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# ECASA Stakeholder Meeting Heraklion 19 Sept 2007

## ECASA & EIA - Vidlin Perspective

Thom Nickell, SAMS

# EIA - What is it?



- The EU Directives are the major legislation controlling EIA
- Directives administered nationally through Acts of Parliament and Statutory Instruments in UK
- England & Wales separate legislation from Scotland



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# EIA

- In EU, Council Directive 85/337/EEC came into force in 1988. Directive 97/11/EC, which amends Directive 85/337/EEC, came into force on 14 March 1999
- In UK, 1998 Planning Regs (Ammended), followed by various Statutory Instruments in 1999
- In Scotland, The Environmental Impact Assessment (Scotland) Regulations 1999
- Oil installations under separate DTI control (Offshore Petroleum Production & Pipelines Regulations 1999)



# EIA

- The 1999 regulations specify criteria which determine whether a proposed new aquaculture development or modification to an existing development requires an EIA.

These are:

- All proposals in 'sensitive areas' as defined in the regulations
- All new proposals with a designed biomass  $\geq 100$  tonnes or cage surface area  $\geq 1000\text{m}^2$
- Any modifications with a designed biomass  $\geq 100$  tonnes or cage surface area  $\geq 1000\text{m}^2$



# EIA

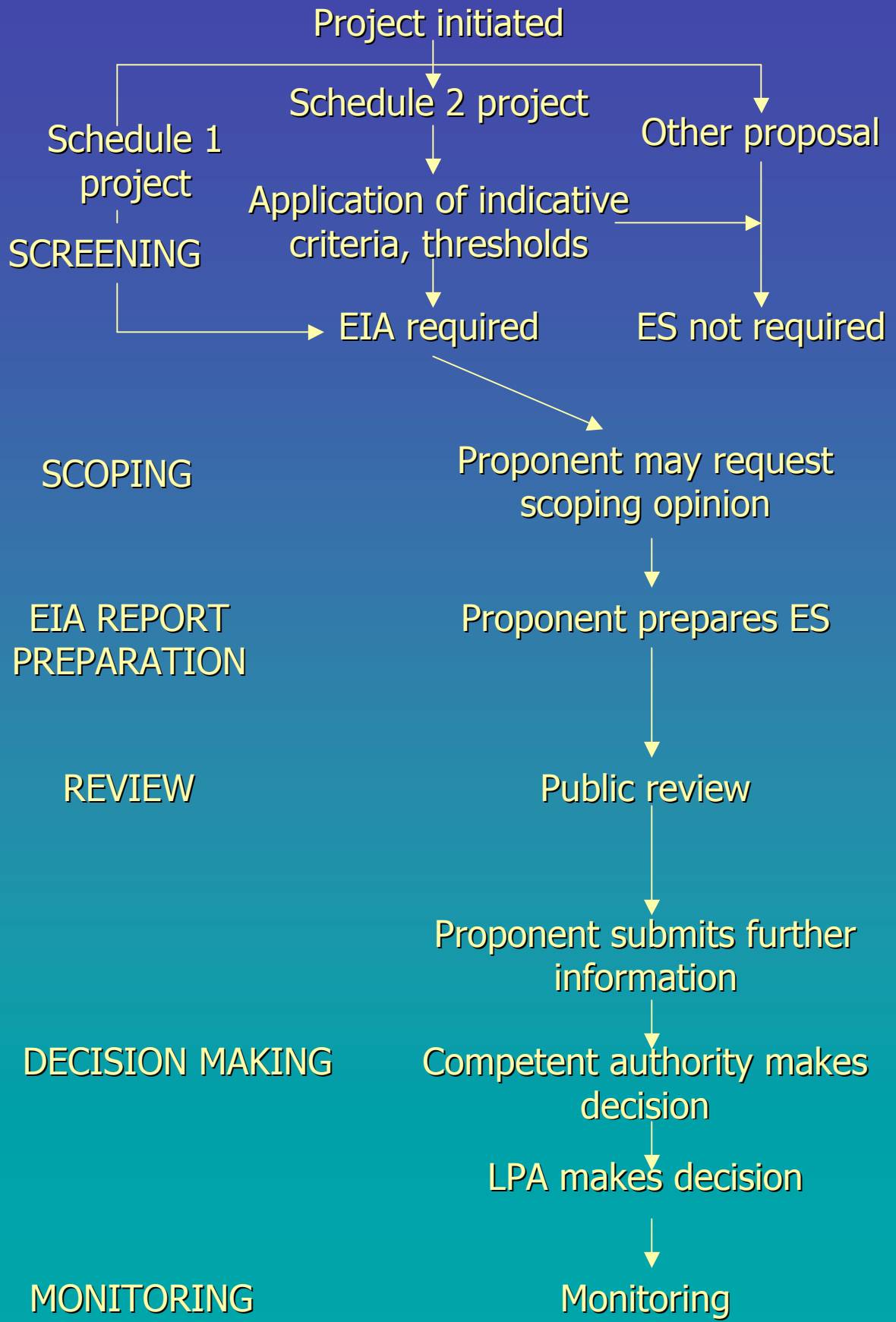
- New legislation (Environmental Assessment [Scotland] 2005 Act) came into force in Scotland in February 2006. This Act:
- Transfers authority to Scottish local authorities who now have the responsibility for formally determining whether an EIA is required which previously rested with the Crown Estate.
- In the Scottish Islands of Shetland and Orkney, local councils have been awarded that authority since 1974, under the Zetland County Council Act (1974)



# EIA

- Annex 1 - Projects likely to have an effect on the environment to undergo obligatory EIA e.g. oil refineries, power stations
- Annex 2 - Smaller projects (member states to decide criteria)
- Annex 3 - Selection criteria for screening Annex 2 projects
- Annex 4 - Information to be included in an assessment







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# Environmental Statements

Procedures in Scotland when EIA is required:

- It is the applicant's responsibility to prepare the Environmental Statement (ES). There is no statutory provision as to the form of an ES
- However, “it must contain the information specified in Part II ..... as is reasonably required to assess the effects of the project and which the developer can reasonably be required to compile”



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# Environmental Statements

- Emphasis on the 'main' or 'significant' environmental effects to which a development is likely to cause.
- Other impacts from the development may be of little or no significance, and will need only very brief treatment, to indicate that their possible relevance has been considered.
- Each ES should be prepared on a realistic basis and without unnecessary elaboration.



