Science Series
Technical Report no.133

A report on the perceptions of the fishing industry into the potential socio-economic impacts of offshore wind energy developments on their work patterns and income

S. Mackinson, H. Curtis, R. Brown, K. McTaggart, N. Taylor, S. Neville and S. Rogers

Appendices

SEAFISH Cefas

Appendix 1. Awareness and contacts

A1.1 Criteria used to identifying commercial boat fishing in wind farm areas

Criteria 1: Vessels that reported catching fish within the ICES rectangles encompassed by the wind farms areas during the period 2000-2004 (Table A1.1, Figures A1.1-A1.3).

Criteria 2: Vessels whose homeport or administration port occurred in the wind farm areas (Table A1.2).

Table A1.1. ICES statistical rectangles covering the 3 strategic areas (GW – Greater Wash, T- Thames Estuary, NW – North West).

ICES rectangle	Wind farm area
36 E9	Greater Wash
36 F0	GW
35 F0	GW
34 F0	GW
34 F1	GW
35 F1	GW
32 F1	Thames
32 F0	T
31 F0	T
31 F1	T
38 E5	North West
38 E6	NW
37 E6	NW
36 E6	NW
37 E7	NW
36 E7	NW
35 E6	NW

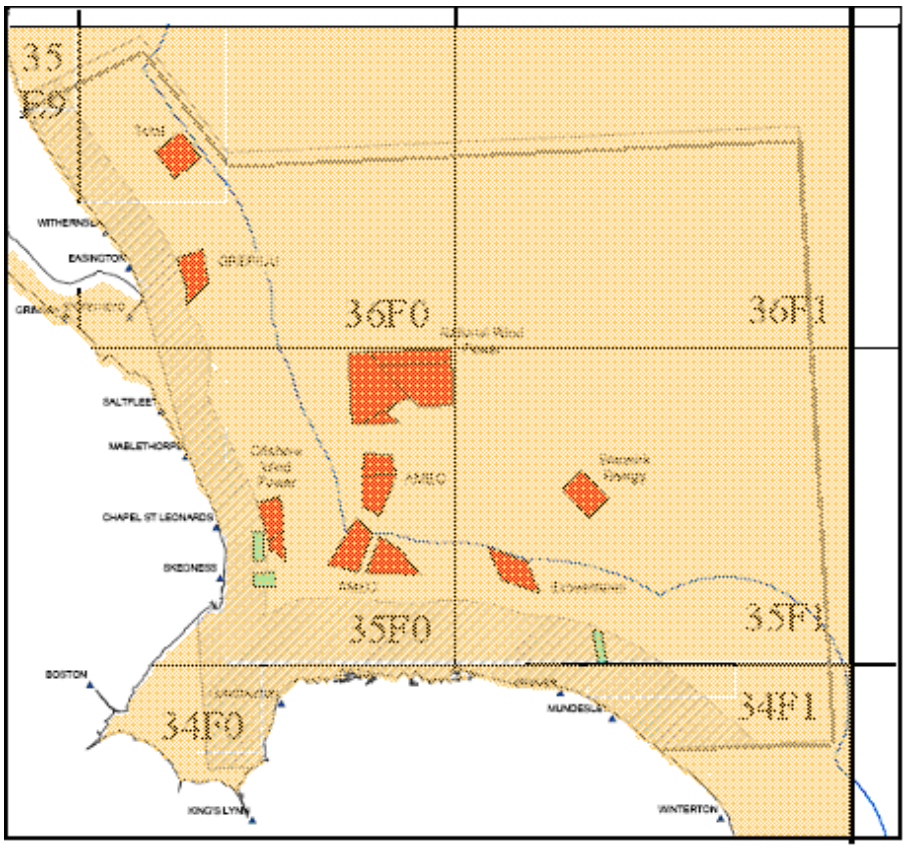


Figure A1.1. Greater Wash Area showing ICES rectangles and Round 1 and Round 2 wind farm areas.

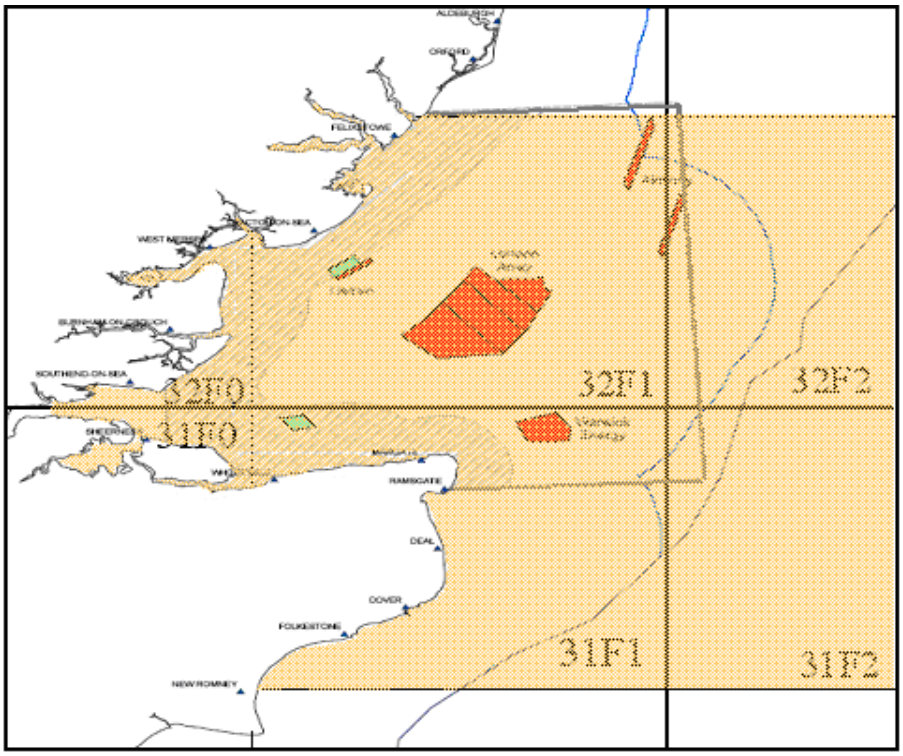


Figure A1.2. Thames Area showing ICES rectangles and Round 1 and Round 2 wind farm areas.

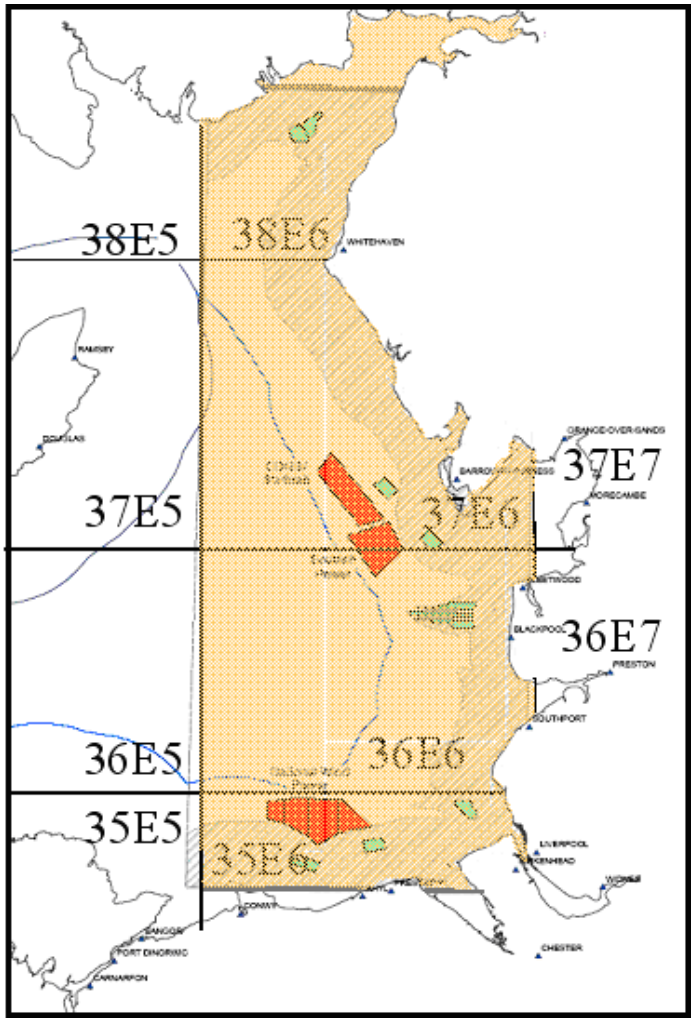


Figure A1.3. North West Area showing ICES rectangles and Round 1 and Round 2 wind farm areas.

Table A1.2. Ports occurring in the 3 strategic wind farm areas (GW – Greater Wash, T- Thames Estuary, NW – North West).

Port	Wind farm area	Port	Wind farm area
Hull	Greater Wash	Sheerness	Thames
Bridlington	GW	Gravesend	T
Withernsea	GW	Rochester	T
Hornsea	GW	Queenborough	T
Goole	GW	Whitstable	T
Grimsby	GW	London	T
Immingham	GW	Margate	T
Boston	GW	Broadstairs	T
Fosdyke	GW	Ramsgate	T
Kings Lynn	GW	Conwy	North West
Wisbech	GW	Rhyl-Connah's Quay	NW
Lowestoft	Gw	Chester	NW
Brancaster Staithe	GW	Fleetwood	NW
Wells	GW	Hoylake	NW
Blakeney	GW	Mersey Estuary	NW
Sheringham	GW	Runcorn	NW
Cromer	GW	Liverpool	NW
Winterton	GW	Southport	NW
Great Yarmouth	GW	Manchester	NW
Orford	Thames	Preston	NW
Ipswich	T	Lytham St Annes	NW
Felixstowe	T	Blackpool	NW
Harwich	T	Knott End	NW
Walton-on-Naze	T	Lune Estuary	NW
Clacton	T	Lancaster	NW
Wivenhoe	T	Morecambe	NW
Tollesbury	T	Hest Bank	NW
Brightlingsea	T	Borrowstowness	NW
Colchester	T	Kent Estuary	NW
West Mersea	T	Flookburgh	NW
Maldon	T	Coast Road	NW
Bradwell	T	Barrow	NW
Burnham-on-Crouch	T	Dudden Estuary	NW
Great Wakering	T	Whitehaven	NW
Canvey Island	T	Workington	NW
Southend-on-Sea	T	Maryport	NW
Leigh-on-sea	T	Silloth	NW
Faversham	T	Glasson Dock	NW
Isle of Sheppey	T	Carlisle	NW

A1.2 Fishing News announcements and web-sites posted to

20 April 2005

DEFRA to address impact of windfarms on fishing grounds

Scroby Sands wind farm off the Norfolk coast, at Great Yarmouth.
Picture © Crown copyright 2005, reproduced by permission of CEFAS, Lowestoft.

DEVELOPMENT of offshore windfarms around the coasts of England and Wales could make a significant contribution to the UK's commitment to renewable energy, but the extent of the proposed 'Round 2' windfarms is likely to conflict with a range of marine users and environmental resources, claims DEFRA.

In view of the concerns already expressed by members of the fishing industry, the government department has commissioned a study to assess the physical and economic impacts that the development of windfarms might have on fishing activities.

The purpose of this work is to provide the knowledge necessary to help government make informed decisions on the licensing of new windfarm developments in the Thames Estuary, the Greater Wash and the north west coast of England and Wales.

The study will provide an important opportunity for fishermen to describe and explain the likely impacts of the construction and operation of wind farms on their activities and livelihoods.

Views and suggestions for possible options to alleviate any impacts will also be sought. CEFAS and Seafish will conduct face-to-face interviews and postal questionnaires by during early summer.

A workshop will be held in late summer/early autumn to feedback preliminary results of the survey and to provide an opportunity to engage further in considering options to minimise impacts.

Further details of the study will be advertised through fishing associations and sea fisheries committees, and will be available via websites (www.cefas.co.uk/renewables; www.bwea.com; www.seafish.org; www.dti.gov.uk/renewables).

If you are fishing in these areas and would like to be interviewed then please contact Steven Mackinson on 01502 524295 and email: windfarm@cefas.co.uk, or Rachel White on 0131 524 8696 and email: r_white@seafish.co.uk

6 May 2005 – Correction article amending a telephone number

10 June 2005

Windfarm deadline

TO HAVE your say on the impact of windfarms on fishing activities in your area, please call 0131 524 8659 by 17 June to arrange either a face-to-face interview with a CEFAS or Seafish representative, or to receive a postal questionnaire.

A question and answer sheet, providing details of the study, is available from the following websites: www.cefas.co.uk/renewables; www.bwea.com; www.seafish.org. Alternatively, contact Steven Mackinson (CEFAS) on 01502 524295 or email windfarm@cefas.co.uk

Information posted on websites:
www.cefas.co.uk/renewables
www.bwea.com
www.seafish.org

A1.3 Invitation letter and reminder sent to individual fishermen

Wind farms and Fisheries in your area

Have your say – contact us now!

You are invited to take part in a study on the impacts of wind farms on fishing activities.

The development of offshore wind farms around the coast of England and Wales could make a significant contribution to the UK's commitment to renewable energy, but the extent of the proposed 'Round 2' wind farms (see enclosed map) could conflict with commercial fishing activities.

Responding to concerns already expressed by the fishing industry about possible impacts, Defra has commissioned a study to assess the physical and economic impacts that wind farms might have on fishing activities. This study will inform government decisions on the licensing of new wind farm developments in the Thames Estuary, the Greater Wash and the North West coast of England and Wales.

You now have the opportunity to describe and explain the likely impacts of the construction and operation of wind farms on your activities and livelihood. We also want to hear your views and suggestions for possible options to alleviate any impacts.

Please call us now on 0131 524 8659 to have your say either through a face-to-face interview with someone from CEFAS or Seafish, or by completing a postal questionnaire. Your information will be anonymous in the published report. Interviews will be held in your area and at the Glasgow Fishing Exhibition on 19th to 21st May. You can also fax this letter back to 0131 524 8696 with your name and contact details completed below.

A question and answer sheet providing details of the study is available via these websites: www.cefas.co.uk/renewables; www.bwea.com; www.seafish.org; or on request to Steven Mackinson (CEFAS). Phone 01502 524295, email: windfarm@cefas.co.uk

Regards,

Hazel Curtis

Hazel Curtis (Seafish)

FAX BACK to 0131 524 8696:

Your Name:

Phone: Email:

Preference for input (please tick one): Interview ☐ Postal questionnaire ☐

Remember to call us by 10th June on 0131 524 8659 to have your say on wind farms

REMINDER – Your help is Important!

Impacts of Wind Farms on Fishing Activities

Thank you for agreeing to participate in the study of the socio-economic impacts of offshore wind farms on fisheries. You should have received a questionnaire that we asked you to complete so that CEFAS and Seafish can conduct a meaningful analysis of the impacts on fishing activities and livelihoods.

