

Report on the eel stock and fishery in the Netherlands 2014/2015

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IMARES report C044/16

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Report on the eel stock and fishery in the Netherlands 2014/2015

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1 Nederlandse samenvatting

In de Nederlands samenvatting wordt een overzicht gepresenteerd van de belangrijkste trends in aal en de aalvisserij in 2014/2015 zoals deze zijn gerapporteerd in het Country Report aan de International Council of Exploration of the Sea Working Group on Eel (EIFAAC/GFCM/ICES WGEEL) in november 2015. In deze Nederlandse samenvatting wordt een verkorte presentatie van de inhoud gegeven, met de nadruk op de meest recente gegevens.

1.1 Trend glasaal

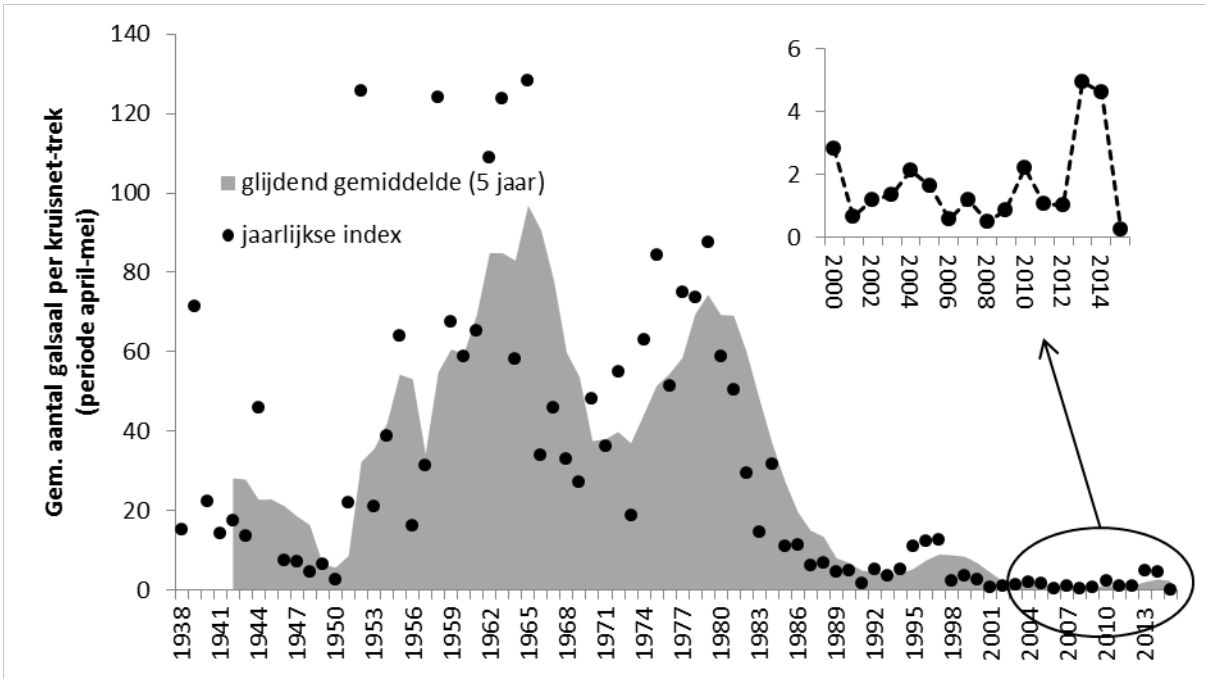
De intrek van jonge aal (glasaal) uit zee naar onze binnenwateren wordt – in principe - bemonsterd op 12 plaatsen langs de kust (Figuur 1). Niet alle locaties worden elk jaar bemonsterd. Bij Den Oever wordt sinds 1938 een intensieve bemonstering uitgevoerd.



Figuur 1. Locaties van de glasaalmonitoring in Nederland.

Er wordt al enkele jaren niet meer gemonitord op de locaties 'Otheense Kreek' en 'Scheepssluis Den Oever'. Op de locaties Krammersluis en Lauwersmeer zijn in 2015 geen metingen verricht. Voor deze locaties moeten voor 2016 nieuwe vrijwilligers worden gezocht.

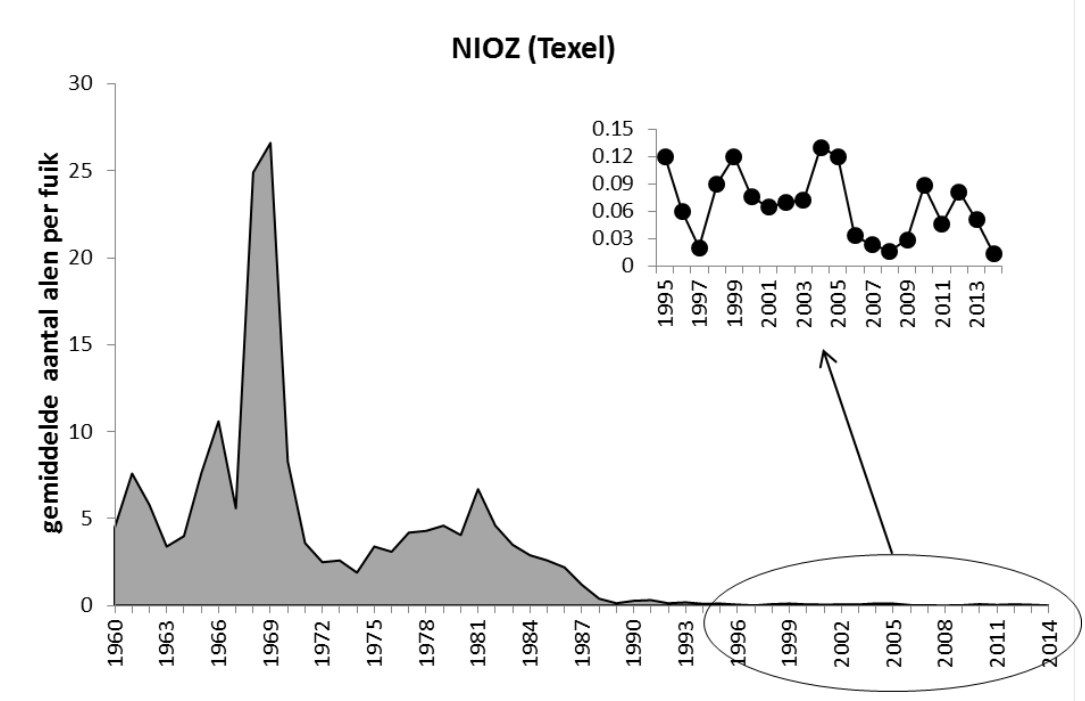
Op zo goed als alle locaties is de intrek afgenomen in 2015 ten opzichte van 2014. De resultaten van de langjarige intrekbemonstering bij Den Oever (locatie 'Spuisluis') tonen een sterk verlaagde intrek na 1985 (Figuur 2). Het gemiddelde niveau van de glasaalintrek in de laatste 15 jaar (2001-2015: gemiddeld 1.6 glasalen per kruisnet-trek, zie inzet in Figuur 2) is minder dan 5 % van het vroegere niveau (1960-1979: 64). Het niveau van de intrek bij Den Oever dit voorjaar (2015: 0.24) was laag, vergelijkbaar met het niveau van de intrek in de jaren 2001, 2006 en 2008. Internationaal is de glasaalintrek in 2015 ook een stuk lager uitgevallen dan in 2014. De internationale glasaal index blijft in 2015 ook ver onder het vroegere niveau (1960-1979) waardoor er weinig verandering in de perceptie van het bestand van de Europese aal is.



Figuur 2. Trend in de intrek van glasaal bij Den Oever (1983-2015).

1.2 Trend (rode) aal Waddenzee

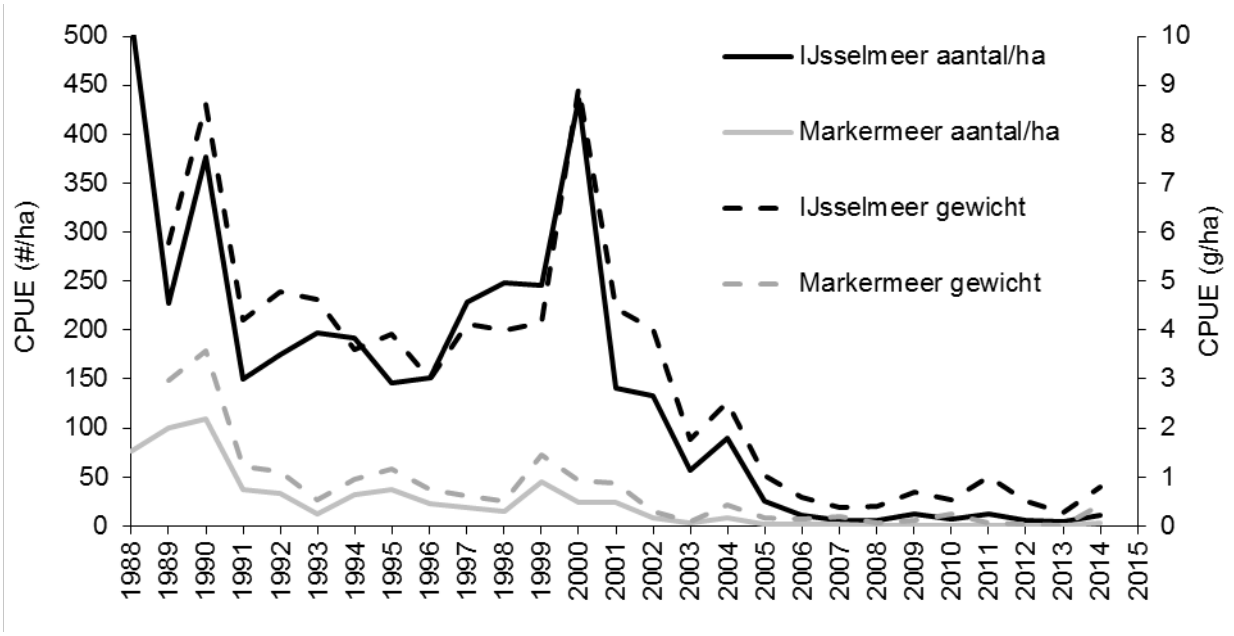
Sinds 1960 worden met een fuikbemonstering de vangsten rode aal in de haven bij de Mokbaai, 't Horntje (Texel) door medewerkers van het NIOZ nauwkeurig bijgehouden (Figuur 3). Deze dataset toont ook een duidelijk afname van de rode aal populatie sinds de jaren tachtig, vergelijkbaar met de drastische afname aan glasaal bij Den Oever. De index vertoont geen tekenen van herstel.



Figuur 3. Trend in de hoeveelheden rode aal in de NIOZ fuik per jaar (1960-2014) (Bron: Van der Meer et al., 2011; http://www.waddenzeevismonitor.nl/vissensoort/paling-anguilla-anguilla-42.html).

1.3 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 4).

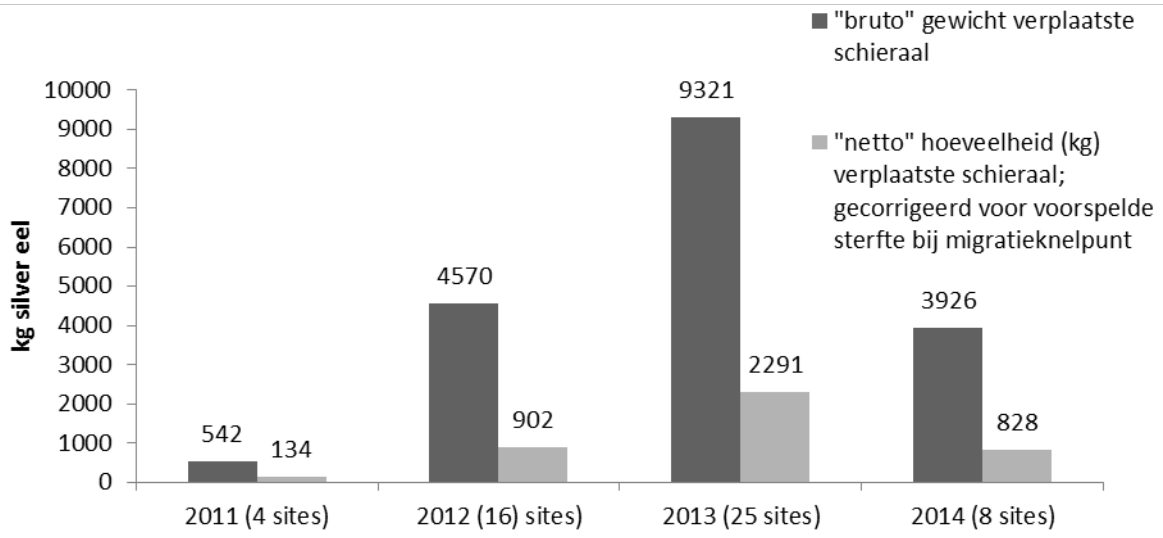


Figuur 4. Trend in de aantallen (linker-as) en gewicht (rechter-as) per ha (rode) aal in het IJsselmeer en Markermeer per jaar op basis van de vangst met de electrostramienkor. CPUE = catch per unit effort.

