Is er nog een toekomst voor de Europese paling?

Onderzoeks- en beheersuitdagingen in de 21e eeuw

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Katholieke Universiteit Leuven

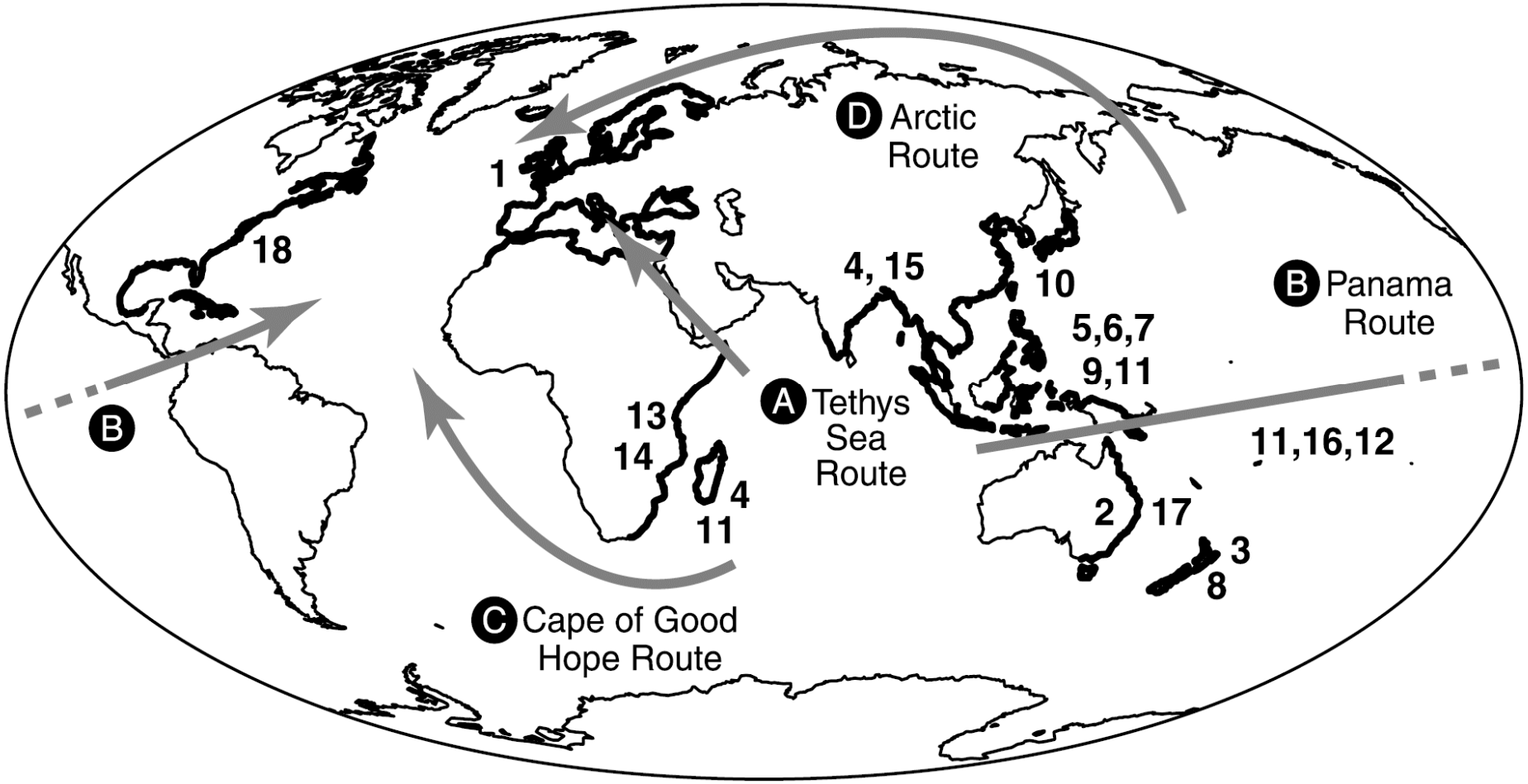
Departement Biologie

Laboratory of Animal Diversity & Systematics

Fish and parasite evolution (F. Volckaert)

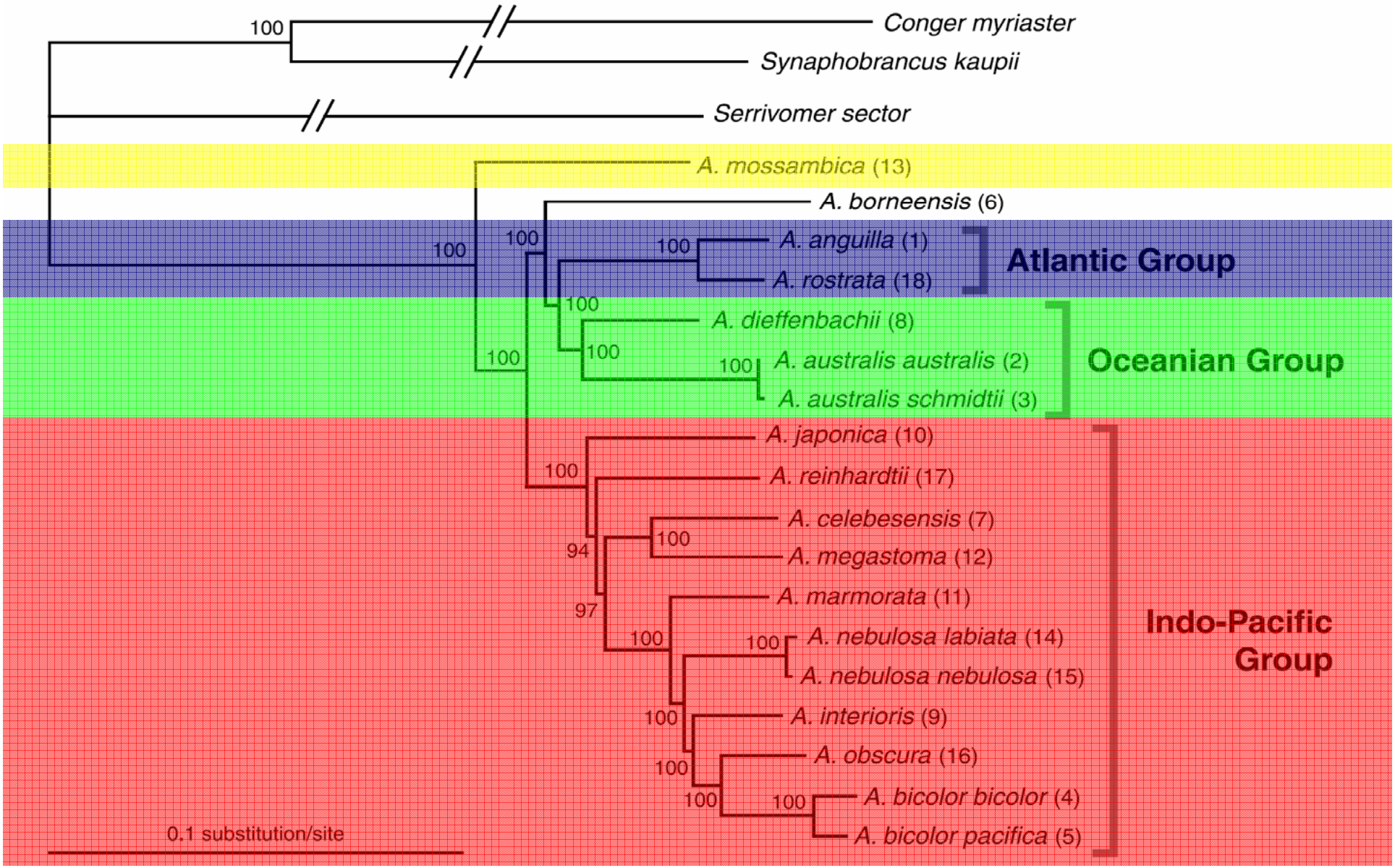
Het geslacht *Anguilla*

15 beschreven soorten

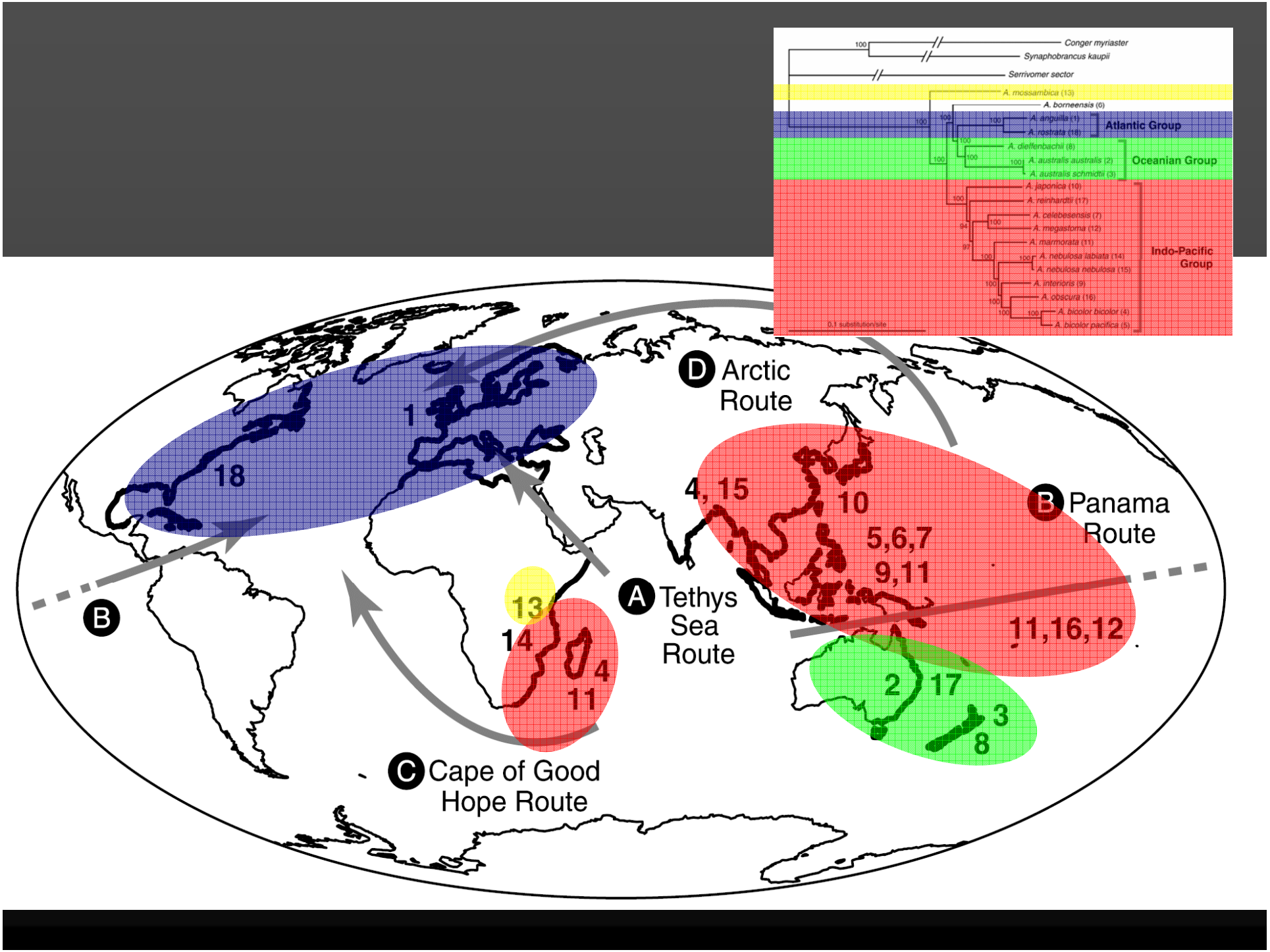


(Aoyama *et al* 2001)

Stamboom familie Anguillidae



Minegishi *et al* 2005


Conger myriaster
Synaphobrancus kaupii
Serrivomer sector
A. mossambica (13)
A. borneensis (6)
A. anguilla (1)
A. rostrata (18)
Atlantic Group
A. dieffenbachii (8)
A. australis australis (2)
A. australis schmidtii (3)
Oceanian Group
A. japonica (10)
A. reinhardtii (17)
A. celebesensis (7)
A. megastoma (12)
A. marmorata (11)
A. nebulosa labiata (14)
A. nebulosa nebulosa (15)
A. interioris (9)
A. obscura (16)
A. bicolor bicolor (4)
A. bicolor pacifica (5)
Indo-Pacific Group
0.1 substitution/site
D Arctic Route
B Panama Route
A Tethys Sea Route
C Cape of Good Hope Route
1
18
4, 15
10
5,6,7
9,11
11,16,12
13
14
4
11
2
17
3
8

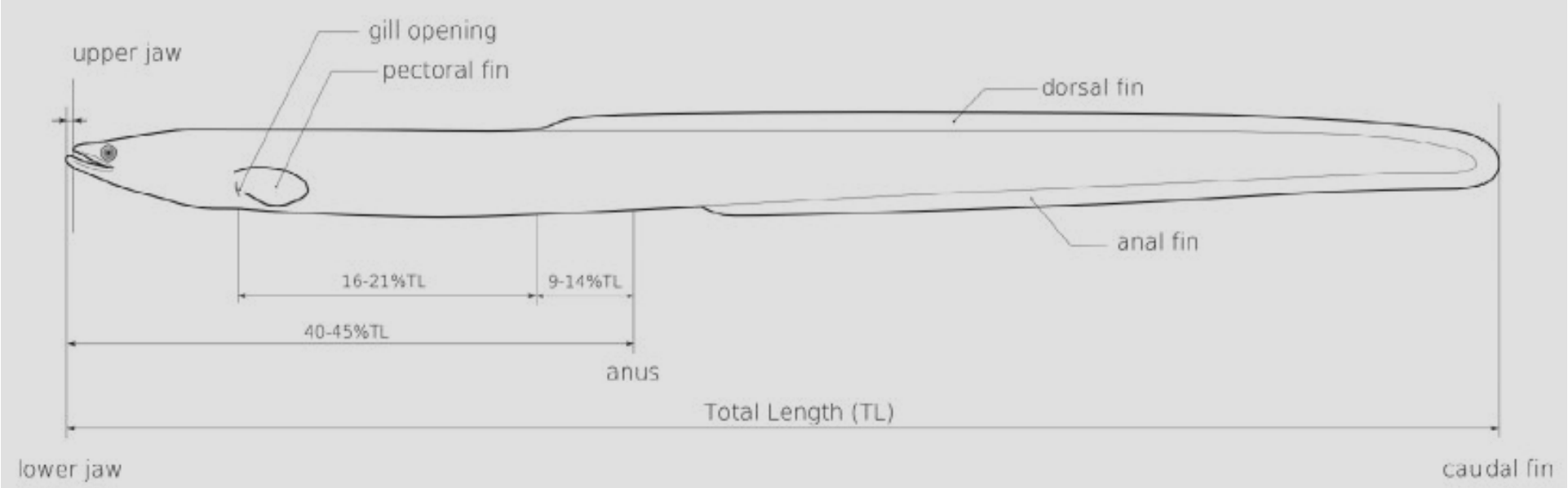
Anguilla anguilla

Anguilla marmorata

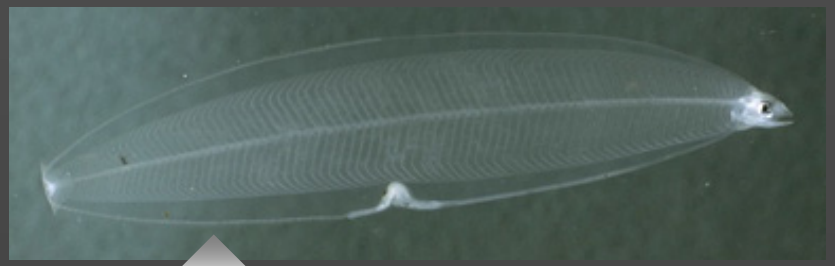
Anguilla japonica

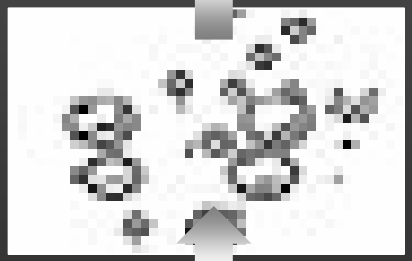
Anguilla megastoma

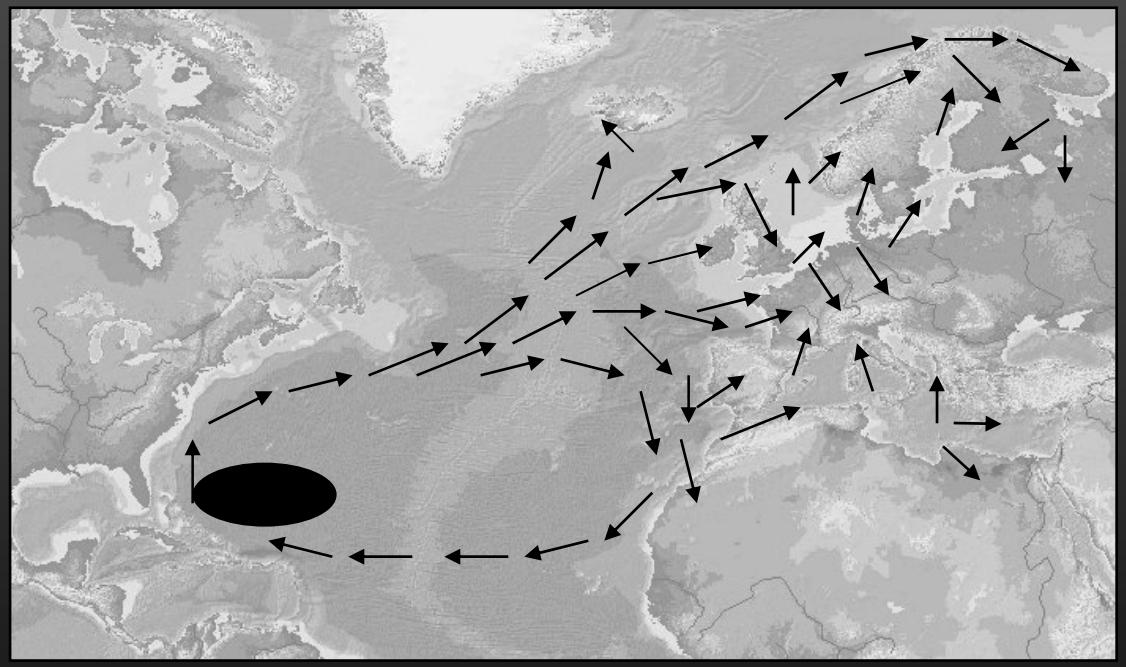
Anguilla anguilla (Linnaeus, 1758)

