The Oosterschelde, a changing ecosystem after the completion of the Deltaworks

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LACPR Workshop Fieldtrip
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Towards an integrated approach

Protest!

OOSTERSCHELDE OPEN
DAT NOOIT!!!

WATERSTAAT ERKEN UW FOUT
LAAT DE OOSTERSCHELDE ZOU

YE 96
LAAT DE OOSTERSCHELDE OPEN!!!

Safety

or

and

Environment

Primary effects:

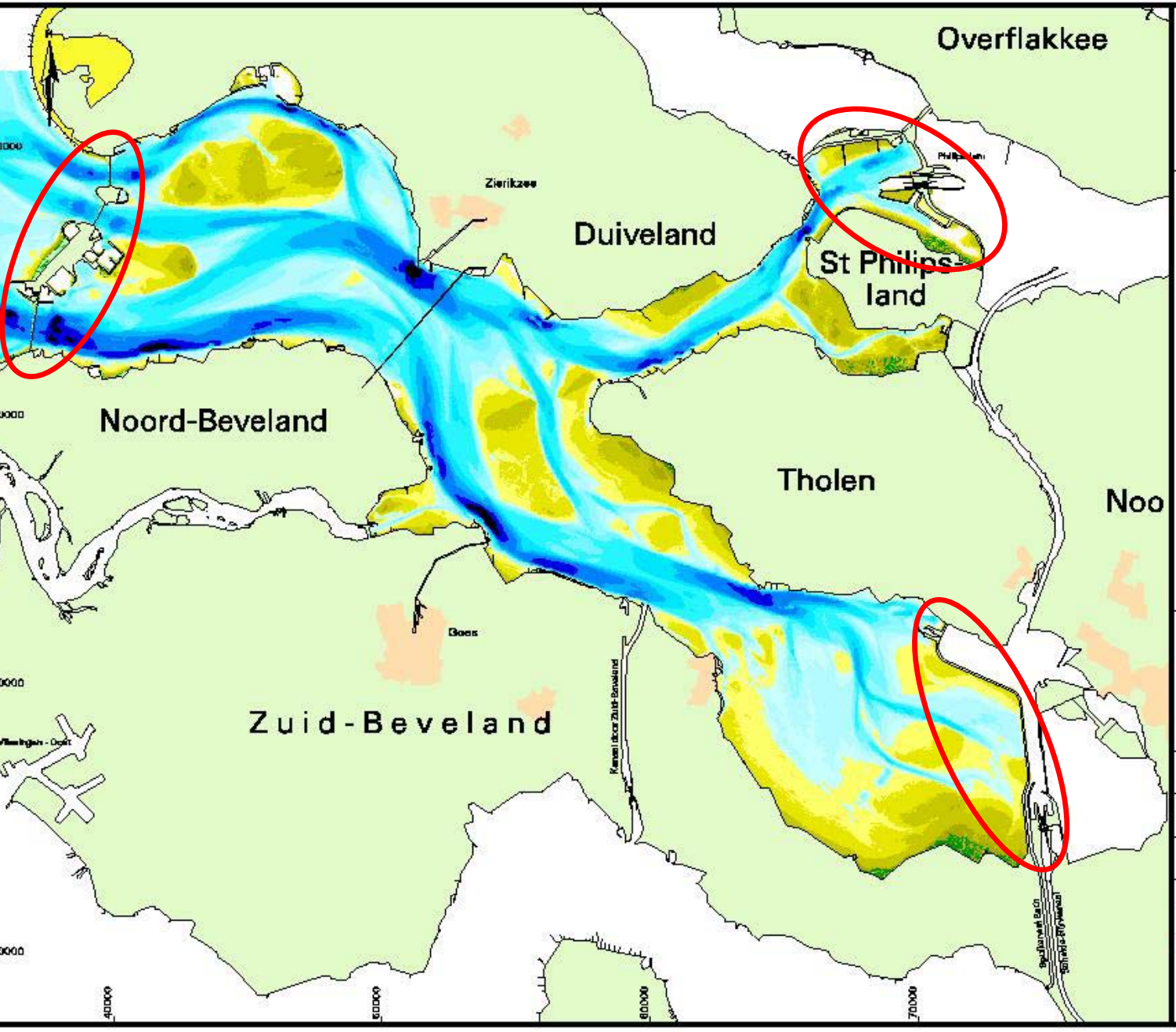
Changes in hydrodynamics & morphology

Secondary effects:

Ecological responses to a changing environment

Tertiary effects:

Reactions of man to a changing ecosystem



Overzichtskaart

Oosterschelde-totale gebied

Bodem: 2001
20m grid

Legenda

Diepte in m t.o.v. NAP

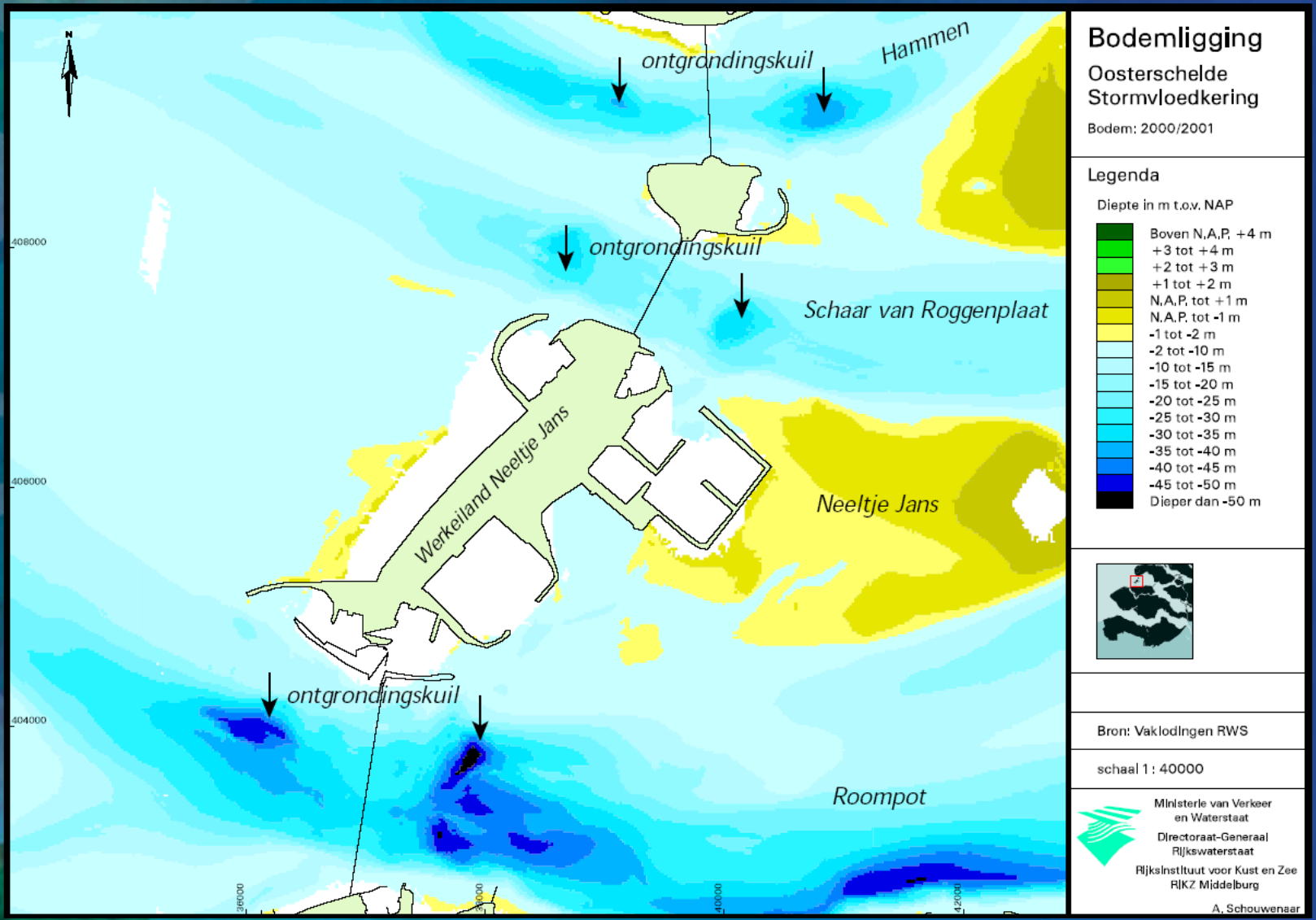
- Boven N.A.P. +4 m
- +4 tot +3 m
- +3 tot +2 m
- +2 tot +1 m
- +1 tot N.A.P.
- N.A.P. tot -1 m.
- -1 tot -2 m
- -2 tot -3 m
- -3 tot -5 m
- -5 tot -7.5 m
- -7.5 tot -10 m
- -10 tot -15 m
- -15 tot -20 m
- -20 tot -25 m
- -25 tot -35 m
- -35 tot -45 m
- Dieper dan -45 m

Bron: Vaklodingen RWS

schaal 1 : 200000

Ministerie van Verkeer en Waterstaat
Directoraat-Generaal Rijkswaterstaat
Rijksinstituut voor Kust en Zee
RIKZ Middelburg