We need your help to increase the return of questionnaires, because so far we have had a very poor return. Only 4 out of the 300+ distributed via post or group meetings have been sent back to us. Whilst we realise that there will be several reasons to explain this, please understand that we need to represent to Defra the views of the fishing industry as thoroughly as we can. From our discussions with numerous fishermen on this issue, we do not think this poor response reflects the strength of feeling that is held by fishermen.

Although choosing not to participate in the study may be meant to send a message of dissatisfaction, Defra and government ministers may view the lack of response as a sign that there are no concerns over the impacts of offshore wind farms.

You might think that your 'locally relevant' information and concerns might be relatively unimportant overall, but they really are important and they will add to the total contributions by fishermen in the Thames Estuary, the Greater Wash and the North West coast of England and Wales. Your information and opinions will help government make informed decisions on the licensing of round 2 wind farm developments.

We kindly ask you to complete and return your questionnaire and if you have distributed them to others, remind them to do so. If you feel strongly that you do not wish to contribute information to the study, we urge you to still return the questionnaire and write on it why you do not wish to participate. This will help us to reflect fishermen's views to Defra.

Please return the questionnaire(s) before the end of September, at which time we will start to analyse responses from around the country.

If you would like to speak to us directly about the questionnaire, or would like another copy, please do not hesitate to call.

Kind regards,

Steven Mackinson (CEFAS)

Phone 01502 524295, email: windfarm@cefas.co.uk

Hazel Curtis (Seafish)

Phone 0131 524 8664, email: h_curtis@seafish.co.uk

A1.4 List of association and organisation contacted and information letter

First name	Last Name	Company Name	Type of organisation	Area
Peter	Winterbottom	Association of Sea Fisheries Committees	Fisheries Committee	All
Doug	Beveridge	National Federation of Fishermen's Organisation	Fishermen's Organisation;	All
Barrie	Deas	National Federation of Fishermen's Organisation	Fishermen's Organisation;	All
Ted	Tuckerman	National Federation of Sea Anglers	Fishermen's Organisation;	All
Peter	Merrick	Scallop Association	Fishermen's Organisation;	All
N	Gooding	Sea Fishery Inspectorate (SFI)	Fisheries Inspectorate	All
Nigel	Atkins	The Fish Producers Organisation Ltd	Producer Org	All
Paul	Lines	Anglia Fishermens Association	Assoc / Co-op	Greater Wash
Ken	Bagley	Boston and District Fishermens Association	Assoc / Co-op	GW
C	Southerland	Brancaster Staithe Fishermens Society Ltd	Assoc / Co-op	GW
Sue	Wilson	Bridlington and Flamborough Fishermens Society	Assoc / Co-op	GW
N	Corner	Central District (Whitby)	Fisheries Inspectorate	GW
Michael	Parker	Central District (Humber)	Fisheries Inspectorate	GW
J	Sooben	Central District (Kings Lynn)	Fisheries Inspectorate	GW
M	Boden	Central District (Scarborough)	Fisheries Inspectorate	GW
B	Smart	Eastern District (Lowestoft)	Fisheries Inspectorate	GW
Matthew	Mander	Eastern Sea Fisheries Committee	Fisheries Committee	GW
Tim	Cartwright-Taylor	Frozen At Sea Fillets Association	Assoc / Co-op	GW
John	McLellan	Grimsby Fishing Vessel Owners Association	Assoc / Co-op	GW
Kurt	Christensen	Grimsby Seiners Association Ltd	Assoc / Co-op	GW
Nigel	Atkins	Hull Fishing Vessel Owners (Allied) Co Ltd	Assoc / Co-op	GW
Roy	Cullen	Humber East Coast Inshore Fishermens Association	Assoc / Co-op	GW
R	Garnett	Kings Lynn Fishing Ind. Co-Operative ltd	Assoc / Co-op	GW
Paul	Martin	Lincolnshire Coast Fishermens Association	Assoc / Co-op	GW
		Lowestoft Fishing Vessel Owners Association	Assoc / Co-op	GW
Mr P	Mantle	National Federation of Sea Anglers	NFSA	GW
Mr I	Bowell	National Federation of Sea Anglers	NFSA	GW
Mr R	Marschalek	National Federation of Sea Anglers	NFSA	GW
Mr F	Nesbitt	National Federation of Sea Anglers	NFSA	GW
Mr D	Shay	National Federation of Sea Anglers	NFSA	GW
Mr K	Horner	National Federation of Sea Anglers	NFSA	GW
Nigel	Proctor	National Federation of Sea Anglers	NFSA	GW
David	McCandless	North Eastern Sea Fisheries Committee	Fisheries Committee	GW
A M J	Roper	North Norfolk Shell Fishermens Association	Assoc / Co-op	GW
David	Cox	North Sea Fishermens Organisation Ltd	Assoc / Co-op	GW
Ivan	Large	Wells & District Inshore Fishermens Association	Assoc / Co-op	GW
		Gt. Yarmouth Port Authority	Port Authority	GW
		Assoc. British Ports	Port Authority	GW
		Assoc. British Ports	Port Authority	GW
		Wells Harbour	Port Authority	GW
		Ramsgate Harbour	Port Authority	GW
		Port of Boston	Port Authority	GW

First name	Last Name	Company Name	Type of organisation	Area
		Yorkshire & Anglia Fish Producers Organisation	Producer Org	GW
		Lowestoft Fish Producers' Organisation Ltd	Producer Org	GW
James	Linstead	Eastern England Fish Producers Organisation Ltd	Producer Org	GW
TW	Plumb	King's Lynn Vessel Owners and Skipper Association	Assoc / Co-op	GW
Malcolm	Willacy	Annan Fishermen's Association	Assoc / Co-op	North West
R	Unsworth	Central District (Fleetwood)	Fisheries Inspectorate	NW
D	Claxton	Cumbria Sea Fisheries Committee	Fisheries Committee	NW
Ken	Moran	Fleetwood Fishermen's Association	Assoc / Co-op	NW
George	Southwell	Maryport & Solway Fishermens Co-op	Assoc / Co-op	NW
Mr S	Quinn	National Federation of Sea Anglers	NFSA	NW
Mr G	Oakes	National Federation of Sea Anglers	NFSA	NW
Dr Jim	Andrews	North Western & North Wales SFC	Fisheries Committee	NW
H	Coulter	Northern District (west)	Fisheries Inspectorate	NW
Kevin	Christin	Whitehaven Fishermens Association	Assoc / Co-op	NW
Terry	Houghton	Wyre Fish Dock Management Ltd	Assoc / Co-op	NW
		Port of Workington	Port Authority	NW
		Mersey Docks Co.	Port Authority	NW
		Whitehaven Harbour Comm's	Port Authority	NW
		Assoc. British Ports	Port Authority	NW
		Alban Fish selling	Sales Agency	NW
		J Ward/Midlands	Sales Agency	NW
		J Wright	Sales Agency	NW
		C&G Neve	Sales Agency	NW
		Richard Donnan Enterprises	Sales Agency	NW
		Kilkeel Fish Selling	Sales Agency	NW
Sean	Douglas	Eastern District (Harwich)	Fisheries Inspectorate	Thames
John	Gale	Folkestone Fishermen's Association	Assoc / Co-op	T
John	Noble	Harwich Fishermens Association	Assoc / Co-op	T
Maggie	Starr	Hastings Fishermens Co-operative Ltd	Assoc / Co-op	T
Paul	Joy	Hastings Fishermens Protection Society	Assoc / Co-op	T
M F	Powis	Kent and Essex Sea Fisheries Committee	Fisheries Committee	T
Mr J	Anderson	National Federation of Sea Anglers	NFSA	T
Mr J	Gardner	National Federation of Sea Anglers	NFSA	T
Mr J	Barrett	National Federation of Sea Anglers	NFSA	T
Mr N	Blythe	National Federation of Sea Anglers	NFSA	T
Tom	Brown	Thanet Fishermens Association	Assoc / Co-op	T
		Whitstable Fishermen's Assoc.	Assoc / Co-op	T
Rodney	Bowes	Wivenhoe Fishermen	Assoc / Co-op	T
		Crouch Harbour Authority	Port Authority	T
		Brightlingsea Harbour Comm's	Port Authority	T
		Port of Ramsgate	Port Authority	T
		Harwich Dock Co.	Port Authority	T
		Whitstable Harbour Authority	Port Authority	T

Study on the impacts of wind farms on fishing activities

This communication provides information about a Defra funded study of the socio-economic impacts of wind farms on fisheries.

The development of offshore wind farms around the coasts of England and Wales could make a significant contribution to the UK's commitment to renewable energy, securing energy supplies for future generations. However, the extent of the proposed 'Round 2' wind farms (see enclosed map) is likely to conflict with a range of marine users and environmental resources.

Responding to concerns already expressed by the fishing industry about possible impacts, Defra have commissioned a study to assess the physical and economic impacts that the development of wind farms might have on fishing activities. The purpose of this work is to provide the knowledge necessary to help government make informed decisions on the licensing of new wind farm developments in the Thames Estuary, the Greater Wash and the North West coast of England and Wales.

The study will provide an important opportunity for fishermen to describe and explain the likely impacts of the construction and operation of wind farms on their activities and livelihoods. Views and suggestions for possible options to alleviate any impacts will also be sought. The Centre for Environment Fisheries and Aquaculture Science (CEFAS) and the Sea Fish Industry Authority (Seafish) will be conducting face-to-face interviews and postal questionnaires with fishermen during the early summer 2005. A workshop will be held in the late summer / early autumn to feedback preliminary results of the survey and provide an opportunity to engage further in considering options to minimise impacts.

Further details of the study are provided in the enclosed Question and Answer document.

What next? An invitation to participate will be sent directly to commercial fishing vessel owners early in May. Angling charter vessel owners interested in participating should contact either:

Rachel White, Phone 0131 524 8659, email: r_white@seafish.co.uk
Steven Mackinson, Phone 01502 524295, email: windfarm@cefas.co.uk

Regards,

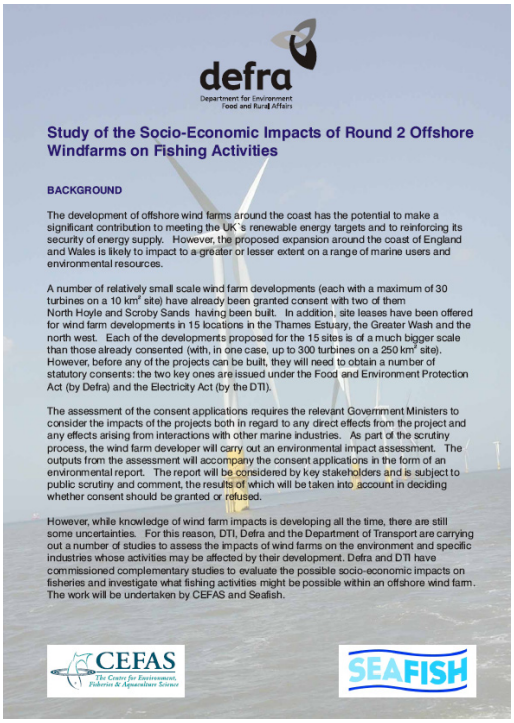
Steven Mackinson (CEFAS)

A1.5 List of participants at face-to-face meetings

		Date	Affiliation	Fishing Method
GROUP MEETINGS				
Ramsgate		16-Jun		
1	Tom Brown		Thanet Fishermen's Association	
2	Derek Balcombe		" "	Netting
3	John Lowe		" "	Potting/ Netting
4	Eddie Temple		" "	Netting
5	Graham Chandler		" "	Trawling
6	Chris Redmond		" "	Netting
7	Andy Temple		" "	Potting/ Netting
8	Graham Hambly		" "	Netting
9	David Turner		" "	Netting
10	Paul Cannon		" "	Potting/ Netting
11	S. Gosman		" "	Gillnets
12	M. Jackson		" "	Drift Netting
13	B. Walton		" "	Charter Angling
14	Allan Booth		" "	Charter Angling
15	P. John Nichols		" "	Drift Netting
Whitstable		17-Jun		
16	A.J. Riches		Whitstable & Thanet Fishermen's Association	Dredge, Trawl, Pots
17	B.I. Foad		" "	Nets, pots
18	R. Cooper		" "	Dredge, Trawl, Pots
19	B.D. Walpole		WE. Swale Angling Association	Trawl & Dredge
20	Tom Brown		Thanet Fishermen's Association	
21	J. Stroud		Kent & Essex SFC	
Kings Lynn		23-Jun		
22	David Little		North Norfolk Shellfishermen Society	
23	Andy Roper		North Norfolk Shellfishermen Society	
24	Neil Lake		Vessel owner	
25	John Lake		John Lake Shellfsih limited	
26	Paul Garnett		Kings Lynn Fishing Industry Coop	
27	RJ Garnett		" "	
30	Eric Oughton		" "	
28	Steve Williamson		Heiplog and Lynn Shellfish + KLFC	
29	Terry Plumb		King Lynn fishing Association	
31	Jes Sooben		Defra	
32	Mat Mander		Eastern Sea Fisheries Committee	

		Date	Affiliation	Fishing Method
Lowestoft		8-Jul		
33	David Richards		Lowestoft liners	Long lining
34	Steve Whiteman		" "	Long lining
Wells-Next-The-Sea		19-Aug		
35	D. Chambres		North Norfolk Fishermen's Association	Pots, nets, lining
36	P. Daniels		" "	Pots, nets, lining
37	C. Daniels		" "	Pots, nets, lining
38	J. East		" "	Pots, nets, lining, trawl
39	N. King		Wells and District Inshore Fishermen's Association	Pots
40	S. Billing		" "	Pots, lining, trawl
41	D. Warnes		" "	Pots, nets, lining
42	J. Nudds		" "	Pots, nets, lining
43	C. Pickering		" "	Pots, nets, lining
44	Ivan Large		" "	
Bridlington		13-Sep		
45	Steve Cowan (chair)		Bridlington & Flamborough Fishermens Asscociation	Pots
46	Gary Hodgson (secretary)		" "	Pots
47	Dave Screeton		" "	Pots
48	Julian Ranshaw		" "	Pots
49	B. Jewitt		" "	Pots
50	Paul Langley		" "	Pots
51	Chris Traves		" "	Pots
52	P. Murray		" "	Pots
INDIVIDUAL MEETINGS				
53	Steve Welsh	22-Jul	Fleetwood Fishermens Association	
54	Nigel Proctor	5-Aug	National Federation of Sea Anglers	Angling
55	Peter Caunter	12-Jul		Netting
56	Trevor Lineham			
57	Clive Mills	14-Jul		
58	Steve Place	13-Jul		
59	Dylan Smith	14-Jul		
60	Paul Gilson	13-Jul		
61	Robert Mole	20-May		Trawling, netting
62	Steve Welsh			Trawling
63	Peter Merrick	20-May		
64	Charles McBride	20-May		Seining
65	Ernest McMath	20-May		Trawling
66	Ove Jinkerson	17-May		Long lining
67	Hayden Jones	19-May		Trawling
68	Steve Whelan			Trawling
69	Peter Parry			

A1.6 Question and Answers information leaflet sent to associations and posted on the web



defra
Department for Environment Food and Rural Affairs

Study of the Socio-Economic Impacts of Round 2 Offshore Windfarms on Fishing Activities

BACKGROUND

The development of offshore wind farms around the coast has the potential to make a significant contribution to meeting the UK's renewable energy targets and to reinforcing its security of energy supply. However, the proposed expansion around the coast of England and Wales is likely to impact to a greater or lesser extent on a range of marine users and environmental resources.