1.4 Trend schieraal

Schieraal over de dijk

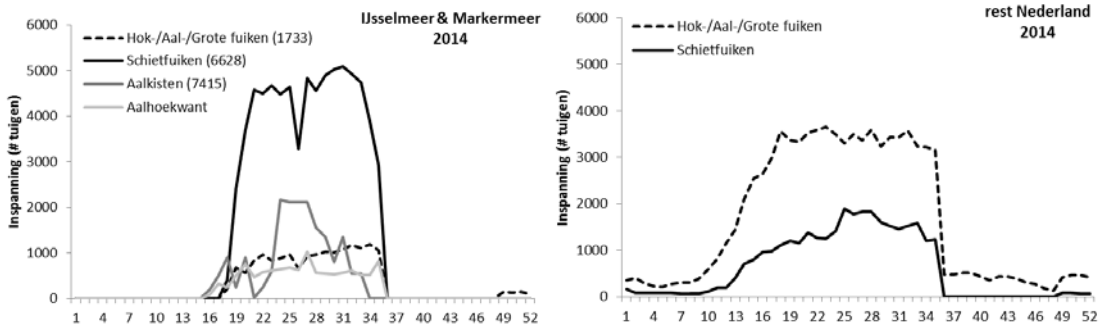
Sinds 2011 worden bij een aantal gemalen in Zeeland, Noord-Holland en Friesland schieralen geassisteerd bij het passeren van de migratieknelpunten (DUPAN “Paling over de dijk” initiatieven). In 2011, 2012, 2013 en 2014 werd respectievelijk “bruto” 0.5, 4.6, 9.3 en 3.9 ton schieraal gevangen en vervolgens over de geselecteerde knelpunten gezet (Figuur 5). Echter een deel van de schieraal had volgens Winter *et al.* (2013) mogelijk ook zonder assistentie het migratieknelpunt kunnen passeren. Gebruikmakend van de verwachte sterfte (Bierman *et al.* 2012; Winter *et al.* 2013) tijdens het passeren van de geselecteerde migratieknelpunten kan een “netto” hoeveelheid aal worden berekend. De hoeveelheid extra schieraal die met succes heeft kunnen uittrekken als gevolg van de geleverde inspanning binnen “Paling over de dijk” initiatieven wordt geschat op 0.1 ton in 2011, 0.9 ton in 2012, 2.3 ton in 2013 en 0.8 ton in 2014.



Figuur 5. Overzicht van de “bruto” en “netto” hoeveelheden aal die in 2011-2014 bij diverse knelpunten “over de dijk” zijn gezet (geassisteerde migratie).

1.5 Trend aalvangsten beroepsvisserij

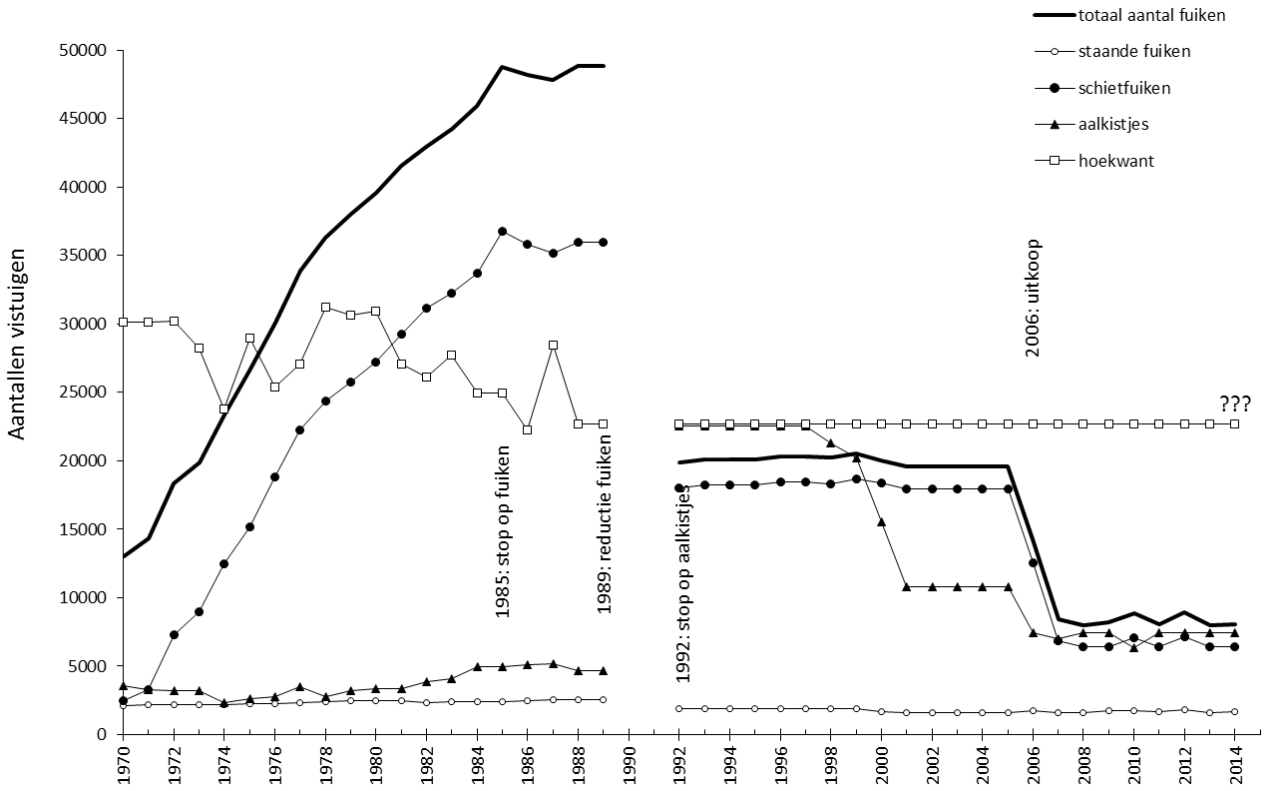
De visserij op aal in Nederland vindt plaats in meren, rivieren, kanalen en kustwateren, met de grootste concentraties in de wateren in de lagere delen van ons land. De visserij op aal in Nederland was tot voor kort nauwelijks gedocumenteerd. Invoering van de Europese Aalverordening en het Nederlandse Aal Beheersplan heeft de situatie echter snel verbeterd. De eerste stap is gezet met de invoering van de verplichte vangstregistratie voor aalvissers per 1/1/2010. Een nadeel van deze registratie was dat rode aal en schieraal vangsten gecombineerd werden geregistreerd en dat vistuig en visserijinspanning niet werden gedocumenteerd. Het Ministerie van EZ heeft per 1/1/2012 de visserijinspanning opgenomen in de verplichte digitale vangstregistratie. Een overzicht van de wekelijkse inspanning die wordt geleverd door beroepsvissers is te zien in Figuur 6.



Figuur 6. Overzicht van de wekelijkse inzet van verschillende vistuigen door beroepsvissers in 2014 in IJsselmeer en Markermeer (links) en rest van Nederland (rechts).De maximale wekelijkse inzet aan tuigen (merkjes) in het IJsselmeer & Markermeer staat tussen haakjes achter elk type tuig (Bron: Min EZ).

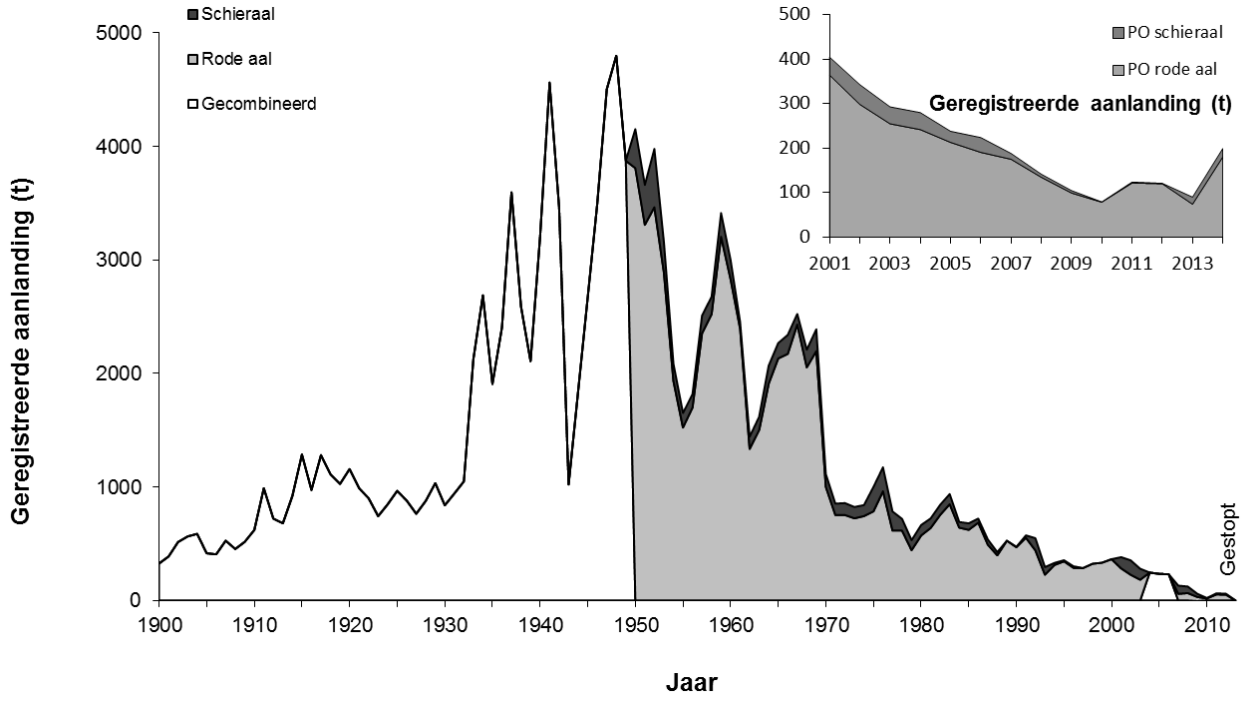
Op het IJsselmeer is het aantal te gebruiken vistuigen gelimiteerd door merkjes (Figuur 7), die aan de vistuigen bevestigd dienen te worden. Dit aantal is in de periode 1970-1985 sterk toegenomen; daarna is het aantal stapsgewijs verminderd. Na de laatste grote beperking in 2006 liggen de aantallen voor de meeste vistuigen nu nog steeds hoger dan in 1970. Alleen voor staande fuiken heeft in de jaren 1970-1980 vrijwel geen groei plaatsgevonden, terwijl later wel reducties zijn doorgevoerd. Daarmee lag het aantal staande fuiken in 2014 een kwart lager dan in 1970. Voor de visserij met hoekwant ligt alleen het maximum aantal hoekwantvissers vast, maar omdat iedere visser zelf mag bepalen met hoeveel “spleten” (een hoekwant met 250 haken) wordt gevist is de daadwerkelijke inspanning niet duidelijk.

Voor alle tuigen geldt dat het tot 2012 onduidelijk was welk deel van de “merkjes” ook daadwerkelijk wekelijks werd ingezet door de beroepsvissers in het IJsselmeer en Markermeer. Figuur 6 laat zien dat in 2014 niet alle toegestane merkjes ook daadwerkelijk wekelijks zijn ingezet.



Figuur 7. Trend in de nominale hoeveelheden vistuig binnen de aalvisserij op het IJsselmeer/Markermeer (Bron: de Leeuw et al., 2006 en PO IJsselmeer).

Voor de Zuiderzee/IJsselmeer zijn gegevens beschikbaar over de aanvoer op de afslagen sinds 1880. 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 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 en 163 ton in 2014 (Figuur 8; Tabel 2). Voor het IJsselmeer/Markermeer valt het verder op dat er behoorlijke verschillen zitten tussen de gegevens afkomstig van PVIS, PO en EZ over de hoeveelheden aal die worden aangeland (Figuur 8 en Tabel 2).



Figuur 8. 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.

Tot voor kort waren er geen aanlandingsgegevens van de wateren buiten het IJsselmeer. Op 1 januari 2010 heeft EZ 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 EZ (Tabel 2).

Tabel 2. Aanlanding van aal (ton) door de beroepsvisserij in Nederland (Bron: PO en EZ).

	IJsselmeer/Markermeer		**Andere gebieden**	**Totaal NL**
	PO	EZ	EZ	EZ
2010	79	128	324	452
2011	124	179	188	367
2012	121	168	182	350
2013	90	144	171	315
2014	199	163	153	317

1.6 Trend aalvangsten recreatieve visserij

In 2009 is het Recreatieve Visserij onderzoeksproject van start gegaan. In december 2009, 2011 en 2013 zijn 50 000 huishoudens benaderd tijdens de Screening Survey om vast te stellen hoeveel recreatieve vissers er zijn in Nederland. Dit waren er 1.7 miljoen in 2009, 1.4 in 2011 en 1.3 in 2013. In zowel 2010 en 2012 zijn ~2500 recreatieve vissers 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 is het aantal onttrokken alen grofweg gelijk gebleven maar is het aantal gevangen en teruggezette alen toegenomen in vergelijking tot 2010 (Tabel 3).

Tabel 3. Overzicht van de aalvangsten door recreatieve vissers in de Nederlandse binnenwateren en kustwateren (van der Hammen & de Graaf 2015). Onttrokken = gevangen en niet terug gezet. % onttrokken is het percentage van het totaal aantal gevangen alen (onttrokken + teruggezet).