A. Schouwenaa


N
ontgrondingskuil
Hammen
ontgrondingskuil
Schaar van Roggenplaat
Werkeiland Neeltje Jans
Neeltje Jans
ontgrondingskuil
Roompot
408000
406000
404000
36000
38000
40000
42000
Bodemligging
Oosterschelde Stormvloedkering
Bodem: 2000/2001
Legenda
Diepte in m t.o.v. NAP
Boven N.A.P. +4 m
+3 tot +4 m
+2 tot +3 m
+1 tot +2 m
N.A.P. tot +1 m
N.A.P. tot -1 m
-1 tot -2 m
-2 tot -10 m
-10 tot -15 m
-15 tot -20 m
-20 tot -25 m
-25 tot -30 m
-30 tot -35 m
-35 tot -40 m
-40 tot -45 m
-45 tot -50 m
Dieper dan -50 m
Bron: Vaklodingen RWS
schaal 1 : 40000
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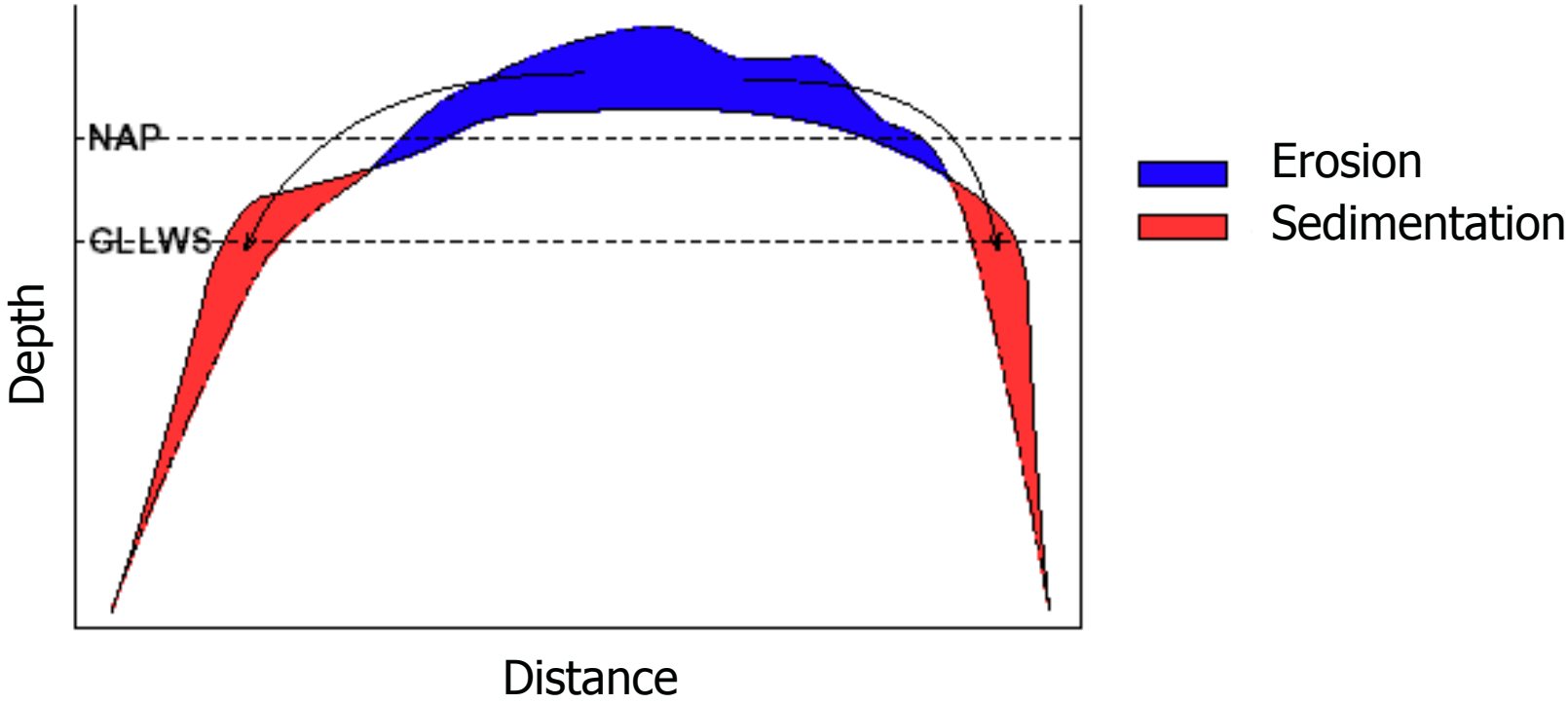
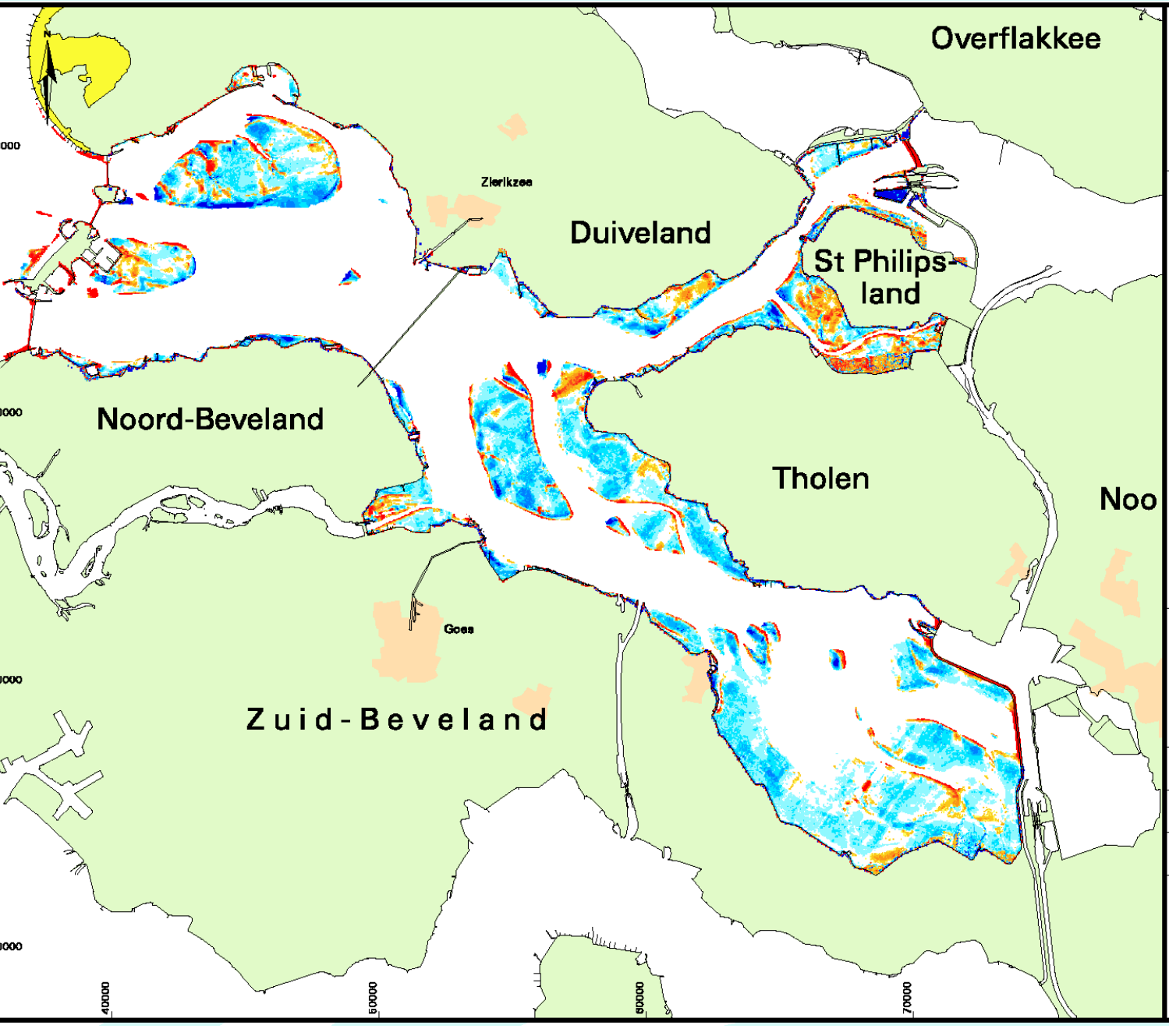
A. Schouwenaar

Erosion of Tidal Mudflats



NAP: Dutch Ordinance Level
GLLW: Mean Low Waterlevel at Springtide



Difference map

1983 – 2001

Legenda

Verschil in m

- Verdieping meer dan 1 m
- -1 tot -0.8 m
- -0.8 tot -0.6 m
- -0.6 tot -0.4 m
- -0.4 tot -0.2 m
- 0.2 tot 0.4 m
- 0.4 tot 0.6 m
- 0.6 tot 0.8 m
- 0.8 tot 1 m
- Verondieping meer dan 1 m

Bron: Vaklodingen RWS

schaal 1 : 200000

Ministerie van Verkeer
en Waterstaat
Directoraat-Generaal
Rijkswaterstaat
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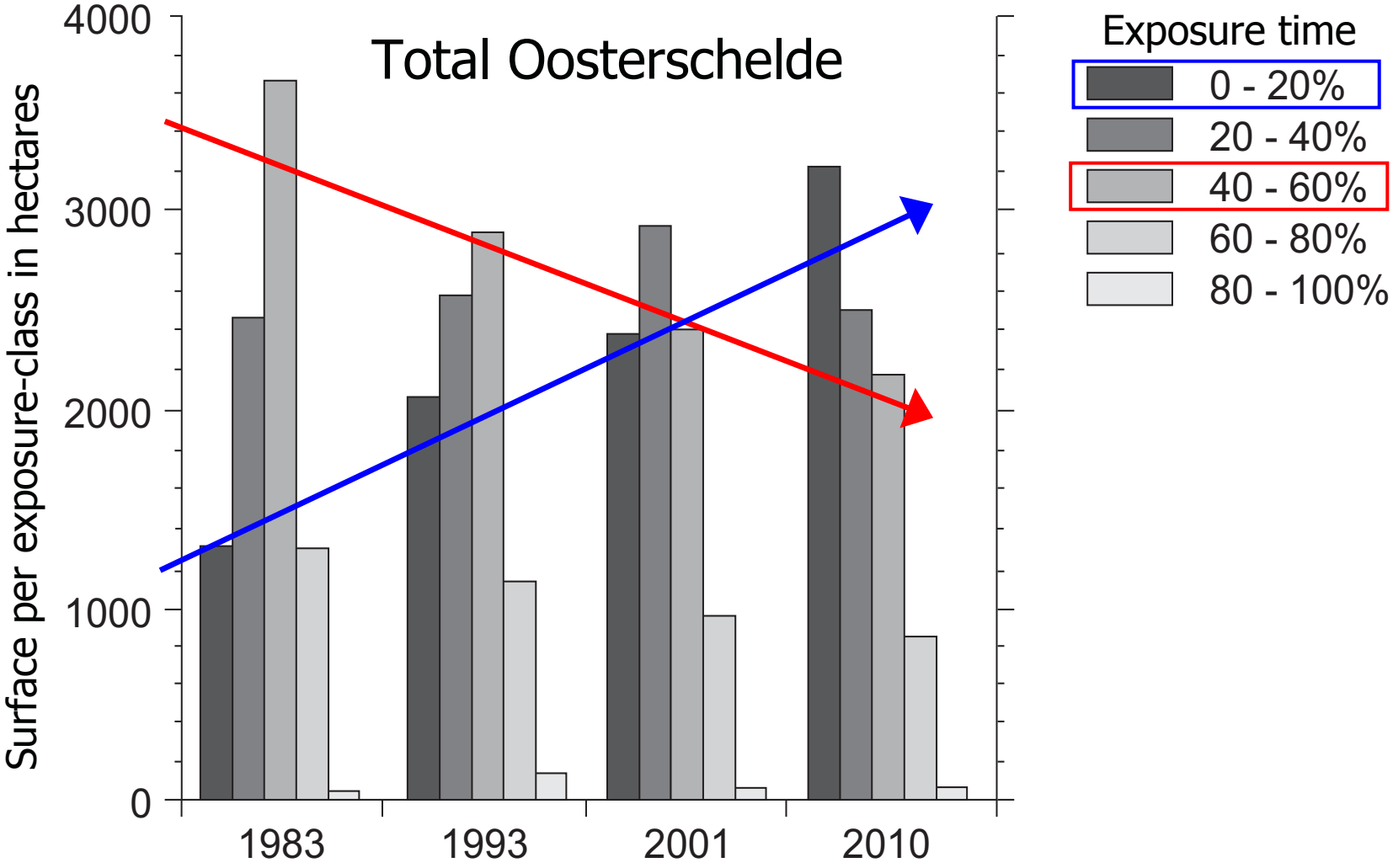
RIKZ Middelburg
A. Schouwenar

Decreasing exposure time of tidal flats



Primary effects:

Changes in hydrodynamics & morphology

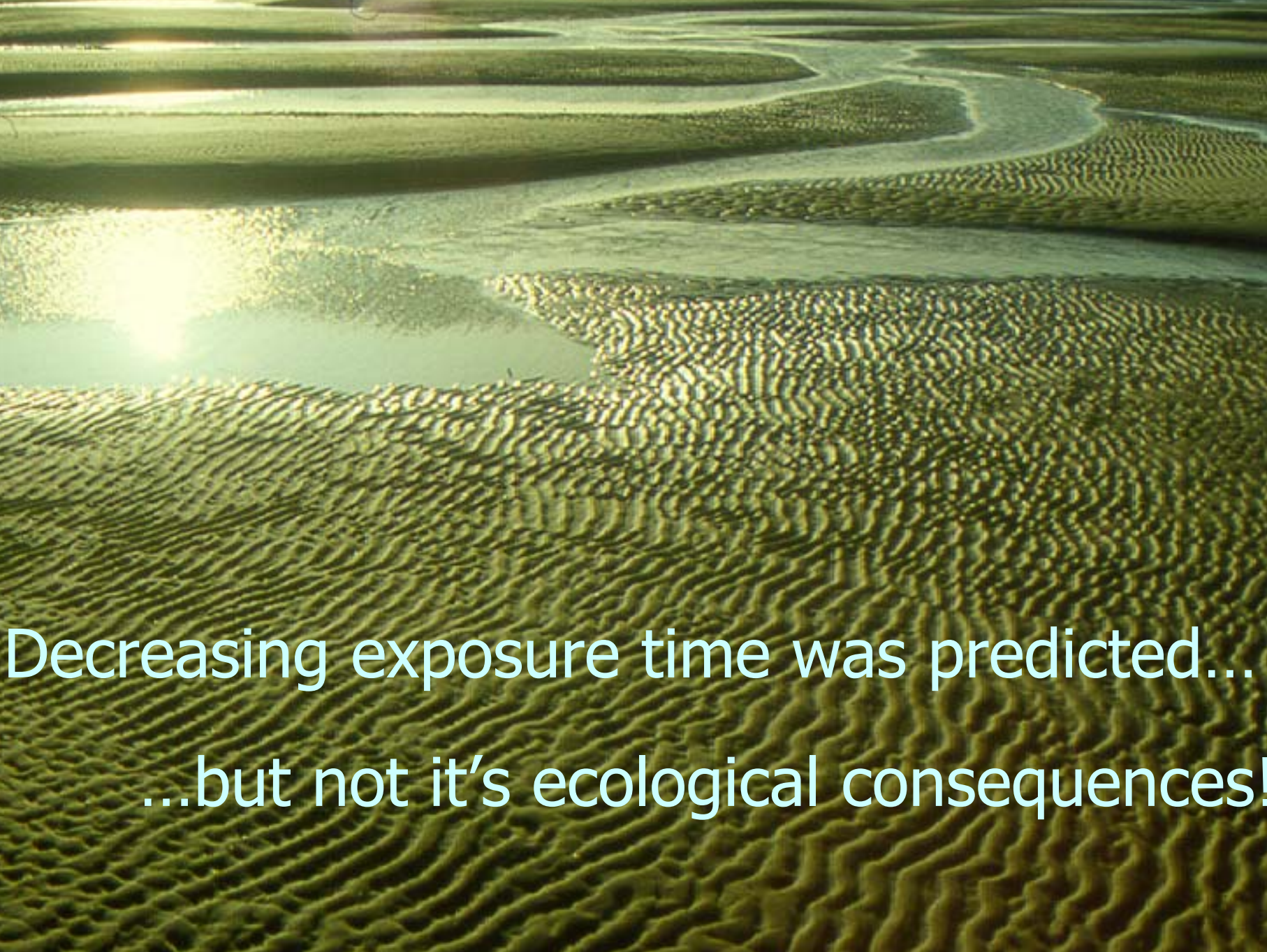
Secondary effects:

