

# Divers and wind farms.

Review of available information and perspectives for German marine areas

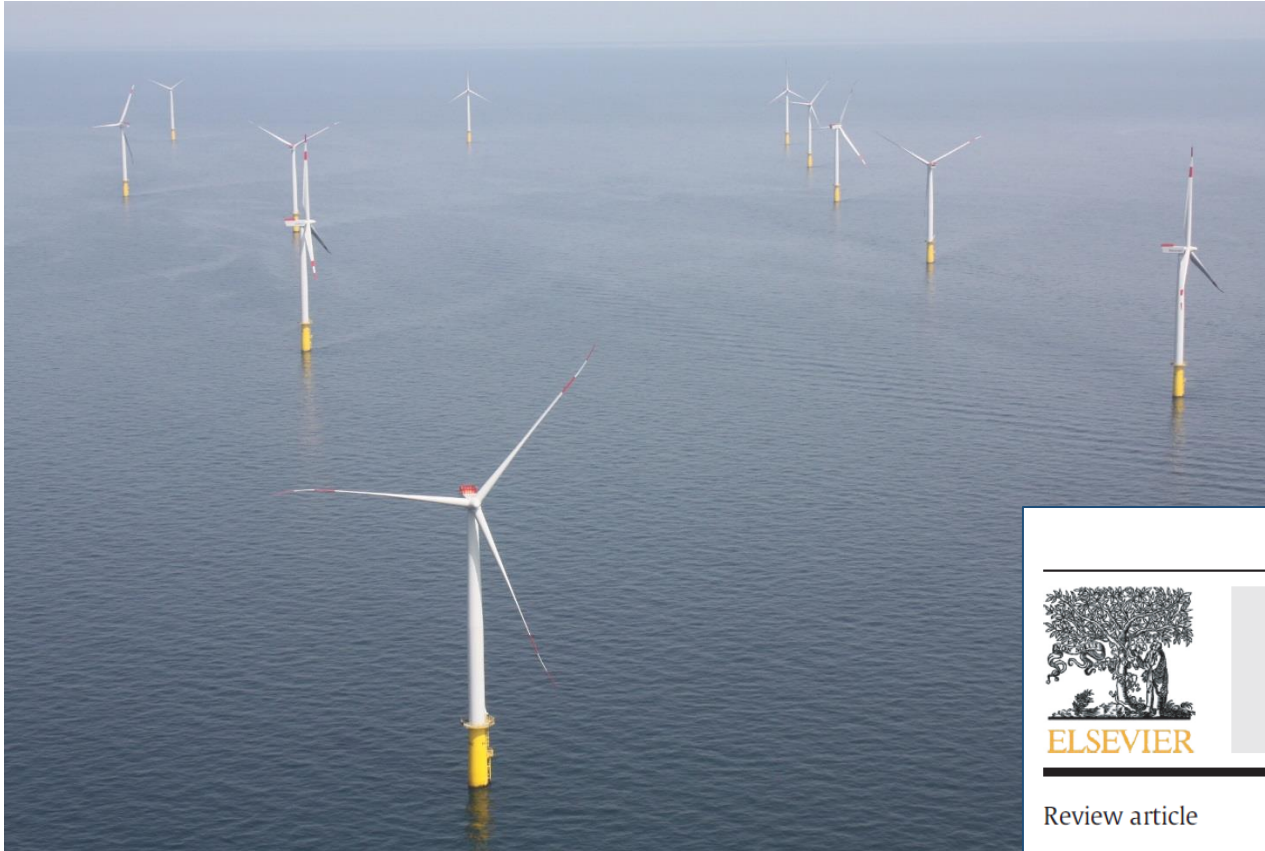


Ben Dean

1. Wind farm effects on divers
2. Impact of wind farms on divers in German Bight (North Sea)
3. Cumulative impact of the commercial use of the German Bight on divers

Volker Dierschke





## 1. Wind farm effects on divers

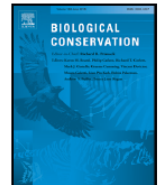
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Review article