A number of relatively small scale wind farm developments (each with a maximum of 30 turbines on a 10 km^2 site) have already been granted consent with two of them North Hoyle and Scroby Sands having been built. In addition, site leases have been offered for wind farm developments in 15 locations in the Thames Estuary, the Greater Wash and the north west. Each of the developments proposed for the 15 sites is of a much bigger scale than those already consented (with, in one case, up to 300 turbines on a 250 km^2 site). However, before any of the projects can be built, they will need to obtain a number of statutory consents: the two key ones are issued under the Food and Environment Protection Act (by Defra) and the Electricity Act (by the DTI).

The assessment of the consent applications requires the relevant Government Ministers to consider the impacts of the projects both in regard to any direct effects from the project and any effects arising from interactions with other marine industries. As part of the scrutiny process, the wind farm developer will carry out an environmental impact assessment. The outputs from the assessment will accompany the consent applications in the form of an environmental report. The report will be considered by key stakeholders and is subject to public scrutiny and comment, the results of which will be taken into account in deciding whether consent should be granted or refused.

However, while knowledge of wind farm impacts is developing all the time, there are still some uncertainties. For this reason, DTI, Defra and the Department of Transport are carrying out a number of studies to assess the impacts of wind farms on the environment and specific industries whose activities may be affected by their development. Defra and DTI have commissioned complementary studies to evaluate the possible socio-economic impacts on fisheries and investigate what fishing activities might be possible within an offshore wind farm. The work will be undertaken by CEFAS and Seafish.

CEFAS
The Centre for Environment, Fisheries & Aquaculture Science

SEAFISH

QUESTIONS & ANSWERS

Q. Why is the study needed?

A. In assessing applications for consent for offshore wind farms, Ministers need to assess the impacts of the proposed development. The socio-economic study will provide quantitative information about the potential effects of proposed development that Ministers will be able to consider in their decision-making.

Q. What are the objectives of the study?

A.
1. Provide a description of the fishing activities in the three strategic areas of Round 2 wind farm developments.
2. Consult with representative parts of the fishing industry for the purpose of describing and evaluating key concerns of fishery stakeholders, determining the socio-economic implications and developing ideas for mitigation options to fleets that may be disadvantaged.
3. Provide direction and discussion how to assess the cumulative effects of the wind farm developments on fisheries.

Q. Which geographical areas are covered by the study?

A. The study will cover fishing activity in the three strategic areas around the coast: the Thames Estuary, the 'Greater Wash' (extending from the north Norfolk coast up to Flamborough Head and out into the North Sea) and the North West (extending from the north Wales coast up to the Solway Firth and out into the eastern Irish Sea).

Q. What will the study ask about?

A. The study will provide the opportunity for fishermen to describe and explain the likely impacts of the construction and operation of wind farms on their activities and livelihoods. Views and suggestions for possible mitigation options will also be sought.

Q. How and when will the study take place?

A. Face-to-face interviews and postal questionnaires will be conducted by CEFAS and Seafish during the early summer 2005.

Q. How do I get involved in the study?

A. Further details will be advertised through Local Fishing Associations, Sea Fisheries Committees and made available via websites (www.bwea.com; www.cefas.co.uk/renewables; www.seafish.org; www.dti.gov.uk/renewables). Alternatively, if you are fishing in these areas and are willing to contribute to the work then please contact:

Steven Mackinson, CEFAS, Pakefield Road, Lowestoft, Suffolk, NR33 0HT. Phone 01502 524295, email: windfarm@cefas.co.uk

Q. When will results be available?

A The final results of the study are expected to be released Q1 2006, but information on fishing activities will be made available as soon as preliminary results emerge. A workshop will be held in the late summer / early autumn to present results of the surveys and provide further opportunity for feedback and consideration of mitigation options.

Q. What other research work is being undertaken to look at impacts of offshore wind farms on the marine environment and other users of the sea?

A. There is a wide range of work underway or to be carried out that looks at the key areas of impact: birds, navigation, coastal processes and fishing. The work is being co-ordinated by the Research Advisory Group, an ad hoc pan-Government group that seeks to ensure research funding for projects relating to wind farm impacts are properly targeted.

For any additional information regarding Government policy on offshore wind farm development, please contact:

Gary Spencer). Email: Gary.Spencer@dti.gsi.gov.uk
Tel: 020 7215 5213 or send comments centrally to: offshore.windfarms@dti.gsi.gov.uk

A1.7 Workshop invitees and participants

Impacts of wind farms on fishing activities

Work Shop, Monday 10 October 2005, Birmingham

	Organisation	Name	Attended
1	Cefas	Steven Mackinson	√
2	Cefas	Stuart Rogers	√
3	Cefas	Steve Milligan	√
4	Cefas	Adrian Judd	√
5	Cefas	Robert Brown	√
6	Cefas	Andy Birchenough	
7	SeaFish	Hazel Curtis	√
8	SeaFish	Philip Macmullen	√
9	SeaFish	Neil Murray	
10	Defra	Alan Dell	
11	Defra	Brian Hawkins	√
12	Defra	Paul Leonard	
13	Dti	John Hartley	√
14	Dti/ FLOW Secretary	Robert Lily	√
15	Dti/ FLOW Chair	Richard Mellish	
16	Defra FISH III	Anthony Hynes	
17	NFFO	Doug Beveridge	
18	NFFO	Dave Bevan	√
19	Thannet Fishermen's Association	Tom Brown	√
20	Thannet Fishermen's Association	P. John Nichols	√
21	Thannet Fishermen's Association	Derek Balcombe	
22	Thannet Fishermen's Association	Merlin Jackson	
23	Kings Lynn Vessel Owners and Skippers Association	Terry Plumb (MBE)	
24	Greater Wash Fishing Industries Group	Andy Roper	√
25	Wells & District Inshore Fishermen's Association	Ivan Large	
26	North Norfolk Fishermen's Association	David Chambres	√
27	North Norfolk Fishermen's Association	James Chambres	
28	North Norfolk Shellfishermens Association	David Little	
29	Bridlington and Flamborough Fishermens Society	Steve Cowan	√
30	Bridlington and Flamborough Fishermens Society	Gary Hodgson	
31	Fleetwood Fishermen's Association	Steve Welsh	
32	Fleetwood Fishermen's Association	an other	
33	Fleetwood Fishermen's Association	an other	
34	Fleetwood Fish Producers Organisation	Tom Watson	√

	Organisation	Name	Attended
35	Fleetwood Fish Producers Organisation	Ken Moran	
36	Lowestoft liners	David Richards	
37	Thames area fishermen	Peter Caunter	√
38	Thames area fishermen	Paul Gilson	
39	North Irish Sea Fishermen's Association	Alan McCulla	
40	Felixstowe Ferry Fishermen's Association	Stuart White	
41	Maryport and Solway fishing Coop	Frank Davis	
42	Interfish	Andrew Pillar	
43	NFSA	Nigel Proctor	
44	Northern Ireland Fish Producers Organisation	Dick James	√
45	Scottish Fishermen's Federation	Michael Sutherland	√
46	Scottish Fishermen's Federation	John Watt	
47	Shellfish Association of Great Britain	Dr Peter Hunt	√
48	BWEA	Michael Hay	
49	BWEA	Ed Romaine	
50	BWEA	Gordon Edge	
51	Strategic area developer North West	Georgia Markwell	
52	Strategic area developer Thames Estuary	Anne-Marie Coyle	√
53	Strategic area developer Greater Wash	Alison Cole	√
54	Norfolk Offshore wind	Alex Tyler	√
55	CIM	Karma Dunlop	
56	Walney Developer	Stephen Appleby	√
57	DONG - Walney Offshore Wind farm	Brian Juel Jensen	√
58	Scottish Power	Ralph Thornton	
59	Scira Offshore Energy Ltd (Sheringham Shoal)	Peter Fish	√
60	The Crown Estate	Carolyn Heeps	
61	The Crown Estate	William Drake	√
62	HR Wallingford	Tom Coates	√
63	Garrad Hassan and Partners Ltd	Colin Morgan	√
	Garrad Hassan and Partners Ltd	Joe Phillips	√
64	English Nature	Dr Robert Blythe	
65	Dti Navigation	Colin Brown	√
66	UK Hydrographic Office	Roger Cavill	
67	UK Hydrographic Office	Glynis Furse	
68	Association of Sea Fisheries Committees	Peter Winterbottom	√
69	Eastern Sea Fisheries Committee	Mrs Judith Stout	√
70	Kent & Essex SFC	John Stroud	
71	North Western and North Wales Sea Fisheries Committee	Dr Stephen Atkins	
72	North Eastern Sea Fisheries Committee	David McCandless	
73	Cumbria SFC	Dave Dobson	
74	Maritime and Coastguard Agency	Simon Gooder	
75	BT Global Submarine Cables/UKCPC	Doug Percy	
76	Scottish Executive	Bruce Stewart	
77	Defra - Sea Fishery Inspectorate (SFI)	Barrie Smart	
78	Defra - Sea Fishery Inspectorate (SFI)	Neil Wellum	
79	Defra - Sea Fishery Inspectorate (SFI)	Nigel Gooding	
80	Defra - Sea Fishery Inspectorate (SFI)	Miss Juliette Parker	√

A1.8. Economic request to associations

Cover letter

Thannet Fishermens Association
Kings Lynn Vessel Owners and Skippers Association
Greater Wash Fishing Industries Group
Wells & District Inshore Fishermens Association
North Norfolk Fishermens Association
Bridlington and Flamborough Fishermens Society
Fleetwood Fishermens Association
Fleetwood Fish Producers Organisation
North Irish Sea Fishermen's Association

2 November 2005

Dear All

Financial performance of fishing boats – Impact of Round 2 Wind Farms

At the wind farms workshop in Birmingham on 10 October, I reported that we did not have enough data relating to the current and recent financial performance of fishing vessels to enable us to estimate the potential scale of impact of the operation of round 2 wind farms on fishing profitability.

One association representative suggested that a way to overcome fishermen's reluctance to reveal their financial information, might be to ask associations to collect the information from their members and then send a summary of the information and characteristics of the vessels involved, to Seafish.

Other fishing industry representatives at the workshop agreed that this sounded like a reasonable suggestion, so I am now writing to ask if you will attempt to gather and summarise this information. I have included a data sheet illustrating the information needed. This information will enable us to describe the scale of economic activity amongst vessels that expect to be affected by round 2 wind farms. We can use this to give some indication to Defra and the Dti of the scale of impact that round 2 wind farms might have on the fishing industry.

Please let me know if you intend to try to gather this data. Because we have a deadline of January for this report and still have to analyse the data and write the report, I would need your information by Friday 25th November.

Kind regards,

Hazel Curtis
Chief Economist

Sea Fish Industry Authority
18 Logie Mill, Logie Green Road, Edinburgh EH7 4HS
Tel:0131 524 8664 Fax: 0131 524 8696
e-mail: h_curtis@seafish.co.uk web site: www.seafish.org

Economic data template

Impact on fishing of Round Two Wind Farms
Research carried out by CEFAS and Seafish, commissioned by Defra

Association name: Form completed by:

Information for associations to collect from member vessels. Estimates to the nearest 10% are acceptable.

vessel no.	vessel type & length	earnings last complete year £	costs last complete year £	profit last complete year £	expected change in profit after round 2 wind farms (%)
example	*otter trawl, 12m*	***105,000***	***85,000***	***20,000***	*-10%*
example	*potter, netter, <10m*	***65,000***	***50,000***	***15,000***	*+5%*
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

The profit figure should not include wages or crew share paid to the owner - that amount should be included in costs. Please show profit before deducting interest and depreciation.

Profit is money left to pay interest on loans and give the investor a return on investment.

Costs include fuel, crew share, boxes, ice, repairs, commission, harbour dues, insurance, gear.

If you cannot give this information but can give some, please do give whatever relevant information you have.

Many thanks for your time. Please return to Hazel Curtis at Seafish by 25th November 2005.

This data will not be reproduced in the final report nor passed to any third party

If you have any questions regarding this form or collecting the information, please call Hazel Curtis at Seafish on 0131 524 8664.

Appendix 2. Questionnaires

A2.1 Ministerial approval

Any structured direct approach made or sponsored by Defra, its Agencies or Non Departmental Public Bodies and designed to obtain aggregated data' should be assessed and approved by both Ministers and the Defra Survey Control Unit before it is conducted. Following devolution, the Devolved Authorities conduct their own survey control procedures. Approval must be obtained from the relevant DA before respondents in their respective countries can be approached. In accordance with the above guidance, an application for ministerial approval was made and granted:

1/2/05 - Survey Notification Form sent to SCLU
2/2/05 – Approval in principle granted
4/2/05 – National Assembly of Wales approved
28/4/05 – Application for full approval sent to SCLU
4/5/05 – Full approval granted

A2.2 Covering Letter

Defra Study on the Impacts of Wind Farms on Fishing Activities

Thank you for agreeing to participate in the study of the socio-economic impacts of wind farms on fisheries.

The purpose of this questionnaire is to provide you with the opportunity to describe and explain the likely impacts of the construction and operation of wind farms on your fishing activities and livelihood. The information will be used to provide the knowledge necessary to help government make informed decisions on the licensing of new wind farm developments in the Thames Estuary, the Greater Wash and the North West coast of England and Wales.

Be assured that any personal information you supply will be processed and kept confidential in accordance with the Data Protection Act 1998*.

Questions are asked to provide information on 4 topics:

1. Knowledge of Wind farms / Impacts
2. Fishing Activities and their Value
3. Impacts and Opportunities for Fishing Activities and their Economic Consequences
4. Mitigation Options

To help capture the important information, it is necessary that some questions are quite detailed, and so some sections will take longer than others. Question 8, on the costs of fishing is particularly detailed. If you are not able to easily provide the relevant information, then alternatively you can either supply a set of accounts for your most recent full year OR sign the enclosed permission form addressed to your accountant so that we can request your accounts directly from your accountant. Please note that this is entirely voluntary and in no way are you obliged to do so.