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# Environmental Statements

- Developer to include in the ES an outline of the main alternatives (sites, choice of process, phasing of construction) and the main reasons for his/her choice.



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# Environmental Statements

Aspects of the environment which might be significantly affected by a project include:

- human beings
- fauna
- soil
- water
- air
- climate
- landscape
- material assets (including architectural and archaeological heritage)
- also likely significant effects from use of natural resources, emission of pollutants, creation of nuisances and elimination of waste.



# Environmental Statements

- The information in the ES must be summarised in a non-technical summary to ensure that the public can comment fully on the ES, i.e. “in accessible plain English”.
- The developer does not need to consult anyone about the information to be included in an ES.
- After a developer formally notifies the LPA that an ES is being prepared, the LPA will inform consultation bodies of the details of the proposed development.



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# Environmental Statements

The consultation bodies are (in Scotland):

- a) any adjoining LPA, where the development is likely to affect land in their area
- b) Scottish Natural Heritage
- c) Relevant water and sewerage authorities
- d) Scottish Environment Protection Agency
- e) Health & Safety Executive
- f) The Scottish Ministers



# Vidlin EIA

## Preliminary site survey (existing farm):

- Bathymetric data
    - Acoustic survey ? x
    - Admiralty chart ✓
  - Hydrographic data
    - 2001 ADCP data available
  - Previous surveys
    - Station positions for regulatory monitoring
  - Feed/biomass data
    - From farmer
- ➔ Modelling for zone of effect



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# Vidlin EIA

## Farm description

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Biomass (tonnes):	2004	2005	2006
Vidlin outer (6 cages)	87 in	181	1390
Vidlin north (11 cages)	total	304	

