De toestand van de Nederlandse aalstand en aalvisserij in 2009

Willem Dekker

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Uitgebreide samenvatting

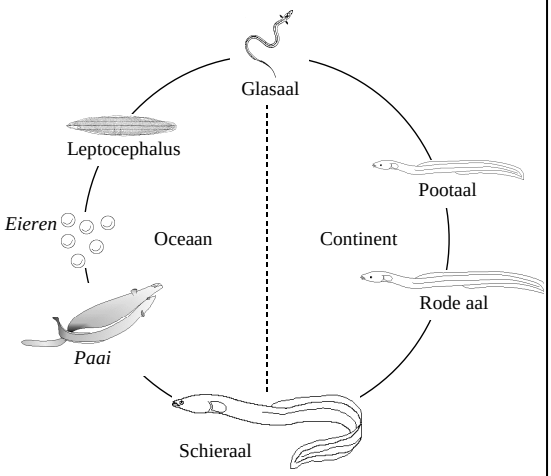
In dit rapport wordt een uitgebreid, Engels-talig overzicht gegeven van de toestand van de aal in Nederland, zoals dat jaarlijks aan de aalwerkgroep van EIFAC/ICES wordt gepresenteerd. In deze Uitgebreide Samenvatting wordt een Nederlandstalige, verkorte presentatie van de inhoud gegeven, met de nadruk op de meest recente gegevens. Het Engelstalige overzicht beoogt compleet en gedetailleerd te zijn - hier staat de leesbaarheid en toegankelijkheid voorop.

Kader

In 2002 (ICES 2003) deed de gezamenlijke aalwerkgroep van de Internationale Raad voor het Zeeonderzoek ICES en de Europese Adviesraad voor de Binnenvisserij EIFAC de aanbeveling dat deelnemers jaarlijks aan de werkgroep zouden rapporteren over de toestand van de aalstand en aalvisserij in hun land. Deze rapportages konden dan vervolgens door de werkgroep gebruikt worden als uitgangspunt voor het internationale bestandsoverzicht en de daarop gebaseerde advisering. In 2003 (ICES 2004) werden gedetailleerde rapporten voor elk van de deelnemende landen opgesteld, die aan het (internationale) rapport van de werkgroep werden toegevoegd. In de jaren daarna zijn deze landen-rapporten telkens bijgewerkt en aangevuld. Onderliggend rapport bevat het overzicht van de toestand van de aalstand in Nederland dat in de zomer van 2009 is opgesteld. De tijdreeksen in dit rapport lopen tot en met 2008, met uitzondering van de glasaal-intrek waarvoor gegevens tot en met het voorjaar van 2009 beschikbaar waren. Verder wordt eenmalig aandacht besteed aan de historische gegevens over de aanvoer van aal uit de kustwateren in de afgelopen eeuw, inclusief de prijsontwikkeling; en aan de trend in de lengte/gewicht-relatie van de aal in het IJsselmeer sinds 1960.
De gerapporteerde gegevens zijn merendeels verzameld in het kader van Wettelijke onderzoekstaken (WOT); de analyse en rapportage heeft ook in dat kader plaatsgevonden.

Biologie van de Aal

De Europese aal *Anguilla anguilla* (L.) komt voor in heel Europa, noordelijk Afrika, en de Mediterrane delen van Azië. Het is slechts globaal bekend waar de aal zich voorplant: de kleinste larven (10 mm) komen in de Sargassozee, nabij Bermuda, voor. Kunstmatige voortplanting in laboratoria of kwekerijen wil tot dusverre nog steeds niet echt lukken. De grotere larven (Leptocephalus, tot 10 cm lengte) drijven op de Warme Golfstroom naar Europa, waar ze omvormen tot glasaal (rolrond en doorzichtig, 7 cm) en in de winter en vroege voorjaar vanuit onze kustwateren de rivieren optrekken. Dan begint het rode aal stadium (donker gekleurd), waarin ze eten en groeien. De maximaal waargenomen lengte bedraagt 133 cm. Het menu bestaat uit insecten, wormen, slakken en schelpen, kreeftjes en vis, maar geen aas. Mannetjes rijpen na 2 - 15 jaar bij een lengte van 30-45 cm, vrouwtjes na 3 - >50 jaar, bij een lengte van > 50 cm. Nu worden ze schieraal genoemd; schier betekent wit (buikzijde). Schieraal trekt in het najaar terug naar zee, en verdwijnt dan uit ons zicht, vermoedelijk richting Sargassozee. Schieraal wordt ook wel paling genoemd, maar meestal zijn de woorden aal en paling synoniem.

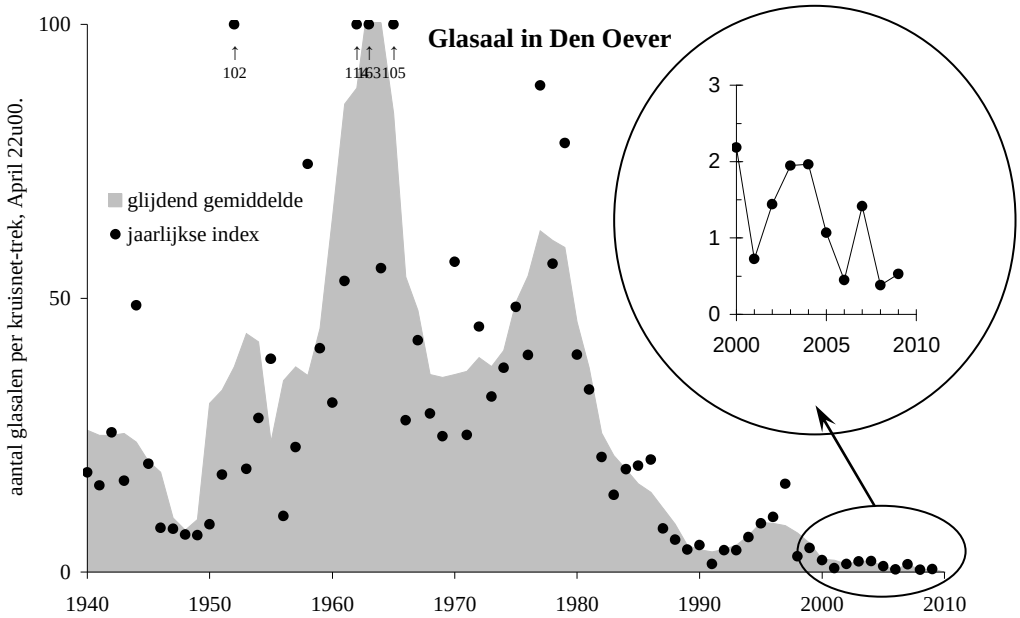


De levenscyclus van de aal. De paai en de eieren zijn nooit werkelijk in de natuur waargenomen.

Glasaal-intrek

De intrek van jonge aal (glasaal) uit zee naar onze binnenwateren wordt bemonsterd op 12 plaatsen langs de kust. In Den Oever is sinds 1938 een intensief programma uitgevoerd, elders is tussen 1970 en 1995 een netwerk van vrijwilligers opgezet.

De resultaten tonen een sterke afname sinds 1980 en het glasaal niveau is momenteel minder dan 1 % van het vroegere niveau. De meest recente gegevens laten zien dat de dalende trend nog steeds voortduurt. In 2009 was er in Den Oever iets meer glasaal dan in 2008, maar nog altijd was in 2009 sprake van de twee na de laagste intrek ooit. Het intrek-seizoen kwam normaal op gang, maar liep vroeg af. De glasaal was, net als in de afgelopen jaren, tamelijk klein. De waarnemingen op de andere locaties bevestigen het algemene beeld, hoewel er wel wat kleine variaties optraden.

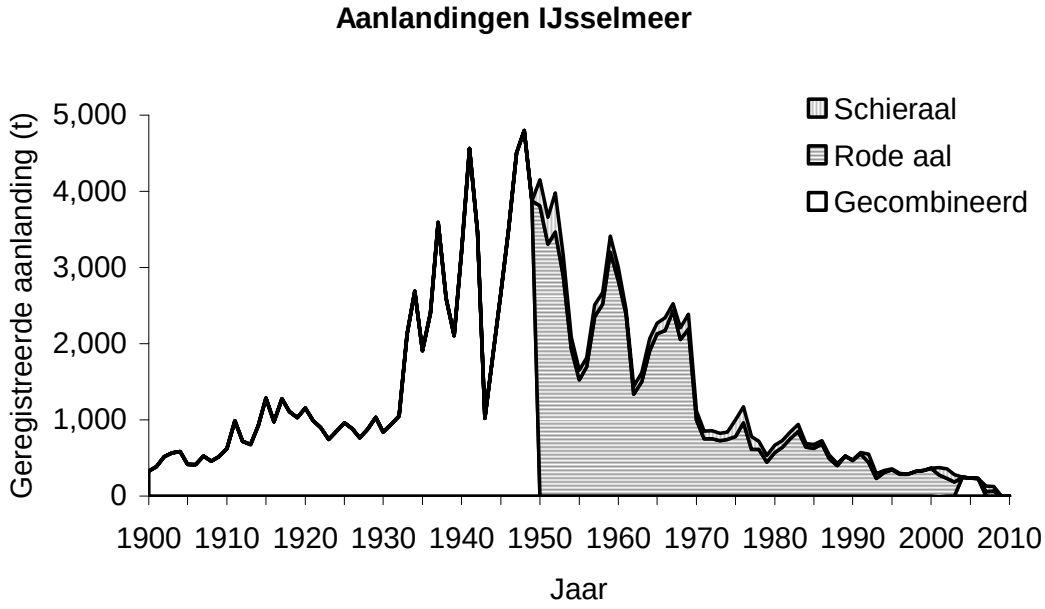


In Vollenhove is eind jaren 1950 een aalval opgesteld, om jonge aal (rode aal) te vangen, en over de dijk in de binnenwateren te kunnen uitzetten. De gegevens vanaf 1976 zijn nog bewaard. Deze tonen dat de aantallen overgezette rode aal een vergelijkbare daling hebben meegemaakt als de glasaal in Den Oever in de jaren na 1980.

Aanlanding

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. Voor de Zuiderzee/IJsselmeer zijn gegevens beschikbaar over de aanvoer op de afslagen sinds 1880. Voor de kustwateren zijn in dit rapport voor het eerst gegevens bij elkaar gebracht over de aanvoer in de periode 1920-1983; daarna zijn geen gegevens meer verzameld (tot 1995), en later (sinds 1995) is de registratie weer opgepakt (EU-logboeken), maar daarbij is er geen onderscheid naar het gebied van herkomst meer mogelijk. Voor de overige binnenwateren zijn geen cijfers beschikbaar.

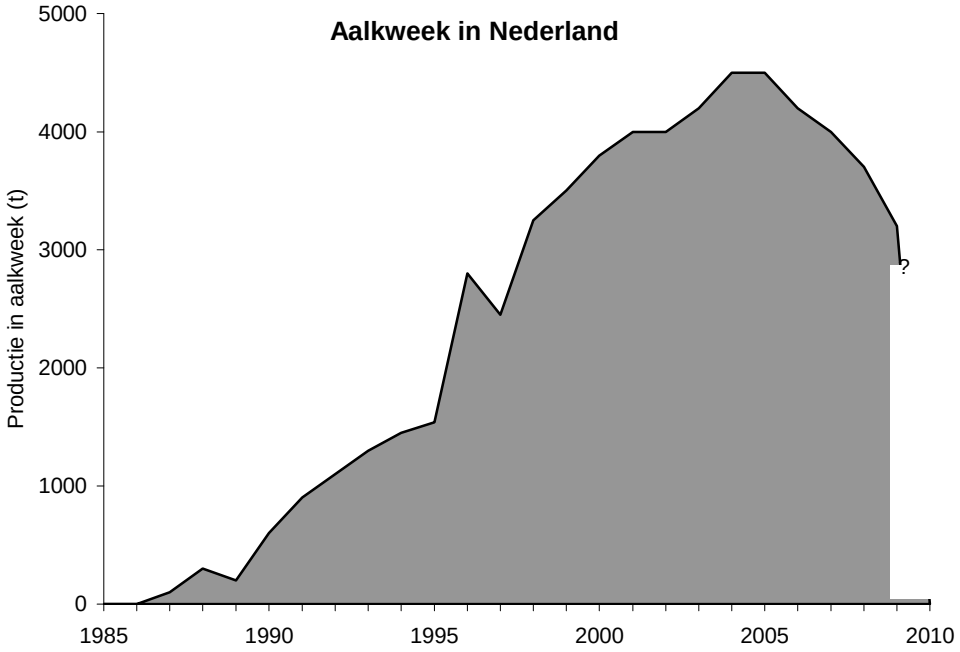
De aanlandingen van de Zuiderzee toonden in de periode 1880-1932 een lichte stijging van 300 naar 1000 t. Bij de afsluiting van het IJsselmeer namen de aanlandingen plotseling toe tot ca. 2500 t, om daarna verder te stijgen tot rond 3500 t in de jaren 1940-1955. Sinds 1950 heeft de aanvoer sterk gefluctueerd, maar is wel een gestage daling opgetreden tot minder dan 400 t sinds 2000, en nog maar 122 t in 2008.



De totale aanvoer uit de Kustwateren heeft in de periode sinds 1920 nooit de 1100 t overschreden, waarvan het merendeel uitsluitend van de Zuiderzee/Waddenzee kwam. Naarmate er meer zee-armen in het zuid-westen werden afgesloten, nam de aanvoer in die regio af, terwijl de aanvoer uit de Waddenzee bij tijden nog wel een hoog niveau van ca. 300 t behield. Sinds 1995 zijn de vangsten in de kustwateren gedaald van ca. 40 t naar minder dan 10 t in 2008.

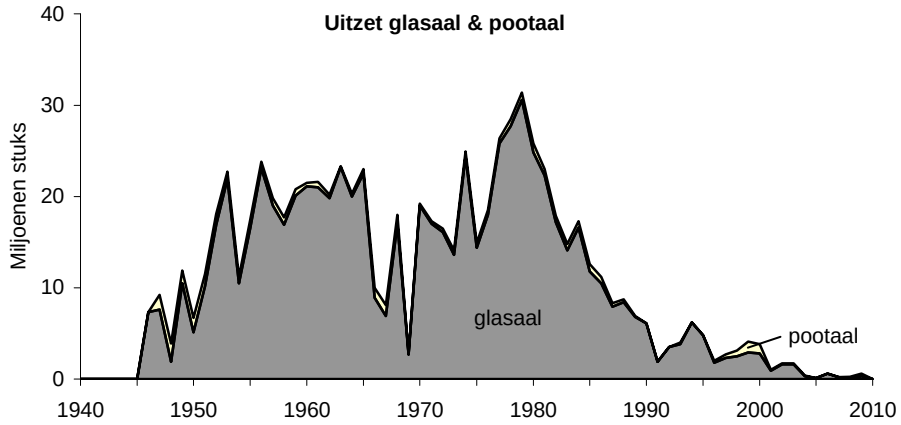
Aalkweek

De grootste hoeveelheid aal in ons land wordt geproduceerd in intensieve kwekerijen. Hierin wordt uit Frankrijk/Engeland geïmporteerde glasaal opgekweekt onder gecontroleerde omstandigheden. De totale productie sinds 1985 is gestegen tot meer dan 4 000 t, maar sinds 2005 neemt de productie weer af. Buiten Nederland, is de intensieve kweek vooral van belang in Denemarken, waar ook sprake is van een sterk dalende productie (nu < 1000 t), en een meer extensieve vorm in Italië (ca. 1000 t). Kunstmatige voortplanting van de aal is tot op heden niet mogelijk.



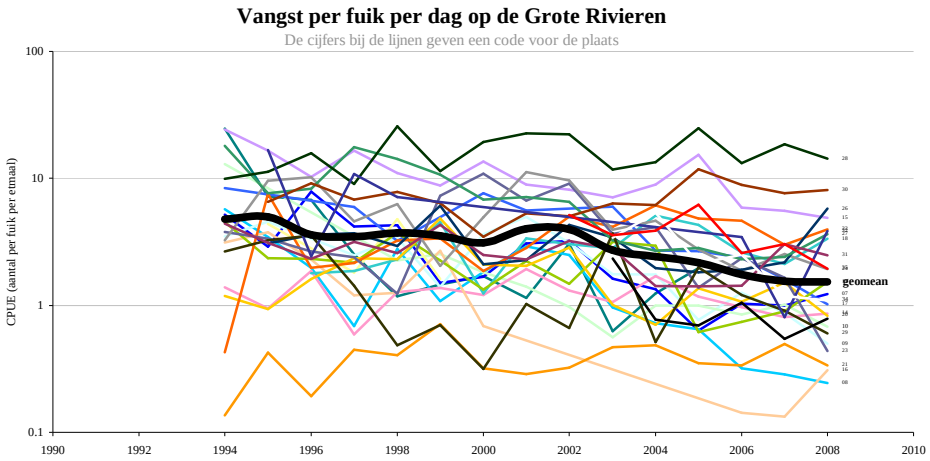
Uitzet van glasaal en pootaal

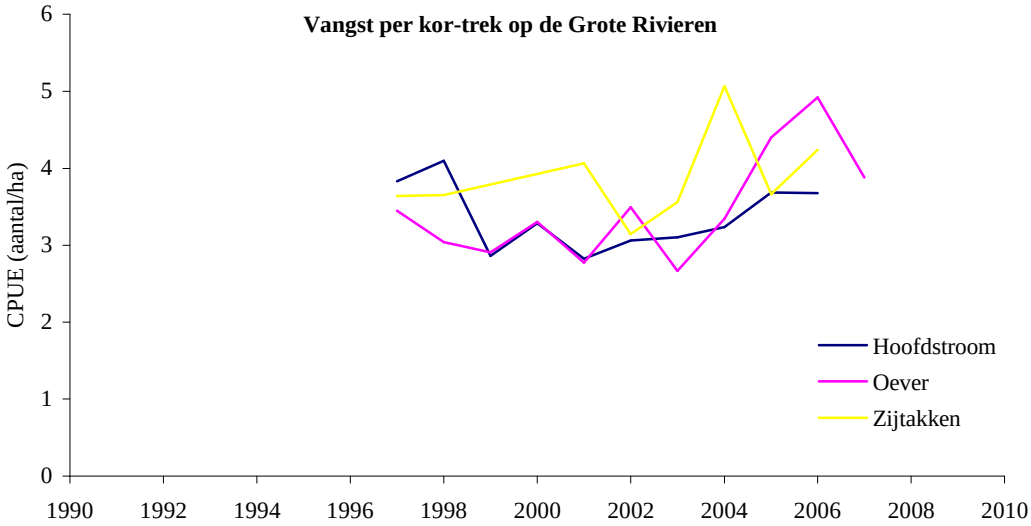
Sinds de jaren 1950 is er op grote schaal glasaal uit de omgeving van de Golf van Biskaje aangekocht en uitgezet in de binnenwateren. Daarnaast is jonge rode aal (pootaal) uitgezet. Deze pootaal werd voornamelijk gevangen in de kustzone en/of de benedenloop van de rivieren. In recente jaren heeft de uitzet van gekweekte aal (opgekweekt uit glasaal van Frankrijk/Engeland) de overhand.
De uitzet van glasaal heeft min of meer gelijke tred gehouden met de natuurlijke intrek; in 2009 werd nog maar ca. 0.3 miljoen glasalen uitgezet. Voorheen was het aantal uitgezette pootaal verwaarloosbaar klein ten opzichte van de glasaal. Deze hoeveelheid is in tegenstelling tot de glasaal echter maar weinig afgenomen, waardoor de hoeveelheden uitgezette glasaal en pootaal nu ongeveer even groot zijn.
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.