Ecological responses to a changing environment

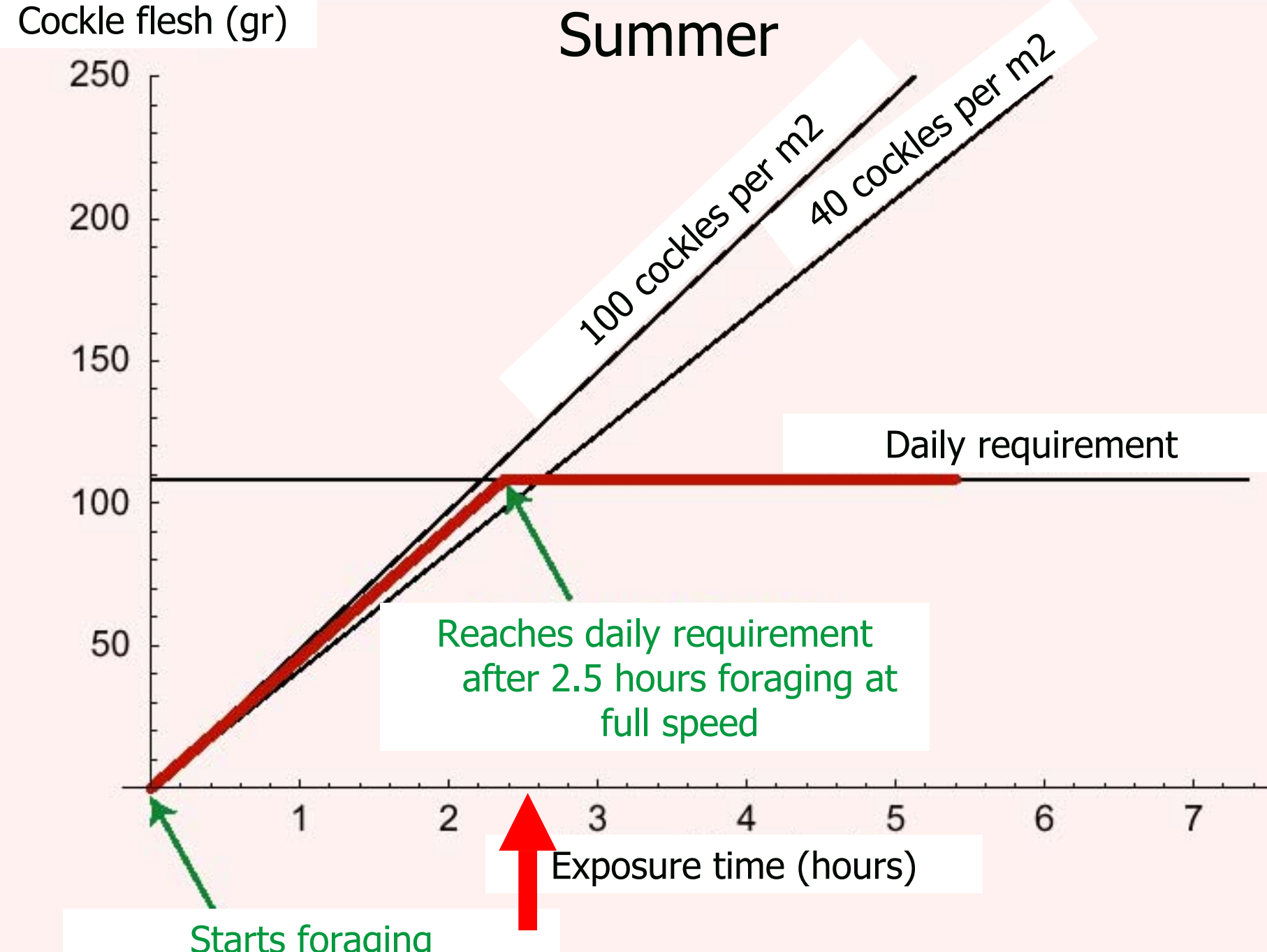
Tertiary effects:

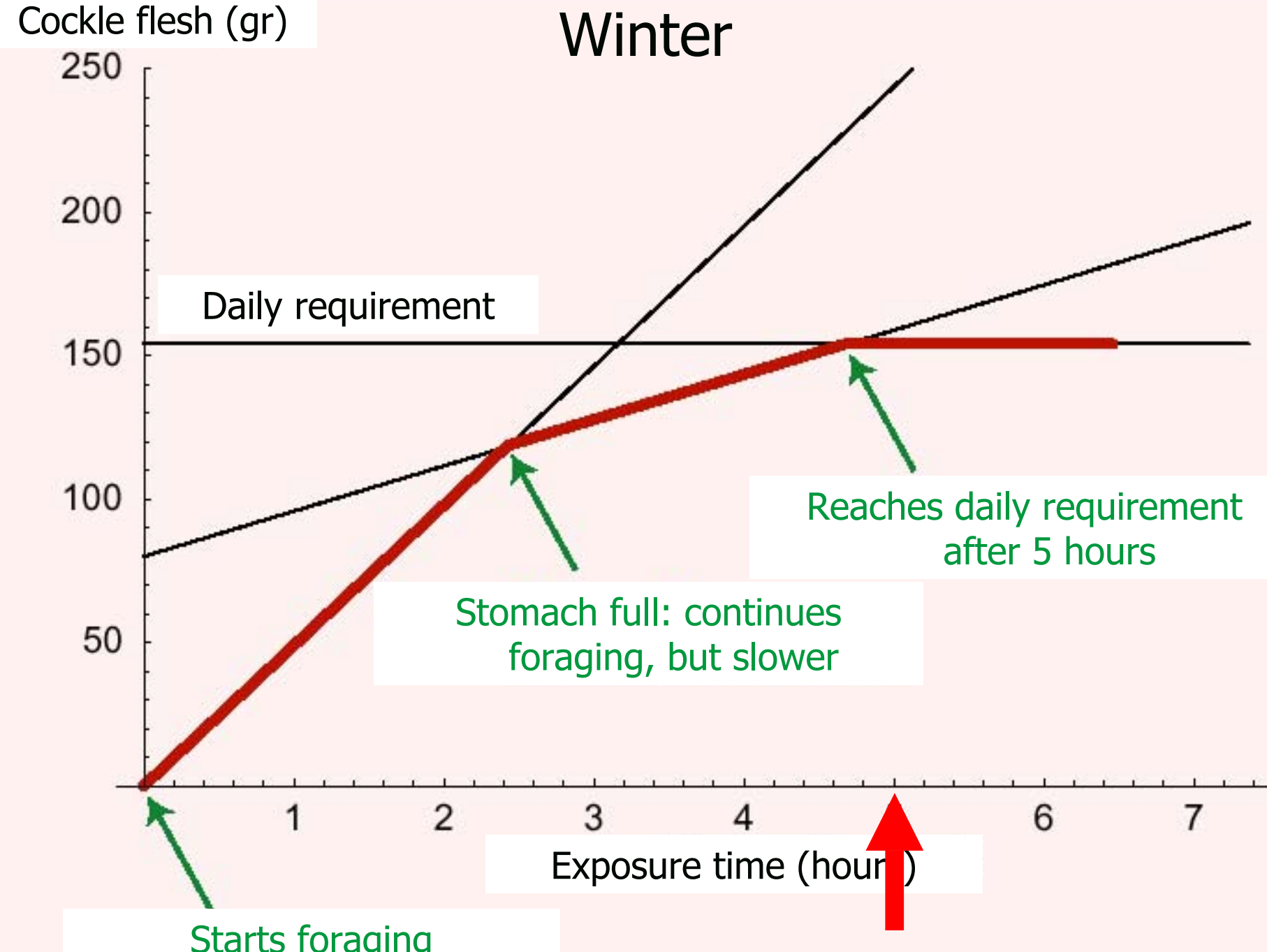
Reactions of man to a changing ecosystem

Well predicted: decline of salt marshes


Decreasing exposure time was predicted...
...but not it's ecological consequences!

Example Oystercatcher


Cockle flesh (gr)
Summer
250
200
150
100
50
100 cockles per m2
40 cockles per m2
Daily requirement
Reaches daily requirement after 2.5 hours foraging at full speed
1
2
3
4
5
6
7
Exposure time (hours)
Starts foraging

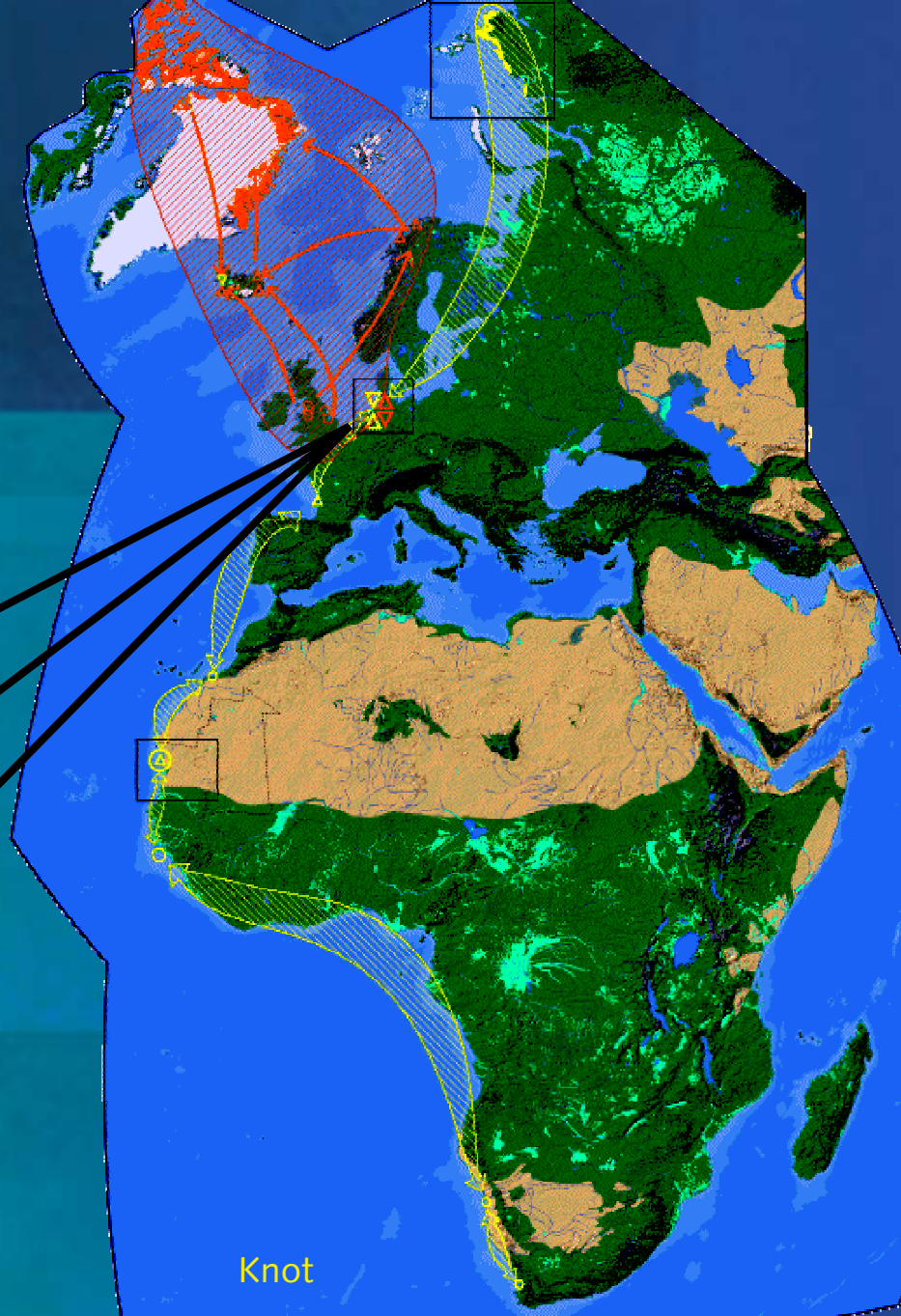

Cockle flesh (gr)
Winter
250
200
150
100
50
Daily requirement
Reaches daily requirement after 5 hours
Stomach full: continues foraging, but slower
1
2
3
4
6
7
Exposure time (hours)
Starts foraging

Netherlands intertidal areas on crossroad of flyways Arctic <-> Africa

Waddensea
260 000 ha.