### Seabirds and offshore wind farms in European waters: Avoidance and attraction



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#### ARTICLE INFO

##### Article history:

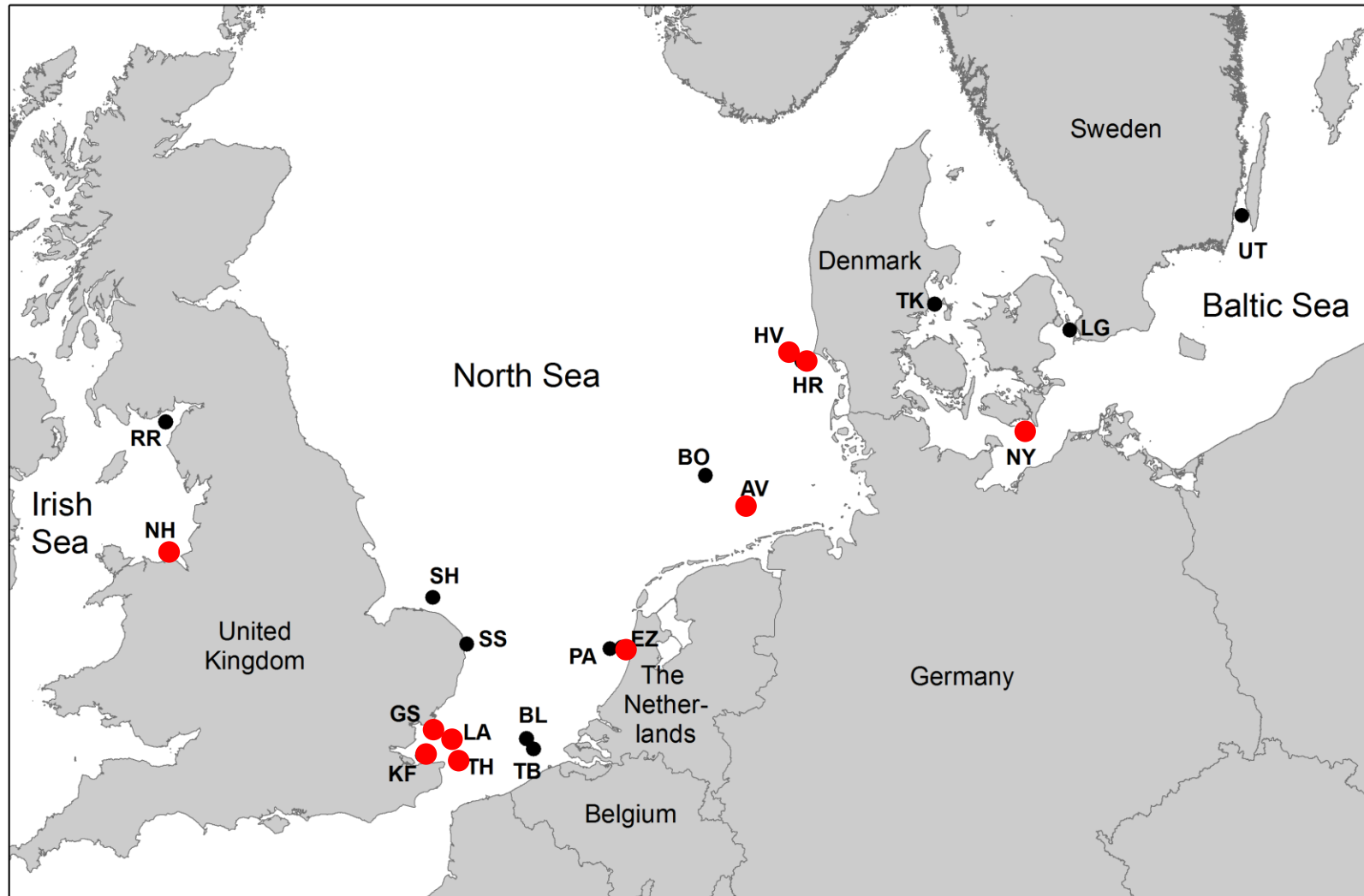
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#### ABSTRACT

The extent to which seabirds are displaced from, or attracted to, offshore wind farms (OWFs) is uncertain, but rapid development of OWFs in European waters could conflict with seabird conservation. We review post-construction studies of seabirds at 20 OWFs in European waters to extract and classify evidence for displacement or attraction of 33 different seabird species. Divers and northern gannets showed consistent and strong avoid-



● wind farm study without diver results      ● wind farm study including diver results

some problems with wind farm studies:

- variety of methods applied (surveys, analyses),
- small study areas,
- „wind farm site“ includes 2-3 km buffers,
- short duration (pre-/post-construction),
- no differentiation of swimming/flying birds,
- no differentiation regarding ship-traffic and turbine effects,

## Criteria for assessing seabird avoidance of / attraction to offshore wind farms

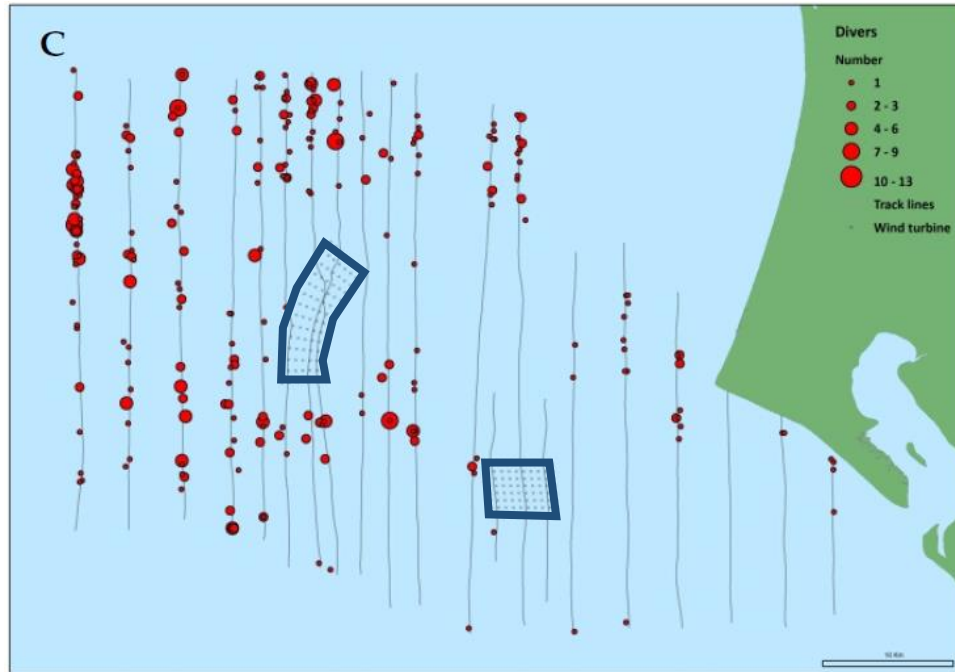
critterion	strong avoidance	weak avoidance	no wind farm effect (indiff. behaviour)	weak attraction	strong attraction
significant abundance change	decrease >50%	decrease <50%	parallel trends inside/outside WF	increase <50%	increase >50%
non-significant abundance change	decrease >80%	decrease >50%	change <50%	increase >50%	increase >80%
distance of effect	significant avoidance >2 km	non-significant avoidance >2 km		non-sign. increased utilization >2 km	sign. increased utilization >2 km
distribution pattern at WF (maps)	obvious gap in distribution at WF and sign. negative model effect of WF	obvious gap in distribution at WF	no distribution gap at WF	obvious concentration at WF	obvious concentration at WF and sign. positive model effect of WF
general occurrence (no test)	complete disappearance following formerly high density	nearly complete disappearance following formerly moderate/low density	numerous in WF, despite criteria for strong/weak avoidance partly met		numerous occurrence following formerly low density or absence
flight behaviour at WF edge	macro-avoidance 50-100 %	significant or obvious avoidance of entering WF	no reluctance to enter WF		
comparison to reference area		significantly higher density in reference area		significantly lower density in reference area	

