Fish space use: development and deployment of acoustic landers with initial fish tracking results

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UNIVERSITY OF PLYMOUTH

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Introduction

Why I'm here

Historical situation and species of interest

Fish tracking equipment - choice of approach

Site choice, lander design

Deployment and recovery

Work

Future and summary

Historical movement studies

At **Marine Biological Association** since at least 1906

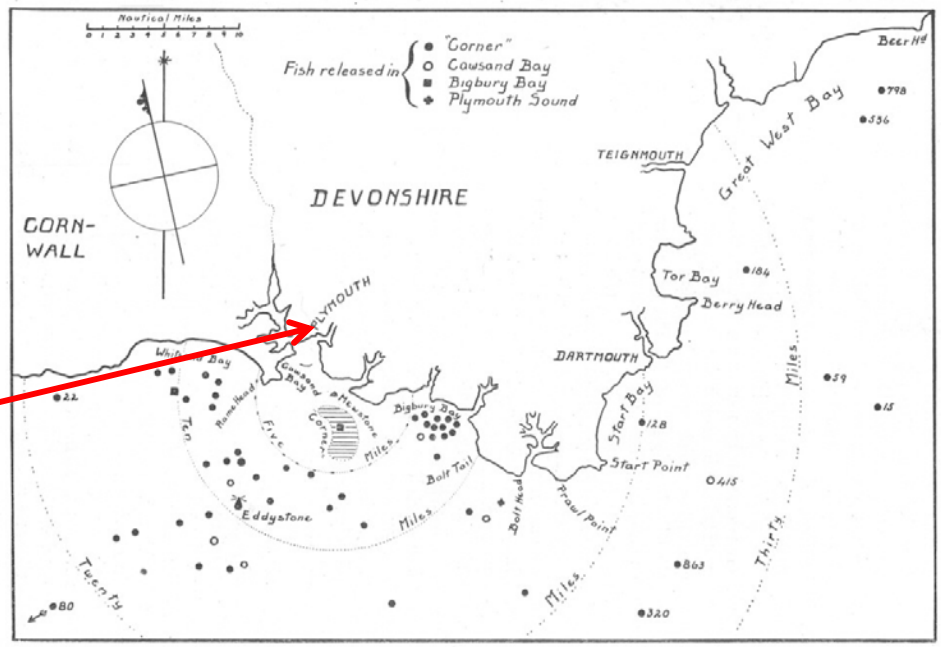

FIG. 1.—Positions of recapture of marked rays which had moved more than 5 miles. Fishes which had exceeded 20 miles have period of liberty shown (in days). For further explanation see text p. 608.

..... = circle of 5 mile radius from Mewstone. .. .. .. = circle of 20 mile radius from Mewstone.

..... = ,, 10 ,, ,, ,, ,, ... = ,, 30 ,, ,, ,, ,,

Steven (1936). *Journal of the Marine Biological Association*. **20**(3): 605-614

Still relatively little known about their **fine-scale** or **local** movements

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Species: Rays, flatfish & dogfish

Long lived

Slow growing

Few offspring

Interesting behaviour

Widespread distribution

e.g. *Raja clavata* (Thornback ray)

Also sensitive to fishing

Picture: Viki Wearmouth, Map: *MarLIN*

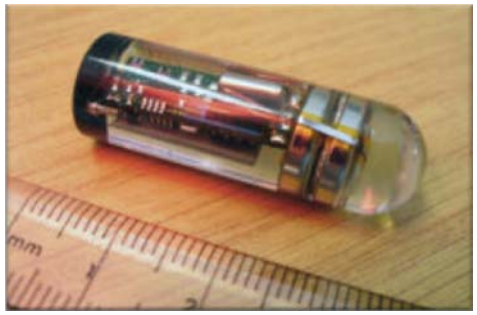
Tracking equipment

Long term and fine scale **horizontal** movement analysis of many individuals via an array of acoustic **receivers** and **pingers**

VR3 **Receiver**

Data storage & telemetry

V9 **Pinger**



Data Storage Tags log **vertical** data

£ reward for tag returns

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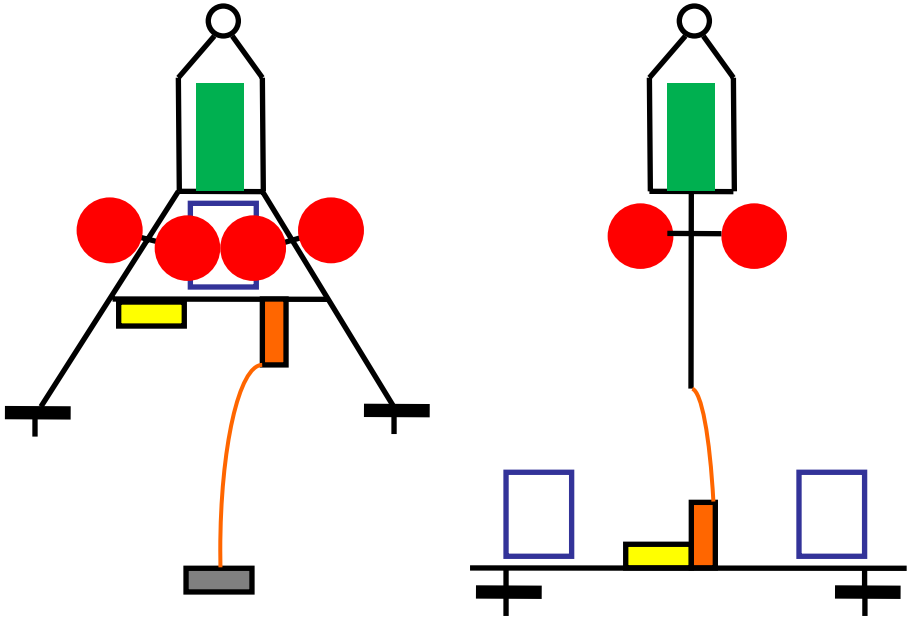
First local VR3 deployment



Mooring V Lander

First area - local test site. Must be scientifically valid.
Later to look at fish movements around wave farm (Wave Hub).