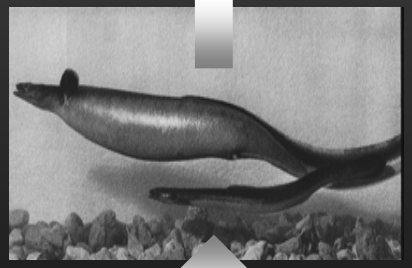


De levenscyclus

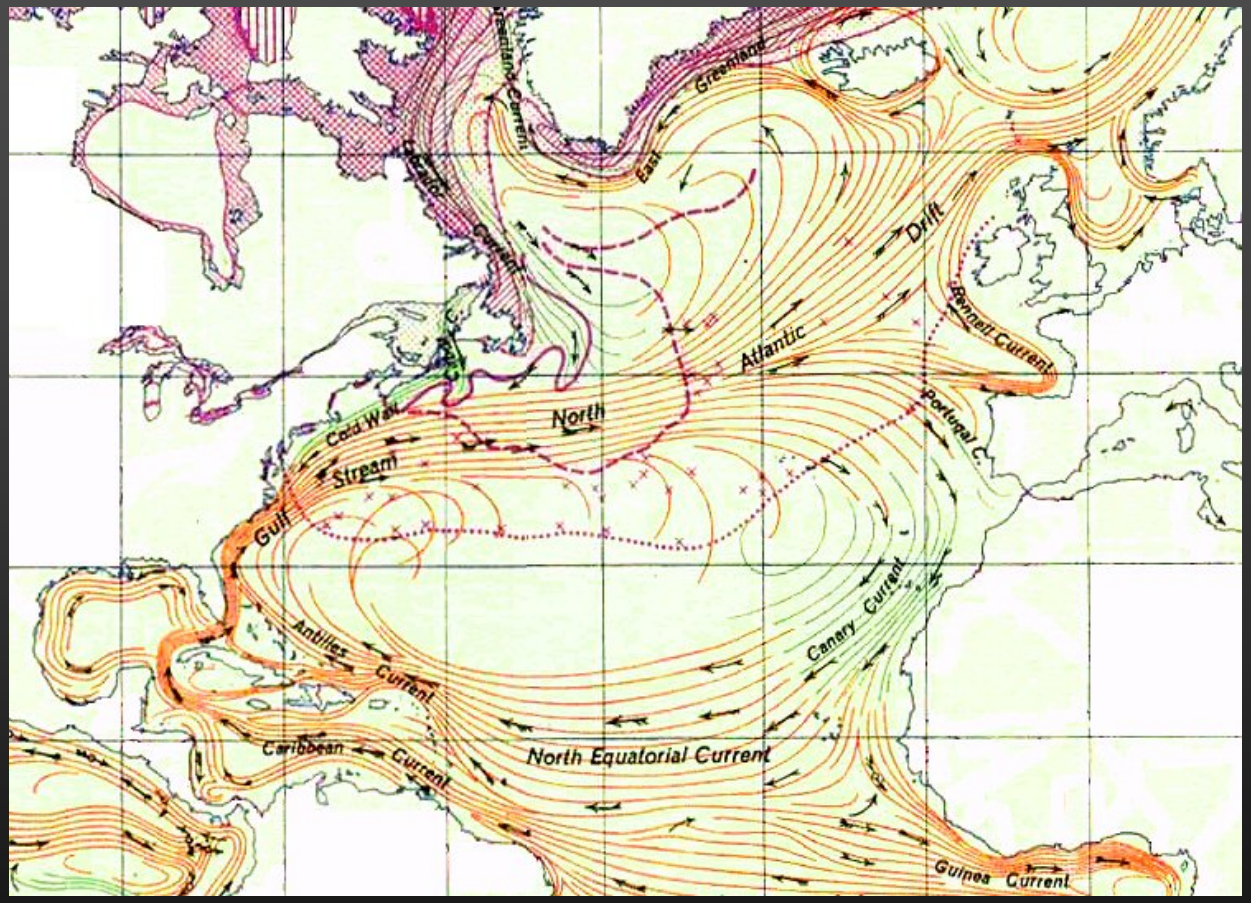








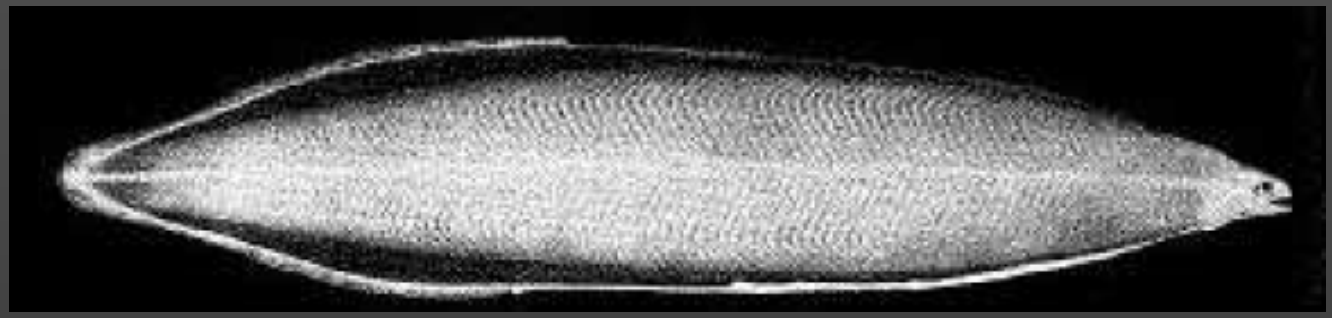
Sargasso Zee



Sargassum wier

Leptocephalus

Wilgebladlarve



Tesch 1999 naar Schmidt 1909

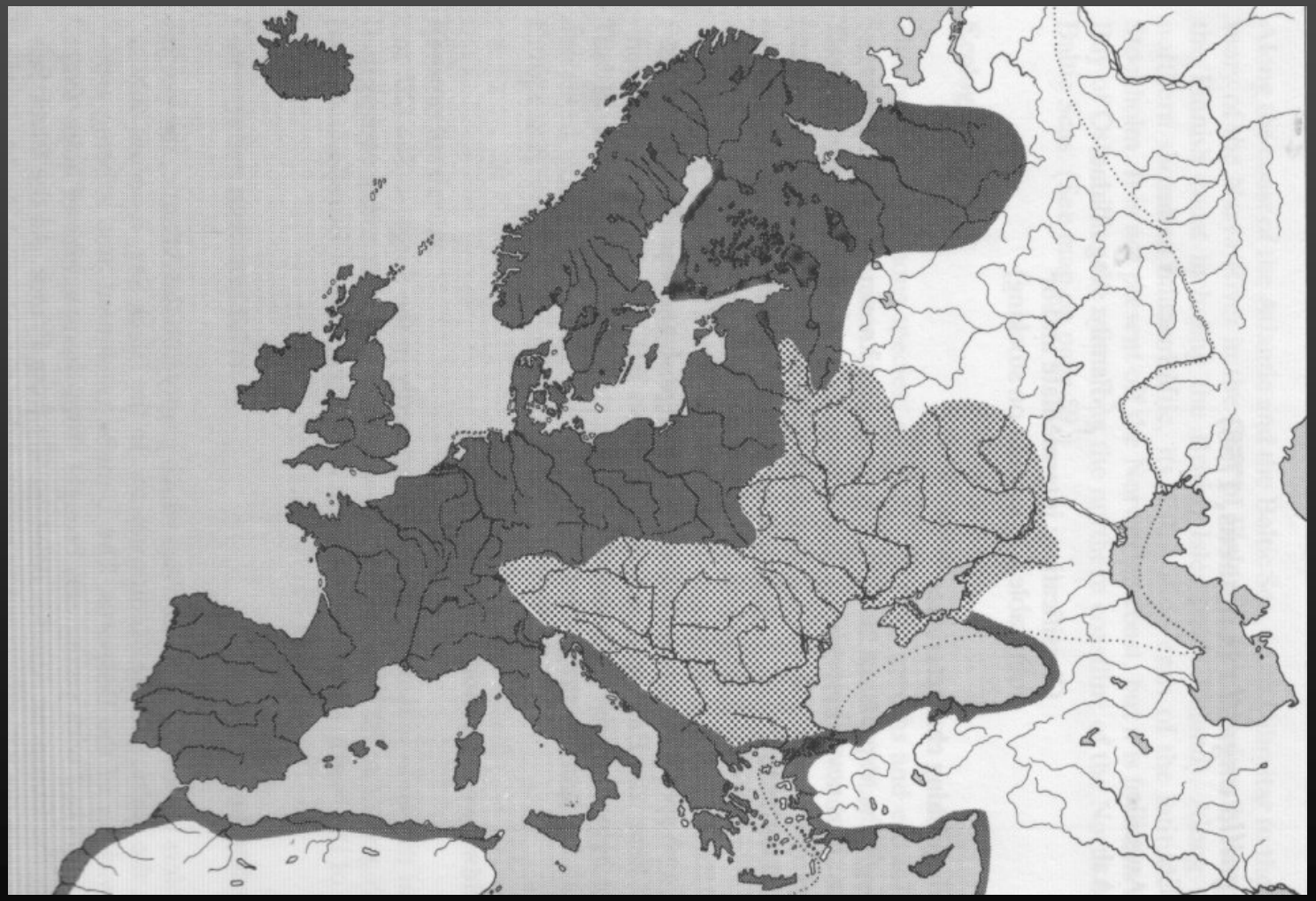
1856 *Leptocephalus brevirostris*

1900 larve *Anguilla anguilla*

Glasaal

Gele paling

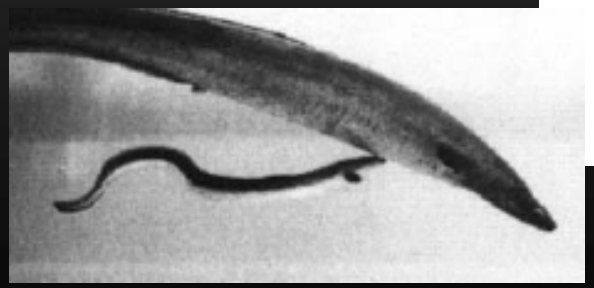
distributie

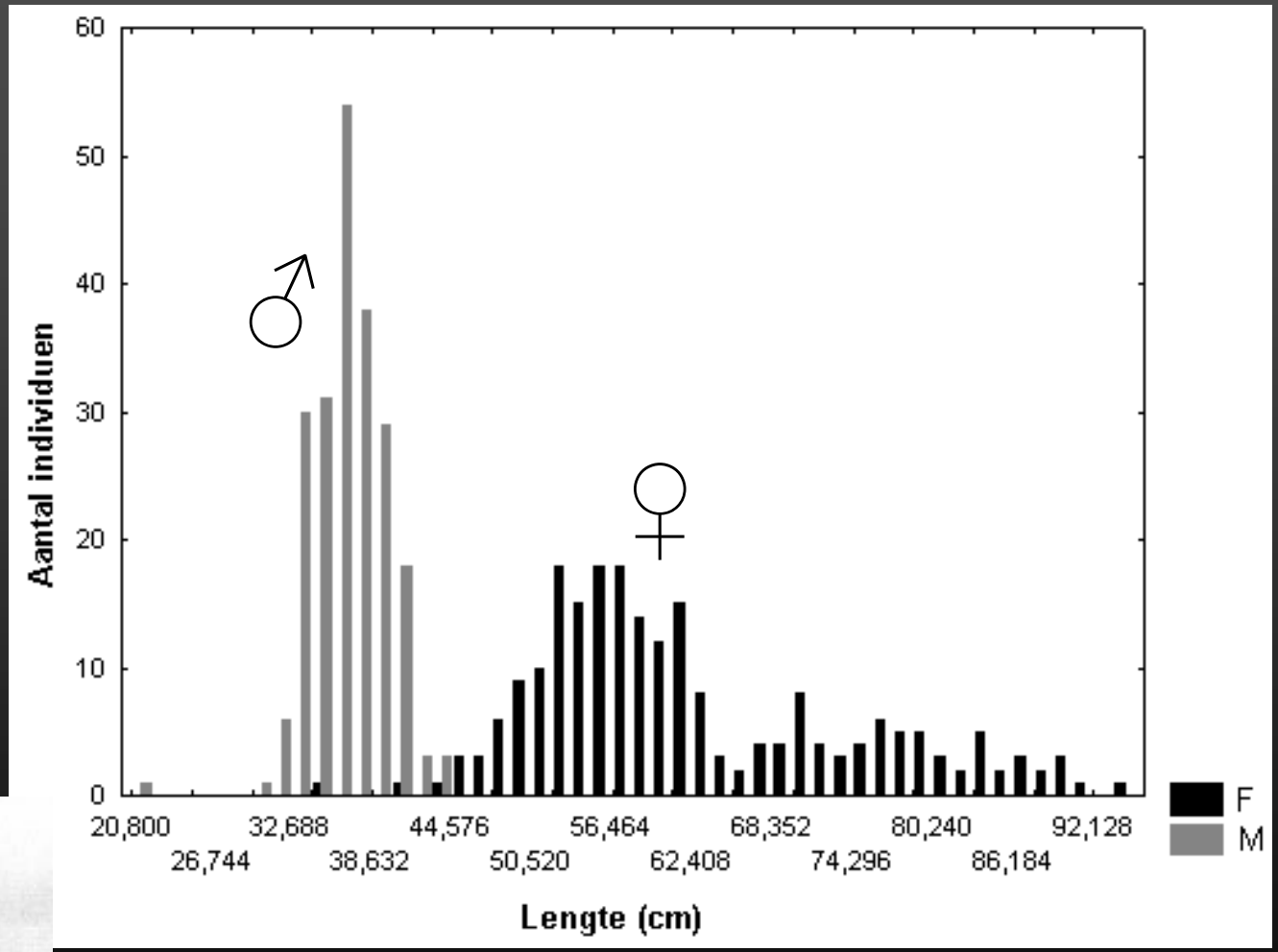


Geslachtsdimorfisme

♂ < 42 cm

♀ > 46 cm



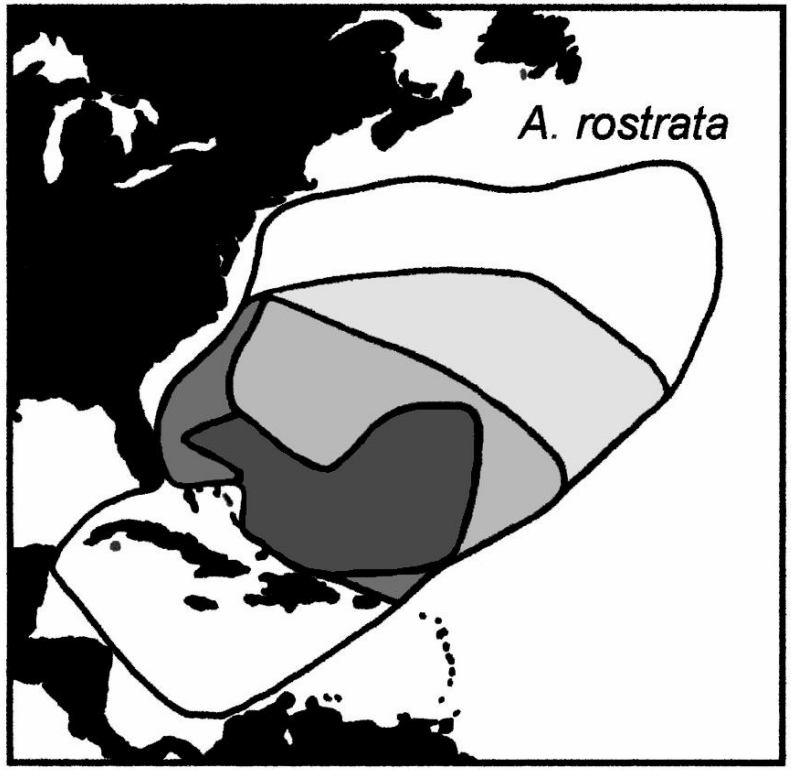


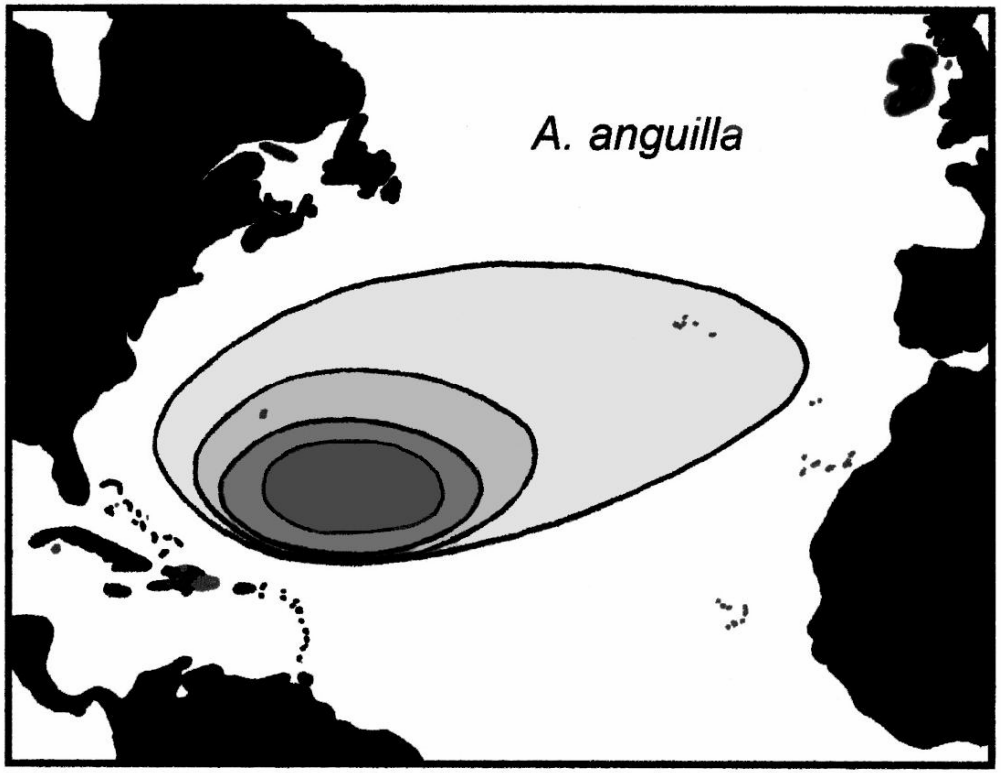
Zilverpaling

Noord-Atlantische palingen

Overlap van paaigebied en larvale distributie

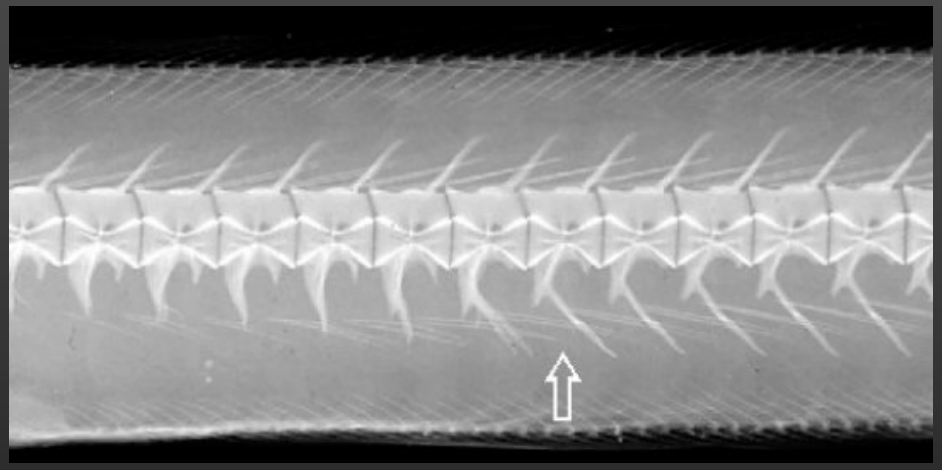
Soortenintegriteit en differentiële migratie blijft behouden