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# Vidlin EIA

Vidlin Voe



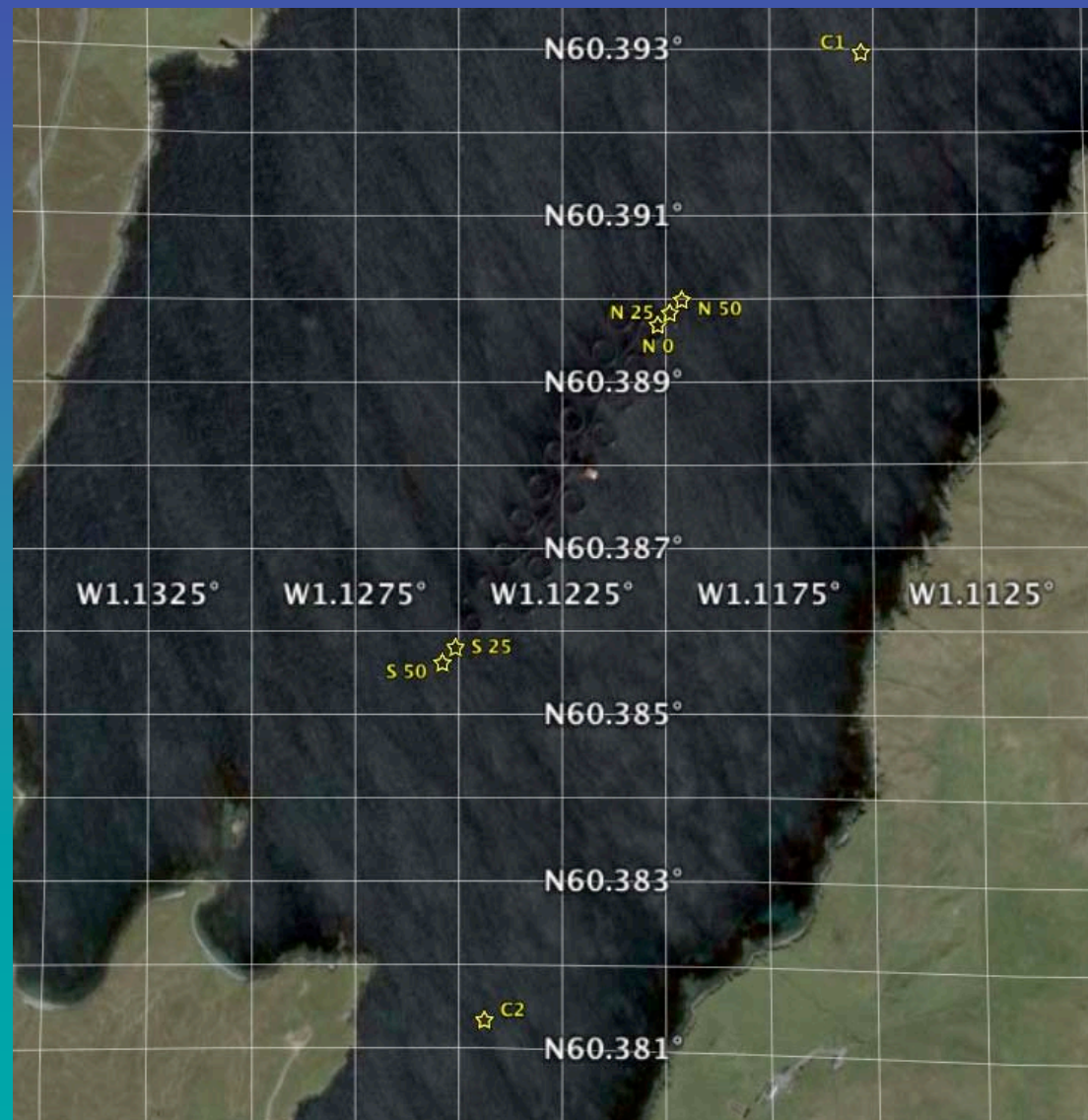


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# Vidlin EIA

## Vidlin Voe



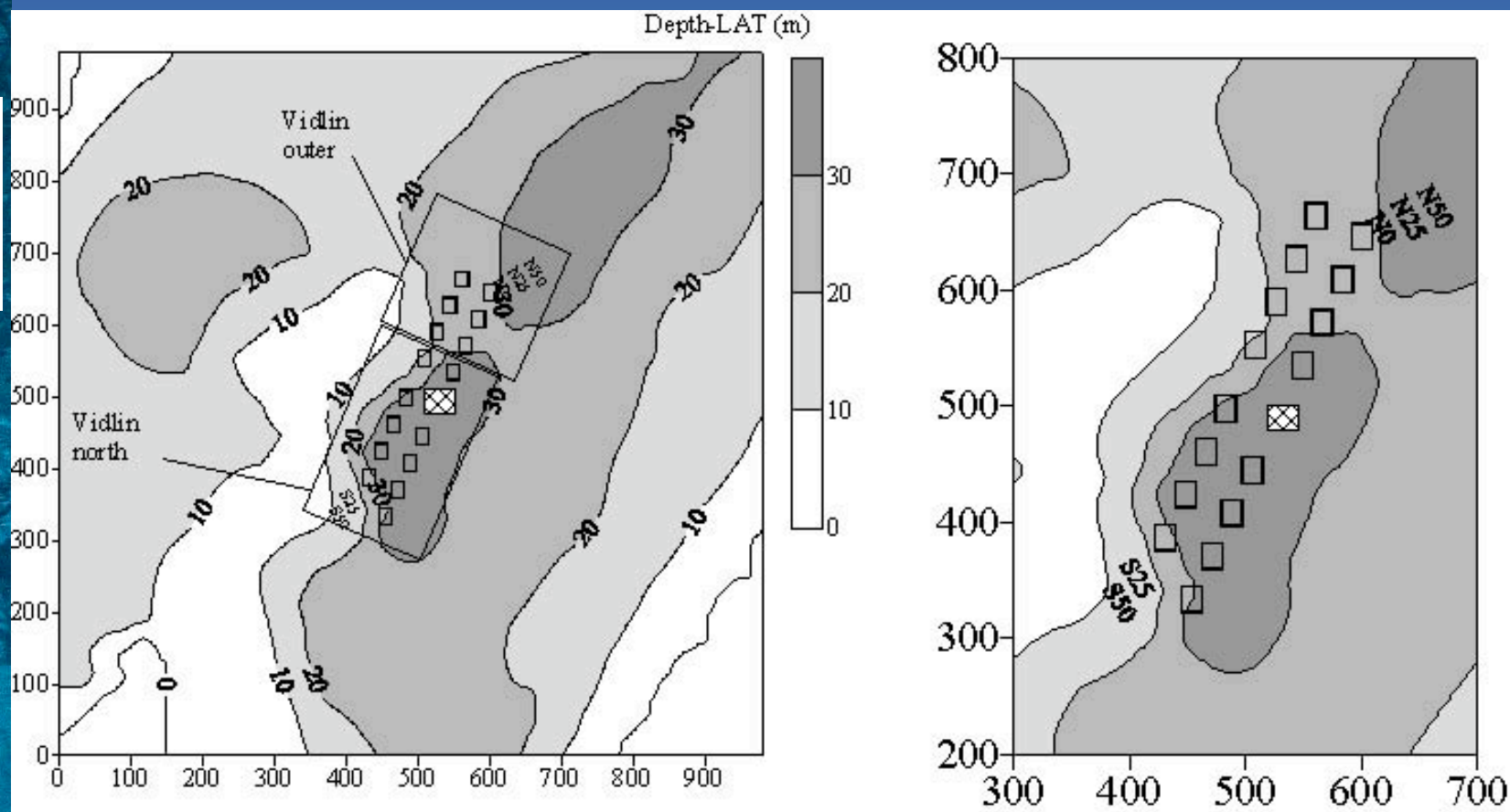


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# Vidlin EIA

## Preliminary site survey (existing farm): Bathymetry



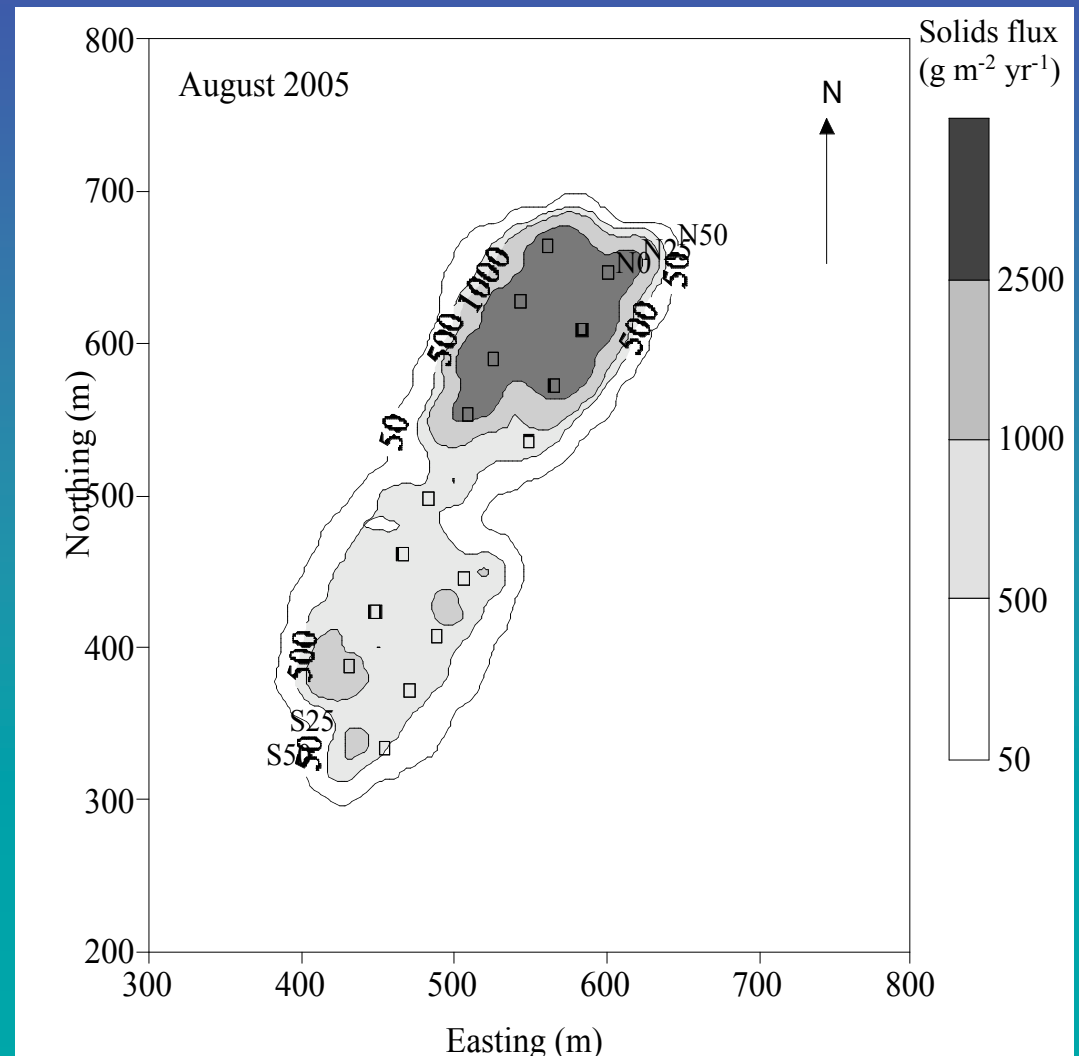


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# Vidlin EIA

## Preliminary site survey (existing farm): Modelling





# Vidlin EIA

## Samples:

- Sediment chemistry
  - Loss on Ignition\*
  - Organic Carbon & Nitrogen\*
  - Particle Size Analysis\*
  - Redox \*
  - Total (organic & inorganic) phosphorous
- Biology
  - Macrofauna\*

\* = mandatory measurement



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# Vidlin EIA

Preliminary site survey (existing farm):  
Positional fix with GPS, measured rope tied to cages





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Survey vessel





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# Vidlin EIA

Skilled personnel





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# Vidlin EIA

Skilled personnel





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# Vidlin EIA

Equipment: 0.1 m<sup>2</sup> van Veen grab



Photo: H. Thetmeyer



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# Vidlin EIA

Equipment: Round mesh sieves; sieve table



Photo: H. Thetmeyer



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# Vidlin EIA

What is Vidlin Voe like (ecosystem, socio-economic factors?)

Area:

Open moorland  
Crofting



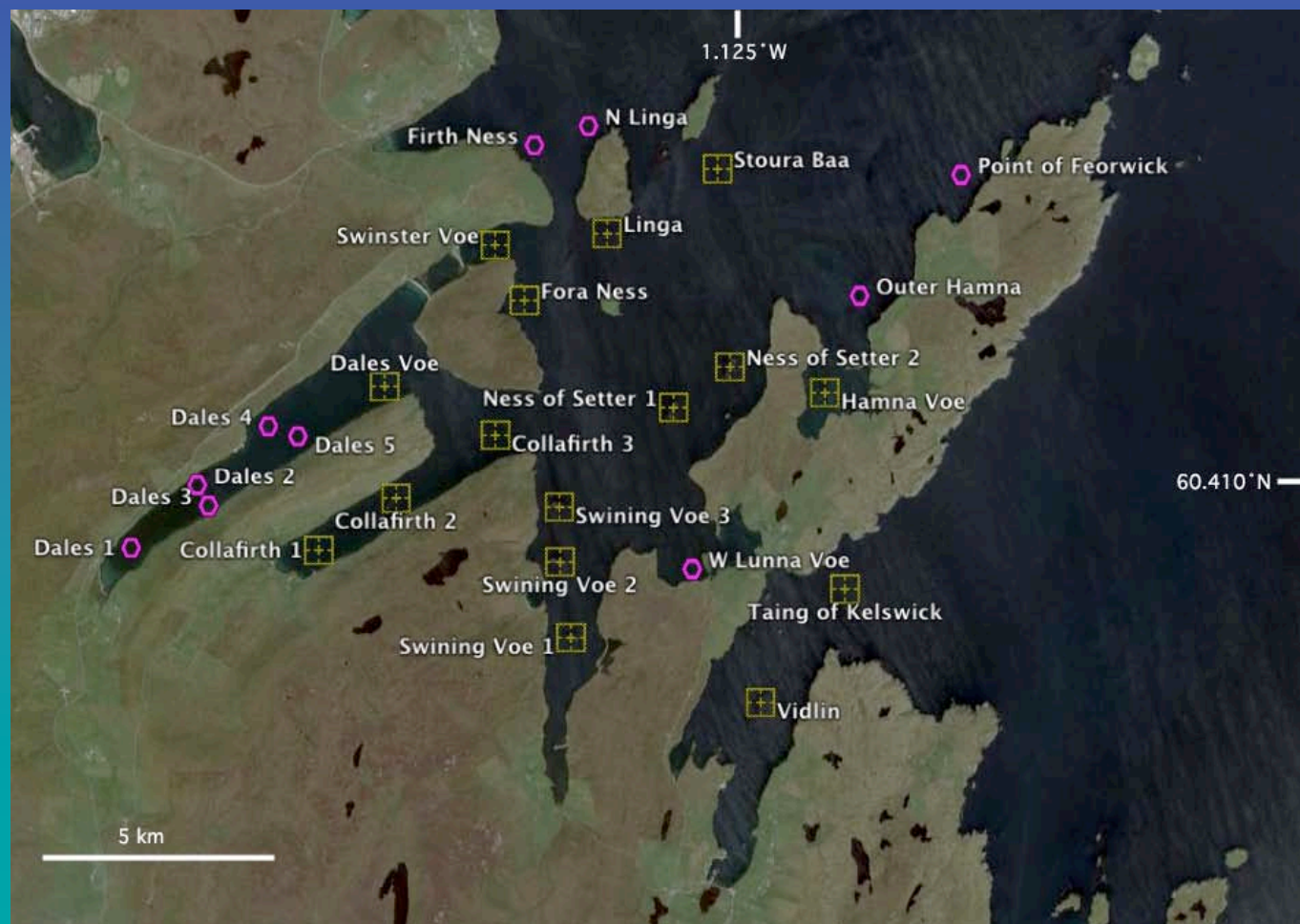


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# Vidlin EIA

What is Vidlin Voe like (ecosystem, socio-economic factors?)



Nearby aquaculture - Swining Voe (2200 m)



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# Vidlin EIA

What is Vidlin Voe like (ecosystem, socio-economic factors?)

Ecosystem:

- Marine mammals; seals, cetaceans, otters
  - Vidlin Voe important for otters, with a significant year-round population.
  - Cetaceans (mostly harbour porpoises) are regularly recorded. Seals haul-out on the skerries off Lunna Ness and Lunna Holm and at the Skerry of Lunning.
  - Static anti-predator nets are employed at the farm, but no other active devices (e.g. sonic scarers) are used



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# Vidlin EIA

## Ecosystem:

- Birds

- significant numbers of eider ducks (distinct Shetland population in decline) and shags. Herring gulls are the most common avian predators at this site
- special high visibility, small mesh netting is used to deter them
- gannets, common guillemots, razorbills, kittiwakes and puffins all common. Migrants e.g. pied wagtails, waxwings, redwings and greylag geese frequent in autumn and spring. Song thrush ( Red List species) common locally.



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# Vidlin EIA

## Ecosystem:

- Fisheries and wild fish populations
  - There is a limited local fishery for scallops, lobsters and crabs
  - Substantial number of wild fish in the vicinity of the cages, notably pollack (*Pollachius pollachius*)
  - Shetland is home to a very large whitefish fleet. It is not thought that there will be any interactions between the cod farm and local stocks.