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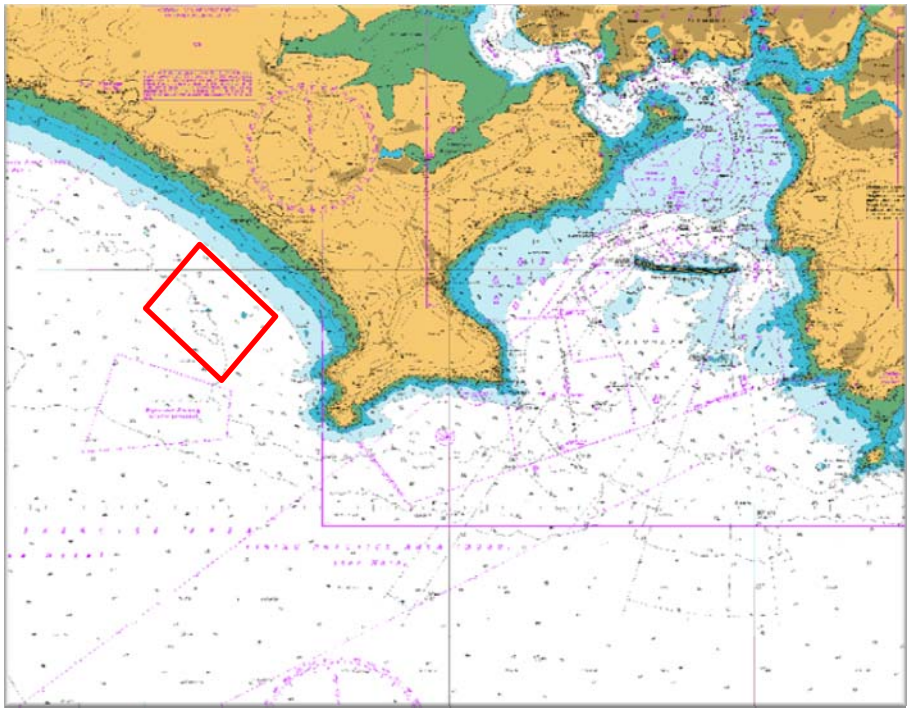
First local VR3 deployment

Close to where MBA carries out long term sampling

Surveyed with own **GeoSwath** onboard ***MBA Sepia***



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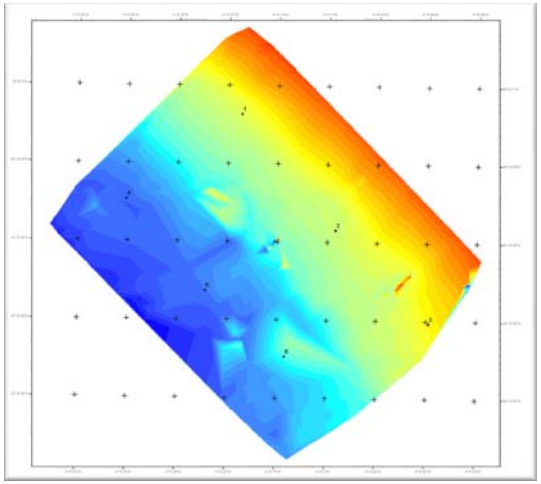
The University of Plymouth

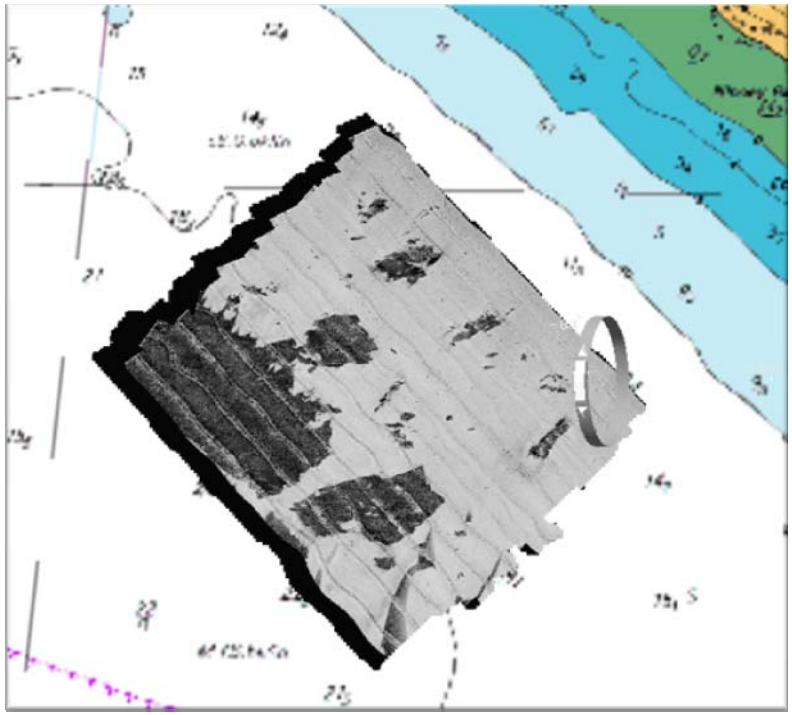
First local VR3 deployment

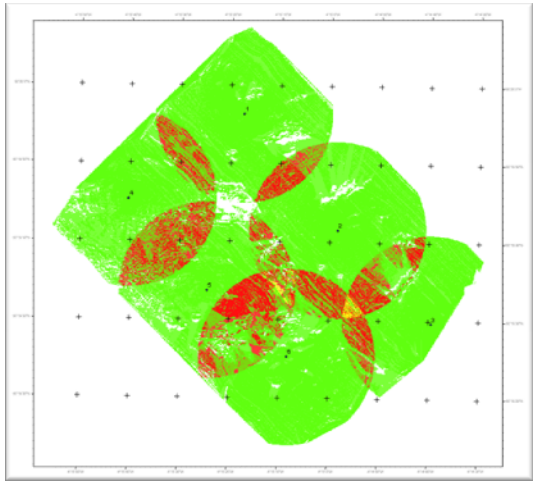
Close to where MBA carries out long term sampling