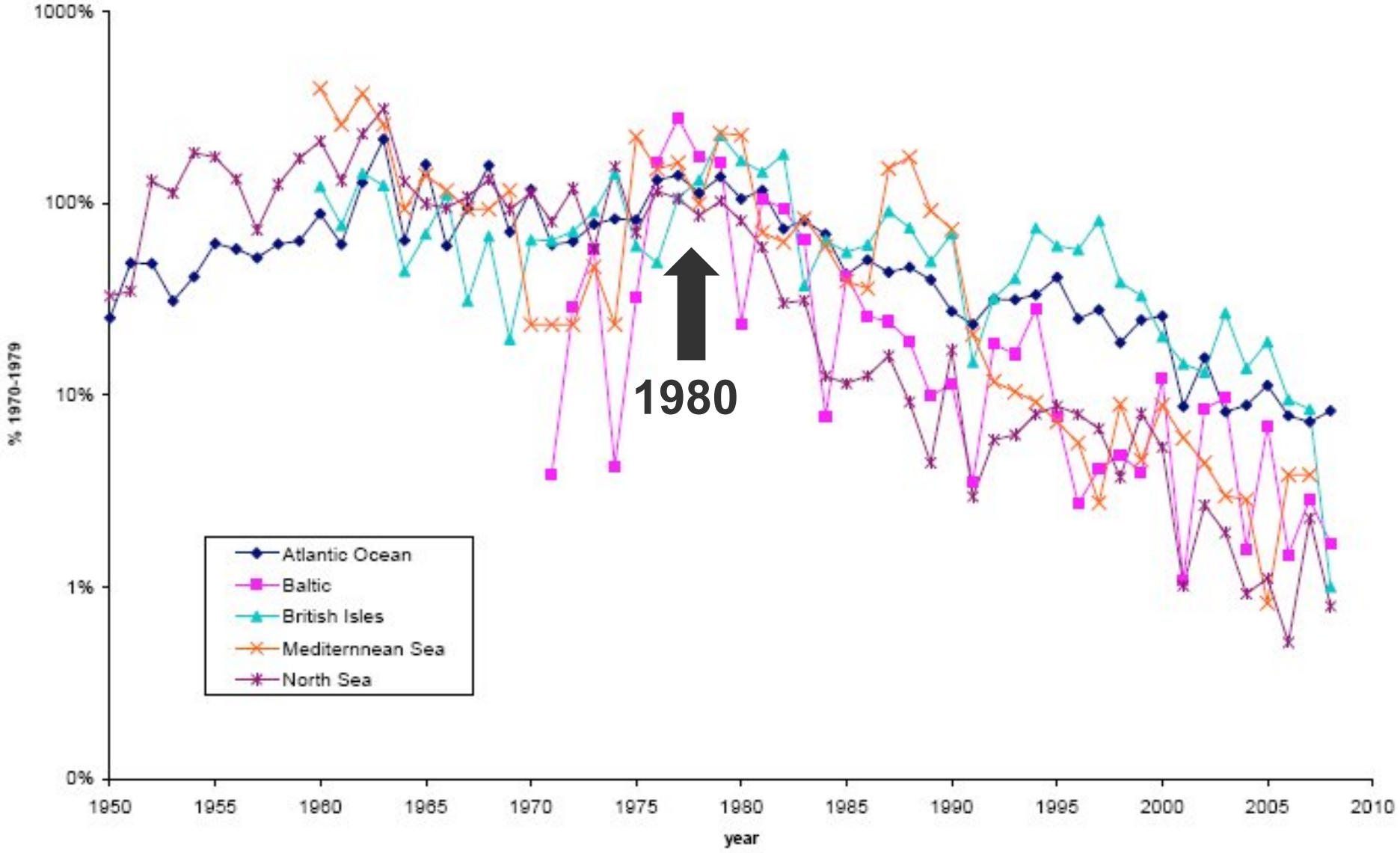
Soortidentificatie

1900 **morfometrische merkers**
> aantal wervels



1970 **allozymatische merkers**
> moleculaire merker op proteïneniveau

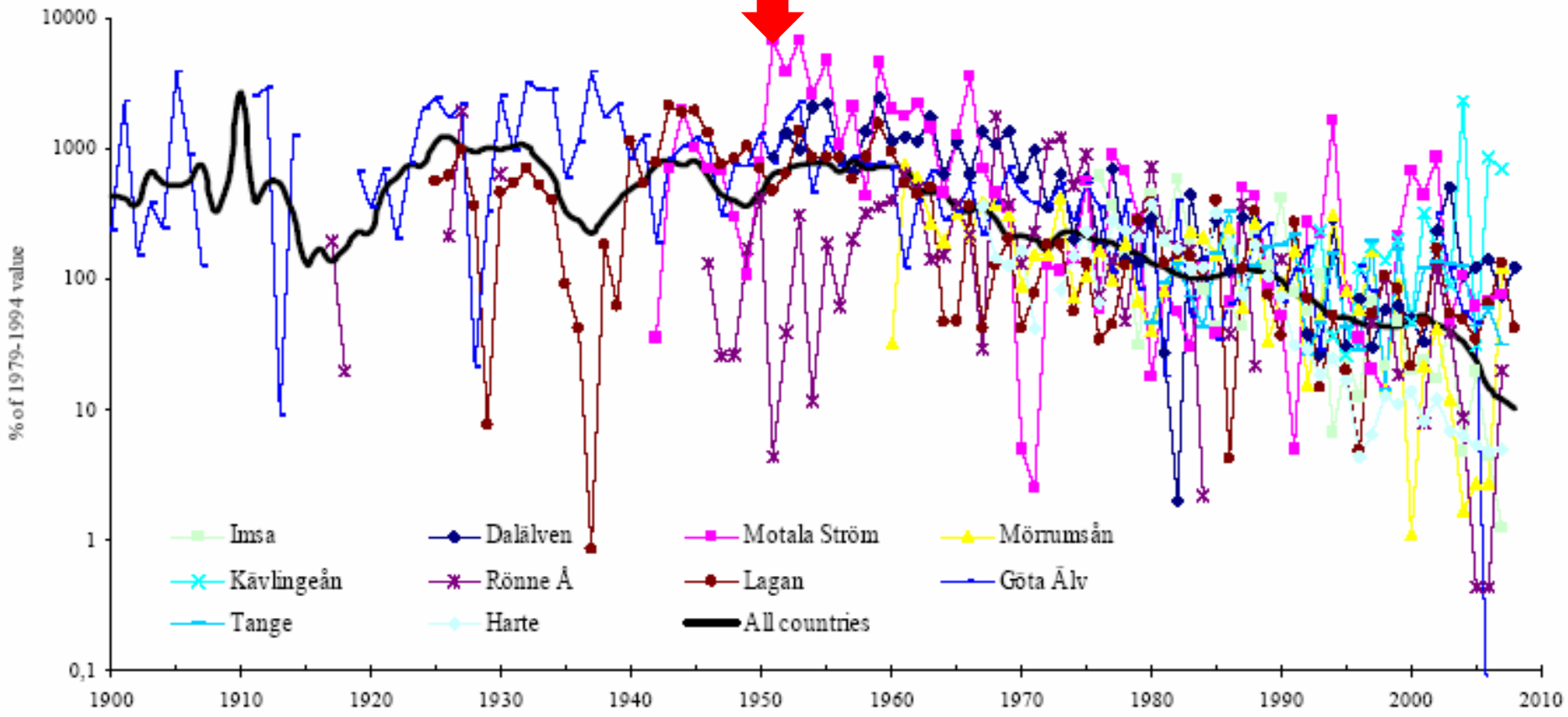
Huidige stockstatus: glasaalrecrutering



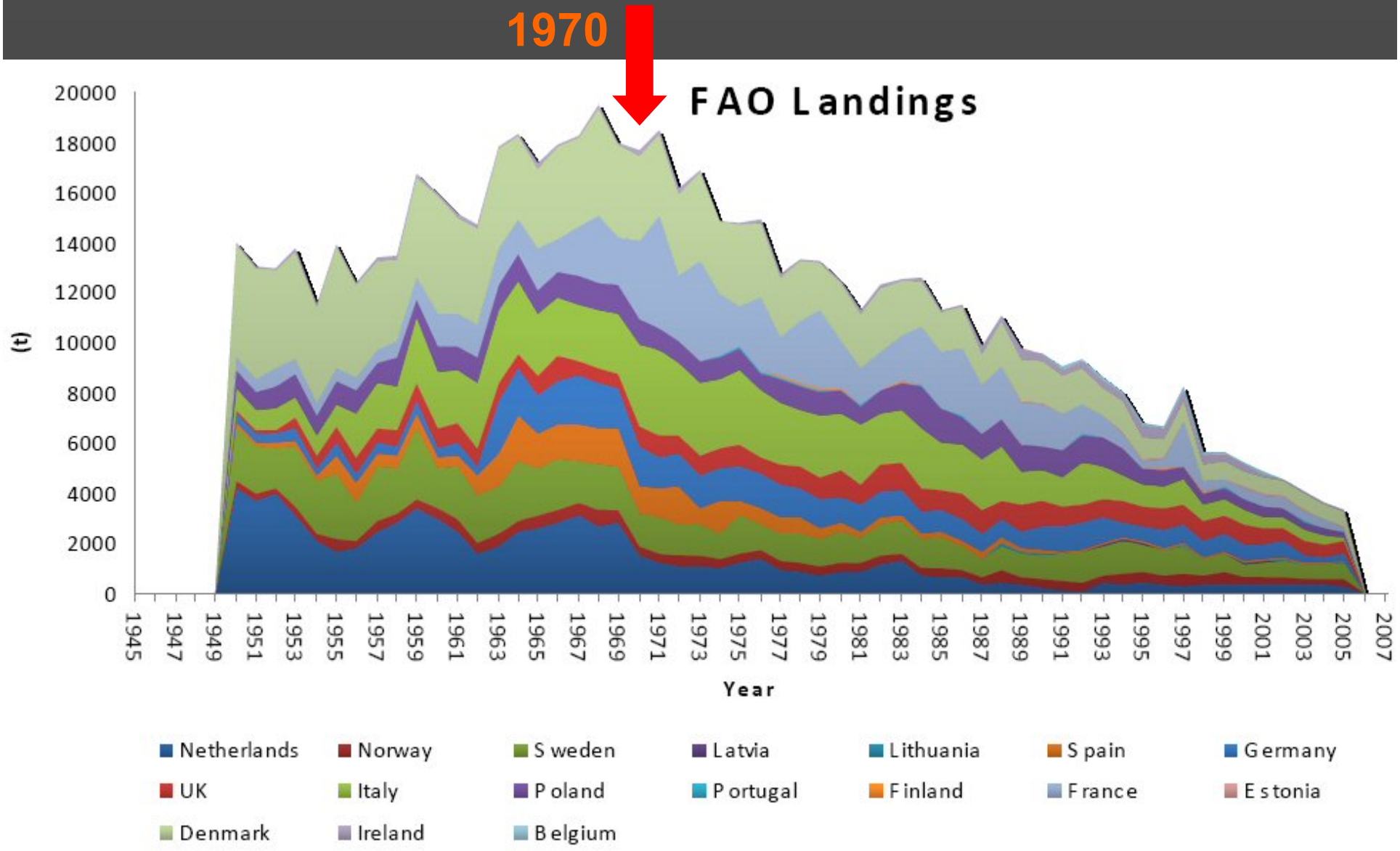
Den Oever (NL)
1958

Continentale populatie

1950



Palingvangsten



Oorzaken achteruitgang?