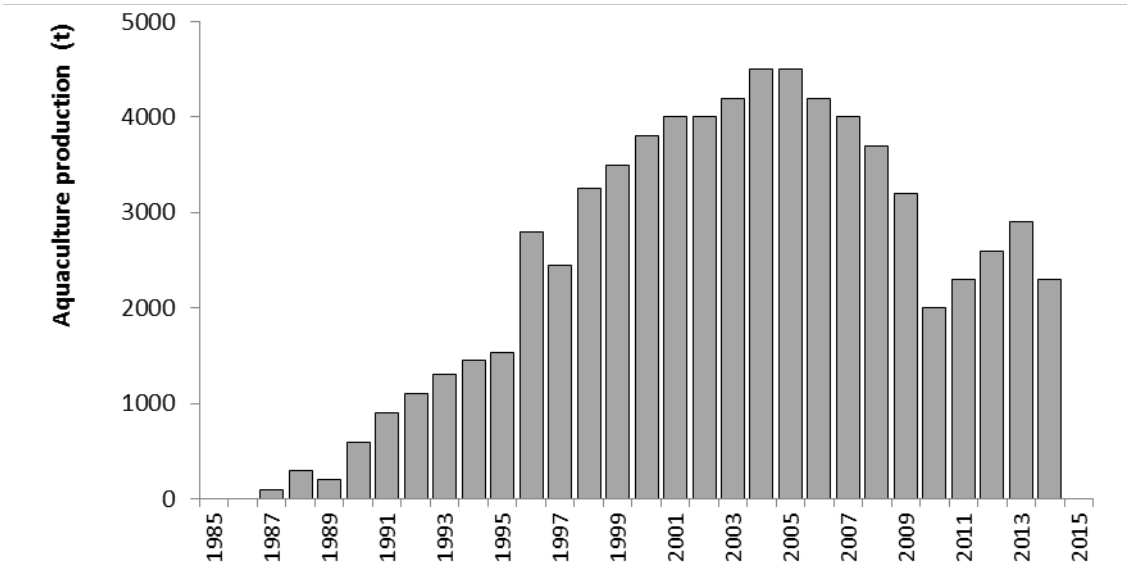
	2010			**2012**		
	onttrokken	teruggezet	% onttrokken	onttrokken	teruggezet	% onttrokken
Aal	466 000	967 000	32%	404 000	1 584 000	20%
Binnenwater	*294 000*	*862 000*	*25%*	*313 000*	*1 517 000*	*17%*
Zee- en kustwater	*172 000*	*114 000*	*69%*	*91 000*	*67 000*	*58%*

1.7 Trend aquacultuur

De grootste hoeveelheid aal (~90%) in Nederland voor consumptie wordt geproduceerd in intensieve kwekerijen. Hierin wordt in het wild gevangen, geïmporteerde glasaal uit voornamelijk Frankrijk en Spanje (Tabel 4), opgekweekt onder gecontroleerde omstandigheden. 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 maar de laatste jaren neemt de productie weer toe. In 2014 is ongeveer 2300 ton aal geproduceerd (Figuur 9). Kunstmatige voortplanting van de aal voor commerciële doeleinden is tot op heden niet mogelijk.

Tabel 4. Herkomst van de geïmporteerde, wild gevangen glasaal in de Nederlandse aquacultuur sector (Bron: DUPAN).

SEIZOEN	FRANKRIJK	SPANJE	ENGELAND	TOTAL (KG)
2010/2011	4.725	1.890	135	6.750
2011/2012	5.325	1.350	100	6.775
2012/2013	5.500	650	550	6.700
2013/2014	3.400	250	1.250	4.900
2014/2015	4.400	500	300	5.200



Figuur 9. Trend in de hoeveelheden aal die worden geproduceerd door de aquacultuur sector.

1.8 Trend uitzet glasaal en pootaal

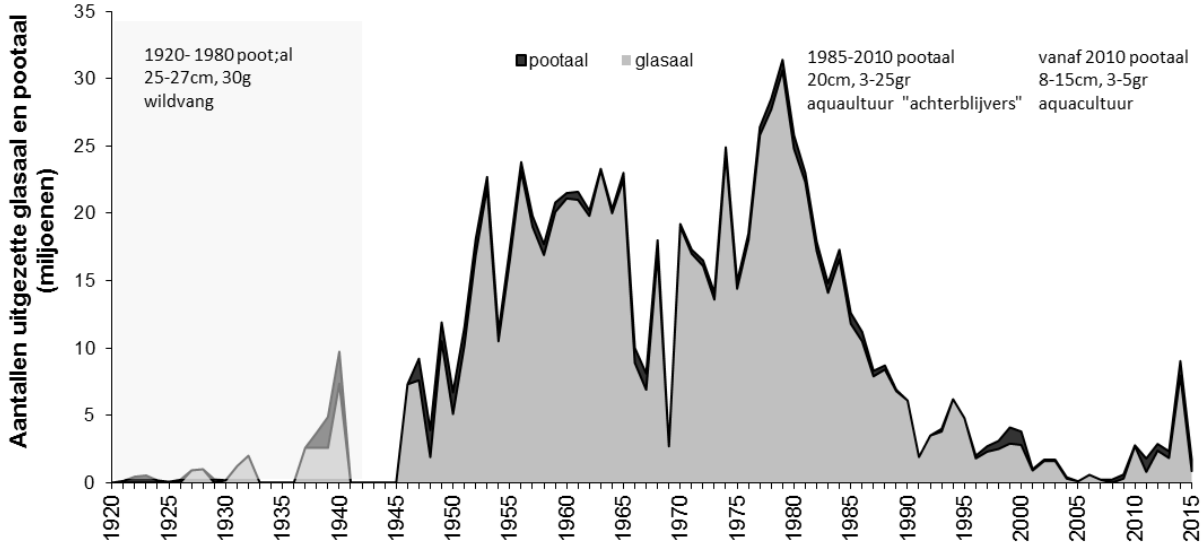
Sinds de jaren '20 van de vorige eeuw is glasaal uit de omgeving van de Golf van Biskaje aangekocht en uitgezet in de Nederlandse binnenwateren (Figuur 10). De uitzet van glasaal heeft waarschijnlijk min of meer gelijke tred gehouden met de natuurlijke intrek, zoals te zien is aan de scherpe daling in de jaren '80. In 2009 werd nog maar ca. 0.3 miljoen glasalen uitgezet. In 2015 waren dit er circa 0.9 miljoen (Tabel 6). Daarnaast is jonge rode aal (pootaal) uitgezet. 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. Sinds de opheffing van de OVB 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.

In 2015 is naar schatting 5% van alle door Nederland geïmporteerde glasaal uitgezet in binnenwateren (Tabel 5 en 6). Tussen 2010 en 2013 heeft het Productschap Vis (PVIS) de uitzet van de door EZ aangekochte glasaal gecoördineerd ter bevordering van het herstel van de aalstand. Vanaf 2014 (opheffing PVIS) is dit overgenomen door DUPAN. Net als in voorgaande jaren is de door EZ aangekochte glasaal in 2015 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 5. 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
Gevangen in commerciele visserij	0	0	0	0	0	0	0
Gebruikt voor uitzet	100	904	244	766	630	2.460	278
Gebruikt voor aquacultuur	?	?	6.750	6.775	6.700	4.900	5.200
Directe consumptie	0	0	0	0	0	0	0
Mortaliteit	?	?	?	?	?	?	?



Figuur 10. Overzicht van de Nederlandse uitzet van glasaal en pootaal in miljoenen stuks per jaar (1920-2015). 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).

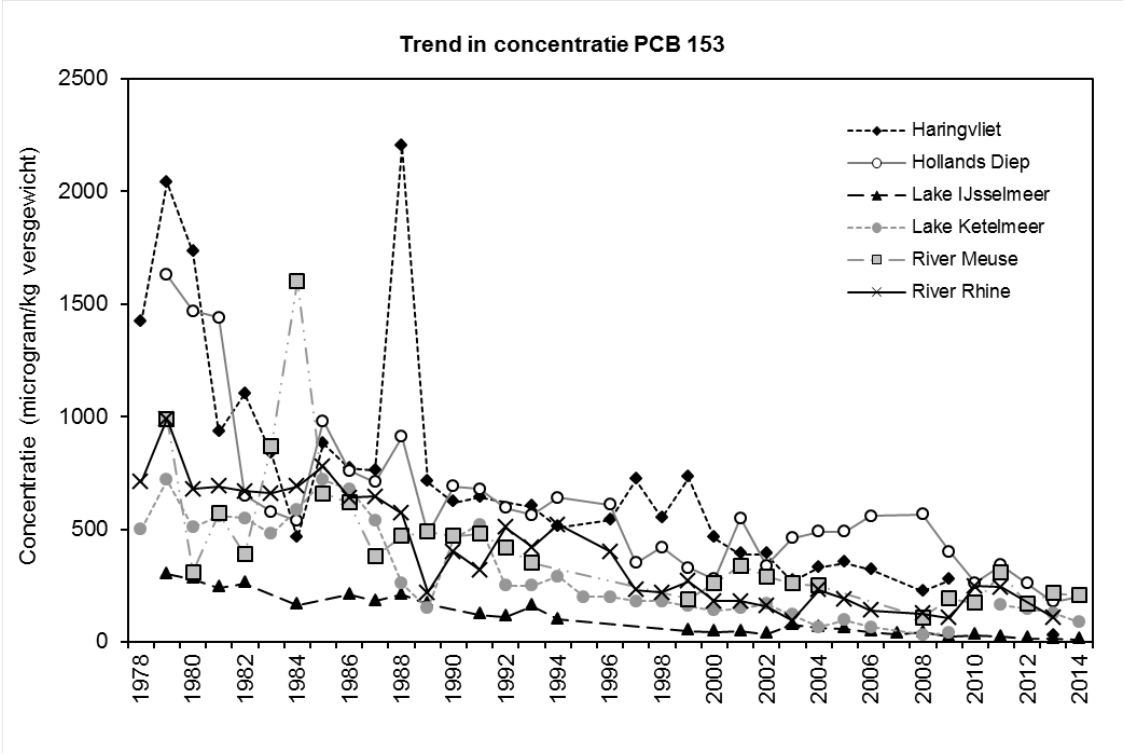
Tabel 6. Overzicht van de in 2015 in Nederland uitgezette glasaal en pootaal (Bron: CvB en DUPAN).

DATUM	LOCATIE	BRON	IN QUARANTAINE	KG	#	#/KG
GLASAAL						
14/04/2014	Veluwe Randmeren	?	?	278	863.226	3.100
			TOTAL	**278**	**863.226**	
POOTAAL						
10/06/2015	Zuidelijke Randmeren	?	?	1.023	435.055	425
21/08/2015	Zuidelijke Randmeren	?	?	682	126.235	185
21/08/2015	Veluwe Randmeren	?	?	532	97.839	185
28/08/2015	Veluwe Randmeren	?	?	1.141	83.285	73
?	Reeuwijk (Viss. Coop. De Schakel)*	?	?	200	51.517	278
?	Kampen (Putten)	?	?	133	36.856	240
?	NW Overijssel (Bergeijk)	?	?	100	24.000	256
			TOTAAL	**3.811**	**854.787**	

**aantal en aantal/kg geschat, gebaseerd op gemiddelde van gewicht/aal van locaties 'Kampen' en 'NW Overijssel'*

1.9 Trend vervuiling

In het kader van de monitoring van voedselkwaliteit, zijn sinds eind jaren 1970 de gehaltes van vervuilende stoffen 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 een enkel voorbeeld (trends in PCB 153) getoond; PCB 153 is een goede indicator voor de andere PCB's.



Figuur 11. Trends in PCB 153 in rode aal. 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.

1.10 Trend zwemblaasparasiet

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 2014 tussen circa 26-63% lag, afhankelijk van de locatie (Tabel 7). Het percentage geïnfecteerde aal lijkt stabiel te blijven sinds de jaren '80 in alle onderzochte gebieden.

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

	IJSSELMEER		MARKERMEER			FRYSLAN		ANDER LOCATIES		
	N aal	% geïnfecteerd	N aal	% geïnfecteerd	N gebieden	N aal	% geïnfecteerd	N gebieden	N aal	% geïnfecteerd
1986	699	31	-	-	-	421	44	-	30	70
2009	-	-	-	-	-	991	44	-	262	55
2010	390	49	225	48	11	534	46	10	1660	48
2011	293	43	104	34	5	107	37	17	1087	33
2012	320	53	253	38	5	133	33	17	1235	34
2013	159	55	93	43	2	17	47	9	531	38
2014	202	50	46	26	3	49	63	8	291	32

2 Introduction

The English part of this report follows the format provided by ICES WGEEL.

2.1 Authors

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2.2 Reporting Period

This report contains data up to 2014 and some provisional data for 2015.

2.3 Contributors to the report

Ingeborg de Boois (IMARES: survey data coastal areas), Mennobart van Eerden (Rijkswaterstaat – Waterdienst; cormorant breedings pairs IJsselmeer area), Ben Griffioen (IMARES; glass eel index); Arjan Heinen (Combinatie van Beroepsvissers; stocking data; silver eel fisheries data), Twan Leijzer (IMARES; parasite infections); Jaap van der Meer (NIOZ; yellow eel data NIOZ fyke), Michiel Kotterman (IMARES; data on contaminants), DUPAN (glass eel stocking data, assisted migration silver eel and eel aquaculture production).

2.4 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)).

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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	

2.5 General overview fisheries

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], 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.



Figure NL. 1. Overview of the areas closed for eel and Chinese mitten crab fishery as of 1 April 2011 (Source: Ministry of Economic Affairs).

2.6 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; <50 tons per year. 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 Economic Affairs (Ministerie van EZ). In 2009 there were 70 fishing licenses, owned by about 30 companies. The total number of gears allowed in 2013 was: fixed fykes 1579, train fykes 6386, eel boxes 7415 and unknown numbers of longlines.

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 the following, 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.

