Assessing the Impact of Oil Pollution on Marine Wildlife: A European Perspective to Study the Effects of Chronic Oil Pollution and Major Spills on Seabird Populations (1950–2010)

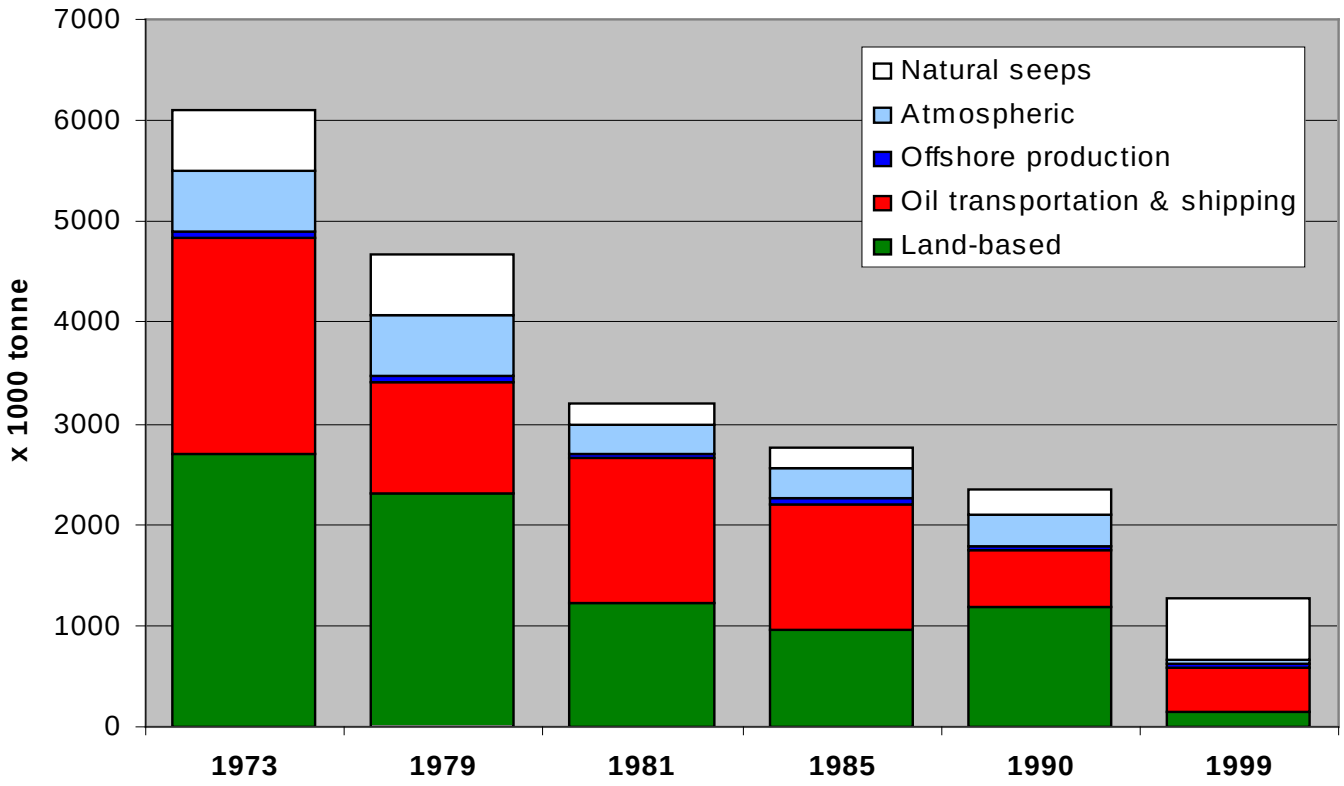
C.J. Camphuysen

Royal Netherlands Institute for Sea Research

Contents of this presentation:

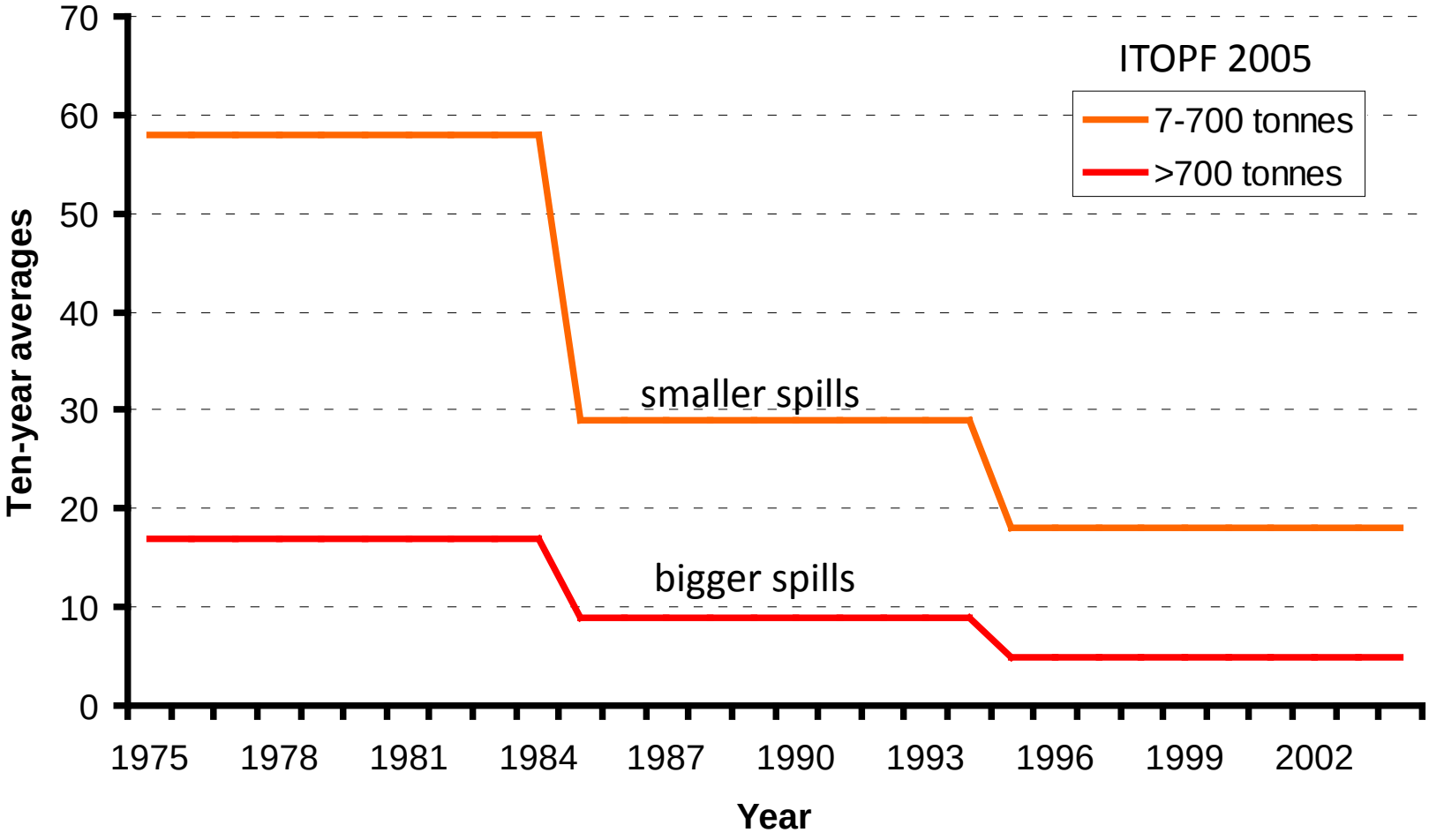
- Oil pollution as an issue today
- Effects of oil pollution on seabird populations: impact assessments
- Sensitivity to oil of wildlife and sea areas

Worldwide annual releases of oil into the marine environment have declined from approx. 6 million tons in the 1970s to less than one million tons per annum in recent years