If you have questions regarding completion of the questionnaire, please contact either

Rachel White, Phone 0131 524 8659, email: r_white@seafish.co.uk
Steven Mackinson, Phone 01502 524295, email: windfarm@cefas.co.uk

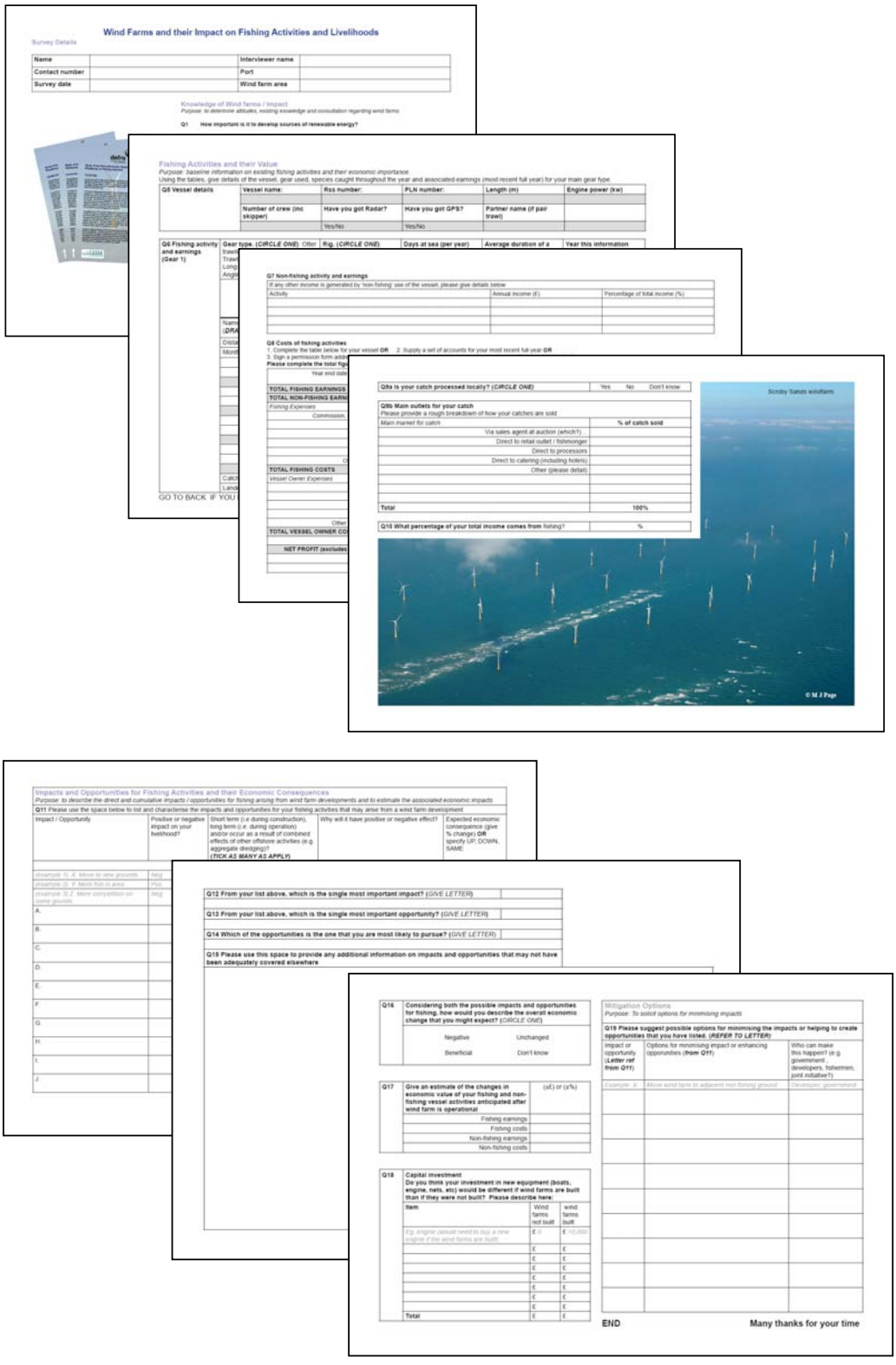
A workshop will be held in the late summer / early autumn to feedback preliminary results of the survey and provide an opportunity to engage further in considering options to minimise impacts.
Regards,

Steven Mackinson (CEFAS)

Hazel Curtis (Seafish)

Defra's public service guarantee on data handling, which gives details of your rights in respect of the handling of your personal data is available on the Defra website at www.defra.gov.uk/corporate/opengov/personaldata.htm. If you don't have access to the internet please contact the CEFAS Data Protection Co-ordinator, CEFAS, Pakefield Road, Lowestoft, Suffolk, NR33 0HT, Telephone 01502 524368.

A2.3 Questionnaire sample



Wind Farms and their Impact on Fishing Activities and Livelihoods

Survey Details

Name		Interviewer name	
Contact number		Port	
Survey date		Wind farm area	

Knowledge of Wind Farms / Impact

Purpose: to determine attitudes, existing knowledge and consultation regarding wind farms

Q1 How important is it to develop sources of renewable energy?

Fishing Activities and their Value

Purpose: baseline information on existing fishing activities and their economic importance.

Using the tables, give details of the vessel, gear used, species caught throughout the year and associated earnings (most recent full year) for your main gear type.

Q5 Vessel details	Vessel name:	Rss number:	PLN number:	Length (m)	Engine power (kw)
	Number of crew (inc skipper)	Have you got Radar?	Have you got GPS?	Partner name (if pair trawl)	
		Yes/No	Yes/No		

Q6 Fishing activity and earnings (Gear 1)	Gear type. (CIRCLE ONE) Other	Rig. (CIRCLE ONE)	Days at sea (per year)	Average duration of a	Year this information

Q7 Non-fishing activity and earnings

If any other income is generated by 'non-fishing' use of the vessel, please give details below

Activity	Annual income (£)	Percentage of total income (%)

Q8 Costs of fishing activities

1. Complete the table below for your vessel OR 2. Supply a set of accounts for your most recent full year OR

Please complete the total figu

Year end date	
TOTAL FISHING EARNINGS	
TOTAL NON-FISHING EARN	
Fishing Expenses	
Commission	
TOTAL FISHING COSTS	
Vessel Owner Expenses	
Other	
TOTAL VESSEL OWNER CO	
NET PROFIT (excludes	

GO TO BACK IF YOU

Q9a Is your catch processed locally? (CIRCLE ONE)	Yes	No	Don't know

Q9b Main outlets for your catch

Please provide a rough breakdown of how your catches are sold

Main market for catch	% of catch sold
Via sales agent at auction (which?)	
Direct to retail outlet / fishmonger	
Direct to processors	
Direct to catering (including hotels)	
Other (please detail)	
Total	100%

Q10 What percentage of your total income comes from fishing?	%

Scroby Sands windfarm

© M J Page

Impacts and Opportunities for Fishing Activities and their Economic Consequences

Purpose: to describe the direct and cumulative impacts / opportunities for fishing arising from wind farm developments and to estimate the associated economic impacts

Q11 Please use the space below to list and characterise the impacts and opportunities for your fishing activities that may arise from a wind farm development

Impact / Opportunity	Positive or negative impact on your livelihood?	Short term (i.e during construction), long term (i.e. during operation) and/or occur as a result of combined effects of other offshore activities (e.g. aggregate dredging)? (TICK AS MANY AS APPLY)	Why will it have positive or negative effect?	Expected economic consequence (give % change) OR specify UP, DOWN, SAME
example 1). X. Move to new grounds	Neg			
example 2). Y. More fish in area	Pos			
example 3). Z. More competition on some grounds	Neg			
A.				
B.				
C.				
D.				
E.				
F.				
G.				
H.				
I.				
J.				

Q12 From your list above, which is the single most important impact? (GIVE LETTER)	
Q13 From your list above, which is the single most important opportunity? (GIVE LETTER)	
Q14 Which of the opportunities is the one that you are most likely to pursue? (GIVE LETTER)	

Q15 Please use this space to provide any additional information on impacts and opportunities that may not have been adequately covered elsewhere

Q16 Considering both the possible impacts and opportunities for fishing, how would you describe the overall economic change that you might expect? (CIRCLE ONE)

Negative Unchanged

Beneficial Don't know

Q17 Give an estimate of the changes in economic value of your fishing and non-fishing vessel activities anticipated after wind farm is operational	(±£) or (±%)
Fishing earnings	
Fishing costs	
Non-fishing earnings	
Non-fishing costs	

Q18 Capital investment

Do you think your investment in new equipment (boats, engine, nets, etc) would be different if wind farms are built than if they were not built? Please describe here:

Item	Wind farms not built	wind farms built
Eg, engine (would need to buy a new engine if the wind farms are built)	£ 0	£ 15000
	£	£
	£	£
	£	£
	£	£
	£	£
	£	£
Total	£	£

Mitigation Options

Purpose: To solicit options for minimising impacts

Q19 Please suggest possible options for minimising the impacts or helping to create opportunities that you have listed. (REFER TO LETTER)

Impact or opportunity (Letter ref from Q11)	Options for minimising impact or enhancing opportunities (from Q11)	Who can make this happen? (e.g. government, developers, fishermen, joint initiative?)
Example: X	Move wind farm to adjacent non fishing ground	Developer, government

END

Many thanks for your time

Appendix 3. Causal maps

Causal mapping can be viewed as a process of 'active listening' that outputs qualitative understanding of causes and effects and a semi-quantitative assessment of their relative importance. The method has been academically justified as a way of writing down and showing links between the processes going on inside people's brains (Kelly 1955). This helps people to verbalize their concepts and logic, helping to keep track of more ideas at the same time. This or similar approaches have been advocated as heuristic tools for developing personal thinking and learning capacity (Buzan and Buzan 1993) and for developing group awareness and consensus (Eden and Ackerman 1998, 2001; Bryson *et al.*, 2004). It is particularly appropriate in the investigative stages of research as a neutral tool for elucidating opinions and attitudes that may be latent and are unlikely to be recognised through a prescribed questionnaire.

Ideally causal maps should be constructed, discussed and finalised jointly with the fishermen over a series of meetings. However, limitations of time and resources meant this was not feasible. To ensure quality control and trace-ability in all analyses, a three-stage approach was applied to the implementation and analysis of the causal mapping process.

Stage 1. Raw data. Fishermen's knowledge and perceptions were described through maps developed on-site with individual/group, written down as stated/ agreed by the participants. Particular wording of concepts may represent very specific interests. The map is 'owned' by the participant(s).

Stage 2. Editing and iteration. Maps were edited by the interviewer for the purpose of clarification, completeness and improving structural organisation, whilst ensuring the map remained a true reflection of the discussions of the meeting. Any information added or requiring clarification by the participant was highlighted and sent back to the participant for their approval. Participants were given two weeks to make changes, which were incorporated and sent back to the participant. The map is 'owned' by the interviewer.

Stage 3. Analysis and interpretation. Maps collated for analysis of clusters, importance, merging individual and group maps to causal maps. Maps are 'owned' by the data analyst.

Maps (made anonymous) from any stage of analysis can be made available to readers upon request to Cefas.

The overall causal map (Figure A3.1) summarises the full discussions of the issues communicated by 58 fishermen. It represents a database of knowledge, thoughts and decision pathways that can be interrogated in various ways to help understand the fishermen's viewpoints and specific concerns regarding the regarding the impact of wind farms on fishing activities and livelihoods.

Which concepts are most important?

The top 15+ concepts are issues that were anticipated as being important before the study. This level of agreement supports the validity of the method in capturing the main concerns and views of fishermen. The occurrence weight is a simple measure of the fishermen's prioritisation, and thus the exact values and order of concepts in the table should be taken as indicators rather than absolutes. For example, the value for [33 Altered fish behaviour] is nearly 3 times the next largest value. Although it is without a doubt an area of key concern, its weighting is atypical because it is the synthesis of many detailed concepts regarding affects on the behaviour patterns of particular species. Because occurrence weight is a direct measure of issues of special interest to fishers was considered to be of greatest significance to the aims of this report and given priority in analyses. However, for comparison we have calculated an alternative measure of importance that combines the occurrence weight with a measure of logical structure called the centrality index. Values for this combined score are given in Table A3.1. The top 15+ concepts ranked by this score also elucidate issues that were known to be of major concern.

Information embedded in structure

Examining the linkages between concepts can be used to help understand the information embedded within the structure of the map. Notice for example, that there are very few links across the Line A marked on Figure A3.1. The pattern of links on each side of the line are also quite different. The right hand side is typified by numerous links spread throughout the concepts, whilst the left hand side is characterised by shorter chains with several concept acting as discrete 'hubs' fed by numerous drivers. This represents a fundamental divide between planning issues (left) and the effects of wind farms (right). The short cause-effect chains in the planning section results from most concepts representing statements by fishermen rather than a clear understanding of the planning process; even though it is a major area of their concern. This may indicate either poor communication about the structure of this process, an actual lack of structure, or lack of understanding.

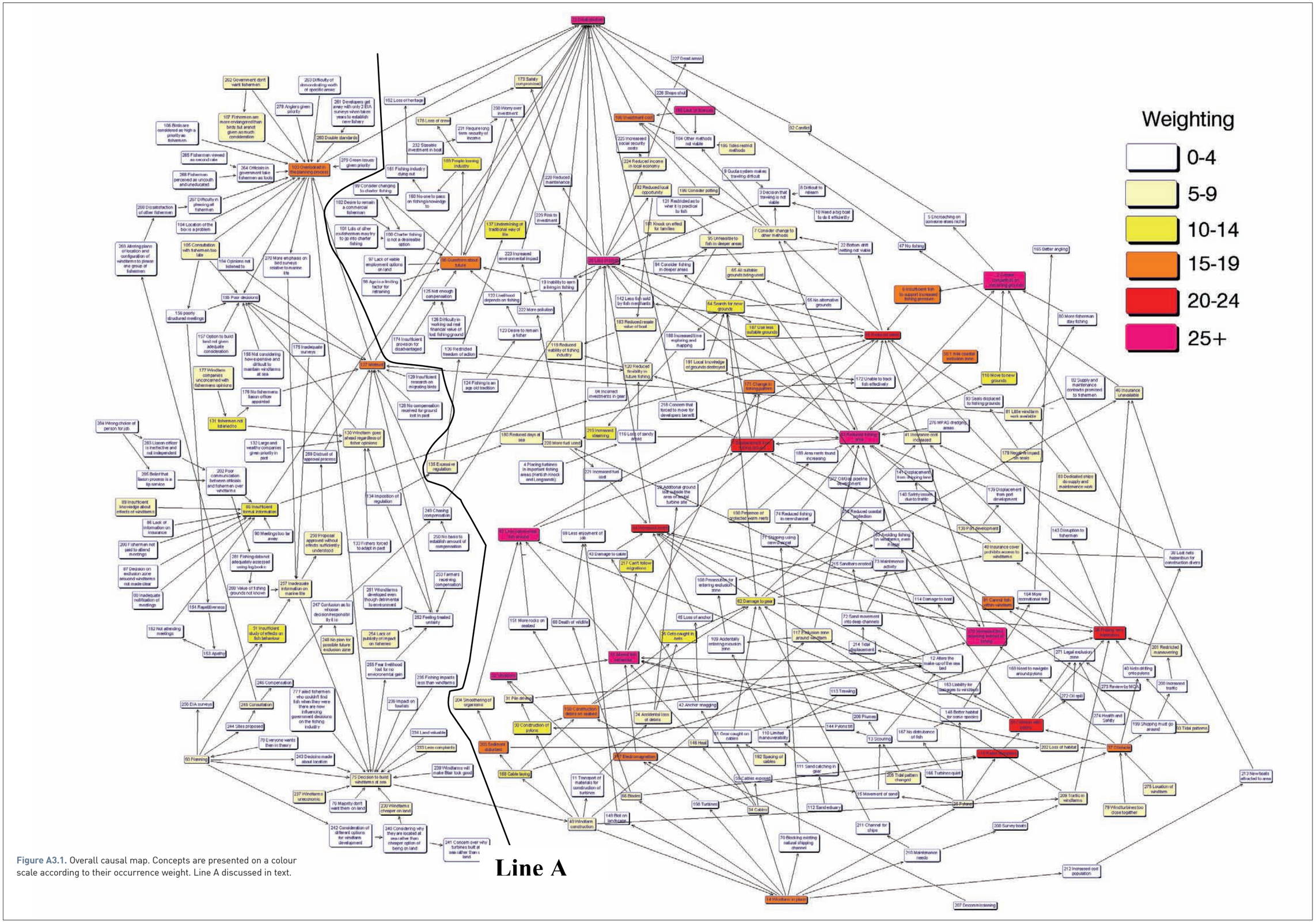


Figure A3.1. Overall causal map. Concepts are presented on a colour scale according to their occurrence weight. Line A discussed in text.