Oosterschelde
37 000 ha.

Westerschelde
43 000 ha.



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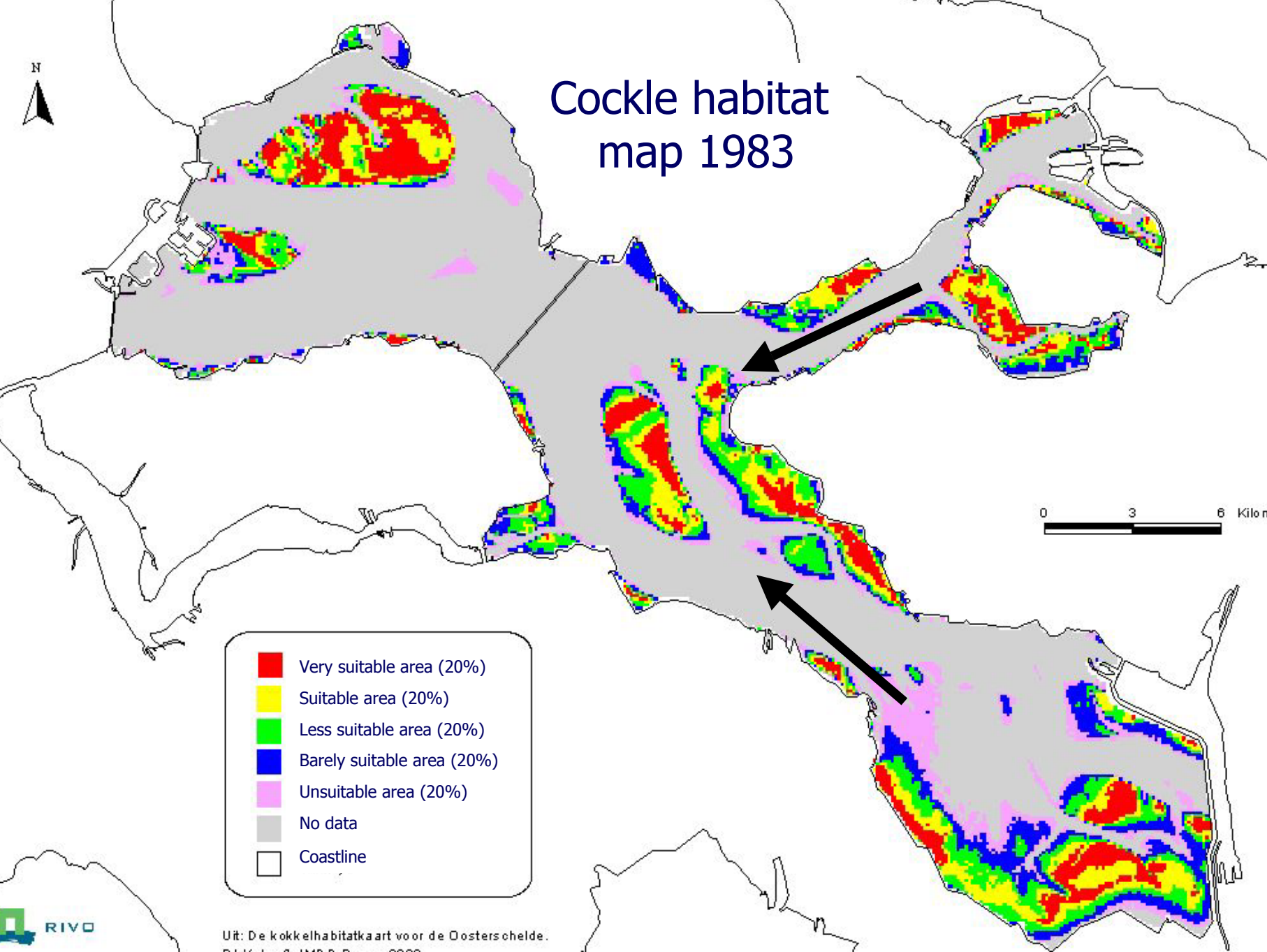
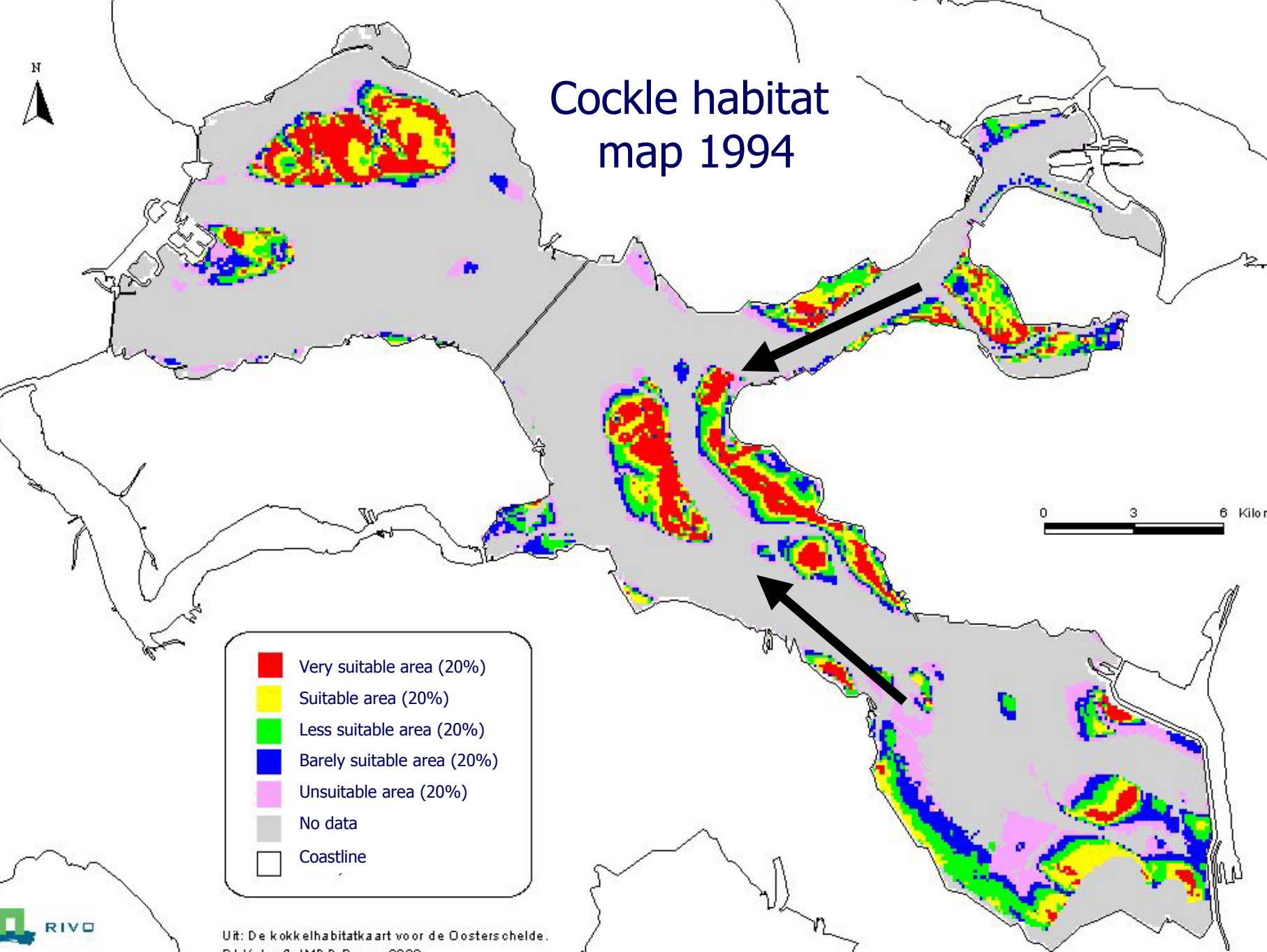
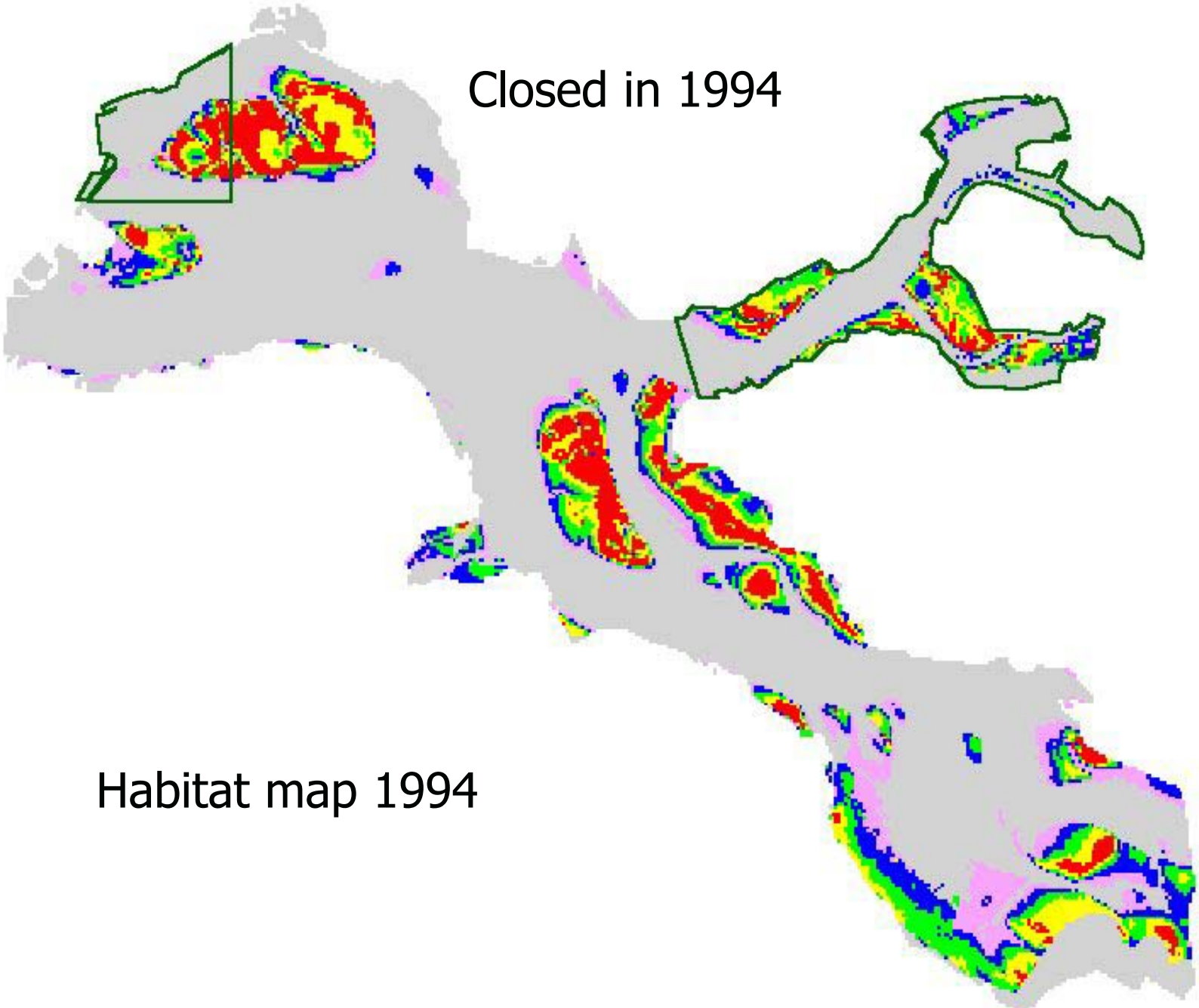
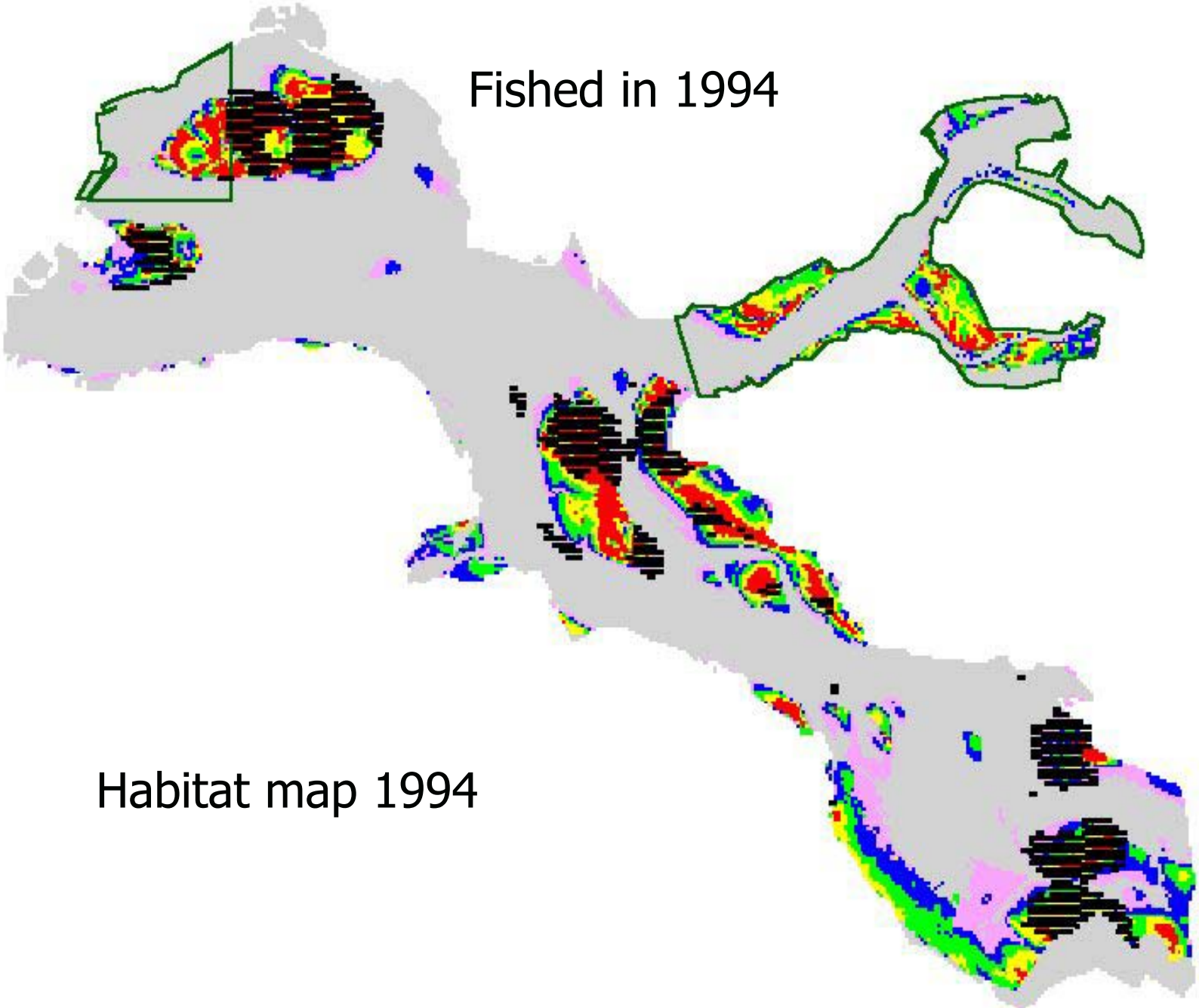
Mechanised cockle fisheries