3 Time-series data

3.1 Recruitment

3.1.1 Glass eel recruitment

3.1.1.1 Commercial

Glass eel fisheries is forbidden, NO AVAILABLE DATA

3.1.1.2 Recreational

Glass eel fisheries is forbidden, NO AVAILABLE DATA

3.1.1.3 Fishery independent

Recruitment of glass eel in Dutch waters is monitored at 12 other sites along the coast (Figure NL. 2; see Dekker 2002 for a full description). In Den Oever (Figure NL.3), 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. The data from the other locations (Figure NL.2) confirmed the overall trend, though individual series may deviate. Note that in contrast to previous years the glass eel data are presented simply 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.



Figure NL. 2. Locations of glass eel monitoring in the Netherlands.

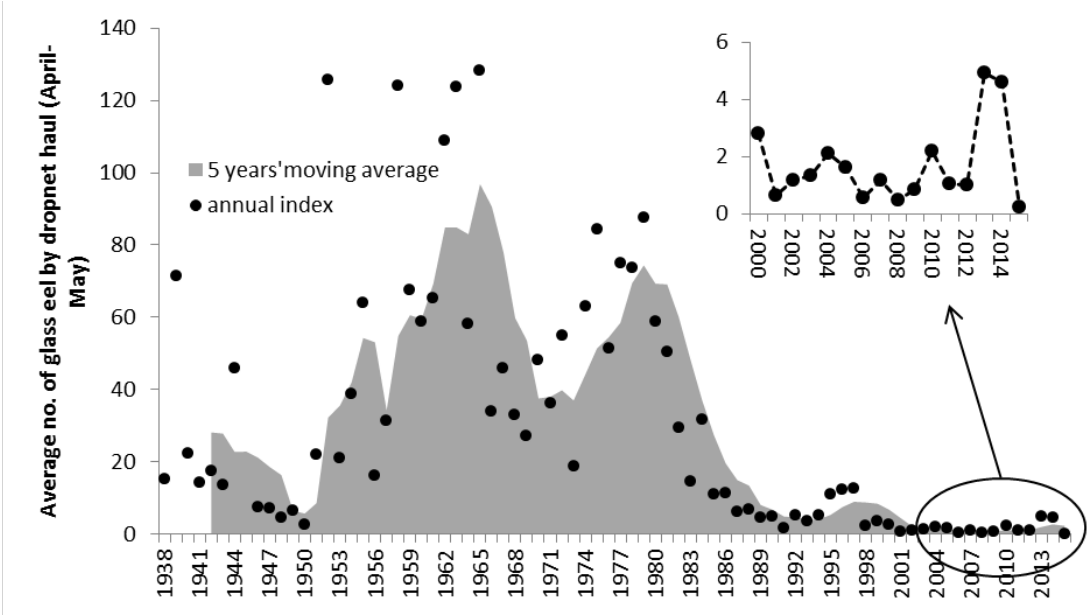


Figure NL. 3 Trend indices (mean number per haul in April and May) of glass eel recruitment at Den Oever (1938-2015).

Table NL. A 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	
7		7.2	31.3	45.8	75.0	6.2	12.6	1.2	
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. B Average number of glass eel caught by dropnet hauls between 18:00 and 8:00 hrs in the period April-May at 12 sites in the Netherlands (1979-2015). If five or less hauls were carried out, this was recorded as NA.

	Otheense Kreek	Bath	Krammersluis	Bergsche Diep	Stellendam	Katwijk	IJmuiden	Den Oever (schiplock)	Harlingen	Lauwersmeer	Nieuwstaten-zijl	Termunten-zijl
RBD	**Scheldt**		**Meuse**			**Rhine**					**Ems**	
1979										100.4		
1980												
1981										75.9		
1982										21.6		
1983										15.8		
1984										9.6		
1985							0.6			25.2		
1986							3.3			1.3		
1987							7.7					
1988					13.8					1.0		
1989					4.4					14.3		
1990	0.3		0.3		10.9					6.0		
1991	0.0		0.2	1.3	3.1	5.1				6.6		0.5
1992	0.0	6.6	0.4		16.9	9.1			16.7	12.1		0.6
1993	0.0	22.7	0.4		10.1	13.5				33.2		1.2
1994	0.0	14.2	0.5		4.0				16.0	31.0		2.8
1995	0.5		0.4		3.3	29.7	2.0	34.7	6.6	16.9		3.7
1996	1.3	22	0.7		0.5	25.3		11.0	34.2	49.4	27.5	7.7
1997			0.6		2.8	12.9		11.4	11.2	27.8	30.0	15.6
1998	0.7		0.6		1.0	38.8	2.0	6.5	18.3	14.4	21.8	1.4
1999	1.4		0.5		1.2	140.1		7.2		31.7	12	10.2
2000	0.9	10.2	1.0	3.8	7.1	11.6		5.0		7.2	38.8	8.7
2001	0.4		0.1		1.0			1.7		2.4	39.7	1.1
2002		1.9	0.2		4.2	13.2	0.1	1.4	3.2	5.5	36.4	1.6
2003		7.5	0.1		0.3	12.7		4.8		1.7	23.6	0.8
2004	0.0	16.4[2]	0.1		0.3	4.5			14.3[2]	2.3	28.1	1.9
2005	0.0	15.3	0.6		0.2	5.6				1.4	21.1	1.8
2006	0.0	12.4	0.2		0.0	1.4		0.3	0.6	1.7	8.3	1.3
2007[1]	0.0	43.9	0.1	0.4	0.1	27.9	0.1		1.7	1.0	21.7	4.0
2008	0.0	13.2	0.0	2.5	0.0	4.5	0.1	0.8	1.1	2.8	15.6	1.3
2009	0.0	9.1	0.0	1.3	0.5	3.5	0.1		0.7	0.6	13.6	1.2
2010		28.4	0.0	1.7	0.2		0.0	1.2	1.0	1.1	13.0	1.2
2011		39.2	0.1	1.3	0.3		0.0		3.1	1.4	11.6	1.4
2012		25.8	0.2	0.8	0.1	1.6	0.2		1.1	2.9	27.6	1.3
2013		73.8	0.0	16.7	0.2	1.6	0.0		5.2	9.1	60.5	1.9
2014		96.3	0.0	6.3	0.6	0.4	0.0		5.8	18.0	72.0	2.1
2015		**24.2**		**2.2**	**0.2**	**0.6**	**0.1**	**0.2**		**1.0**		**3.0**

1 = very early season (warm spring), sampling stopped early (early May), low number of empty samples.

2 = sampling took place in part of the season.

3.1.2 Yellow eel recruitment

3.1.2.1 Commercial

NO AVAILABLE DATA.

3.1.2.2 Recreational

NO AVAILABLE DATA.

3.1.2.3 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) (Fig NL. 4). 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).

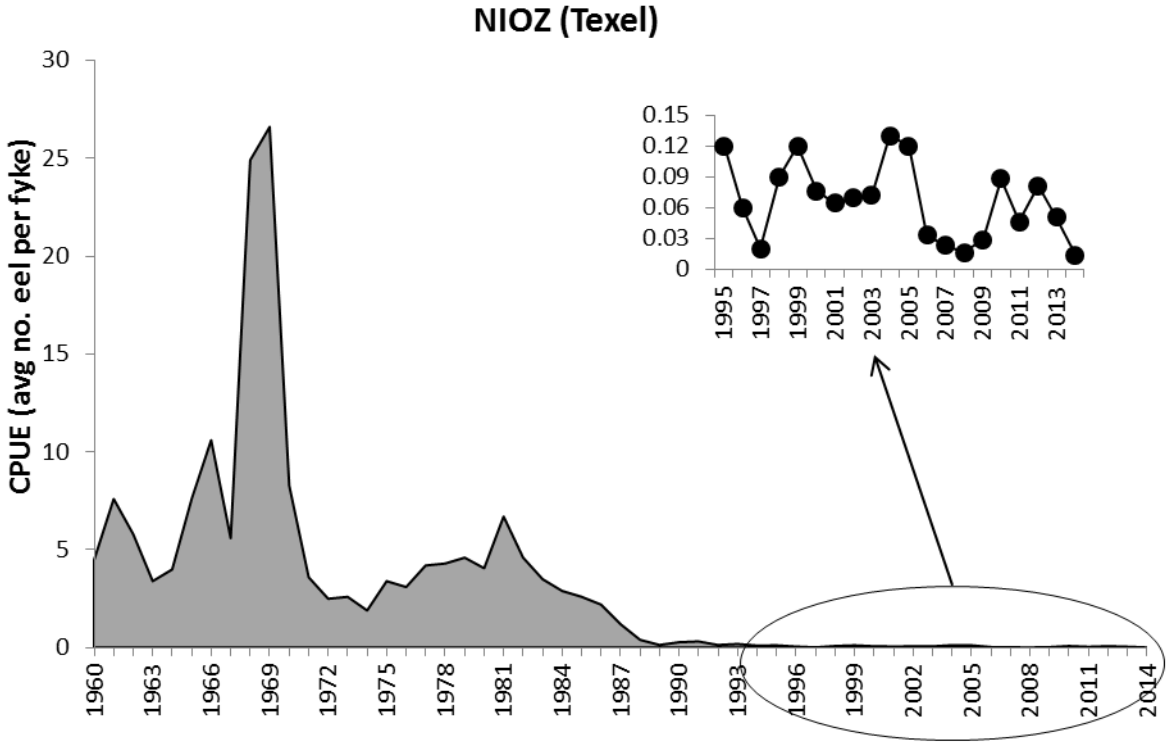


Figure NL. 4 Time series of the mean catch per fyke (numbers) of yellow eel at NIOZ 1960-2014 (data Van der Meer et al., 2011 and NIOZ: http://www.waddenzeevismonitor.nl/vissensoort/paling-anguilla-anguilla-42.html).

3.2 Yellow eel landings

3.2.1 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 Economic Affairs (Ministry of EZ, previously Ministry of LNV) until 1994; since then and until 2012 statistics were kept by the Fish Board (PVis; Table NL.E; Figure NL. 5, 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 (see section NL.6.2.1 for further details).

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. 5, insert graph).

An obligatory catch registration system was introduced in the Netherlands in January 2010 by the Ministry of Economic Affairs (Ministry of EZ). 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. Information from this registration system is reported in section NL.6.2.1.

Table NL. C. 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 Economic Affairs (EZ; 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(99)
5	415	1285	965	1907	2668	1651	2309	1000	666	*354*	*234* (238)	
6	406	973	879	2405	3492	1817	2339	1172	729	*301*	*230* (224)	
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)	

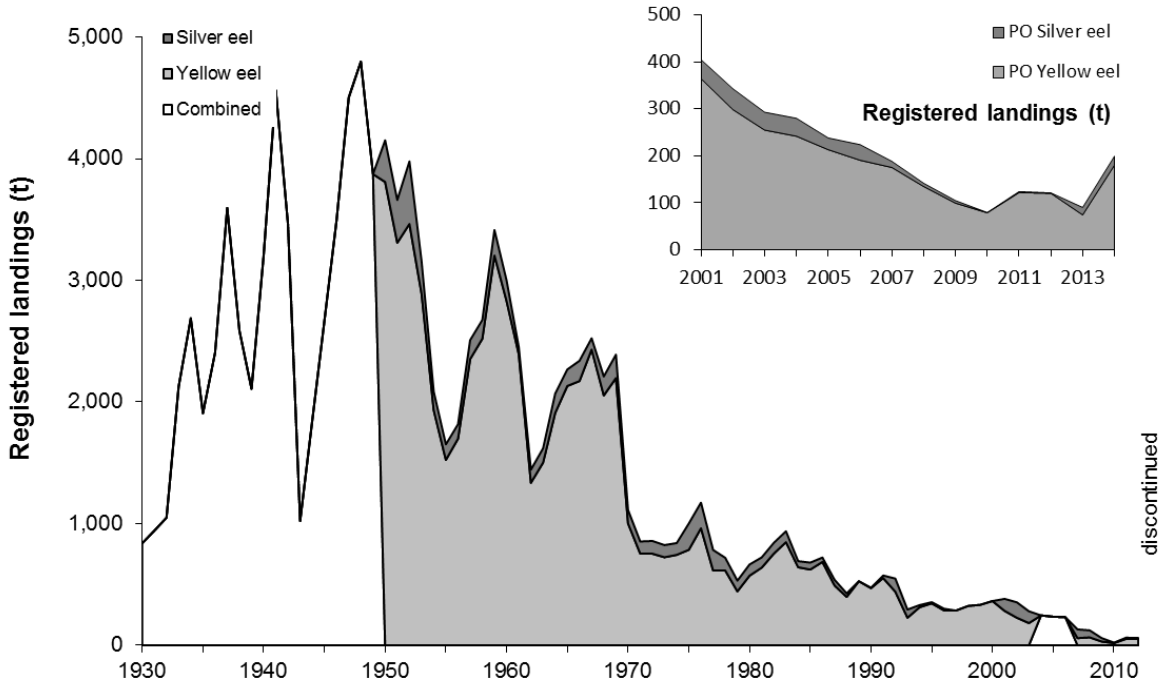


Figure NL. 5. Main graph: Time series of landings of yellow eel and silver eel from Lake IJsselmeer/Markermeer at auctions. Source data main graph EZ and Productschap Vis. Inserted graph: catches of yellow eel and silver eel recorded by PO IJsselmeer.

3.2.2 Recreational

NO AVAILABLE DATA.

3.3 Silver eel landings

3.3.1 Commercial

No reliable long term time series of yellow eel landing exist. Data on total landings of yellow and silver eel combined have been reported for Lake IJsselmeer/Markermeer. Data from auctions around Lake 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. 5). An obligatory catch registration system has been introduced in the Netherlands in January 2010 by the Ministry of Economic Affairs (EZ). 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.

3.3.2 Recreational

NO AVAILABLE DATA.