Table A3.1. Complete list of concepts in the overall causal map. Concepts are sorted according to values of occurrence weighting and showing alternative values from a combined score of importance (see text).

Causal concept number	Description	Theme	Category	Occurrence weight	Combined score
33	33 Altered fish behaviour	Environmental	issue	100.0	95.3
57	57 Less commercial fish around	Environmental	outcome	38.3	50.5
2	2 Greater competition on remaining grounds	Fishing	outcome	33.2	35.3
32	32 Vibrations	Environmental	driver	32.1	13.0
28	28 Loss of profit	Socio-economic	issue	27.0	59.5
170	170 Increased time steaming instead of fishing	Fishing	outcome	26.5	19.5
53	53 Reduced fishing area	Fishing	issue	25.0	48.6
115	115 Radar disruption	Hazards	driver	22.4	9.1
39	39 Collision with pylons	Hazards	issue	21.9	22.5
36	36 Fishing very hazardous	Hazards	issue	20.9	26.8
1	1 Displacement from fishing ground	Fishing	outcome	20.4	32.2
44	44 Increased costs	Fishing	outcome	20.4	29.9
56	56 Reduced catch	Fishing	outcome	19.9	35.0
147	147 Electromagnetism	Environmental	driver	19.4	7.1
150	150 Construction debris on seabed	Environmental	driver	18.9	16.6
58	58 1 mile coastal exclusion zone	Fishing	driver	18.9	15.2
171	171 Change in fishing pattern	Fishing	issue	18.4	16.2
91	91 Cannot fish within wind farm	Hazards	issue	18.4	14.1
203	203 Sediment disturbed	Environmental	driver	18.4	5.4
37	37 Obstacle	Hazards	driver	16.8	14.2
14	14 Wind farm in place	Hazards	driver	16.3	23.3
127	127 Mistrust	Communication	issue	15.8	19.1
6	6 Insufficient fish to support increased fishing pressure	Fishing	outcome	15.3	12.9
96	96 Questions about future	Socio-economic	outcome	15.3	12.3
186	186 Investment cost	Mitigation	outcome	15.3	8.4
103	103 Overlooked in the planning process	Decision making	driver	14.8	16.3
30	30 Construction of pylons	Hazards	driver	14.3	5.8
219	219 Increased steaming	Fishing	outcome	13.3	4.9
85	85 Insufficient formal information	Communication	issue	12.8	5.6
64	64 Search for new grounds	Fishing	issue	12.2	10.8
217	217 Can't follow migrations	Fishing	issue	12.2	9.9
187	187 Use less suitable grounds	Fishing	outcome	11.7	5.2
62	62 Damage to gear	Hazards	issue	11.2	13.6
25	26 Gets caught in nets	Hazards	driver	11.2	7.4
131	131 fishermen not listened to	Decision making	issue	11.2	3.7
51	51 Insufficient study of effects on fish behaviour	Decision making	issue	10.7	1.2
118	118 Move to new grounds	Fishing	issue	10.2	9.0
168	168 Cable laying	Environmental	driver	10.2	9.0
159	159 People leaving industry	Socio-economic	issue	9.7	4.3
137	137 Undermining of traditional way of life	Socio-economic	outcome	9.7	1.4
224	224 Reduced income in local economy	Socio-economic	outcome	9.2	8.1
202	202 Loss of habitat	Environmental	outcome	9.2	5.7
258	258 Proposal approved without effects sufficiently understood	Decision making	issue	9.2	2.0
245	245 Consultation	Decision making	driver	9.2	1.7
49	49 Wind farm construction	Environmental	driver	8.7	9.9

Causal concept number	Description	Theme	Category	Occurrence weight	Combined score
119	119 Reduced viability of fishing industry	Socio-economic	outcome	8.7	6.4
135	135 Excessive regulation	Decision making	issue	8.7	4.1
7	7 Consider change to other methods	Fishing	outcome	8.2	10.5
35	35 Pylons	Hazards	driver	8.2	10.2
48	48 Insurance cover prohibits access to wind farms	Hazards	issue	8.2	8.7
46	46 Insurance unavailable	Hazards	issue	8.2	5.4
31	31 Pile driving	Environmental	driver	8.2	3.0
146	146 Heat	Hazards	driver	8.2	3.0
89	89 Insufficient knowledge about effects of wind farms	Decision making	issue	8.2	1.2
65	65 All suitable grounds being used	Fishing	driver	7.7	7.6
182	182 Reduced local opportunity	Socio-economic	outcome	7.7	6.5
189	189 Area reefs found increasing	Fishing	driver	7.7	6.5
34	34 Cables	Environmental	driver	7.7	6.2
181	181 Knock on effect for families	Socio-economic	issue	7.7	6.2
50	50 Planning	Decision making	driver	7.7	5.6
180	180 Reduced days at sea	Fishing	issue	7.7	5.1
191	191 Local knowledge of grounds destroyed	Fishing	issue	7.7	4.2
196	196 Consider potting	Mitigation	issue	7.7	3.9
75	75 Decision to build wind farms at sea	Decision making	outcome	7.7	3.9
194	194 Opinions not listened to	Decision making	driver	7.7	3.6
183	183 Reduced resale value of boat	Socio-economic	issue	7.7	2.5
193	193 Tidal patterns	Hazards	driver	7.7	2.0
178	178 Loss of crew	Fishing	issue	7.7	1.7
192	192 Spacing of cables	Hazards	driver	7.7	1.7
190	190 Presence of protected worm reefs	Fishing	driver	7.7	1.4
185	185 Lack of licences	Mitigation	issue	7.7	1.1
179	179 Negative impact on seals	Fishing	driver	7.7	1.1
177	177 Wind farm companies unconcerned with fishermen's opinions	Decision making	driver	7.7	0.8
195	195 Tides restrict methods	Mitigation	driver	7.7	0.8
120	120 Reduced flexibility in future fishing	Socio-economic	outcome	7.1	7.6
209	209 Traffic in wind farms	Hazards	driver	7.1	3.7
262	262 Government don't want fishermen	Communication	driver	7.1	3.4
257	257 Inadequate information on marine life	Decision making	issue	7.1	2.1
220	220 More fuel used	Fishing	outcome	7.1	1.8
41	41 Insurance cost increased	Hazards	issue	6.6	8.3
105	105 Consultation with fishermen too late	Decision making	issue	6.6	4.1
24	24 Accidental loss of debris	Hazards	driver	6.6	2.2
138	138 Port development	Fishing	driver	6.6	1.7
201	201 Restricted maneuvering	Hazards	driver	6.1	3.1
204	204 Smothering of organisms	Environmental	issue	6.1	3.1
260	260 Double standards	Decision making	driver	6.1	2.9
173	173 Safety compromised	Socio-economic	outcome	6.1	1.8
238	238 Wind farms cheaper on land	Decision making	driver	6.1	1.8
275	275 Location of wind farm	Hazards	driver	6.1	1.8
233	233 Less complaints	Decision making	driver	6.1	1.3
237	237 Wind farms uneconomic	Decision making	driver	6.1	1.3
254	254 Lack of publicity of impact on fisheries	Communication	issue	6.1	1.3
205	205 Tidal pattern changed	Environmental	issue	6.1	1.1

Causal concept number	Description	Theme	Category	Occurrence weight	Combined score
248	248 No plan for possible future exclusion zone	Decision making	issue	6.1	0.7
92	92 Conflict	Socio-economic	outcome	5.6	0.4
130	130 Wind farm goes ahead regardless of fisher opinions	Decision making	outcome	5.1	3.9
117	117 Exclusion zone around wind farm	Hazards	issue	4.6	5.4
66	66 Blades	Hazards	driver	4.6	4.0
81	81 Little wind farm work available	Fishing	issue	4.6	3.4
95	95 Unfeasible to fish in deeper areas	Fishing	issue	4.6	2.2
107	107 Fishermen are more endangered than birds but are not given as much consideration	Communication	driver	4.6	2.2
79	79 Wind turbines too close together	Hazards	driver	4.6	1.3
83	83 Dedicated ships do supply and maintenance work	Fishing	issue	4.6	0.8
84	84 Incorrect investments in gear	Fishing	issue	4.1	3.9
40	40 Nets drifting onto pylons	Hazards	driver	4.1	2.7
184	184 Other methods not viable	Mitigation	issue	4.1	2.2
134	134 Imposition of regulation	Communication	issue	4.1	1.9
125	125 Not enough compensation	Socio-economic	issue	4.1	1.5
59	59 Cables exposed	Hazards	driver	4.1	1.3
126	126 Difficulty in working out real financial value of lost fishing ground	Socio-economic	driver	4.1	0.6
97	97 Lack of viable employment options on land	Socio-economic	driver	3.6	1.2
4	4 Placing turbines in important fishing areas (Kentish Knock and Longsands)	Hazards	driver	3.6	0.9
8	8 Difficult to relearn	Mitigation	driver	3.6	0.8
249	249 Chasing compensation	Decision making	outcome	3.1	4.4
229	229 Risk to investment	Socio-economic	outcome	3.1	2.8
228	228 Reduced maintenance	Socio-economic	outcome	3.1	2.7
252	252 Feeling treated unfairly	Communication	outcome	3.1	2.6
172	172 Unable to track fish effectively	Fishing	outcome	3.1	2.5
188	188 Increased time exploring and mapping	Fishing	outcome	3.1	2.5
199	199 Shipping must go around	Hazards	issue	3.1	2.5
163	163 Liability for damages to wind farm	Hazards	outcome	3.1	2.4
198	198 Turbines	Environmental	driver	3.1	2.4
176	176 No fishermen's liaison officer appointed	Decision making	driver	3.1	1.9
221	221 Increased fuel cost	Fishing	outcome	3.1	1.8
230	230 Worry over investment	Socio-economic	outcome	3.1	1.7
267	267 Difficulty in pleasing all fishermen	Decision making	issue	3.1	1.7
270	270 More emphasis on bird surveys relative to marine life	Decision making	driver	3.1	1.7
271	271 Legal exclusion zone	Hazards	outcome	3.1	1.6
148	148 Better habitat for some species	Fishing	issue	3.1	1.6
264	264 Officials in government take fishermen as fools	Communication	driver	3.1	1.6
218	218 Concern that forced to move for developers benefit	Decision making	issue	3.1	1.6
247	247 Confusion as to whose decision/responsibility it is	Decision making	issue	3.1	1.5
263	263 Difficulty of demonstrating worth of specific areas	Communication	driver	3.1	1.5
169	169 Need to navigate around pylons	Hazards	issue	3.1	1.3
206	206 Plumes	Environmental	driver	3.1	1.3
255	255 Fear livelihood lost for no environmental gain	Decision making	issue	3.1	1.3
272	272 Oil Spill	Fishing	driver	3.1	1.3
211	211 Channel for ships	Hazards	issue	3.1	1.3

Causal concept number	Description	Theme	Category	Occurrence weight	Combined score
175	175 Inadequate surveys	Decision making	issue	3.1	1.2
214	214 Tidal displacement	Environmental	driver	3.1	1.1
250	250 No basis to establish amount of compensation	Decision making	issue	3.1	1.1
200	200 Increased traffic	Hazards	driver	3.1	1.0
213	213 New boats attracted to area	Fishing	issue	3.1	1.0
268	268 Dissatisfaction of other fishermen	Decision making	issue	3.1	0.9
226	226 Shops shut	Socio-economic	outcome	3.1	0.8
240	240 Considering why they are located at sea rather than cheaper option of being on land	Decision making	driver	3.1	0.7
231	231 Require long term security of income	Socio-economic	issue	3.1	0.7
225	225 Increased social security costs	Socio-economic	outcome	3.1	0.7
234	234 Land valuable	Decision making	driver	3.1	0.7
235	235 Fishing impacts less than wind farms	Decision making	driver	3.1	0.7
236	236 Impact on tourism	Decision making	driver	3.1	0.7
239	239 Wind farms will make Blair look good	Decision making	driver	3.1	0.7
243	243 Decisions made about location	Decision making	outcome	3.1	0.7
251	251 Wind farms developed even though detrimental to environment	Decision making	issue	3.1	0.7
253	253 Farmers receiving compensation	Communication	driver	3.1	0.7
265	265 Fishermen viewed as second rate	Communication	driver	3.1	0.7
266	266 Fishermen perceived as uncouth and uneducated	Communication	driver	3.1	0.7
164	164 More recreational fish	Fishing	outcome	3.1	0.6
167	167 No disturbance of fish	Environmental	issue	3.1	0.6
246	246 Compensation	Decision making	issue	3.1	0.6
261	261 Developers get away with only 2 EIA surveys when takes years to establish new fishery	Communication	driver	3.1	0.6
273	273 Review by MCA	Fishing	driver	3.1	0.6
274	274 Health and safety	Socio-economic	issue	3.1	0.6
215	215 Sandbars eroded	Environmental	issue	3.1	0.4
174	174 Insufficient provision for disadvantaged	Socio-economic	issue	3.1	0.4
208	208 Survey boats	Hazards	driver	3.1	0.4
269	269 Altering plans of location and configuration of wind farms to please one group of fishermen	Decision making	issue	3.1	0.3
222	222 More pollution	Fishing	outcome	3.1	0.3
212	212 Increased cod population	Fishing	issue	3.1	0.2
216	216 Reduced coastal protection	Environmental	outcome	3.1	0.2
241	241 Concern over why turbines built at sea rather than on land	Decision making	driver	3.1	0.2
242	242 Consideration of different options for wind farm development	Decision making	driver	3.1	0.2
244	244 Sites proposed	Decision making	issue	3.1	0.2
259	259 Distrust of approval process	Decision making	issue	3.1	0.1
165	165 Better angling	Fishing	outcome	3.1	0.1
166	166 Turbines quiet	Environmental	driver	3.1	0.1
207	207 Decommissioning	Environmental	driver	3.1	0.1
210	210 Maintenance needs	Hazards	driver	3.1	0.1
223	223 Increased environmental impact	Fishing	outcome	3.1	0.1
227	227 Dead areas	Socio-economic	outcome	3.1	0.1
232	232 Sizeable investment in boat	Socio-economic	driver	3.1	0.1
256	256 EIA surveys	Decision making	issue	3.1	0.1