Oceanische factoren

klimaat

stromingspatronen

Continentale factoren

visserij

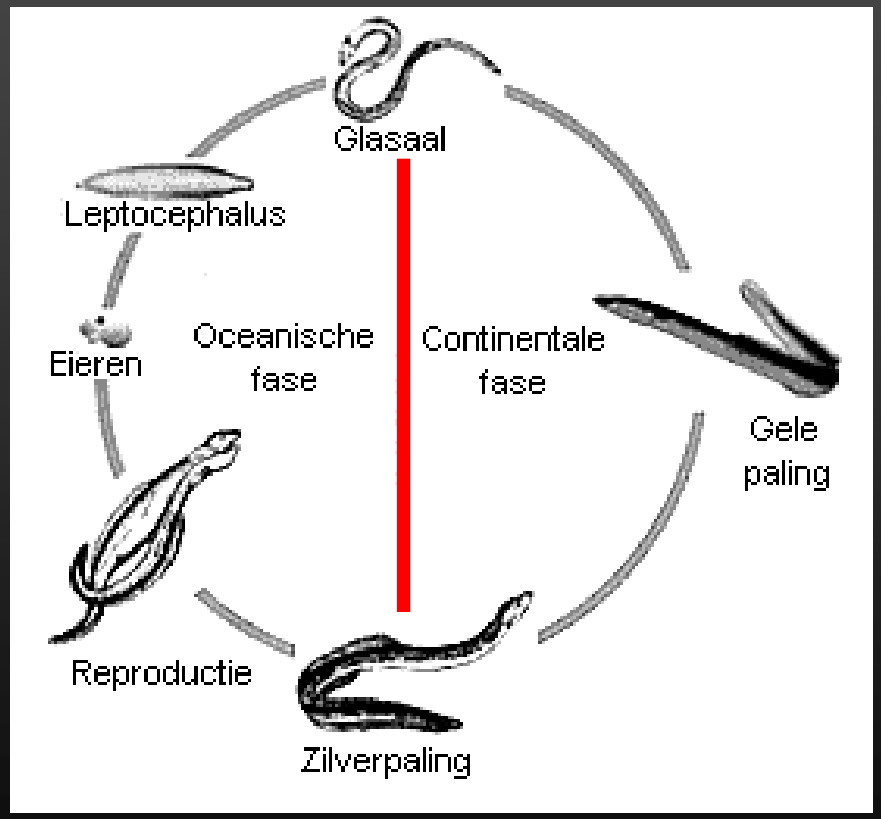
vervuiling

parasieten en virussen

habitatdestructie

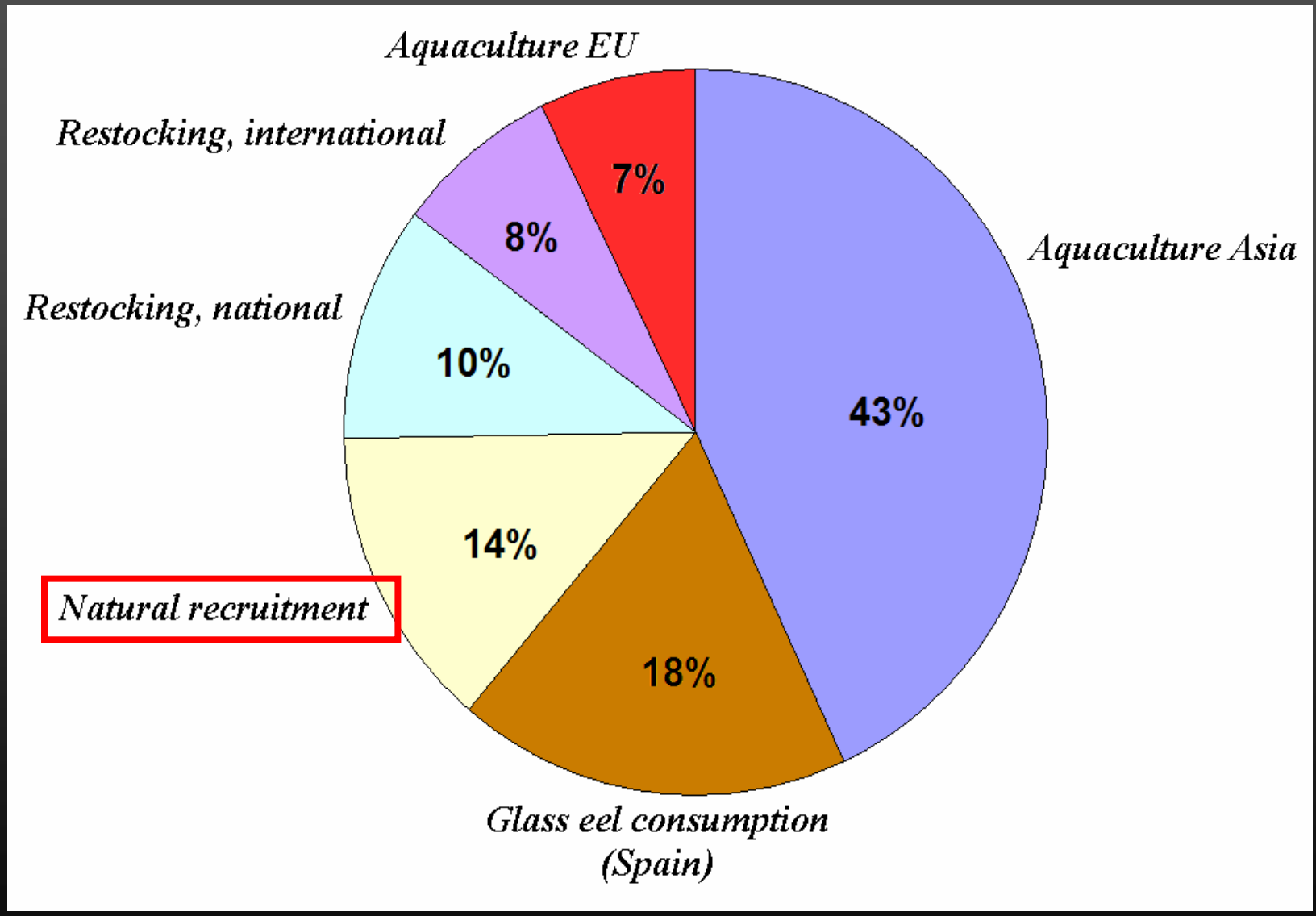
pompgemalen en

waterkrachtcentrales

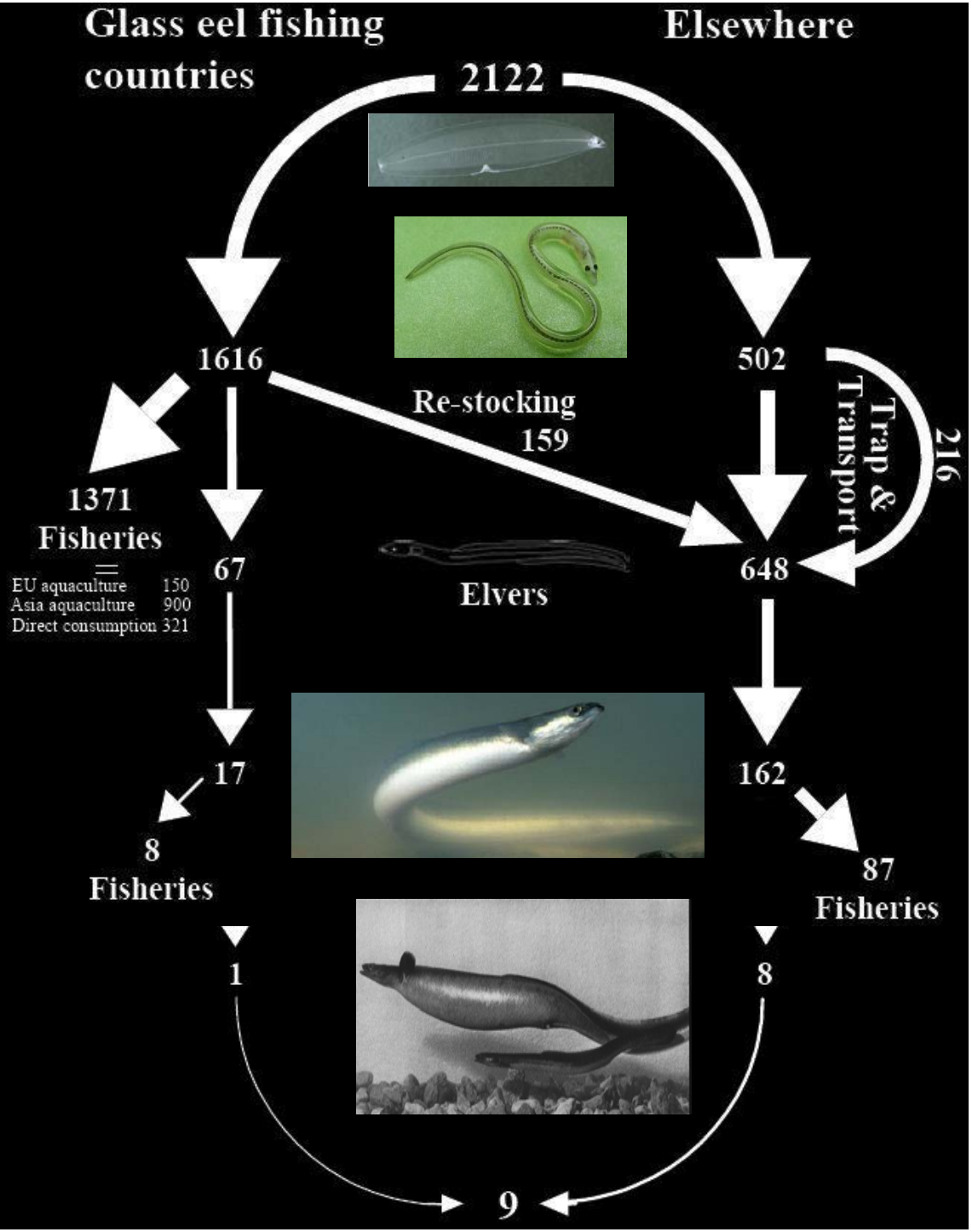


Visserij

Bestemming glasalen



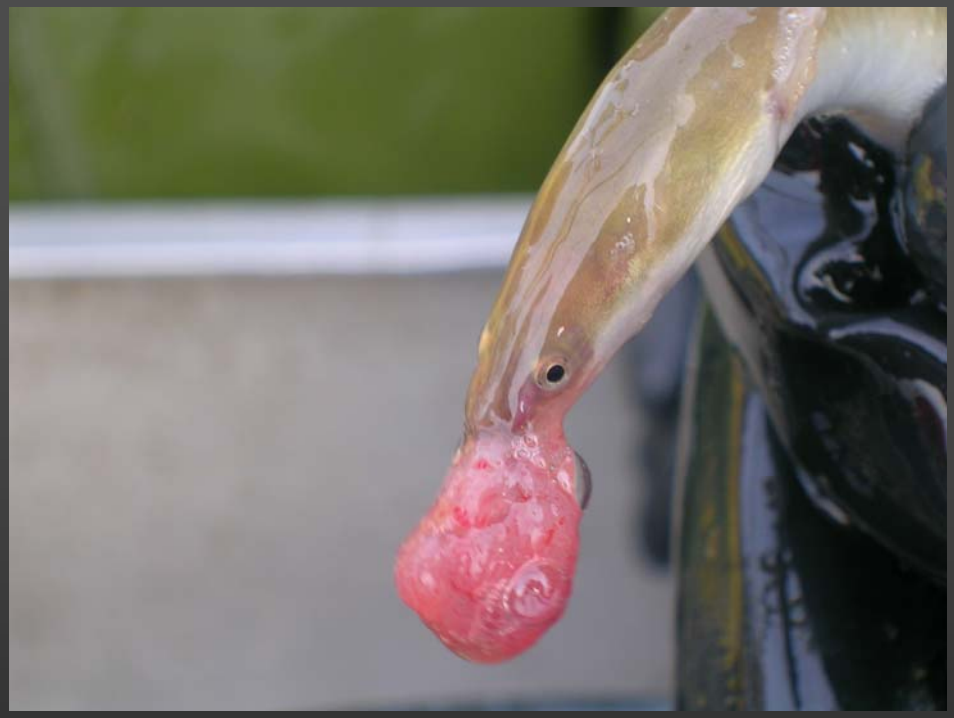
Visserijmortaliteit



Virale ziekten

EVEX

bloemkoolziekte

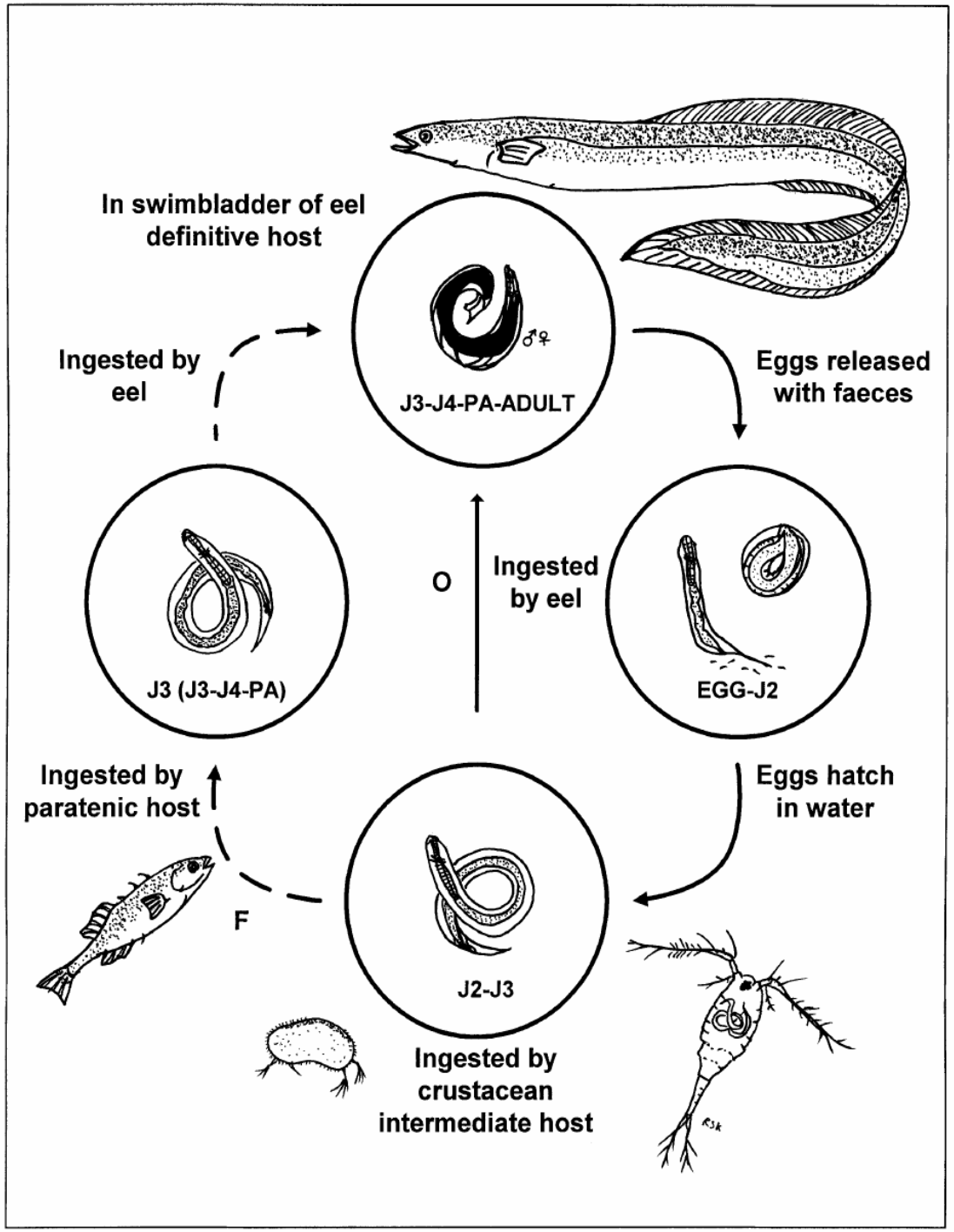


Bacteriële ziekten

vb. roodziekte

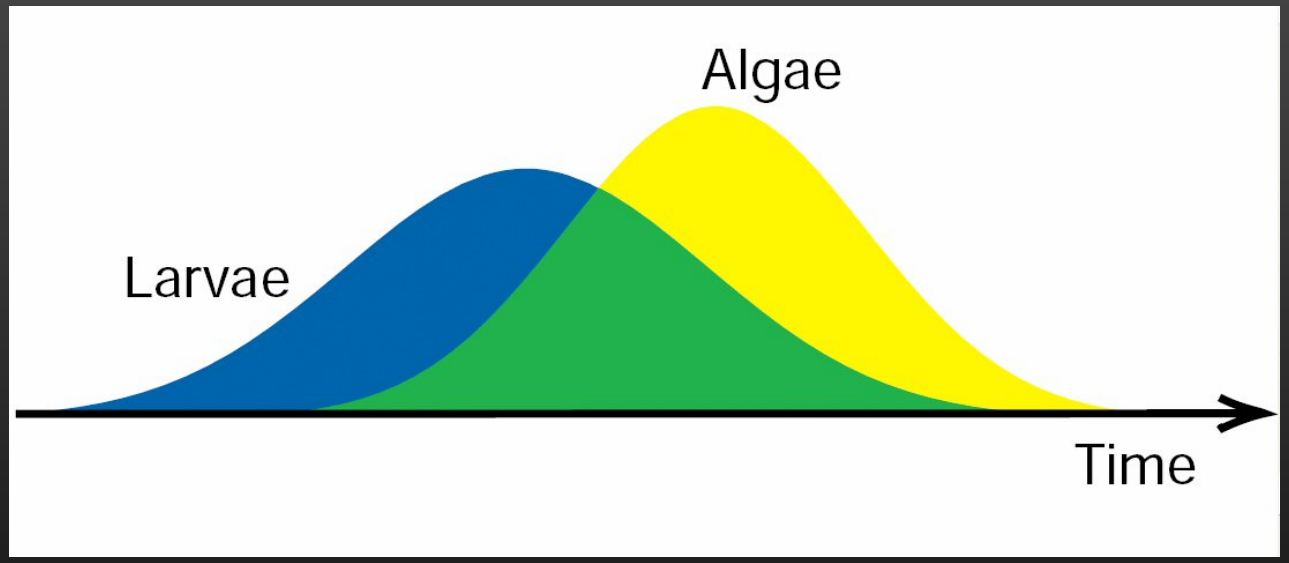
Parasieten

vb. *Anguillicola crassus*


In swimbladder of eel
definitive host
J3-J4-PA-ADULT
Ingested by
eel
Eggs released
with faeces
J3 (J3-J4-PA)
O
Ingested
by eel
EGG-J2
Ingested by
paratenic host
Eggs hatch
in water
F
J2-J3
Ingested by
crustacean
intermediate host

Klimaat

> groot aantal eitjes
> uitwendige bevruchting
> eenmalige voortplanting

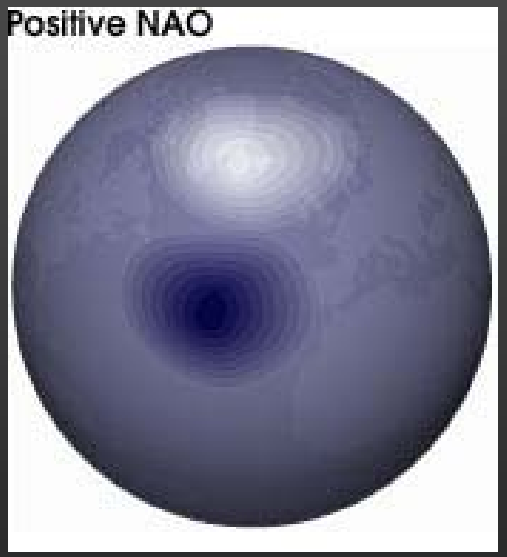


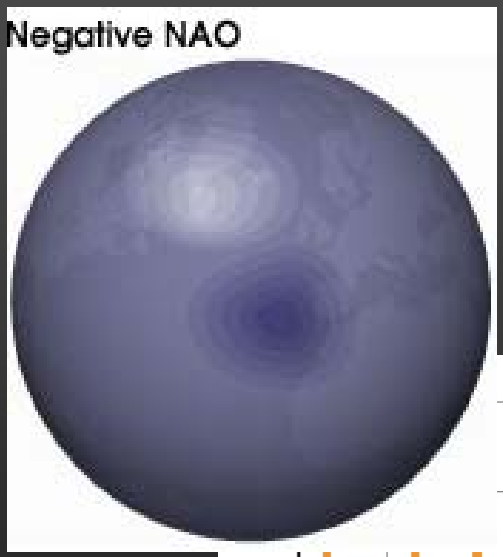
> grote variatie in voortplantingsucces

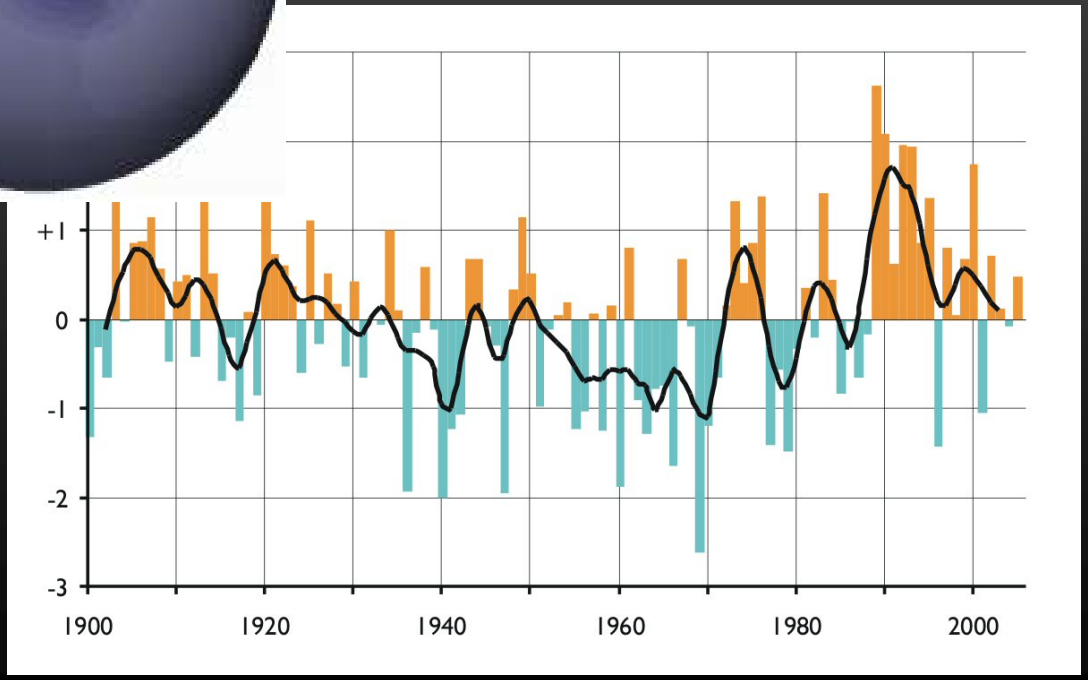
> sterke invloed van natuurlijke selectie tijdens vroeg stadium