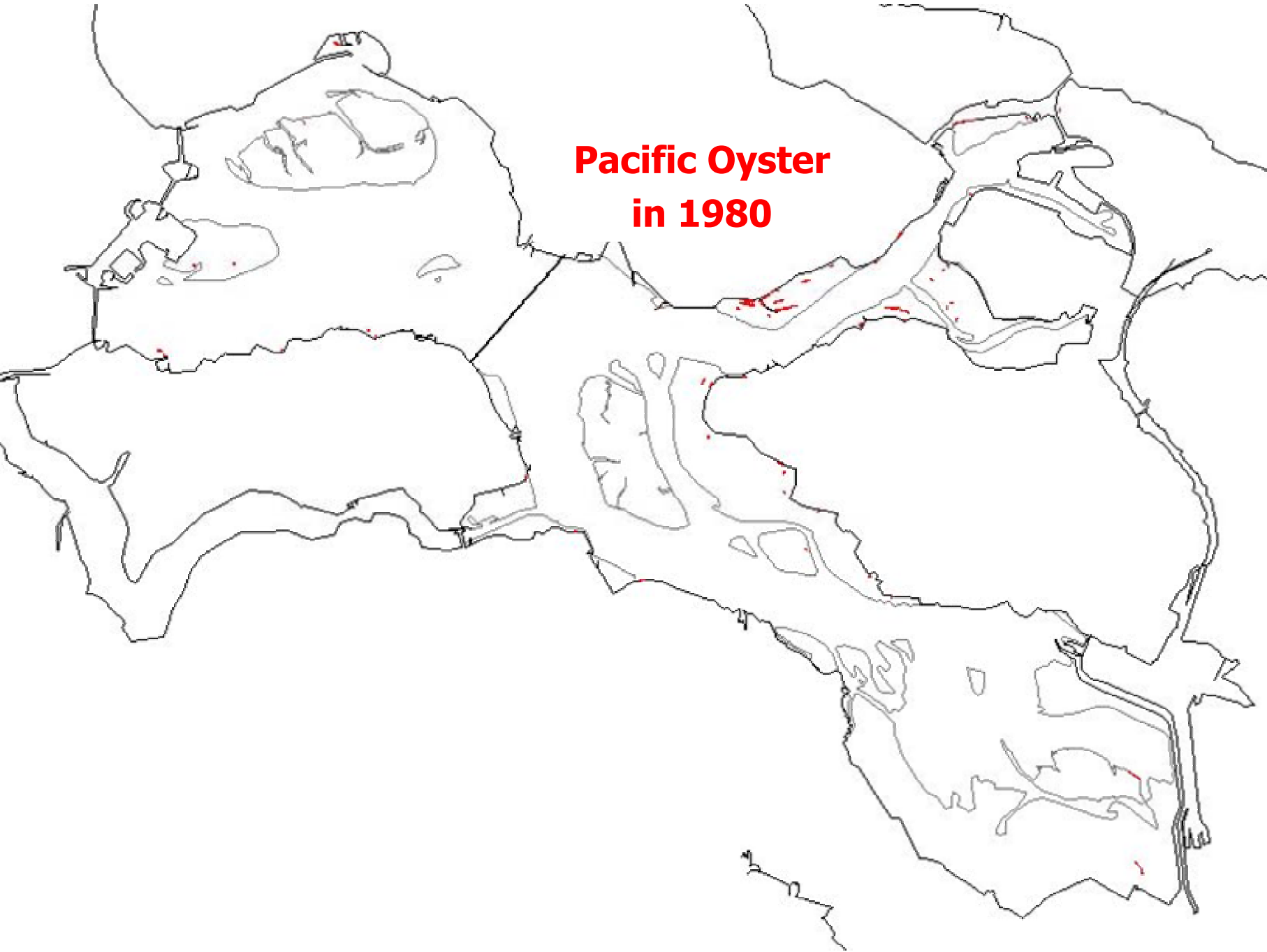

Cockle habitat map 1983
N
0
3
6
Very suitable area (20%)
Suitable area (20%)
Less suitable area (20%)
Barely suitable area (20%)
Unsuitable area (20%)
No data
Coastline
RIVO
Uit: De kokkelhabitatkaart voor de Oosterschelde.

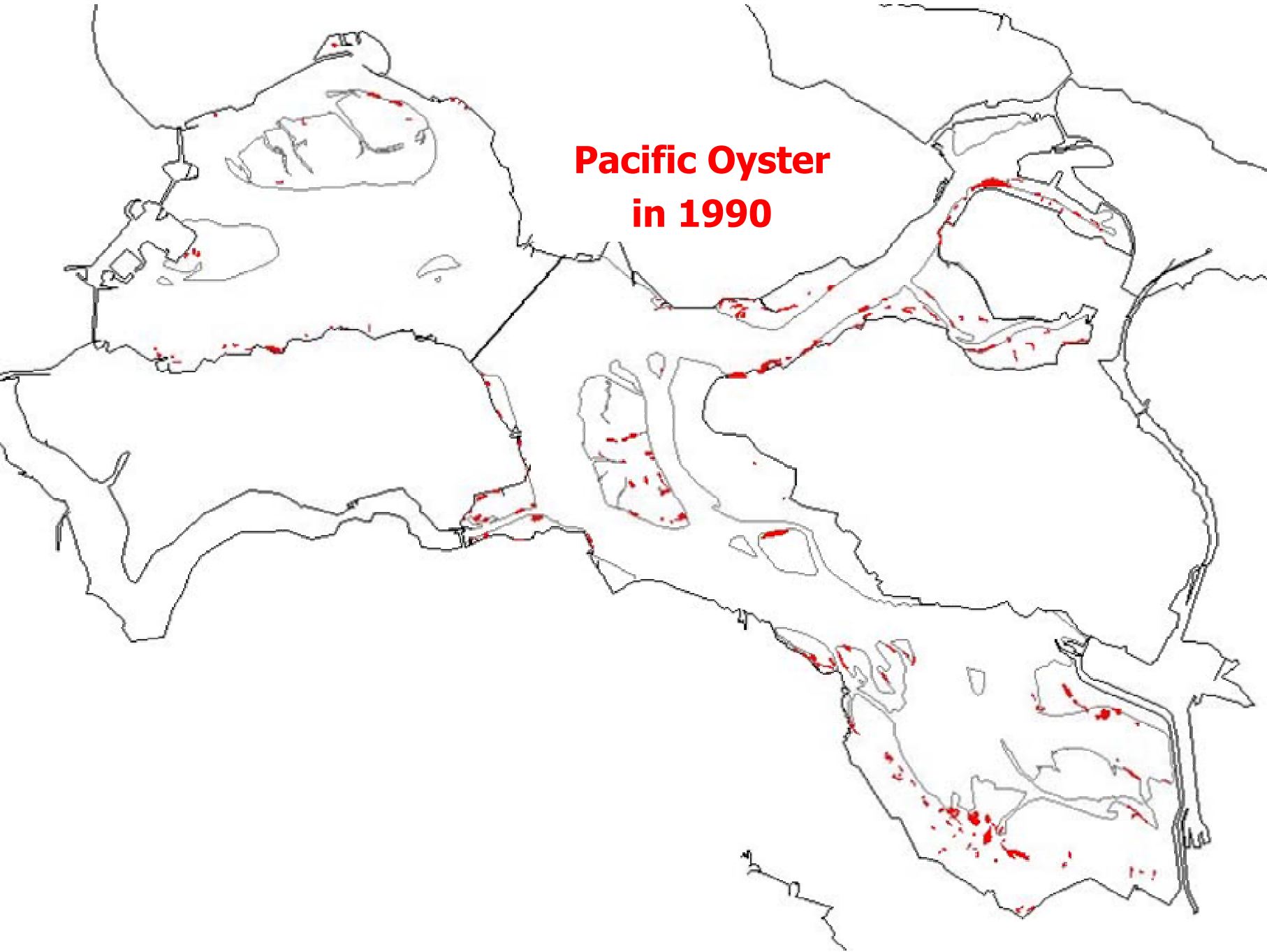

Cockle habitat map 1994
N
0
3
6
Very suitable area (20%)
Suitable area (20%)
Less suitable area (20%)
Barely suitable area (20%)
Unsuitable area (20%)
No data
Coastline
RIVO
Uit: De kokkelhabitatkaart voor de Oosterschelde.