Bestandsopnames

Onafhankelijke bestandsopnames bevestigen de sterk dalende trends voor de glasaal en de aanlandingen. Registratie van de vangst per fuik per etmaal door een geselecteerde groep vissers toont een gestage achteruitgang tot ca. 30 % van de vangst sinds het begin van de registraties in 1994. Een uitzondering vormt echter de bemonstering van de Grote Rivieren. De opnames aan boord van onderzoeksschepen lieten namelijk in dezelfde periode eerder een lichte stijging zien dan een afname.



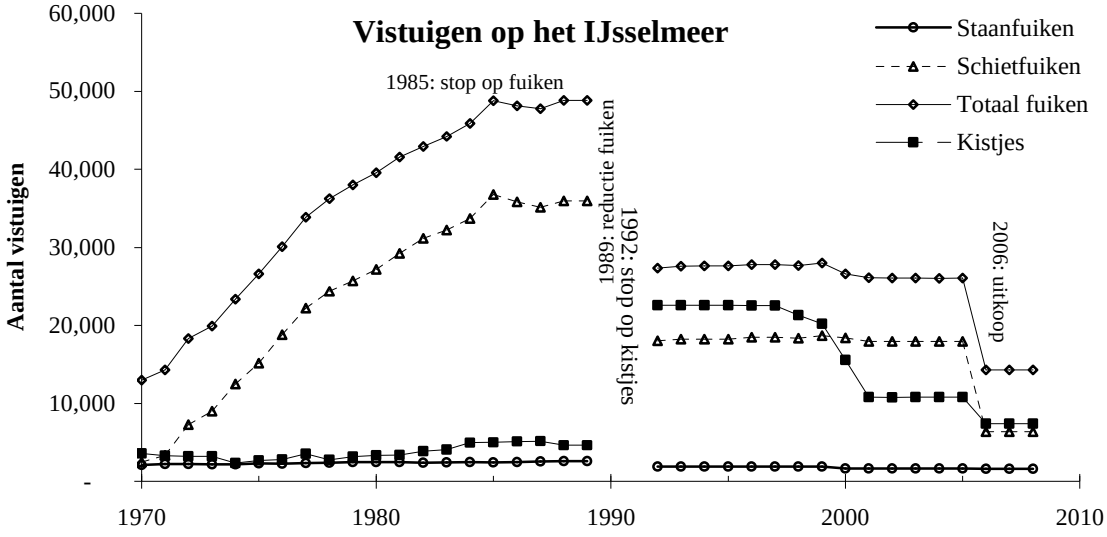


Visserij

De visserij in Nederland is nauwelijks gedocumenteerd; het aantal vergunningen is bekend, maar van de aantallen vistuigen, het gebruik daarvan en de vangsten zijn slechts schattingen beschikbaar, en deze schattingen verouderen nu snel. Invoering van de Europese Aalverordening en het Nederlandse Aal Beheersplan zal de documentatie naar verwachting snel verbeteren.

Geschatte aantallen vistuigen per type en gebied aantal bedrijven, en beschikbaar wateroppervlak	Ijsselmeer/ Markermeer	Rivieren	Kustwateren, beroepsmatig	Overige wateren	Kustwateren, recreatief	Totaal
Grote fuiken	1,579	155	-	+		>1734
Hokfuiken		163	574	+		>737
Schietfuiken	6,386	2,433	233	+		>9052
Kleine fuiken		51		+	1,956	>2007
Kisten/kubben	7,415	551	+	+		>7966
Hoekwant/dobbers	+	+	+	+		+
Electroschepnet		+	-	+		+
Overige aalvistuigen				+		+
Visserijbedrijven	73	28	48	ca. 100	978	ca. 250+978
Oppervlak, ha	169,150	20,867	354,959	134,966	354,959	679,942

Op het IJsselmeer is het aantal te gebruiken vistuigen gelimiteerd door merkjes, 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 staanfuiken heeft er in de jaren 1970-1980 vrijwel geen groei plaatsgevonden, terwijl er later wel reducties zijn doorgevoerd. Daarmee ligt het aantal grote fuiken in 2008 een kwart lager dan in 1970.



Conditie

Uit eerdere analyse van historische gegevens die destijds verzameld zijn voor de bepaling van chemische vervuiling, zou zijn gebleken dat de aal in Nederland in de loop der jaren magerder en minder vet was geworden. Een verminderde capaciteit om terug te zwemmen naar de Sargassozee voor de voortplanting, zou dan mede een mogelijke verklaring kunnen zijn voor de slechte intrek van jonge glasaal. Deze bevinding wekte destijds verbazing, omdat een zo sterke afname van vet en conditie in de dagelijkse praktijk niet was gebleken. Subjectieve indrukken kunnen er echter net zo goed naast zitten en daarom was er behoefte aan een nieuwe analyse op basis van uitgebreidere gegevens.

In dit rapport wordt een statistische analyse gepresenteerd van biologische gegevens van het IJsselmeer, waarbij over de jaren 1960-heden in totaal meer dan 100 000 alen zijn onderzocht. Hieruit blijkt dat de conditie (de verhouding tussen werkelijk en verwacht gewicht) vrij aanzienlijk is toegenomen in de jaren 1980. Deze trend komt overeen met de opgetreden veranderingen in de watertemperatuur, maar of hier sprake is van een oorzakelijk verband is vooralsnog niet te bepalen. In ieder geval blijkt de eerder gerapporteerde conditie-afname nu in het geheel niet te worden bevestigd. Nadere vergelijking en analyse van de verschillende gegevensbestanden is gewenst.
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Vervuiling en ziektes

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 daarvoor, is een gestage daling in de gehaltes van PCBs en dioxines in aal waargenomen. Hieronder wordt een enkel voorbeeld (PCB 153) getoond; PCB 153 is een goede indicator voor de andere PCBs.

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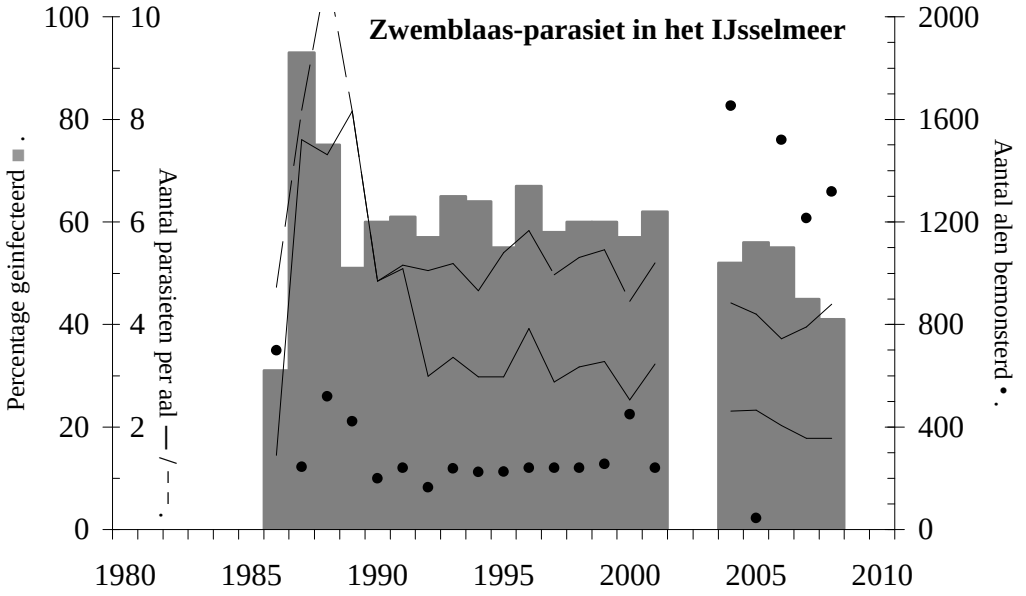
Sinds de jaren 1980 komt in Europa een Aziatische parasiet voor in de zwemblaas van Europese alen. Na een snelle verspreiding in midden jaren 1980, is de infectie nu alom aanwezig. De mate van infectie daalt langzaam.



Overige informatie

Alle hierboven gepresenteerde informatie wordt in het Engelstalige rapport nader gedocumenteerd en toegelicht. Daarnaast bevat het rapport een overzicht van de Nederlandse binnenwateren, de ruimtelijke verdeling van de visserij, de inhoud van het door Nederland ingediende Aal Beheers Plan, en een analyse van de statistische betrouwbaarheid van de belangrijkste tijdreeksen.

Conclusie

In dit rapport wordt een up-to-date overzicht gegeven van de beschikbare informatie over de toestand van de aal en de aalvisserij in ons land, op basis van de in zomer 2009 beschikbare informatie. Alle informatie wijst erop dat het bestand zich op een historisch dieptepunt bevindt, en vermoedelijk nog verder zal afnemen. De invloed van de mens (visserij, gemalen, vervuiling, etc.) is groot, en in veel gevallen onvoldoende gedocumenteerd. Het bestand in de rivieren vormt mogelijk een uitzondering op de algemene trend: in dit gebied geven onafhankelijke bestandsopnames een lichte stijging te zien, anderzijds toonde de informatie van een kleine steekproef van de vissers een aanzienlijke daling van hun vangsten.

Bijlage A

Het hieronder weergegeven rapport is als bijlage opgenomen in het (jaarlijkse) rapport van de EIFAC/ICES working group on eels. In dat rapport is voor elk deelnemend land een dergelijke bijlage te vinden. De hoofdstuk-indeling is in grote lijnen uniform voor alle landen; waar geen informatie beschikbaar was, of een hoofdstuk niet relevant, is dat als zodanig vermeld.

☙ ❧

Report on the eel stock and fishery in the

Netherlands
2009

NL.1 Authors

IMARES, Institute for Marine Resources & Ecosystem Studies
PO Box 68, 1970 AB IJmuiden, the Netherlands
Tel. +31 317 487 164. Fax: +31 317 487 326
Willem.Dekker@WUR.NL
Reporting Period: This report was completed in August 2009, and contains data up to 2008 and recruitment data for 2009.
Contributions: the following persons and institutions provided information for this report: Nico van Doorn (Combinatie van Beroepsvissers), Bond van Binnenvissers van Noordwest Overijssel, Wim van Eijk (Nederlandse Vereniging van Viskwekers), Jan Klein Breteler (Vivion).

NL.2 Introduction

NL.2.1 Status of this report

In 2002 (ICES 2003), the EIFAC/ICES working group on eels recommended that member countries should report annually on trends in their local populations and fisheries to the Working Group. In 2003 (ICES 2004), detailed data reports per country were annexed to the working group report, which have subsequently been updated, refined and restructured to match the set-up of the EU Data Collection Regulation. FAO/ICES (2009) is the most recent version. This report on the status of and trend in the eel stock in the Netherlands updates the information presented before, and elaborates the following topics: historical landings from estuaries and coastal areas, including prices; historical trend in length/weight relation for IJsselmeer eel.

NL.2.2 General overview of fisheries

Eel fisheries in the Netherlands occur in coastal waters, estuaries, larger and smaller lakes, rivers, polders, etc. The total fishery involves approx. 200 companies, with an estimated total catch of nearly 1000 tonnes. 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. Within the licensed fishing area, and obeying the general rules, fishermen are currently free to execute the fishery in whatever way they want. There is no general registration of fishing efforts or landings yet. 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 Plans. The Management Plans are currently not subject to general objectives or quality criteria.

NL.2.3 Spatial subdivision of the territory

The fishing areas can be categorized into 5 groups:

1. The Waddensea; 53ºN 5ºE; 2591 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 Waddensea. The fishery in the Waddensea 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 Waddensea is obliged to apply standard EU fishing logbooks. Landings statistics are therefore available from 1995 onwards; <50 tons per year. There are 21 companies having a commercial license for fishing eel, and the total number of fyke nets is 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 Waddensea in 1932 by a dike (Afsluitdijk), substituting the estuarine area known before as the Zuiderzee. The surface of the lake was stepwise reduced by land reclamation, from an original 3 470 km^2 in 1932, to just 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 1200 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 Waddensea 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 80% of the actual total. There are 70 fishing licenses, owned by ca. 30 companies. The total number of gears allowed in 2008 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 constitute a network of dividing and joining river branches in the Netherlands. 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 efforts or landings is required. There are 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).
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. 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. There are 27 companies, using an estimated number of 174 fixed fykes, 233 train fykes, and unknown numbers of eel pots.
5. Remaining waters; inland 1340 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. 8 small companies operating scattered along the North Sea coast have been added to this category. There are approx 100 companies, using unknown quantities of gears of all types.

The Water Framework Directive subdivides the Netherlands into 4 separate River Basin District, all of which extend beyond our borders. These are:

a. 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 Drente. Drainage area: 18,000 km^2, of which 2,400 km^2 in the Netherlands.
b. 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.
c. 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.
d. 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, while 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.

Table NL.a Overview of water surface, number of commercial companies and their annual landings (2004), by fishing area. Estimates in Italics have been broken down by RBD, assuming that catches are proportional to the number of fishing companies.

		SURFACE	ESTIMATED LANDINGS (T)		DATA SOURCE
Area	RBD	(km^2)	yellow eel	silver eel	
Waddensea	Rhine	2591	*37*	-	EU logbooks
	Ems	38	*3*	-	EU logbooks
IJsselmeer	Rhine	1820	240	40	Auction statistics
Rivers	Rhine	*120*	*46*	*91*	Informed guess
	Meuse	*60*	*4*	*9*	Informed guess
Zeeland	Meuse	535	75	?	(EU logbooks)
	Scheldt	428	0		
Others	Rhine	900	*222*	*133*	Informed guess
	Ems	86	*9*	*5*	Informed guess
	Meuse	288	*4*	*2*	Informed guess
	Scheldt	67			
Sum		6528	640	280	

NL.2.4

NL.2.5 Dutch Eel Management Plan

The Ministry of Agriculture, Nature and Food Quality (responsible for fisheries) has submitted an Eel Management Plan (MinLNV 2008); the initial version (December 2008) has been replaced by a second version (April 2009), which in turn has been replaced by a new decision in July 2009 (decision published 14 July 2009, but EMP not yet adapted). Major elements of this plan are:

1. One single Eel Management Plan for the whole territory, including coastal areas.
2. Target escapement for Lake IJsselmeer estimated at 3080 t (length structured model, auction statistics), for the whole country at 4000-6000 t (historical landings per surface area, 1950s data, recent surfaces). Following the initial version of the EMP, the calculations have been reviewed by a committee, and targets are now set at 2600-8100 t, "most probably lower than the previous" calculations.
3. Current escapement is estimated at 400 t, half of which is silver eels from upstream, only passing through Dutch territory.
4. Fisheries for yellow and silver eel currently occurs in almost all waters, see previous section. Relative impact on the stock is unknown.
5. Other mortalities are omnipresent, but unquantified. Minimum estimates (including fishing) are: 1000 t for yellow eel, and 345 t for silver eel.
6. Restocking of approx 0.2 million individuals (mostly bootlace); future restocking of 1 – 1.6 t of glass eel is foreseen.
7. Management measures planned as follows:
    a. Reduction of mortality at pumping stations. Within the framework of the WFD, a budget of 200 M€ is available.
    b. The hydropower industry will be asked to reduce mortality by 35%. On new installations, a migration passage is obligatory.
    c. Fishery-free zones near barriers and sluices, presumably extending 500 m up- and downstream.
    d. Release of angler catches; this is a voluntary measure by the sport fisheries.
    e. Ban on recreational fishing (a few fyke nets per person) in coastal areas from 2011.
    f. Stop on sniggle licenses in state owned waters.
    g. For the fishery, version 1 of the EMP set a closed season in Sept + Oct (yellow & silver eel, total ca. 50% of the annual catch).; version 2 decided to trap and transport 157 t of silver eels (of which 50 t from unpolluted waters) for release into the sea, but no closed season; and the July 2009 decision returns to a closed season (2009: Oct + Nov; 2010 onwards: Sept + Oct + Nov).
    h. The time until recovery depends very much on the immigration of glass eels in the years to come. Assuming that glass eel recruitment will have recovered by 2027, the targets set for silver eel escapement will be met.

The final political discussion on the July 2009 decisions are still pending.

NL.3 Time Series Data

NL.3.1 Recruitment series and associated effort

NL.3.1.1 Glass eel

Commercial
Glass eel fishing is forbidden.

Recreational
Glass eel fishing is forbidden.