## Criteria for assessing seabird avoidance of / attraction to offshore wind farms

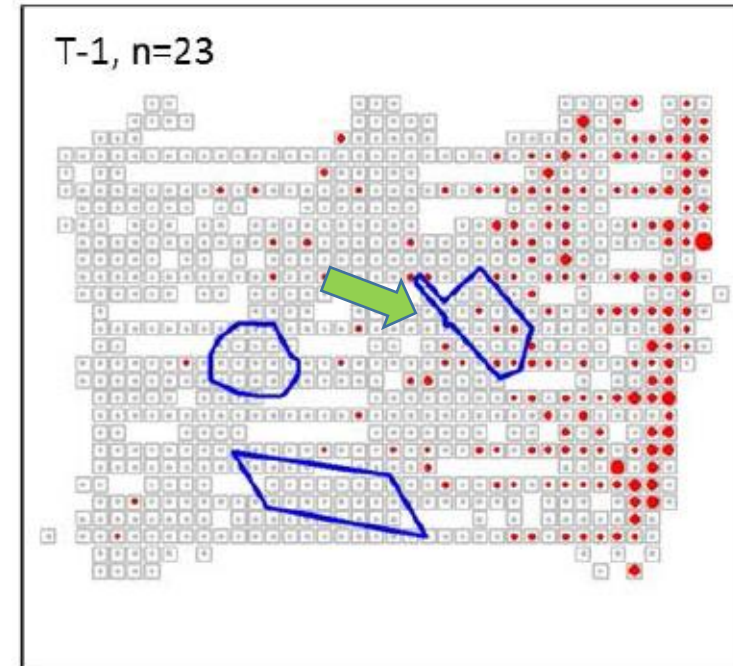
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distribution pattern at WF (maps)	obvious gap in distribution at WF and sign. negative model effect of WF ●●●●●●	obvious gap in distribution at WF ●●●	no distribution gap at WF	obvious concentration at WF	obvious concentration at WF and sign. positive model effect of WF
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comparison to reference area		<b>significantly higher density in reference area</b>		significantly lower density in reference area	