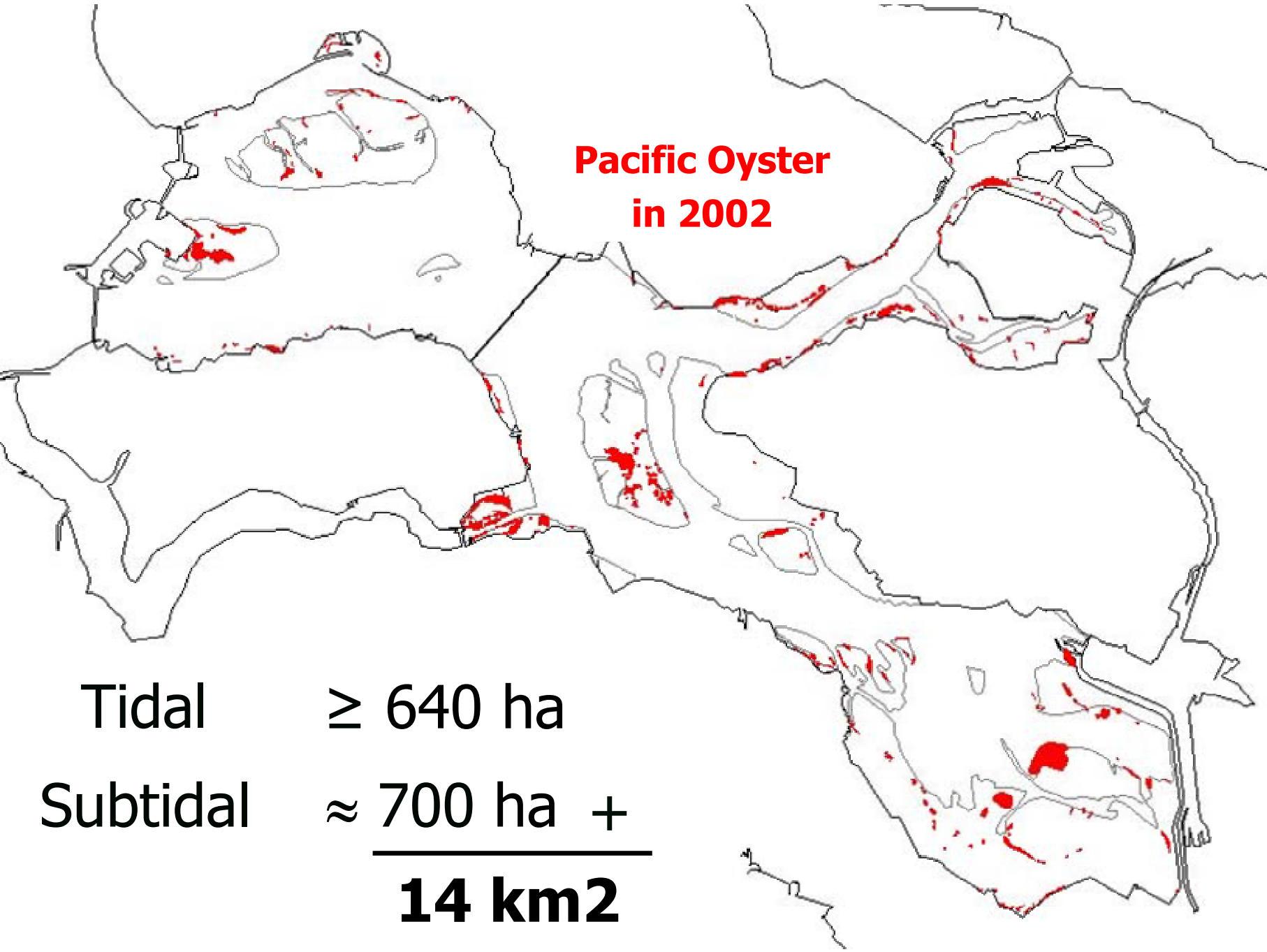

Closed in 1994
Habitat map 1994


Fished in 1994
Habitat map 1994

Unlimited spreading of the introduced Pacific oyster?


Pacific Oyster
in 1980

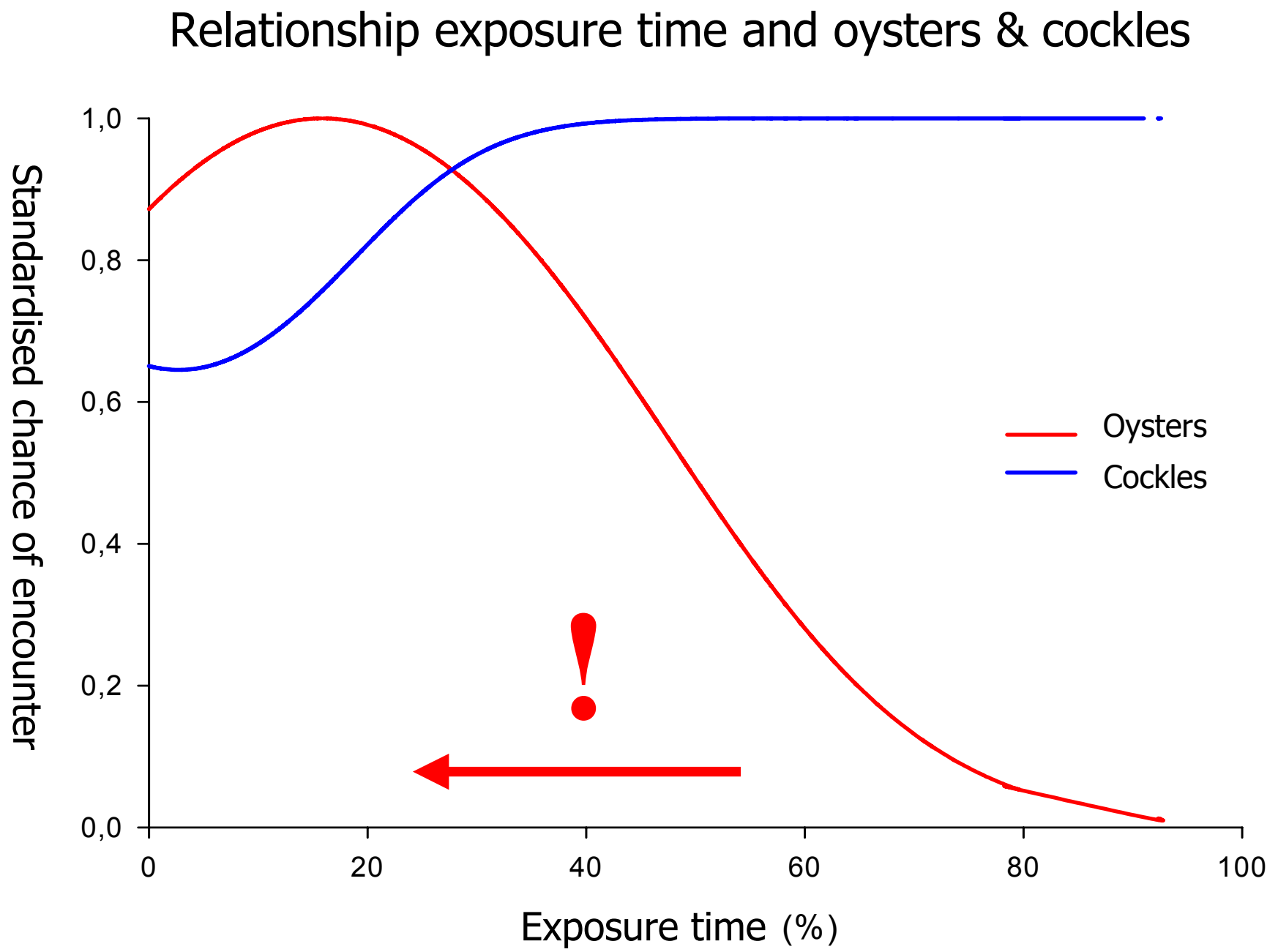

Pacific Oyster
in 1990



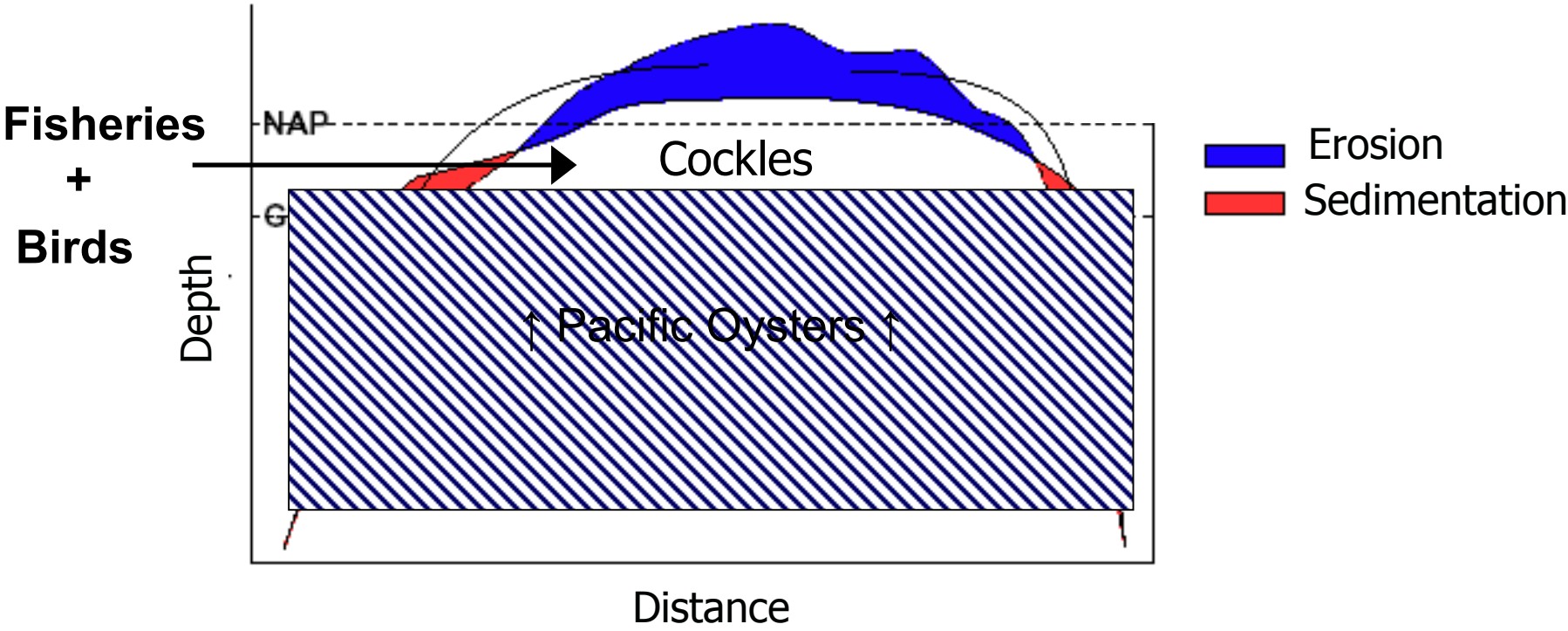
Tidal ≥ 640 ha

Subtidal ≈ 700 ha +

14 km2


Relationship exposure time and oysters & cockles
Standardised chance of encounter
1,0
0,8
0,6
0,4
0,2
0,0
0
20
40
60
80
100
Exposure time (%)
Oysters
Cockles
!