NAO index

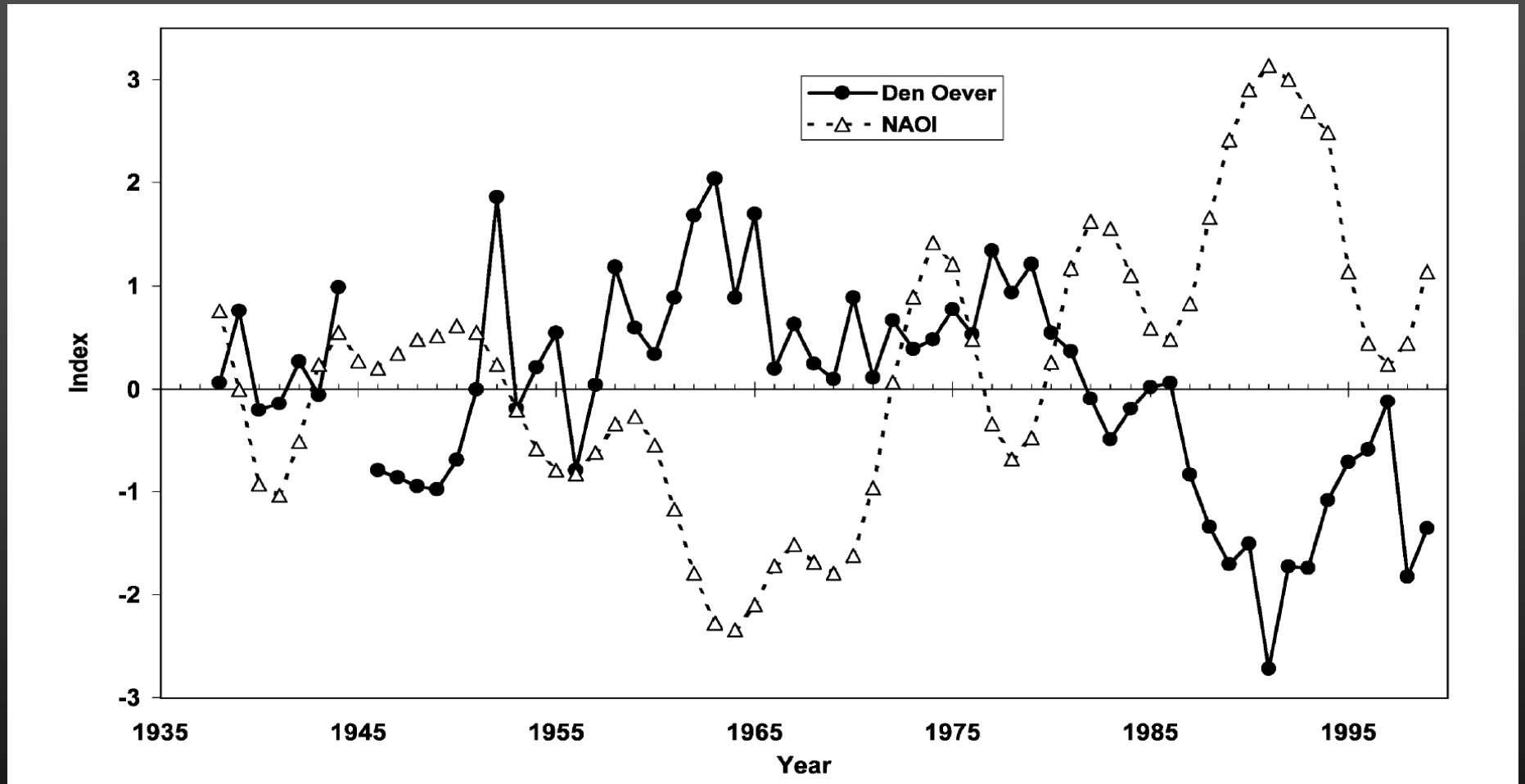
Noord-Atlantische Oscillatie

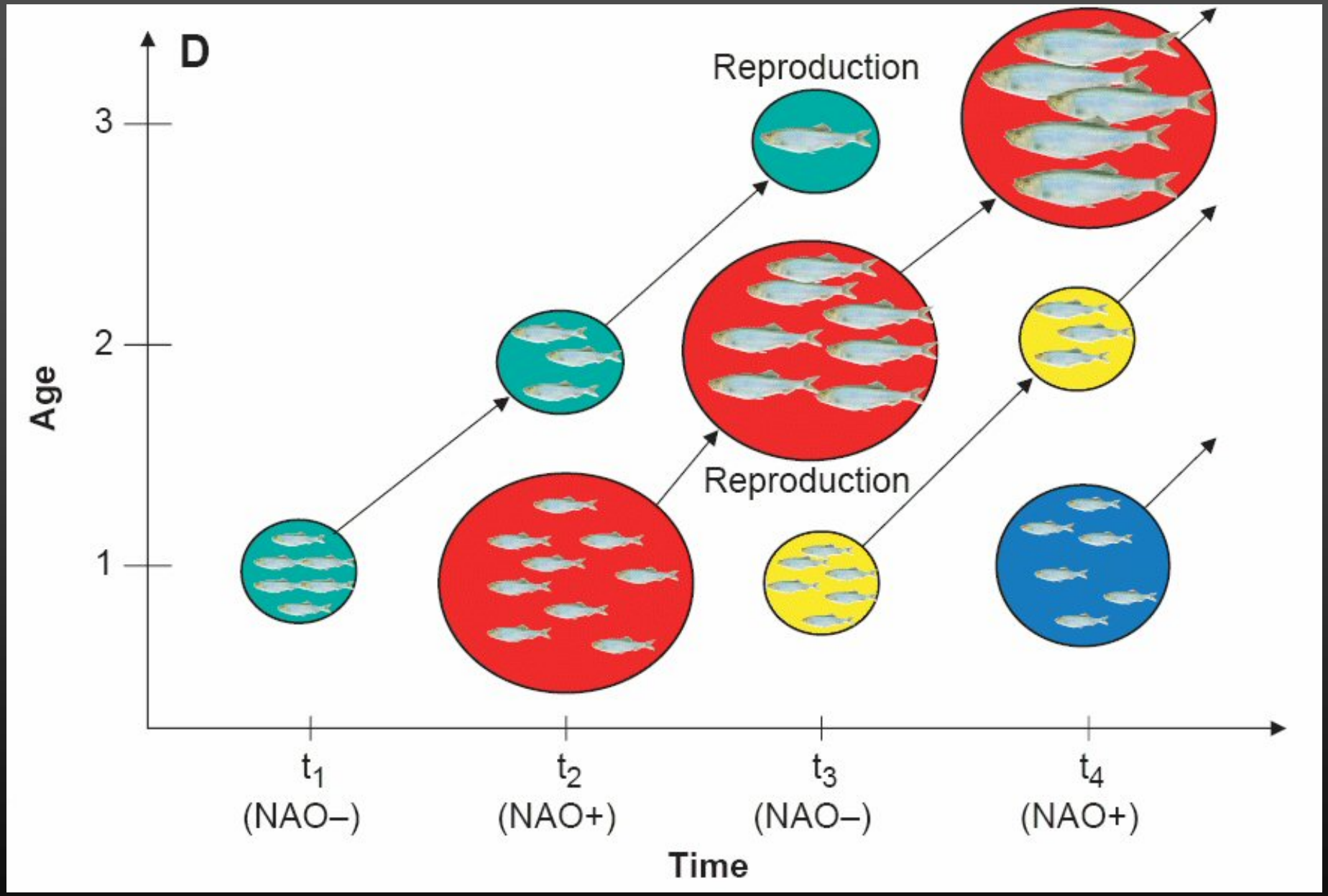






Den Oever Recruterings Index


Den Oever
NAOI
Index
Year
3
2
1
0
-1
-2
-3
1935
1945
1955
1965
1975
1985
1995


D
Reproduction
3
2
Age
Reproduction
1
t_1
(NAO–)
t_2
(NAO+)
t_3
(NAO–)
t_4
(NAO+)
Time

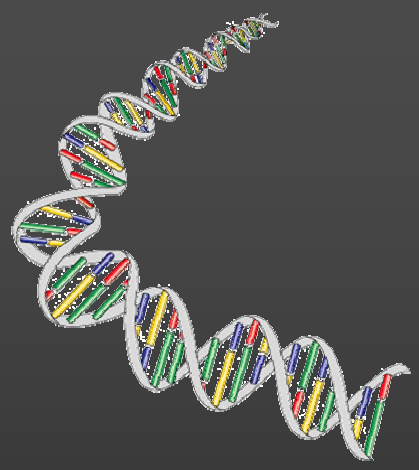
Beheer van de paling

- **Verleden**
  lokaal, versnipperd beheer
  vanuit economisch standpunt

- **1998**
  ICES adviseert herstelplan aan EU

- **2007**
  Appendix II CITES lijst van bedreigde soorten
  Europees stock herstelplan
  > migratie van 40% adulte stock nastreven

Populatie-genetisch onderzoek



> grote genetische diversiteit

variatie van genetisch materiaal in en tussen groepen van individuen

Weinig Vlaams-Waalse huwelijken

De Standaard Woensdag 7 december 2005

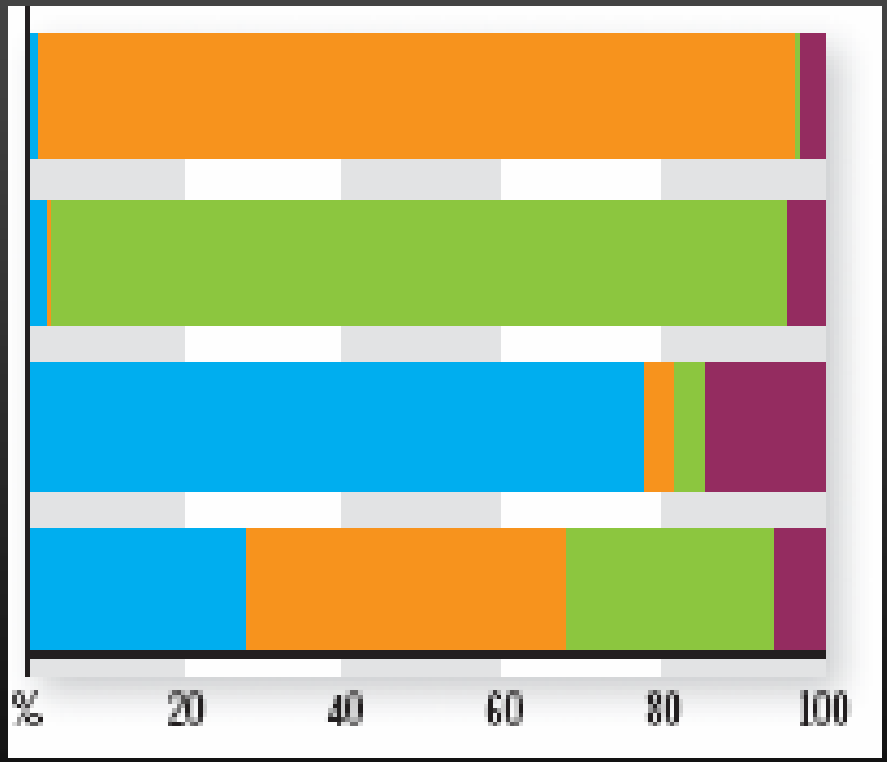
Wie trouwt er met een …

Vlaamse ♀

Waalse ♀

Brusselse ♀

Buitenlandse ♀



Vlaamse ♂ **Waalse ♂** **Brusselse ♂** **Buit. ♂**

Het belang van genetische diversiteit

populatie

- vermijden van inteelt
- fitness

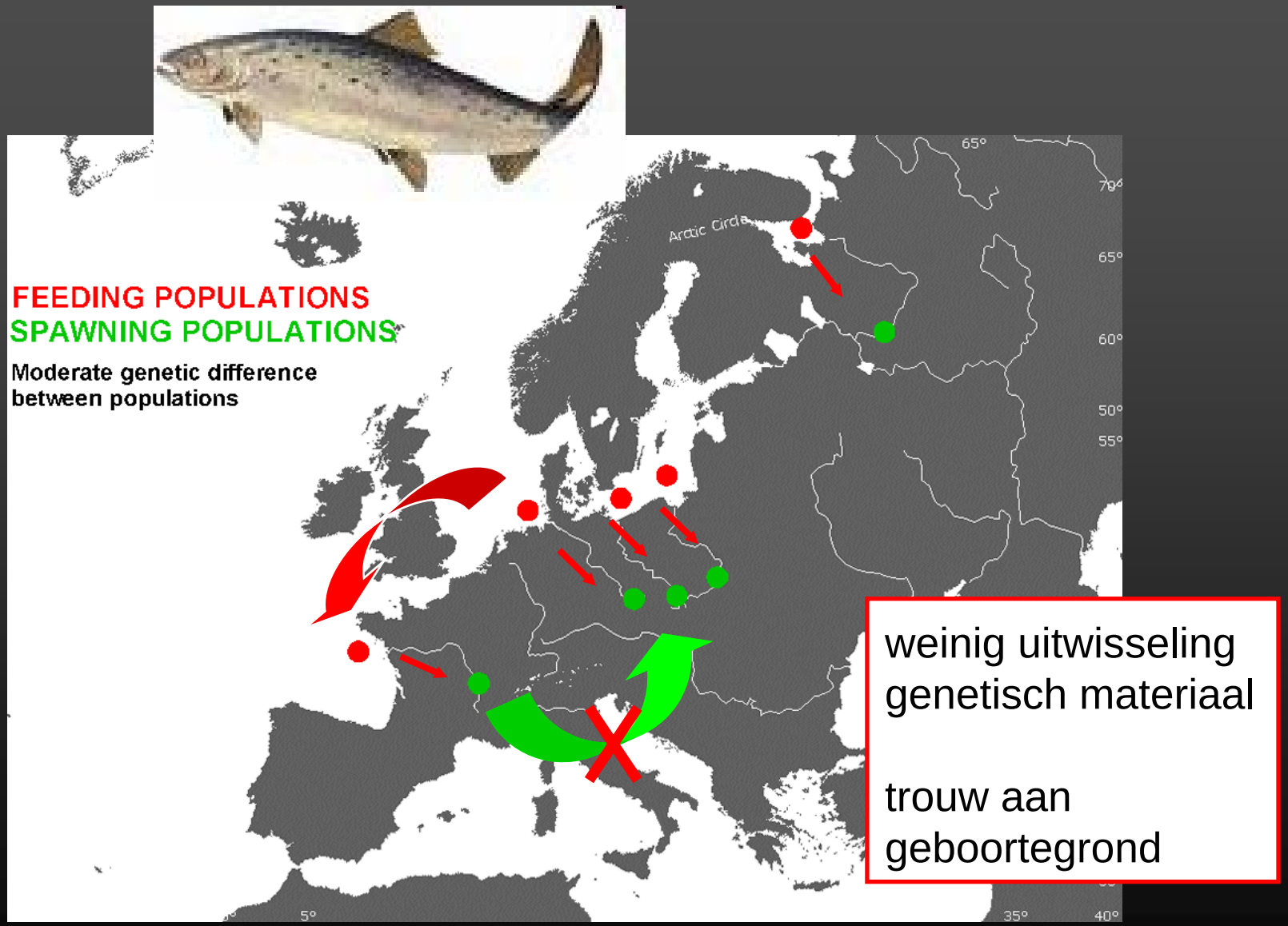
soort

- aanpassing aan veranderende condities
  (klimaat, visserij, competitie, predatie, parasitisme, ...)