3.4 Aquaculture production

3.4.1 Seed supply

Table NL. D. Origin of glass eel used for aquaculture in the Netherlands since 2010 (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

3.4.2 Production

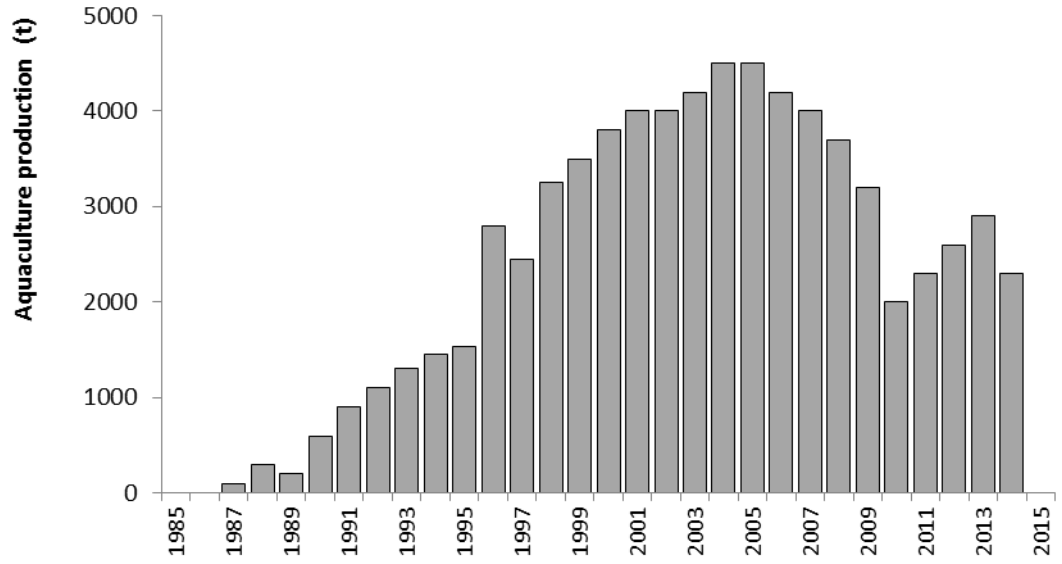


Figure NL. 6. Trend in aquaculture production of yellow eel for consumption in the Netherlands (Source DUPAN).

3.5 Stocking

3.5.1 Amount stocked

Table NL. E Overview of glass eel and young yellow eel stocked in the Netherlands in 2015 (Source DUPAN and CvB). For yellow eel, the location where they have been raised is set between brackets in the column 'Origin'.

DATE	STOCKING LOCATION	ORIGIN	QUARANTINED	KG	#	#/KG
GLASSEEL						
14/04/2015	Veluwe Randmeren	?	?	278	863,226	3100
			TOTAL	**278**	**863,226**	
YOUNG YELLOW EEL						
10/06/2015	Zuidelijke Randmeren	?	?	1023	435,055	425
21/08/2015	Zuidelijke Randmeren	?	?	682	126,235	185
21/08/2015	Veluwe Randmeren	?	?	532	97,839	185
28/08/2015	Veluwe Randmeren	?	?	1141	83,285	73
?	Reeuwijk (Viss. Coop. De Schakel)*	?	?	200	51,517	278
?	Kampen (Putten)	?	?	133	36,856	240
?	NW Overijssel (Bergeijk)	?	?	100	24,000	256
			TOTAL	**3811**	**854,787**	

*number and number/kg estimated, based on average weight/eel of 'Kampen' and 'NW Overijssel'

3.5.2 Catch of eel <12 cm and proportion retained for restocking

Catch and retention of eels < 28 cm is illegal. There is no organised trap and transport of these undersized eels.

3.5.3 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 Fig. NL.7) is sourced outside the Netherlands.

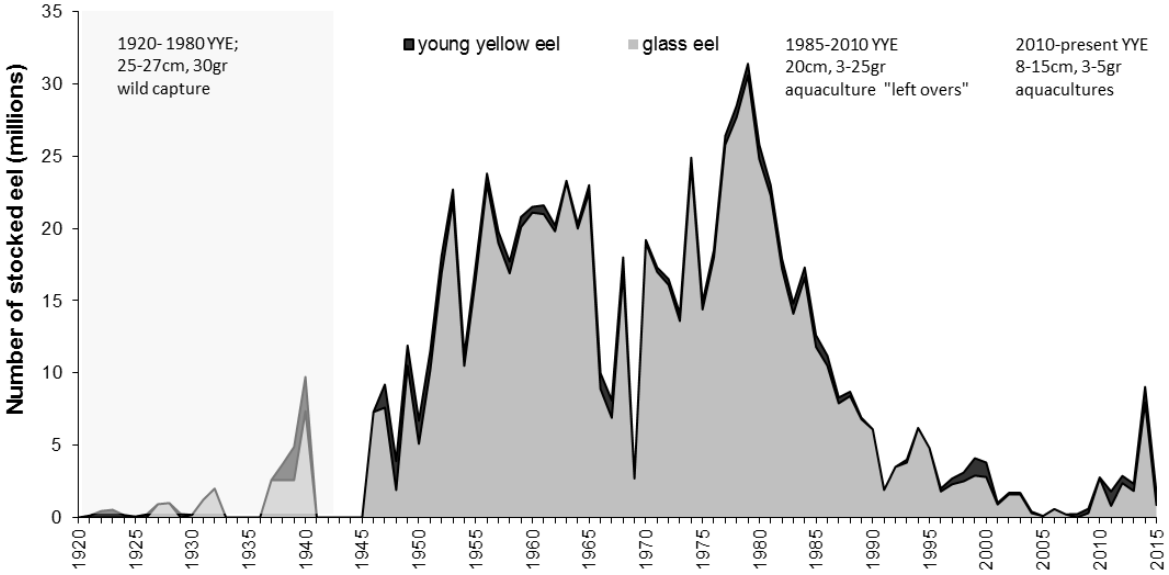


Figure NL. 7. Overview of stocking of glass eel and young yellow eel in the Netherlands (1920-2015). Note that the average weight of stocked young yellow eel decreased from ~30g to ~3 g between 1920 and 2010.

3.6 Trade in eel 2015

SOURCE	DESTINATION	STAGE	KG	MARKET VALUE (€/KG)
South France	Netherlands	glass eel (for aquaculture)	4,400	?
Spain	Netherlands	glass eel (for aquaculture)	500	?
England	Netherlands	glass eel (for aquaculture)	300	?
Unknown	Netherlands	glass eel (for stocking)	278	?
	TOTAL		5,478	

4 Fishing capacity

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 (Figure NL. 8), 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.

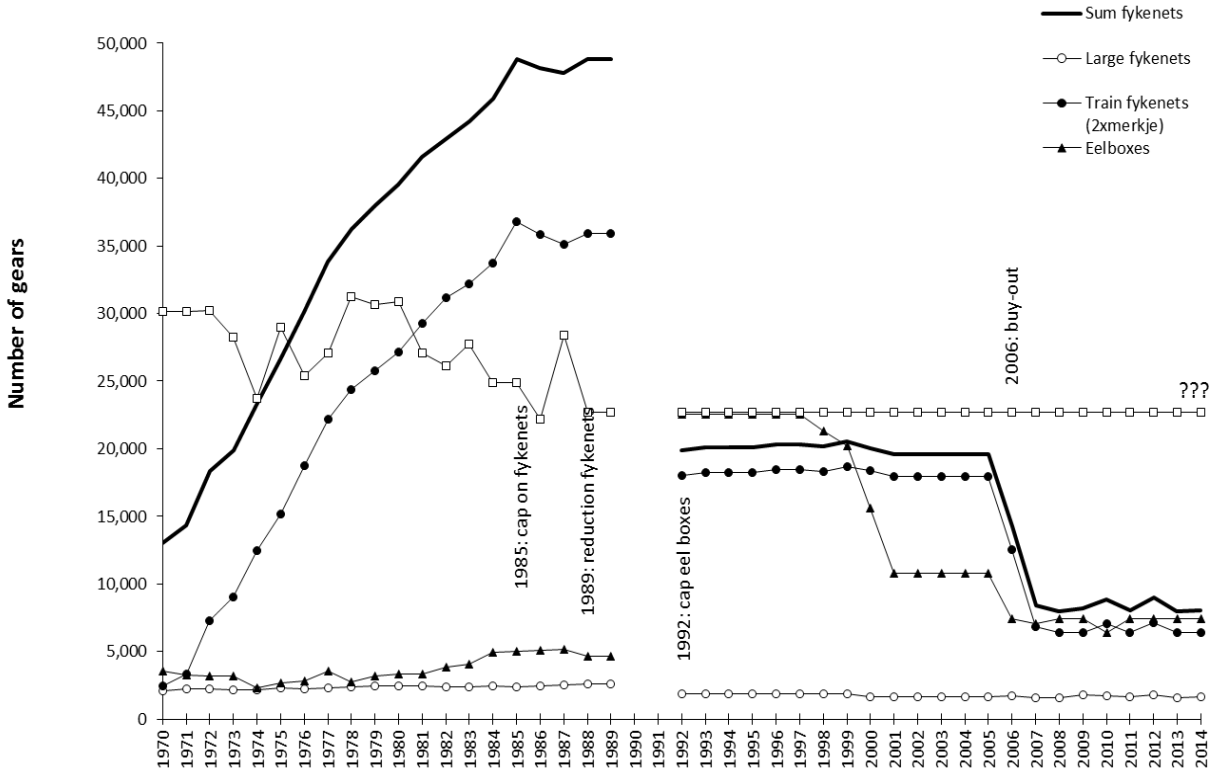


Figure NL. 8. Trends in the nominal number of fishing gear employed in the eel fishery on Lake IJsselmeer/Markermeer. Information before 1989 is based on a voluntary inquiry in 1989 (Dekker 1991); after 1992, the licensed number of gear is shown. Note that long line fishery is only restricted by the number of licences, the number of long lines per licence is not regulated. The number of long lines since 1992 is unknown.

5 Fishing effort

5.1 Glass eel

No fishing on glass eel.

5.2 Yellow eel

No distinction between fishing effort on yellow eel and silver eel could be made and as a result data are combined.
For most of the country, fishing effort was unknown until 2012. In areas where fishing capacity was known (IJsselmeer/Markermeer), no record had been kept of the actual usage of fishing gears. For Lake IJsselmeer, a maximum number of gears by company is enforced (authenticated tags are attached to individual gears), but the actual usage is often much lower, amongst others since restrictions apply on the combinations of types of fishing gears (e.g. fyke nets and gill nets should not be operated concurrently, since perch and pikeperch are target species of the gill netting, whereas landing perch and pikeperch from fyke nets is prohibited).
A national catch registration system was introduced by Ministry of Economic Affairs on 1/1/2010. Since 2012, eel fishers are obliged for the first time to record their effort weekly in addition to their catches; all eel fishers have to record the type of gear and number of gear used. Overviews of the number and type of gear deployed weekly throughout 2014 is presented in Figure NL. 9A for Lake IJsselmeer/Markermeer (combined) and in Figure NL. 9B for the other locations in The Netherlands (combined). In general, effort was fairly constant throughout the season, with at most a slight increase during the season. Only eelboxes were deployed mainly in the first half of the season. In Figure NL. 10 the developments between years is shown for CPUE, effort and catch.

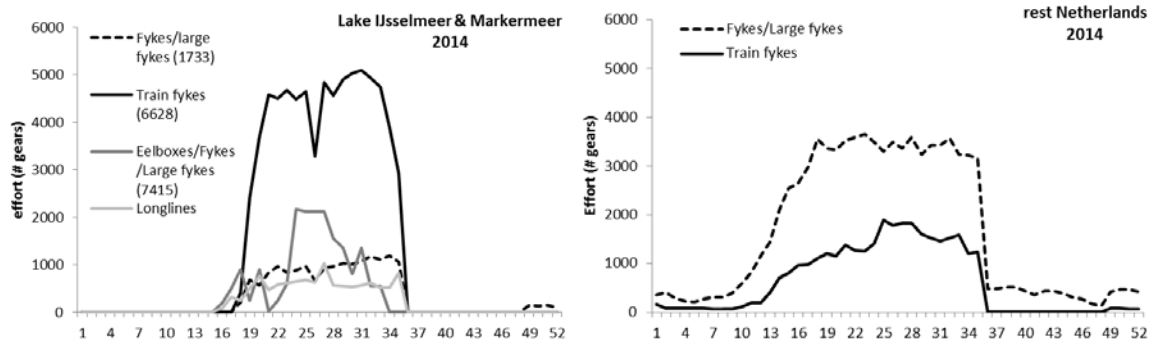


Figure NL. 9. (A) The number of fishing gear employed weekly in 2014 in the eel fishery on Lake IJsselmeer and Markermeer (Source Ministry of Economic Affairs) and (B) on other locations throughout the Netherlands (source Ministry of Economic Affairs).