Growing conflict fisheries & birds



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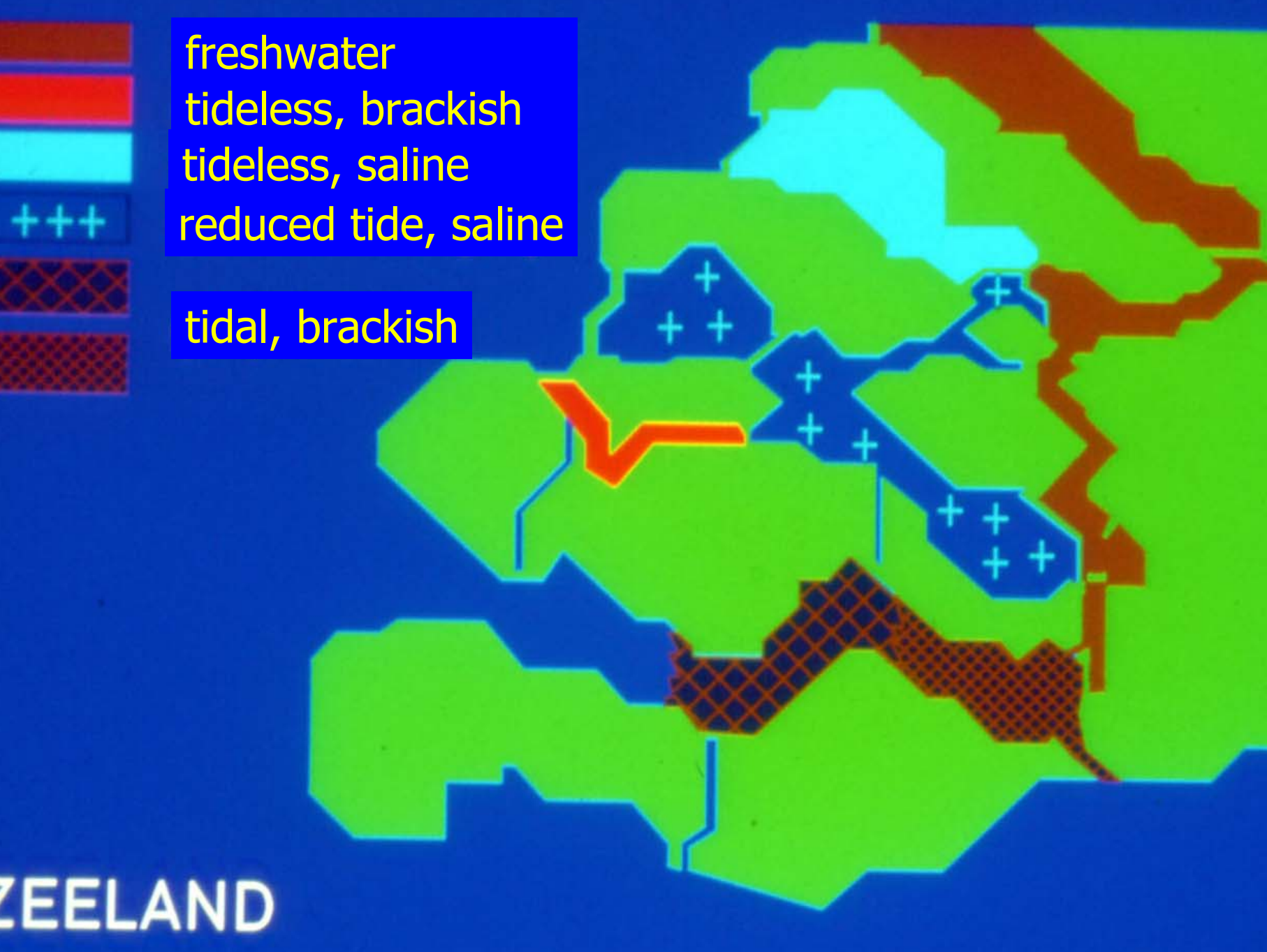
Aftercare is an inevitable
part of the project


freshwater
tideless, brackish
tideless, saline
reduced tide, saline
tidal, brackish
ZEELAND

Satellietbeeld AGI, Rijkswaterstaat, ESA

Conclusion restoration:

- All Dutch Delta waters have been heavily modified by alteration of driving processes like tidal influence, salinity regime, river- and morphodynamics

- Restoration of estuarine dynamics is partly possible

- But: even with great efforts the restoration of <u>morphodynamical processes</u> (sedimentation, erosion, sand and silt transport) needed to preserve intertidal areas, stays behind in the case of the Oosterschelde..

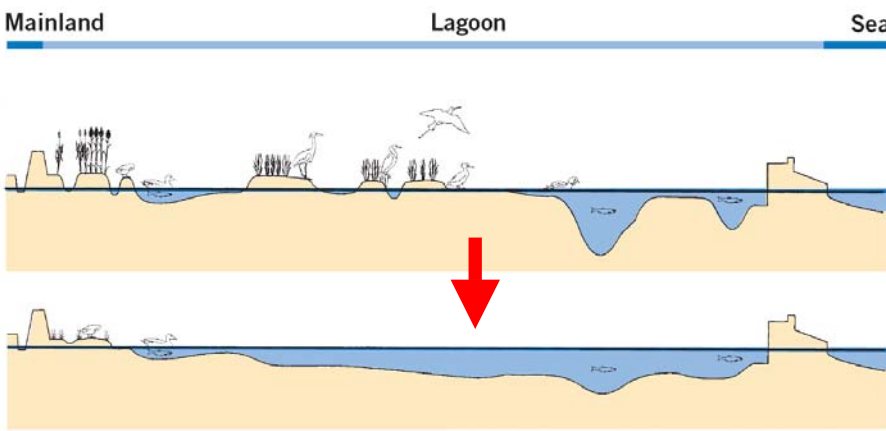
Lagoon of Venice

THE PROBLEMS OF THE VENICE LAGOON

The well known problem: floods with increasing frequency and intensity

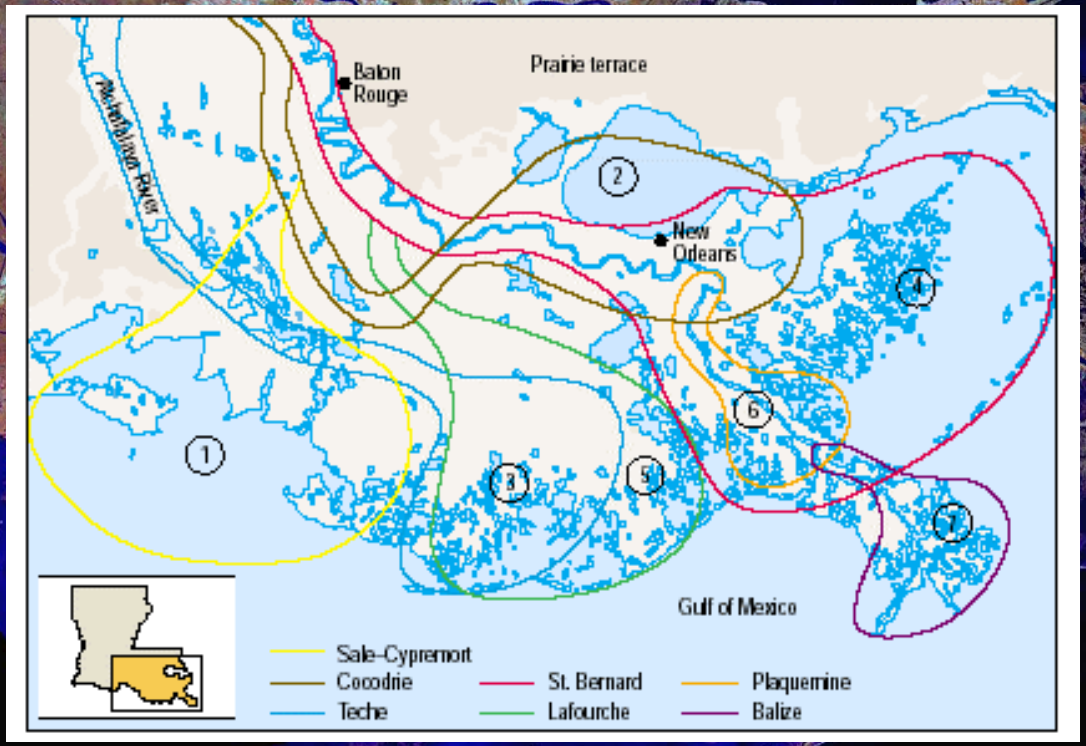
The less known problems: loss of sediments,
flattening of shallow waters
loss of marshlands and habitats
increasing water depth
inadequacy of the coastal protection
pollution from the drainage basin
pollution in the sediments
increase of human pressure
- port activities
- navigation
- urbanization of the mainland
- agriculture
- intensive fishing
- tourism