● diver in wind farm study

# Examples for wind farm avoidance by divers

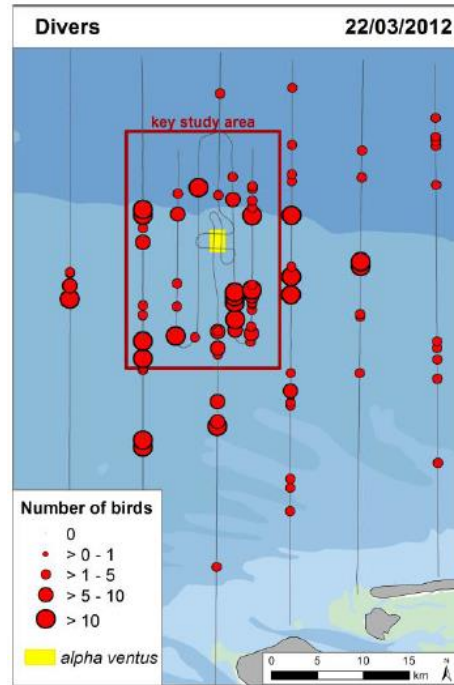


Horns Rev 2: Petersen et al. 2014

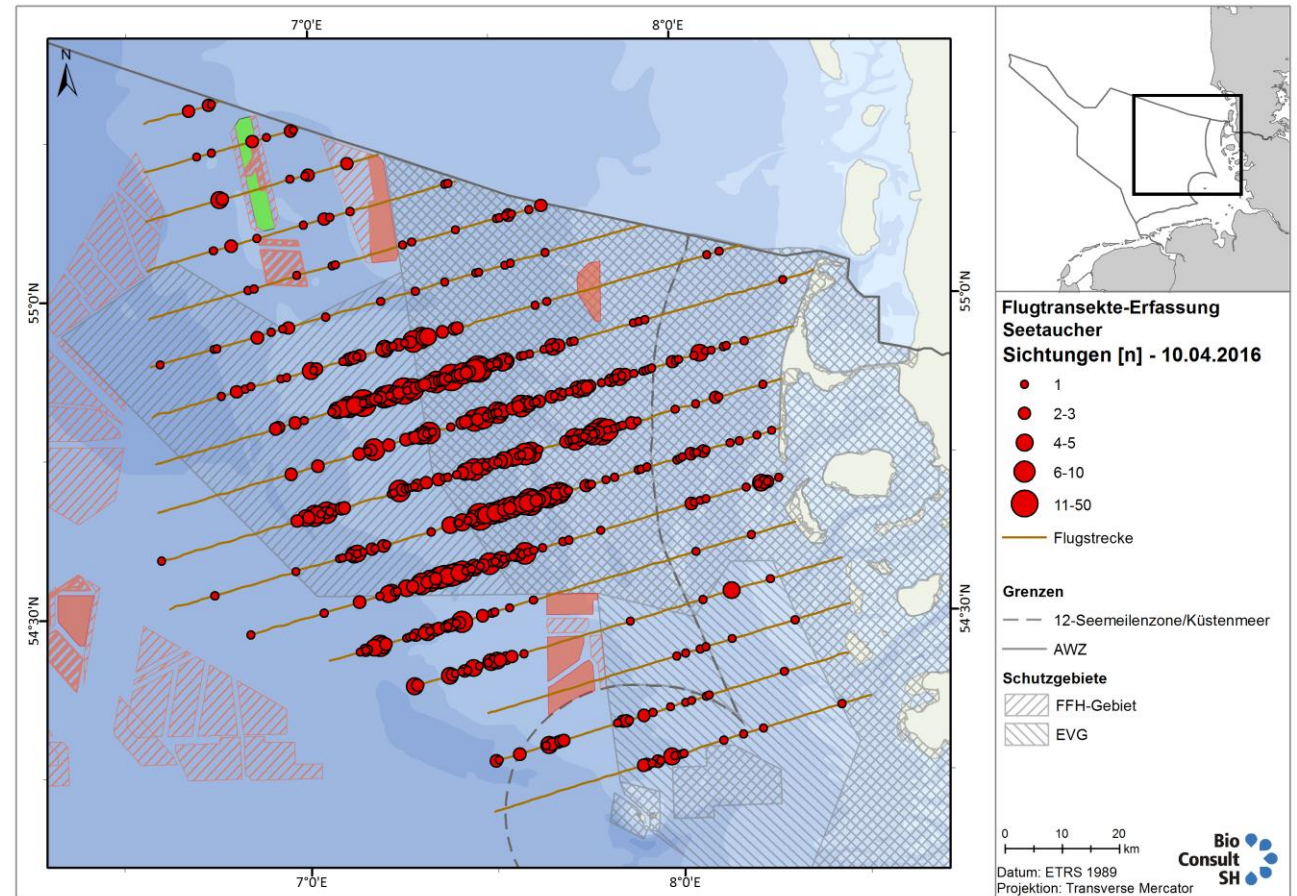


Egmond aan Zee: Leopold et al. 2013

## Examples for wind farm avoidance by divers



alpha ventus: Mendel et al. 2015



6 wind farms: [www.divertracking.com](http://www.divertracking.com)  
n = 1,427 divers (extrapolation: 21,700 divers)

## Seabird avoidance of / attraction to offshore wind farms

species group	strong avoidance	weak avoidance	no wind farm effect (indiff. behaviour)	weak attraction	strong attraction
Divers	Red-throated Diver Black-throated Diver				
Grebes	Great Crested Grebe				
Petrels		Northern Fulmar Manx Shearwater			
Gannets	Northern Gannet				
Cormorants					Great Cormorant European Shag
Ducks		Long-tailed Duck Common Scoter	Common Eider	Red-br. Merganser	
Gulls		Little Gull	Bl.-legged Kittiwake	Common Gull Black-headed Gull Gr. Black-backed Gull Herring Gull Less. Bl.-backed Gull	
Terns		Sandwich Tern	Common Tern Arctic Tern		
Auks		Razorbill Common Guillemot			



Conclusion:

Divers strongly avoid wind farms.

+ few collisions expected

- habitat loss

(wind farm footprint + 2 km buffer)

- barriers in marine environment





## 2. Impact of wind farms on divers in the German Bight (North Sea)

VOGELWELT 133: 163 – 194 (2012)