Sources: Patin 1999; Committee on Oil in the Sea *et al*. 2003

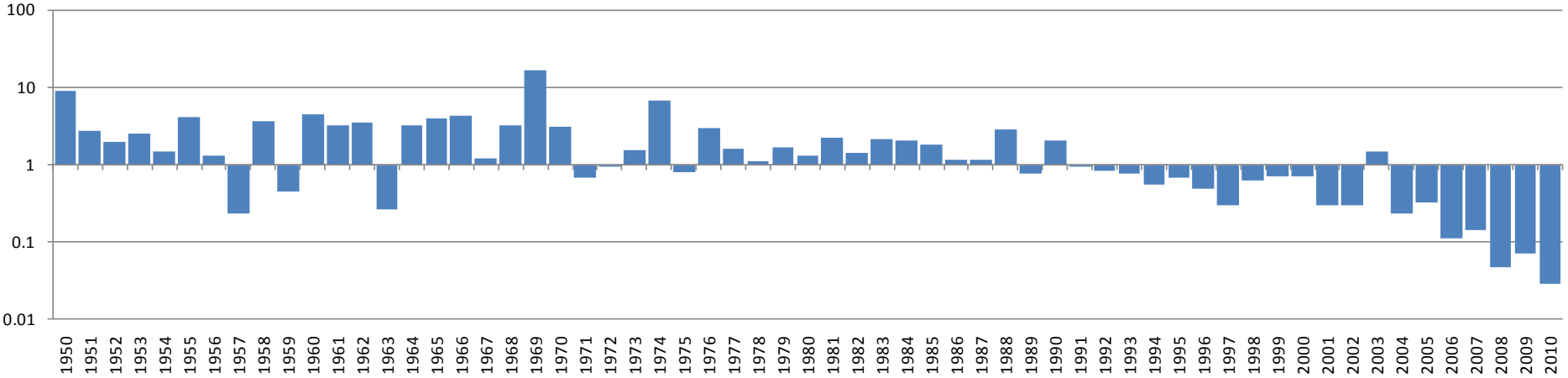
The number of tanker spills declined



Source: Huijer 2005

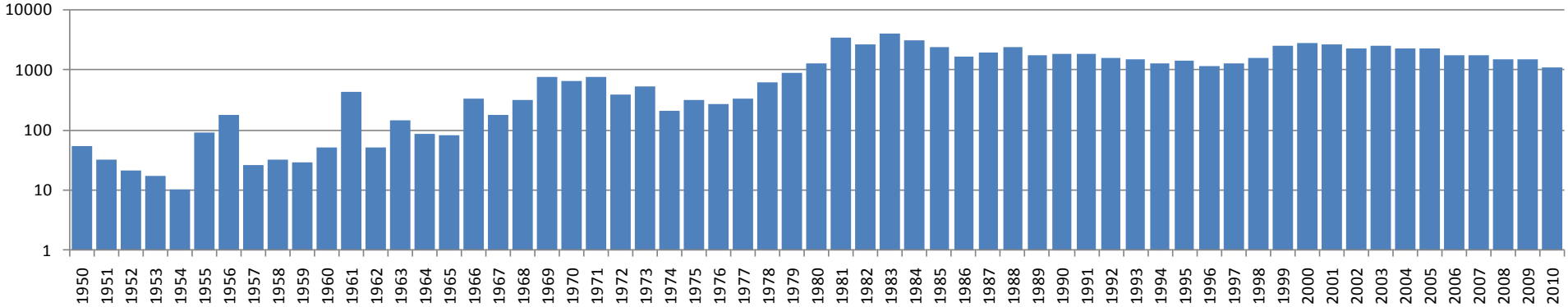
Densities of oiled birds

Seabird mortality due to chronic oiling



Beached Bird Survey Effort, The Netherlands (km surveyed)

1950 – 2010



But accidental oil spills cannot be fully prevented

Argo Merchant

Amoco Cadiz

Braer

Erika

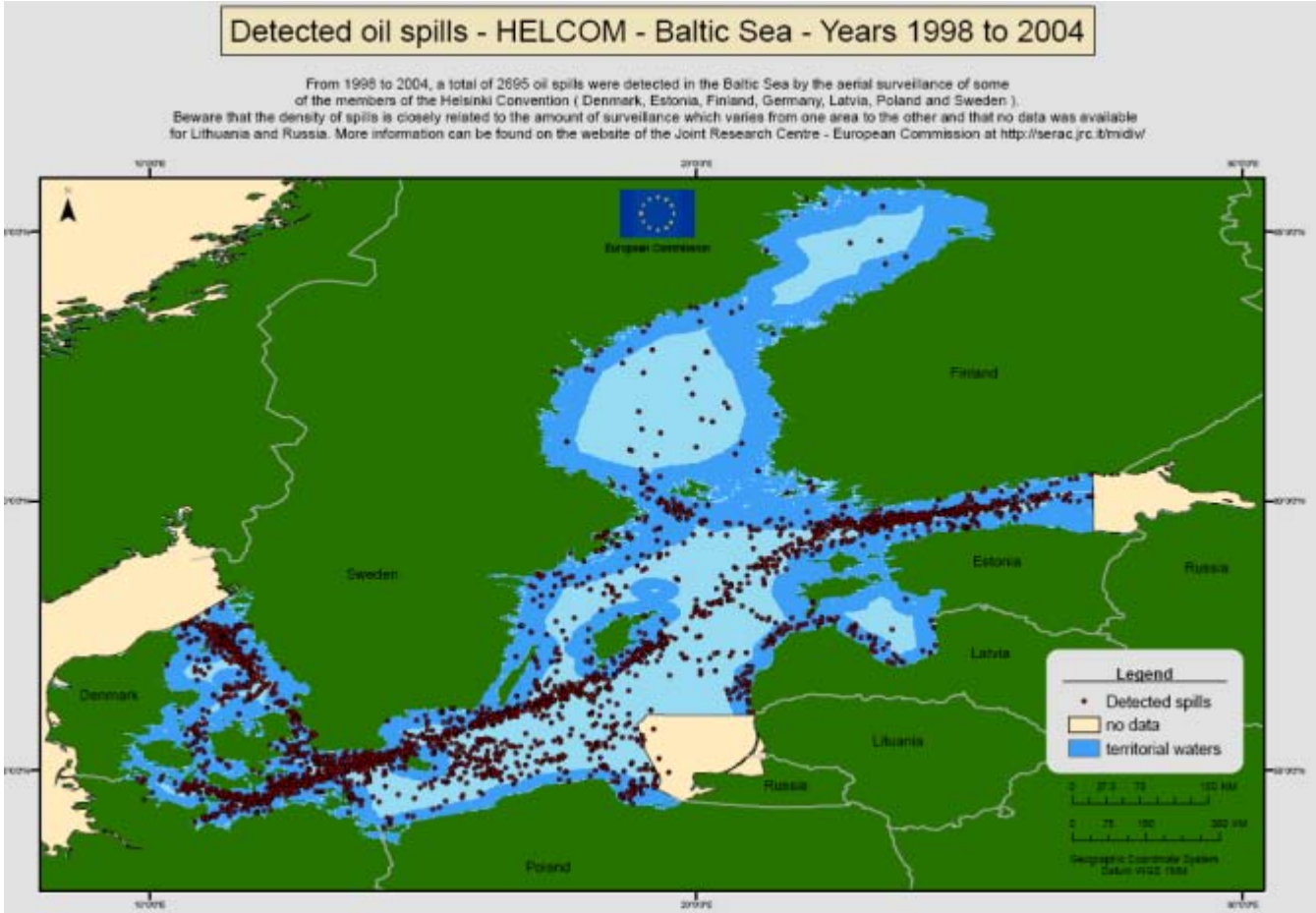
Prestige

Point clearly demonstrated . . .

Published online by the Tristan da Cunha Government and the Tristan da Cunha Association.

- *MS Oliva* ran aground on Nightingale Island (Tristan da Cunha) on March 16, 2011
- All 22 crew were rescued by March 17
- The ship then broke up and Nightingale Island is now facing an environmental disaster

