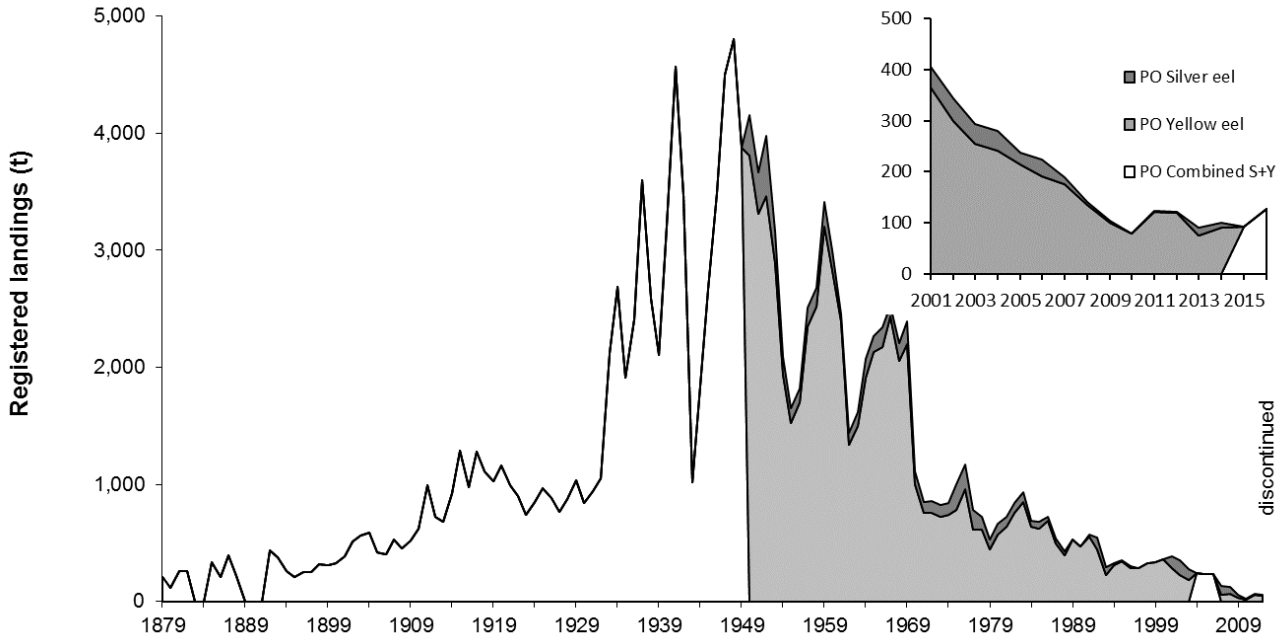

Figure NL 2. Main graph: Time series of landings of yellow eel and silver eel from Lake IJsselmeer/Markermeer at auctions. Source data: main graph LNV and Productschap Vis. Inserted graph: catches of yellow eel and silver eel recorded by PO IJsselmeer.

5.1.5.2 *Recreational Fishery*

In 2009 an extensive Recreation Fisheries Program was started in the Netherland. In December 2009, 50,000 households were approached during the screening survey to determine the number of recreational fishermen in the Netherlands (result 1.69 million recreational fishermen). In 2010, 2000 recreational fishermen were selected for a 12-month logbook programme (March 2010 – February 2011). In this period in the Netherlands about 1,500,000 eels were caught by recreational fishermen, while about 500,000 eels were retained. Due to the lack of reliable length frequency data of the eel caught, raising the number of eel caught to a biomass estimate of eel caught was difficult (Van der

Hammen & de Graaf, 2012). The program was repeated in 2012/2013 and in 2014/2015 (Van der Hammen & Van der Graaf, 2017).
It was estimated that recreational fishers in marine waters retained 91,000 eels and returned 67,000 eels (in total 18 tons retained), although these numbers are less precise than those of fresh water catches. In fresh waters the anglers were estimated to have retained 313,000 eels (41 tons) and have returned 1,517,000 eels. A third survey was conducted in the period April 2014-March 2015. In total, in fresh waters, 2,156,000 eels were caught of which 1,936,000 were released and 220,000 eels (30 tons) were retained. In marine waters, 440,000 eels were estimated to have been caught of which 247,000 were released and 193,000 were retained (40 tons) (Van der Hammen & de Graaf, 2017). In 2015, the 70 tons of landed eels (fresh waters + marine waters) made 1.77% of the total landings (Van der Hammen & de Graaf, 2017).
The number of recreational fishers was estimated to have declined from 1.7 million in 2009 to 1.4 million in 2011, 1.3 million in 2013 and 1.2 million in 2015.

*Table NL. E. Recreational Fisheries: retained and released catches of eel (in numbers) in the Netherlands in inland and marine areas. Only estimated numbers from angling were available (Van der Hammen & de Graaf, 2013, 2015, 2017).*data less accurate.*

	RETAINED				**RELEASED**			
	INLAND		MARINE		INLAND		MARINE	
YEAR	ANGLING	PASSIVE GEARS	ANGLING	PASSIVE GEARS	ANGLING	PASSIVE GEARS	ANGLING	PASSIVE GEARS
2010	341,000	Not allowed	180,000	Not known	887,000	Not allowed	117,000	Not known
2012	313,000	Not allowed	91,000*	Not known	1,517,000	Not allowed	67,000*	Not known
2015	220,000	Not allowed	193,000	Not known	1,936,000	Not allowed	247,000	Not known

Table NL. F. Recreational Fisheries: catch and release mortality for eel in the Netherlands (Van der Hammen & de Graaf, 2017 based on Bartholomew & Bohnsack, 2005).

	RELEASED			
	INLAND		MARINE	
YEAR	ANGLING	PASSIVE GEARS	ANGLING	PASSIVE GEARS
2017	11%	Not allowed	11%	Not known

5.1.6 Silver eel fisheries

5.1.6.1 *Commercial*

No reliable long term time series of yellow eel landings exist. Data on total landings of yellow and silver eel combined have been reported for IJsselmeer/Markermeer. Data from auctions around IJsselmeer did report yellow and silver eel separately, but information in recent years (early 1990s onwards) is unreliable: yellow eel from eel boxes and silver eel from all gears have been combined and labelled 'silver eel' (see section 6.2. for details). In addition, catches registered by the PO IJsselmeer from 2001 onwards do distinguish silver eel from other eel catches. However, some silver eel may still be reported amongst the catches of 'other eel'. Still, landings and catches of silver eel are included "as is" in the figure of yellow eel landings and catches (Figure NL 3). An obligatory catch registration system has been introduced in the Netherlands in January 2010 by the Ministry of Agriculture, Nature and Food quality (LNV). However, weekly catches of eel have been reported, but they consist of combined data for yellow eel and silver eel and no information on effort or gears have been reported.

5.1.6.2 *Recreational*

NO AVAILABLE DATA.

5.1.6.3 *Marine fishery*

The number of marine fishing vessels that have landed eel in the Netherland consisted of 37 fishing vessels in 2016. Together, they landed 11,177 kg (11 tons) of eel, which is more than double of the catch in 2015 and the years before, but low compared to Lake IJssel (126 t for 2016).

Table NL E. Marine fisheries capacity (N vessels per country) that have landed eel in the Netherlands from ICES areas IVa, IVb, IVc, UNK, VIIa, VIId and VIIIb).