Surveyed with own **GeoSwath** onboard ***MBA Sepia***

Bathymetry → Landscape → Terrain analysis







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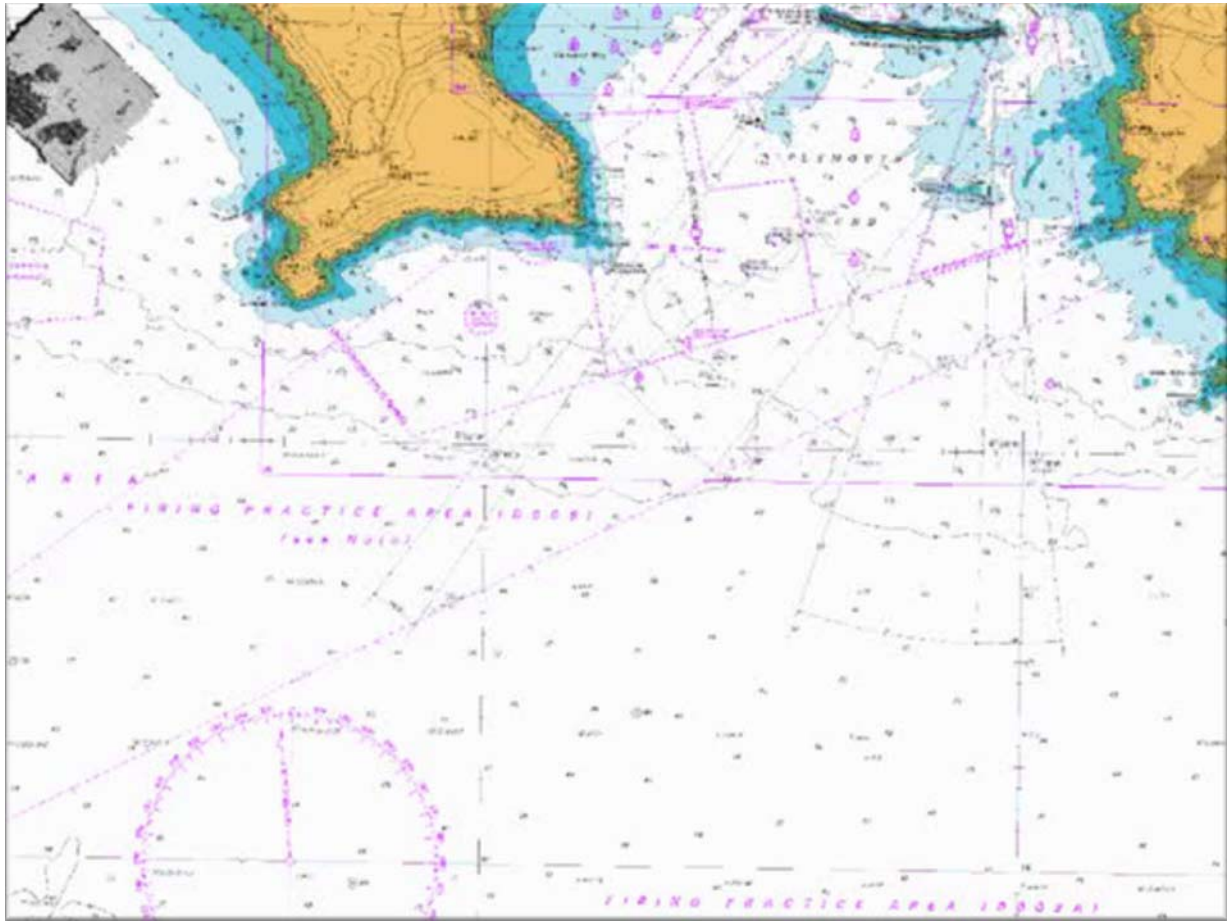
Landscape fly through

Sidescan sonar (texture) draped over bathymetry (shape)



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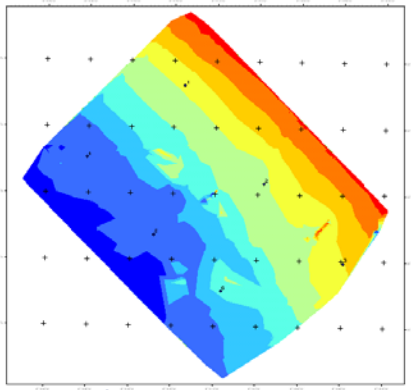
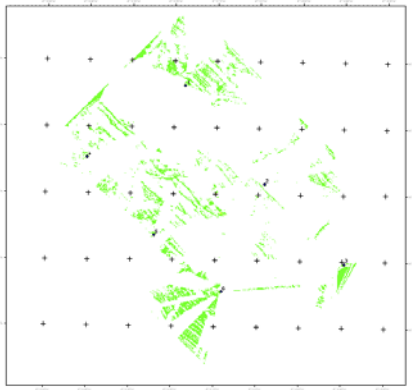
Terrain analysis for antenna height