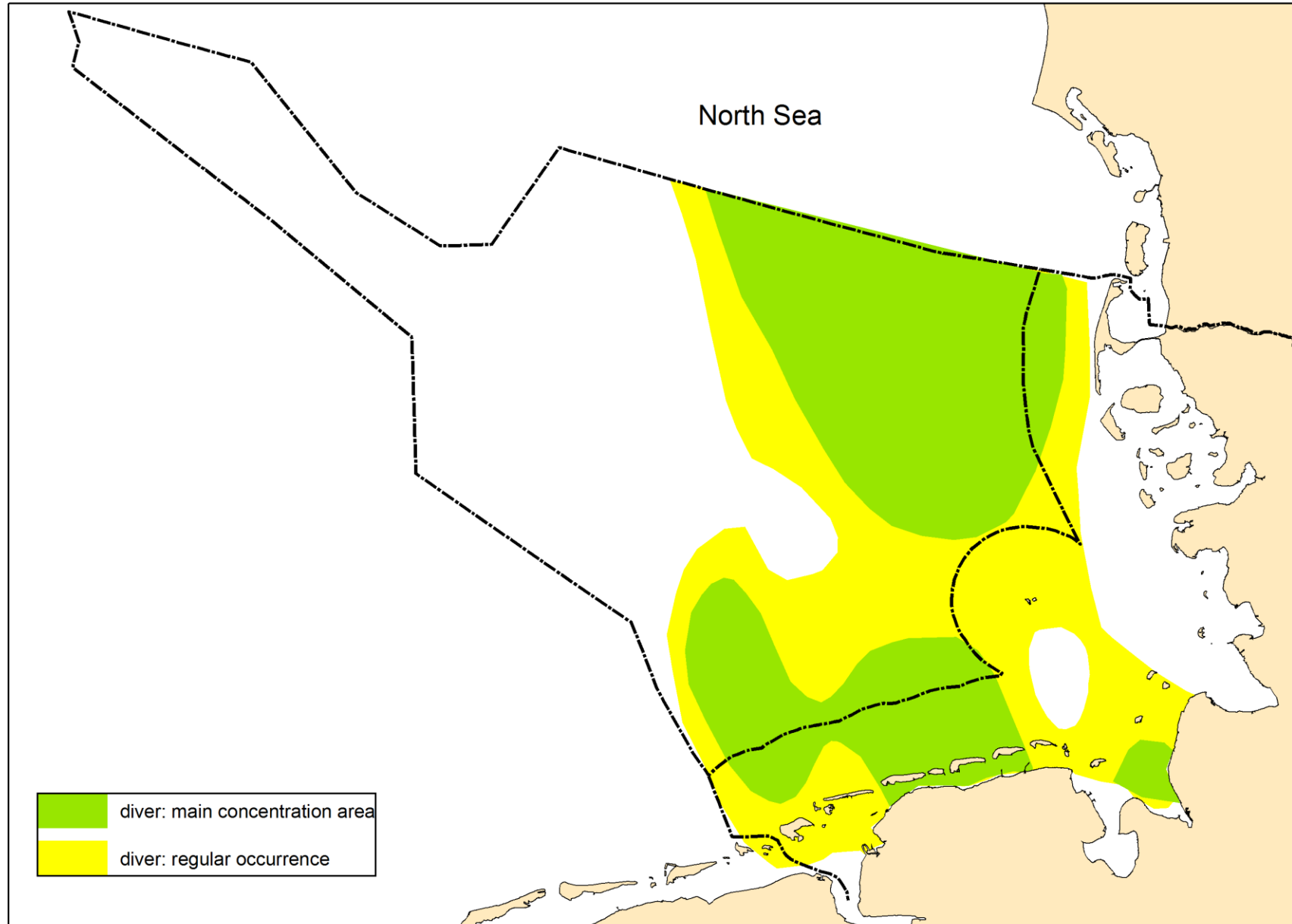
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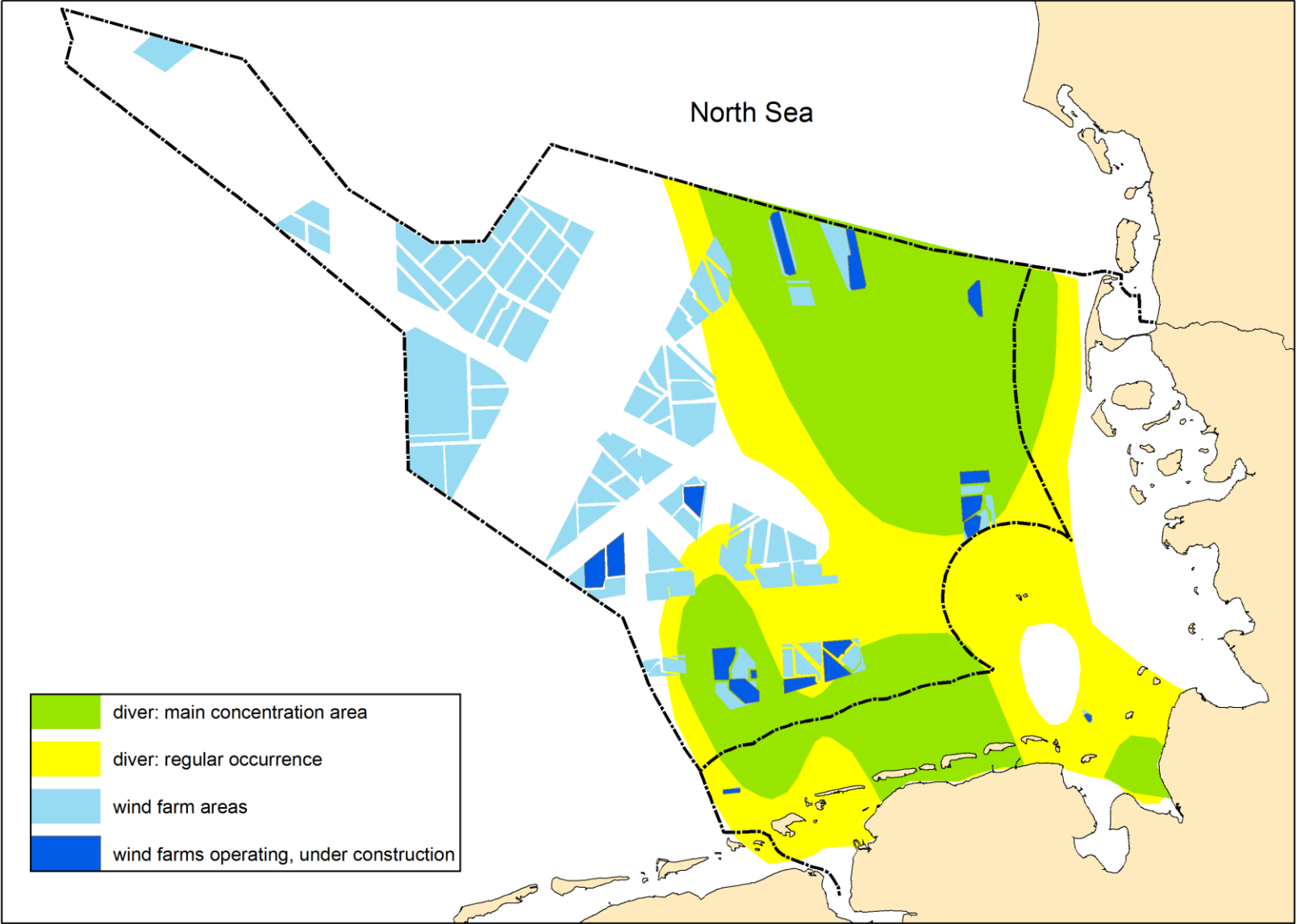
### **Gefährdung von Sterntaucher *Gavia stellata* und Prachtttaucher *G. arctica* in Brut-, Zug- und Überwinterungsgebieten – eine Übersicht mit Schwerpunkt auf den deutschen Meeresgebieten**

Volker Dierschke, Klaus-Michael Exo, Bettina Mendel & Stefan Garthe

Dierschke, V., K.-M. Exo, B. Mendel & S. Garthe 2012: Threats for Red-throated Divers *Gavia stellata* and Black-throated Divers *G. arctica* in breeding, migration and wintering areas: a review with special reference to the German marine areas. Vogelwelt 133: 163 – 194.

During most sections of the annual cycle, Red-throated and Black-throated Divers breeding in N Eurasia and wintering in European coastal marine areas are influenced by human activities, which have impact on habitat quality and eventually on reproduction and mortality. Human actions in breeding, migration and wintering areas are summarized and their effects predicted quantitatively with respect to the German sections of North and Baltic Seas.