Zoetwater

geen uitwisseling
genetisch materiaal

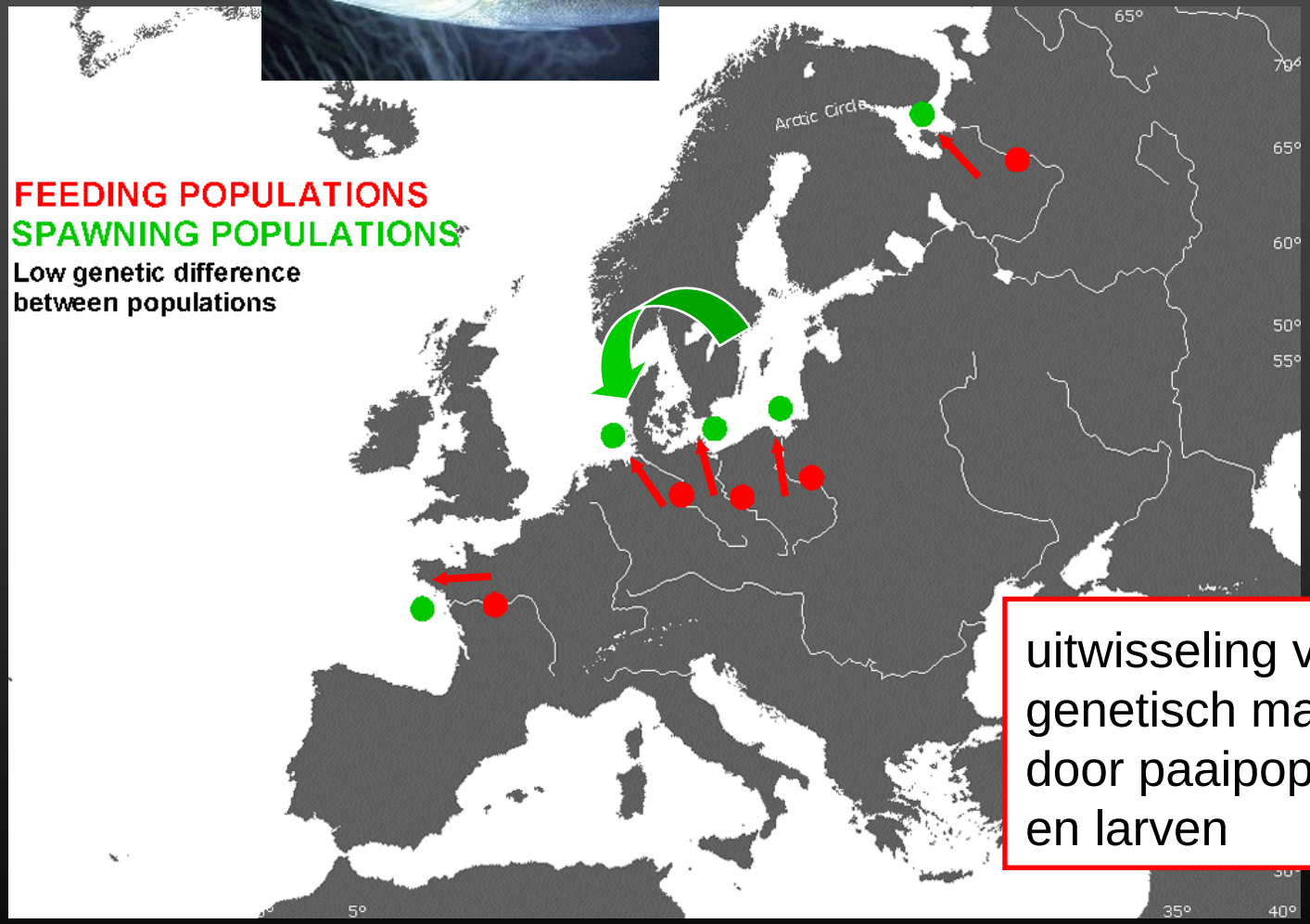
Anadromie



weinig uitwisseling genetisch materiaal

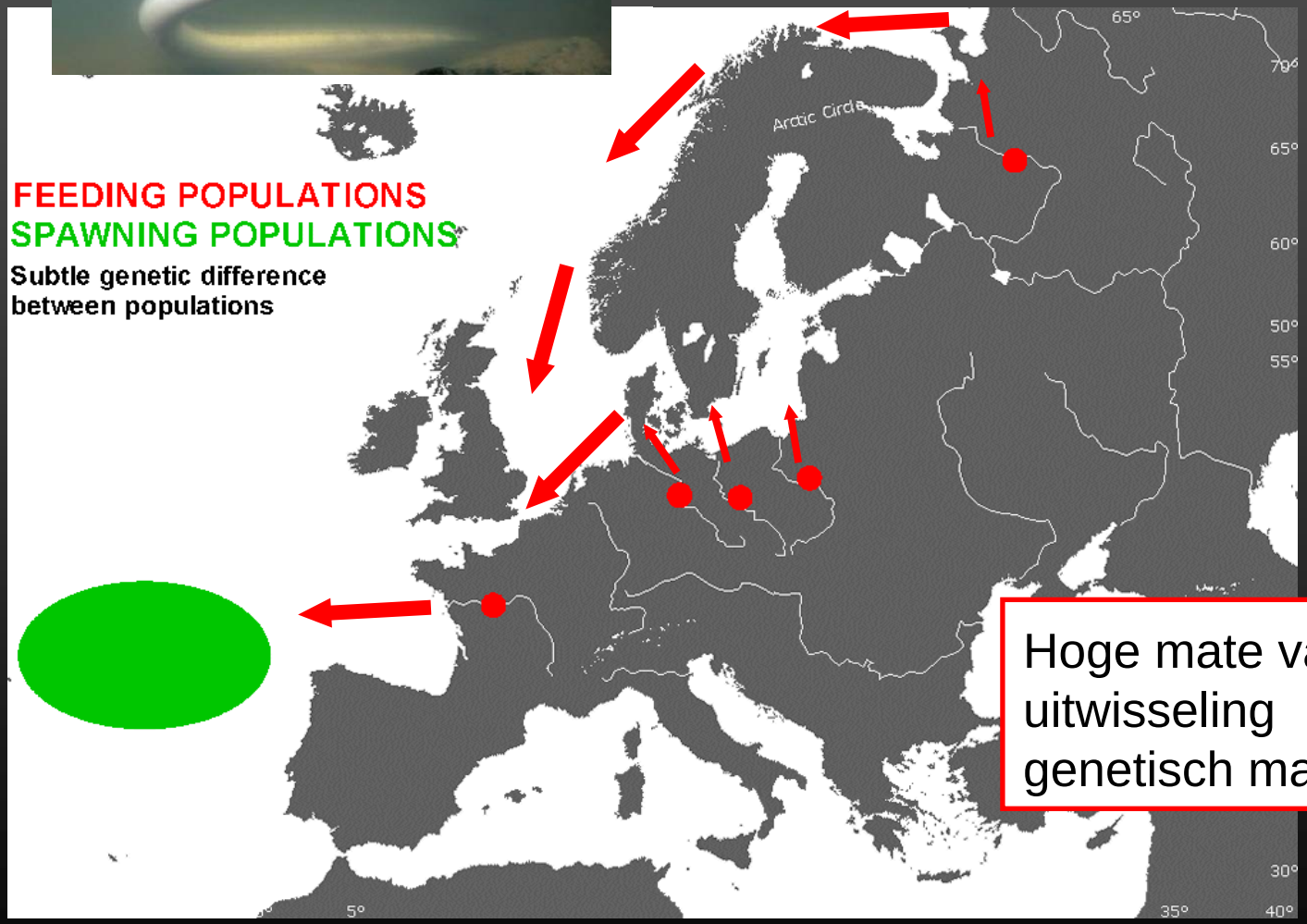
trouw aan geboortegrond

Katadromie



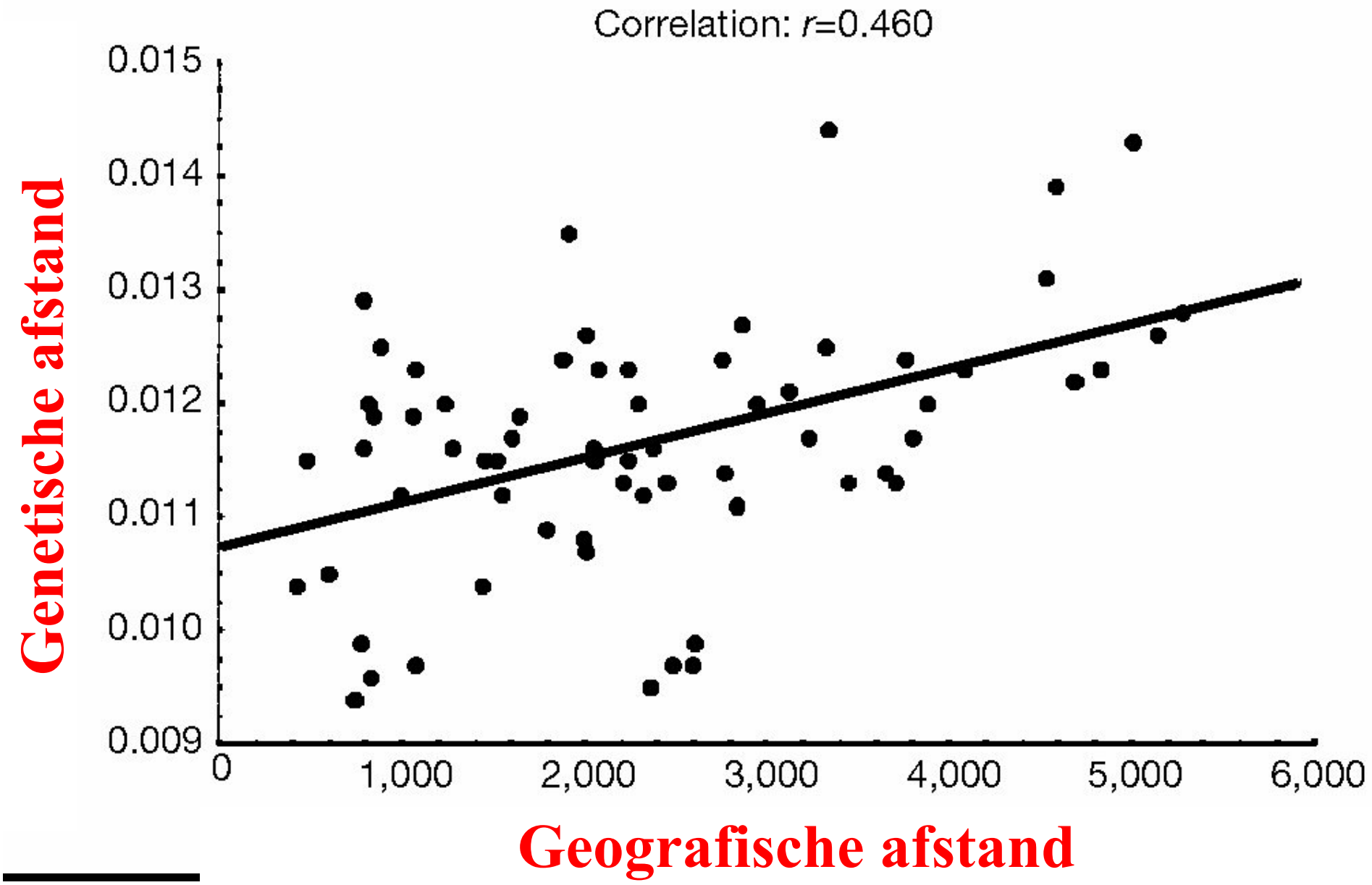
uitwisseling van genetisch materiaal door paaipopulaties en larven

Katadrome paling

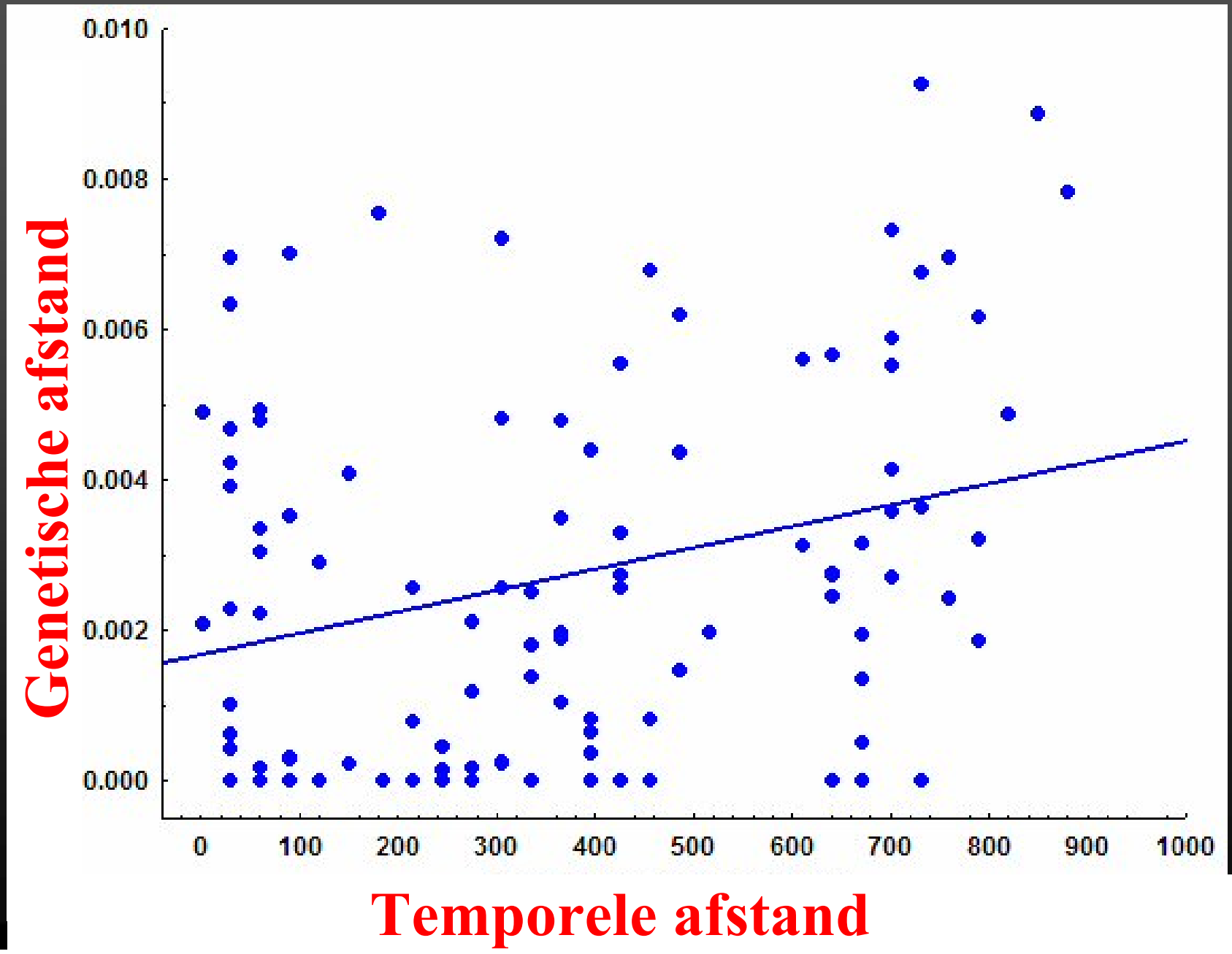


Hoge mate van uitwisseling genetisch materiaal

Genetische isolatie door afstand



Genetische isolatie door tijd



Huidig onderzoek

Structuur, grootte en kwaliteit van de paaipopulatie

- Sargasso Zee
- glasaalrecrutering
- kwaliteit paaiers
- historische analyse

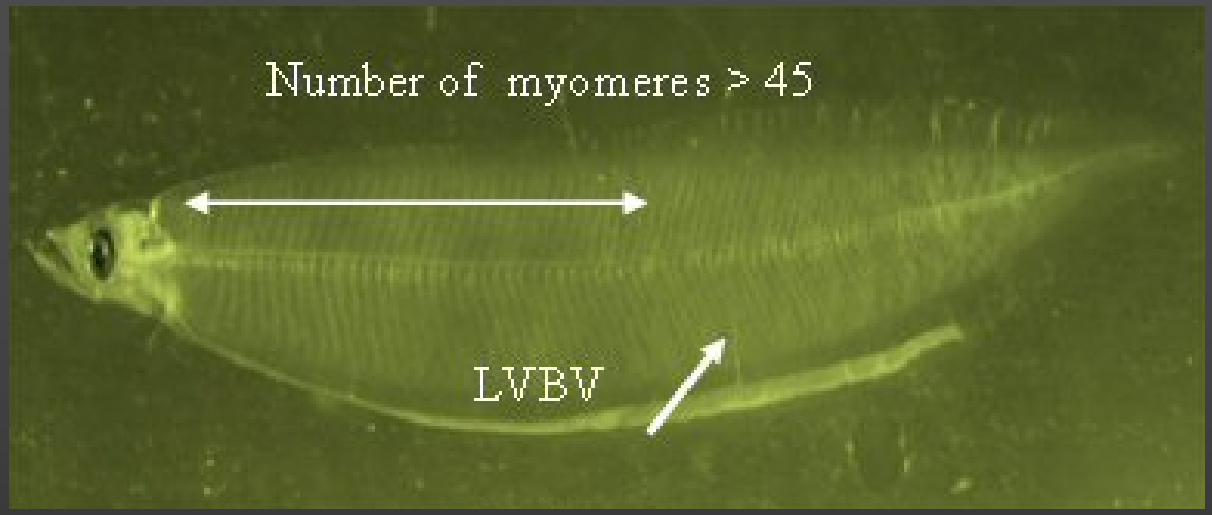
Adaptieve genetische variatie

- genetische gevolgen van overbevissing
- Functionele verschillen tussen populaties

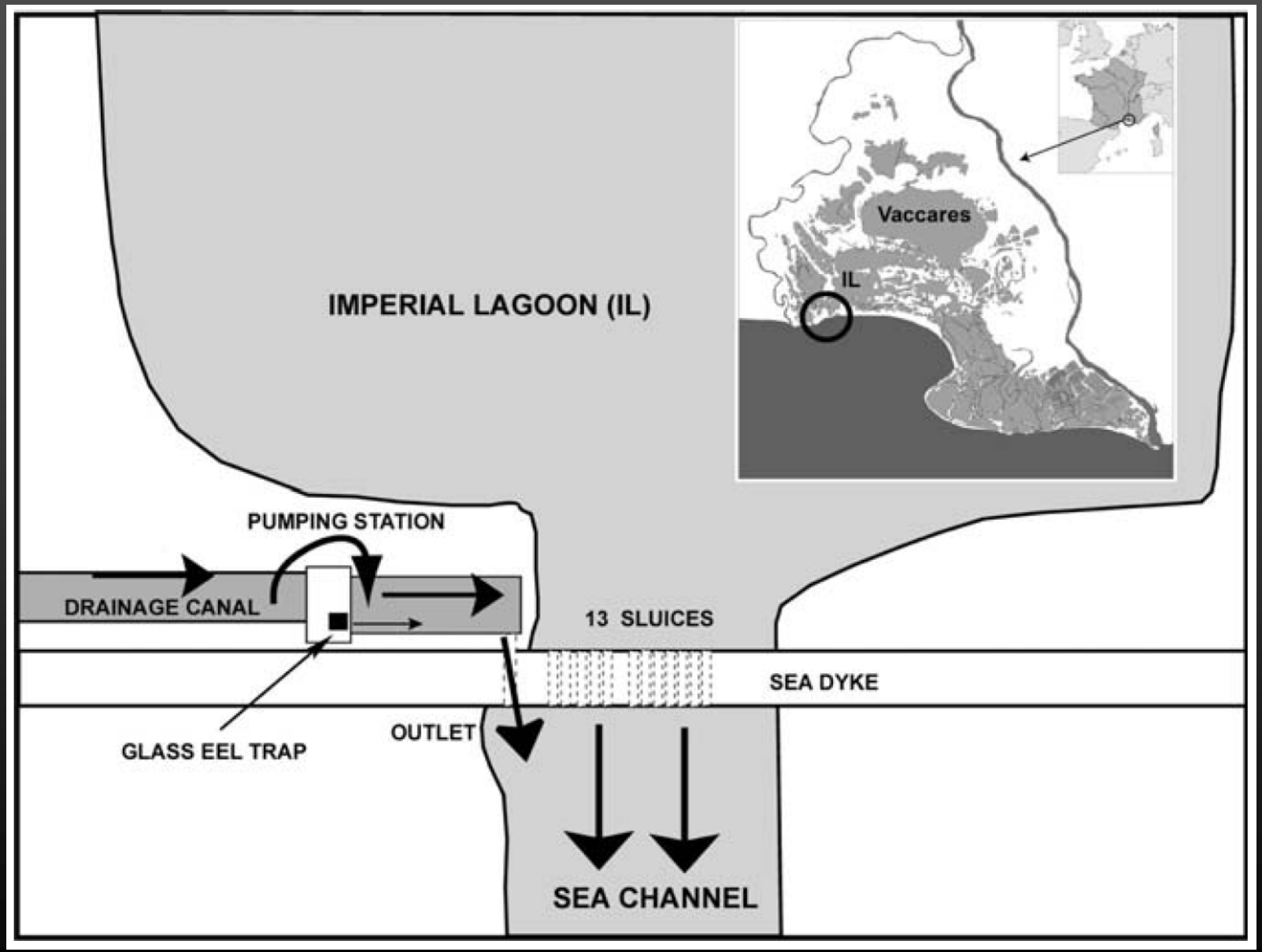
Artificiële reproductie en aquacultuur

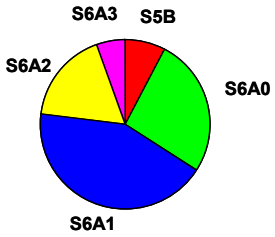
Staalname Sargasso Zee - Galathea 3

Morfologische identificatie

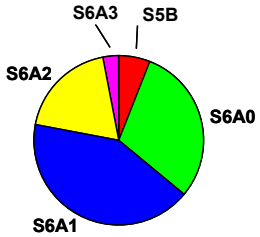


Monitoring van glasaalrecrutering





Month: Jan04



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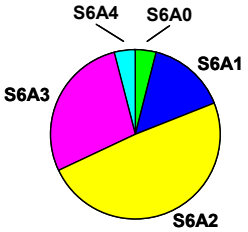