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# Vidlin EIA

## Ecosystem:

### Benthic environment

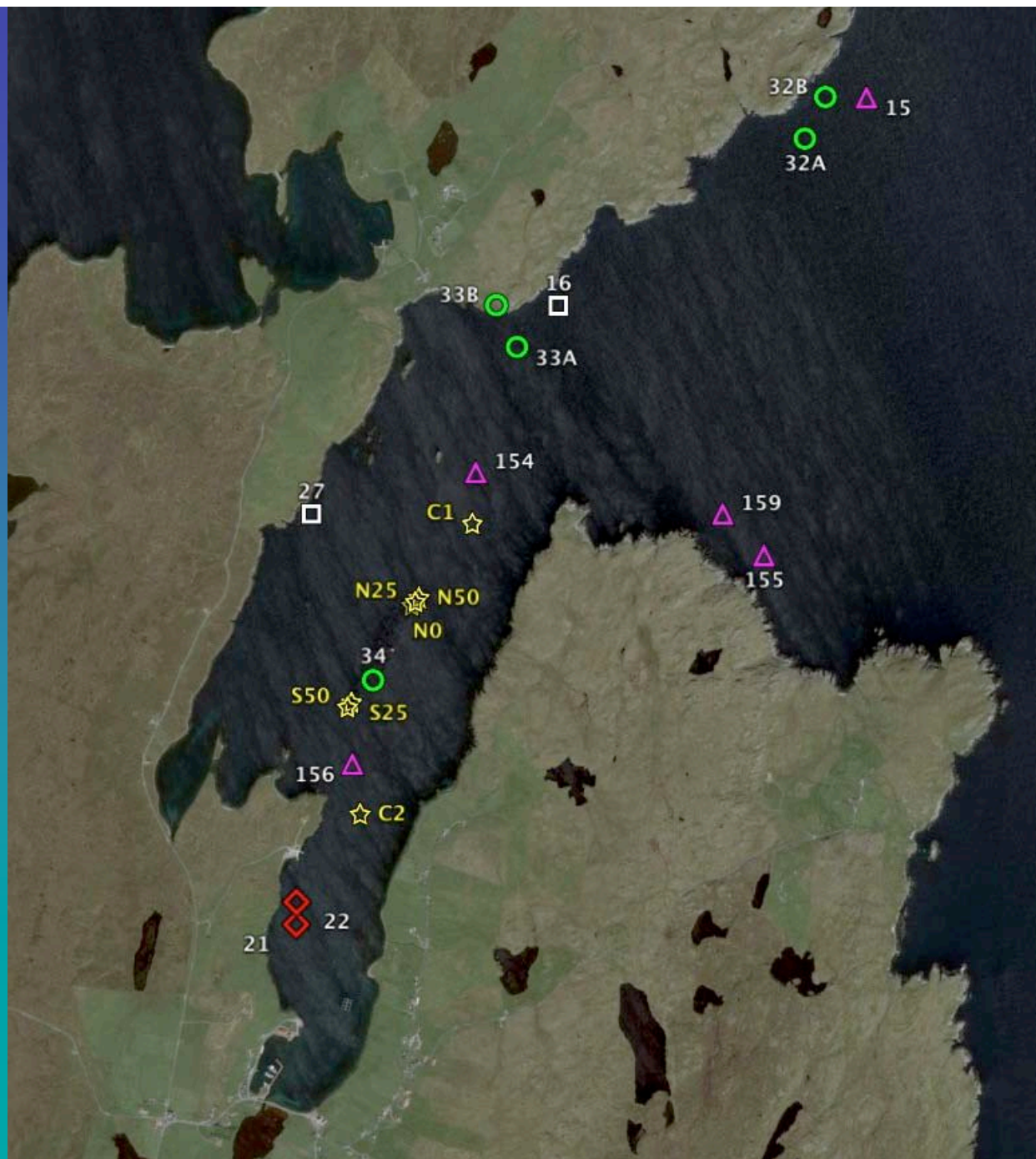
- The voe is open, with no definable sill or basins. Flushing time is calculated at 5 days
- Bathymetry at the site varies from 16-17 m in the south to ca 30 m at the northern edge of the cage group
- The substrate is muddy sand, becoming more coarse towards the mouth of the voe.
- NE of the cage group is a wave dominated, sand/gravel biotope subjected to strong water movement.
- SW of cage group sediment becomes muddy.



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# All historic & present benthic survey stations in Vidlin Voe



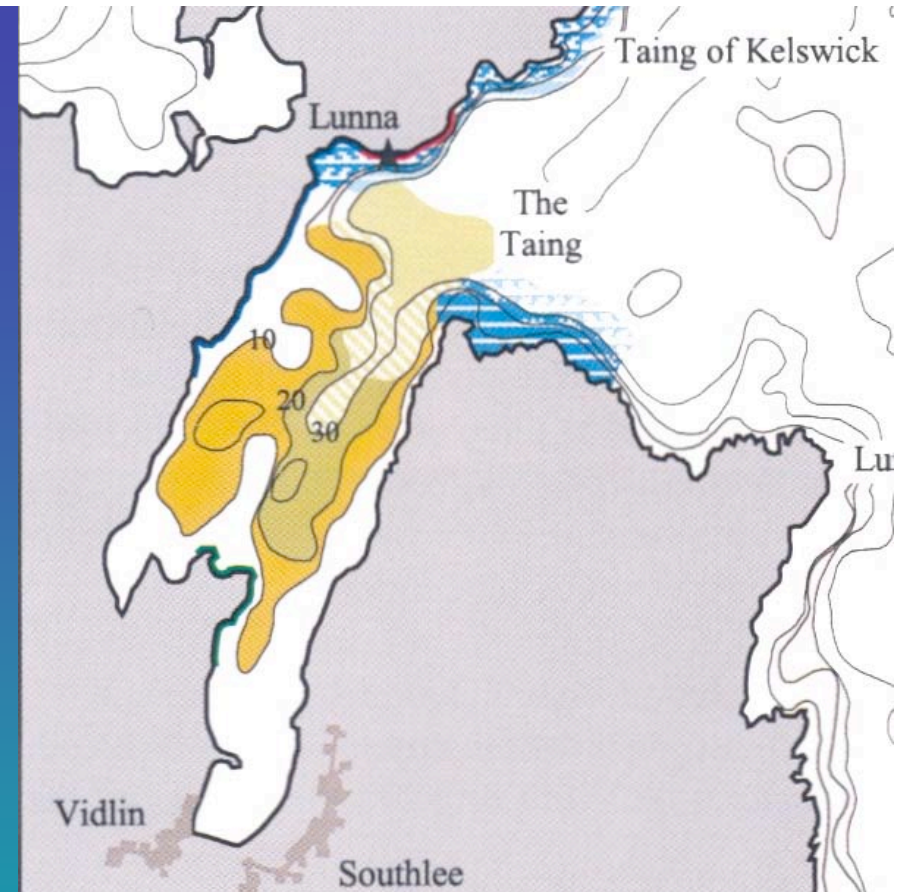















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## Biotores in Vidlin Voe from Howson, 1999

Sea pens (BAP biotope)  
rare in Shetland at  
mouth of voe



- |  |   |
|--|---|
|  Littoral rock with mussels and barnacles (MytB; BPat.Sem; Ala.Myt)                            |  Circalittoral rock with sparse fauna (FaAIC)                         |
|  Littoral rock with barnacles, fucoids and red algae (BPat; BPat.Sem; PelB; Fser.R; Ala.Ldig) |  Circalittoral rock or mixed substrata with dense brittlestars (Oph) |
|  Littoral rock with dense fucoid algae (Pel; Fspi; Fves; Asc.Asc; Fser.Fser; Ldig.Ldig)       |  Infralittoral gravels and sands (IGS)                               |
|  Sublittoral caves (SCAs.DenCla)  |  Infralittoral muddy sands (IMS)                                     |
|  Kelp <i>Laminaria hyperborea</i> with dense red algae (Lhyp.Ft)                              |  Circalittoral muddy sands (CMS)                                     |
|  Grazed kelp <i>Laminaria hyperborea</i> (LhypGz.Ft)  |  Circalittoral shelly and sandy mud with ascidians (VirOph)          |
|  Infralittoral rock with mixed kelps and scour-tolerant algae (XKScrR)                        |   |