Fishery Independent
Recruitment of glass eel in Dutch waters is monitored at Den Oever and 11 other sites along the coast (see Dekker 2002 for a full description).
In Den Oever (Figure NL.1), 2009 recruitment was a little above the previous, historically low year; 2009 being the third lowest on record. The 2009 immigration season started as usual, but ended early in the beginning of May. The glass eels had a low total length, in the same order as in recent years (Figure NL.2). The data at the other sites (Figure NL.3) confirm the overall trend, though individual series may deviate.

Table NL.b Number of glass eel caught per lift net haul at the sluices in Den Oever. All observations have been corrected for the time of day and the month of sampling, and averaged per year.

DECADE YEAR	**1930**	**1940**	**1950**	**1960**	**1970**	**1980**	**1990**	**2000**
0		18.19	8.71	30.95	56.64	39.66	4.88	2.18
1		15.79	17.77	53.17	25.01	33.32	1.47	0.72
2		25.52	113.86	124.33	44.78	21.01	3.94	1.44
3		16.71	18.82	178.02	32.03	14.07	3.95	1.95
4		48.72	28.15	55.50	37.26	18.80	6.37	1.96
5		19.78	38.94	115.22	48.44	19.41	8.85	1.07
6		8.03	10.22	27.71	39.63	20.56	10.06	0.45
7		7.89	22.79	42.33	88.85	7.96	16.11	1.41
8	21.63	6.82	74.50	28.91	56.32	5.91	2.88	0.38
9	48.53	6.72	40.83	24.82	78.36	4.10	4.35	0.53

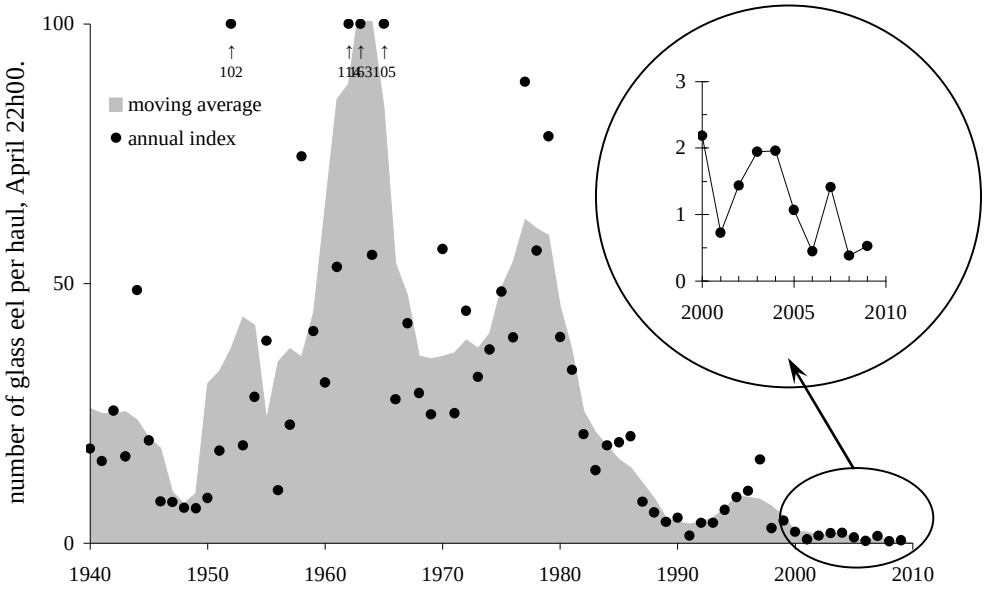


Figure NL.1 Time trend in the glass eel survey at the sluices in Den Oever.

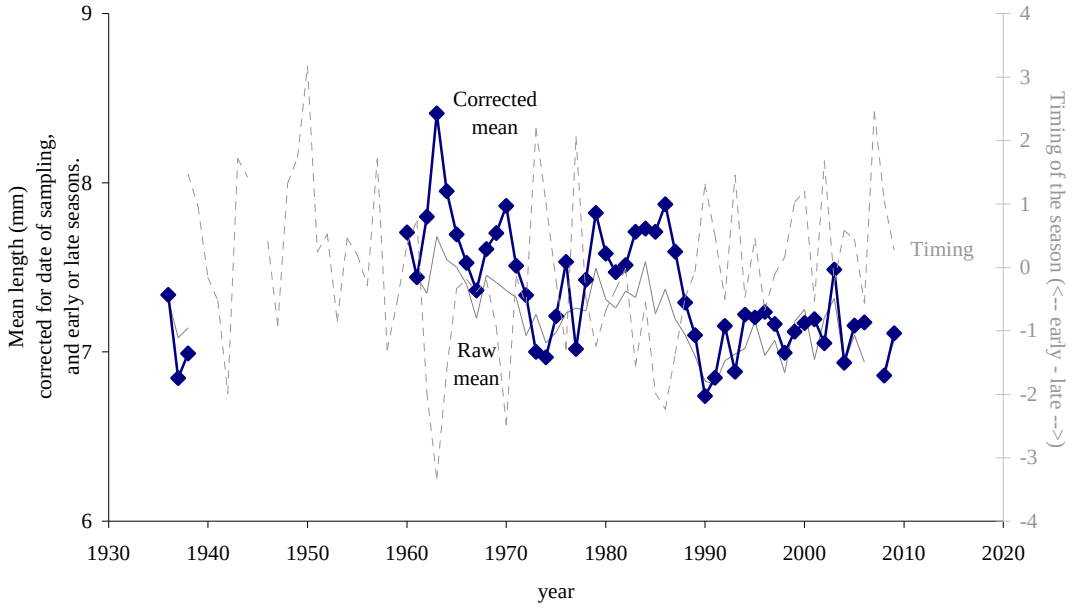


Figure NL.2 Time trend of the length of the glass eel sampled in Den Oever. The measurements have been corrected for the date of sampling within the season, and for the average timing of each season within each year. (Timing for 2006 currently unavailable).

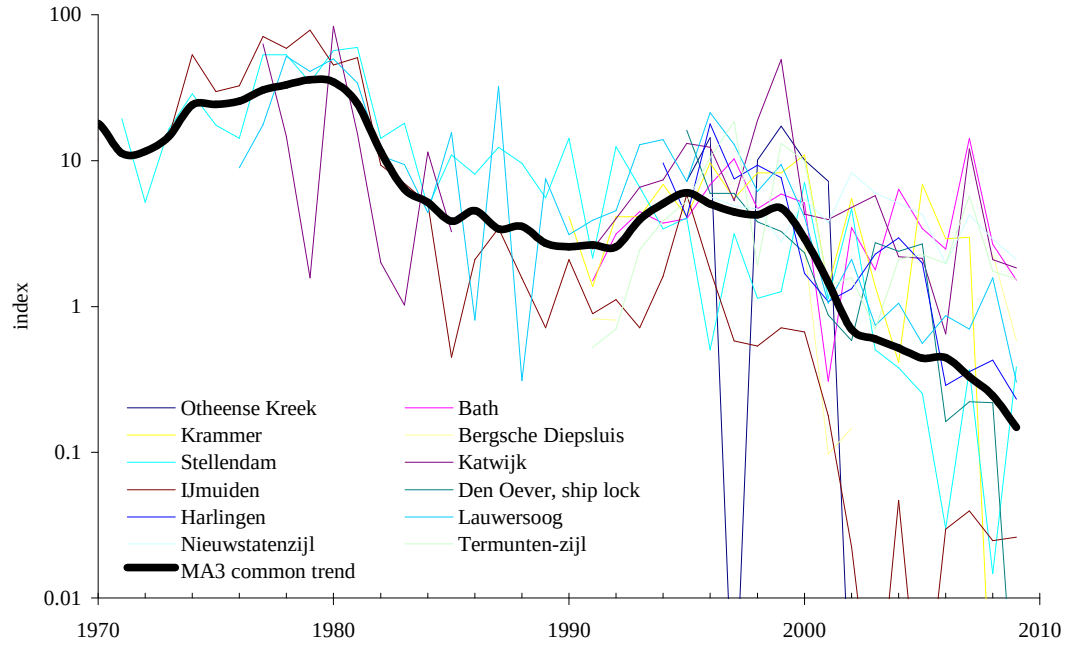


Figure NL.3 Long-term trends in the glass eel catches in the experimental fisheries at various places along the Dutch coast. MA3 indicates the moving average of the geometric mean of all series, averaged over three years.

Table NL.c Annual indices of glass eel recruitment at places in the Netherlands, other than Den Oever. Annual indices are expressed as the mean catch per lift net haul, at whatever time in the night. Most hauls are made in the evening, just in the dark.

Year	Otheense Kreek	Bath	Krammer	Bergsche Diepsluis	Stellendam	Katwijk	IJmuiden	Den Oever ship lock	Harlingen	Lauwersoog	Nieuwstatenzijl	Termunten-zijl
RBD	Scheldt	Scheldt	Meuse	Meuse	Meuse	Rhine	Rhine	Rhine	Rhine	Rhine	Ems	Ems
1969							47.30					
1970							31.50					
1971					15.40							
1972					4.10							
1973					13.10		32.80					
1974					22.80		119.30					
1975					13.90		66.80					
1976					11.30		73.10			14.40		
1977					42.10	130.25	159.20			28.40		
1978					42.10	30.23	131.70			83.90		
1979					27.30	3.23	176.00			66.20		
1980					45.10	171.60	101.50			80.30		
1981					47.30	31.65	113.90			55.10		
1982					11.30	4.13	20.80			17.40		
1983					14.30	2.10	15.60			15.10		
1984					3.80	23.62	11.40			7.10		
1985					8.70	6.67	1.00			25.20		
1986					6.40		4.70			1.30		
1987					9.80	14.00	7.70			52.00		
1988					7.60		3.50			0.50		
1989					4.40	3.67	1.60			12.10		
1990			0.30		11.30		4.70			5.00		
1991		5.90	0.10	1.41	1.70	5.10	2.00			6.30		0.30
1992		12.30	0.30	1.38	9.90	8.20	2.50		14.80	7.30		0.40
1993		17.50	0.30		5.20	13.50	1.60			20.80		1.40
1994		14.60	0.50	7.94	2.70	15.10	3.60		16.00	22.50		2.20
1995	0.50	15.70	0.30		3.20	27.10	13.10	27.80	6.80	11.60		3.00
1996	1.00	26.80	0.70		0.40	25.40	4.00	10.20	29.70	34.40	24.00	6.00
1997	0.00	40.40	0.40	33.33	2.50	10.90	1.30	10.20	12.40	20.90	21.00	10.60
1998	0.70	18.30	0.60		0.90	38.80	1.20	6.50	15.40	9.90	19.90	1.10
1999	1.20	23.10	0.60		1.00	101.30	1.60	5.60	12.70	15.10	11.80	7.50
2000	0.70	20.10	0.80	4.36	5.60	8.80	1.50	4.00	2.80	6.60	23.30	5.70
2001	0.50	(1.2†)	0.10	0.17	0.90	8.10	0.40	1.50	1.80	1.70	16.10	0.80
2002	0.00	13.60	0.40	0.25	3.70	9.80	0.05	1.00	2.20	3.40	35.30	0.90
2003	0.00	7.00	0.10		0.40	11.80	0.00	4.70	3.80	1.20	25.50	0.40
2004	0.00	(24.9†)	0.03		0.30	4.50	0.11	4.10	(4.9†)	1.70	21.70	1.20
2005	0.00	13.40	0.50		0.20	4.40	0.00	4.60	3.30	0.90	18.20	1.30
2006	0.00	9.70	0.21		0.02	1.33	0.07	0.28	0.48	1.39	8.33	1.13
2007‡	0.00	55.86	0.22		0.29	24.77	0.09	0.38	0.59	1.13	18.11	3.26
2008	0.00	10.49	0.00	3.91	0.01	4.31	0.06	0.38	0.71	2.54	12.36	1.00
2009	0.00	5.94	0.00	1.00	0.30	3.79	0.06	0.00	0.38	0.49	8.95	0.88

†Sampling only took place in part of the season.

‡ Very early season (warm spring), sampling stopped early (start of May) --> low number of empty samples.

NL.3.1.2 Yellow Eel Recruitment

Commercial

No commercial data series on recruitment exist.

Recreational

No recreational data series on recruitment exist.

Fishery Independent

At various places in the Netherlands, facilities have been built to allow glass eel and yellow eel to migrate through or over dykes and sluices. Some of these places monitor the quantities of eel being caught and transported, but these data series are currently too short to be used as time series. There is one noticeable exception: for the eel trap at pumping station Stroink in Vollenhove (52º42'16N 5º28'22E), records have been kept since the late 1950s, but unfortunately, the data prior to 1976 have been lost. The remaining data (Figure NL.4, Table NL. d) show a sharp decline in the late eighties,

comparable to the trend in Lake IJsselmeer eel stock, to which the pumping station drains. Until the early 1990s, the trap was of the conventional type (a ramp filled with willow twigs; c.f. Dekker 2002, p. 27), thereafter a new type has been added/replacing (stainless steel kind of fyke net funnel into a hard cover box; see Dekker 2002, p. 253).

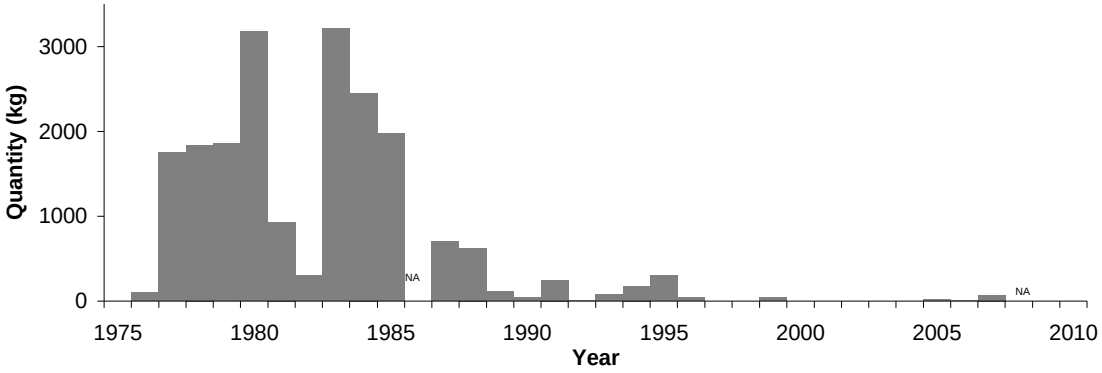


Figure NL.4 Time series of the quantity of yellow eel caught in the eel trap at Stroink, Vollenhove.

Table NL.d Annual catches of bootlace eel in the eel trap at Stroink, Vollenhove, in kg per year.

Decade Year	1970	1980	1990	2000
0		3180	41	0
1		935	250	0
2		300	5	0
3		3213	75	0
4		2455	175	0
5		1972	300	21
6	100	#N/A	40	3
7	1750	703	0	70
8	1840	628	0	
9	1860	110	40	

NL.3.2 Yellow Eel Landings

No reliable long term time series of yellow eel landing exist; total landings of yellow and silver eel combined, have been reported. However, 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; see section NL.6.1.2 for details.

NL.3.3 Silver Eel Landings

No reliable long term time series of yellow eel landing exist; total landings of yellow and silver eel combined, have been reported. However, 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; see section NL.6.1.2 for details.

NL.3.4 Aquaculture Production

Different sources reported slightly diverging results for the Dutch aquaculture industry (Table NL.d)

Table NL.e Aquaculture production in the Netherlands, as reported by different sources.

	Data source			
	FEAP	wgeel2003	FAO Fishsta	Nevevi
1985		20	20	
1986		100	100	
1987		200	200	100
1988		200	200	300
1989		350	350	200
1990		550	500	600
1991		520	550	900
1992		1250	520	1100
1993		1487	1250	1300
1994		1535	1487	1450
1995		2800	1535	1540
1996	1800	2443	2800	2800
1997	1800	3250	2443	2450
1998	3250	3800	2634	3250
1999	3800	4000	3228	3500
2000	4000	3800	3700	3800
2001	4000	3228	4000	4000
2002	4000		3868	4000
2003			4200	4200
2004			4500	4500
2005			4000	4500
2006				4200
2007				4000
2008				3700
2009				?? 3200

Nevevi is the national organization of fish farmers; one would expect their own estimates to be the best.

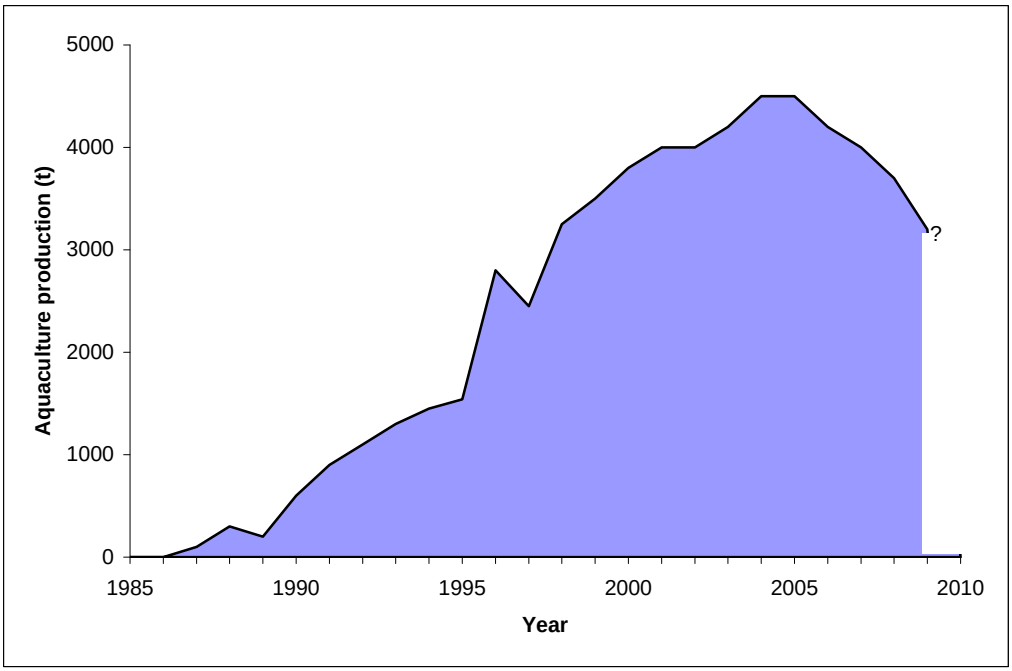


Figure NL. 5 Trend in aquaculture production in the Netherlands.