Bathymetry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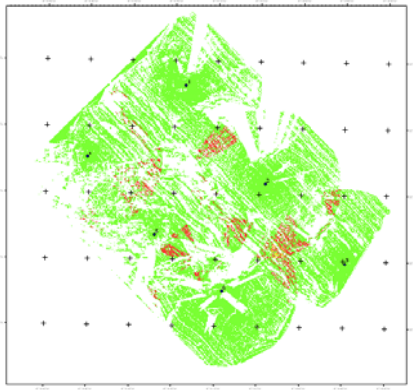
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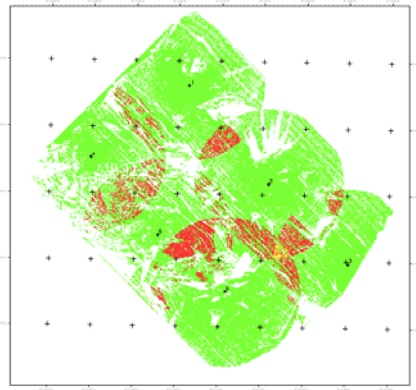
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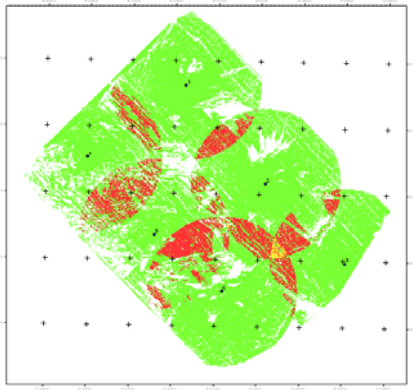
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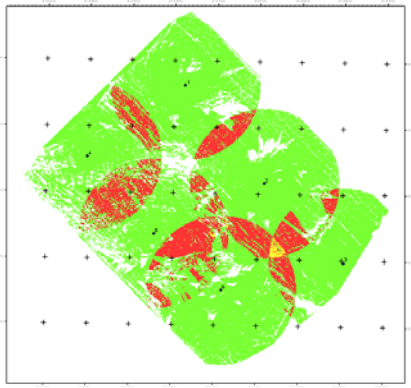
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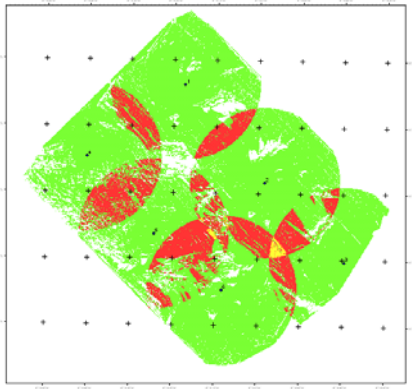
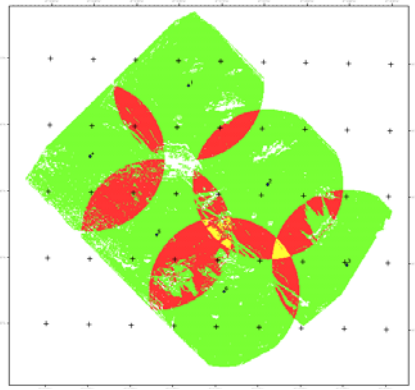

5m


10m

Bathymetry and visible seabed when antenna is placed at various heights above seafloor in Whitsand Bay

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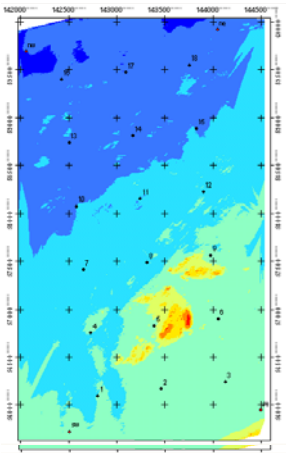
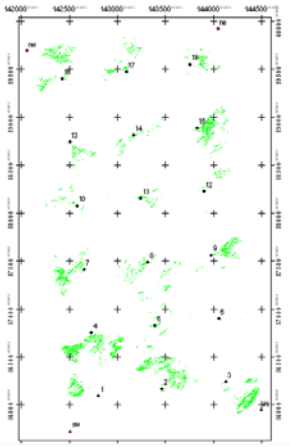
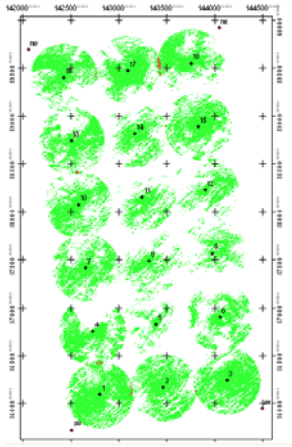
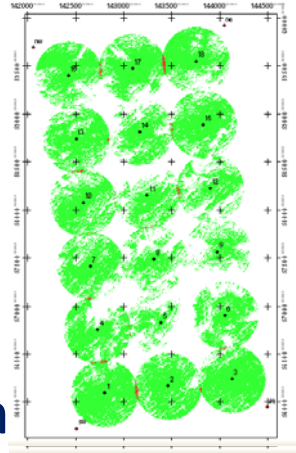
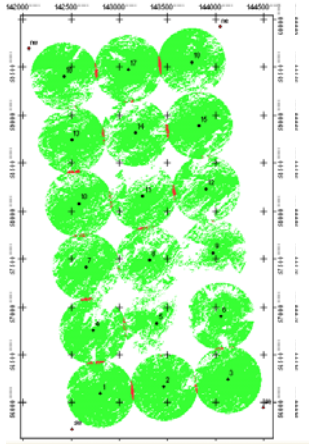
Terrain analysis for antenna height