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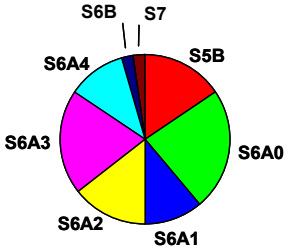

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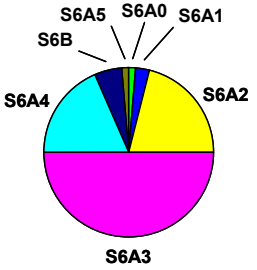

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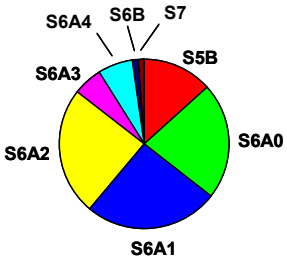

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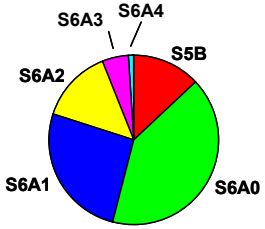

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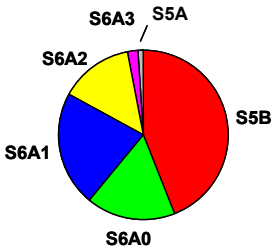

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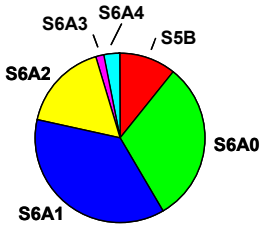
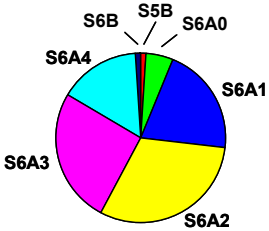
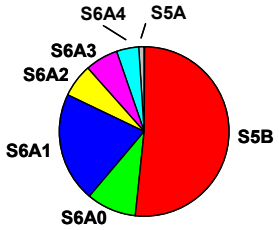


Month: Sep04



Month: Oct04



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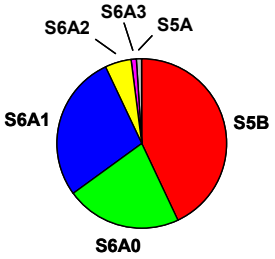
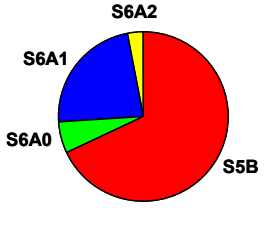
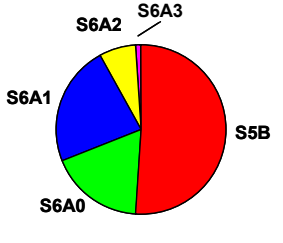


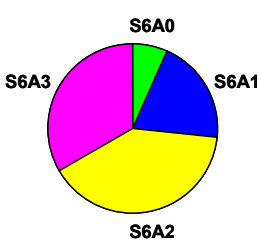
Month: Dec04



Month: Jan05



Month: Feb05



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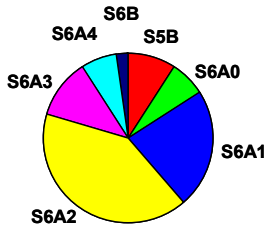

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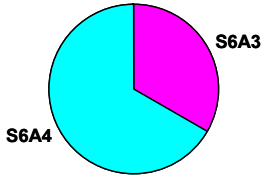

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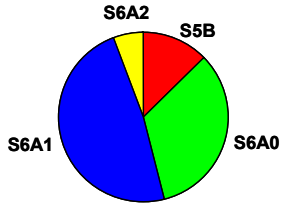
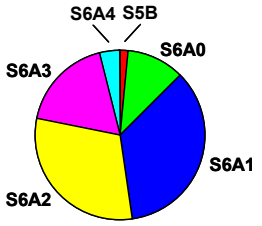
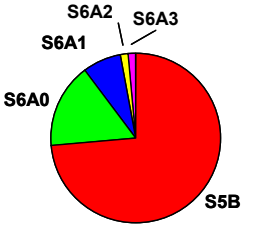


Month: Oct05



Month: Nov05



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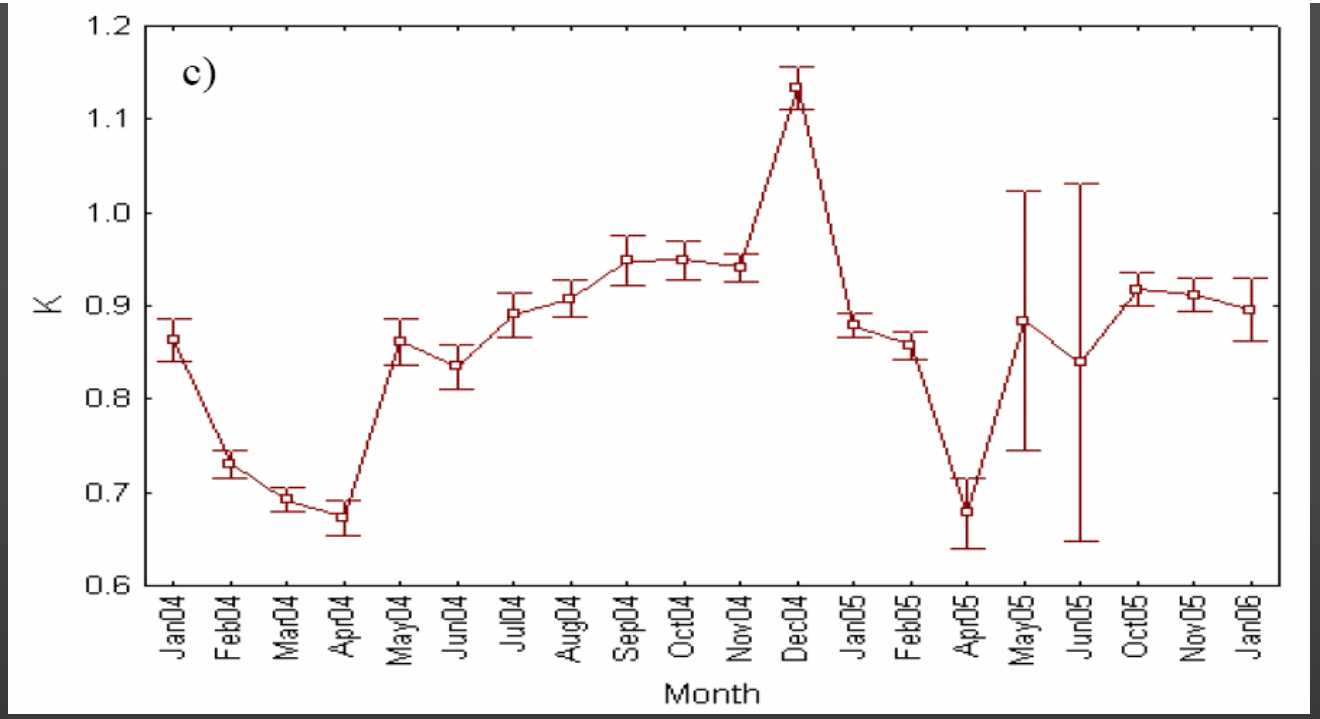
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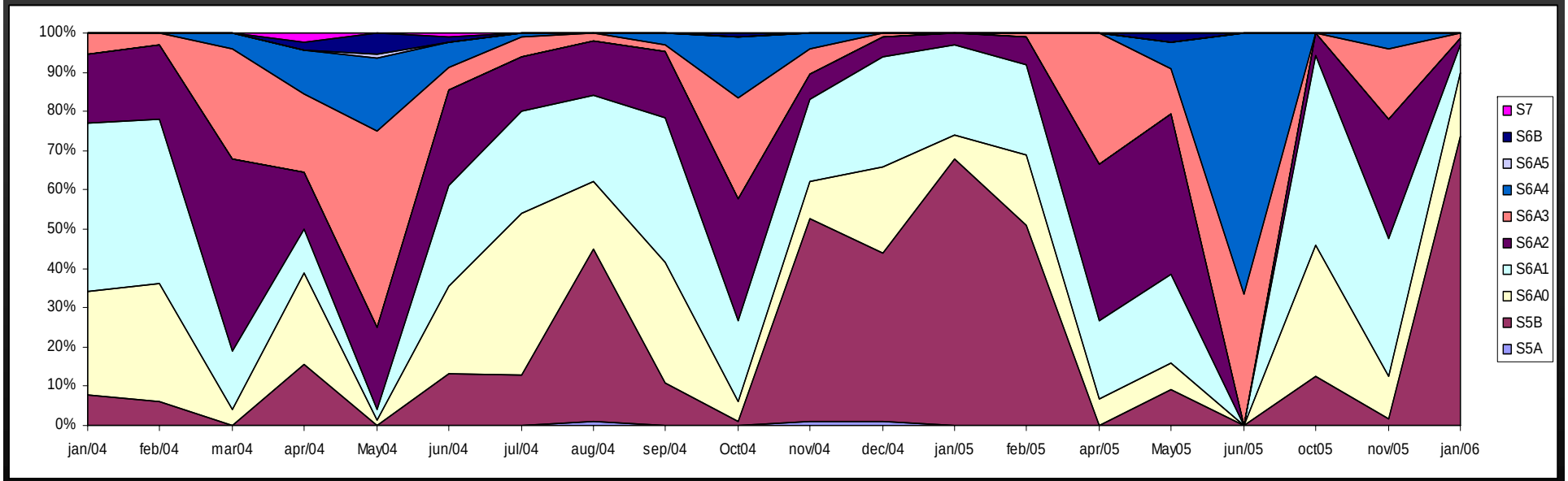
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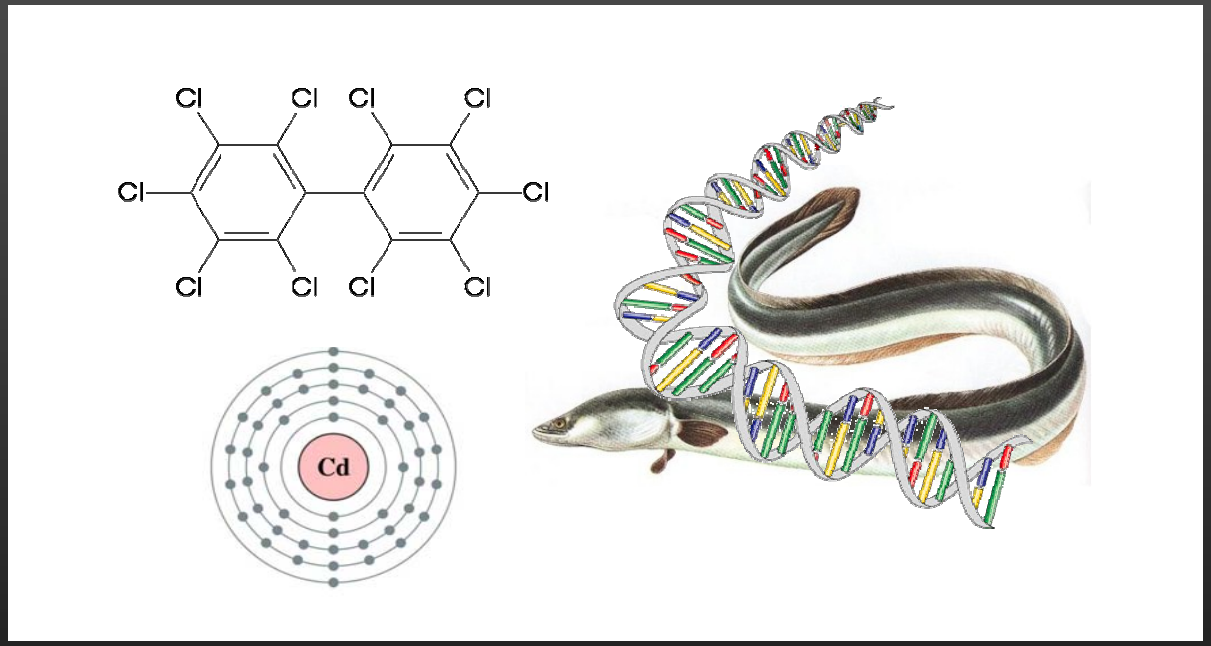
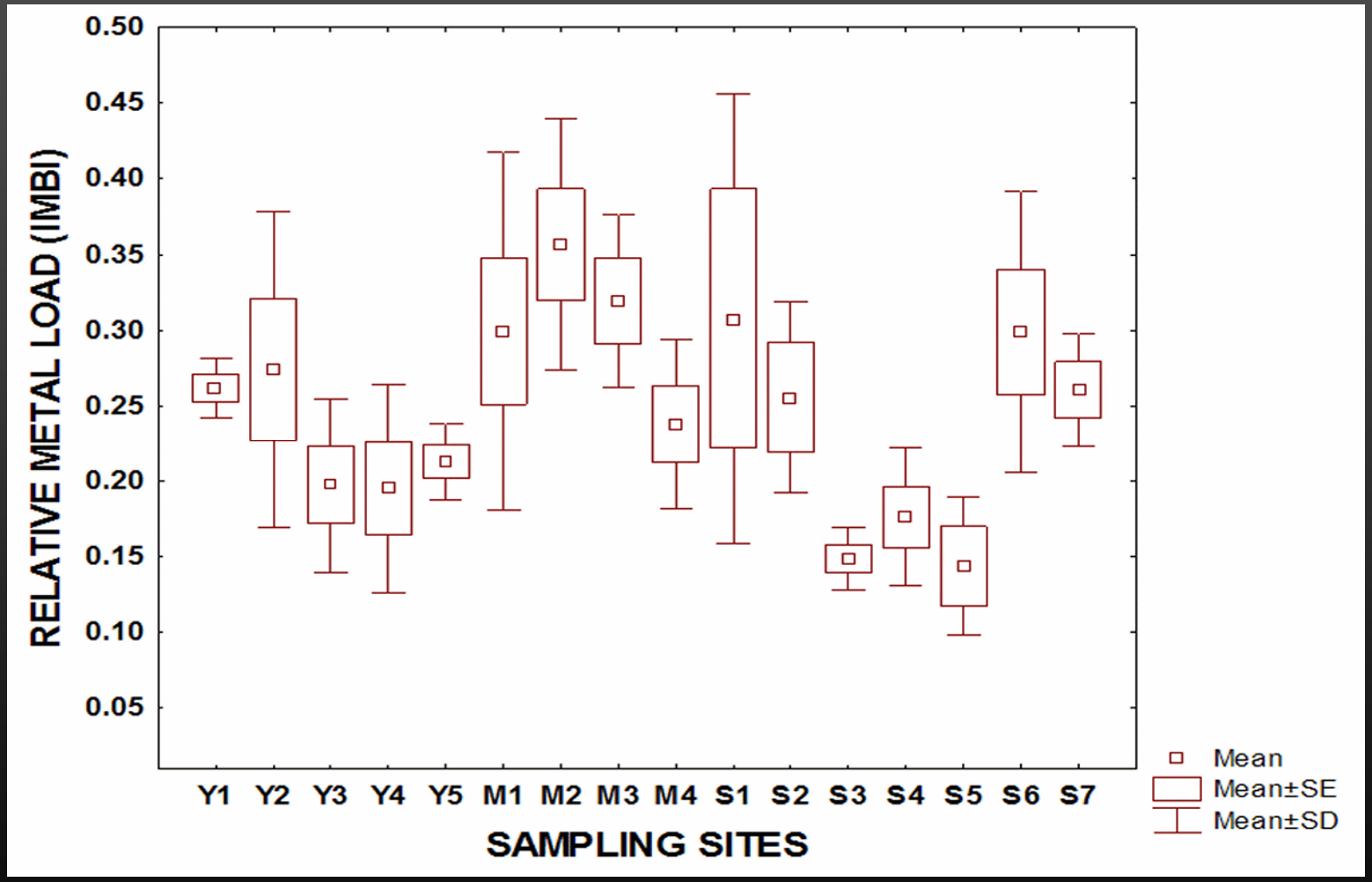
S5B
S5A