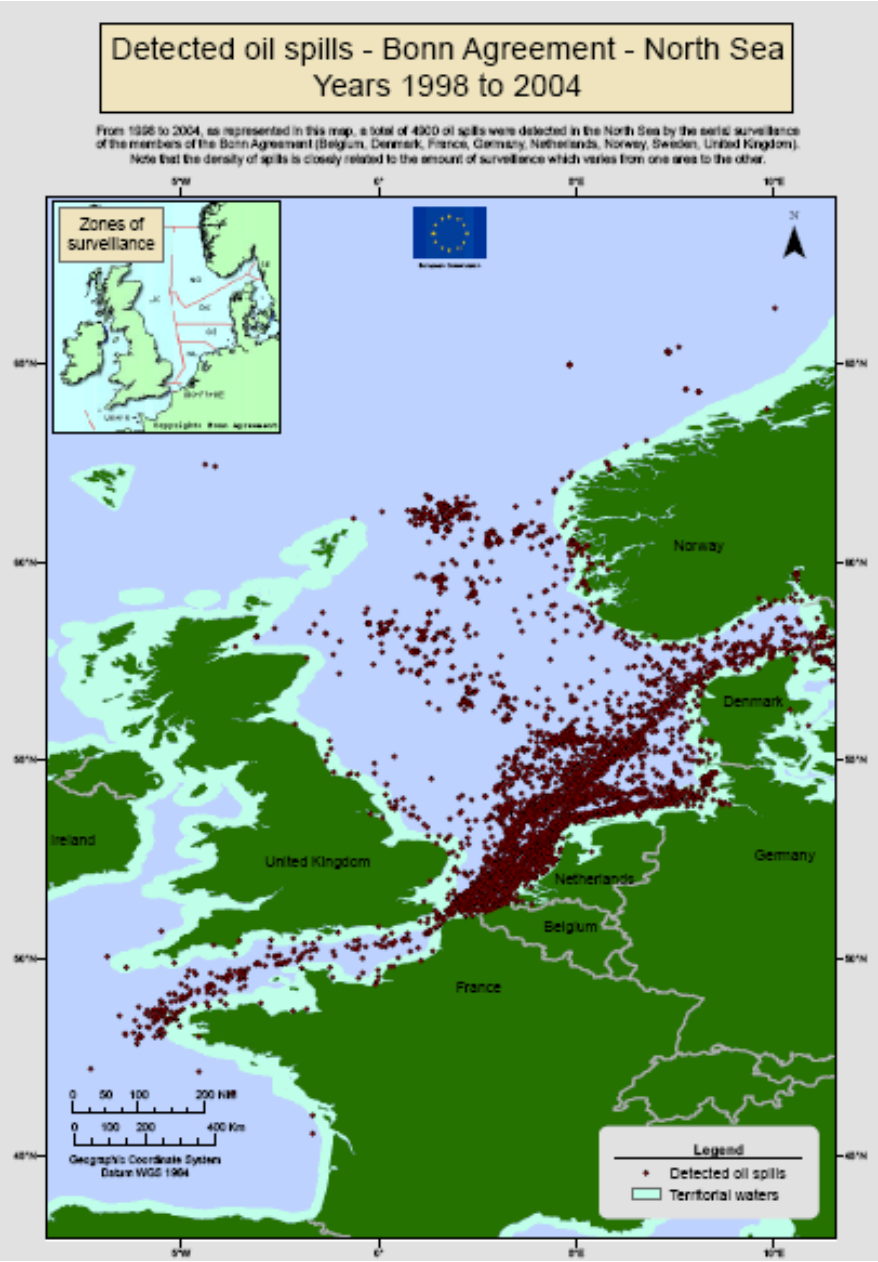
Chronic oil pollution: inputs have declined, monitoring still required



The Baltic (Norway, Sweden, Finland, Denmark, Germany, Poland, Estonia , Latvia, Lituania, Russia)

Sources: EC MIDIV Project of JRC/IPSC http://serac.jrc.it/midiv/ and http://serac.jrc.it/midiv/maps/baltic/density_oil_helcom_1998_2004.pdf

Chronic oil pollution: inputs have declined, monitoring still required



From 1998 to 2004, 4,900 oil spills were detected in the **North Sea** by the aerial surveillance of the members of the Bonn Agreement (Belgium, Denmark, France, Germany, Netherlands, Norway, Sweden, United Kingdom)

Source: EC MIDIV Project of JRC/IPSC http://serac.jrc.it/midiv/maps/northsea/aerial/oilspill_bonn_1998_2004.pdf

Contents of this presentation:

- Oil pollution as an issue today
- Effects of oil pollution on seabird populations: impact assessments
- Sensitivity to oil of wildlife and sea areas

Technical response

National or regional authorities (dependent on size of spill)

Wildlife response

NGOs

Level

Equally low

Mutual understanding?
Limited

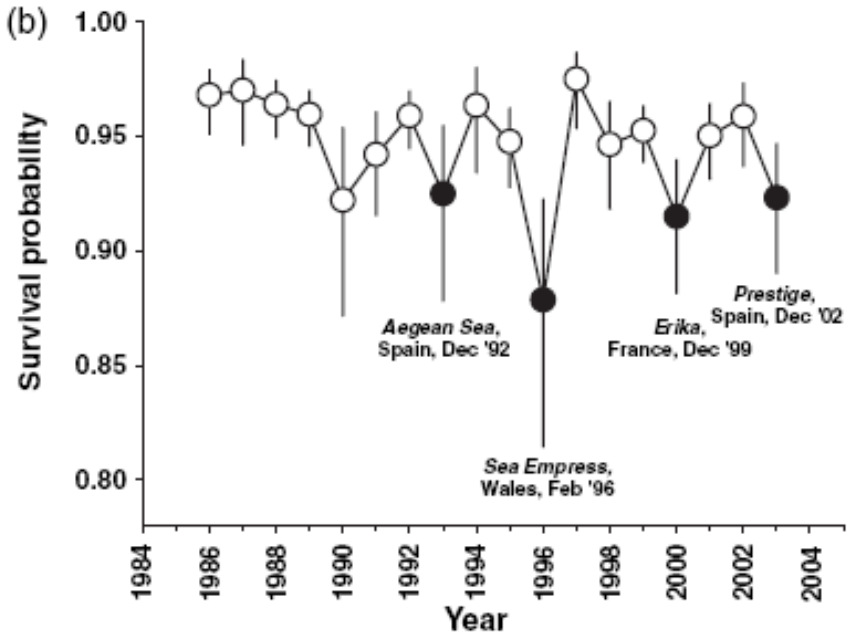
We know the killing effects of oil.

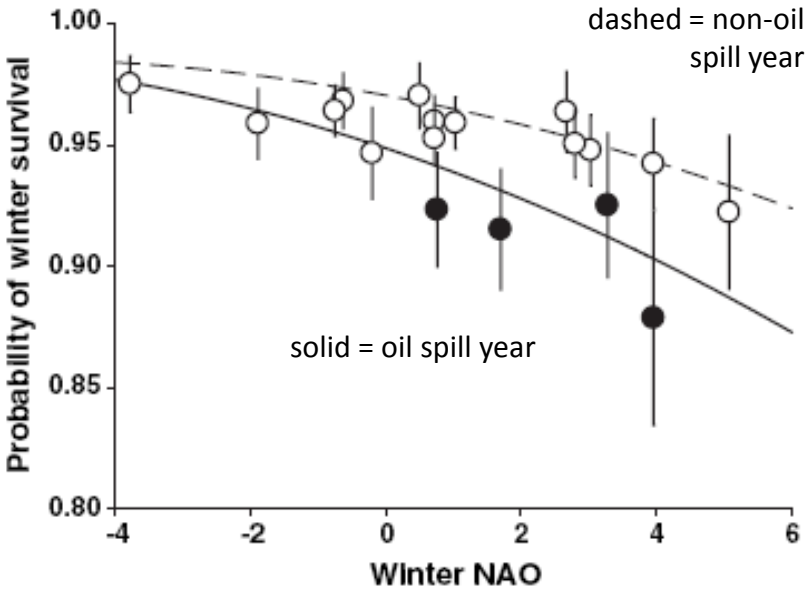
Population level effects?

Oil spill impact assessments

- How many casualties?
- From where are they (breeding origin)?
- What is the age composition?
- Can we minimize further damage (biological advice)?

Recent studies showed that winter mortality of adult guillemots was doubled by major oil pollution incidents





Variation in over-winter survival probability over time (mean with 95% confidence intervals, 1985 – 2004).

Years following over-winter oil spills (closed symbols) are labelled with the name of tanker, date and location of spill.

Relationship between over-winter survival estimates of adult common guillemots, winter NAO ('climate') and occurrence of major oil spills.