Causal concept number	Description	Theme	Category	Occurrence weight	Combined score
19	19 Inability to earn a living in fishing	Socio-economic	issue	2.6	3.2
5	5 Encroaching on someone else's niche	Fishing	issue	2.6	0.8
116	116 Loss of sandy areas	Environmental	issue	2.0	1.9
133	133 Fishers forced to adapt in past	Communication	driver	2.0	0.6
69	69 Less enjoyment of job	Fishing	issue	2.0	0.1
68	68 Death of wildlife	Environmental	issue	2.0	0.1
63	63 Avoiding fishing in wind farms, even if legal	Hazards	outcome	1.5	1.7
73	73 Maintenance activity	Environmental	driver	1.5	1.0
13	13 Scouring	Environmental	driver	1.5	0.7
82	82 Supply and maintenance contracts promised to fishermen	Fishing	issue	1.5	0.3
90	90 Meetings too far away	Communication	driver	1.5	0.2
114	114 Damage to boat	Hazards	issue	1.0	1.0
155	155 Poor decisions	Communication	outcome	1.0	0.9
108	108 Prosecution for entering exclusion zone	Hazards	issue	1.0	0.8
122	122 Livelihood depends on fishing	Socio-economic	issue	1.0	0.6
109	109 Accidentally entering exclusion zone	Hazards	issue	1.0	0.6
128	128 No compensation received for ground lost in past	Communication	driver	1.0	0.6
129	129 Insufficient research on migrating birds	Decision making	issue	1.0	0.6
136	136 Restricted freedom of action	Socio-economic	driver	1.0	0.5
55	55 No alternative grounds	Fishing	issue	1.0	0.5
144	144 Pylons tilt	Environmental	issue	1.0	0.3
132	132 Large and wealthy companies given priority in past	Communication	driver	1.0	0.3
123	123 Desire to remain a fisher	Socio-economic	driver	1.0	0.2
110	110 Limited maneuverability	Hazards	issue	1.0	0.2
121	121 Restricted as to where it is practical to fish	Fishing	driver	1.0	0.1
111	111 Sand catching in gear	Hazards	issue	1.0	0.1
113	113 Trawling	Hazards	driver	1.0	0.1
112	112 Sand estuary	Hazards	driver	1.0	0.0
124	124 Fishing is an age old tradition	Socio-economic	driver	1.0	0.0
22	22 Bottom drift netting not viable	Fishing	issue	0.5	0.6
142	142 Less fish sold by fish merchants	Socio-economic	issue	0.5	0.5
74	74 Reduced fishing in new channel	Fishing	driver	0.5	0.5
143	143 Disruption to fishermen	Hazards	issue	0.5	0.5
3	3 Decision that trawling is not viable	Mitigation	issue	0.5	0.4
139	139 Displacement from port development	Fishing	driver	0.5	0.4
141	141 Displacement from shipping lane	Fishing	issue	0.5	0.4
12	12 Alters the make-up of the sea bed	Environmental	issue	0.5	0.4
61	61 Gear caught on cables	Hazards	driver	0.5	0.4
151	151 More rocks on seabed	Environmental	issue	0.5	0.4
38	38 Lost nets hazardous for construction divers	Hazards	driver	0.5	0.3
29	29 Additional ground lost outside the area of actual turbine site	Fishing	driver	0.5	0.3
93	93 Seals displaced to fishing grounds	Fishing	driver	0.5	0.3
43	43 Damage to cable	Hazards	issue	0.5	0.3
45	45 Loss of anchor	Hazards	driver	0.5	0.3
80	80 More fisherman stay fishing	Fishing	driver	0.5	0.3
156	156 poorly structured meetings	Communication	issue	0.5	0.2
104	104 Location of the box is a problem	Fishing	issue	0.5	0.2

Causal concept number	Description	Theme	Category	Occurrence weight	Combined score
106	106 Birds are considered as high a priority as fishermen	Communication	driver	0.5	0.2
72	72 Sand movement into deep channels	Environmental	issue	0.5	0.2
157	157 Option to build land not given adequate consideration	Decision making	driver	0.5	0.2
158	158 Not considering how expensive and difficult to maintain wind farms at sea	Decision making	driver	0.5	0.2
100	100 Charter fishing is not a desirable option	Mitigation	outcome	0.5	0.2
94	94 Consider fishing in deeper areas	Fishing	issue	0.5	0.2
99	99 Consider changing to charter fishing	Mitigation	issue	0.5	0.2
98	98 Age is a limiting factor for retraining	Socio-economic	driver	0.5	0.2
71	71 Shipping using new channel	Fishing	issue	0.5	0.1
15	15 Movement of sand	Environmental	driver	0.5	0.1
140	140 Safety issues due to traffic	Fishing	issue	0.5	0.1
76	76 Majority don't want them on land	Decision making	driver	0.5	0.1
160	160 No-one to pass on fishing knowledge to	Socio-economic	issue	0.5	0.1
9	9 Quota system makes trawling difficult	Mitigation	driver	0.5	0.1
10	10 Need a big boat to do it efficiently	Mitigation	driver	0.5	0.1
47	47 No fishing	Fishing	outcome	0.5	0.1
77	77 Failed fishermen who couldn't find fish when they were there are now influencing government	Decision making	driver	0.5	0.1
152	152 Not attending meetings	Communication	outcome	0.5	0.1
153	153 Apathy	Communication	issue	0.5	0.1
154	154 Repetitiveness	Communication	issue	0.5	0.1
42	42 Anchor snagging	Hazards	driver	0.5	0.1
86	86 Lack of information on insurance	Communication	outcome	0.5	0.1
87	87 Decision on exclusion zone around wind farms not made clear	Communication	issue	0.5	0.1
88	88 Inadequate notification of meetings	Communication	driver	0.5	0.1
101	101 Lots of other ex-fishermen may try to go into charter fishing	Mitigation	driver	0.5	0.1
102	102 Desire to remain a commercial fisherman	Mitigation	driver	0.5	0.1
11	11 Transport of materials for construction of turbines	Environmental	driver	0.5	0.1
161	161 Fishing industry dying out	Socio-economic	outcome	0.5	0.0
70	70 Blocking existing natural shipping channel	Fishing	driver	0.5	0.0
78	78 Everyone wants then in theory	Decision making	driver	0.5	0.0
149	149 Blot on landscape	Environmental	issue	0.5	0.0
162	162 Loss of heritage	Socio-economic	outcome	0.5	0.0

Logical clusters of closely linked concepts were not easily identified using a mathematical routine available in the program. The complexity and uncertainties of the concepts and the linkages between them, resulted in a map with a poor logical (mathematical) structure. Since a primary goal of the analysis was to produce and honest representation of the knowledge and views given by fishermen, we have deliberately chosen not to meddle with the structure of the causal map, presenting here in it's completeness. However, by virtue of its completeness it is also somewhat illogical in places and poorly structured. Endeavouring to extract the salient points we have, however, made a simplified version of the overall causal map by clustering and merging the concepts manually through discussion. Weightings applied to the concepts in the overall causal map were added together for representation in the simplified map. This simplified causal map can be seen to represent a visualisation of the main cause and effect factors, whereas the overall causal map represents the fishermen's thoughts. The analysis and results are presented in Section 4 of the main report. The themes and categories applied to the simplified map can be used as a key to further analysis of the complete causal map (Table A3.1).

Appendix 4. Estimating loss of profit from fishing activities in the event of a closed area

If an area of sea which has previously been available to and used by fishing vessels, either for fishing or passing through, becomes unavailable for those purposes, it can be anticipated that the balance of fishing costs and fishing earnings may change as a result.

If an area is in use by fishing vessels then it can safely be assumed that the area is in use because it offers advantages over other areas. These advantages may relate to the fish available in the area, fish available in adjacent areas, tides, water depth, wind direction, proximity to the port or any of several other factors which affect skippers' decisions about where to fish on any given day.

Therefore, if an area in use becomes unavailable, it is also safe to assume that fishing vessels which previously used that area will suffer disadvantage through being unable to pass through or fish in the excluded area. Their alternative activities may result in lower total earnings and no change in costs, or may result in higher earnings, but a greater increase in costs, which would result in a loss of profit.

If an area is used for passing through *en route* to a fishing area, then the disadvantage may be due to having steam around the excluded area instead of through it. This may cost more time and fuel than previous fishing practices and the disadvantage might be in lower earnings, due to less time being available for fishing (due to more time spent steaming between the fishing grounds and the port), and to higher fuel costs for the steam between the port and the fishing grounds (in both directions), although some fuel use may be offset by reduction in fishing time.

If an area has been used for hauling nets at the end of a trawl, the loss of access to this area may mean the trawl has to be reconsidered, possibly cut short, in order that nets can be hauled in time to avoid drifting into the excluded area (eg. a wind farm) during hauling. Then, loss would relate to loss of trawl time and % loss of trawl time could be used as a proxy for % loss of earnings. Or, if the trawl took place further away from port in order to keep it at its full length, then, there might be additional steaming costs, or less income if the alternative trawl site was in some way inferior on average to the preferred site.

If an area has been used for fishing, and is then closed, then the loss of the area would mean the loss of income from fish caught in that area. Alternative fishing areas may not yield the same level of earnings, or, it may cost more to exploit alternative areas.

In each of these cases, the **method of estimating net disadvantage** due to the existence of an exclusion area (for whatever reason) needs to take account of the expected costs and income from fishing in the event that the area remained available, compared to the costs and earnings from fishing given that the area was not available for use. So, it is not a matter of comparing business before and after a closure.

If a closure has already occurred, the actual costs and earnings after the closure will be apparent and the estimated element therefore, is what *would* the costs and earnings have been had the area remained available for fishing access. The means of estimating these figures is to use as a proxy the average of several years previous actual figures, in order to take account of the cyclical nature of fisheries activity and income and the elements of unpredictability.

If a closure has not yet occurred, eg. in the case of a proposed wind farm in an area previously used for fishing and access to fishing grounds, in order to estimate expected net loss to a mobile gear vessel, a good starting place is to describe what the fishing activity would have been were there to be no closure (and this can be based on past fishing patterns) and then estimate the costs and earnings likely to have been generated by those activities (this can be done by finding the average of several years previous activity).

Next, list the various activities (fishing, steaming, hauling nets aboard while drifting) which are expected to be impinged by the presence of the turbines. Then, characterise the new fishing pattern, including replacement activities for those no longer possible.

Having established a new pattern of fishing required to account for the exclusion area, the next step is to estimate the costs and earnings of the new activities. It will be necessary to use past figures in order to estimate the likely costs and earnings of the new shape of fishing activities.

Estimating net disadvantage to vessels excluded from an area previously in use

Step	How?
1. Describe / detail fishing activity that are likely to have occurred had there been no closure	Use typical recent fishing practices as example. Describe steaming, towing and drifting patterns by time spent, time of day, location, season, etc. Give a total number of fishing days per year expected, and try to estimate total towing, steaming and drifting time, based on typical pattern per day.
2. Estimate the costs and earnings likely to have been associated with that activity	Expected fishing time, multiplied by average catch per hour towing, gives total expected catch per day. Expected catch multiplied by average prices = expected earnings. Costs: use standard Seafish costs and earnings breakdown to detail costs for expected activity. Use costs per hour for fuel for steaming and towing and apply to new fishing pattern. Apply fuel use to expected fuel prices.
3. List various activities that will be impacted by the closed area	Eg. for a wind farm, will have to steam around the farm to get to fishing areas, will not be able to tow gear within 2 miles of the farm, will have to make shorter tows, or move to further away grounds.
4. List alternative activities likely to replace previous activities	Eg. same length and type of tow but different place, same tow but shorter time duration, longer steaming, less towing time.
5. Characterise new fishing activities	Summarise total expected fishing days per year and new total breakdown of towing, steaming and drifting time, based on change of location to avoid wind farm and surrounding area.
6. Estimate costs and earnings generated by new fishing pattern	Use existing figures generated by known fishing patterns. eg. if a typical day included 8 hours towing and average catch per day was 400kg, then average hourly rate might be 50 kg per hour towing. Under a shorter tow regime, there would be lower earnings, but also, possible lower fuel costs if the day consisted of more steaming and less towing. This needs to be illustrated and backed up for each vessel.
7. Compare gross earnings minus costs for the expected activity with the wind farm, against the figures that would have been expected had there been no wind farm	

Example 1.	earnings	costs	profit
Without wind farm	£100k	£70k	£30k
With wind farm	£80k	£75k	£5k

Loss as a result of the wind farm is the difference in earnings minus costs between the two scenarios, ie. £25k, not the loss of gross earnings, which in this example would be £20k.

Example 2.	earnings	costs	profit
Without wind farm	£200k	£180k	£20k
With wind farm	£185k	£175k	£10k

Loss as a result of the wind farm is the difference in earnings minus costs between the two scenarios, ie. £10k, not the loss of gross earnings, which in this example would be £15k.

Example under 24m whitefish trawl costs and earnings table

NS & WoS Demersal Trawl ‹ 24 m for 2005

Costs and Earnings Estimate

	Average (£)	As a % of average sales	As a % of Average Total Expenses
Total Earnings	380,000		
Costs			
Fishing Costs			
Commission	18,619	4.90%	5.02%
Harbour Dues	16,339	4.30%	4.41%
Subscriptions & Levies	2,097	0.55%	0.57%
Shore labour	380	0.10%	0.10%
Fuel & Oil	85,000	22.37%	22.92%
Boxes	4,038	1.06%	1.09%
Ice	3,768	0.99%	1.02%
Crew Travel	550	0.14%	0.15%
Food & Stores	7,978	2.10%	2.15%
Quota Leasing	20,000	5.26%	5.39%
Days Leasing	2,500	0.66%	0.67%
Bait			
Other Expenses	14,305	3.76%	3.86%
Crew Share	102,213	26.90%	27.57%
Total Fishing Expenses	277,787	73.10%	74.92%
Vessel Owner Expenses			
Insurance	23,179	6.10%	6.25%
Repairs	29,710	7.82%	8.01%
Gear	16,151	4.25%	4.36%
Hire & Maintenance	8,983	2.36%	2.42%
Other Vessel Owner Expenses	14,972	3.94%	4.04%
Total Vessel Owner Expenses	92,994	24.47%	25.08%
Total Expenses	370,781	97.57%	100.00%
Net Profit	9,219	2.43%	

Appendix 5. Mackinson *et al.* 2005

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Mind games: Cognitive mapping of fishers' knowledge and perceptions on the impacts of wind farms on fisheries

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Abstract

The development of offshore wind farms around the coasts of England and Wales could make a significant contribution to securing energy supplies for future generations. However, while knowledge of wind farm impacts is developing all the time, there are still some uncertainties about the impacts of wind farms on the environment and specific industries whose activities may be affected by their development. Cognitive mapping was used as a tool in the dialogue between fishers and researchers in a study that investigates the socio-economic impacts and opportunities arising from wind farm developments. Cognitive mapping helped fishers to express their knowledge and perceptions of impacts in a structured way that facilitated a comprehensive and transparent understanding of the issues and concerns of fishers. Specific consideration of possible options to minimise the impacts of developments during construction and operation phases highlight some factors that shape fishers' adaptation to management actions.