NL.3.5 Stocking

NL.3.5.1 Amount Stocked

Glass eel and young yellow eel are used for re-stocking inland waters since time immemorial, mostly by local action of stakeholders. Although a minimum legal size for capture, holding and transport of eels is set in a byelaw, the existing practice of short-range transports has never been prosecuted. Since World War II, the Organization for the Improvement of Inland Fisheries OVB has organized a re-stocking programme, importing glass eels from France and England, and buying yellow eel from commercial fishermen fishing in the Waddensea.
Data on re-stocking quantities are listed in Table NL.f.
In recent years, the OVB has merged with the major anglers organization, and subsequently handed over the glass eel importing to the Organization of Professional Fishermen CvB. Information on recent glass eel imports was made available by the CvB. Restocking of young eel is no longer organized centrally, although trade of small eels (undersized) still occurs. The listed estimates are probably a minimum, not including unregistered trade. Since the government does not keep track of imports and re-stockings anymore, it is not known anymore to what extend re-stocking has been practiced by other parties. In 2009, more than 0.3 million glass eels and 0.3 million yellow eels have been re-stocked by some parties.
In the earlier decades, young yellow eels were derived from fisheries for wild eel in the Wadden Sea; in recent years, the catches in the Wadden Sea have dropped to almost nothing, and young yellow eels are derived from the aquaculture industry, i.e. eels derived from imported glass eel (England, France).

Table NL.f Re-stocking of glass eel and young yellow eel in the Netherlands, in millions re-stocked†.

DECADE	1940		1950		1960		1970		1980		1990		2000	
Year	Glass eel	young yellow eel	glass eel	young yellow eel	glass eel	young yellow eel	glass eel	young yellow eel	glass eel	young yellow eel	glass eel	young yellow eel	glass eel	young yellow eel
0			5.1	1.6	21.1	0.4	19.0	0.2	24.8	1.0	6.1	0.0	2.8	1.0
1			10.2	1.3	21.0	0.6	17.0	0.3	22.3	0.7	1.9	0.0	0.9	0.1
2			16.9	1.2	19.8	0.4	16.1	0.4	17.2	0.7	3.5	0.0	1.6	0.1
3			21.9	0.8	23.2	0.1	13.6	0.5	14.1	0.7	3.8	0.2	1.6	0.1
4			10.5	0.7	20.0	0.3	24.4	0.5	16.6	0.7	6.2	0.0	0.3	0.1
5			16.5	0.9	22.5	0.5	14.4	0.5	11.8	0.8	4.8	0.0	0.1	0
6	7.3		23.1	0.7	8.9	1.1	18.0	0.5	10.5	0.7	1.8	0.2	0.582	0
7	7.6	1.6	19.0	0.8	6.9	1.2	25.8	0.6	7.9	0.4	2.3	0.4	0.216	0
8	1.9	2.0	16.9	0.8	17.0	1.0	27.7	0.8	8.4	0.3	2.5	0.6	0	0.230
9	10.5	1.4	20.1	0.7	2.7	0.0	30.6	0.8	6.8	0.1	2.9	1.2	>0.3	>0.3

†Conversion from weight into numbers: it was assumed that there are 3000 glass eels per kg, resp. 30 young yellow eels per kg.

NL.3.5.2 Catch of Eel <12 cm and proportion retained for restocking

Catch and retain of eels < 28 cm is illegal. There is no organized trap and transport of undersized eels.

NL.4 Fishing capacity

Table NL.a lists the number of fishing companies having a specific eel fishing license, by fishing area. Most licenses are linked to a specific ship. 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 is lacking. For Lake IJsselmeer, a maximum number of gears per 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. no fyke nets and gill nets should be operated concurrently, since perch and pikeperch are the target species of the gill netting, while landing perch and pikeperch from fyke nets is prohibited).

NL.5 Fishing effort

For most of the country, fishing capacity is unknown. In areas where fishing capacity is known, no record is kept of the actual usage of fishing gears. Consequently, no information is available on fishing effort. For Lake IJsselmeer, 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.

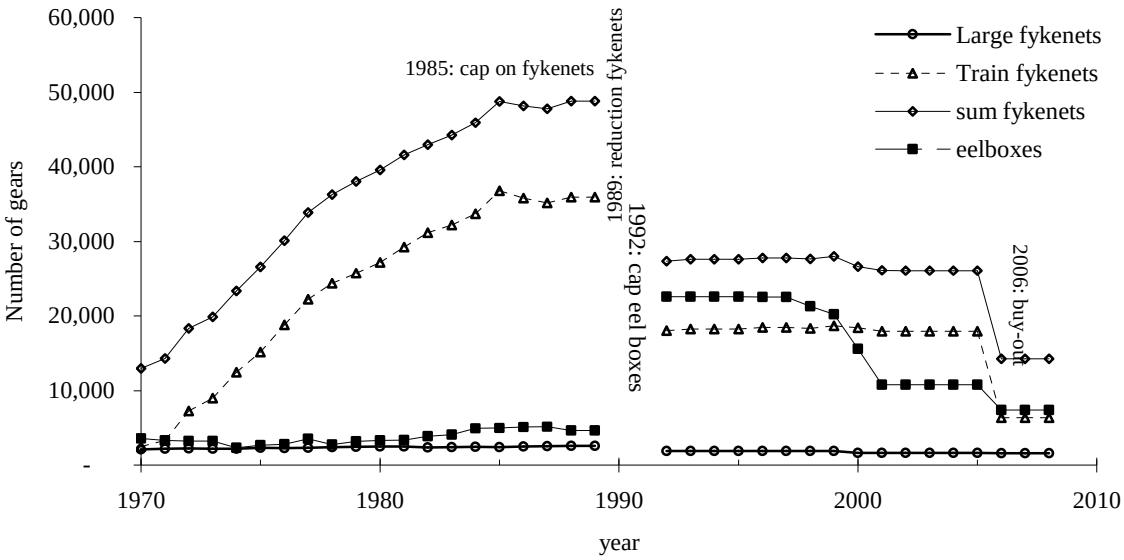


Figure NL.6 Trends in the nominal number of fishing gear employed in the eel fishery on Lake IJsselmeer. Information before 1989 is based on a voluntary inquiry in 1989 (Dekker 1991); after 1992, the licensed number of gear is shown. The reduction in-between is realistic.

A tentative overview of the number of gears for the whole country is presented in Table NL.g, based on inquiries, interviews and voluntary reporting by fishermen.

Table NL.g Overview of the number of fishing gears used. Information from inquiries in 2007. Data from Dekker et al. 2008.

	Ijsselmeer/ Markermeer	Rivers	Coastal waters	Elsewhere	Coastal, recreational	Total
Large fyke nets	1,579	155	-	+		>1734
Pound nets		163	574	+		>737
Train fyke nets	6,386	2,433	233	+		>9052
Small fyke nets		51		+	1,956	>2007
Boxes, pots	7,415	551	+	+		>7966
Long lines, hook & line	+	+	+	+		+
Electro-dipnet		+	-	+		+
Otherwise				+		+
Number of companies	73	28	48	ca. 100	978	ca. 250+978

NL.6 Catches and Landings; restocking; aquaculture

NL.6.1 Catches and landings, commercial fisheries

NL.6.1.1 Catches and Landings from Marine Waters

Catches and landings in marine waters are registered in EU logbooks, but these do not allow for a break down by RBD. Registrations are available for the years since 1995; data prior to 1984 are presented in section NL.6.1.4. Up to 2001, ships with a total length (LOA) ≥ 15 m were obliged to report all their eel catches, but smaller ones were not; since 2001, ships with a total length ≥ 10 m are obliged to report their eel catches, if their landings per day exceeded 50 kg per species. That is: in 2001 the number of ships potentially reporting rose, but the actual reporting per ship declined. This change in the regulations was partly driven by changing practices, and vice versa. In practice, the abrupt change in the regulations in 2001 led to a gradually changing reporting practice, before and after 2001. Overall, the number of ships reporting in a year declined from 130 before 2001 to 59 thereafter, while the average landing per ship increased from 230 kg/ship/year before 2001 to 436 kg/ship/year thereafter.

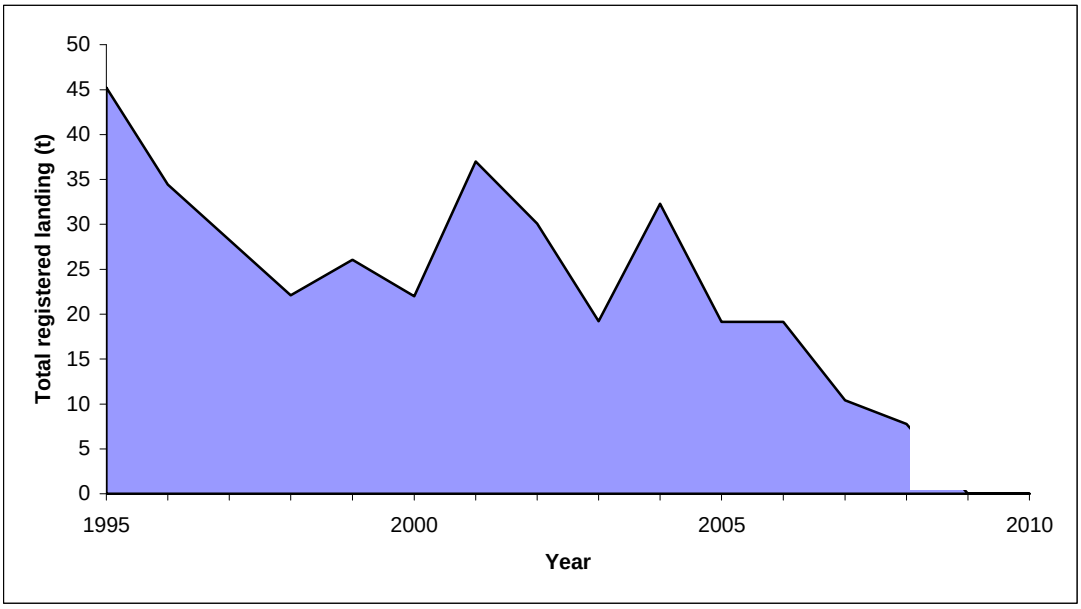


Figure NL.7 Time trend in the total registered landings from marine waters in Dutch harbours by country of origin of the ship.

NL.6.1.2 Catches and Landings from Lake IJsselmeer

For Lake IJsselmeer, statistics from the auctions around Lake IJsselmeer are now kept by the Fish Board (Table NL.h); before 1994, the government kept statistics. These statistics are broken down by species, month, harbour and main fishing gear; the quality of this information has deteriorated considerably over the past decade, due to misclassification of gears, and the trading of eel from other areas at IJsselmeer auctions.

Table NL.h Landings in tons per 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 are suspect, due to misclassification of catches and trade from areas outside Lake IJsselmeer at the IJsselmeer auctions.

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

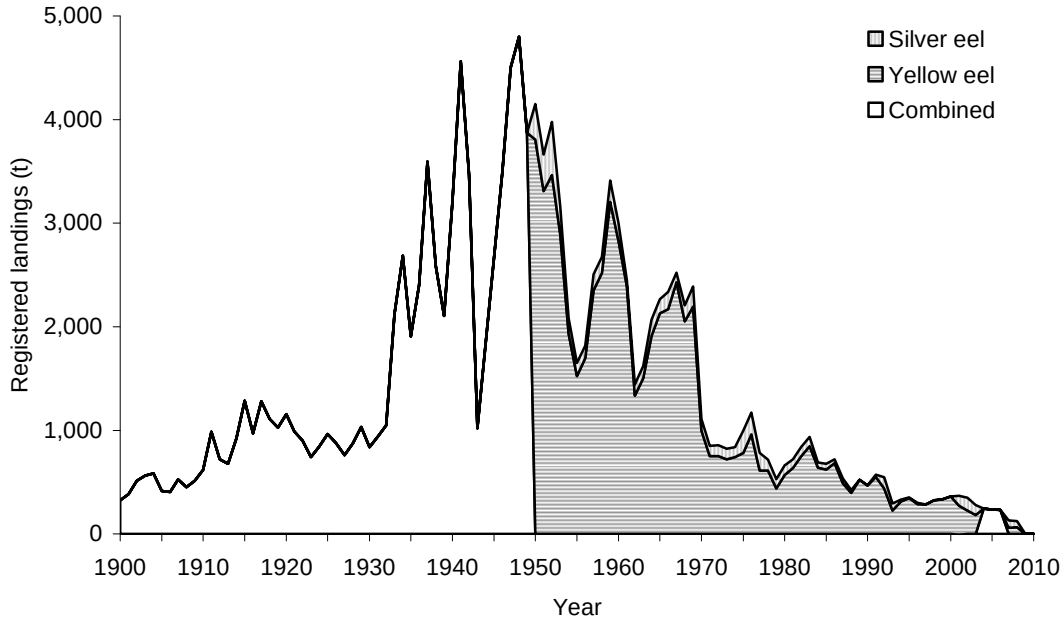


Figure NL.8 Time trend in the landings from Lake IJsselmeer.

NL.6.1.3 Catches and Landings from inland waters outside Lake IJsselmeer

For the inland areas outside Lake IJsselmeer, no detailed records of catches and landings are available. Dekker (1998) gave a rough estimate, which was subsequently refined on the basis of new information, and personal communication with individual fishermen and their organisations. The resulting figures (Table NL.a) probably give a reasonable estimate of the actual landings, but obviously do not allow for an analysis of time trends. Overall, only one-third of the total landings is accurately documented.

NL.6.1.4 Catches and Landings: historical records from estuaries and coastal areas

For estuaries and coastal areas, the Ministry of Agriculture and Fisheries has published records of landings per year, over the range of years 1920-1983. In 1983, these publications were stopped. In 1995, EU logbooks were introduced, but these new data did not follow the same spatial subdivision as the historical records.
An overview of the estuaries is presented in Table NL.i.

Table NL.i Overview of the former and present estuaries in the Netherlands.

Estuary	RBD	area, ha	closed in	comments
Dollard	Ems	3,843		still open
Lauwerszee	Rhine	5,790	1969	now Lauwersmeer
Zuiderzee	Rhine	347,000	1932	now Ijsselmeer/Markermeer
Waddenzee	Rhine/Ems	259,214		still open
Haringvliet	Rhine/Meuse	10,794	1970	now fresh
Grevelingen	Rhine/Meuse	13,869	1971	still saline
Oosterschelde	Scheldt	36,298	1986	only partly closed, still saline
Volkerak/Krammer	Scheldt	6,077	1987	now fresh
Veerse Meer	Scheldt	2,577	1961	now brackish
Westerschelde	Scheldt	42,840		still open

Table NL.j presents the historical records, compiled from the annual reports. Because of the building of dykes and water works, the interpretation of what quantities of eel originate from what area is not always straightforward. The originally reports listed Zuiderzee, but from the context, it appears that catches from the Waddenzee were included too. From 1932 onwards, the Zuiderzee was transformed into Lake IJsselmeer (see above), and the remaining catches from the Waddenzee were listed separately. Zuid-Hollandse Stroomen is an administrative wording for Haringvliet, but might have included some tidal fresh water areas further inland. Zeeuwsche Stroomen likewise is an administrative region, that will have covered Oosterschelde, Volkerak/Krammer, Veerse Meer and Westerschelde, and possibly Grevelingen (Grevelingen constitutes the border between Zuid-Holland and Zeeland).
Quantities are reported in kilograms, values in Dutch guilders (Dfl), uncorrected for inflation. In 2002, 1 € equalled 2.20371 Dfl.
Note that the combined production from estuarine areas has never exceeded 1 100 t, of which less than 150 t came from areas other than the Zuiderzee/Waddenzee; while the yield from Lake IJsselmeer amounted to 3 000-4 500 t, and the yield from inland waters was assumed to be of comparable magnitude. Landings from marine areas have thus played a minor role in the national eel fisheries, and current stock (Dekker 2009a) and landings (section NL.6.1.1) are of minor importance in comparison to inland stocks.

Table NL.j Quantities (kg) and value (Dfl) of eel landings from estuaries, over the period 1920-1983, as reported in annual overviews of the Dutch fisheries, published by the Ministry for Fisheries.