Alteration of the morphological structures



Mississippi Delta Plain

7000 years of sediment deposition
Land loss balanced by land gain

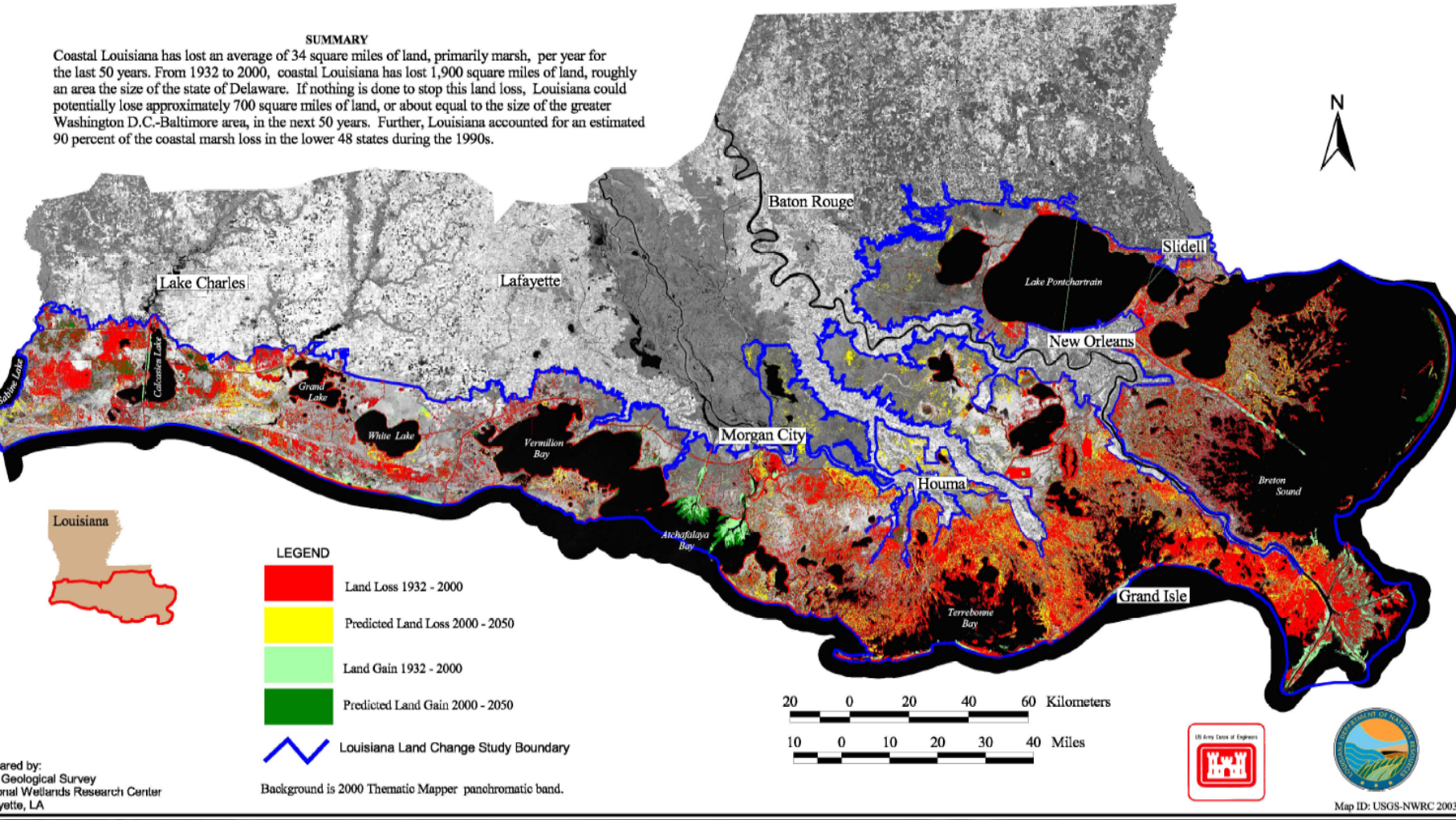


3000-4000 yrs old

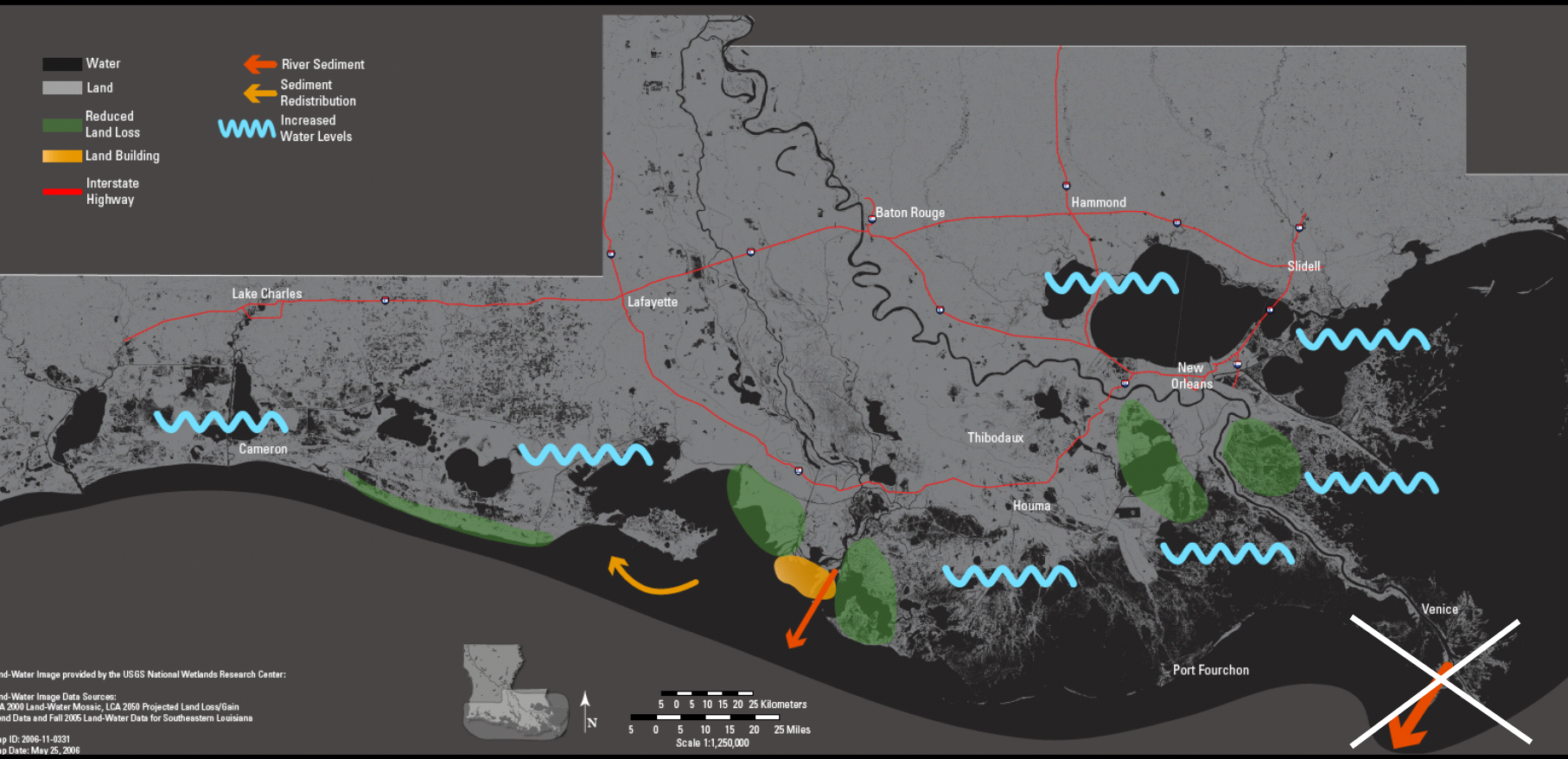
Thickest and youngest

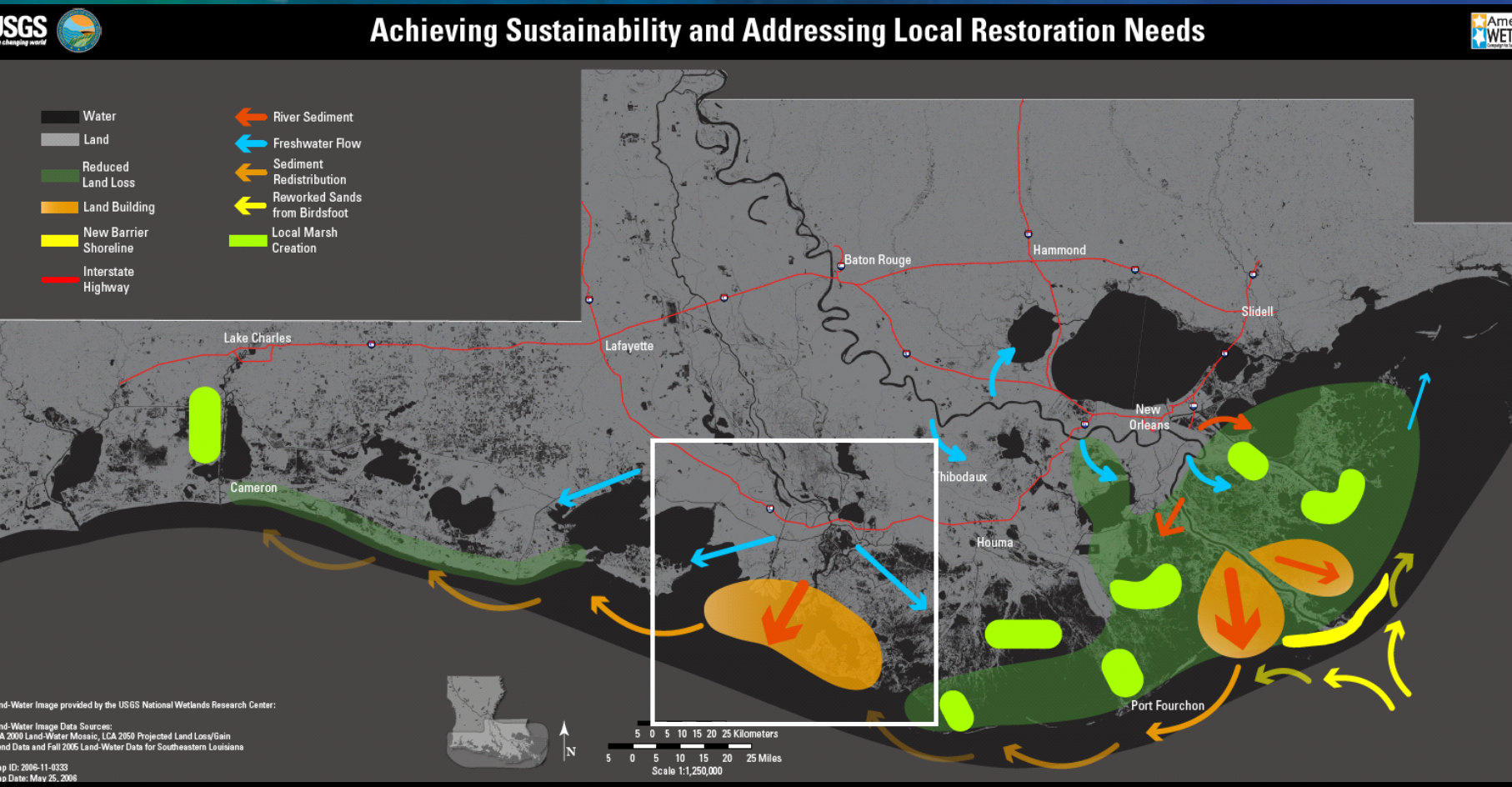
Varying sediment thickness

100+ Years of Land Change for Coastal Louisiana



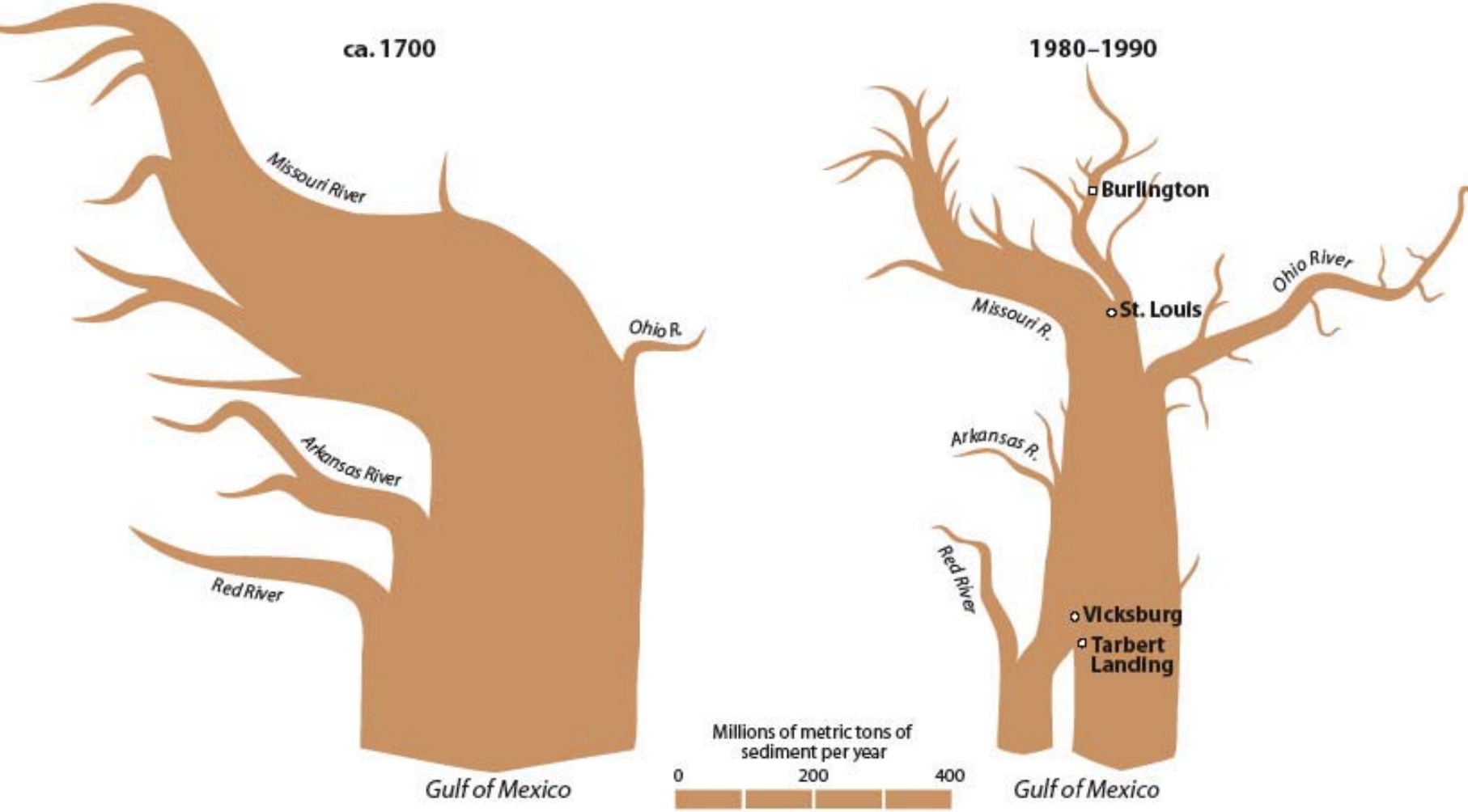
Continuing Current Management





With: 60 cm/100yrs sea level rise & 40 cm/100yrs subsidence

Sediment load decreased by 50%



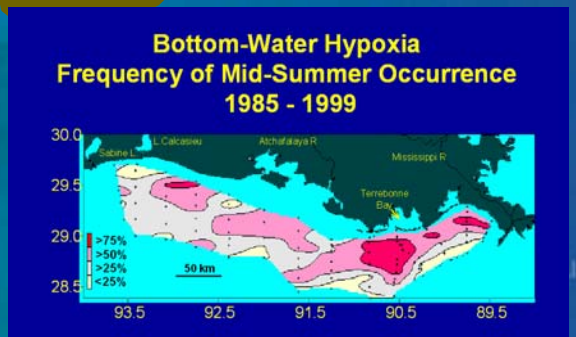
Mississippi River Drainage Basin

Basin Facts

Drains 41% of continental U.S.

Includes 31 states & 2 Canadian provinces

Total area drained 1.2 million square miles



ut voor Kust en Zee/RIKZ

Lessons learned:

- An integrated water system approach is a must!
- There are many ways to reach safety, but who makes the choice?
- Some effects are predictable, others are not
- Aftercare is an inevitable part of the project
- Estuaries are irreplacable
- Preserve/restore natural processes! These are essential for a sustainable delta landscape and the society and economy it supports