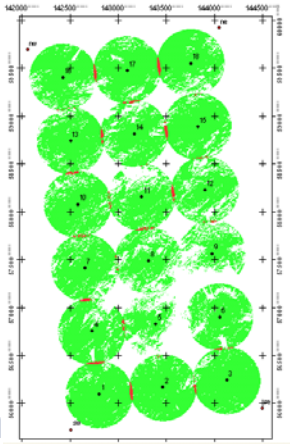
B 

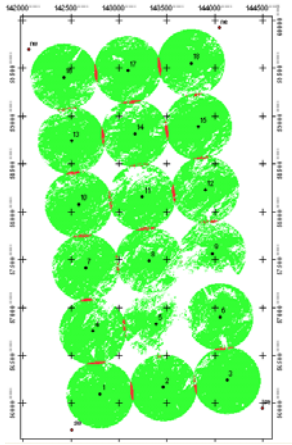
0m 

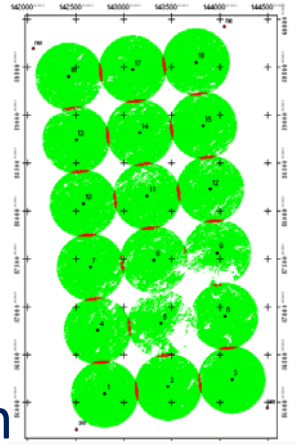
1m 

2m 

3m 

4m 

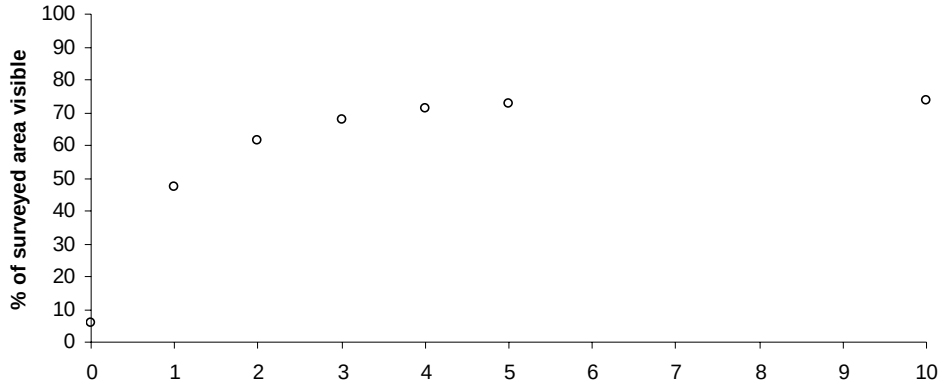
5m 

10m 

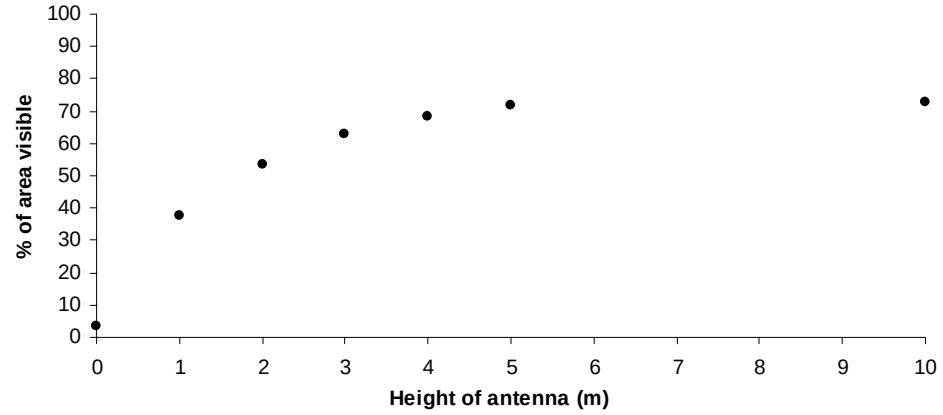
Bathymetry and visible seabed when antenna is placed at various heights above seafloor at Wave Hub site

Data from Halcrow plc

Terrain analysis for antenna height



Whitsand Bay (1.8m grid)



Wave Hub (1.0m grid)

2m antenna height is a good compromise between elevation and area cover

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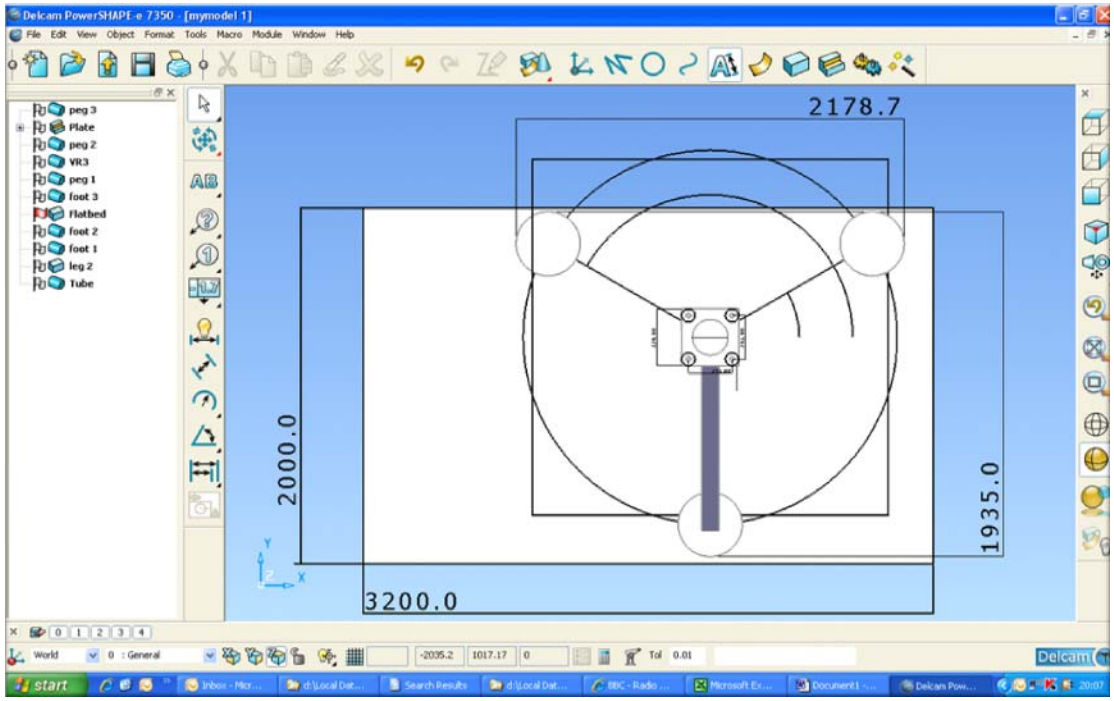
Lander footprint