	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**		
bel						7	2	2		1		
deu										1		
eng						1						
nld	52	44	39	45	42	34	53	64	55	51		
Grand Total	**52**	**44**	**39**	**45**	**42**	**42**	**55**	**66**	**55**	**53**		
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
bel	1								1			
deu												
eng					1							
nld	47	48	49	36	33	33	25	29	37	29	31	37
Grand Total	**48**	**48**	**49**	**36**	**34**	**33**	**25**	**29**	**38**	**29**	**31**	**37**

Table NL F. Marine fisheries landings (kg per country) in the Netherlands from ICES areas IVa, IVb, IVc, UNK, VIIa, VIId and VIIIb).

	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**		
bel						1539	750	980		40		
deu										15		
eng						64						
nld	35535	27725	24129	18395	21906	19488	34973	28205	17951	31153		
Grand Total	**35535**	**27725**	**24129**	**18395**	**21906**	**21091**	**35723**	**29185**	**17951**	**31208**		
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
bel	50								60			
deu												
eng					20							
nld	18155	17414	9131	6909	3960	4971	3684	4338	5797	4241	4297	11177
Grand Total	**18205**	**17414**	**9131**	**6909**	**3980**	**4971**	**3684**	**4338**	**5857**	**4241**	**4297**	**11177**

Table NL G. Summary table of landings (t)

Decade / **Year**	**1990**	**2000**	**2010**
0		21	5
1		36	4
2		29	4
3		18	6
4		31	4
5	36	18	4
6	28	17	11
7	24	9	
8	18	7	
9	22	4	

5.2 Restocking

5.2.1 Reconstructed Time Series on Stocking

No (historical) data available with regards to origin and whether or not stocked eels were quarantined, overall all stocked of glass eel (see Figure NL 3) is sourced outside the Netherlands.

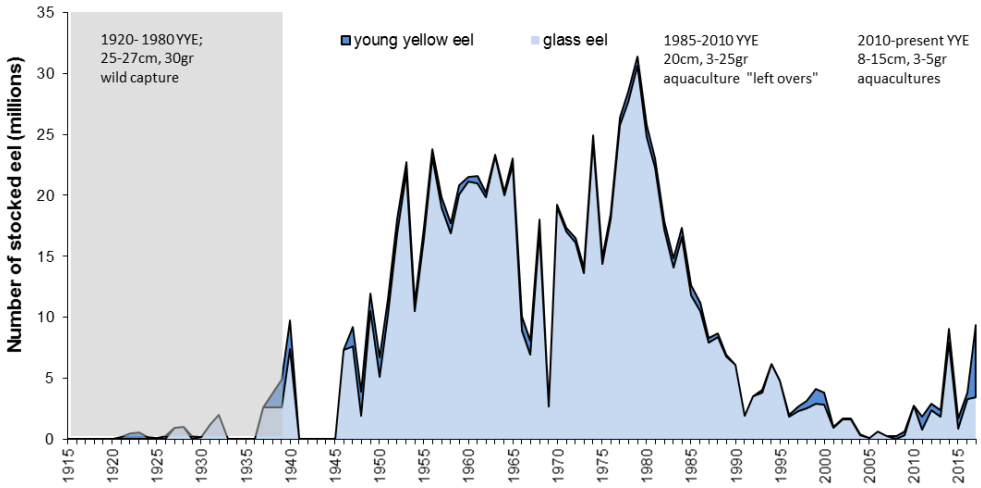

Figure NL 3. Overview of stocking of glass eel and young yellow eel in the Netherlands (1920-2017). Note that the average weight of stocked young yellow eel decreased from ~30g to ~3 g between 1920 and 2010.

5.2.2 Amount stocked

Table NL H. Overview of glass eel and young yellow eel stocked in the Netherlands in 2017 (Source DUPAN). The location where they have been raised is set between brackets in the column 'Origin'. Source data: DUPAN (1, 2, 3, 4, 8, 9), Visnetwerk (5+6), NVWA (7): 72 kg of glass eel were found at the airport, in the luggage of Chinese smugglers travelling from Spain to China.

	DATE	STOCKING LOCATION	ORIGIN	KG	N	N/KG
N	**GLASS EEL**					
1	10/03/2017	Veluwe Randmeren	France	253	792,680	3133
2	10/03/2017	Zuidelijke Randmeren	France	170	531,930	3129
3	10/03/2017	Markermeer	France	150	469,650	3131
4	31/03/2017	Grevelingen	France	341	1,250,100	3666
5	2017	Various locations	France	33	107,738	3265*
6	07/04/2017	Kanaal van Steenenhoek	France	10	35,000	3500
7	26/04/2017	Zeeuws-Vlaanderen	Spain	72	235,064	3265*
	TOTAL Glass eel			1029	3,422,162	
	YOUNG YELLOW EEL					
8	6/05/2017	Gemeente Kampen: Ganzendiep en De Goot	Glass eel from France (aquaculture in NL)		25,000	
9	24/05/2017	Friesland	Glass eel from France (aquaculture in NL)		574,000	
	TOTAL young yellow eel				599,000	
	TOTAL glass eel+yellow eel				4,021,162	

*Using an average of the DUPAN data (3265/kg) for estimates of N/kg

5.3 Aquaculture

5.3.1 Seed supply

Table NL. G. Origin of glass eel used for aquaculture in the Netherlands since 2010. Numbers are rough estimates (Source DUPAN).

SEASON	FRANCE	SPAIN	ENGLAND	TOTAL (KG)
2010/2011	4725	1890	135	6750
2011/2012	5325	1350	100	6775
2012/2013	5500	650	550	6700
2013/2014	3400	250	1250	4900
2014/2015	4400	500	300	5200
2015/2016	5200		Few hundred*	5500
2016/2017	5300	800	150	6250

*assuming 'a few hundred' to be 300 kg

5.3.1.1 *Production*

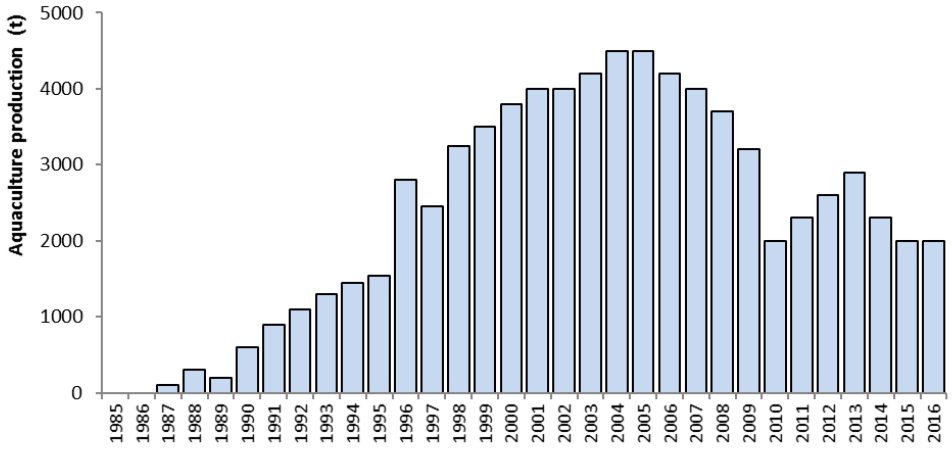

Figure NL. 2. Trend in aquaculture production of yellow eel for consumption in the Netherlands. In 2016, the production was ~2000 t (rough estimate) (Source DUPAN).

5.4 Entrainment

Details on entrainment can be found in Van de Wolfshaar et al. (2015)

5.5 Habitat Quantity and Quality

General information on habitat quantity is mentioned in paragraph 5.1.2 and in Van de Wolfshaar et al. (2015).