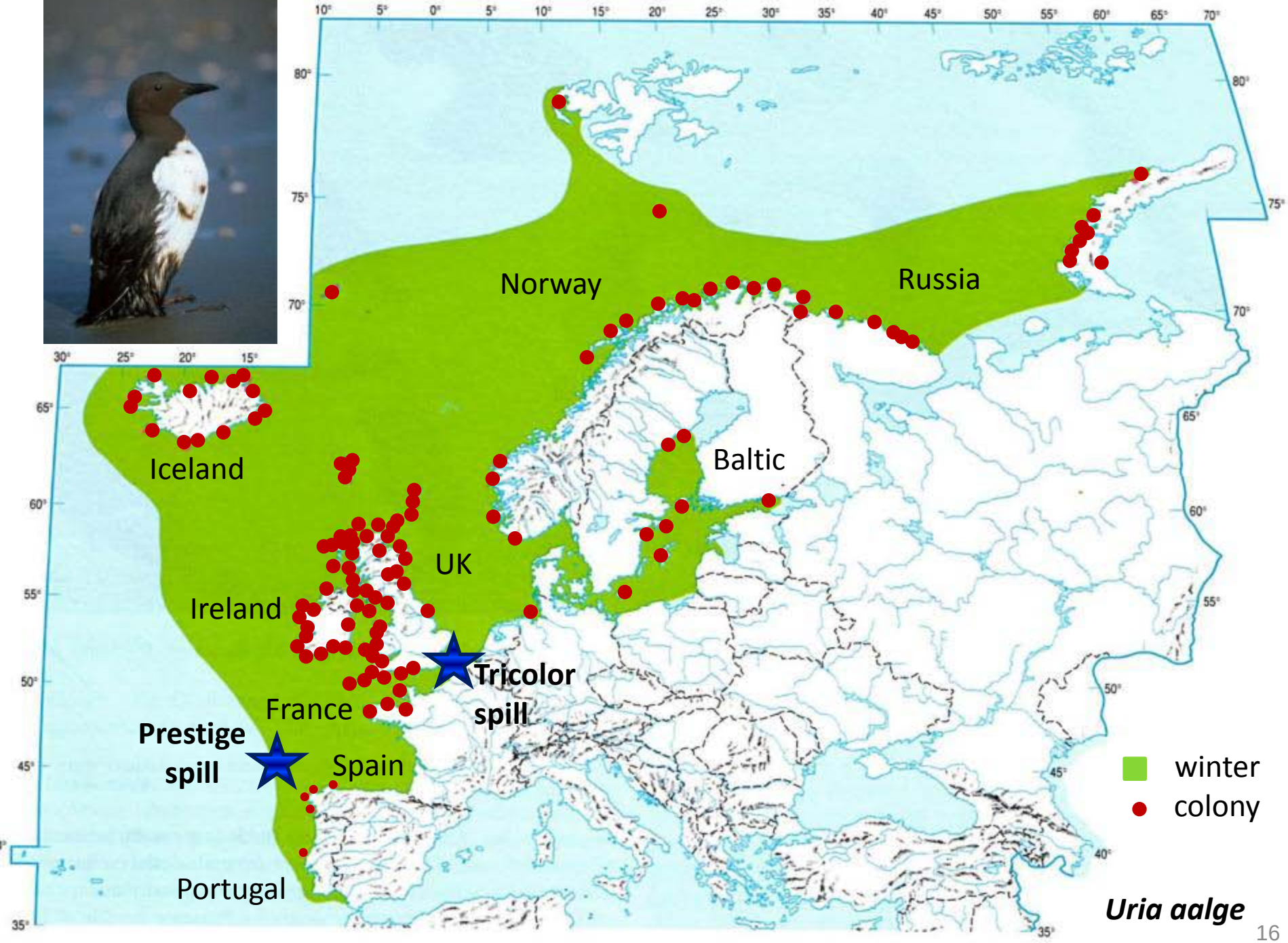
Source: Votier *et al.* 2005

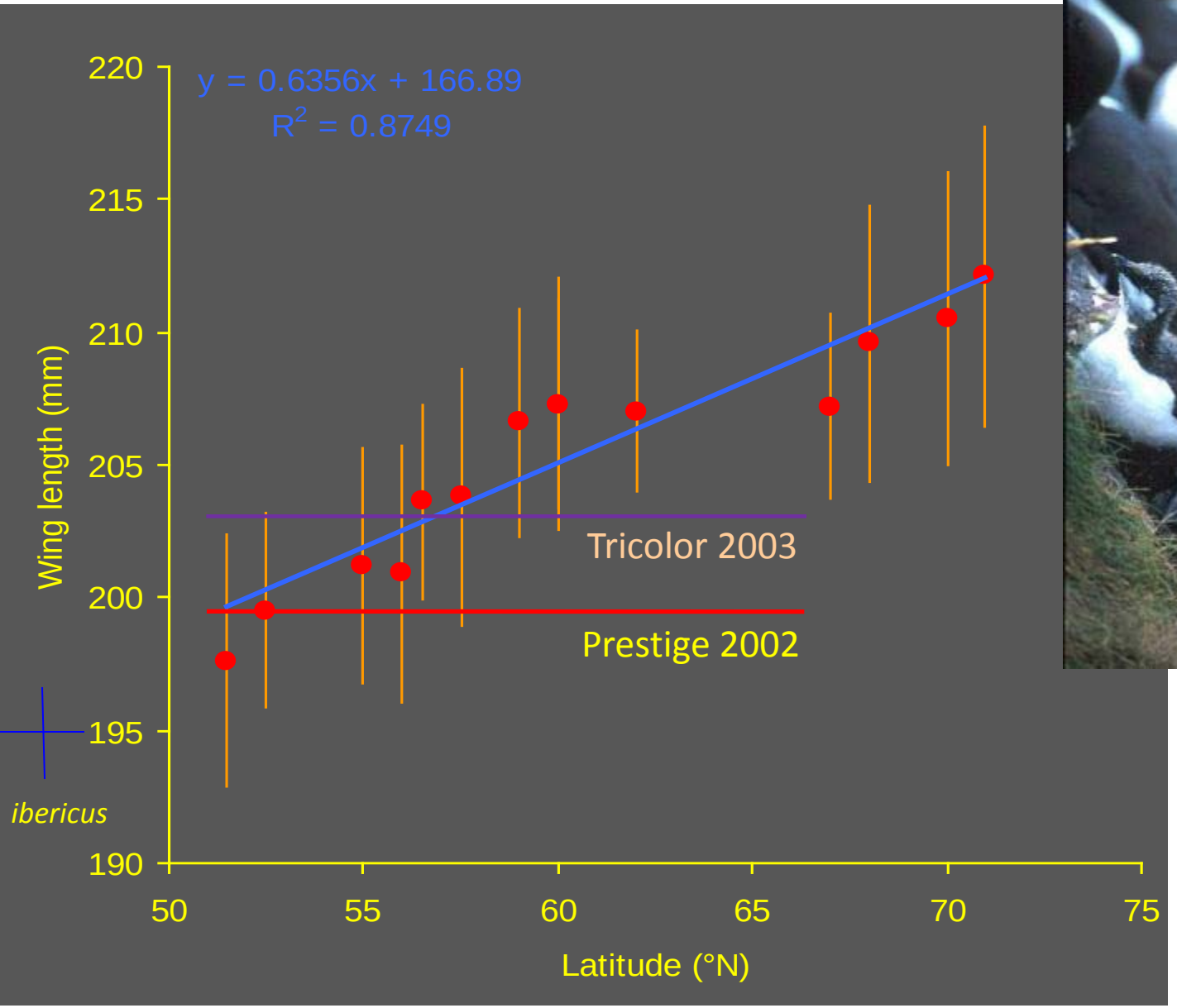
Effect studies can be facilitated by detailed, standardized impact assessments during spills

Breeding origin

Sex ratio

Age composition

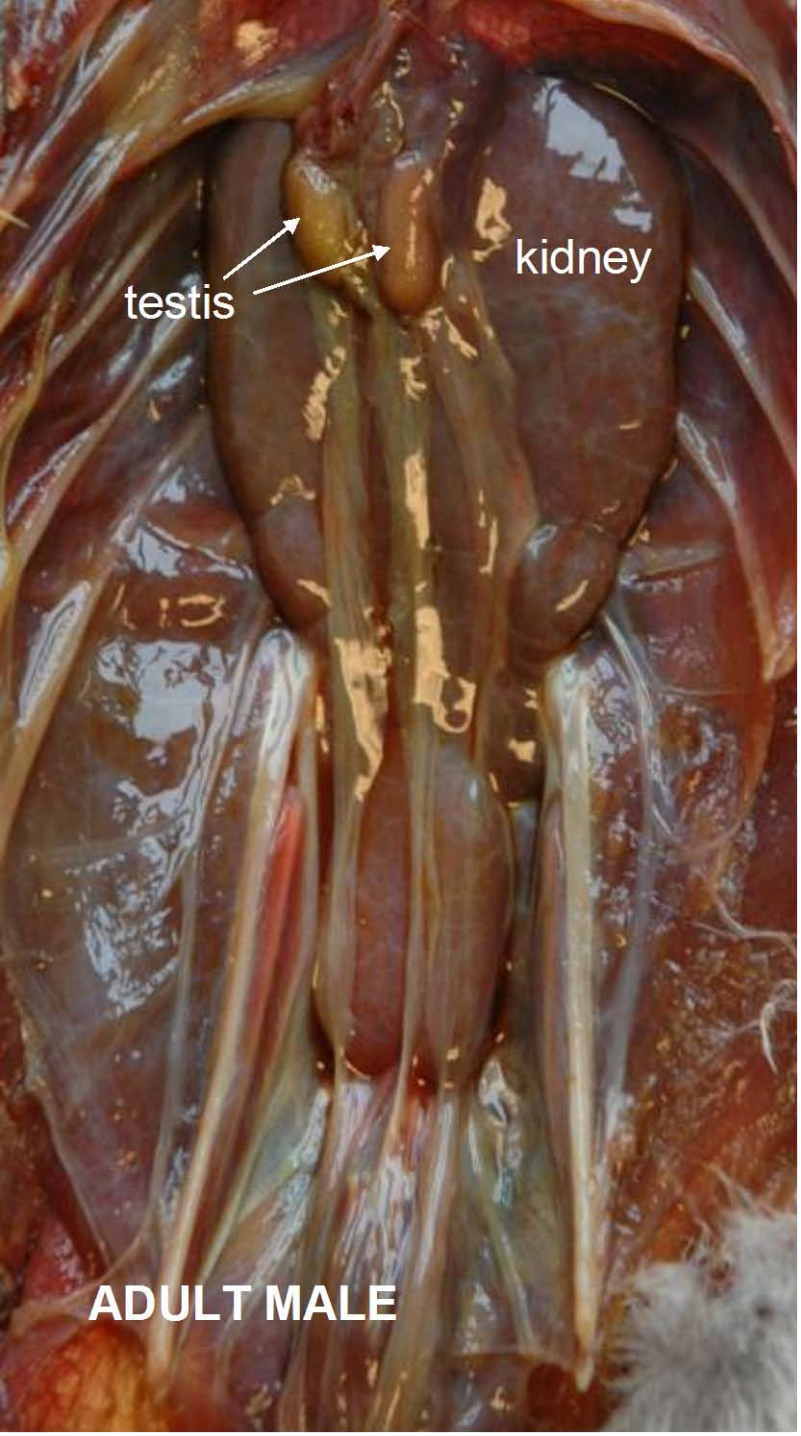

Norway
Russia
Iceland
Baltic
UK
Ireland
Tricolor spill
France
Prestige spill
Spain
Portugal
winter
colony
Uria aalge