Keywords: Wind farm, knowledge, perception, adaptation

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Introduction

Stakeholder participation is an integral part of the changing face of the constitution of fisheries management in Europe. The reformed common fisheries policy, strategies and specific initiatives of independent Governments are demanding so (e.g. Net Benefits, UK Fisheries Science Partnership program). The opportunity for industry to participate in the ICES annual talks on scientific advice together with the creation of partnership bodies such as the North Sea Partnership have paved the way for science and industry to engage and collaborate. More formally, stakeholder participation is embodied in the core principals behind Regional Advisory Councils, giving a decision-making platform from which to develop independent advice on regional management and scientific issues of primary concern to industry. Such issues go beyond traditional fisheries management policies, extending to all aspects of Marine Spatial Planning such as Marine Protected Areas, offshore energy projects and seabed extraction and disposal activities.

For science and industry to collaborate effectively requires that the knowledge and perceptions from consultations / dialogues can be extracted, synthesised and communicated. In short, the output needs to capture the understanding of both groups and be 'available' for others to understand. It might sound simple and obvious, but problems capturing and translating knowledge to decision-makers is a frequent failing that prevents action being taken when it is needed. To be able extract information, foremost we must listen. By doing so, we adapt our own understanding, and intuitively select

and apply appropriate contextual frames that allow us to communicate our own views on issues of common concern. Ineffective synthesis and communication can render otherwise fruitful discussions useless, serving to invite the criticism of only 'paying lip-service'. For instance, how many times have you been to a 'good' discussion, only to see it regurgitated monologue style in the meeting minutes that now languish unremembered? It's what you do with the knowledge that's important.

Cognitive mapping (Tolman 1948, Eden & Ackerman 1998) is a method that can be used to synthesise and communicate the knowledge and perceptions from open discussions. It can be viewed as a process of 'active listening' that outputs qualitative understanding of causes and effects and a semi-quantitative assessment of their certainty/ relative importance. Recognised as a tool to aid decision-making, it is particularly useful where there is a need to clarify alternative and contrasting thought-processes. Unsurprisingly, it does not appear to have been widely applied in fisheries management, perhaps because of the non-collaborative traditions that have prevailed over the past 50 years.

This paper describes the application of cognitive mapping to synthesise and communicate the knowledge from discussions between fishermen and scientists on the impacts of offshore wind farm developments on fishing activities and livelihoods. Based on the specific experiences, benefits, challenges and pitfalls of the method are discussed.

Wind farms background

The development of offshore wind farms around the coasts of England and Wales could make a significant contribution to the UK's commitment to renewable energy, securing energy supplies for future generations. However, the extent of the proposed 'Round 2' wind farms (Figure 1) is likely to conflict with a range of marine users and environmental resources. Responding to concerns already expressed by the fishing industry about possible impacts, Defra commissioned a study to assess the physical and socio-economic impacts that the development of wind farms might have on fishing activities. The purpose of this work is to provide the knowledge necessary to help government make informed decisions on the licensing of new wind farm developments. Specifically, the study provides an important opportunity for fishermen to describe and explain the likely impacts of the construction and operation of wind farms on their activities and livelihoods. Views and suggestions for possible options to alleviate any impacts are also sought. The Centre for Environment Fisheries and Aquaculture Science (CEFAS) and the Sea Fish Industry Authority (Seafish) will conducted face-to-face interviews and postal questionnaires with fishermen during the early summer 2005.

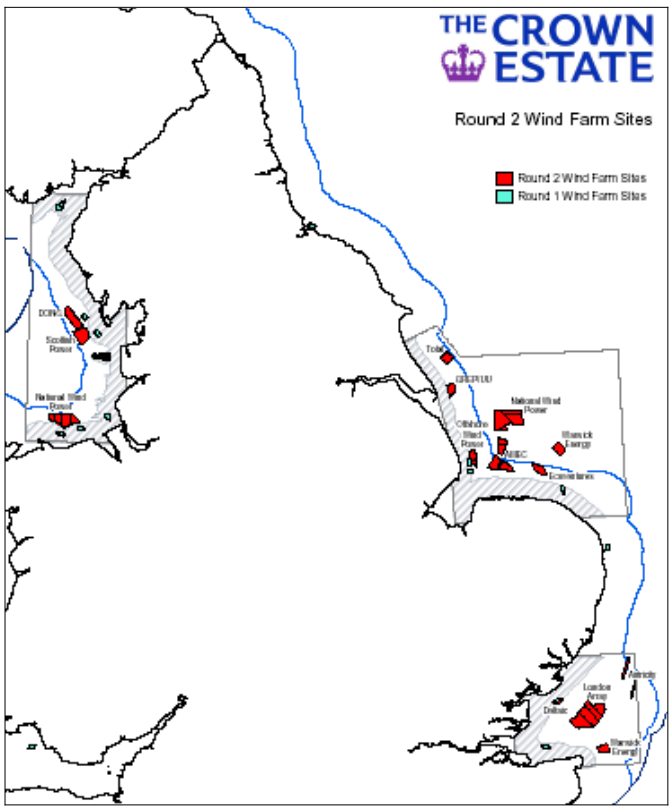

Figure 1. Site leases for proposed 'Round 2' wind farms. Note: Before any of the projects can be built, they need to obtain a number of statutory consents: the two key ones are issued under the Food and Environment Protection Act (by Defra) and the Electricity Act (by the DTI). The assessment of the consent applications requires the relevant Government Ministers to consider the impacts of the projects both in regard to any direct effects from the project and any effects arising from interactions with other marine industries.

Methods

Cognitive mapping: rationale and principles

Maps can be viewed as a type of model, which can be used to enhance understanding of systems of many types; for example flow diagrams. Simple maps are often used in this way to develop an understanding of individual or group thoughts as exemplified by Buzan's mind maps (Buzan & Buzan 1993). The term cognitive map was first used by Tolman in 1948 and has been applied in various ways by various authors (Eden & Ackerman 2001).

The cognitive map has been most intensively developed by Eden and Ackerman within the framework of their SODA (Strategic options development and analysis) method (Eden & Ackerman 1998, 2001; Bryson et al 2004). This is a decision-making method in which cognitive maps are used as a tool for negotiating differences in viewpoints. Specific software can be used to implement and analyse the maps (Decision Explorer; Banxia, 1999).

Cognitive maps as used by Eden and Ackerman represent a rigorous approach to the use of maps as tools for understanding and negotiation. This is based in the personal construct theory of Kelly (1955) within cognitive psychology. In simple terms this states that individuals strive to make sense of the world using a rational approach in which actions have effects. This leads to the development of a subjective 'construct' of the world as a means to making sense of and managing the world. This construct is a model of the world that is expressed through language and varies from person to person as a consequence of their experiences. To the individual, the construct represent the real world. This construct can be modelled using a language based cognitive map. As such the maps can be seen as approximating the way in which people think. This is supported by considerable empirical evidence that people find the method easy to understand and useful in gaining a better understanding of situations(Eden & Ackerman 1998, 2001; Bryson et al 2004).

In the SODA method, the diversity of viewpoints represented in the maps reflects the different constructs of the individuals. This diversity is seen as a benefit in the same way as the different skills of different team members is viewed. Thus it is a way to explore the richness of the issue. Since they share a common structure, the maps are a facilitative device to assist in understanding and negotiating consensus.

Through discussion, the map is constructed by identifying concepts (or constructs) that are actions or events that can cause other concepts. This forms a directed graph comprising cause-effect nodes and links. For clarity it is usual for the concepts to take the form of pairs of opposite actions, often referred to as the emergent (or positive) and contrasting (or negative) poles. There is also a possibility of negative links where the link causes the contrasting pole rather than the emergent. The map is usually developed with a structure having goals, aims and objectives at the top and issues at the bottom. It is elaborated through a process of discussion, which can begin from goals and work down or from the issues and working up. The developing map is then explored interactively with the interviewee to ensure the model is accurate. This is often done by laddering up and laddering down the map. It is stressed that the map must be 'owned' by the interviewee and not be a product of the facilitators thoughts. Nonetheless they note the move from empathic to negotiative relationship as the facilitator ensures that the map is adequate.

In the SODA method, cognitive maps are developed for individual decision makers and then merged in a group map that encompasses all viewpoints. Eden & Ackerman (1998) note that 'most people do not know for sure what they think about many important matters' and the cognitive map helps to clarify thinking and is also used as a tool to broaden thinking. This stresses the view that these maps are qualitative, and the implications of this need to be understood.

A group map merged from individual maps provides a tool to facilitate group discussion from which a group consensus map that represents the more general views of the group may be drawn. Such group consensus maps are often known as causal maps as they represent general perceptions of cause and effect rather than individual thoughts. More recently the method has been simplified by developing a causal map directly from a group setting rather than through the intermediary of individual cognitive maps (Ackerman & Eden, 2001). This is primarily because of the high cost in time of cognitive mapping.

Quantitative analysis is not normally a part of the use of cognitive mapping. However, the software developed for implementation of the method does have the ability to recognize clusters of concepts which are regarded as 'emerging themes' and which can also be used to collapse the maps to make them easier to understand. The software can also identify tails of models, which are concepts having no causal link. These are typically important starting points or triggering events. Similarly heads can be identified as outcomes, goals or conclusions. Busy concepts can also be identified as those with a high level of connectivity according to various algorithms. These can be seen as key concepts in the model. These analyses are used as a basis for understanding the model and discussion rather than for quantitative analysis.

It is also usual to ask participants in mapping sessions to allocate a number (usually 10) of stars to concepts they regard as important. These stars can be allocated as the interviewee sees fit, so that all 10 may be allocated to one concept or each one to 10 different concepts. This can give an assessment of the importance of the various concepts to participants in mapping sessions.

Although quantitative analysis is not normally part of cognitive mapping there would seem to be a potential for such analysis if it was felt to be useful. In general terms if multiple maps (representing multiple viewpoints) are merged into a causal map then it should be possible to record the number of individual maps contributing to the general map. This can be perceived as providing an assessment of the level of agreement on the contribution of that concept or link to the overall model.

Data treatment/ locating fishermen

Two sets of criteria were used to identify from Defra's Fishing Activity Database those boats fishing in the proposed Round 2 wind farm sites. The first identified boats that reported catching fish within the ICES rectangles encompassed by the wind farms areas during the period 2000-2004. This identified mainly those vessels over 10m long since they are obliged to report catches. Vessels under 10m, who do not have a statutory obligation to report catches, were identified using the criteria that either their homeport or administration port occurred in the wind farm areas. It assumes that these smaller vessels generally operate locally. The combined criteria identified a total of 1270 of commercial registered fishing vessels. This did not include charter-angling vessels.

Numerous approaches were implemented to solicit fishermen's participation in the study:

(i) Invitation letters were sent to the owners of the commercial vessels identified from the database.
(ii) Announcements of the study, invitation to participate published in the Fishing News (29th April, 6th May and reminder on 10th June). Specific request was made for charter angling interests to participate.
(iii) Information and invitation to participate on 3 web sites.
(iv) Detailed information and contact information sent to representatives of 38 fishermen's associations/ co-ops, 6 Sales agencies, 5 Producer organisations, 13 area-based representatives of the National Federation of Sea Anglers, 4 Fishermen's organisations.

To be as flexible as possible in meeting individual circumstances and availability, fishermen were given the option to specify how they wished to be participate in the study, either (i) face-to-face meeting, (ii) postal questionnaires. They were requested to respond to the invitation within 5 weeks.

Response to the 1270 invitation letters was 75 phone calls. Some of these were calls from representatives of fishing associations who wished to meet as a group. A total of 6 group meetings, 8 individual interviews and 44 postal follow-ups were made as a result of following up the 75 calls. Table 1 provides greater detail of the number of meetings and questionnaires that were distributed by each area. Cognitive maps were made for all face-to-face meetings.

Table 1. Postal questionnaires, face-to-face group and individual meetings and questionnaires distributed by area. Numbers in brackets represent the number of questionnaires given out.

		Greater Wash	Thames	North West	Outside
Postal		13	22	3	6
Face-to-face					
	Group	Greater Wash Fishing Industry Group (90)	Thanet Fishermen's Association (30)	Fleetwood Fishermen's Association (3)	
		North Norfolk Coast Inshore Fishermen's association & Wells and District Fishermen's association	Whitstable Fishermen's Association (7)		
		Bridlington and Flamborough Fishermen's Association			
	Individual	Lowestoft liners (2)	8	uncertain?	

Cognitive mapping: implementation

In all cases, a brief introduction to the rationale and purpose of the cognitive mapping was given to the participants. In group meetings, two alternative approaches for constructing the maps were tried. In 2 meetings a computer image of the map was projected on to a large white board and was used to construct a single group map. One person operated the computer the other facilitated the discussion. In a 3rd meeting, the group was split in two and separate group maps were constructed using pens and post-it labels as tools. Each facilitator explained the rationale and led their group through the steps to constructing the map (i) brain-storming the cause-effect concepts, (ii) organise concepts in to groups, (ii) connect cause-effects by drawing arrows, (iv) weight importance of concepts using stars.
Meetings with individuals were held at the location preferred by the participant. Single cognitive maps were produced directly on a laptop PC viewed by both the interviewer and participant. During these meetings, participants were also asked to complete the full questionnaire.

Our early experiences quickly led us to apply a three-stage approach to the implementation and analysis of mapping process.

- Stage 1: Raw data (Extraction). Map recorded on-site with individual / group. The concepts are written down as stated/ agreed by the participants. Particular wording may represent very specific interests. The participant is the 'owner'.
- Stage 2. Editing and iteration (Synthesis 1) Edited for the purpose of clarification, structural organisation of concepts and ensuring completeness. The main purpose is to get a complete and true reflection of the discussions of the meeting. Concepts that are added or require clarification by the participant are highlighted. This map is 'owned' by the interviewer and is sent back to the participant for their approval. Participants were given two weeks to make and changes. In group cases this can lead to the creation of a consensus map. Any changes are incorporated and sent back again to the participant so they have a final copy.
- Stage 3. Analysis and interpretation (Synthesis 2). Maps collated for analysis of clusters, importance, merging individual and group maps to causal maps. Maps are 'owned' by data analyst.