	Zuiderzee/Waddenzee		Dollart & Lauwerszee		Zuid-Hollandse stroomen		Zeeuwsche stroomen		Total	
year	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1920										
1921	880,249	991,122	1,215	789	102,475	76,613	4,841	4,545	988,780	1,073,069
1922	784,193	721,836	656	292	110,917	72,708	4,212	2,998	899,978	797,834
1923	636,062	508,770	1,781	886	100,688	49,339	41,928	24,100	780,459	583,095
1924	860,955	629,188			74,451	48,228	3,307	2,672	938,713	680,088
1925	870,856	756,038	1,160	608	89,308	48,302	3,219	2,534	964,543	807,482
1926	804,272	742,430	868	521	71,162	41,657	2,510	2,382	878,812	786,990
1927	672,783	635,815	1,562	781	85,121	52,124	3,656	3,494	763,122	692,214
1928	750,600	691,760			123,819	72,093	2,173	2,096	876,592	765,949
1929	932,058	838,384			99,489	63,112	1,587	1,307	1,033,134	902,803
1930	900,135	806,616	627	382	97,942	61,666	1,955	1,560	1,000,659	870,224
1931	998,137	846,163	1,767	1,335	70,287	39,597	1,232	890	1,071,423	887,985
1932	141,598	82,902	11,189	3,388	76,918	32,065	1,930	1,777	231,635	120,132
1933	165,914	81,228	10,780	3,259	89,317	33,052	3,818	3,133	269,829	120,672
1934	151,937	78,536	3,615	1,127	135,786	48,766	3,685	2,840	295,023	131,269
1935	178,390	108,541	3,836	1,181	138,974	47,226	2,705	1,874	323,905	158,822
1936	215,534	121,527	9,614	2,986	85,748	32,664	3,090	2,207	313,986	159,384
1937	244,402	142,462	6,032	1,903	96,812	39,809	3,135	2,242	350,381	186,416
1938	159,689	88,823	2,955	1,000	63,592	31,239	2,903	2,020	229,139	123,082
1939	156,225	85,074	2,435	901	82,323	39,987	3,520	2,406	244,503	128,368
1940										
1941										
1942										
1943					no data					
1944										
1945										
1946	4,997	8,345	145	252	41,899	65,642	4,360	9,746	51,401	83,985
1947	19,133	58,456	2,004	3,819	62,767	167,844	2,510	9,749	86,414	239,868
1948	15,185	40,109	1,420	2,840	61,790	152,376	4,243	17,999	82,638	213,324
1949	13,127	22,289	1,863	3,726	49,203	87,085	3,768	10,726	67,961	123,826
1950	7,525	10,916	1,647	3,295	55,307	92,360	1,908	5,246	66,387	111,817
1951	7,624	11,724	1,990	3,980	50,279	98,421	5,848	12,908	65,741	127,033
1952	8,179	12,853	1,405	2,810	49,698	101,660			59,282	117,323
1953	10,632	15,832	995	1,493	47,153	100,169			58,780	117,494
1954	10,520	22,751	1,245	1,913			407	643	12,172	25,307
1955	11,283	18,774	830	1,208	35,425	80,308	96	219	47,634	100,509
1956	11,733	24,690	1,000	1,501	35,518	85,068	663	1,366	48,914	112,625
1957	23,787	41,862	1,135	1,606	42,675	93,767	425	1,054	68,022	138,289
1958	41,040	86,403	970	1,455	43,988	109,060	548	1,299	86,546	198,217
1959	56,195	89,958	1,495	2,273	39,942	104,511	4,231	10,376	101,863	207,118
1960	79,040	160,592	1,924	2,889	48,201	143,102	4,350	10,195	133,515	316,778
1961	81,226	192,930	2,623	4,203	59,433	178,266	10,884	29,374	154,166	404,773
1962	63,892	162,461	2,540	3,812	55,385	206,047	16,867	46,343	138,684	418,663
1963	145,719	386,022	4,650	6,977	30,497	111,652	25,562	82,374	206,428	587,025
1964	182,939	612,094	4,585	6,878	29,752	148,724	51,892	215,841	269,168	983,537
1965	129,070	545,519	3,205	4,710	39,435	209,472	54,067	234,383	225,777	994,084
1966	239,373	763,458			36,670	172,580	60,968	266,520	337,011	1,202,558
1967	292,992	844,213			39,354	194,446	73,806	343,773	406,152	1,382,432
1968	252,678	709,915			32,371	145,810	85,104	392,023	370,153	1,247,748
1969	382,365	955,042			15,113	79,094	83,106	360,668	480,584	1,394,804
1970	224,904	1,013,497					98,545	516,359	323,449	1,529,856
1971	144,539	665,942			12	84	62,016	448,227	206,567	1,114,253
1972	90,733	464,506			242	1,709	41,002	310,212	131,977	776,427
1973	145,132	713,102					39,864	313,774	184,996	1,026,876
1974	99,315	457,817					32,931	271,421	132,246	729,238
1975	119,973	529,656					34,962	293,859	154,935	823,515
1976	65,310	405,125					47,055	418,300	112,365	823,425
1977	60,832	447,646					68,819	675,867	129,651	1,123,513
1978	64,599	516,602					65,401	695,502	130,000	1,212,104
1979	87,291	749,362					66,073	757,772	153,364	1,507,134
1980	90,575	664,629					38,512	416,305	129,087	1,080,934
1981	128,291	867,125					26,170	305,648	154,461	1,172,773
1982	192,218	1,146,914					64,982	689,475	257,200	1,836,389
1983	242,725	1,575,934					34,501	362,574	277,226	1,938,508
1984	data series discontinued.									

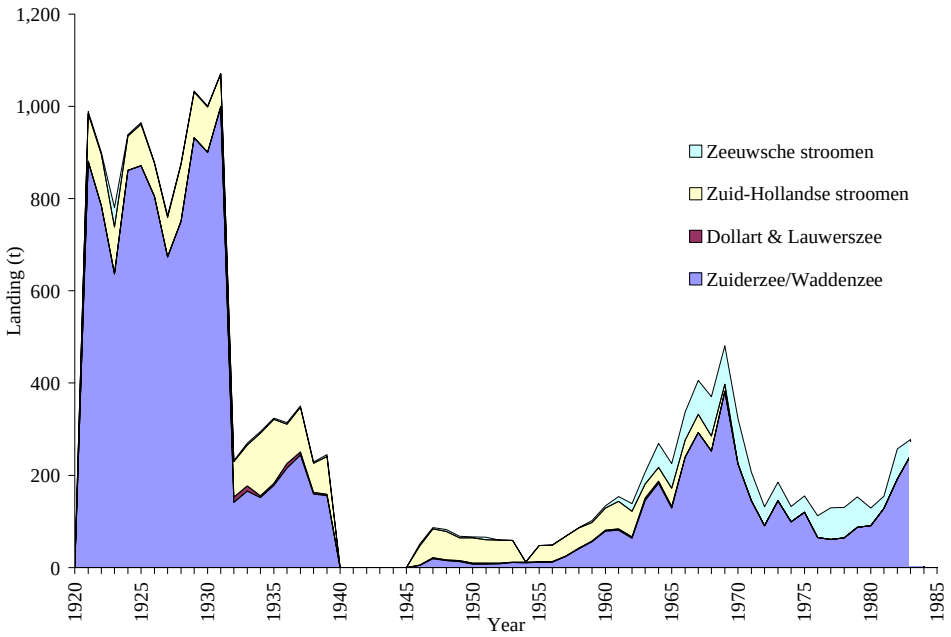


Figure NL.9 Time trend in the landings from estuaries and coastal areas, as derived from historical reports. Figure NL.7 presents more recent data.

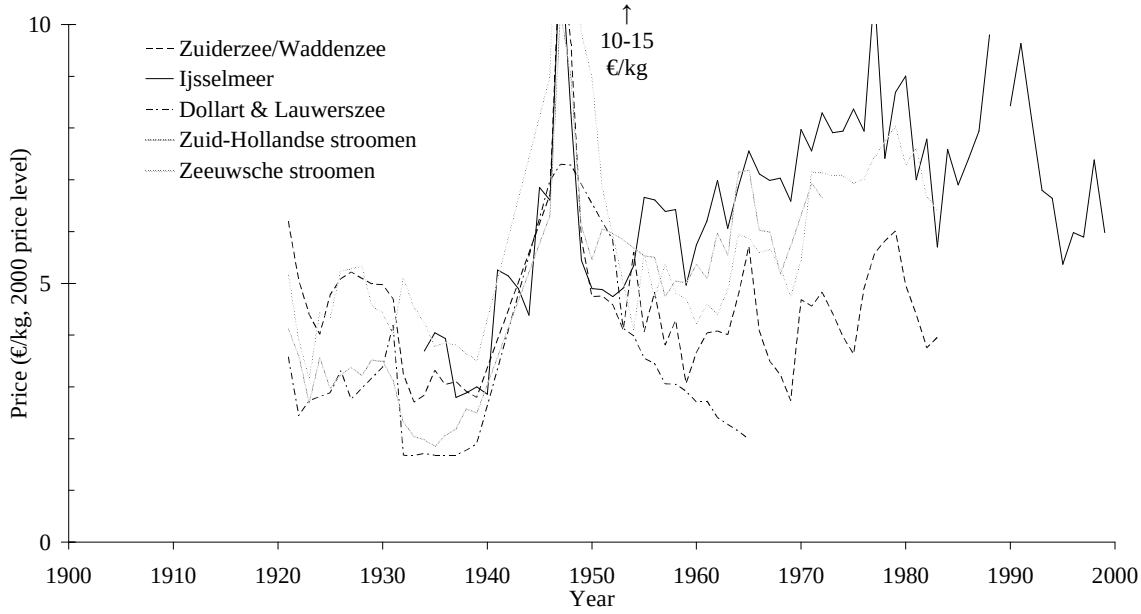


Figure NL.10 Prices in € per kg, corrected for inflation to 2000 price level. For comparison, the IJsselmeer time series has been added, as derived from Dekker (2004b).

The historical data sources list quantities and values of landings, by area and year, which allows for an analysis of price developments, Figure NL.10. Without going into full detail here, Figure NL.10 indicates that prices in various areas developed largely in parallel, but also that prices in areas with smaller catch volumes were consistently lower. In Dollart & Lauwerszee (the far north of the country), prices fell completely down after 1950, when catches declined to a few tons only.

NL.6.2 Catches and landings, recreational fisheries

Recreational catches of eel are not systematically recorded, and the order of magnitude is not well known. Inquiries related to angler licensing indicate that 350,000 out of 913,000 male anglers fish for eels (in 2003); 57,500 of them take eels back home, in an average annual quantity of 18 specimens, approx. 1 kg per capita per annum. The number of female anglers is much lower, but not exactly reported. The total quantity of eels taken home has recently been analysed (Vriese, Klein Breteler, Kroes & Spierts 2008), coming to an order of magnitude of 200-400 t per annum. Circumstantial evidence indicates that the true figure is probably close to the lower bound of 200 t.
Additionally, some 1000 individuals are licensed for recreational use of 2 fyke nets per license in coastal waters. Assuming 50 fishing days per year, and a daily catch of 0.5 kg per fyke, their catch will be in the order of 25 t.
A preliminary breakdown of catches by the type of fishers is given in Table NL.k.

Table NL.k Breakdown of commercial and recreational fishing and landings by the type of fisher. Data from Vriese et al (2008), Dekker et al (2008) and guestimates.

	Individual catch kg/year	**Number of individuals**	**Total catch ton/year**
Full time commercial	7700	100	770
Part time commercial	1000	150	150
Poaching	?	?	?
Recreational (small fykes)	25	1000	25
Snigglers†	2.650	3,773	10
Eel anglers	0.863	95,000	82
Other anglers	0.100	1,000,000	100
Non-anglers		15,898,977	
Totals		17,000,000	> 1,227

† Translation: sniggle=peur.
In summer 2008, the prime organization of recreational fishers (Sport Visserij Nederland) has announced a voluntary ban on eel landing from 2009 onwards. According to this decision, no eel should be taken, though catch-and-return will remain allowed. This is a voluntary restriction, not translated into law. Catch per Unit of Effort
Data on Catch per Unit of Effort are only available within the framework of a stock monitoring programme in State controlled waters. Starting in 1993, the fish assemblage in the main rivers and linked waters (Figure NL.11) has been monitored, by means of logbook registration of commercial catch and by-catch, in a restricted number of fyke nets (4 large fyke nets or 2 pairs of summer fyke nets per location), mostly on a weekly basis. For eel, the number of yellow eels and silver eels caught is recorded. Results show a slowly declining trend over the years down to about □ of the earlier value, but the year-to-year and site-to-site variation is considerable. There is no formal application of these data in eel fisheries management, but the perceived lack of a declining trend has frequently been quoted in the debate on the status of the eel stock.

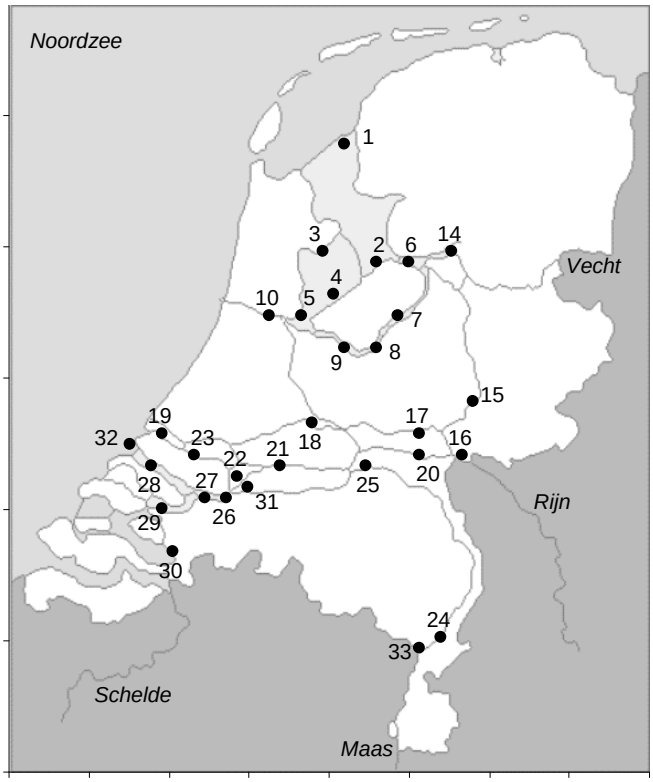


Figure NL.11 Sampling sites for the 4-fyke monitoring of commercial catches and by-catch

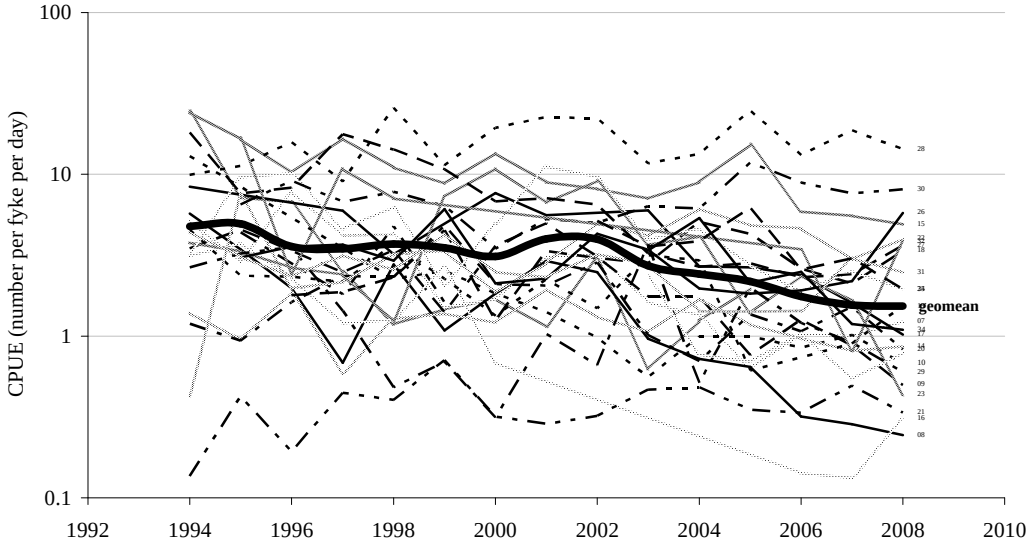


Figure NL.12 Time trends in the 4-fyke monitoring of commercial eel catches per sampling site. The geometric mean (thick line) has been calculated for all available data in each year, irrespective of the spatial coverage.

NL.7 Scientific surveys of the stock

NL.7.1 Recruitment surveys

NL.7.2 Yellow eel stock surveys

NL.7.2.1 Yellow eel stock surveys in Lake IJsselmeer

Figure NL.13 presents the trends in CPUE for the yellow eel surveys in Lake IJsselmeer, using the electrified trawl. The long term trend in this survey has been analysed by Dekker (2004a), in a wider setting, using more sources of information. In that long term analysis, a smooth function over the years was fitted to the data. Figure NL.13 presents the raw data per year.

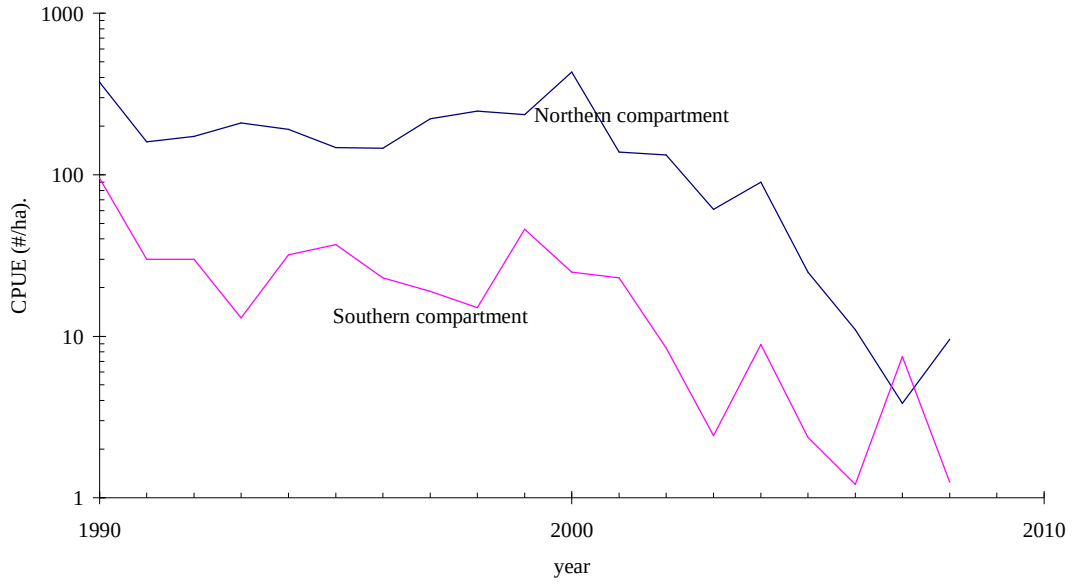


Figure NL.13 CPUE trends in Lake IJsselmeer stock surveys, in number per hectare swept area, using the electrified trawl. Note: The northern and southern compartments are separated by a dyke.

NL.7.2.2 Yellow eel stock surveys in the Main Rivers

Figure NL.14 presents the trends in the Main Rivers survey, for the common trawl and the hand-held electric dipnet, for the main stream, the shore area, and the oxbow and other adjacent waters separately. None of these series shows a clear upward or downward trend.
Starting in 2008, the execution of these surveys has been granted to another consortium. The basic data are not yet available. The report published by that consortium (Kessel et al. 2008) seems to indicate that the eel stock has declined from 2007 to 2008 by an order of magnitude. This result is so unlikely, that for the time being no update of the data series is presented here.