## Estimated habitat loss

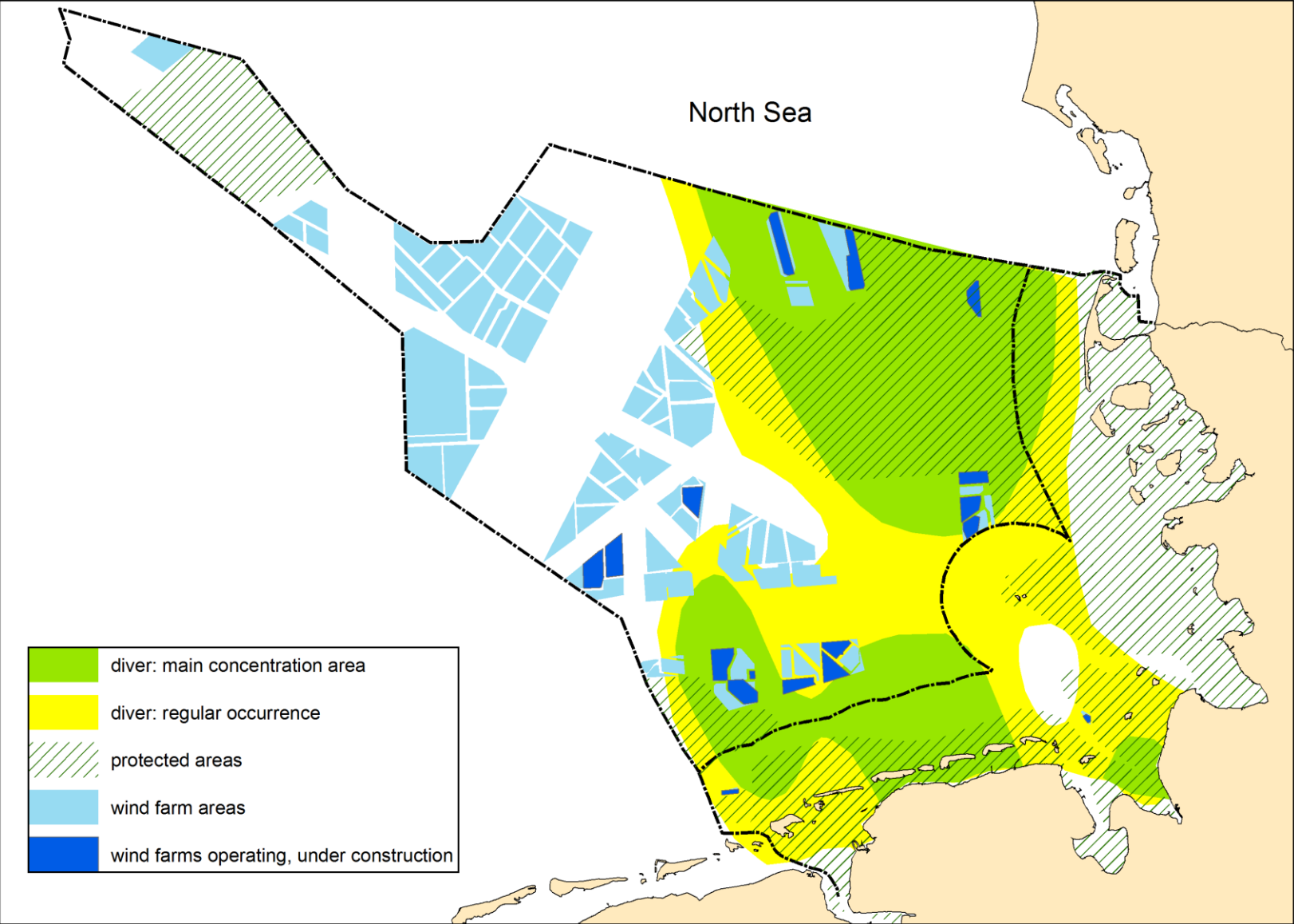
wind farm area + 2-km-buffer [km<sup>2</sup>] \* diver density [birds/km<sup>2</sup>]

season	share RTD	share BTD
winter	92 %	8 %
spring	89 %	11 %

by January 2013:

**26** wind farms (operating, under construction, approved) covering **2,296 km<sup>2</sup>** (including 2 km buffer)

	no. Red-throated Divers affected (winter)	no. Red-throated Divers affected (spring)	no. Black-throated Divers affected (winter)	no. Black-throated Divers affected (spring)
German North Sea	283	1,310	26	163
share of German North Sea population	7.9 % (of 3,600)	7.9 % (of 16,500)	8.7 % (of 300)	8.2 % (of 2,000)
share of (NW) European winter population	0.3 % (of 90,000)	1.5 % (of 90,000)	0.1 % (of 31,250)	0.5 % (of 31,250)





### 3. Cumulative impact of the commercial use of the German Bight on divers

VOGELWELT 133: 163 – 194 (2012)

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#### **Gefährdung von Sterntaucher *Gavia stellata* und Prachtttaucher *G. arctica* in Brut-, Zug- und Überwinterungsgebieten – eine Übersicht mit Schwerpunkt auf den deutschen Meeresgebieten**

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wind farms:  
habitat loss  
disturbance  
barrier