Stage 1 represents the extraction of knowledge and perceptions, whilst stage 2 and 3 reflect synthesis of that information. No results for stage 3 analysis are present here.

Results

Opportunities to try both group and individual mapping arose in this study by providing fishermen flexibility in the way that they wished to participate in the study. It allowed us to compare alternative methods for group mapping, compare group maps with individual maps and group maps with merged maps.

Comparison of mapping approaches

Group mapping
In group situations, the facilitator must react to and manage the dynamics of the group and in our experiences, we found ourselves in contrasting situations. In one case, the group was very keen and enthusiastically provided concepts. In this situation, the main task of the facilitator was to keep track of lines of thought, stop and re-open where necessary, prevent stagnation and encourage participation by all members of the group. When a single projected map was used, we found that quieter individuals in the group tended not to contribute.

Another meeting was typified by a greater degree of apathy, participants perhaps having the impression they were there to listen rather than participate. Building a successful map required more leading and examples, prompting of thoughts, cajoling and presenting participants with 'what if?' scenarios. More challenging was a group that at first flatly refused to participate. To engage them in the process required first listening with empathy, breaking down scepticism, developing an understanding in the reasons for undertaking the exercise and providing clarity on what it would provide and how the information would be used. In short, in required developing trust and understanding between the researcher and participants. In this scenario, the post-it method helped provide the much need closer personal interaction between the facilitator and the participants.

The concepts emerging from group dialogues arose anywhere on the scale from issues to goals. They often came out rapidly, out of sequence and sparked other tangent lines of thought before any particular threads were clearly completed. Although this task was considerably more difficult than guiding individuals through cause-effect it had the benefit of catalysing thoughts through the group and building the confidence to explore areas of thought that as individuals they may not have been prepared to consider. Comfort of the group environment, whether to shout as a group or hide within it, is undoubtedly critical to the dynamics of the discussion and resulting outputs.

The post-it group method seemed to provide the benefit that it engaged individuals more actively in the exercise than when a single map was done on-screen. With on-screen mapping we noticed that as soon as participants had seen that their thoughts and views were being captured, they lost interest in the activity and focussed on the issues. None-the less, the on-screen map was a useful tool to allow the facilitator to summarise and re-iterate themes, thus maintaining direction to the discussions.

In all group cases, it was difficult to achieve complete maps where all cause-effects links were made and thoughts thoroughly fleshed out to exhaustion. Constraints of meeting time and ability to maintain attention were important practical constraints. Considerable skill in facilitation was needed in order to balance these sometimes-conflicting issues and achieve a successful outcome. In our experience, it was generally clear when areas of dialogue / the whole meeting was running out of steam, so it is important that the facilitator recognises this natural end and adapts to the situation.

Individual mapping

Of the seven meetings with individual participants, three were held at the Cefas laboratory, three were held at participants' homes and one was held in a local café. All seven meetings were held at times and places chosen by the participants. Two facilitators attended each meeting; this enabled one to guide the discussion and one to operate the computer. To help put them at ease and stimulate initial dialogue from less vocal participants, more background information and examples were given. Once the discussion was underway, ideas were very forthcoming, but as with the group mapping, ideas came rapidly and out of sequence. To maintain focus we tried to introduce times in the discussion where participants could focus on grouping the concepts together and structuring the map on the computer.

There were two main drawbacks to the individual method; it was time consuming and labour intensive. The length of interviews ranged between two and three hours. Most interviews came to a natural close at the end of this time because both the participants and facilitators were nearing the end of their concentration. The participants could have probably contributed new ideas or developed existing ones had the process been less intense and tiring.

The individual method enabled a natural, free flowing and interactive discussion. The participants being in familiar surroundings and being able to take more control helped this in some cases. Participants had the opportunity to personalise the map according to their own situations and opinions. They were able to express personal views and emotional issues without the pressure of a group situation. Involvement did not depend on how shy or outgoing the participant was.

An example map

Both the survey and analysis of maps are ongoing at the present time, thus results presented here are very preliminary. Purely as an example, we present a group map and discuss its main features and information regarding the impact of wind farms on fisheries. Our ongoing analyses include merging of maps from individuals and groups, and expressing the relative importance of concepts and decision paths through quantifying the occurrence of concepts and their links.

The map shown in Figure 2 is in stage 2 of analysis. Some of the concepts have been edited to aid clarity and missing links have been added to complete the decision paths. The map has both a vertical and horizontal structure. Going from bottom to top, the concepts are organised by cause and effect, with final consequences at the top. Clusters of concepts or 'themes' tend to emerge horizontally. For convenience in this map, these have been organised from left to right according to three phases in the lifetime of a wind farm, planning, construction and operation. In this map, no mention is made of the impacts of the decommissioning phase.

Five clusters of concepts denoting themes of issues are highlighted in the example map, (i) views, information & consultation, (ii) physical and (iii) biological effects of construction and operation of a wind farm, (iv) effects on fishing activities and (v) wellbeing and safety.

Similar themes have been represented (to a greater or lesser extent) in each of the maps we have so far developed with fishermen. As might be expected, the main differences between maps occur because of alternative perspectives associated with different fishing methods.

Some of the important messages that have so far emerged through discussions with fishermen on the impact of wind farms on fishing activities and livelihoods are:

- Belief that no one listens anyway. This belief is rooted in an overwhelming mistrust in consultation processes that is partly influenced by the cumulative experiences of impacts that other offshore developments have had on fishing opportunities and a prevailing view that the energy vs. fishing debate is a lost battle already.
- Consultation is too late in their eyes. Much of the negative attitudes apparent now, would have been avoided if appropriate consultation occurred before Crown Estates published the sites for proposed round 2 wind farms. It seems that the experiences from round 1, where the development of wind farms has progressed through very fast with little consultation, has down-trodden the fishermen's faith that anything they say will be listened to at all.
- Many representatives of fishermen's groups are very well informed and have engaged both government and developers in their concerns on the impact of wind farms.
- Even though fishermen might accept that wind farms are likely to impact their livelihoods and they will have to adapt, it does not change their feelings of despair, disheartenment and being disenfranchised. Uncertainty in what the impacts could be contributes further to this.
- Statements about possible positive impacts of wind farms are rare. For most gear sectors, the impacts appear to be negative.
- The seafaring right of passage ('right to roam') ethos is deeply embedded in the livelihoods of many (particularly) inshore fishermen.
- Fishermen are most focussed on local concerns needing, to draw from their own experiences. It was less common to find them extrapolating more generally on the impact of wind farms to the whole fishing industry and associated shore-based activities and community.
- Fishermen tend to separate the biological effects from the impacts on their ability to operate and many express greater concerns over the unknown ecosystem knock-on effects.

Mitigation and adaptation to management actions

Relating to the information on the impacts of wind farms elucidated through our discussions, fishermen were asked to suggest mitigation and minimisation measures. We experienced on numerous occasions that fishermen found it difficult to provide ideas for mitigation/ minimisation that adequately addressed their own concerns. They often replied in frustration, 'do not build it at all', a response that is largely embedded in the fact that they think construction is already a done deal, and because the many uncertainties make it difficult to know how they might be able to adapt. Given that each of the proposed wind farms sites has a very different ecological and socio-economic environment, establishing appropriate mitigation measures ideally requires that case-by-case evaluations of the impacts that particular wind farms might have on particular fishing activities be conducted. To some degree, this information is a requirement of the developer.

Summary and Discussion

Cognitive maps were successfully used to extract and synthesise the views and perceptions of fishermen on the impact of wind farms on their fishing activities and livelihoods. When individual maps are combined from all surveys, the resultant causal maps will help to elucidate the overall views and knowledge of the fishing industry. The easy-to-understand nature of the maps provides a simple, yet effective tool to communicate the information to Defra.

Application of the cognitive mapping approach was not always straightforward, requiring us to adapt the approach to circumstances. Much has been learned through our current experiences and some issues of application remain to be resolved. With the benefit of hindsight we can reflect on how some aspects could be improved, but nonetheless we feel that the resulting maps are a true reflection of the concerns of fishermen over the impacts of wind farms. This is further evidenced by the fact that fishermen who returned maps after checking had few or no additional comments.

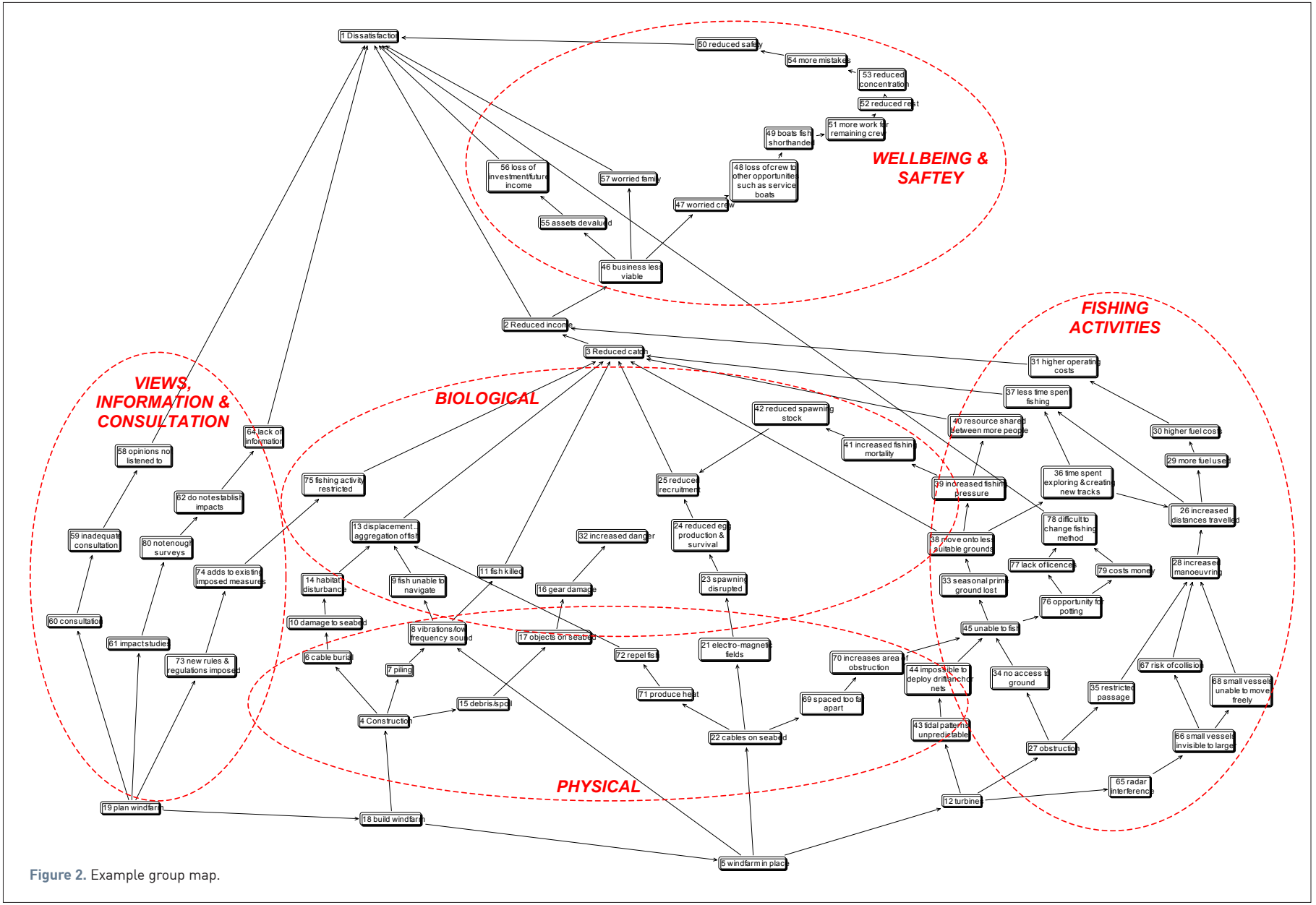

Figure 2. Example group map.

Some of the key lessons learned from our experiences in applying cognitive mapping are:

- Whether the map is developed in a group setting or with individuals, the role and skill of the facilitator and his/her interaction with the interviewee is of critical importance. Group mapping exercises required sensitivity to the group size and dynamic, being adaptable to apply a suitable method given the circumstances. i.e. you need several tricks up your sleeve.
- Practical constraints of the environment can play a major role dictating what approach to use. More than one facilitator may be required. Good projection facilities are useful.
- 'Post-its' method suitable where no more than 6-8 participants per interviewer. Offers better personal interaction, particularly when individuals are reticent to get involved.
- On-screen method good where individuals in the group have similar issues and can head toward consensus map. Need good projection facilities.
- Individual maps provide clearer insight on some issues because of the ability to follow single lines of thought. The greater number of maps produced by individual mapping increases the information available for statistical analysis. Group mapping facilitates better chance of agreement on a common causal map, but the group setting has the danger that it does not fully document the thoughts of individuals, being biased to those who are dominant. With groups of different sizes the analysis can be complicated by the need to weight the results of the different groups accordingly.
- Fishermen most often wished to be consulted as a group.
- To ensure ownership of the maps, it is vitally important to explain the methodology to the participants, since even though the method is intuitive; it is not a typical way for people to express their knowledge and thoughts.
- Variability in the approaches/ style of different facilitators complicates the process of coding and merging maps and greatly increases the time this requires. Statistical rigour would be improved if a single person did all of the collection and analysis. We have found however, that the possible impingement on statistical quality is generally offset by the benefits that can be gained through alternative aspects of the maps being explored as a result of different styles of individual facilitators. Contrasting approaches can serves to cancel particular biases of any one individual and provide a more broad and complete description of the subject.
- Since the maps provide a summary of concepts that 'may lead to' other concepts, uncertainty is an inherent feature. Unfortunately, it is not easy to assess how likely each of the links are, and this can be an issue where levels of uncertainty are seen as major areas of interest. Causal maps can be developed into fully quantitative systems dynamics models if this uncertainty is quantified, and the relationship between the concepts determined mathematically.

During recent years, the approach of European fisheries management has turned in favour of cooperation rather than administration; providing opportunity for managers, scientists and fishermen to work more closely on the common problems they face. From a practical level, doing so requires developing trust between individuals and applying simple communication tools that enable the sharing and understanding of others knowledge, views and perspectives. Cognitive mapping is one such tool.

Because of the many existing uncertainties surrounding the impacts of round 2 wind farms on ecology, navigation and sediment dynamics, it is not clear how fishermen might respond to the presence of wind farms. The impacts they have elucidated in this study are concerns that are perceived to threaten their livelihoods in a very real way. Although resistance and negotiation might be expected to be a fishermen's first line of response to the implementation of round 2 wind farms, it seems that their overwhelming feeling that 'fishermen as a species' are simply not valued, is dispiriting to the extent that it hinders the collective views of fishing industry from emerging fully. This scepticism, unwillingness or lack of interest to participate in the study, means that it is challenging to adequately assess the impacts that round 2 wind farms might have on livelihoods dependent on fishing.

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