Required to fit on transit flatbed

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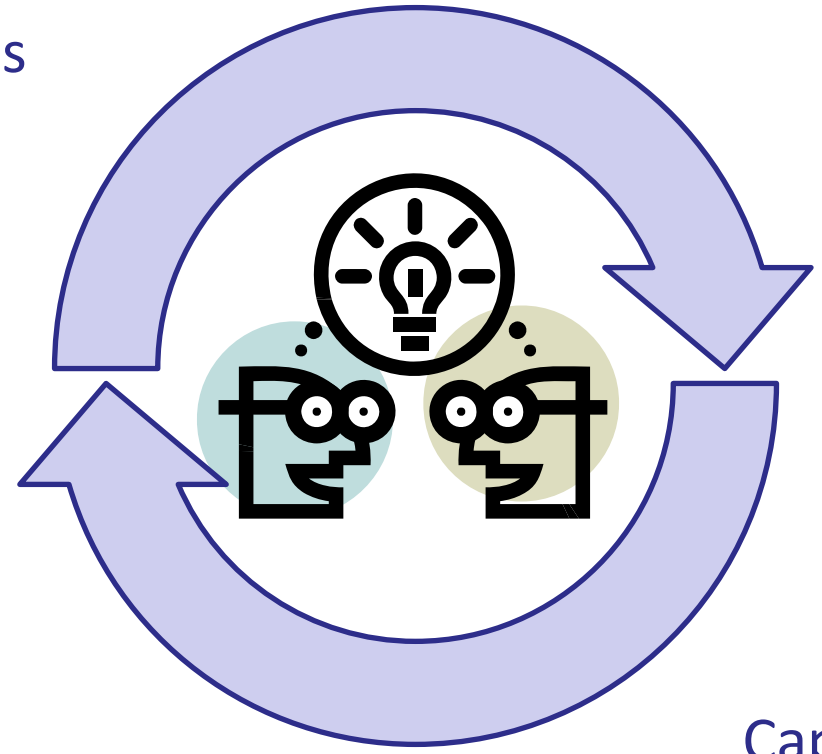
Other lander considerations

Cost effective:
esp materials

Small footprint:
w/o ground lines
or surface
marking

Modular:
handling parts
and transport
when complete



No jettisoned
ballast

Simple to deploy.
Reliable onboard
recovery.
No chance of
accidental triggering

Capable of long
deployments

Stable:
low CoG

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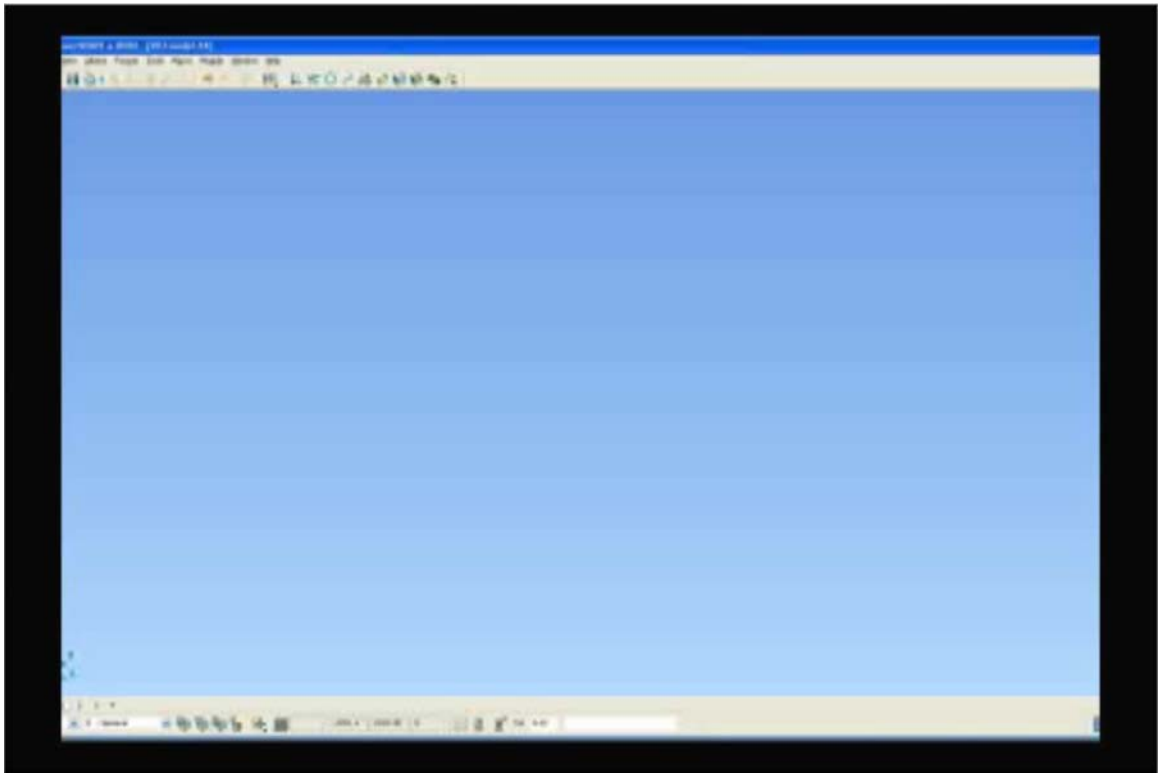
Lander design