Table NL I. Overview of the assessed impacts per habitat type or for 'All' habitats where the assessment is applied across all relevant habitats. Barriers include habitat loss; indirect impacts are anthropogenic impacts on the ecosystem, but only indirectly on eel (e.g. eutrophication). A = assessed, MI = not assessed, minor, MA = not assessed major, AB = impact absent).

EMU CODE	HABITAT	FISH COM	FISH REC	HYDRO & PUMPS	BARRIERS	RESTOCKING	PREDATORS	INDIRECT IMPACTS
NL_Neth	Riv	A	A	A	A	MI/MA	MI/MA	MI/MA
	Lak	A	A	A	A	MI/MA	MI/MA	MI/MA
	Est	NP	NP	NP	NP	NP	NP	NP
	Lag	NP	NP	NP	NP	NP	NP	NP
	Coa	MI	A	AB	AB	AB	AB	MI
	All							

5.6 Others

5.6.1 Assisted migration of silver eel

Since 2011 several (pilot)projects have started at migration barriers (pumping stations) to assist the migration of silver eel (programme 'Paling Over De Dijk', PODD). In 2011 0.54 t of silver eel was caught and released again past barriers at four sites ('assisted migration'). In 2015, over 8 t was caught and released (Figure NL 4).
However, the mortality rates of silver eel passing the selected barriers has been assessed at moderate to low (Bierman *et al.* 2012; Winter *et al.* 2013). Thus, the net amount of eels saved by the assisted migration is much lower than the amount caught and released. In 2013 the barriers for silver eel were prioritised (Winter *et al.* 2013) to improve the selection and efficiency of assisted migration initiatives. Applying location-specific mortality rates, the net amount of 'saved' eels in 2016 was 2.5 t (Figure NL 4). Rates of 35% mortality were used for unknown locations.

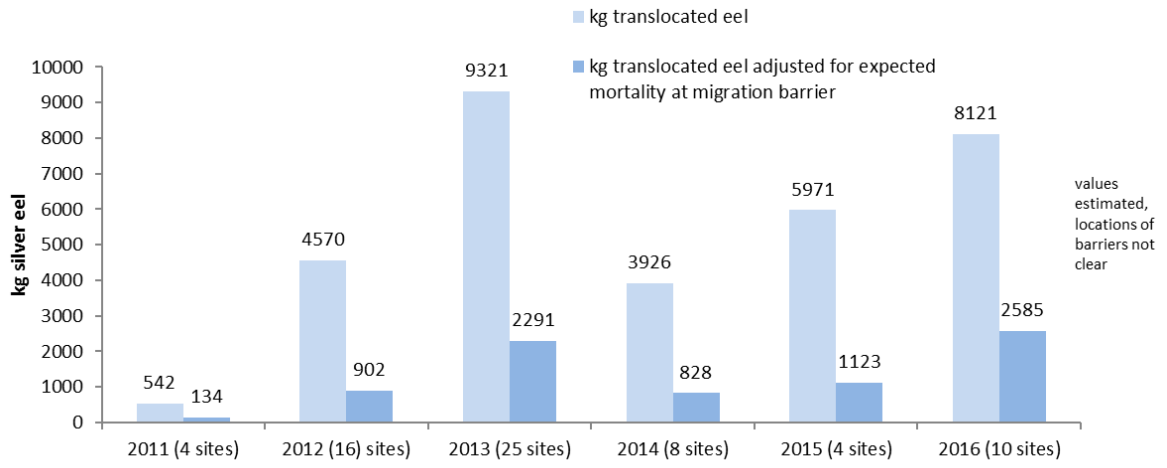

Figure NL 4. Overview of the "gross" and "net" amount of silver eel assisted over migration barriers in the Netherlands (2011-2016).

5.6.2 Illegal, unreported and unregulated (IUU) fishing

The task of adherence to rules and regulations pertaining to eel fishery is carried out by the Netherlands Food and Consumer Product Safety Authority (NVWA). Following indication of illegal eel fishing in 2012, they intensified their monitoring in 2013. In 2015 in total 202 fishing gears associated with illegal eel fishing were seized. In 2016, a total of 80 fishing gears were seized. The NVWA does not record weights of illegal catches (Table NL J).

Glass eel: On 8 March 2016, 92 kilos (1.6 million eels) of European glass eel were found in Hong Kong in the suitcases of 2 Chinese people, travelling from Vigo (Spain) via Madrid and Amsterdam Schiphol Airport[5]. The glass eel was smuggled through Schiphol Airport, just because the smugglers used the airport as a stop-over.

On 17 April 2017, 72 kg of glass eel (~250,000 eels) were seized on Schiphol Airport (Amsterdam). Two Chinese people illegally tried to smuggle the glass eel from Spain via Amsterdam to China, where it would be worth 115,000 Euros[6]. After a period of quarantine, these glass eel were released in Zeeland[7].

[5] http://www.paling.nl/nederlands/informatie/het-laatste-palingnieuws/smokkelaars-reisden-via-amsterdam/
[6] https://www.nvwa.nl/nieuws-en-media/nieuws/2017/04/18/nvwa-en-douane-nemen-72-kilo-glasaal-in-beslag
[7] http://www.dupan.nl/files/Image//nl/nieuwsberichten/journaal/journaal-mei-2017/journaal__mei_2017.pdf

Table NL J. Overview of suspected causes of illegal fishing activities in the Netherlands (2016). Number of cases per cause per area. Weights of illegal catches are not known (Source: NVWA).

CAUSE	IJSSELMEER	MARKERMEER	IJSSEL/ZWARTE	FRIESLAND	ZEELAND	VINKEVEENSE	TOTAL
1. Fishing out of the season						9	9
2. Fishing without licence							
3. Fishing using illegal gears	4	10	2	4	43		63
4. Retention of eel below size limit							
5. Illegal selling of catches							
6. Fishing in closed areas	8						8
TOTAL							**80**

6 National stock assessment

6.1 Description of Method

Methods are described in Van de Wolfshaar *et al.* (2015) and in Van der Sluis et al. (2016). The status of the Dutch eel population in the framework of the Dutch Eel Management Plan is assessed every 3 years. The latest report is Van de Wolfshaar *et al.* (2015).

6.1.1 Data collection

GLASS EEL MONITORING

GEAR	LOCATION	FREQUENCY	TIME	PERIOD
liftnet (1x1m; mesh 1x1mm)	Den Oever	daily	5 hauls every 2 hours between 22:00-5:00	~Mar-May
liftnet (1x1m; mesh 1x1mm)	10 other locations along the coast	weekly	2 hauls at night time	~Mar-May

SILVER EEL MONITORING

GEAR	LOCATION	FREQUENCY	TIME	PERIOD
Fykes (6 sites)	Den Oever, Kornwerderzand, Noordzeekanaal, Nieuwe waterweg, Haringvliet, upper reaches river Meuse	continuous	weekly	Sep-Nov
Eel shocker	upper reaches river Rhine	continuous	once a week	Sep-Nov

PASSIVE MONITORING PROGRAM: MAIN RIVERS AND LAKE IJSSELMEER

GEAR	LOCATION	FREQUENCY	PERIOD
Fykes (4) (stretched mesh 18-20mm)	Veerse Meer, Haringvliet (North Sea)	continuous	~May-Sep
Fykes (10) or summer fykes (20-40) (stretched mesh 18-20mm)	7 locations in main rivers, estuaries and lakes	continuous	Sep-Nov
Fykes (10) or summer fykes (20-40) (stretched mesh 18-20mm)	6 locations in main rivers, estuaries and lakes	continuous	Mar-May

Due to closure of the eel fishery in polluted areas, this program, which started in the 1990s, has been interrupted. Almost two thirds of the sampling locations were located in the polluted areas and sampling ceased on 1 April 2011. An alternative program to study diadromous fish started in 2012.