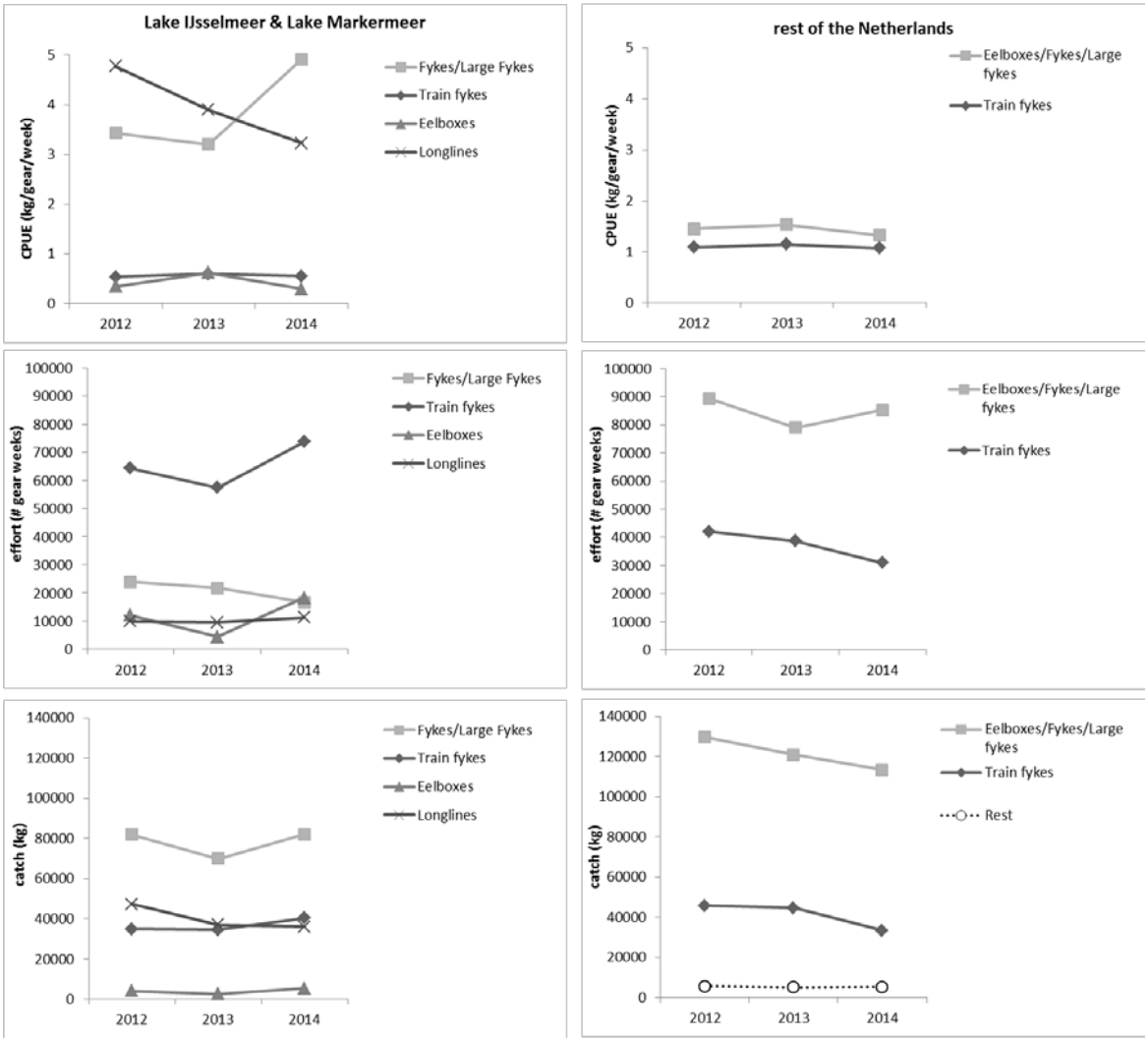


Figure NL. 10. Time series of fishing gear in the Dutch eel fishery in Lake Ijsselmeer and Lake Markermeer versus the rest of the Netherlands (source Ministry of Economic Affairs).

5.3 Silver eel

No distinction between fishing effort on yellow eel and silver eel. Data are combined and reported under yellow eel (Paragraph 5.2).

5.4 Marine fishery

Only the number of vessels reporting eel catches are known. These are reported in paragraph 6.4, Figure NL. 11.

6 Catches and landings

6.1 Glass eel

Glass eel fishing is forbidden; no data available.

6.2 Yellow eel

6.2.1 Catches and/or landings from Lake IJsselmeer/Markermeer

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 (see section NL 3.2.1). Yellow eel catches and silver eel catches are reported separately (Table NL. F). In addition, in January 2010 an obligatory catch registration system was introduced in the Netherlands by the Ministry of Economic Affairs. In this program weekly catches of eel are reported, but yellow eel and silver eel catches are combined (Table NL. G, Fig NL. 11). No information on effort and gears is reported.
Catches from Lake IJsselmeer have declined following the partial ban on eel fishery (September-November annually) as a result of the Council regulation for European Eel (2008) and the ensuing Dutch Eel management plan.

Table NL. F. Left table: Catches of yellow eel in tonnes by year for the IJsselmeer area. Right table: Catches of silver eel in tonnes by year for the IJsselmeer area (data 2001-2014). (Source: PO IJsselmeer).

YELLOW EEL		
DECADE	2000	2010
YEAR		
0		78
1	364	122
2	299	120
3	255	74
4	242	180
5	213	
6	191	
7	175	
8	135	
9	99	

SILVER EEL		
DECADE	2000	2010
YEAR		
0		1
1	41	2
2	44	1
3	38	16
4	38	19
5	25	
6	33	
7	13	
8	7	
9	5	

6.2.2 Catches and/or landings from other areas

In January 2010, an obligatory catch registration system was introduced in the Netherlands by the Ministry of Economic Affairs. In this program weekly catches of eel are reported, but yellow eel and silver eel catches are combined (Table NL. G). No information on effort and gears is reported.
The reduction in catches following the closure of a most river systems in 2011 due to high contaminant levels in eel is apparent (Table NL. G).

Table NL. G. Comparison of combined yellow eel and silver eel catches (2010-2014) from different sources for IJsselmeer area and other areas in The Netherlands.

SOURCE	IJSSELMEER		OTHER AREAS	TOTAL
	PO	EZ	EZ	EZ
2010	79	128	324	452
2011	124	179	188	367
2012	121	168	182	350
2013	90	144	171	315
2014	199	163	153	317

6.3 Silver eel

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 (see section NL 3.2.1). Yellow eel catches and silver eel catches are reported separately (Table NL. F).
Catches from the IJsselmeer area have declined following the partial ban on eel fishery (September-November annually) as a result of the Council regulation for European Eel (2008) and the ensuing Dutch Eel management plan. Catches in 2014 reported by PO IJsselmeer were high compared to the previous years.

6.4 Marine fishery

Catches and landings in marine waters are registered in EU logbooks, but these do not allow for a break down by river basin district. Annual registrations are available since 1995; data prior to 1984 are presented in the 2009 Country Report. Until 2001, vessels with a total length (LOA) ≥ 15 m were obliged to report all their eel catches; this obligation did not apply to smaller vessels. From 2001 onwards, vessels with a total length ≥ 10 m have been obliged to report their eel catches, but only if their landings per day exceeded 50 kg. Thus, in 2001 the number of ships potentially reporting eel catches rose, but the actual reporting per ship potentially declined. This change the regulation was partly driven by changing practices, and vice versa.

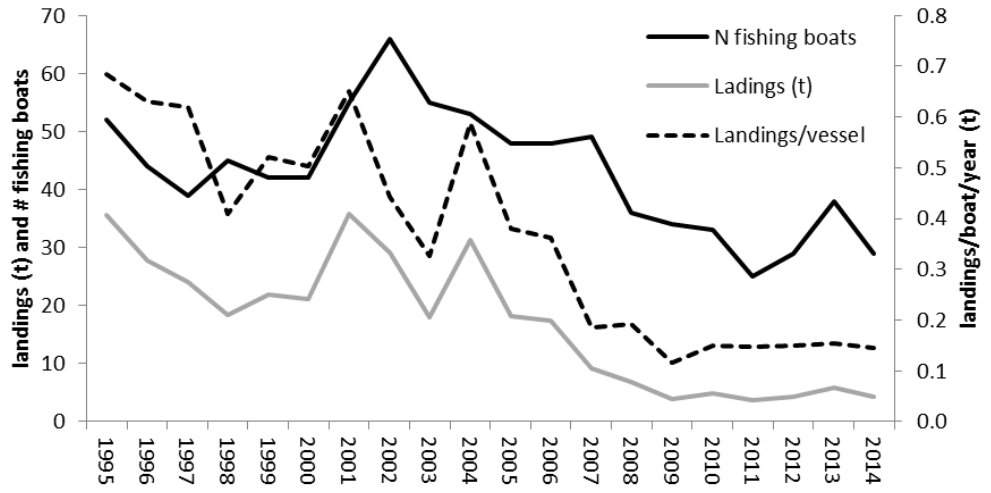


Figure NL. 11. Registered landings of eel (no distinction available between yellow eel and silver eel) from marine waters in Dutch harbours between 1995-2014.

The number of vessels reporting eel catches, total landings and the landings per vessel declined from 2001 until 2009. Since 2009, landings and landings by vessel have remained more or less constant, whereas the number of vessels reporting catches varied, with lower numbers in 2011 and 2012, an increase in 2013 and a decrease in 2014.

6.5 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 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 remains difficult (van der Hammen & de Graaf, 2012). The program was repeated in 2012/2013 (van der Hammen & de Graaf, 2015) with 2400 fisherman from the 2009 survey with an additional 100 fanatic fishermen that were recruited at recreational fishery websites. 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 and have returned 1,517,000 eels (41 tons retained). The number of recreational fishers was estimated to have declined from 1.7 million in 2009 to 1.4 million in 2011 and 1.3 in 2013. In 2012, the 41 tons of landed eels made 11% of the total landings, the major part consisting of 372 t of commercial landings (van der Hammen & de Graaf, 2015).

*Table NL. H. 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).*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

Table NL. I. Recreational Fisheries: catch and release mortality for eel in the Netherlands (van der Hammen & de Graaf, 2015 based on Bartholomew & Bohnsack 2005).

	Released			
	Inland		Marine	
Year	Angling	Passive gears	Angling	Passive gears
2012	12%	Not allowed	12%	Not known

6.6 Bycatch, underreporting, illegal activities

6.6.1 Bycatch

No available data.

6.6.2 Underreporting and illegal catches

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. The overall result (no. of fishers involved and total illegal catch) of the illegal fishing activities were reported in the annual report of the NVWA over 2013: http://www.nvwa.nl/onderwerpen/meest-bezocht-a-z/dossier/ jaarverslag-2013/palingstroperij (Table NL. K). For 2014 no data were reported by the NVWA.

Table NL. J. Estimation of underreported catches in 2013 by stage.

	Glass eel				**Yellow eel**				**Silver Eel**				**Combined (Y + S)**			
EMU	Reported catches (kg)	Underrept. %	Underrept. (kg)	Total catches (kg)	Reported catches (kg)	Underrept. %	Underrept. (kg)	Total catches (kg)	Reported catches (kg)	Underrept. %	Underrept. (kg)	Total catches (kg)	Reported catches (kg)	Underrept. %	Underrept. (kg)	Total catches (kg)
NL																
Total/mean (%)															NC	

Table NL. K.. Existence of illegal activities, its causes and the seizures quantity they have caused. For indications used in the column 'Cause' see Table NL. L. (2013)

	Glass eel			**Yellow eel**			**Silver Eel**			**Combined (Y +S)**		
EMU	Y/N/?	Cause	Seizures (kg)	Y/N/?	Seizures (kg)	Cause	Y/N/?	Seizures (kg)	Cause	Y/N/?	Seizures (kg)	Cause
NL	NP			ND			ND			Y	4.402	1.

Table NL. L. Overview of suspected causes of illegal fishing activities in the Netherlands (2013).

Cause		IJsselmeer	other areas
1.	Fishing out of the season	Y	Y
2.	Fishing without licence	Y	Y
3.	Fishing using illegal gears	Y	Y
4.	Retention of eel below size limit	?	?
5.	Illegal selling of catches	Y	Y

7 Catch per unit of effort

No data available.

8 Other anthropogenic and environmental impacts

8.1 Assisted migration of silver eel

Since 2011 several (pilot)projects have started at migration barriers (pumping stations) to assist the migration of silver eel. In 2011 0.54 t of silver eel was caught and released again past barriers at four sites ('assisted migration'). In 2012 this amount increased almost tenfold to 4.80 t (15 sites), and in 2013 to 9.32 t (25 sites; Fig. NL. 12)
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 was 0.14 t in 2011, 0.72 t in 2012 and 0.86 t in 2013, a five-fold (2012) to six-fold increase (2013) compared to 2011 (Fig. NL. 12)

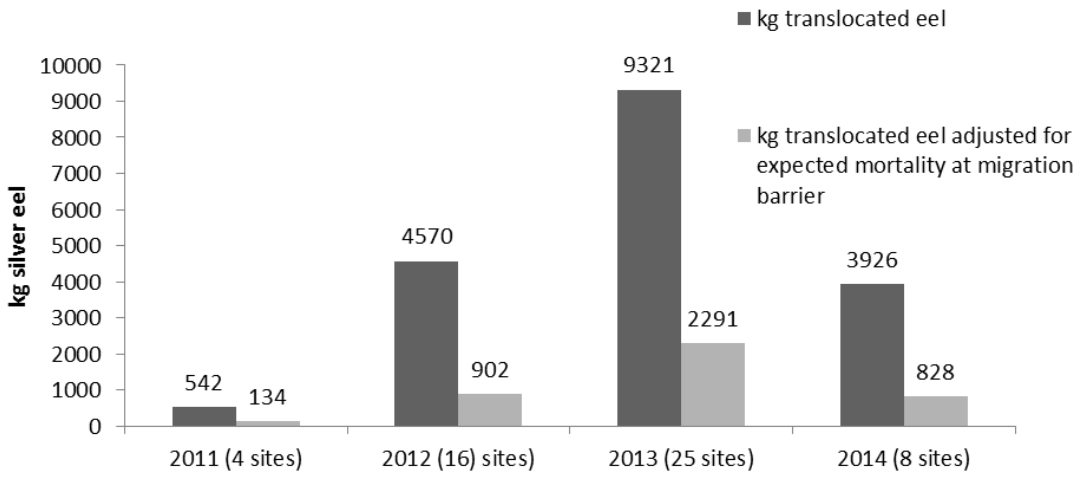


Figure NL. 12. Overview of the "gross" and "net" amount of silver eel assisted over migration barriers in the Netherlands (2011-2014).