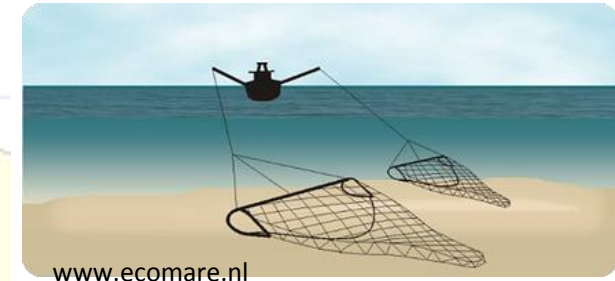


shipping:  
habitat loss  
disturbance  
oil pollution

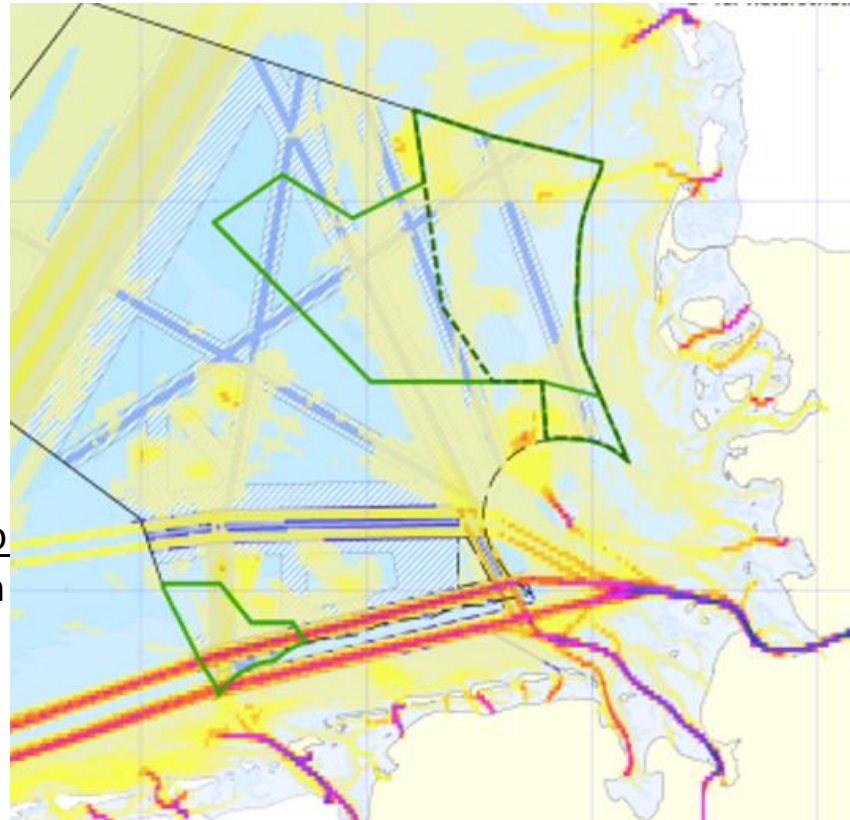


aggregate extractio  
habitat destruction  
food reduction  
disturbance

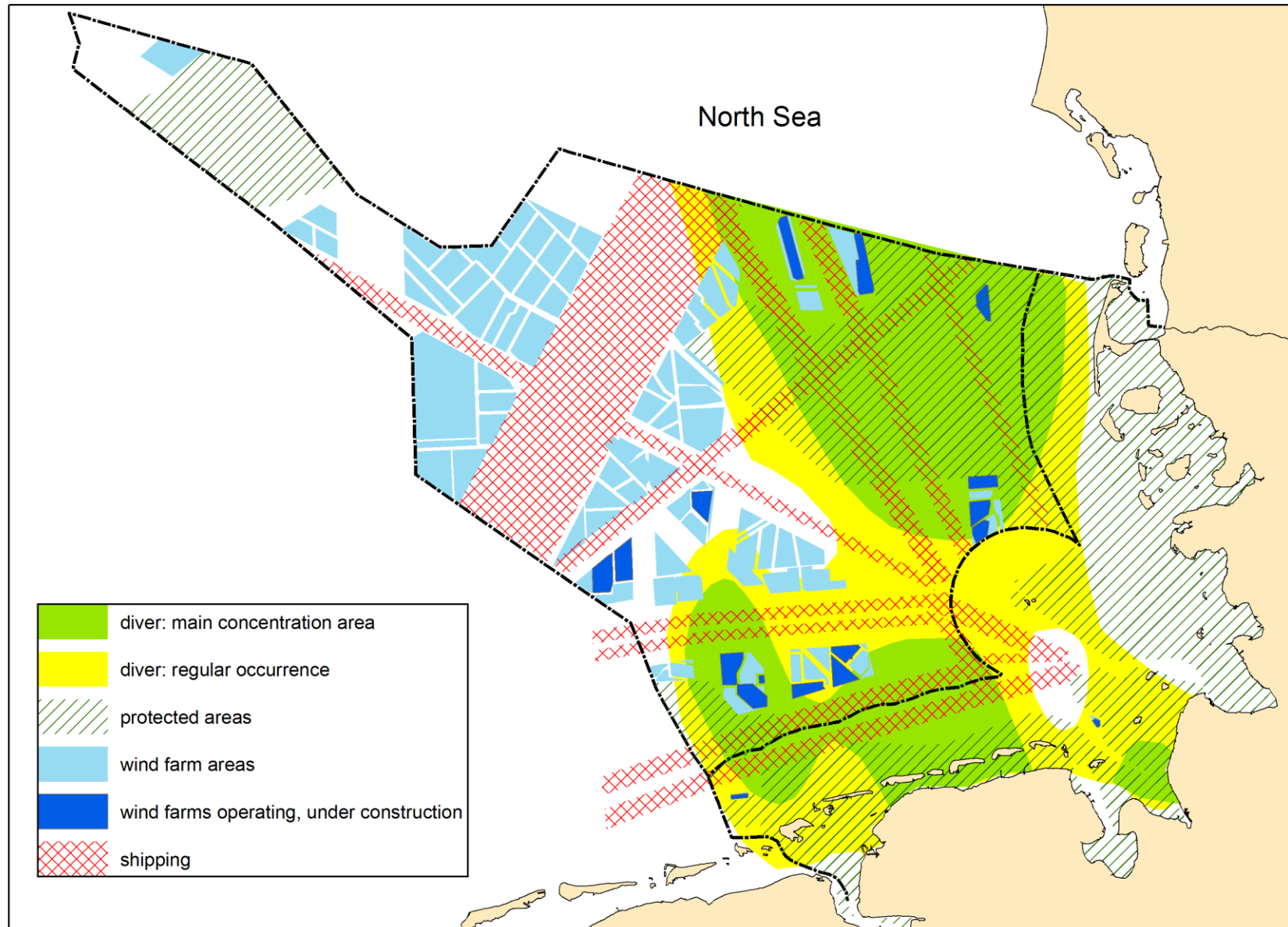
fishing:  
habitat destruction  
food reduction  
disturbance