ACTIVE MONITORING PROGRAM: MAIN RIVERS

GEAR	LOCATION	FREQUENCY	PERIOD
Bottom trawl (channel; 3m beam; 15mm stretched mesh)	~50 locations in main rivers	10 min trawl, ~1000m transect	~May-Sep
Electrofishing (shore area)	~50 locations in main rivers	20 min, 600m transect	~May-Sep

6.1.1.1 *Sampling commercial catches*

AREA	SAMPLING FREQUENCY	NO. OF FISHERS SAMPLED	GEAR
Grevelingen	once	1	large fyke
Friesland	once	2	large fyke
Hollands Noorderkwartier	twice	2	large fyke
IJssel Plus	twice	1	large fyke
Lauwersmeer	once	1	large fyke
Noorderzijlvest	once	1	large fyke
Veluwe Randmeren	twice	1	large fyke
Rijnland	twice	1	large fyke
Volkerak-Zoommeer	twice	1	large fyke
Lake IJsselmeer	once	1	train fyke
Lake IJsselmeer	once/twice	2	large fyke
Lake IJsselmeer	twice	1	eel boxes
Lake IJsselmeer	once	1	longlines
Lake Markermeer	once/twice	2	large fyke
Lake Markermeer	twice	1	longlines

PARAMETER	SAMPLE DETAILS
No. eels for length-frequency	max. 150 eels per sample
No. eels for biology (sex, life stage, parasites)	< 50 cm: 4 eels per 10 cm size class ≥ 50 cm: 2 eels per 10 cm size class
Period	June – August (Fryslan: February – April)

6.1.2 Analysis

The national stock assessment methodology is described in Van de Wolfshaar et al. (2015).

6.1.2.1 *Age and growth increment analysis*

Since 2010, age readings have been obtained annually of ~300 otoliths, which were collected from eels in different areas of the Netherlands. The number of annuli were counted to determine the age of individuals ("crack and burn" method). Furthermore, distances between consecutive annuli were measured using image analysis software to determine growth increments.

6.1.2.2 *Life stages*

Life stages (yellow, silvering, silver) are visually determined based on colouration of body and fins and eye diameter. Criteria for life stages are at present not formally described.

6.1.2.3 *Sex determinations*

Sex is determined by macroscopic examination of the gonads.

6.1.3 Reporting

Van de Wolfshaar *et al.* (2015) report on the status of the eel population in the periods 2005-2007, 2008-2010 and 2011-2013.

6.1.4 Data quality issues and how they are being addressed

See Van de Wolfshaar et al. (2015)

6.2 Assessment results

See Van de Wolfshaar et al. (2015)

6.2.1 Habitat quantities

See Van de Wolfshaar et al. (2015)

6.2.2 Silver Eel biomass indicators

See Van de Wolfshaar et al. (2015)

6.2.3 Anthropogenic mortality rates

See Van de Wolfshaar et al. (2015)

6.2.4 Data collection

See 6.1.1.

6.2.5 Analysis

See Van de Wolfshaar et al. (2015).

6.2.6 Reporting

See Van de Wolfshaar et al. (2015).

6.2.7 Data quality issues and how they are being addressed

See Van de Wolfshaar et al. (2015)

6.3 Assessment results

See Van de Wolfshaar et al. (2015)

7 Other data collection

7.1 Recruitment time series

7.1.1 Fishery independent

Recruitment of glass eel in Dutch waters is monitored at 12 other sites along the coast (Figure NL 5; see Dekker (2002) for a full description). In Den Oever (Figure NL 6) recruitment significantly increased in 2013-2014 and was at the highest level since the mid-'90s. However, overall the recruitment levels were still low compared to the reference period (1960-1979) and in 2015 recruitment level reached a historic low, and in 2016 and 2017 there was a small increase. The data from the other locations (Table NL K) confirmed the overall trend, though individual series may deviate. Glass eel data are presented as the average number of glass eels per haul in the months April and May, between 18:00-8:00 and only years with >5 hauls are included (details in Griffioen et al. 2017).

Figure NL 5. Locations of glass eel monitoring in the Netherlands.

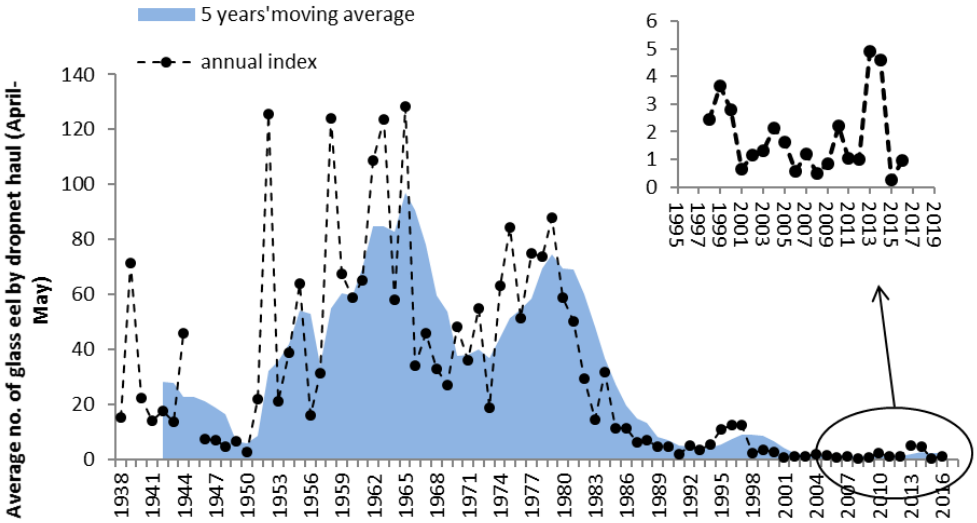

Figure NL 6. Trend indices (mean number per haul in April and May) of glass eel recruitment at Den Oever (1938-2016).

Table NL K. Average number of glass eel caught per lift net haul at the sluices in Den Oever in the period April-May.

DECADE / YEAR	1930	1940	1950	1960	1970	1980	1990	2000	2010
0		22.4	2.7	58.9	48.1	59.0	4.9	2.8	2.2
1		14.3	21.9	65.2	36.1	50.4	1.8	0.6	1.1
2		17.5	125.6	108.9	55.0	29.4	5.2	1.2	1.0
3		13.7	21.1	123.7	18.8	14.7	3.5	1.3	4.9
4		46.1	38.8	58.1	63.0	31.6	5.4	2.1	4.6
5		NA	64.1	128.3	84.3	11.2	11.1	1.6	0.2
6		7.5	16.1	34.0	51.4	11.4	12.5	0.6	1.0
7		7.2	31.3	45.8	75.0	6.2	12.6	1.2	2.3
8	15.3	4.8	124.0	32.9	73.6	7.0	2.5	0.5	
9	71.5	6.6	67.6	27.1	87.7	4.8	3.7	0.9	

Table NL L. Average number of glass eel caught by dropnet hauls after sunset, before sunrise in the period April-May at 12 sites in the Netherlands (1979-2016). If five or less hauls were carried out data are not presented. Data are visualised in Figure NL 7.