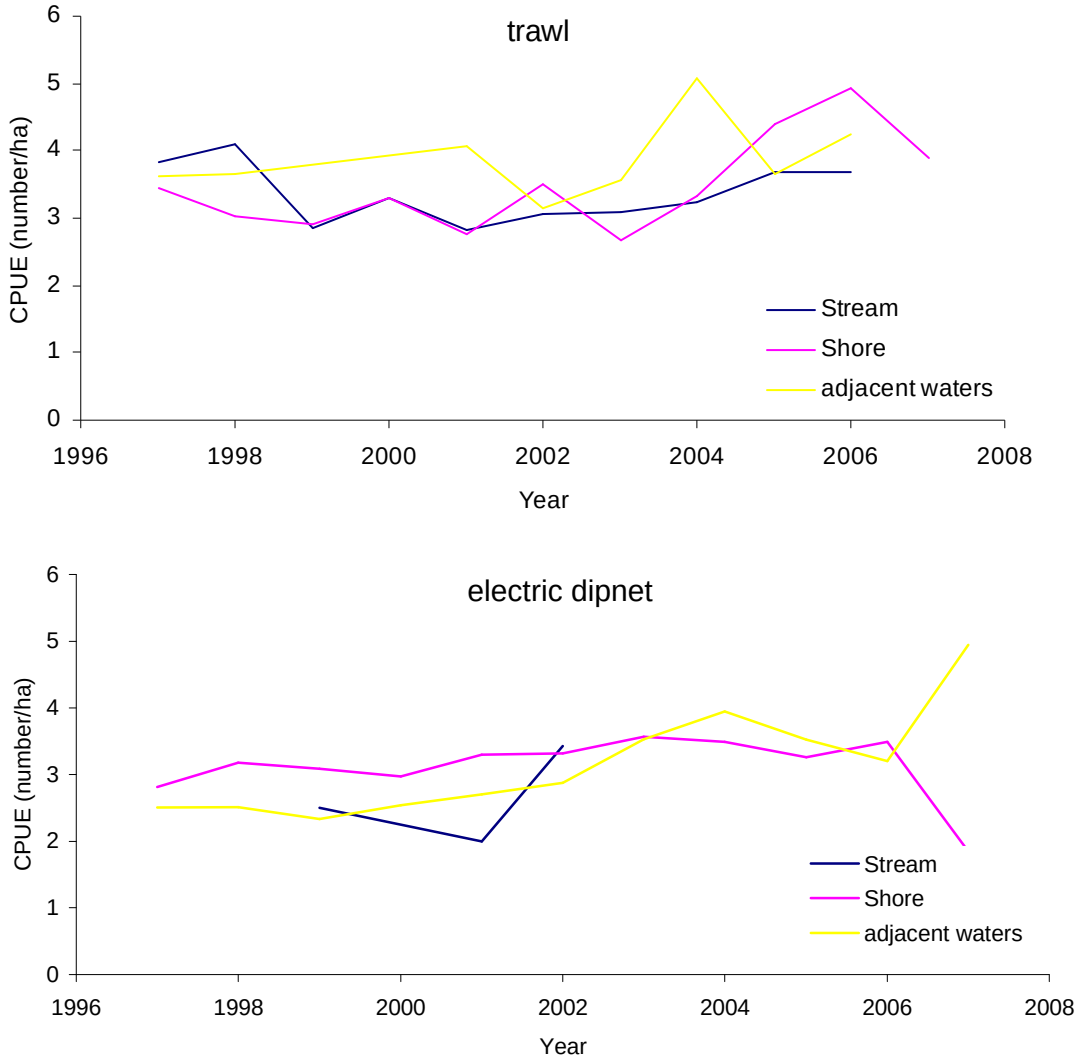


Figure NL.14 Trends in CPUE in numbers per hectare, for the trawl (top) and electric dipnet (bottom), in the Main River surveys.

NL.7.2.3 Yellow eel stock surveys in coastal waters

The number of eels caught in coastal surveys (Dutch Young Fish Survey) is presented in Figure NL.15. Until the mid-1980s, considerable catches of eel were observed. Since that time, a gradual decrease is observed.

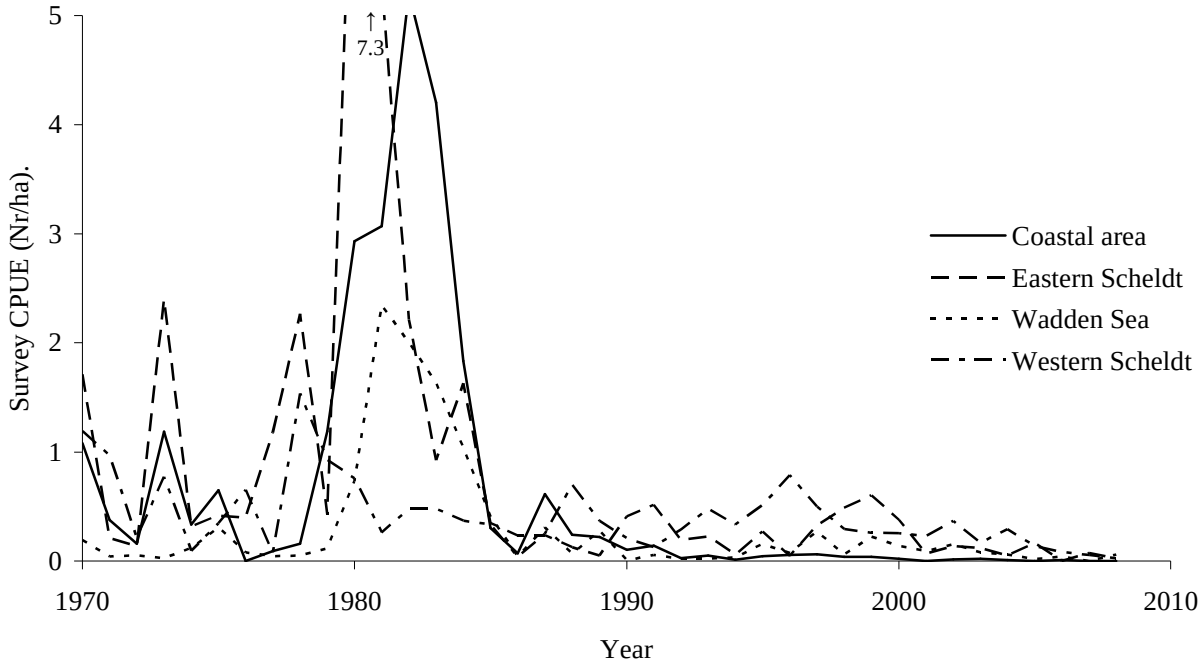


Figure NL.15 Trends in coastal survey CPUE. Most of the Wadden Sea belongs to RBD Rhine; Eastern Scheldt is mixed Scheldt and Meuse; Western Scheldt belongs to RBD Scheldt (with an extra inflow from Meuse), Coastal area belongs to RBD Rhine.

A more elaborate statistical analysis of the abundance and length composition of the eel stock in coastal waters is presented in Dekker (2009b).
Overall, the yellow eel surveys are not representative for the whole River Basin Districts or the Country, especially since the smaller water bodies (canals, polders, regional lakes) are not surveyed; these waters cover nearly 25 % of the total water surface, but probably constitute the preferred eel habitat. Lake IJsselmeer is extremely overexploited, while fisheries in the remainder of the country is less severe, resulting in larger average sizes being exploited. The Main Rivers Surveys are probably reasonably representative for the rivers. However, Lake IJsselmeer and the Main Rivers differ substantially, and it is not quite clear how the two should be weighted, and how the uncovered waters relate.

NL.7.2.4 Silver eel surveys

There are no routine surveys for silver eel in the Netherlands. Ad hoc estimates based on tagging and/or transponder experiments are available from
- Klein Breteler, J., Vriese, T., Borcherding, J., Breukelaar, A., Jörgensen, L., Staas, S., de Laak, G., and Ingendahl, D. 2007. Assessment of population size and migration routes of silver eel in the River Rhine based on a 2-year combined mark-recapture and telemetry study. – ICES Journal of Marine Science, 64: 1–7.
- Winter, H. V., Jansen, H. M., and Breukelaar, A. W. 2007. Silver eel mortality during downstream migration in the River Meuse, from a population perspective. – ICES Journal of Marine Science, 64(7):1444-1449.

NL.8 Catch composition by age and length

NL.8.1 Long term trends in length compositions

For Lake IJsselmeer, the landings are regularly sampled at the auctions. Results have indicated extreme overfishing. Since the catch composition did not change much over the years (see Dekker 2004b), results have not been reported in detail for the past years.
In most recent years, length frequency distributions of commercial catches from Lake IJsselmeer have shown a remarkable shift upwards (Figure NL.16). This shift is observed consistently in all gears, and in several years in a row. This upward shift might be the result of the effort reductions in 2005, of the further decline in recruitment since 2000 now progressing into the commercial sizes (corresponding to a sharp drop in commercial yield now observed), or of increased dependence on eels from other habitats (outside Lake IJsselmeer and/or hitherto unexploited habitats, such as dykes), which are less overexploited.

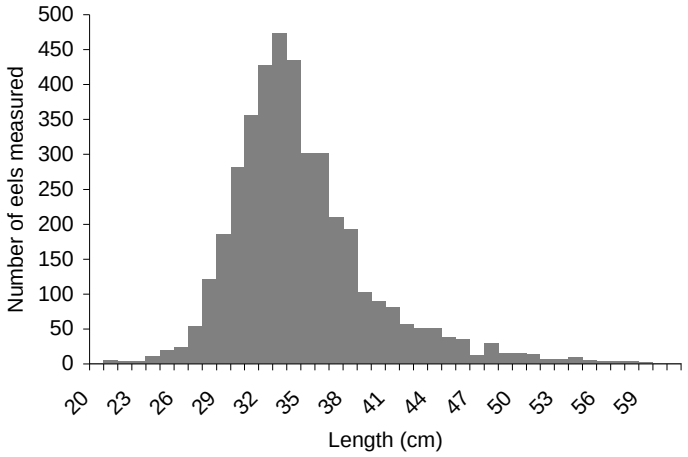


Figure NL.16 Length frequency of fyke net catches in Lake IJsselmeer, in 2006.

NL.9 Other biological sampling

NL.9.1 Length & Weight & Growth (DCR)

For Lake IJsselmeer, the market sampling described in section NL.9 comprises measurements of length, weight, sex, maturity, liver weight, stomach content weight, parasitism (*Anguillicola crassus*), and otolith collection; see under NL.H. In addition to the market sampling, an annual sample of 100 specimens is collected during the autumn stock survey on Lake IJsselmeer; see NL.G.2. This survey sampling conforms to the protocol for market samples (NL.9). For market and survey samples, otoliths are collected and stored dry, but no age reading is performed.
For all other areas, no biological sampling of catches has been performed. A pilot study has been started up in 2009, sampling two restricted areas (province Friesland 53ºN 5º45'E, main rivers), which will give insight in the statistical requirements of further sampling. This programme will likely be continued in 2010, before the final analysis and the subsequent implementation of a country-wide programme.

NL.9.1.1 Historical trend in condition

Belpaire et al (2008) report decreasing fat levels and condition in Dutch eel samples over the years 1980-current, suggesting a relationship between the declining recruitment observed and the fat levels of the yellow eels. Between 1980 and 2005, the fat content is reported to have halved. For Belgian eel,

they also report a significant decrease in (le Cren's) condition factor, down by 11%. These observations surprised us, since it does not correspond to unquantified impressions by experienced staff taking regular market samples over the past four decades. The Dutch data analysed by Belpaire et al (2008) are based on pooled samples of 25 eels in the size range 30-40 cm. During the study period, the length composition of catches changed considerably (see section xxx above), for which Belpaire et al (2008) could not correct. The historical sampling of individual eels in the market sampling programme in Lake IJsselmeer allows for a more detailed analysis, presented below.

For the historical market sampling in Lake IJsselmeer, only data on length & weight have been collected; fat contents have not been determined. All in all, data on a total of 108,435 yellow eels and 11,924 silver eels are currently available. Belpaire et al (2008) express fish conditions in terms of le Cren's relative condition index (le Cren 1951), in which actual weights are compared to standardised weights, based on the expression $W = aL^b$. In using le Cren's relative condition, however, all data are pooled to determine the average weight at length; consistently low conditions (as opposed to declining trends) will not be detectable. Fulton condition factor k (Nash et al. 2006, Ricker 1975) does not suffer from this draw back, but takes a fixed value of b=3, which suffers from changes in length being sampled.

Figure NL.17 presents the time series of Fulton condition factors for Lake IJsselmeer, averaging the Fulton index over all eels measured in a year, irrespective of their length, the month of sampling, the gear and mesh size, etc. This shows stable Fulton index over the period 1960-1985, and a slow but consistent rise thereafter. All in all, Fulton indices, and thus individual weights, rose by 13.6% for yellow eel and by 13.9% for silver eel.

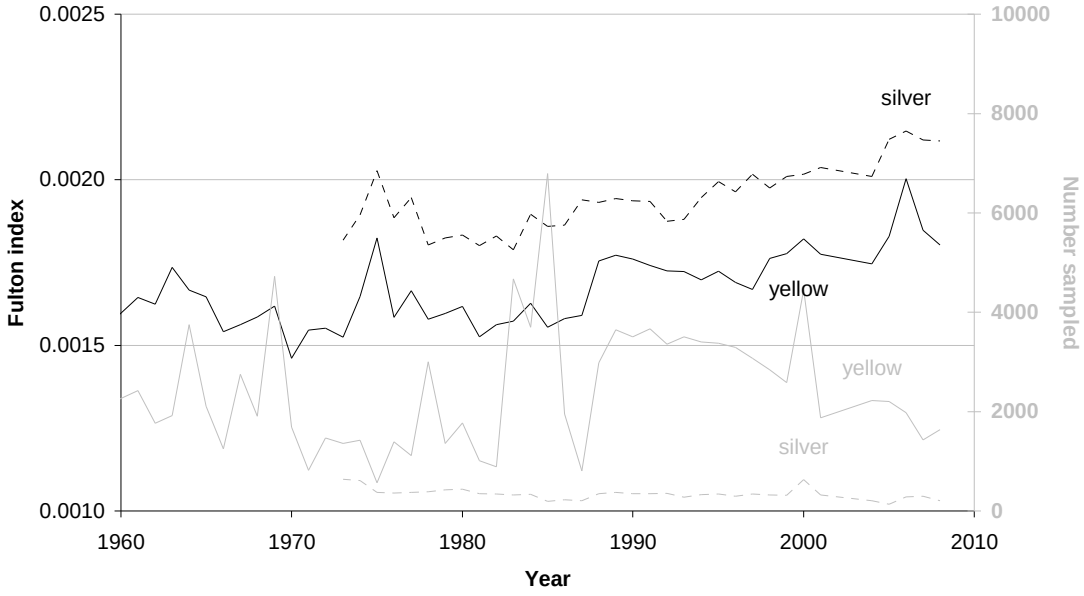


Figure NL.17 Time series of Fulton condition factors for individual eels from Lake IJsselmeer, averaged over all eels being sampled, irrespective of sampling conditions.

Correcting for changes in length composition of the samples, for variation between months, for differences between gears and mesh sizes, applying the model $W = \exp^{\ln(a) + b \times \ln(L) + year + month + gear + mesh} + \varepsilon$, where W=individual weight; L=individual length; year, month, gear and mesh are class variables; and ε is a Gamma-distributed error, results in a value for b of 3.1307 for yellow eel and 3.1576 for silver eel. The estimated trend over the years is shown in Figure NL.18. During the years 1960-1980, a slight decrease in individual weight was observed by ca. 5 %. From 1980 until present, a consistent rise is estimated, by 9.4% for yellow eel and by 11.3% for silver eel. The Analysis of Variance for this model is presented in Table NL.I. Comparison of condition to local water temperatures (Figure NL.18) suggests a causal relationship, but the number of data points is much too low to allow a definite conclusion.

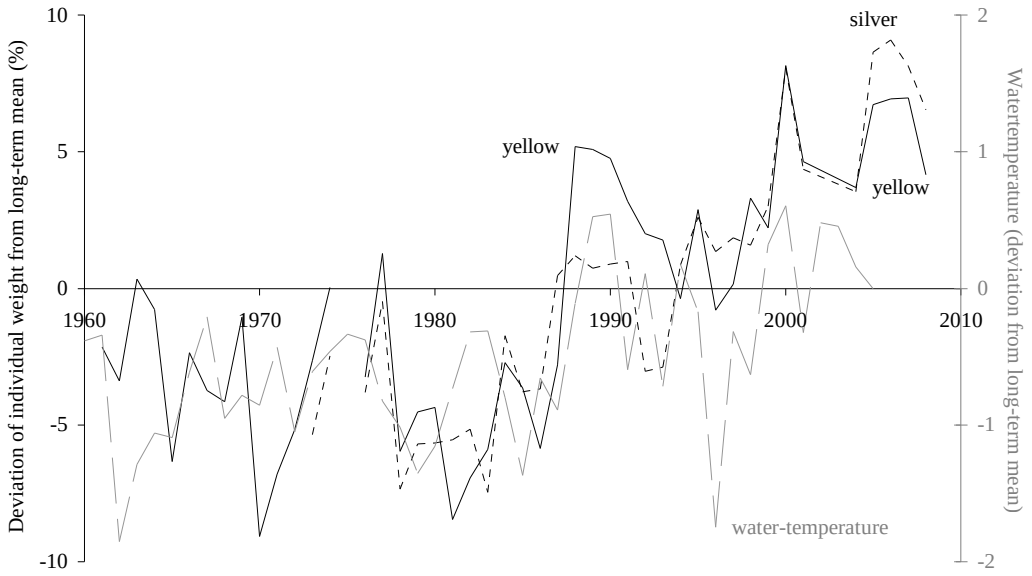


Figure NL.18 Time series of the weight of individual eels, after correction for the length of the eel being sampled, the gear and mesh size, and the month of sampling.