9 Scientific surveys of the stock

9.1 NL.G.1 Recruitment surveys, glass eel

See paragraph 3.1.4.

9.2 NL.G.2 Stock surveys, yellow eel

9.2.1 Lake IJsselmeer/Markermeer (active gear)

Figure NL.13 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.

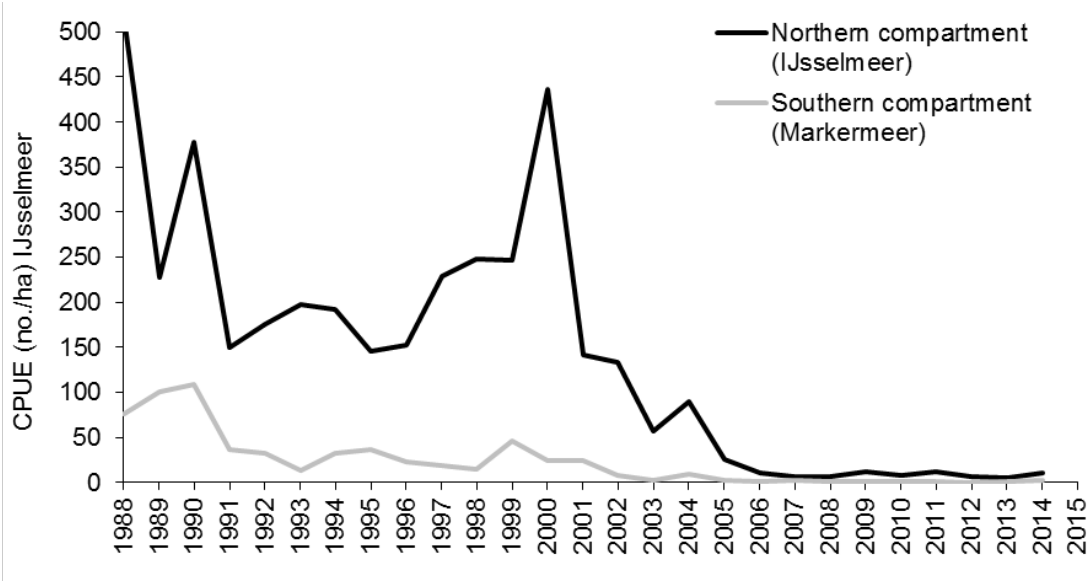


Figure NL. 13. CPUE trends in Lake IJsselmeer stock surveys, in number per hectare swept area, using the electrified trawl. Note: The northern and southern compartments have been separated by a dyke since 1976.

9.2.2 Main rivers (active gear)

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

9.2.3 Main rivers (passive gear)

No new data.

9.2.4 Coastal waters (active gear)

The number of eels caught in a coastal survey (Demersal young Fish Survey) is presented in Figure NL.14. 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).

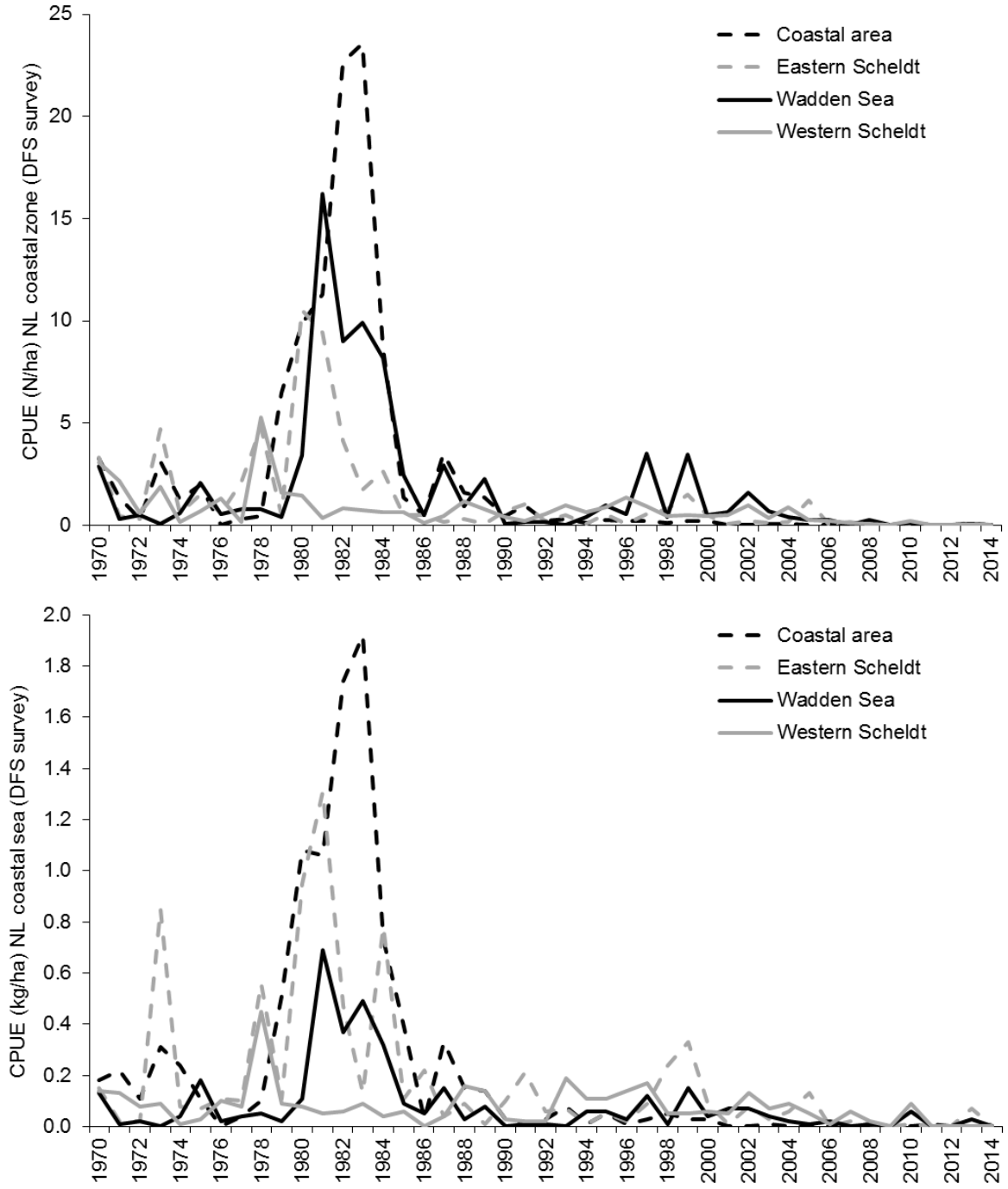


Figure NL. 14. Trends in coastal survey CPUE 1970-2014. Top graph: n/ha; lower graph: kg/ha. Most of the Wadden Sea belongs to RBD Rhine; Eastern Scheldt is mixed RBD Scheldt and Meuse; Western Scheldt belongs to RBD Scheldt (with an extra inflow from Meuse), the coastal area belongs to RBD Rhine (data: Ingrid Tulp/IMARES).

9.3 NL.G.3 Silver eel

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.

10 Data collected for the DCF

Table NL. M. Summary of the DCF monitoring implementation for The Netherlands 2014.

Data	River	Lakes	Estuaries	Lagoons	Coastal & Marine
Production / escapement surveys[1]	Y (WFD)	Y (WFD)	NP	NP	NP
No. of recruitment time-series surveys[2]	10	1	NP	NP	NP
No. fished aged	49		0	0	0
No. of fished sexed	280		0	0	0
No. of fish examined for parasites	280		0	0	0
No. of fish examined for contaminants	ca. 475 (in 2013)		0	0	0
No. of non-fishery mortality studies[3]	1	0	0	0	0
Socio-economic survey	0	0	0	0	0

[1] Surveys to estimate B_{best} and/or $B_{current}$, including WFD surveys of which the data are being used to estimate production and/or escapement of eel

[2] Fishery-independent surveys

[3] Studies to determine $\sum H$ for non-fisheries anthropogenic impacts (hydropower, barriers, predation, etc.)

11 Life history and other biological information

11.1 Growth, silvering and mortality

See Bierman et al. 2012.

11.2 Parasites and 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 years, infection rates appear slightly lower both in Lake Markermeer and on average in the rest of the Netherlands (Table NL. N).

Table NL. N Infection rates of eels with A. crassus in the Netherlands. 1Median infection rates of all sampled locations.

	IJSSELMEER		MARKERMEER		FRYSLAN	OTHER LOCATIONS				
	N eels	% infected	N eels	% infected	N locations	N eels	% infected	N locations	N eels	% infected[1]
2010	390	49	225	48	11	534	46	10	1660	48
2011	293	43	104	34	5	107	37	17	1087	33
2012	320	53	253	38	5	133	33	17	1235	34
2013	159	55	93	43	2	17	47	9	531	38
2014	202	50	46	26	3	49	63	8	291	32

11.3 Contaminants

In 2014, 17 locations were sampled to assess contaminant levels (sum-TEQ and sum Non-dioxin-like PCBs) in eel. Samples consisted of about 25 individuals, 30-40 cm or >45 cm length, and filets were pooled prior to analysis (Table NL-O).

Contaminant concentrations are higher in larger eel than in smaller eel from the same locations. In 2014, several samples had contaminant levels above the revised regulatory limits of 2012 (10 pg/g Sum TEQ[1] and 350 ng/g Sum Non-dioxin-like PCBs[2], 10% uncertainty included). All locations that did have eels with a concentration of Sum TEQ or Sum Non-dioxin-like PCBs above the regulatory levels were fed by the rivers Rhine (IJssel) and Meuse.
Since 1978/1979 several locations have been monitored annually for PCBs. The levels for PCB 153 are shown in Figure NL. 15. Concentrations in 2014 were about similar to those in previous years. Decrease of PCB-contamination occurs very slowly, if any.

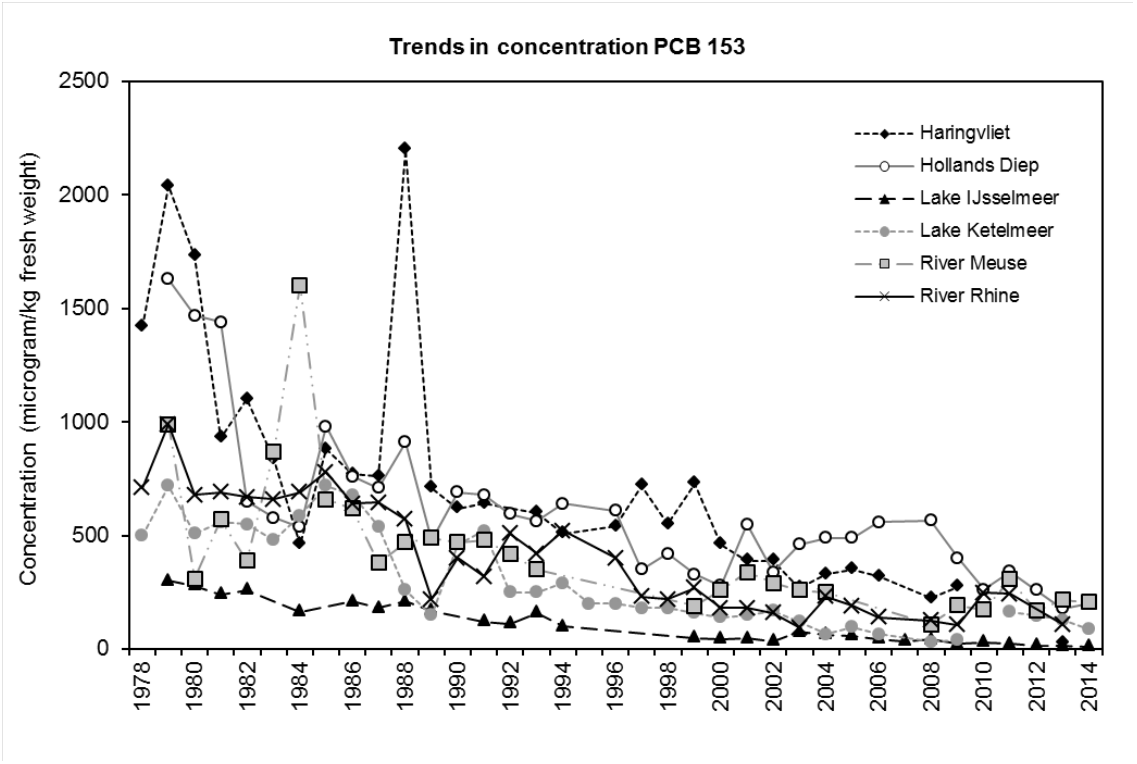


Figure NL. 15. Trend in PBC-153 in 30-40 cm eel (1978-2014) (data: IMARES and RIKILT).

[1] TEQ=Toxic Equivalent: sum of dioxines, furanes and dioxine-like PCBs
[2] Sum of 6 PCBs including PCB153. These are non-toxic indicator PCBs that can be measured easily.