YEAR	Schelde_Bath_BATH	Maas_BergscheDiep_BDSL	Maas_Krammersluizen_KRAS	Maas_Stellendam_STGS	Rijn_DenOever_DOSP	Rijn_Harlingen_HTHS	Rijn_IJmuiden_IJMS	Rijn_Katwijk_KATW	Rijn_Lauwersmeer_LAUS	Eems_NieuwStatenzijl_NSZS	Eems_Termunterzijl_TMZS
1979					87.7		222.3		100.4		
1980					59.0						
1981					50.4		188.7		75.9		
1982					29.4				21.6		
1983					14.7				15.8		
1984					31.6		8.1		9.5		
1985					11.2		0.6		25.2		
1986					11.4		3.3		1.3		
1987					6.2		7.7				
1988				13.8	7.0		4.0		1.0		
1989				4.4	4.8		1.5		14.3		
1990			0.3	10.9	4.9		3.2		6.0		
1991		1.3	0.2	3.1	1.8		3.6	5.1	6.6		0.5
1992	14.5	2.2	0.4	16.9	5.2	16.7	5.8	8.1	12.1		0.6
1993	22.7		0.4	10.1	3.5		3.3	13.5	33.2		1.2
1994	14.2		0.5	4.0	5.4	16.0	4.0	15.1	31.0		2.8
1995	17.8		0.4	3.3	11.1	6.6	2.0	29.7	16.9		3.7
1996	35.3		0.7	0.5	12.5	34.2	4.5	25.3	49.4	27.5	7.7
1997	41.6		0.6	2.8	12.6	14.0	1.8	12.3	27.8	30.0	15.6
1998	28.2		0.6	1.0	2.5	18.3	2.0	38.8	14.4	21.8	1.4
1999	29.7		0.5	1.2	3.7	19.1	1.9	122.7	31.7	13.5	10.1
2000	10.2	3.8	1.0	7.1	2.8	2.9	0.7	11.6	7.2	38.8	8.7
2001		0.1	0.1	1.0	0.6	2.3	0.5	14.1	2.4	39.7	1.1
2002	1.9		0.2	4.2	1.2	3.2	0.1	12.3	5.5	36.4	1.6
2003	7.5		0.1	0.3	1.3	5.1	0.0	12.7	1.7	23.6	0.8
2004	16.4		0.0	0.3	2.1	14.3	0.1	4.5	2.3	28.1	1.9
2005	14.6		0.6	0.2	1.6	6.8	0.0	5.6	1.4	21.1	1.8
2006	12.0		0.2	0.0	0.6	0.6	0.0	1.4	1.7	8.3	1.3
2007	40.5	0.4	0.1	0.1	1.2	1.7	0.1	24.8	0.9	21.7	4.0
2008	13.2	2.3	0.0	0.0	0.5	1.1	0.1	4.1	2.8	15.9	1.3
2009	9.1	1.1	0.0	0.4	0.9	0.7	0.1	3.5	0.6	13.6	1.2
2010	28.4	1.7	0.0	0.2	2.2	1.0	0.0		1.1	13.0	1.2
2011	39.2	1.3	0.1	0.3	1.1	3.1	0.0		1.4	11.6	1.4
2012	25.8	0.8	0.2	0.1	1.0	1.1	0.1	1.6	2.9	27.6	1.3
2013	69.5	16.7	0.0	0.2	5.0	4.8	0.0	1.4	9.1	60.5	1.9
2014	96.3	6.3	0.0	0.5	4.6	5.8	0.0	0.4	16.2	72.0	2.1
2015	24.2	2.2		0.2	0.2	1.0	0.1	0.6		3.0	0.4
2016	22.8	4.7	0.0	1.0	1.0	1.5	0.0	0.7		31.1	0.8
2017	12.2	0.5		0.1	2.3		0.0	0.4	2.3	7.6	1.4

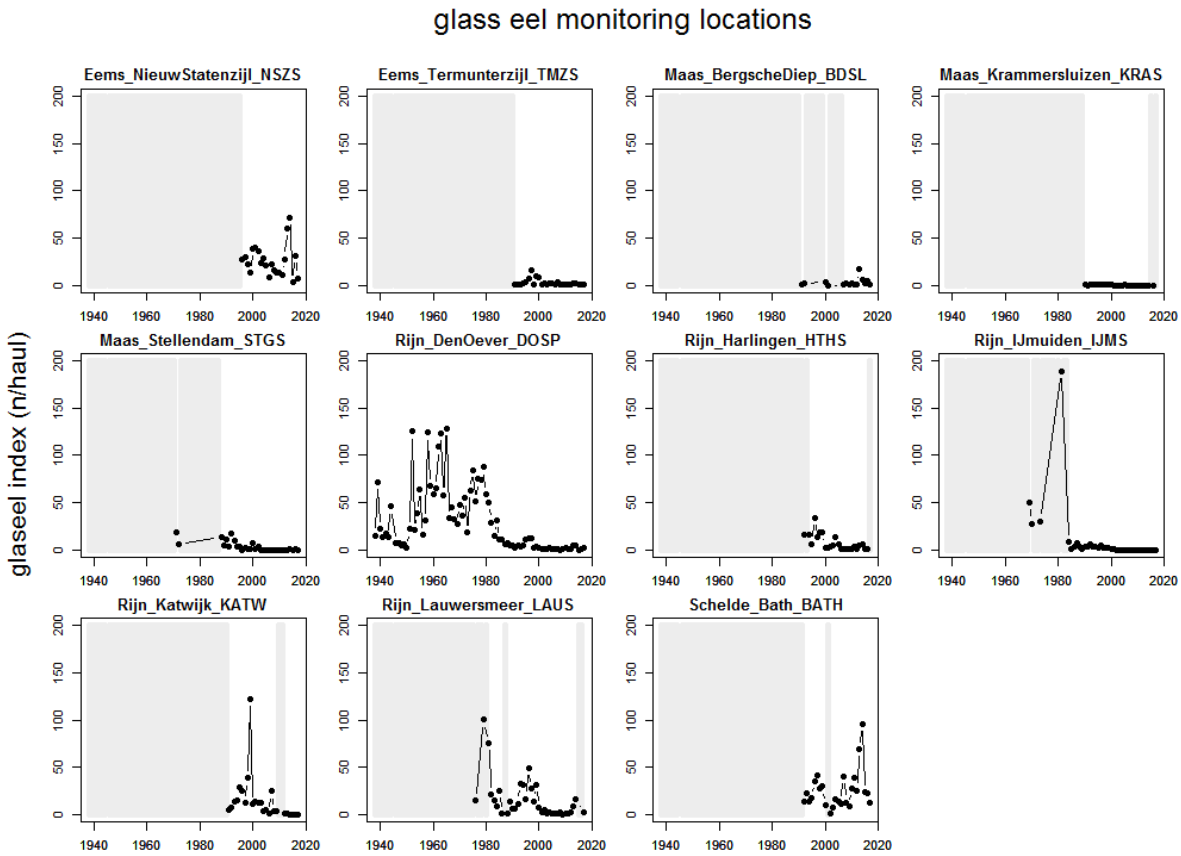

Figure NL 7. Time series of the glass eel indices (data of Table NL L). Grey = not sampled (data Wageningen Marine Research).

7.2 Yellow eel abundance surveys

NO AVAILABLE DATA.