Height, footprint etc etc fed into brief

Designed at MBA in PowerSHPAE-e™



Lander design

Height, footprint etc etc fed into brief

Designed at MBA in PowerSHPAE-e™

Various components tested and refined through fields trials

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Lander construction

First 6 made locally by Underhill Engineering Ltd

Shown here ready for deployment

Self-recovery is optional

Can be fitted with more ballast or other instruments

Remaining 14 almost ready for delivery

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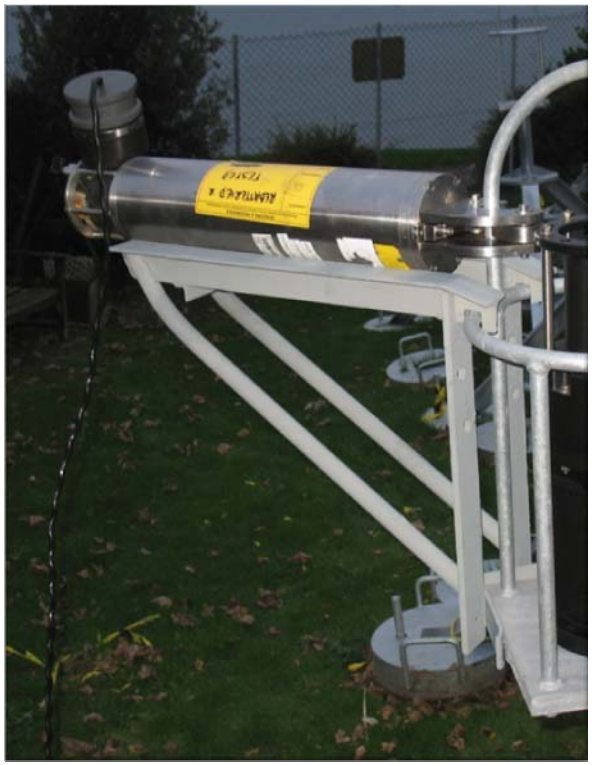
Lander deployment

Assistance of NOC Oceano 2500 and deckbox, thank you!

Bracket made to aid attachment



45kg buoyancy added to release

Lander lowered to seabed

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The University of Plymouth

Lander recovery

Buoyancy from 2, 20cm deep-water floats.
Sonardyne LRT (with ranging capability) coupled to 100m of 4t, 8mm dyneema spooled into canister.
Metal lower shield and plastic top cowl keeps parts secure

Line connected to lander via nylon shock-pendent.

On activation, floats bring LRT and line canister (paying out line) to the surface. Vessel hauls lander up and onboard.

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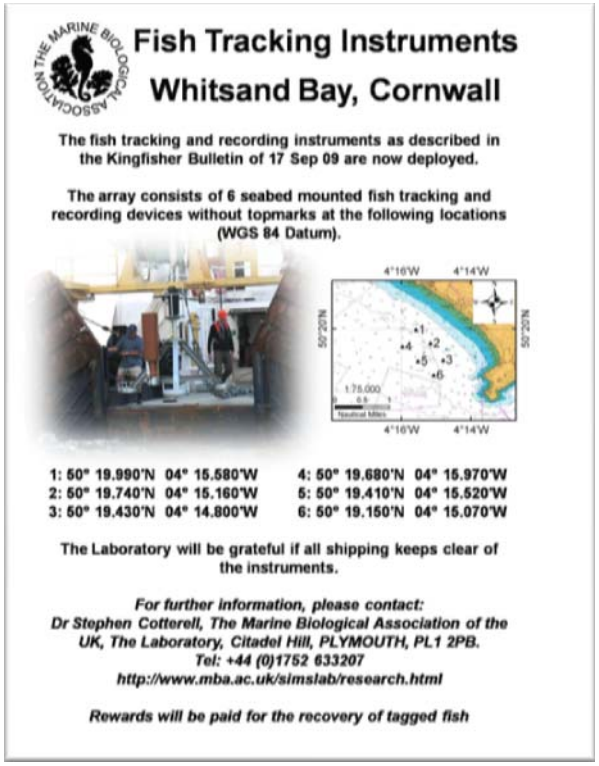
Deployed VR3s on landers

6 VR3 landers now (since 4 Jan) at test site

50 locally caught fish tagged from 7 important species



Fish Tracking Instruments
Whitsand Bay, Cornwall

The fish tracking and recording instruments as described in the Kingfisher Bulletin of 17 Sep 09 are now deployed.

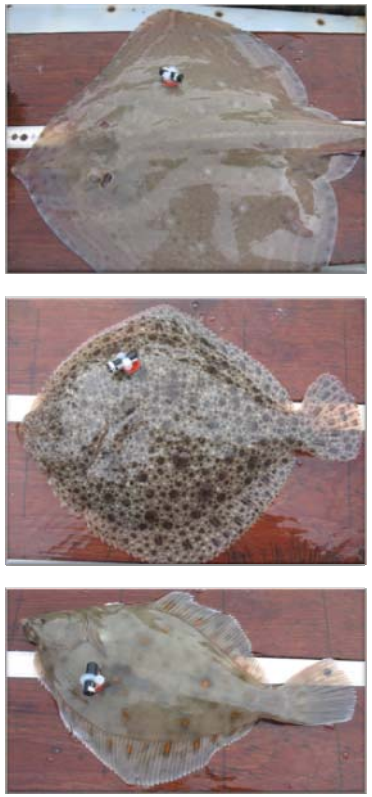
The array consists of 6 seabed mounted fish tracking and recording devices without topmarks at the following locations (WGS 84 Datum).

1: 50° 19.990'N 04° 15.580'W
2: 50° 19.740'N 04° 15.160'W
3: 50° 19.430'N 04° 14.800'W
4: 50° 19.680'N 04° 15.970'W
5: 50° 19.410'N 04° 15.520'W
6: 50° 19.150'N 04° 15.070'W

The Laboratory will be grateful if all shipping keeps clear of the instruments.