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# Vidlin EIA

## Results - Hydrography

Instrument depth	Max Speed (cm s <sup>-1</sup> )	Mean Speed (cm s <sup>-1</sup> )	Residual Direction (° True)	Residual Speed (cm s <sup>-1</sup> )
Surface	17.7	4.7	220	2.4
Mid-water	21.4	5.2	50	1.0
Near-bed	20.0	6.9	44	3.4



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# Vidlin EIA

## Results - Benthos 2005

Parameter	Station							
	N0	N25	N50	N75	S25	S50	C1	C2
ITI	42.73	40.6	39.17	46.31	43.2	57.08	56.46	45.46
No. species S	14	25	47	36	17	20	57	20
Abundance N	69	161	379	365	104	193	373	428
Abundance m <sup>-2</sup>	690	1610	3790	3650	1040	1925	3725	4275
Margalef's d	2.98	4.72	7.64	5.85	3.34	3.61	9.45	3.13
Pielou's J'	0.76	0.72	0.72	0.63	0.77	0.73	0.82	0.46
Brillouin	1.72	2.11	2.58	2.09	1.93	2.03	3.07	1.31
Shannon H' log <sub>e</sub>	1.98	2.32	2.75	2.23	2.15	2.18	3.29	1.38
Simpson's 1-λ	0.79	0.83	0.89	0.81	0.83	0.83	0.94	0.58
AMBI	2.47	3.54	3.34	3.29	2.8	1.69	2.43	2.27
Redox <sub>-2cm</sub>	-56	4.5	-20.5	89	-52	241	277	98.5
% Carbon	1.2	1.2	1.2		1.5	1.0	0.9	1.1
% Nitrogen	0.14	0.15	0.15		0.15	0.13	0.12	0.13
Distance (m)	0	25	50	75	25	50	500	500
Depth	29	28	25	26	17	16	32	17



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# Vidlin EIA

## Results - Benthos 2006

Parameter	Station						
	N0	N25	N50	S25	S50	C1	C2
ITI	1.89	3.63	40.18	0.01	14.1	55.55	37.46
No. species S	16	18	16	3	12	46	8
Abundance N	1031	458	83	6907	136	159	51
Abundance m <sup>-2</sup>	10310	4580	830	69070	1355	1585	510
Margalef's d	2.09	2.69	3.28	0.23	2.14	8.78	1.65
Pielou's J'	0.18	0.25	0.75	0.38	0.58	0.86	0.57
Brillouin's	0.48	0.66	1.78	0.42	1.31	2.9	0.97
Shannon H' log <sub>e</sub>	0.72	1.03	2.99	0.6	2.05	4.73	1.66
Simpson's 1-λ	0.19	0.25	0.81	0.26	0.61	0.94	0.52
Redox -2 cm	61.5	112.5	46.5	112.5	-45.5	221.5	-38.5
% Carbon	1.04	1.09	1.11	3.79	1.97	1.32	1.11
% Nitrogen	0.16	0.15	0.13	0.41	0.23	0.18	0.16
mean labile OM	3.65	4.26	4.035	10.2	5.73	5.52	4.67
Distance (m)	0	25	50	25	50	500	500
Depth (m)	29	28	25	17	16	32	17