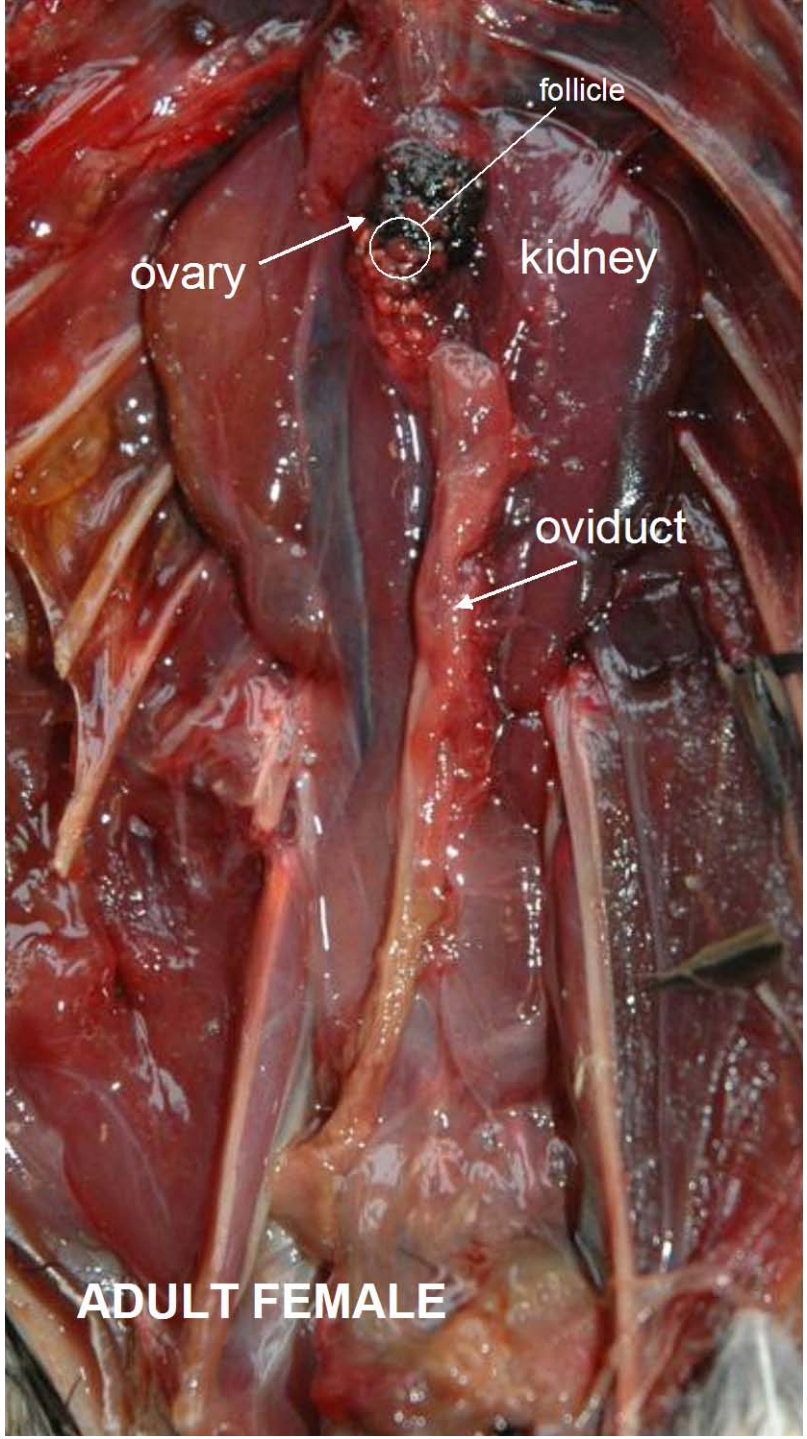


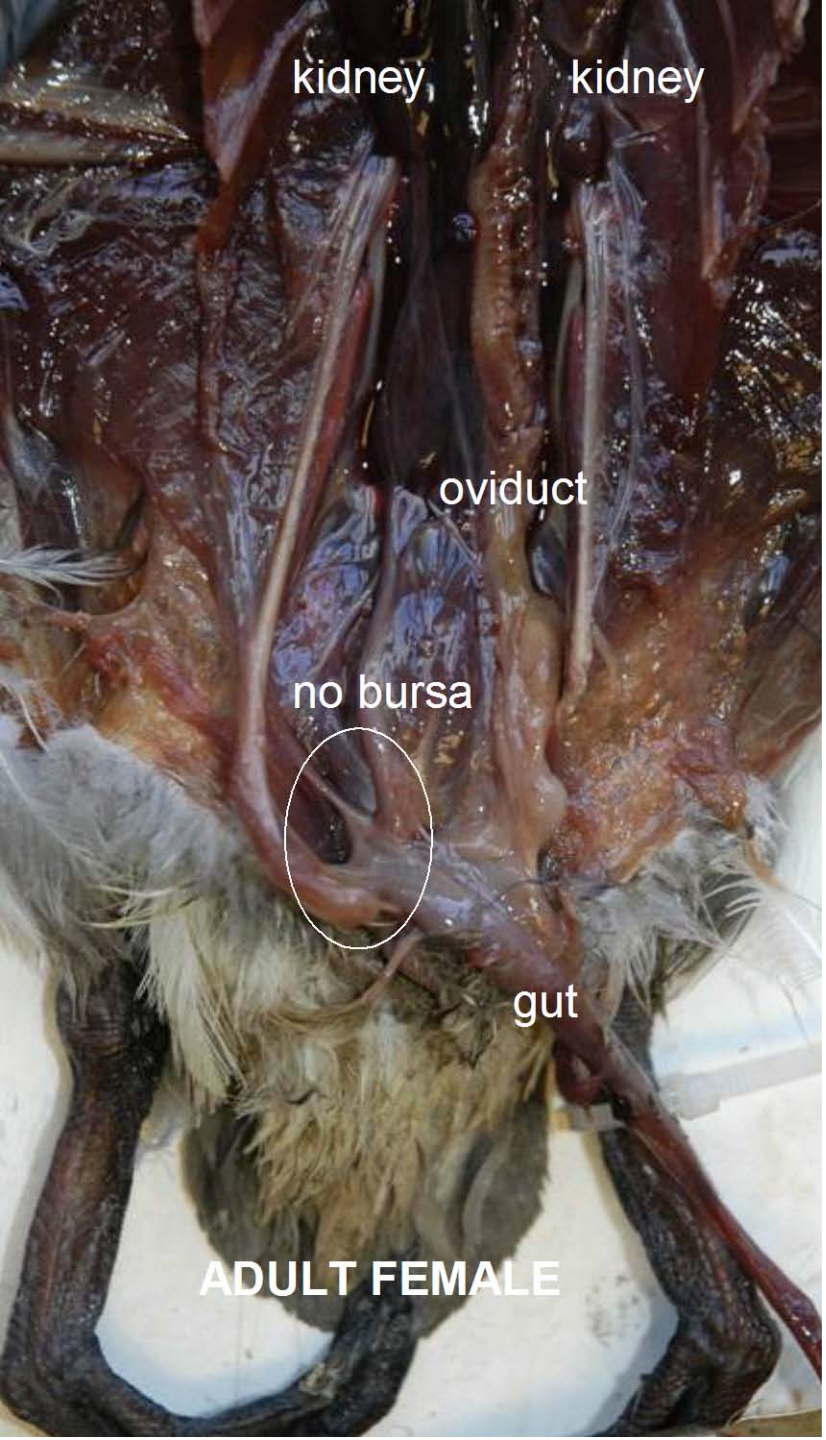
The European cline in wing length of Common Guillemots *Uria aalge*