7.2.1 Recreational

NO AVAILABLE DATA.

7.2.2 Fishery independent

One of the few long time series for eel is the fyke monitoring at NIOZ (Den Burg, Texel; van der Meer *et al.* 2011) (Figure NL 8). This data set shows a familiar pattern of a steep decline in abundance since the 1980s.
In the past almost all catches were yellow eel, based on their length. More recently, the catches also comprise silver eel (source: NIOZ). In 2016, 16 eel were caught within a period of 116 fyke days.

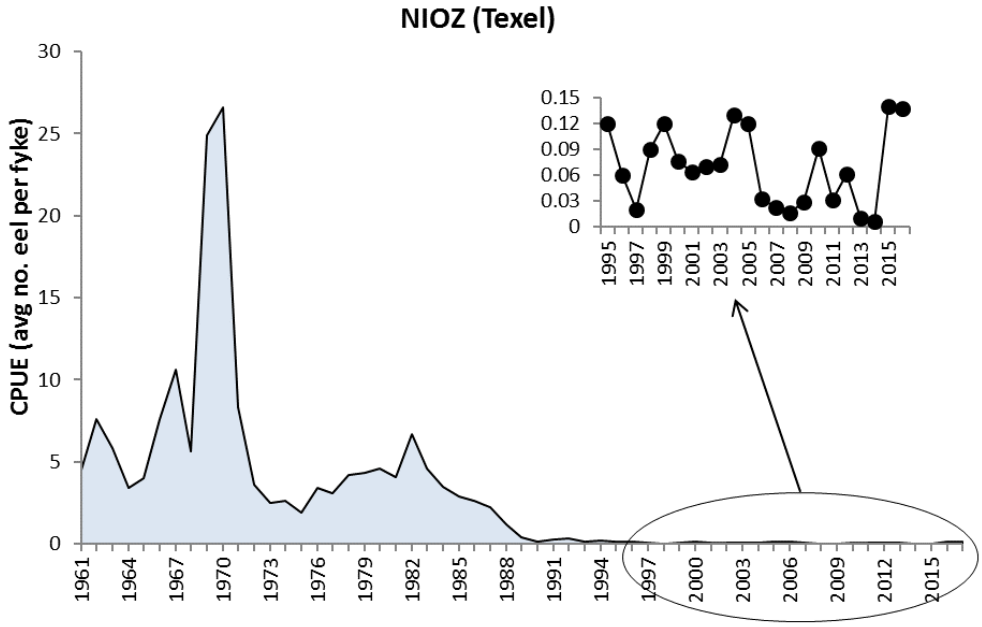

Figure NL 8. Time series of the mean catch per fyke (numbers) of yellow eel at NIOZ 1960-2016 (data Van der Meer et al., 2011 and NIOZ).

7.2.2.1 *Lake IJsselmeer/Markermeer (active gear)*

Figure NL 9 presents the trends in CPUE for the annual (yellow) eel surveys in Lake IJsselmeer (25 sites) and Lake Markermeer (15 sites), using the electrified trawl.

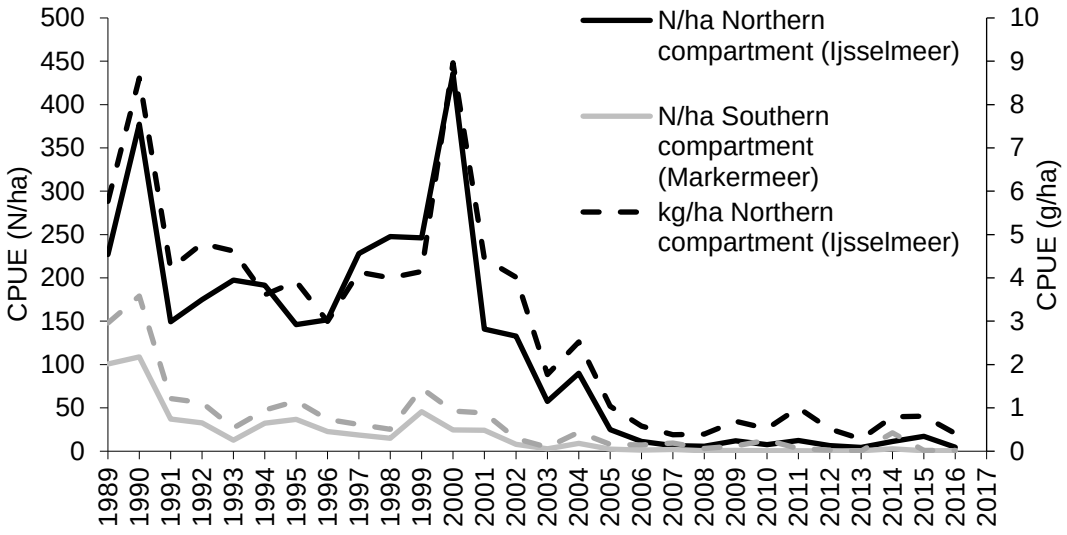

Figure NL 9. CPUE trends in Lake IJsselmeer stock surveys (N/ha and kg/ha), using the electrified trawl. Note: The northern and southern compartments have been separated by a dyke since 1976 (data: Wageningen Marine Research).

7.2.2.2 *Main rivers (active gear)*

Data is collected for the main rivers, but is not yet available.

7.2.2.3 *Main rivers (passive gear)*

Data is collected for the main rivers, but is not yet available.

7.2.2.4 *Coastal waters (active gear)*

The number of eels caught in a coastal survey (Demersal young Fish Survey) is presented in Figure NL 10. Until the mid-1980s, considerable catches of eel were observed, after which a gradual decrease

was observed. A more elaborate statistical analysis of the abundance and length composition of the eel stock in coastal waters is presented in Dekker (2009).