*Table NL. O. Monitoring data of PCBs in eel in the Netherlands. Values of Sum-TEQ above the regulatory limit of 11pg/g (10+10%*10) and of Sum-BCB above the regulatory limit of 385 ng/g (350+10%*350) are indicated in grey.*

Location	Size class	N total	N males	N females	Average Length (cm) per class	Average Weight per class (g)	Fat content (%)	Sum-TEQ (pg/g)	Sum-PCB (ng/g)
Hollands Diep	30-40	25	4	21	34.6	83.2	5.98	8.6	441
	>45			25	54.3	348.0	16.31	18.6	881
IJssel, Deventer	30-40	5	0	5	35.9	85.4	2.8	4.0	177
	>45			25	59.8	443.8	15	14.6	461
IJsselmeer Medemblik	30-40	22	1	21	35.7	89.0	7.67	1.6	23
	>45			25	54.0	346.4	16.2	3.5	49
Lek, Culemborg	>45			25	56.8	360.3	14.3	13.1	577
Maas, Eijsden	30-40	3	2	1	36.2	83.0	4.77	6.5	453
	>45			8	71.2	802.4	18.07	18.9	780
Rijn, Lobith	>45			16	63.9	573.2	16.1	13.1	458
Volkerak (Sluizen)	30-40	25	1	24	36.2	93.8	5.95	4.0	160
	>45			25	55.5	382.0	15.8	9.5	294
Waal Tiel	>45			25	56.9	399.4	17	14.2	469
Volkerak (Steenbergen)	30-40	25	1	24	35.8	83.6	5.89	2.7	72
	>45			23	58.9	445.3	16.4	6.2	163
Amsterdam Rijnkanaal	30-40	25	12	13	35.6	88.0	16.3	8.9	309
	>45			12	52.4	296.1	14.2	9.8	390
Vossemeer	30-40	12	2	10	36.1	82.8	6.4	5.5	173
	>45			19	55.3	357.2	15.9	9.1	224
Amstel	>45			21	61.3	484.3	19.2	2.5	106
Markermeer - Enkhuizen	>45			14	56.3	395.1	12.81	3.6	44
Ketelbrug Noordzijde	>45			21	55.3	360.4	17.5	14.9	402
Ketelbrug Zuidzijde	>45			24	54.3	364.1	16.5	12.9	493
Ketelmeer Noord	30-40	25	4	21	35.1	79.8	7.8	4.8	190
	>45			25	58.0	437.7	20.3	14.0	389
IJsselmeer Urk	>45			17	50.7	272.8	15.7	5.6	158

11.4 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. 16). 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.

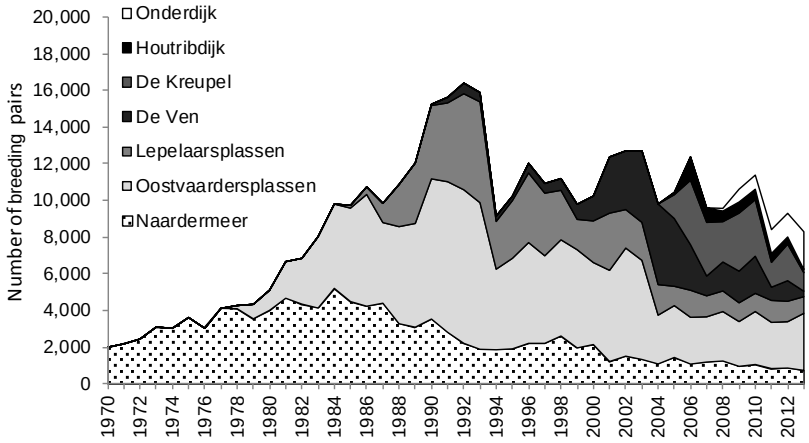


Figure NL. 16. Trends in the number of breeding pairs of cormorants (Phalacrocorax carbo) in and around Lake IJsselmeer/Markermeer (Source: Waterdienst RWS) (1970-2013). Data for 2014 were not made available.

12 Other sampling

Nothing to report.

13 Stock assessment

13.1 Method summary

Van de Wolfshaar *et al.* (2015).

13.1.1 Estimate of B_0

Table NL. P. Reference period for B0.

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

13.2 Summary data

The summary data in the tables below are from "2011-2013" as presented in Van de Wolfshaar *et al.* (2015).

13.2.1 Stock indicators and Targets

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

EMU CODE	INDICATOR	BIOMASS (T)		MORTALITY (RATE)			TARGET		
	B_0	B_{best}	B_{curr}	$\sum A$	$\sum F$	$\sum H$	Source	Biomass (t)	$\sum A$ (rate)
NL_Neth	10400	1697	1057	0.47	0.35	0.12	EMP		
							EU Reg	4160	
							WGEEL		0.106

13.2.2 Habitat coverage

Table NL. R. 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

13.2.3 Impact

Table NL. S. 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							

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

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							

13.2.4 Precautionary Diagram

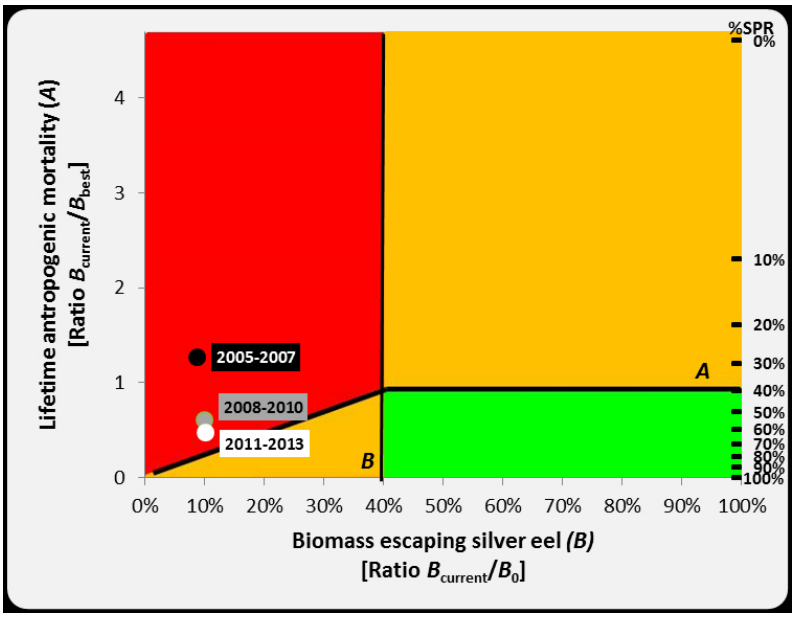


Figure NL. 17. Modified precautionary diagram for the Netherlands EMU (Van de Wolfshaar et al. 2015 after WGEEL 2012), see section 1.3.2 of ICES (2013) for more information.

13.2.5 Management Measures

Table NL. U. 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

13.3 Summary data on glass eel

Table NL. V. Overview of use of glass eel.

USE OF GLASS EEL	2009	2010	2011	2012	2013	2014	2015
Caught in commercial fishery	0	0	0	0	0	0	0
Used in stocking[1]	100	904	244	766	630	2,460	278
Used in aquaculture for consumption	?	?	6,750	6,775	6,700	4,900	5,200
Consumed directly	0	0	0	0	0	0	0
Mortalities	?	?	?	?	?	?	?

1. Not all translocated glass eel is stocked for recovery purposes.

13.4 Sampling intensity and precision

No new information.

14 Standardisation and harmonisation of methodology

14.1 Survey techniques

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

14.2 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)

14.3 Sampling

Nothing to report.

14.4 Age analysis

Since 2010, age readings have been obtained annually of ~150 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 individual growth curves.

14.5 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.

14.6 Sex determinations

Sex is determined by macroscopic examination of the gonads.

14.7 Data quality issues

Nothing to report.

15 Recommendations

(The text in this Chapter is taken from Wolfshaar *et al.*, 2015)
During the development of the current models used to calculate the stock indicators, the main weaknesses of the methodology surfaced quickly. Here we list the main improvements to the calculation of the stock indicators based on the recommendations from Bierman *et al.* (2012) and we provide an overview of recommendations for further adjustments to improve the quality of the assessment before the next evaluation in 2018.

15.1 Demographic Model

Key biological parameters: improve to quality of the following key biological parameters
Sex-ratio: ***2012 -*** Sex ratios could be improved by using eels smaller than 30 cm. These eels could be obtained during the WFD fish sampling. ***2015 –*** Eels smaller than 30 cm are currently collected (e.g. IJsselmeer electro trawl survey) and used to determine sex ratios.
Growth rate: ***2012 -*** Growth rates could be improved by including eels smaller than 30 cm. These eels could be obtained during WFD fish sampling. ***2015 –*** Age and growth increments of eel <30 are being determined as part of the WOT eel research programme.
Maturation-at-length: The silvering ogive for a given area could be improved by using data collected year round.

Anthropogenic mortalities: ***2012 -*** quantify sources of anthropogenic mortalities that were excluded from the 2012 assessments such as 1) catch-&-release mortality of recreational fisheries, 2) yellow eel mortality pumping stations and hydropower plants, 3) poaching. ***2015 –*** A rough estimate of eel catch-&-release mortality by recreational fishers has been accounted for during the current evaluation. In 2015 experiments will be conducted in collaboration with German scientists to determine C&R mortality for eel and improve the current estimate. Quantifying yellow eel mortality by pumping stations and hydropower plants and estimating the impact of poaching remains to be done.
Survey data: Combining two surveys to increase the data pool for especially Lake Markermeer may be a possibility in obtaining a data set with enough individuals, but is a daunting task given the differences in methods, habitat, season and the number of years the programs are running.

15.2 Spatial Model

WFD survey data: ***2012 -*** Improve the accessibility of WFD fish survey data of regionally managed waters by establishing a central data base for the Netherlands, and ensure that the data is properly checked to ensure the quality of data. ***2015 –*** Accessibility of WFD fish survey data remains difficult and a central data base is highly recommended before the 2018 evaluation of the Dutch eel management plan.
Catch efficiency: ***2012 -*** Conduct experiments to determine efficiencies of electrofishing for eel in different WFD water types in both nationally and regionally managed waters. ***2015 –*** Experiments to determine efficiencies of electrofishing for eel remain to be done.
Spatial distribution*: 2012 -* Conduct experiments to determine the spatial distribution of eel in wide rivers and lakes in both nationally and regionally managed waters. ***2015 –*** In 2013 a pilot study was conducted in wide rivers to study the spatial distribution of eel. The results were ambiguous and in the coming years further (internationally co-ordinated) experiments are planned to determine the spatial distributions of eel in wide rivers and lakes for the 2018 evaluation.

Ditches: ***2012 -*** Conduct electrofishing surveys for eel in ditches to supplement the existing WFD eel survey data in regionally managed waters. ***2015 –*** Since 2013 annual electrofishing surveys for eel in ditches have been part of the WOT eel research programme.
Habitat: ***2012 -*** Correct eel densities for habitat in nationally and regionally managed waters. ***2015 –*** Correcting eel densities for habitat remains to be done.
Electro-beam trawl: ***2012 -*** Develop an electro-beam trawl to provide reliable estimates of eel (>30 cm) densities in large lakes and wide rivers. ***2015 –*** In co-operation with an environmental consultancy company an improved electro-beam trawl was developed, however, this new electro-beam trawl remains to be tested and calibrated (efficiency) and is not being used in standard surveys to date.

15.3 Silver Eel Migration Model

Migration routes: ***2012 -*** finalise the GIS model (Appendix A in Bierman *et al.* 2012) to improve the estimate of silver eel mortality during migration. ***2015*** Based on a new barrier assessment for migrating silver eel in 2013 silver eel mortality estimates were improved by using a weighted importance of individual barriers based on catchment size for the boezem and national waters. The barrier-mortality model as presented here to estimate mortality of silver eels during migration can be further developed to enable a full 'bottom up and site-specific data driven' approach for all types of waters and barriers.

Silver eels migrating downstream from Belgium and Germany: The mortality caused by hydropower stations on silver eels migrating downstream on the river Meuse from Belgium and the river Rhine from Germany ('foreign' silver eels) have not been taken into account in the estimation of LAM in this report. It is still unclear as it was during the 2012 evaluation, whether these mortalities should have been included in the LAM of silver eels in the Netherlands or in the country where the silver eels were produced (Germany, Belgium). It is recommended that international agreement is achieved how these mortalities should be accounted for when silver eels pass several MS during migration.

International "level playing field" stock indicators
As many other European countries (France, UK, Ireland) are using similar spatial models to estimate yellow eel standing stock and silver eel production, close international co-operation and collaboration will enhance the quality and uniformity of these models in the future. An independent international review of the methods used to estimate the stock indicators is required to create a level playing field and to enhance trust among member states. Furthermore standardization of assessment methods is of utmost importance to ensure the recovery of the European eel stock and its sustainable exploitation. The need for a "level playing field" was acknowledged by the European Commission which intends to request an external scientific review of the methodologies used by Member States to estimate the stock indicators.

16 Quality Assurance

IMARES utilises an ISO 9001:2008 certified quality management system (certificate number: 187378-2015-AQ-NLD-RvA). This certificate is valid until 15 September 2018. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V.

Furthermore, the chemical laboratory at IJmuiden has NEN-EN-ISO/IEC 17025:2005 accreditation for test laboratories with number L097. This accreditation is valid until 1th of April 2017 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation. The chemical laboratory at IJmuiden has thus demonstrated its ability to provide valid results according a technically competent manner and to work according to the ISO 17025 standard. The scope (L097) of de accredited analytical methods can be found at the website of the Council for Accreditation (www.rva.nl).

On the basis of this accreditation, the quality characteristic Q is awarded to the results of those components which are incorporated in the scope, provided they comply with all quality requirements. The quality characteristic Q is stated in the tables with the results. If, the quality characteristic Q is not mentioned, the reason why is explained.

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Justification

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Project Number: 4311209006

The scientific quality of this report has been peer reviewed by a colleague scientist and a member of the Management Team of IMARES.

Approved: Olvin van Keeken
Reseacher

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