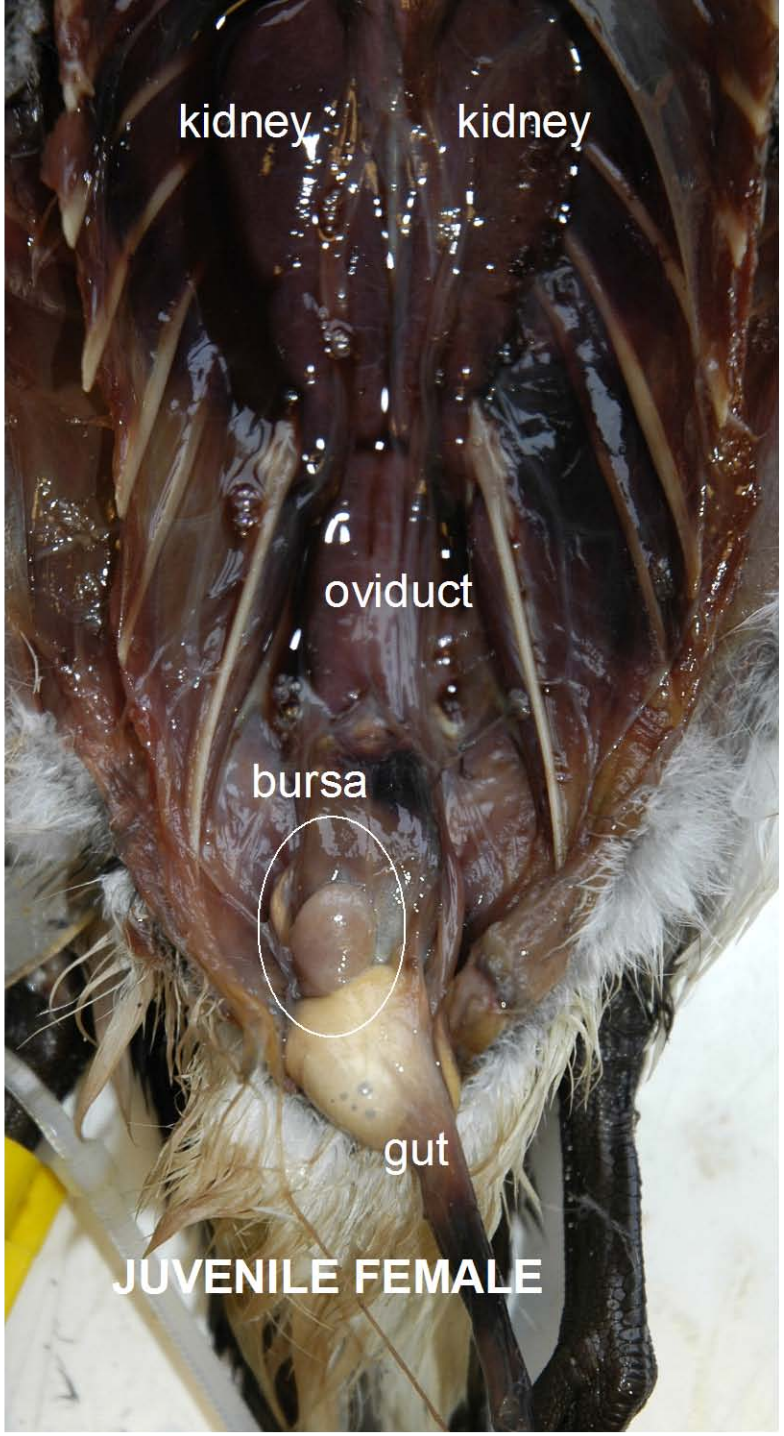
After Hope Jones 1984, 1988 (modified)

Razorbill *Alca torda*		Atlantic Puffin *Fratercula arctica*
0+0		no grooves
W+0	**Delayed population level effects**	faint groove
W+1		½ groove
W+1.5	**Immediate population level effects**	single groove
W+2		three grooves


testis
kidney
ADULT MALE


follicle
ovary
kidney
oviduct
ADULT FEMALE


kidney
kidney
oviduct
no bursa
gut
ADULT FEMALE


kidney
kidney
oviduct
bursa
gut
JUVENILE FEMALE

Training standard necropsies, *during* a spill, Keila, Estonia, winter 2006

Long-tailed Ducks lined up for necropsy

Training standard necropsies as a workshop during EOW 2009, Keila, Estonia, September 2009

Handbook on Oil Impact Assessment

Online guidelines ...

www.oiledwildlife.eu/publications/handbook-oil-impact-assessment-seabirds

(Camphuysen *et al*. 2007)

Contents of this presentation:

- Oil pollution as an issue today
- Effects of oil pollution on seabird populations: impact assessments
- Sensitivity to oil of wildlife and sea areas

Biological advice during spills / clean-up chronic oil

→ **Which are the most sensitive species?**

→ **Which are the most sensitive areas?**

Not all sea areas are equally sensitive to oiling

Oil Vulnerability Indices (OVI) are widely used to rank species in terms of their perceived sensitivity to oiling

Important parameters are: behavior, exposure, biogeographical population, reproductive potential, and reliance on the marine environment.

OVIs should preferably be calculated at the highest taxonomic level (species or subspecies), but unfortunately, OVIs have not been calculated for most European taxa of seabirds.

High OVI, higher sensitivity to oil

lower OVI, lower sensitivity

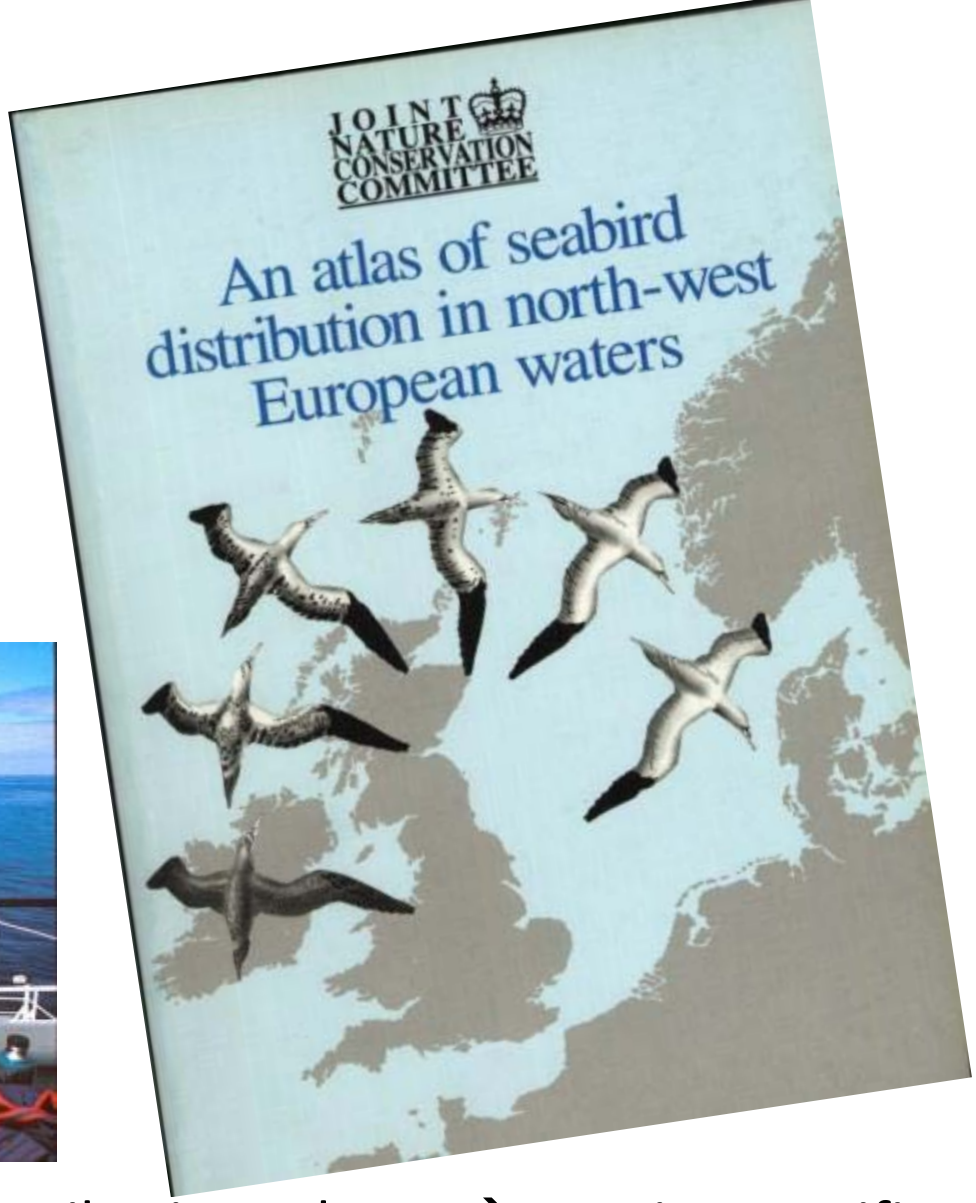
Family	Mean OVI	Min		Max
Auks	77.2	65	-	86
Divers	66.3	65	-	68
Cormorants and shags	66.0	59	-	73
Gannets and boobies	65.0	65	-	65
Sea ducks	64.2	45	-	75
Petrels and shearwaters	59.2	47	-	65
Diving ducks	58.0	58	-	58
Grebes	53.3	46	-	58
Storm-petrels	50.3	49	-	54
Terns	47.9	46	-	51
Gulls	45.1	36	-	66
Skuas	42.6	36	-	58
Phalaropes	38.0	37	-	39