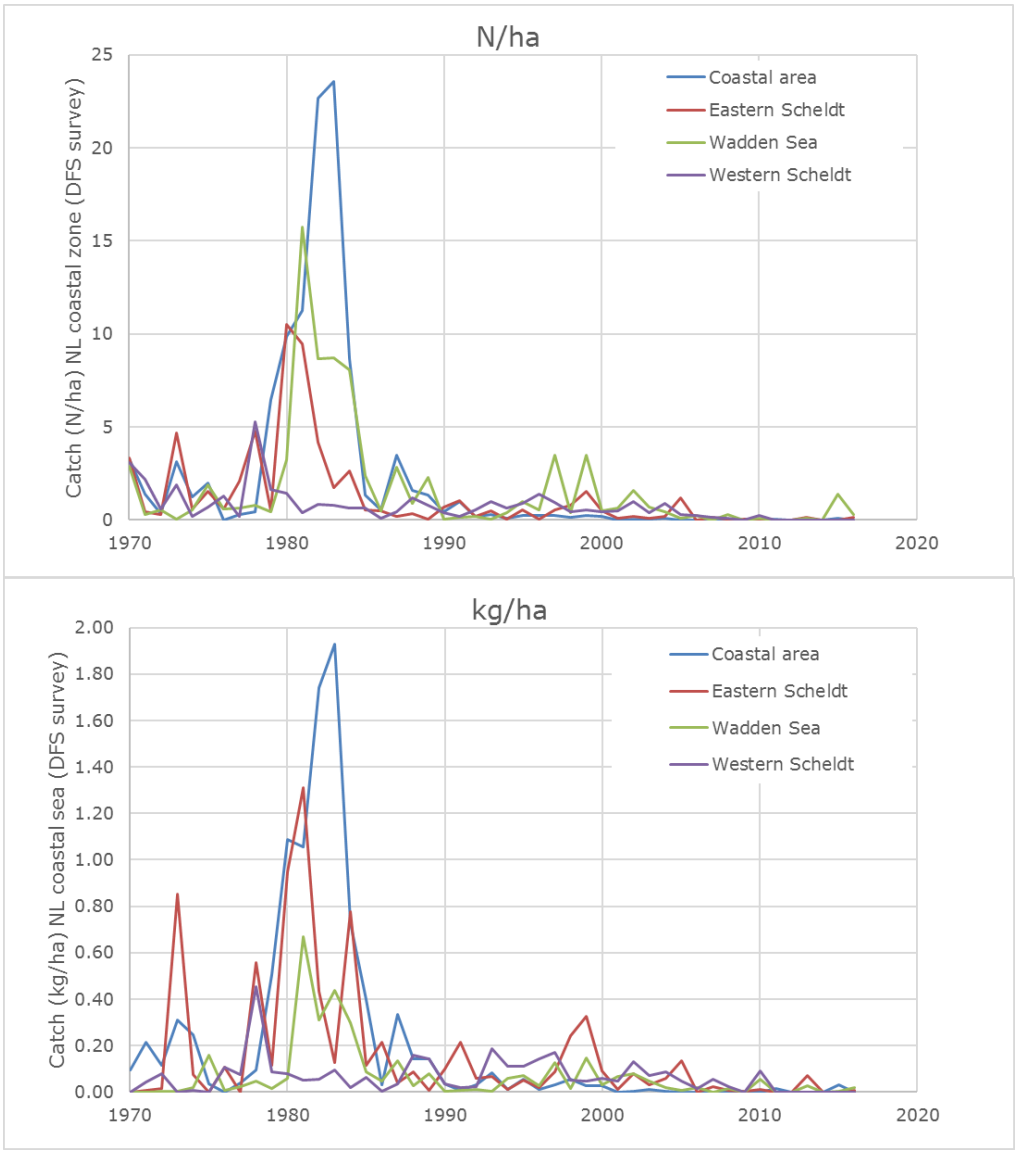

Figure NL 10. Trends in coastal survey catch 1970-2016. Top graph: n/ha; lower graph: kg/ha. Most of the Wadden Sea belongs to RBD Rhine; Eastern Scheldt is mixed RBD Scheldt and Meuse; Western Scheldt belongs to RBD Scheldt (with an extra inflow from Meuse), the coastal area belongs to RBD Rhine (data: Wageningen Marine Research).

7.3 Silver eel escapement surveys

The Silver Eel Index has been implemented in the Netherlands since 2012. In co-operation with commercial fishermen the abundance of migrating silver eel is monitored on seven locations (main entry and exit points for migratory fish) during the months September-November. The programme and the results will be presented and discussed when sufficient data will become available, after at least five years. Due to irregular activities of participating fishermen in the research programme significant gaps in the data series already exist, especially for the locations at Den Oever and Kornwerderzand.

7.4 Biological parameters

See Van de Wolfshaar et al. 2015.

7.5 Parasites & Pathogens

The swim bladder nematode *Anguillicoloides crassus* was introduced from South-East Asia in wild stocks of European eel in The Netherlands in the early 1980s. The market sampling for Lake IJsselmeer collects information on eels showing *Anguillicoloides crassus* infection based on inspection of the swim bladder by the naked eye. We scored an infection as 'present' when either we observed one or more *Anguillicoloides crassus* or a thickened swim bladder. As part of the extended market sampling program in 2009, data on *Anguillicoloides* infection rates have since also been collected in two other areas (Friesland and Rivers), and since 2011 the market sampling was conducted in most of the Netherlands.
Following the initial break-out in the late 1980s, infection rates in Lake IJsselmeer have been stable around 50%. Over the past year, infection rates appear slightly lower both in Lake Markermeer and on average in the rest of the Netherlands (Table NL M).

Table NL M. Infection rates of eels (2010-2016) with Anguillicoloides crassus in the Netherlands. Median infection rates of all sampled locations.

	FRYSLAN		LAKE IJSSELMEER		LAKE MARKERMEER		REST NL	
	N eels	N infected (% infected)	N eels	N infected (% infected)	N eels	N infected (% infected)	N eels	N infected (% infected)
2010	534	243(46%)	390	190(49%)	225	107(48%)	511	258(50%)
2011	107	40(37%)	293	127(43%)	104	35(34%)	583	231(40%)
2012	133	44(33%)	320	167(52%)	253	95(38%)	529	185(35%)
2013	17	8(47%)	14	7(50%)	93	40(43%)	283	106(37%)
2014	49	31(63%)	202	100(50%)	46	12(26%)	321	127(40%)
2015	61	24(39%)	267	110(41%)	nc	nc	297	112(38%)
2016	65	14(22%)	260	89(34%)	78	28(36%)	258	79(31%)

7.6 Contaminants

In 2016, 15 locations were sampled to assess contaminant levels (sum-TEQ and sum Non-dioxin-like PCBs) in eel (Table NL N). TEQ=Toxic Equivalent: sum of dioxines, furanes and dioxine-like PCBs. Samples consisted of about 25 individuals, 30-40 cm and or approximately 15 eels, from a defined length class of 53 up to 75 cm. Filets of the small eels were pooled (same mass per eel), for the large eels the mass of filet per eel used is determined by the size of the eel. In this way, the pooled sample is a proper representation of the eel composition in the Dutch waters (determined by monitoring the eel catch of fisherman.

Contaminant concentrations are always higher in larger eel than in smaller eel from the same locations. As in previous years, several samples had contaminant levels above the revised regulatory limits of 2012 (10 pg/g Sum TEQ and 300 ng/g Sum Non-dioxin-like PCBs[8], plus 10% uncertainty) (Table NL N). All locations that did have eels with a concentration of Sum TEQ or Sum Non-dioxin-like PCBs above the regulatory levels were fed (directly or indirectly) by the rivers Rhine (IJssel) and

[8] Sum of 6 PCBs including PCB153. These are non-toxic indicator PCBs that can be measured easily.

Meuse, except one. Weesper trekvaart is connected to the Rhine and Meuse, but only through a series of canals. The high level of pollution is probably due to an identified old dumpsite nearby.
Since 1978/1979 several locations have been monitored annually for PCBs. The levels for PCB 153 are shown in Figure NL 11. Concentrations in 2016 were about similar to those in previous years. Decrease of PCB-contamination occurs very slowly, if any. As the number of small eels is very low on some of the trend locations the number of locations with data for small eels declines. Therefore, nowadays large eels are monitored from all locations.