Table NL.I Analysis of Variance (Deviance) of individual eel weights. See text for details about the model. Left panel: type 1 (sequential inclusion of explanatory variables), right panel: type 3 (marginal contributions of explanatory variables). The model used reads:
$W = \exp^{\ln(a) + b \times \ln(L) + year + month + gear + mesh} + \varepsilon$.

		Type 1					Type 3				
	source	Deviance	df	MS	F	p	Deviance	df	MS	F	p
Yellow eel	ln(L)	55386	1	55386.4	2211990.61	0	30939	1	30938.55	1235606.12	0
	year	206	45	4.57	182.54	0	121	45	2.7	107.74	0
	month	133	9	14.73	588.39	0	114	8	14.19	566.6	0
	gear	67	12	5.59	223.29	0	37	11	3.38	135.04	0
	mesh	34	7	4.79	191.4	0	34	7	4.79	191.4	0
	Colinearity						24581				
	Explained	55825	74	754.4	30128.64	0	55826	75	744.34	29727.1	0
	Unexplained	2625	104840	0.03			2625	104840	0.03		
	Total	58450	104914	0.56			58451	104915	0.56		
Silver eel	ln(L)	6520	1	6519.54	464943.76	0	4796	1	4795.77	342012.62	0
	year	20	33	0.61	43.72	0	19	33	0.57	40.38	0
	month	1	6	0.15	10.66	0	1	6	0.15	10.64	0
	gear	0	4	0.01	0.52	0.71766	0	3	0.01	0.61	0.60628
	mesh	0	0					0			
	Colinearity						1725				
	Explained	6541	44	148.65	10601.19	0	6541	44	148.65	10601.19	0
	Unexplained	154	10970	0.01			154	10970	0.01		
	Total	6695	11014	0.61			6695	11014	0.61		

Both a simple averaging of Fulton indices over all sampled eels, and a more complex statistical analysis indicate, that condition of eels being sampled in the regular market sampling in Lake IJsselmeer rose since the early 1980s by an order of 10%, for yellow and silver eels alike. This contrasts with the findings by Belpaire et al (2008). Whether condition (length/weight analysed here) and fat content (analysed by Belpaire et al) developed in opposite directions, or methodological problems cloud one or the other analysis, is not yet clear. Further analysis of both data sets will be required.

NL.9.2 Parasites

The market sampling for Lake IJsselmeer collects information on the percentage of eels showing *Anguillicola* infection (Figure NL.19, based on inspection of the swim bladder by the naked eye). Following the initial break-out in the late 1980s, infection rates have stabilised between 40 and 60%, while the number of parasites per infected eel fluctuates between 4 and 6. In recent years, the infection rate and the parasite burden are slightly decreasing.

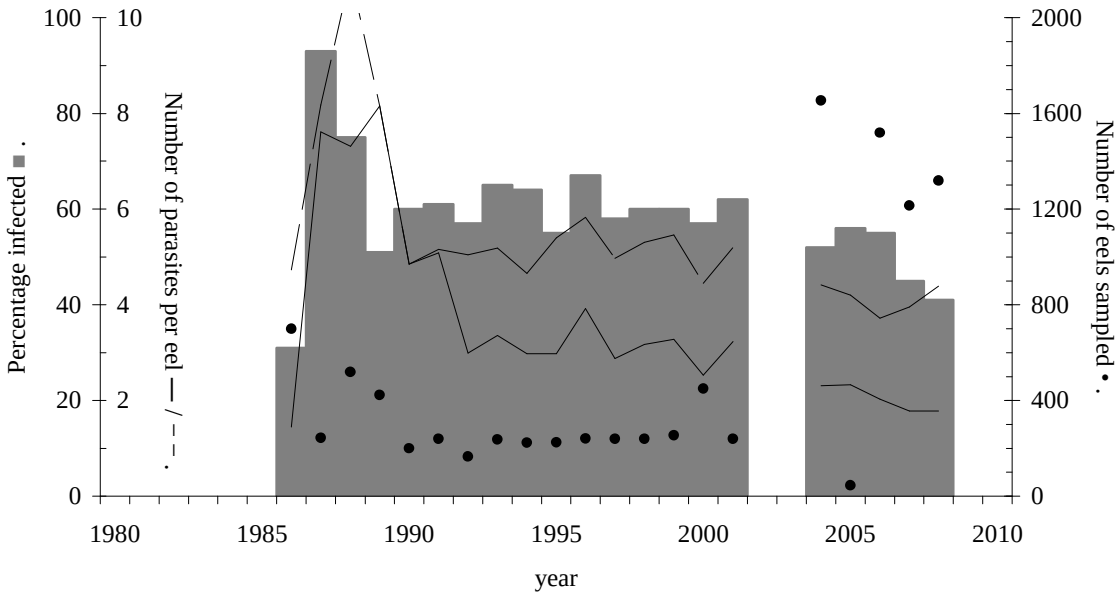


Figure NL.19 Trend in *Anguillicola* infections in Lake IJsselmeer eel. Based on visual inspection by the naked eye.

NL.9.3 Contaminants

For a recent overview of contamination in eel in the Netherlands, see Hoek-van Nieuwenhuizen & Kotterman (2007) and Hoogenboom et al. (2007).

NL.9.3.1 Spatial pattern

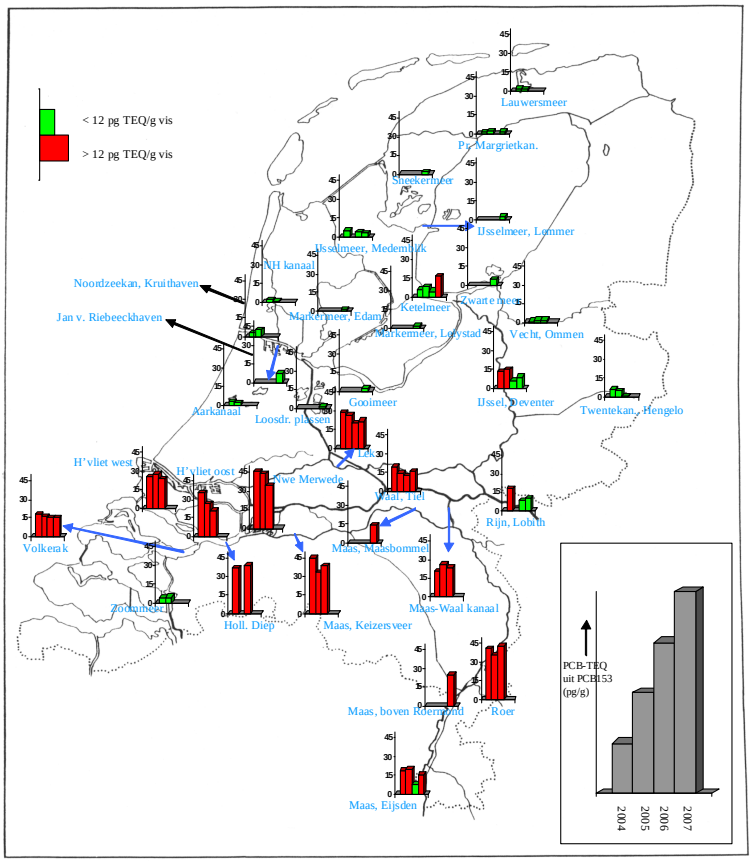


Figure NL.20 Temporal trend in PCB in eel (from Hoek-van Nieuwenhuizen & Kotterman 2007).

NL.9.3.2 Temporal trend

The temporal trend differs substantially between sampling locations, but overall a decline is observed. Figure NL.21 shows the trend in eels derived from Lake IJsselmeer and several places in the main rivers.

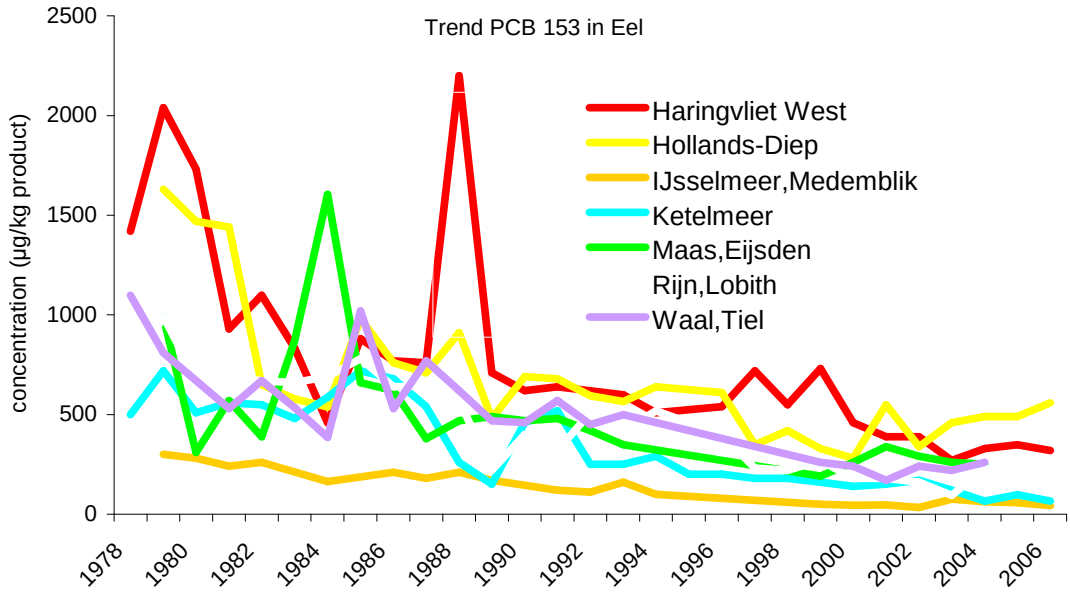


Figure NL.21 Temporal trend in PCB in eel (data from Hoogenboom et al. 2007).

NL.9.4 Predators

Predation of eel by cormorants (*Phalacrocorax carbo*) is much disputed amongst eel fishermen and bird protectionists. The number of cormorant breeding pairs increased rapidly until the early 1990s, and then stabilised (Figure NL.22), remaining stable in recent years. For Lake IJsselmeer, food consumption has been well quantified (van Rijn & van Eerden 2001; van Rijn 2004); eel constitutes a minor fraction here. In other waters, neither the abundance, nor the food consumption is accurately known, but predation on eel appears to be a bigger issue here.

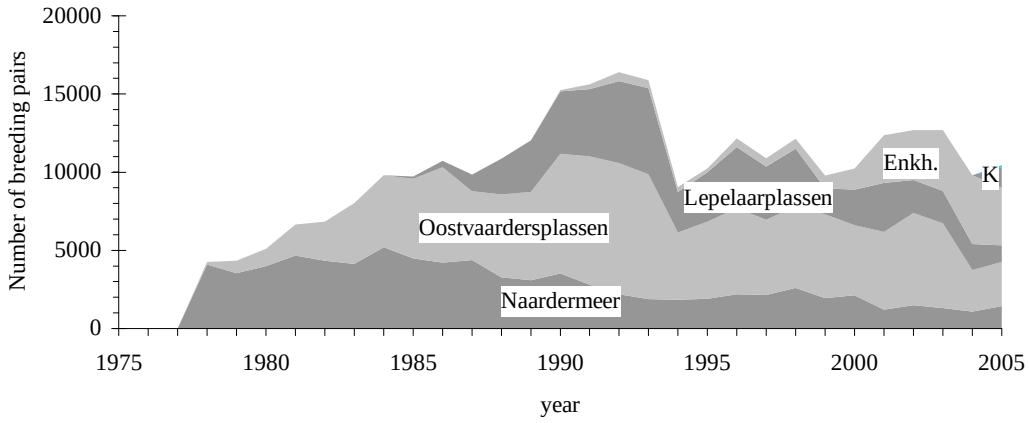


Figure NL.22. Trend in the number of breeding cormorants around Lake IJsselmeer, by breeding place. The breeding places are ordered from south (bottom) to north (top). Enkh=Enkhuizer Zand (de Ven), K=Kreupel.

NL.10 Other sampling

Nothing to report under this heading.

NL.11 Stock assessment

NL.11.1 Local stock assessment

The basic results of the monitoring programmes in Lake IJsselmeer and the main rivers, the landings statistics and age-and-length sampling of the catch in Lake IJsselmeer are reported to the Ministry of Fisheries in annual status reports; salient details are published in the fishing press.
Dekker (1996, 2000c) developed a VPA-type assessment model for the eel fisheries on Lake IJsselmeer. This model has been applied to data from Lough Derg (Ireland) in the context of FP6-project 022488 SLIME (Dekker et al. 2006).
Growth in eel shows considerable inter-individual variation; individual year classes overlap almost completely in length. Additionally, fisheries, predation mortality (cormorants) and silvering are length-, rather than age-specific. The traditional age-structure of the VPA was therefore replaced by a length-structuring; a length-length transition matrix then replaces the conventional ageing process. Unfortunately, the retrospective application of this deterministic model yielded numerically unstable results (small glitches in the data causing huge shifts in outcome). Dekker (2004a) replaced the deterministic model by a statistical analysis, and included landings and catch-composition data as well as stock survey data. Although this cleared the numerical instability problem, results no longer match the status of the stock in individual years precisely, but reflect the overall trend over the years.
Initial assessment of the status of Lake IJsselmeer eel fishery indicated extremely severe overexploitation ($F \approx 1.0$; Dekker 1996, 2004a). A 50% reduction in the nominal fishing effort in 1989 resulted in an effective drop in fishing mortality of only 25%. Although assessments were still available, further effort reductions in the 1990s have only loosely been related to monitoring and catch sampling results. In the mid-1990s, the quality of the landing statistics deteriorated, following the transfer of the registration from the Ministry of Fisheries to the Fish Board. Subsequently, the annual assessments have been discontinued. The latest formal management advice dates back to 2000 (an 80% reduction in fishing effort is required to obtain the maximal sustainable yield). Current fishing effort is in the order of 50% of that in 2000, and thus still well above the level of maximum sustainable yield. However, Dekker et al (2008) indicated that the fishing level F_{max} establishing the maximum sustainable yield MSY, is above the level at which the eel stock can be expected to recover (that is: F_{max} still establishes recruitment overfishing): only a further reduction in effort will be in accordance with the EU Eel Regulation. A preliminary estimate of the maximum acceptable effort is indicated in Figure NL.6, for the years 2009-2010.

NL.11.2 International stock assessment

NL.11.2.1 Habitat

An overview of habitats available is presented by Dekker et al. (2008), based on the information in Tien & Dekker (2004, 2005), complemented with data from various sources. The summarising table is reproduced here in Table NL.m.

Table NL.m Overview of available water surface in the Netherlands, in hectares.

Province	Ditches †	Canals †	Lakes ‡	Rivers	Coastal waters	sum
Friesland	5,345	7,057	9,454		-	21,856
Groningen	2,003	2,040	6,905		3,843	14,791
Drenthe	657	503	-		-	1,160
Overijssel	1,516	1,985	1,872		-	5,372
Gelderland	831	733	-		-	1,564
Flevoland	3,115	4,959	-		-	8,074
Utrecht	1,699	2,349	2,699		-	6,747
Noord-Holland	5,227	7,938	1,243		-	14,408
Zuid-Holland	4,843	6,935	7,454		-	19,232
Zeeland	2,421	2,873	17,871		95,745	118,909
Noord-Brabant	1,247	1,241	-		-	2,488
Limburg	-	-	-		-	-
Larger water bodies						
Randmeer			16,110		-	16,110
Ijsselmeer/Markermeer			169,150		-	169,150
Rijn & Maas				18,067	-	18,067
kleinere rivieren				2,800	-	2,800
Waddenzee, incl Eems			-		259,214	259,214
Zeeuwse Delta			17,871		95,745	113,616
sum	28,905	38,610	232,758	20,867	358,802	679,942

† For ditches and canals, only the areas less than 1 m above sea level have been considered.
‡ Fresh water areas in the south-western delta have been included under Lakes, the saline waters under Coastal Waters.

NL.11.2.2 Silver eel production

The IJsselmeer eel stock constitutes approx. 30% of the total stock in the Netherlands (see Table NL.a), and is well documented. For the rest of the country, information is scarce or lacking. Consequently, estimates of silver eel production can only be given for Lake IJsselmeer. According to Dekker et al. (2008), historical landings were in the order of 3000 t, 10% of which was made up of silver eel. Based on the assessment of Dekker (1996, 2000c) of the stock in the early 1990, assuming a linear relationship between recruitment and production, the historic potential production is estimated at approx. 7700 t, 10% of which is made up of males. This historic extrapolation is in reasonable agreement with the historic landings. The actual escapement in the early 1990s was estimated by Dekker (1996, 2000c) to be approx 11 t; current escapement will be somewhat lower, because of declining recruitment; indeed, landings declined in parallel with recruitment. Recent information on silver eel landings is unreliable, due to misclassifications of life stages and/or the trading of eel from other areas at IJsselmeer auctions. According to these statistics, approx. 50% of the current landings (120-130 t) is made up of silver eel.
For the remainder of the country, Klein Breteler (2008) provided an estimate of potential production, based on historic landings per ha of 4 (coastal waters) to 25 (rivers) kg/ha, a minimum production of 10,000 – 15,000 t is derived.

NL.11.2.3 Production values

Combining the information on production from Table NL.a with the data on water surfaces from Table NL.m, estimates of productivity result in Table NL. n.

Table NL. n Production values by water type. Data derived from Dekker et al (2008).

	Ijsselmeer/ Markermeer	Rivers	Coastal waters	Other waters	Total
Number of fishing companies	73	28	48	ca. 100	249
Surface area, ha	169,150	20,867	354,959	134,966	679,942
Landings, tons	280	150	115	375	920
Surface area per company, ha	2,317	745	7,395	1,350	2,731
Landings per company, kg	3,836	5,357	2,396	3,750	3,695
Landings per surface area, kg/ha	1.66	7.19	0.32	2.78	1.35

NL.11.2.3.1 Impacts

Vriese et al. (2007) and Dekker et al. (2008) estimated quantities of eel impacted by anthropogenic impacts, from which the summary in Table NL. o is compiled. In the majority of cases, the relative impact on the stock is unknown. For Lake IJsselmeer fishery, current fishing mortality F ≈ 0.33 per annum (Dekker et al. 2008). For hydropower generation in the main rivers, the impact on the silver eel is estimated at H ≈ 16 – 34 % per run. For all other factors and other areas, the relative impact is unknown, and consequently, the interaction and overlap between different mortality sources can not be assessed.