Source: Camphuysen 2007

Mean oil vulnerability scores (OVI) for seabird families in the North Sea (Source: Camphuysen 1989)

most sensitive

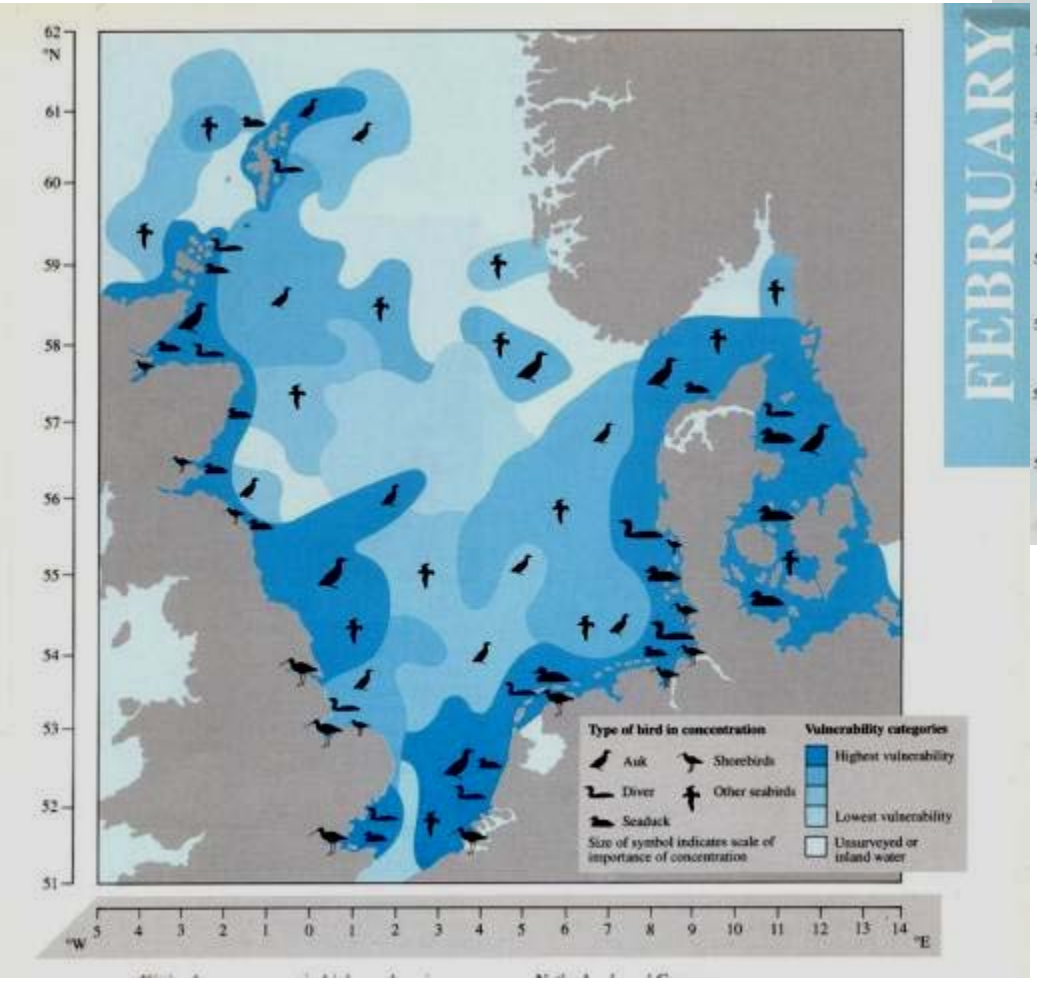
least sensitive

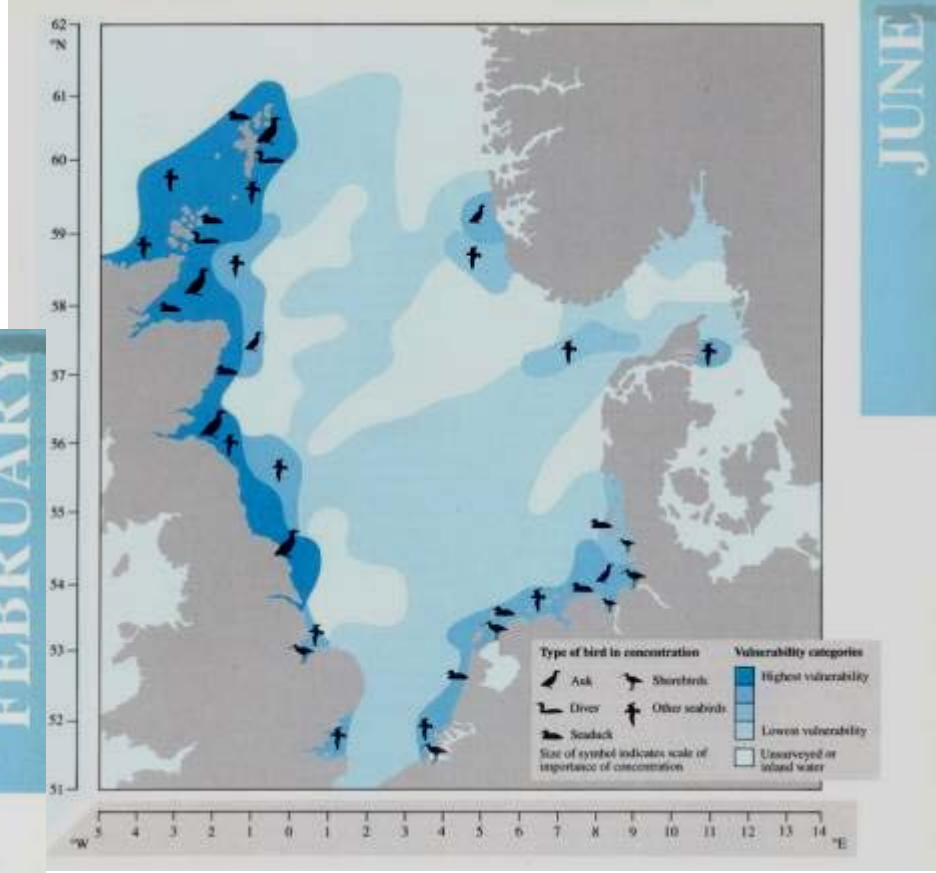


At-sea censuses to produce distribution atlases → species specific distribution maps

Source: Stone et al. 1995

Highlighting areas to avoid with risky operations → areas to prioritise during clean-up operations during oil spills

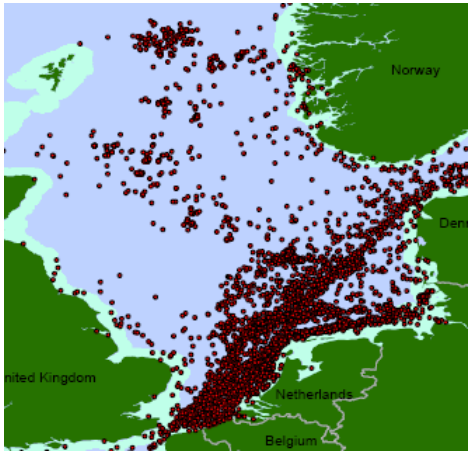




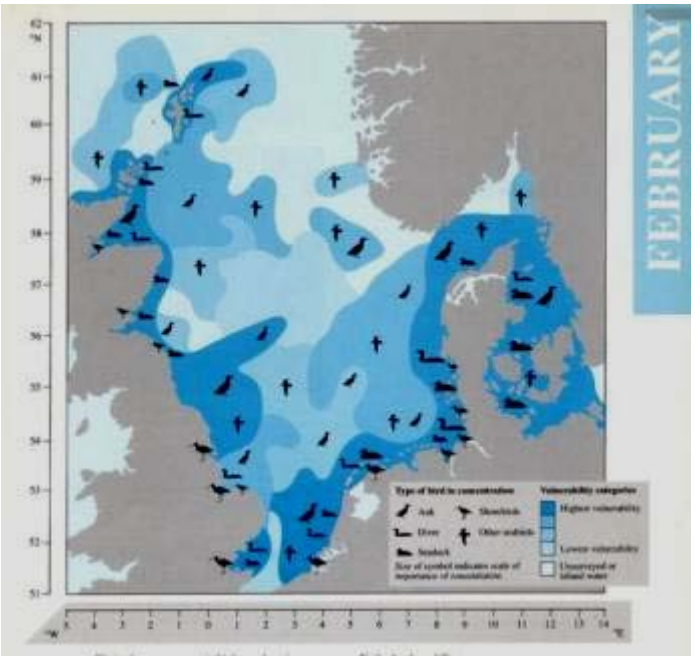
Monthly vulnerability maps: distribution data / oil vulnerability indices (OVI)