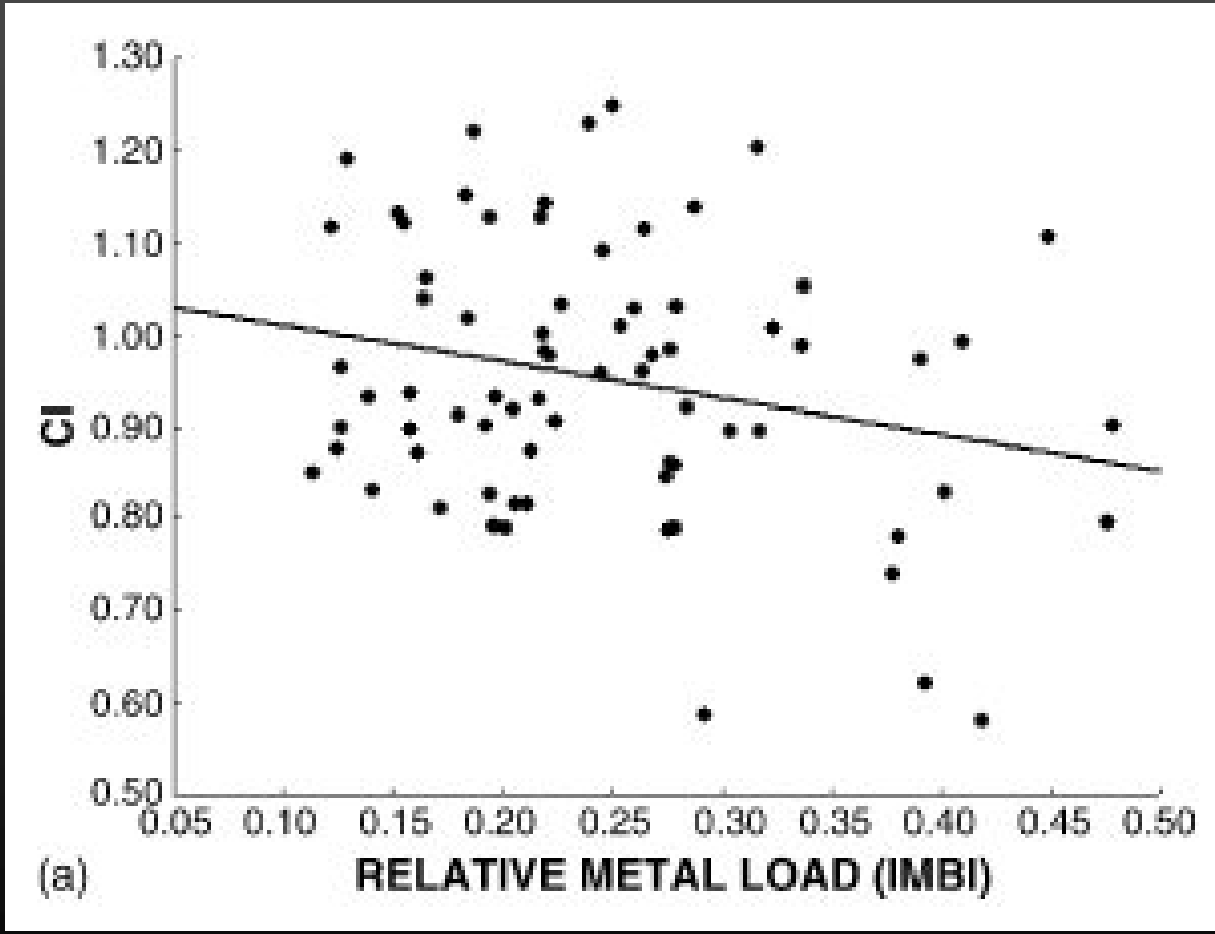
Kwaliteit van toekomstige paaiers



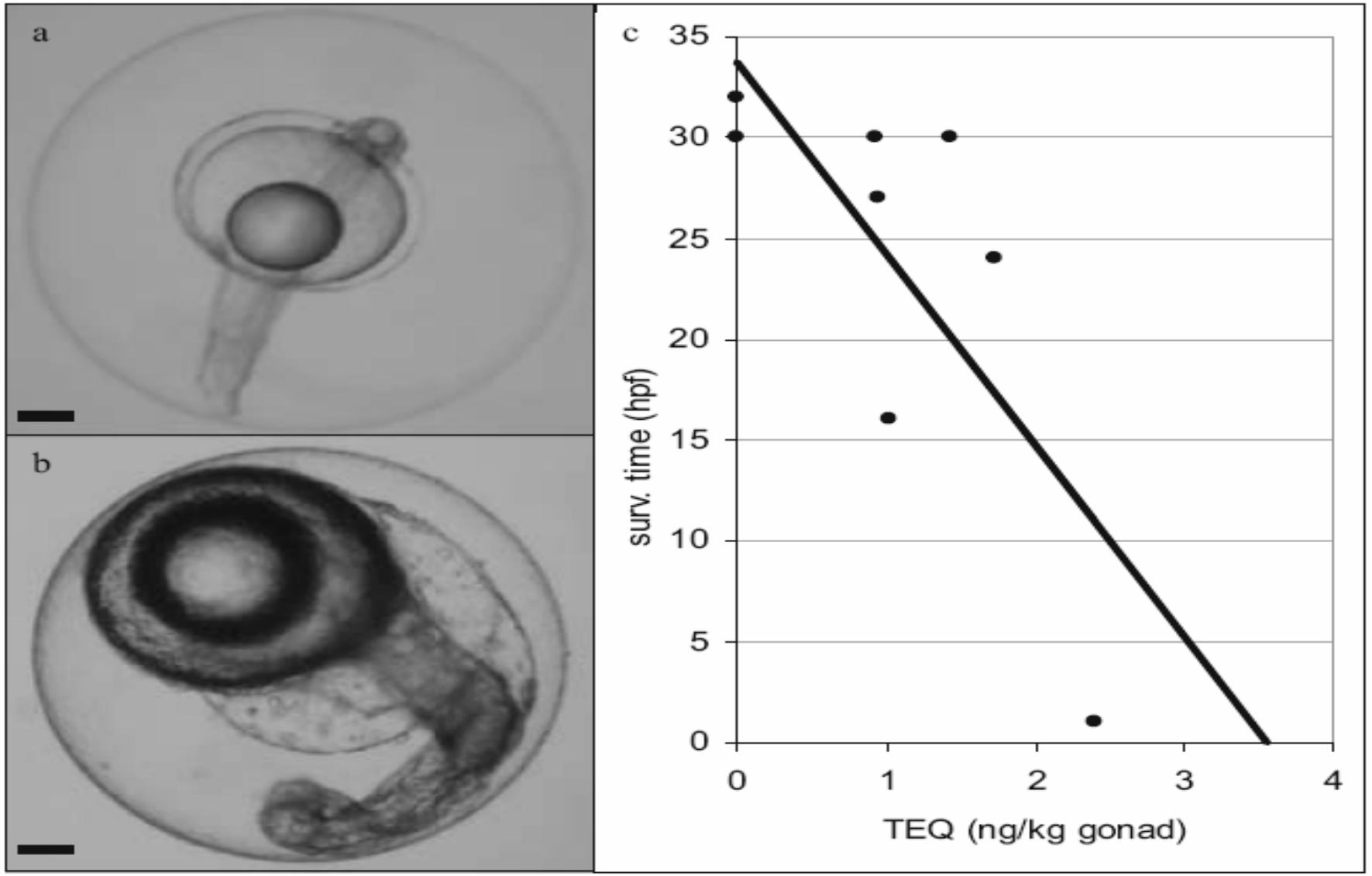
> continentale populaties zijn zwaar verontreinigd
> bioaccumulatie van PCB's, zware metalen, vlamvertragers, …



> zwemcapaciteit
> genetische diversiteit
> conditie-index
> eikwaliteit



Pollutie en larvale overleving



Palstra *et al* 2005

Ecotoxicogenomica

> respons op pollutie

expressie sleutelgenen in detoxificatie- en respiratieprocessen
Individuen met uiteenlopende vervuilingsgraden

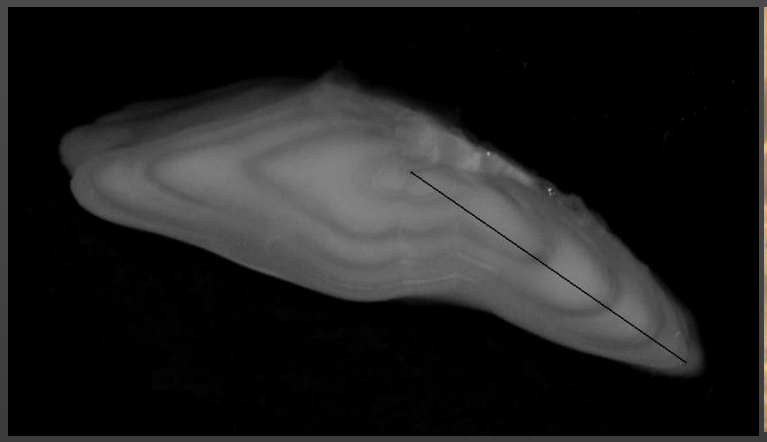
> Ontwikkeling van nieuwe biomerkers

Historische analyse

indicatie van uiterlijke veranderingen tijdens laatste decennia

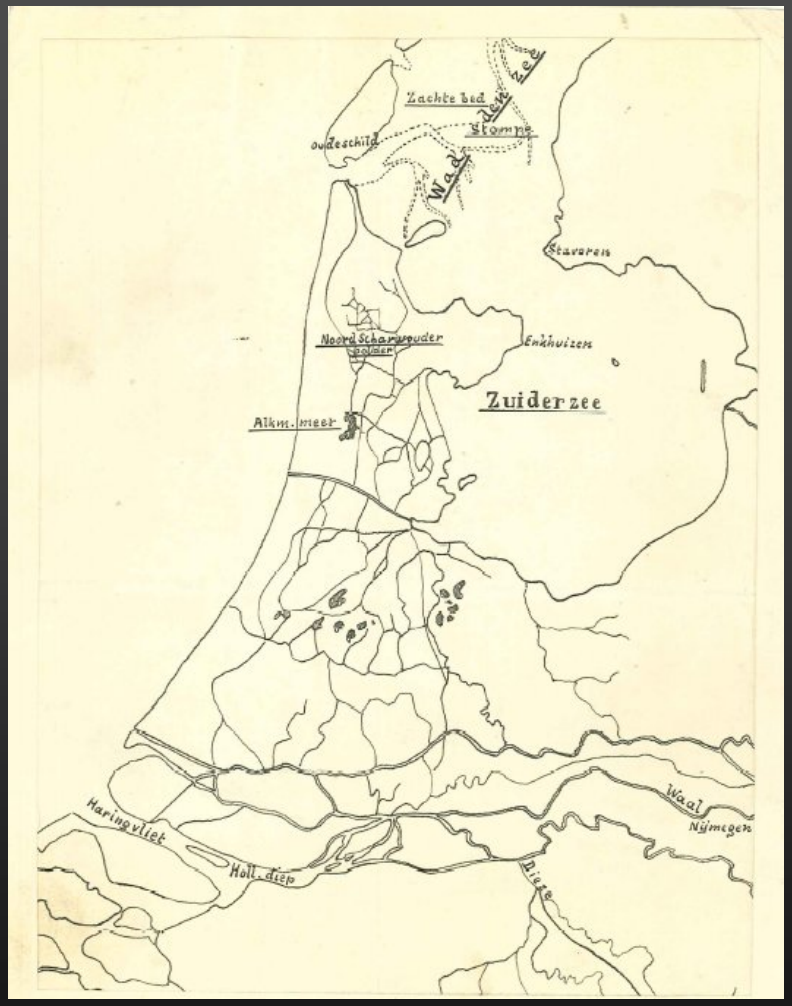
> densiteitseffect?
> milieu effect?
> evolutie van genetische basis voor groei?

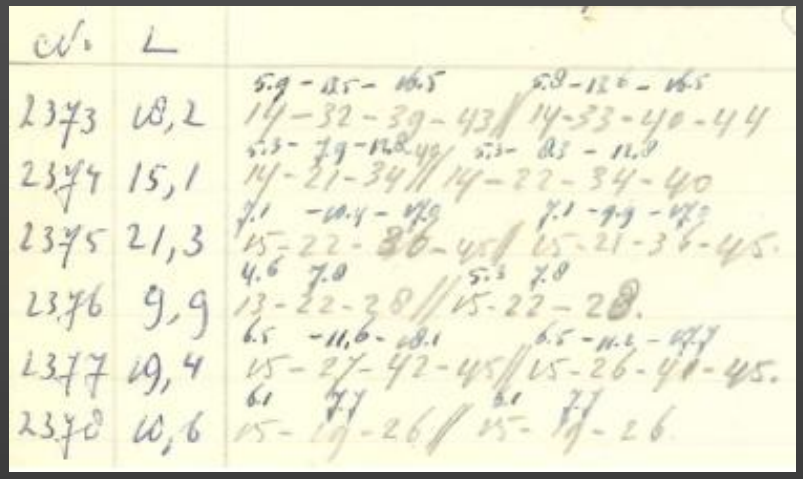
> leeftijdsanalyse van recente en historische otolietcollecties



Wat is de Invloed van visserij op uiterlijke kenmerken?
(lengte, groei, maturatie, …)

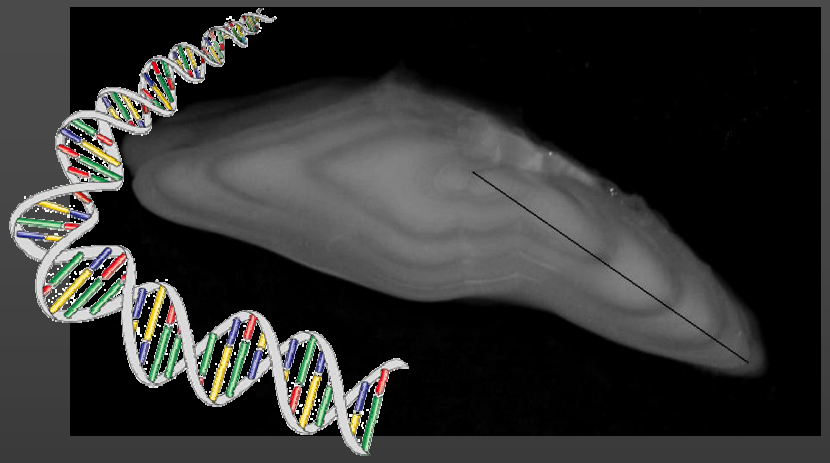
Historische otolietcollectie





Evolutieve gevolgen van overbevissing

DNA isolatie van otolieten



> referentiepunt voor beheer

Evolutionary Change in Northeast Arctic Cod

100

50

Length (cm)

1923

1990

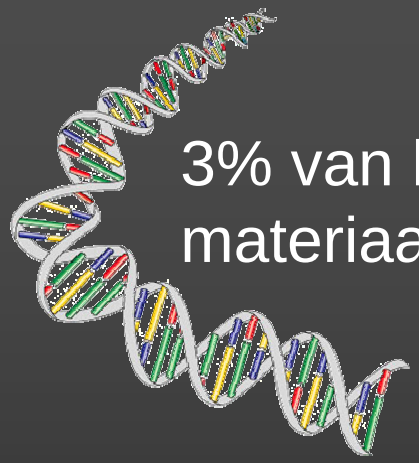
Significant shift in maturation reaction norm
in agreement with theoretical predictions

5

Age (years)

12

Functionele verschillen tussen populaties



3% van het genetisch materiaal

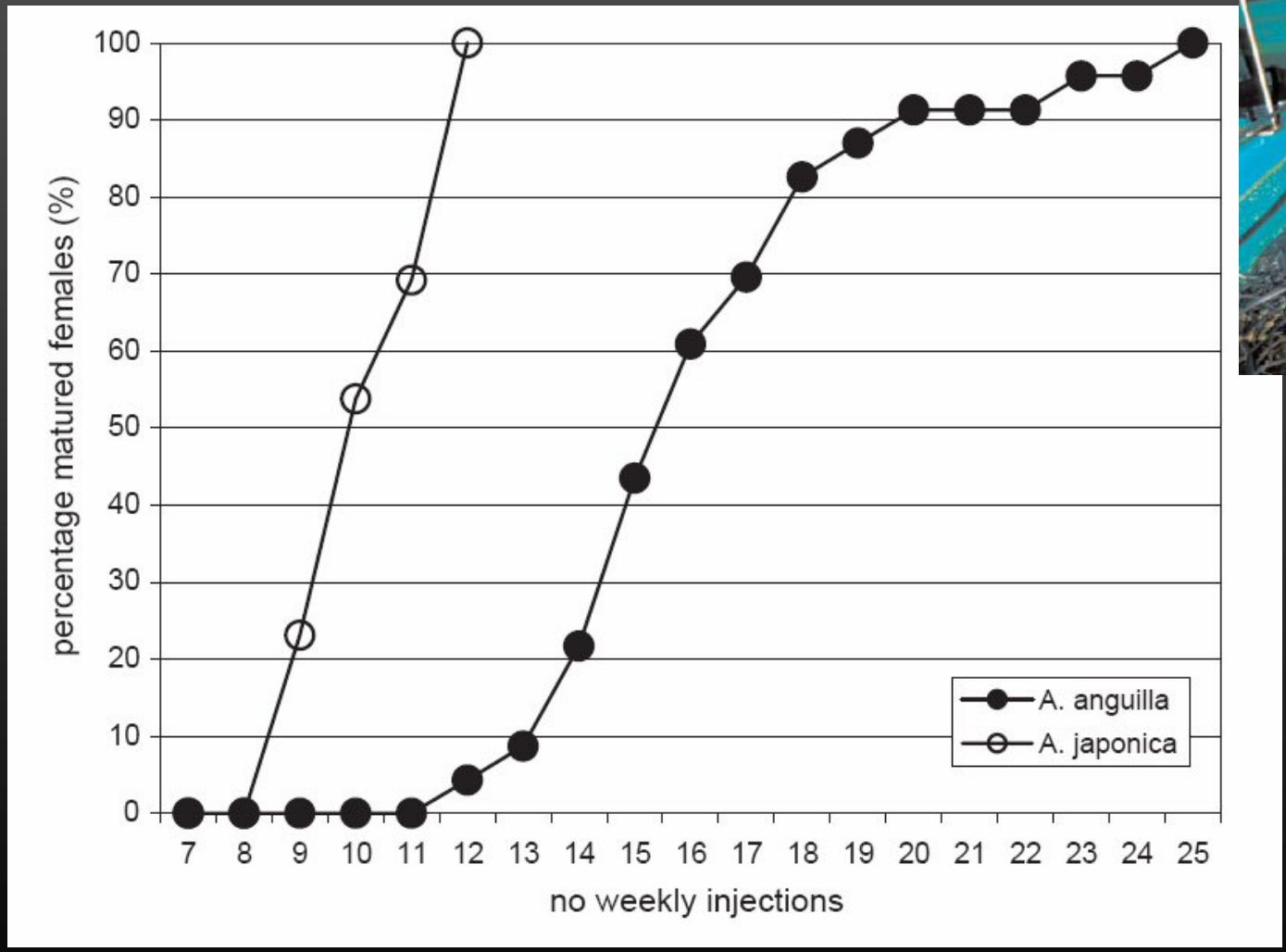
omgeving

eiwitten

individuele kenmerken

> definiëren van beheerseenheden (herstockering)
> opspoorbaarheid (import)

Aquacultuur en artificiële reproductie



- moleculaire mechanismen voor differentiële groei
- sexuele determinatie en differentiatie
- genen identificeren voor parasietresistentie en lage stressgevoeligheid

Na meer dan een eeuw onderzoek blijft het mysterie bestaan …

Een lange weg is afgelegd sinds Aristotoles' theorie van spontane generatie …

Reeds 3 miljoen jaar bleek de paling succesvol …

De invloed van de mens heeft de soort op de rand van de totale ondergang gebracht …

Er blijft niet veel tijd over om de soort te redden …

Bedankt voor uw aandacht!