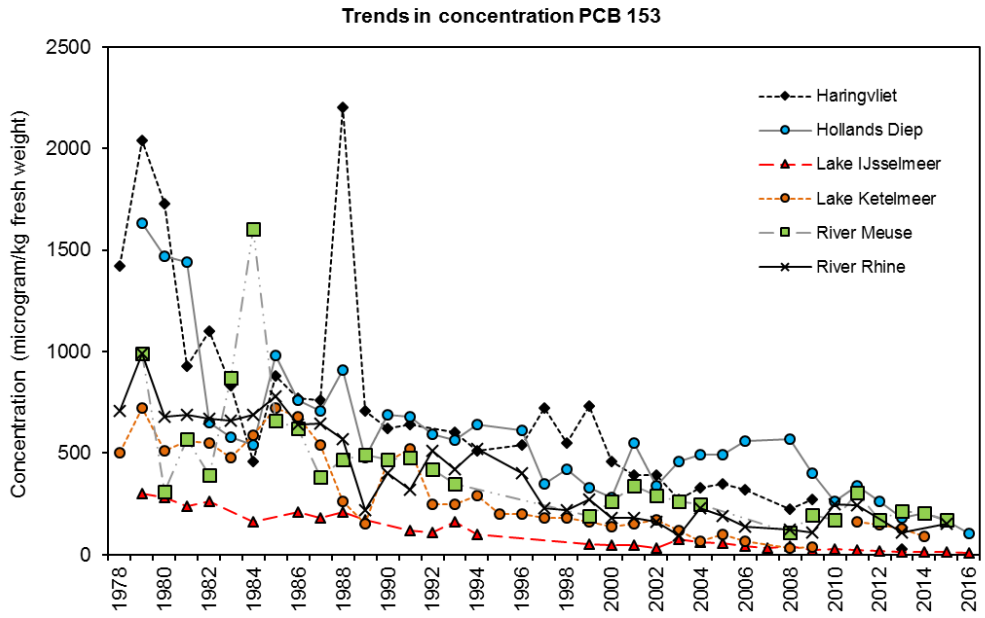

Figure NL 11. Trend in PBC-153 in 30-40 cm eel (1978-2016). Only data for 2 locations for this size class are available, see Table NL N (data: Wageningen Marine Research and RIKILT).

*Table NL N. Sum-TEQ, sum Non-dioxin-like PCBs, and PBC-153 in eel (2016) (data: Wageningen Marine Research and RIKILT). PCB-153 is plotted in Figure NL 11. Values of Sum-TEQ above the regulatory limit of 11pg/g (10+10%*10) and of Sum-ndl-PCB above the regulatory limit of 330 ng/g (300+10%*300) are indicated in grey.*

Nr	Location	Size	Lipid level (%)	Sum-TEQ	Sum-ndl-PCB	PCB 153
1	IJssel, Wijhe	>45	14.6	15.8	464	195
2	Lek, Culemborg	>45	18.8	17.2	695	291
3	2de Maasvlakte	30-40	6.4	3.5	73	37
	2de Maasvlakte	>45	18.9	7.0	137	62
4	Volkerak, Sluizen	>45	22.7	10.8	321	150
5	Volkerak, Steenbergen	>45	18.6	6.8	149	71
6	Volkerak, Krammersluizen	30-40	3.0	1.4	25.8	12.6
	Volkerak, Krammersluizen	>45	18.7	5.7	113	55
7	Hollands Diep	30-40	4.1	4.7	223	102
	Hollands Diep	>45	16.2	17.7	749	345
8	IJsselmeer, Medemblik	30-40	4.8	1.5	21.8	9.8
	IJsselmeer, Medemblik	>45	16.1	4.1	49.3	23.5
9	Maas, Eijsden	>45	9.2	9.7	535	228
10	Rijn, Lobith	>45	15.9	19.6	584	235
11	Amsterdam Rijnkanaal - Tiel	>45	20.9	17.7	540	237
12	Zijkanaal C	>45	14.7	15.3	544	240
13	Weesper trekvaart	>45	17.5	18.4	687	322
14	Nieuwe Merwede thv Woudrichem	>45	17.9	21.4	709	309
15	Waal, Tiel	>45	15.3	21.6	700	282

7.7 Predators

Predation of eel by cormorants (*Phalacrocorax carbo*) is much disputed amongst eel fishermen and bird protectors. The number of cormorant breeding pairs increased rapidly until the early 1990s, then stabilised and even decreased in recent years (Figure NL 12, Figure NL 13). For Lake IJsselmeer, food consumption has been well quantified (van Rijn & van Eerden 2001; van Rijn 2004); eel constitutes a minor fraction of the diet of cormorants. In other waters, neither the abundance, nor the food consumption is accurately known.

Figure NL 12. Natura 2000 areas with cormorant breeding colonies adjacent to the IJsselmeer and Markermeer: (72) IJsselmeer (73) Markermeer & IJmeer (78) Oostvaarderplassen (79) Lepelaarsplassen (94) Naardermeer.

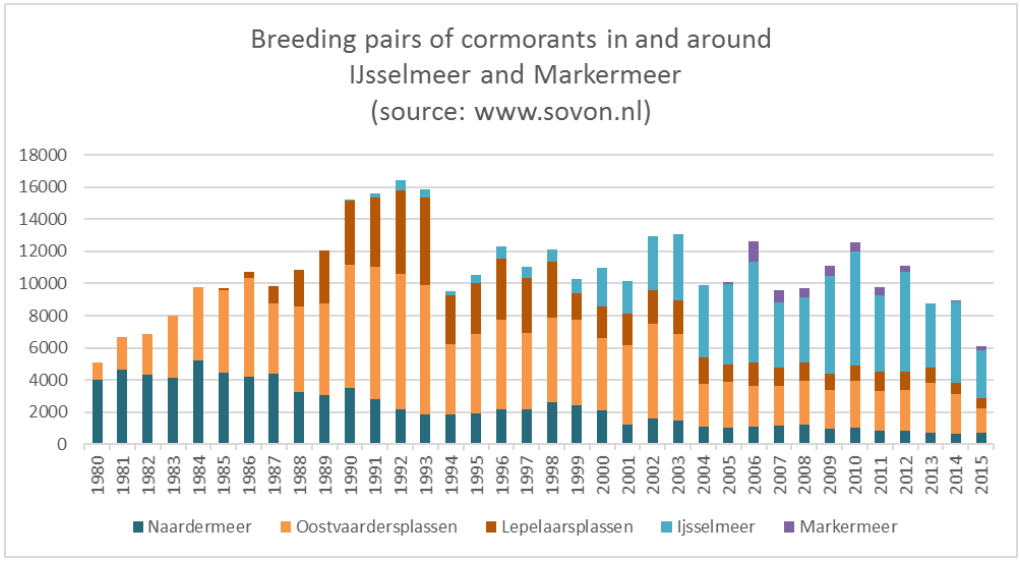

Figure NL 13. Trends in the number of breeding pairs of cormorants (Phalacrocorax carbo) in and around Lake IJsselmeer/Markermeer (Source: Netwerk Ecologische Monitoring, Sovon & CBS) (1980-2015).

8 New Information

Not applicable

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Quality Assurance

CVO utilises an ISO 9001:2008 certified quality management system (certificate number: 187378CC1-2015-AQ-NLD-RvA). This certificate is valid until 15 September 2018. The certification was issued by DNV GL Business Assurance B.V.

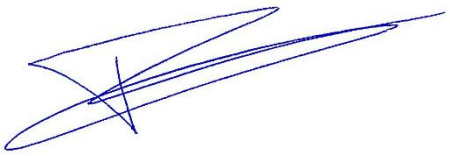
Justification

CVO Report 18.005
Project Number: 4311218539

The scientific quality of this report has been peer reviewed by a colleague scientist and the head of WOT, Centre for Fisheries Research

Approved: Dr. T. van der Hammen
Researcher

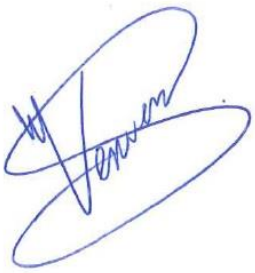
Signature:



Date: 27/03/2018

Approved: Ing. S.W. Verver
Head WOT, Centre for Fisheries Research

Signature:



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