Source: Carter et al. 1993

Traffic (input) versus sensitivity → high risk, high oil rates

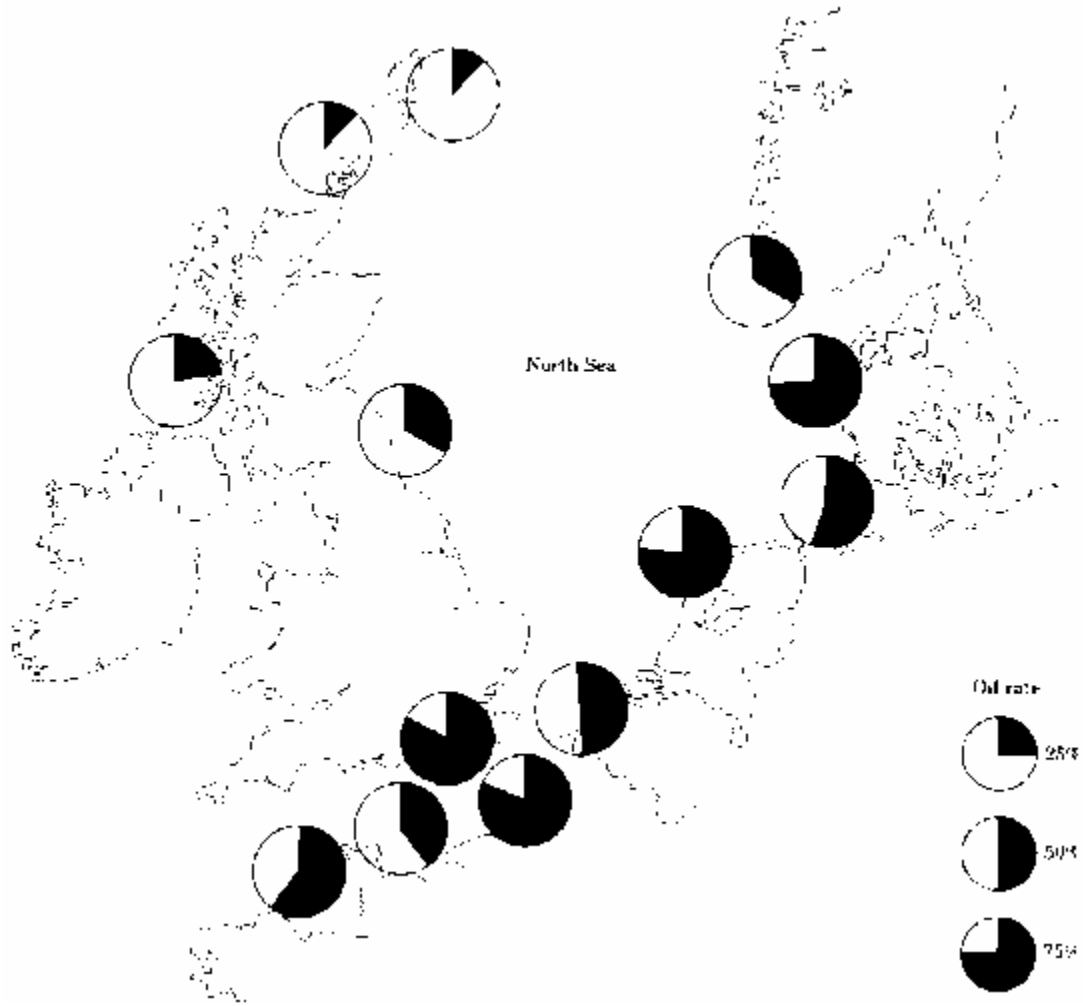


Source: EC MIDIV Project of JRC/IPSC
http://serac.jrc.it/midiv/maps/northsea/aerial/oilspill_bonn_1998_2004.pdf



Source: Carter et al. 1993

Oil rates (%) of stranded Guillemots



Source: Furness and Camphuysen 1997

Technical response is usually directed at the wreck site. Are further wildlife effects considered unavoidable?

Available knowledge on the specific sensitivity of seabirds and sea areas seems to play a minor part in orienting the decision in the planning of clean-up operations in the aftermath of oil incidents or in planning aerial surveillances of oil at sea.

Biological advice

- an immediate update on area sensitivity (utilizing recent data)

  → Produce area sensitivity maps

  → Update them with recent information (contact locals)

  → Highlight areas of extraordinary sensitivity

  → Communicate the findings with response team

Biological advice

- forecasting near future changes in wildlife abundance

What if the spill is large and will last long?

→Assess status of wildlife in area (winter, breeding, …)

→ Evaluate expected migratory movements

→ Communicate the findings with response team

Biological advice

- assist in planning clean-up operations: select and prioritize the most vulnerable sea areas if ever possible
- advice to postpone or speed up risky operations

→ Make sure update biological info is included in response planning

Conclusions

(1) Despite a reduction of oil pollution, we still need further action to minimize wildlife effects → both from chronic oil and incidental spills

(2) High-quality Impact Assessments are required to evaluate population level effects; monitoring and ringing in colonies is vital

(3) Biological advice should be used to help set priorities during an oil spill response

References

Camphuysen, C.J. 1989. Beached Bird Surveys in the Netherlands 1915–1988; Seabird Mortality in the southern North Sea since the early days of oil pollution. Amsterdam: Techn. Rapport Vogelbescherming 1, Werkgroep Noordzee. 322 pp.

Camphuysen, C.J. 2007. Chronic oil pollution in Europe, a status report. Brussels: Royal Netherlands Institute for Sea Research, commissioned by International Fund for Animal Welfare (IFAW). 85 pp.

Camphuysen, C.J., R. Bao, H. Nijkamp, and M. Heubeck, eds. 2007. Handbook on Oil Spill Assessment. Online edition, version 1.0. www.oiledwildlife.eu/publications/handbook-oil-impact-assessment-seabirds

Carter, I.C., J.M. Williams, A. Webb, and M.L. Tasker. 1993. Seabird concentrations in the North Sea: An atlas of vulnerability to surface pollutants. Aberdeen: Joint Nature Conservation Committee. 39 pp.

Committee on Oil in the Sea: Inputs, Fates, and Effects, Ocean Studies Board and Marine Board, Divisions of Earth and Life Studies and Transportation Research Board, National Research Council of the National Academies. 2003. Oil in the sea III: Inputs, fates, and effects. Washington, D.C.: National Academies Press. 280 pp.

EC MIDIV Project of JRC/IPSC. http://serac.jrc.it/midiv/

EC MIDIV Project of JRC/IPSC. http://serac.jrc.it/midiv/maps/baltic/density_oil_helcom_1998_2004.pdf

References (continued)

EC MIDIV Project of JRC/IPSC. http://serac.jrc.it/midiv/maps/northsea/aerial/oilspill_bonn_1998_2004.pdf

Furness R.W. and C.J. Camphuysen. 1997. Seabirds as monitors of the marine environment. ICES Journal of Marine Science 54:726–737.

Hope Jones, P. 1984. Skins of guillemots Uria aalge and razorbills Alca torda examinated at Cascais, Portugal, in May 1982. Mem. Mus. Mar. Portugal 3(27):1–10.

Hope Jones, P. 1988. The European cline in wing-length of guillemots Uria aalge. Seabird 11:19–21.

Huijer, K. 2005. Trends in oil spills from tanker ships 1995–2004. London: International Tanker Owners Pollution Federation (ITOPF). http://www.itopf.com/_assets/documents/amop05.pdf

Patin, S. 1999. Environmental impact of the offshore oil and gas industry. East Northport, New York: Eco Monitor Publishing. 425 pp.

Stone, C.J., A. Webb, C. Barton, N. Ratcliffe, T.C. Reed, M.L. Tasker, C.J. Camphuysen, and M.W. Pienkowski. 1995. An atlas of seabird distribution in north-west European waters. Peterborough: Joint Nature Conservation Committee. 326 pp.

Votier, S.C., B.J. Hatchwell, A. Beckerman, R.H. McCleery, F.M. Hunter, J. Pellatt, M. Trinder, and T.R. Birkhead. 2005. Oil pollution and climate have wide-scale impacts on seabird demographics. Ecology Letters 8(11):1157–1164.

Handbook Oil Impact Assessment

version 1.0

www.oiledwildlfe.eu

/ publications

/ 2007 Handbook on Oil Impact Assessment for Seabirds

kees.camphuysen@nioz.nl