Table NL. o Estimated quantities of eel, by anthropogenic impact. Data from Vriese et al. (2007) and Dekker et al. (2008).

Impact	**Yellow eel**	**Silver eel**	**Yellow & Silver**
Cormorants	50	0	50
Barriers	?	?	?
Pumping stations	50	40	90
Parasites	?	?	?
Pollution	?	?	?
Inland fishery	640	280	920
Marine fisheries	20	0	20
Sports fishing	200	0	200
Hydropower	4	15	19
Total (min. est.)	970	335	1305

NL.11.2.3.2 Stocking requirements < 20 cm

The Dutch EMP mentions a budget of 300 k€, but additional budget may become available from private sources. It is unclear what quantities of eel will be purchasable for this budget, while a turbulent price development is expected, because of the implementation of CITES restrictions and the impact of restocking programmes on the glass eel market.

NL.12 Sampling intensity and precision

Last years report (Dekker 2008) gave an overview of analyses of sampling intensity and precision of sampling programmes based on historical (up to present) data, repeated below. In 2009, a statistical pilot study is being conducted for sampling commercial catches outside Lake IJsselmeer. To this end, samples of 100-200 eels are taken from the catch of some ten fishers each month in the province of Friesland (53ºN 5º45'E); a parallel programme will be started up in fall in the main rivers.

NL.12.1 Recruitment surveys

The glass eel survey at Den Oever collects between 200 and 500 hauls per year. The statistical properties of these data have been analysed by Dekker (1998, 2004c), including the relation to environmental influences and sampling conditions. Above all, the relation between precision and (expected) mean catch determines the overall precision of the individual observations. Additionally, the number of observations per year is amongst others determined by the average catch: after several weeks without any glass eel, the motivation to continue sampling obviously declines, and the sampling programme is then closed. A lower precision of individual observations in combination with a lower number of observations per year, results in a drastically expanded confidence limits of the annual mean. (Since 2004, the sampling is no longer done by sluice personnel while on duty, but by people specifically hired for the job. They replaced the two-hourly sampling by hourly sampling, but did not extend the sampling season).

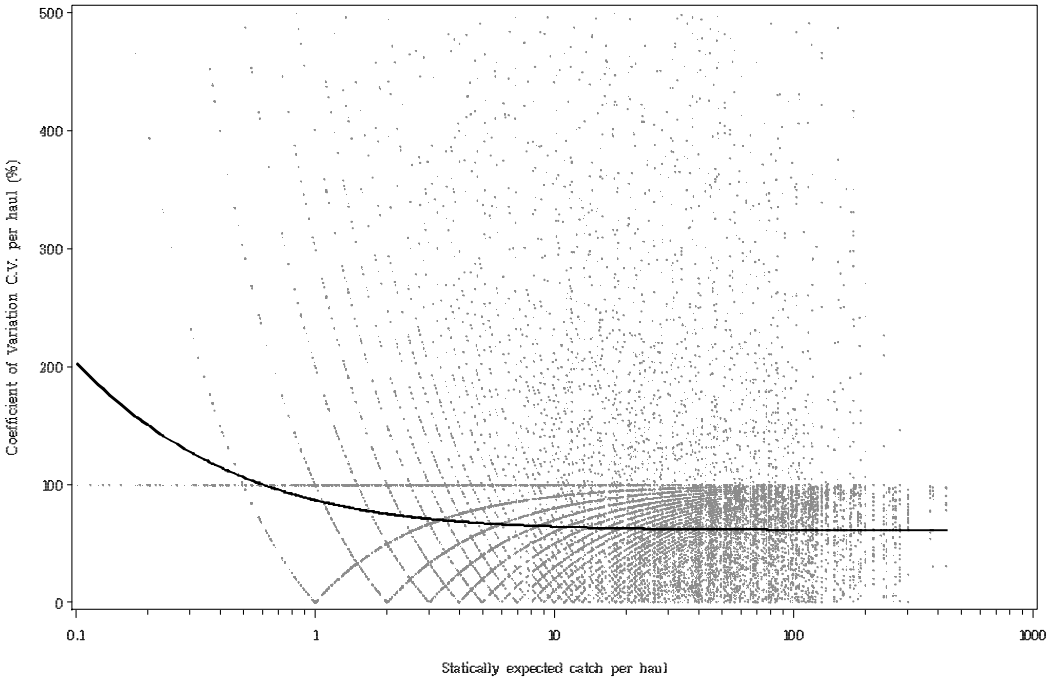


Figure NL.23. Relation between the statistically expected catch (horizontal) and the coefficient of variation (vertical) for the glass eel sampling at Den Oever. The dots represent the individual observations (one haul at a specific hour at a specific day), the line the functional relationship between residual and expectation (Var $\propto$ mean^2+mean). Since the number of glass eels caught is an integer number (0, 1, 2, etc), observations with 1½ or 2⅜ glass eels are lacking. Consequently, all observations of exactly 1 glass eel form a conspicuous V-shaped line (hitting the x-axis at 1), and all observations of exactly 2 glass eels too (hitting the x-axis at 2), etc. with no observations in between. The zero observations are on the horizontal line at CV=100%.

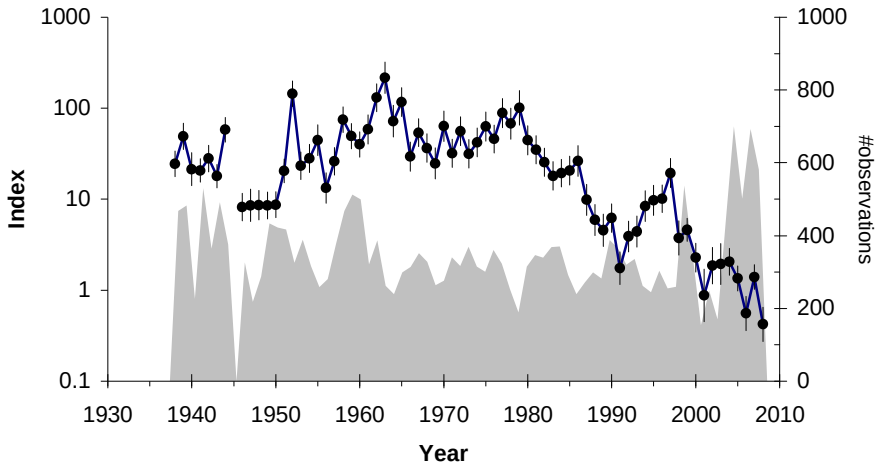


Figure NL.24. Time series of the recruitment series in Den Oever, presenting the index and confidence intervals (± 1 SD).

NL.12.2 Yellow eel surveys

The precision of the yellow eel surveys in Lake IJsselmeer has been analysed by Dekker (1998). The same data contributed to the comprehensive analysis of historical data by Dekker (2004a).
The precision of the yellow eel surveys in the main rivers has been analysed by Winter et al. (2006).

NL.12.3 Length composition from market sampling

The spatial and temporal variation in market sampling of length compositions has been described by Dekker (2005) before, leading to the following results:

NL.12.3.1 Spatial variation

The spatial variation in mean length of fyke net catches was analysed by Dekker (2000a). For Lake IJsselmeer, the mean length varied irrespective of the distance between samples, while for other inland waters, the variation increased considerably from a distance of 10 km upwards (Figure NL.25).

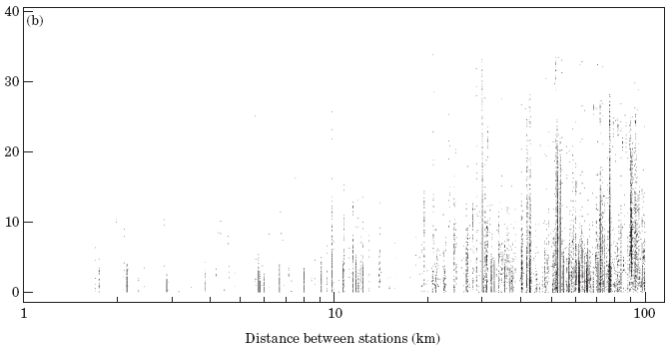


Figure NL.25 Variogram of mean length of yellow eel in fyke nets, outside Lake IJsselmeer (Dekker 2000a). The vertical axis shows the difference in mean length between two samples, the horizontal axis the spatial distance between the two samples.

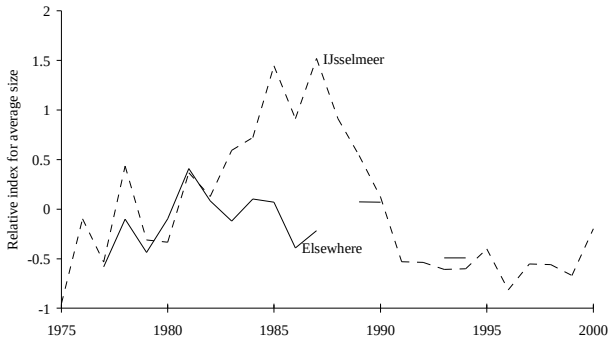


Figure NL.26 Relative change in size composition of eel landings. Positive values indicate a shift towards larger size classes. In Lake IJsselmeer, effort reductions and the recruitment failure in the 1980s initially shifted the length composition gradually to higher values. When the low recruitment had progressed into even the largest size classes, the mean size restored to normal values. Elsewhere, the data showed less variability. Presumably, sampling ceased before the 1980s recruitment failure had progressed into the exploited length classes.

NL.12.3.2 Temporal variation

The temporal variation in length composition of Lake IJsselmeer eel catches was analysed by Dekker (2000c) in a VPA-type deterministic model, and in combination with survey data by Dekker (2004a) in a statistical model. However, the statistical properties of the sampling protocol were not highlighted.
Re-analyses of the length compositions of market samples from Lake IJsselmeer (Table NL.p), using the multinomial model of Dekker (2004a) indicates that 40% of the explained variance is accounted for by gear type and market selections, while the remaining 60% is related to temporal variation. The unexplained variance, however, is much larger, as usual. The temporal variation is largely due to year-to-year differences in length composition (Table NL.p, Figure NL.26**)**. From 1975 until 1987, a gradual shift towards larger sizes was observed; between 1987 and 1989, a rapid decrease occurred (Figure NL.26).
The quarterly and monthly variation in length composition is much smaller than the inter-annual variation, and very inconsistent over the years (interactions year*quarter and year*month exceed the main effects quarter and month).

Table NL.p Temporal resolution of market samples. Analysis of variance (type 1) in the length composition of market samples of legal sized eels from Lake IJsselmeer. Data since 1975; 1811 samples; 19657 eels. See Dekker (2004a) for details on the data and statistical model.

source	deviance	df	MS	F	p
gears	4200	5	840.08	632.31	<.0001
market selection	2020	2	1010.02	760.23	<.0001
√mesh	5	1	4.57	3.44	0.0637
year	6310	25	252.40	189.97	<.0001
quarter	32	3	10.81	8.14	<.0001
month	160	6	26.74	20.12	<.0001
year*quarter	1064	49	21.71	16.34	<.0001
year*month	1243	88	14.13	10.63	<.0001
explained	15035	179	83.99	63.22	<.0001
residual	25877	19477	1.33		
total	40912	19656	2.08		

NL.12.3.3 Comparison of spatial and temporal variation

The variogram of Figure NL.25 (Dekker 2000a) is based on sample mean lengths, grouped by decade. Re-analysing the same data, using the multinomial model of Dekker (2004a) allows a comparison of temporal and spatial variation. Figure NL.25 indicates that spatial processes apply at a spatial scale in

the order of 10 km. Grouping the data in 10*10 km grid cells, and dropping the decadal grouping, results in a moderately sized model (Table NL.q). The spatial variation in length composition of the catches exceeds the temporal variation by more than a factor 20. However, this data set was not designed for comparison of spatial and temporal variation; consequently, the colinearity is relatively large. The interaction between year and spatial grid, however, is relatively small, indicating that the time trend was largely shared by all areas.

Table NL.q Comparison of temporal and spatial variation in market samples. Analysis of variance (type 3) in the length composition of market samples of legal sized eels, from areas outside Lake IJsselmeer. Data since 1975; 330 samples; 9871 eels. See Dekker (2000a) for details on the data, and Dekker (2004a) for details on the statistical model.

source	deviance	df	MS	F	P
10*10 km grid	3876	27	143.55	106.37	<.0001
year	174	14	12.44	9.22	<.0001
colinearity	1738				
grid*year	645	28	23.03	17.88	<.0001
explained	5789	43	134.62	99.75	<.0001
residual	13262	9827	1.35		
total	19051	9870	1.93		

NL.12.3.4 Precision of estimates

The analyses of variance presented in Table NL.p and Table NL.q are based on all historically available information. Therefore, these analyses are not fully representative for data collection under the Data Collection Regulation. However, the results do give an indication of the precision achieved (Figure NL.27). This indicates that the relative abundance of length classes can be estimated with a precision of slightly less than 10% for Lake IJsselmeer, respectively slightly less than 15% elsewhere. However, the consequence of this acquired precision on the assessment of the status of the stock and fisheries is not clear yet.

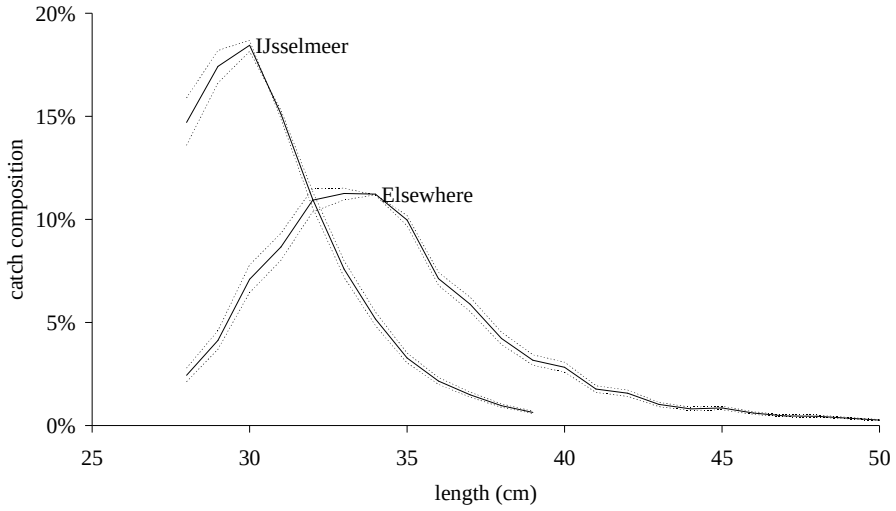


Figure NL.27 Average length composition of fyke net catches, with confidence intervals (±1 std), for Lake IJsselmeer and Elsewhere, based on the entire historical data sets. The presented length distributions conform to the situation in 1990.

Summarising the above findings:

1. the length composition of catches varies considerably between gears and market selections,
2. spatial variation at a 10-km scale plays a dominant role, but not in Lake IJsselmeer,
3. year-to-year variation is considerable, including gradual trends and sudden transitions,
4. within-year variation is small and inconsistent over the years,
5. spatial differentiation in time trends appears to be weak, and
6. about 2/3 of the total variance remains unexplained.

NL.13 Standardisation and harmonisation of methodology

Techniques and methods are standardised within the (marine and freshwater) institute, and are up to international quality standards (ISO 9000, DCR requirements).

NL.14 Overview, conclusions and recommendations

The availability of data on eel stock and fisheries presented in this report is summarised in Table NL.r. Over all, the larger, State owned waters are reasonably documented, but the smaller regional waters are not yet. Within the framework of the implementation of the national EMP, various extensions are being developed.

Table NL.r Overview of the data collection by area, described in this report.
+ = present, - = absent, +/- = incompletely present, (+) = present, but inadequate, !=under development.

Area	Waddensea	IJsselmeer	Main	Zeeland, waters:		Smaller inland waters
Item			Rivers	open	closed	(lakes, polders, small rivers)
C capacity	+	+/-	-	+	-	-
D effort	+	-	-	+	-	-
E catch	+	+	-!	+	-!	-!
F CPUE	-	(+)	(+)	-	-	-
G surveys	+	+	+	+	-	-
H age/length	-	+	-!	-	-	-!
I sex, growth	-	+/-!	-	-	-	-!
J other sampling						
K assessment	-	(+)	-!	-	-	-!
L precision		+				
M methodology						

In conclusion: this report provides an update of all data series regarding the eel stock in the Netherlands. Almost all data series show a further decline of the stock and fishery; anthropogenic impacts are high, or undocumented. The stock in the main rivers is possibly an exception: research surveys showing no decline over the past 12 years here, though the commercial CPUE data do.

NL.15 Literature references

This list of references has been extended with some recent and relevant publications.

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Dekker W. 2000b A Procrustean assessment of the European eel stock. ICES Journal of Marine Science 57: 938-947.

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Dekker W. (ed.) 2002 Monitoring of glass eel recruitment. Report C007/02-WD, Netherlands Institute of Fisheries Research, IJmuiden, 256 pp.

Dekker W. 2004a What caused the decline of Lake IJsselmeer eel stock since 1960? ICES Journal of Marine Science 61: 394-404

Dekker W. 2004b Slipping through our hands - Population dynamics of the European eel. PhD thesis, 11 October 2004, University of Amsterdam, 186 pp.

Dekker W. 2004c Monitoring van de glasaalintrek in Nederland [Monitoring of glass eel immigration in the Netherlands]. RIVO report C005/04, 33 pp.

Dekker W. 2004d De aal en aalvisserij van het IJsselmeer [The eel and eel fisheries on Lake IJsselmeer]. RIVO report C002/04, 24 pp.

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The scientific quality of this report has been peer reviewed by the a colleague scientist and the head of the department of IMARES.

Approved: J. Steenbergen
Fisheries scientist

Signature:

Date: 13 oktober 2009

Approved: Dr. ir. T.P. Bult
Head of Department

Signature:

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