# Indicator correlation matrix 2006

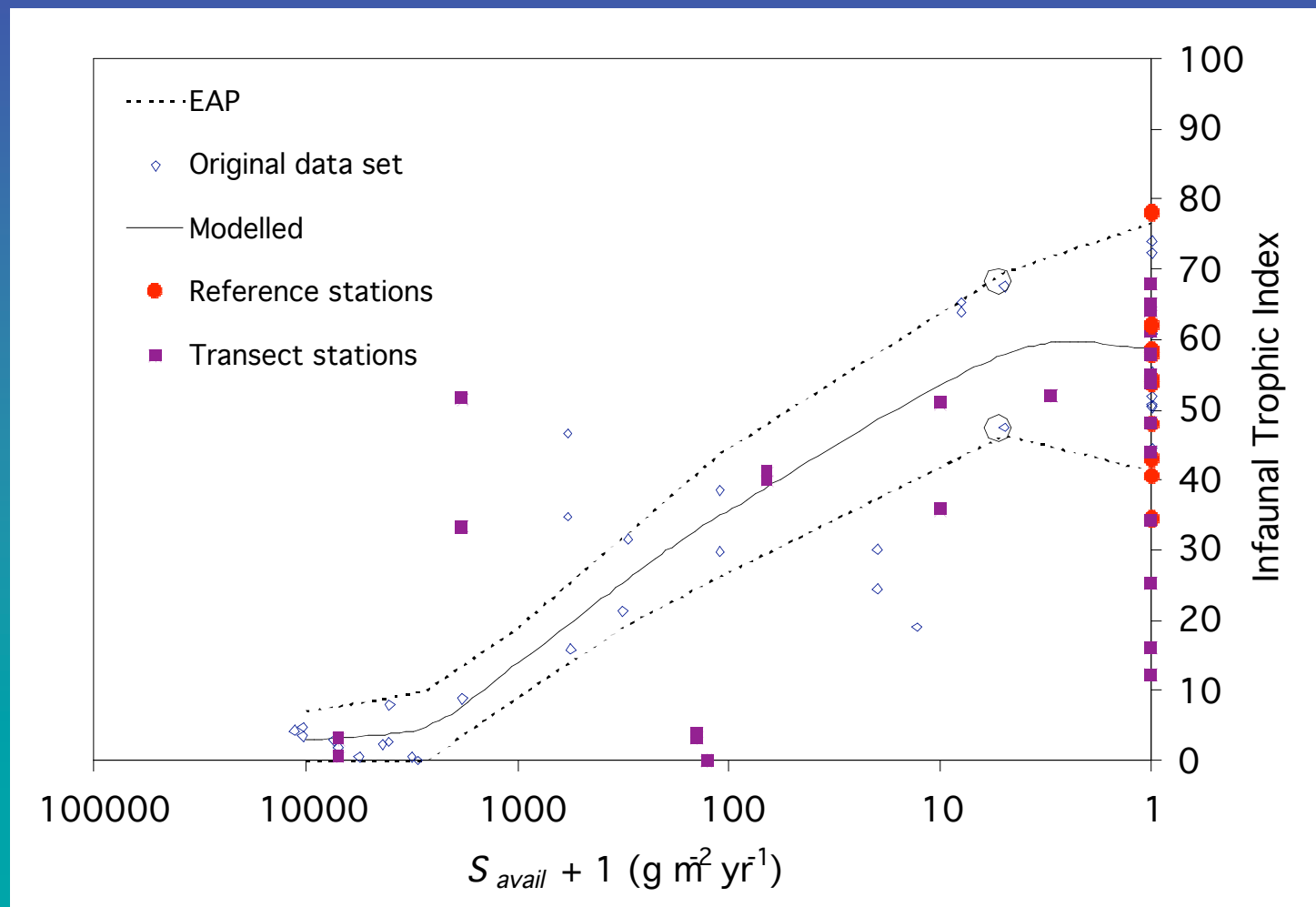
	ITI	S	N	N m <sup>2</sup>	Margalef's d	Pielou's J'	Brillouin's	Shannon	Simpson's	Redox -2 cm	% C	% N	labile OM	Distance (m)	Depth (m)
ITI	1.0000														
S	0.5917	1.0000													
N	-0.9330	-0.4888	1.0000												
N m <sup>2</sup>	-0.9330	-0.4877	1.0000	1.0000											
Margalef's d	0.7304	0.9758	-0.5938	-0.5929	1.0000										
Pielou's J'	0.8214	0.3201	-0.6244	-0.6250	0.5128	1.0000									
Brillouin's	0.8023	0.7333	-0.5621	-0.5619	0.8525	0.8569	1.0000								
Shannon	0.8223	0.7281	-0.5857	-0.5856	0.8515	0.8664	0.9990	1.0000							
Simpson's	0.8792	0.5566	-0.6828	-0.6829	0.7139	0.9599	0.9478	0.9549	1.0000						
Redox -2 cm	-0.2400	0.2342	0.4414	0.4420	0.1886	-0.1770	0.0896	0.0919	-0.1011	1.0000					
% C	-0.6053	-0.7175	0.7162	0.7153	-0.6794	-0.0659	-0.3072	-0.3271	-0.2662	0.0001	1.0000				
% N	-0.6210	-0.6863	0.7305	0.7296	-0.6593	-0.1092	-0.3137	-0.3370	-0.3023	-0.0308	0.9862	1.0000			
labile OM	-0.5095	-0.6471	0.6640	0.6630	-0.5847	0.0370	-0.1901	-0.2085	-0.1717	0.0699	0.9792	0.9739	1.0000		
Distance (m)	0.7174	0.1726	-0.5899	-0.5908	0.3636	0.8108	0.6321	0.6452	0.7012	-0.1798	-0.0523	-0.0567	0.1078	1.0000	
Depth (m)	0.1565	0.8184	-0.0242	-0.0229	0.7298	-0.0691	0.4150	0.4105	0.1693	0.7030	-0.5558	-0.5397	-0.5017	-0.1870	1



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# Vidlin EIA Model output





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# Vidlin EIA

## Site specific conclusions

### Zone A

- For 2006 the indicators describe impacted sediments up to 25 m N (N0, N25) and up to 50 m S (S25, S50).
- All of the biotic indices (no. species, abundance, ITI, Margelef's, Pielou's, Shannon, Simpson's and Brillouin's) showed impact at these stations. This suggests they are all useful indicators.
- sediment indicators - at these impacted stations, LOI describes the effect adequately, correlating with biotic indices.



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## Site specific conclusions

### Zone A

- Redox at -2 cm RPD did not correlate with the biotic indices very well at three out of the four biologically impacted stations
- Redox measured at S50 indicated a greater impact than was described by the biotic indices.
- % C and % N indicators have generally flat gradients showing little difference between the stations, apart from station S25.



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## Site specific conclusions

### Zone A

- **Modelling:** the impact described was to some extent confirmed by the CODMOD model which was validated at the site.
- Predictions of flux and ITI at stations suggest impact, but the impact at the 50 m station (S50) was not predicted by the model.
- Sensitivity analysis showed that model performance was improved by including some cage rotation effects and modifying the current flows at the southern end of the group.



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# Vidlin EIA

## Site specific conclusions

### Zone B

- All of the biotic indicators suggested that control station C2 was disturbed.
- Redox correlated with biotic indicators at this station → disturbed sediments
- Given the impact at control station C2 and station S50, the area to the south of the cages is likely to have reduced current, longer flushing time and has disturbed sediments.
- ➔ Development of aquaculture in the southern corner of the voe should be avoided.

Thank You