For further information, please contact:
Dr Stephen Cotterell, The Marine Biological Association of the UK, The Laboratory, Citadel Hill, PLYMOUTH, PL1 2PB.
Tel: +44 (0)1752 633207
http://www.mba.ac.uk/simslab/research.html

Rewards will be paid for the recovery of tagged fish



Initial data

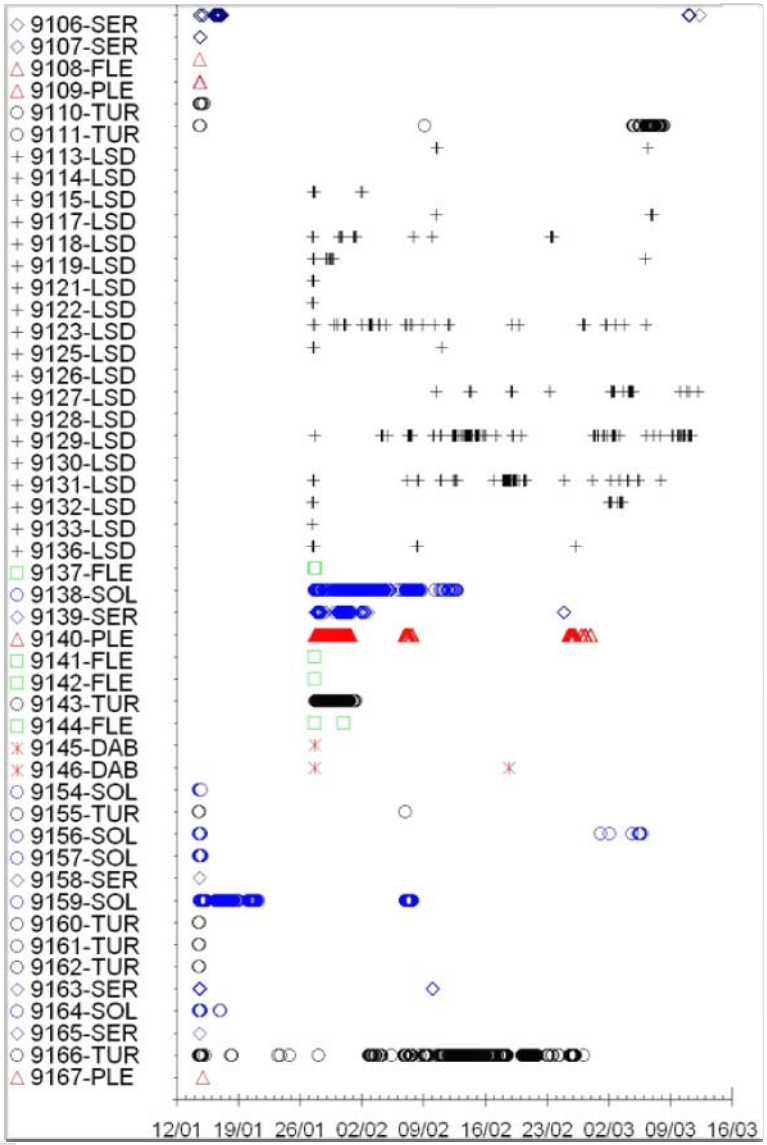
Between 14 Jan and 12 Mar 2010 (60 days), 11,086 pings were logged by 5 landers (L1 so far a problem) but with 11,048 being valid.

22 fishes have been resident for >5 days and 10 fish for >30 days.

All except 3 dogfish have been detected.

7 fish and tags so far returned for rewards (via M&FA / MMO).

Ongoing upload & additional tagging



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Track analysis

Acoustic tracking is prone to echoes giving infeasible locations, based on **speed**, **distance** and **time**

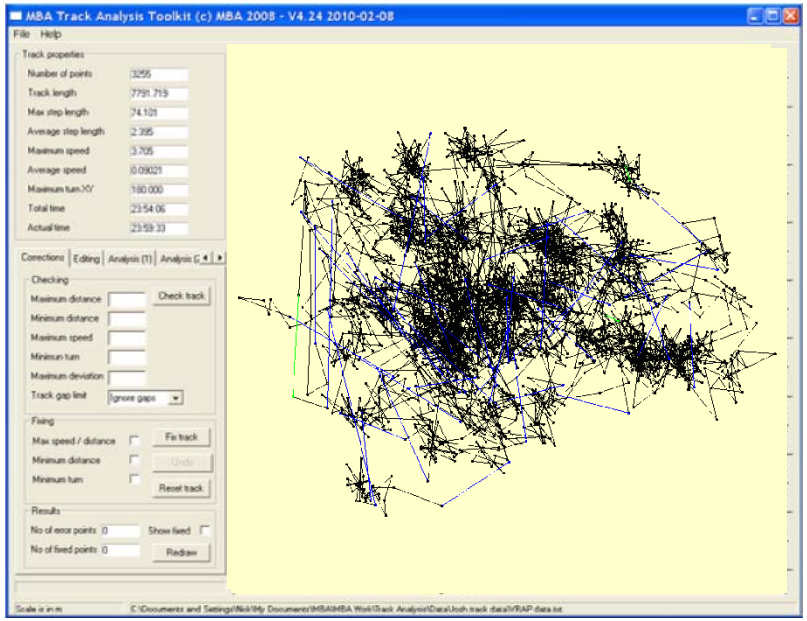
Programs semi-automate and speed up the complex task of error checking

Now that errors are identified (in red) statistical and analytical functions can be applied

Iteration 2 shows more realistic tracks

These are then fixed

Other programs have been developed to process dive data



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Summary

Applying a mixture of survey, engineering and analysis tools, built on extensive experience and historical data, means we can study population level movements of fishes at fine-scales and over extended time periods

This is just a flavour of our work. For more details see:

www.mba.ac.uk/simslab

scotterell@plymouth.ac.uk or scotterell@mba.ac.uk

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