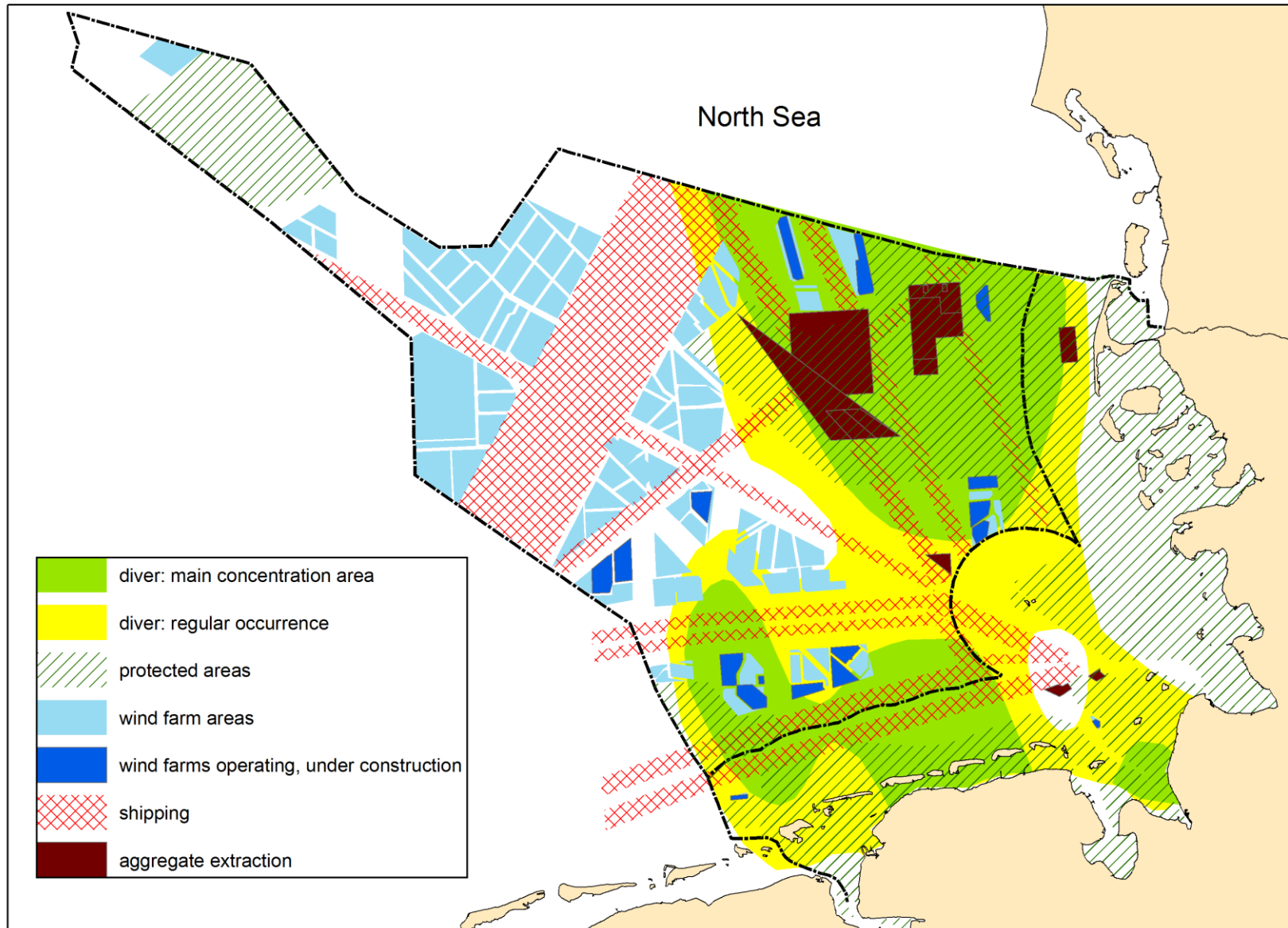


AIS data 2014



Der Bau der künstlichen Insel in der Doggerbank könnte 2030 beginnen





## Estimated habitat loss

$$\text{stressed area [km}^2\text{]} * \text{diver density [birds/km}^2\text{]}$$

## Red-throated Diver

## Black-throated Diver

influencing factor	Red-throated Diver			Black-throated Diver		
	no. of birds loosing habitat	share of spring population German North Sea (16,500 birds)	share of NW European winter population (90,000 birds)	no. of birds loosing habitat	share of spring population German North Sea (2,000 birds)	share of European winter population (31,250 birds)
offshore wind farms	1,310	7.9 %	1.5 %	163	8.2 %	0.5 %
ship traffic	3,130	19.0 %	3.5 %	380	19.0 %	1.2 %
aggregate extraction	1,025	6.2 %	1.1 %	127	6.4 %	0.4 %
allowance for overlap	-423			-52		
<b>cumulative habitat loss</b>	<b>5,042</b>	<b>30.6 %</b>	<b>5.6 %</b>	<b>618</b>	<b>30.9 %</b>	<b>2.0 %</b>

by January 2013

Which pressures are divers facing ?



(German) North Sea:

- shipping
- offshore wind farms
- aggregate extraction
- fishing
- oil pollution

(German) Baltic Sea:

- shipping
- offshore wind farms
- aggregate extraction
- fishing
- oil pollution
- **drowning in gill nets**

breeding area:

- habitat degradation (water chemistry, disturbance, climate change)
- hunting
- hazardous substances

Manifold pressure on divers!

**Many thanks to all the flock mates during studies on divers and wind farms:**

Markus Ahola, Kai Borkenhagen, Ben Dean, Kalevi Eklöf, Bob Furness, Stefan Garthe, Nils Guse, Nicole Jüngling, Pertti Koskimies, Nele Markones, Bettina Mendel, Thomas Merck, Gerrit Peters, Ævar Petersen, Ib Krag Petersen, Philipp Schwemmer, Stefan Weiel, Axel Zinke ... an many others!

