

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

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Traditional techniques to study fish movements are based around mark and recapture, which have been applied to rays, especially *Raja clavata* L., at the MBA since at least 1906. While suitable for migratory species, these methods are not ideal for highly philopatric fishes as distance covered may not be strongly related to time at liberty.

The development of miniature, acoustic transmitters and economical, robust, automated receivers has enabled researchers to study fine scale movements over long periods of time.



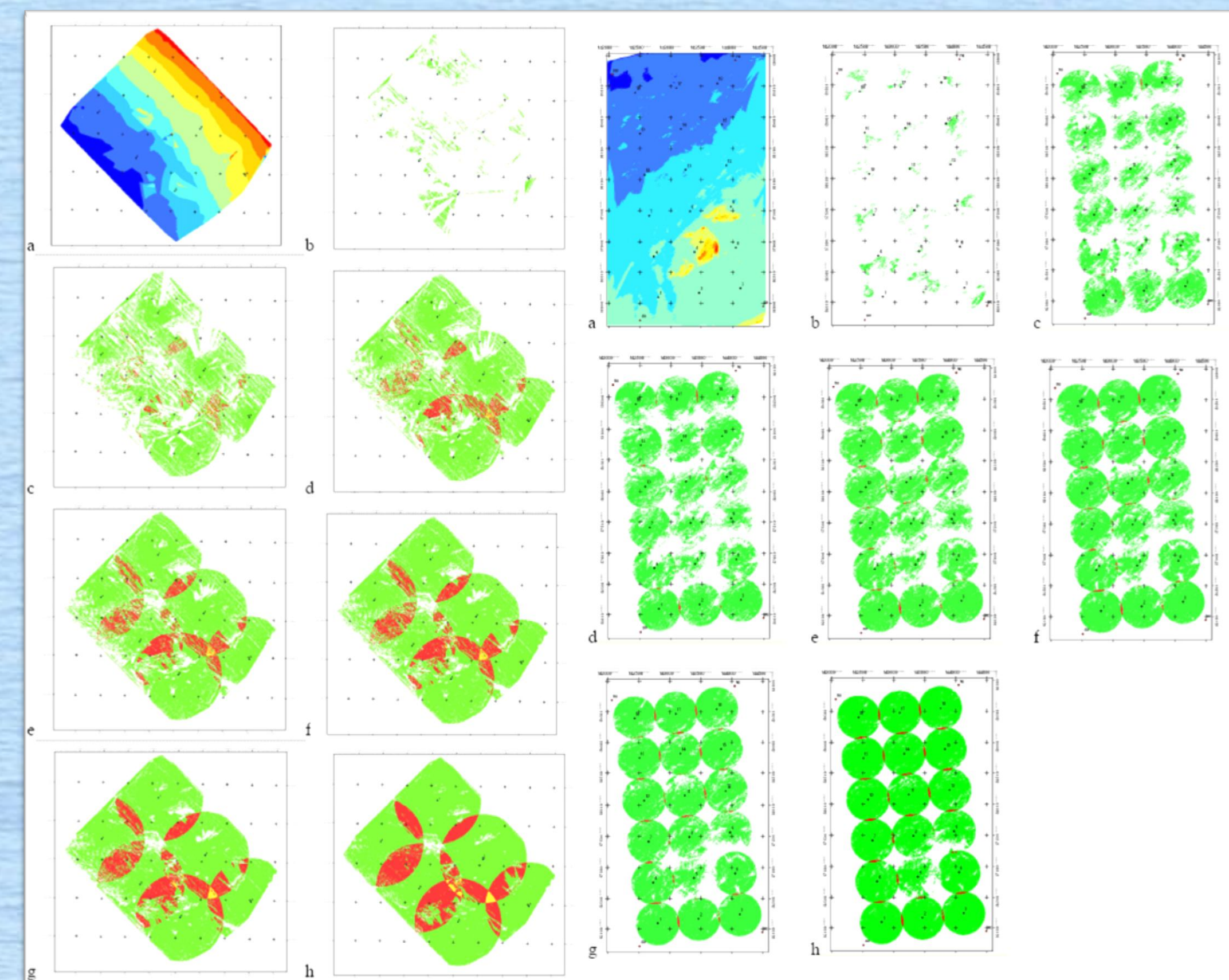
As part of the 'Oceans 2025' programme, the MBA received a capital award to determine movement patterns of marine fish across a variety of natural and man-made environments, by developing an array of up to:

- 300 V9 acoustic pingers, coupled with
- 20 Vemco VR3 acoustic receivers and data loggers



It may be possible to moor the receivers in relatively benign or isolated estuaries although to investigate the movements of fishes in coastal waters and to expand the study to areas of offshore renewable energy generation we chose to mount each VR3 on a recoverable **lander**.

Terrain analysis (right) of bathymetric data showed that an antenna height of 2m above the seabed at both our test site in Whitsand Bay and at the Wave Hub Deployment Area (WHDA, a wave energy harnessing project) was a good compromise between elevation and area cover (panel d).



GIS viewshed analysis showing bathymetry and 'visible' seafloor for increasing antenna height for Whitsand Bay (left) and Wave Hub site (right). Data: MBA and Halcrow plc, respectively

The landers were designed in PowerSHAPE-e CAD software. Plymouth based Underhill Engineering Ltd made the first 6 and have now completed the remaining 14.

Lander design constraints:

- Cost effective - especially for array deployments
- Modular - ease of transport
- Low centre of gravity - required stability analysis
- Capable of long deployments - rugged, reliable and reusable
- Small footprint - without ground lines or surface marking
- Simple to deploy with onboard recovery system (right)
- No jettisoned ballast - Consent requirement

Onboard recovery system (below on LHS):

- Deepwater trawl floats
- Release transponder (RT) with ranging capability and up to 4.5y battery life
- Line canister with 4t dyneema, connected via shock pendent
- Cowl to keep parts secure, reduce fouling risk yet allows movement to prevent seizing through bio-fouling
- Painted with anti-fouling
- Independently tested
- On activation, floats bring RT and line canister (paying out line) to the surface. Vessel hauls lander up and onboard

Fish Tracking Instruments Whitsand Bay, Cornwall

The fish tracking and recording instruments as described in the Kingfisher Bulletin Issue 19/2009, updated Issue 02/2010 are now deployed as Consented (#34420/09/0/CON) by the Coast Protection Act (1949).

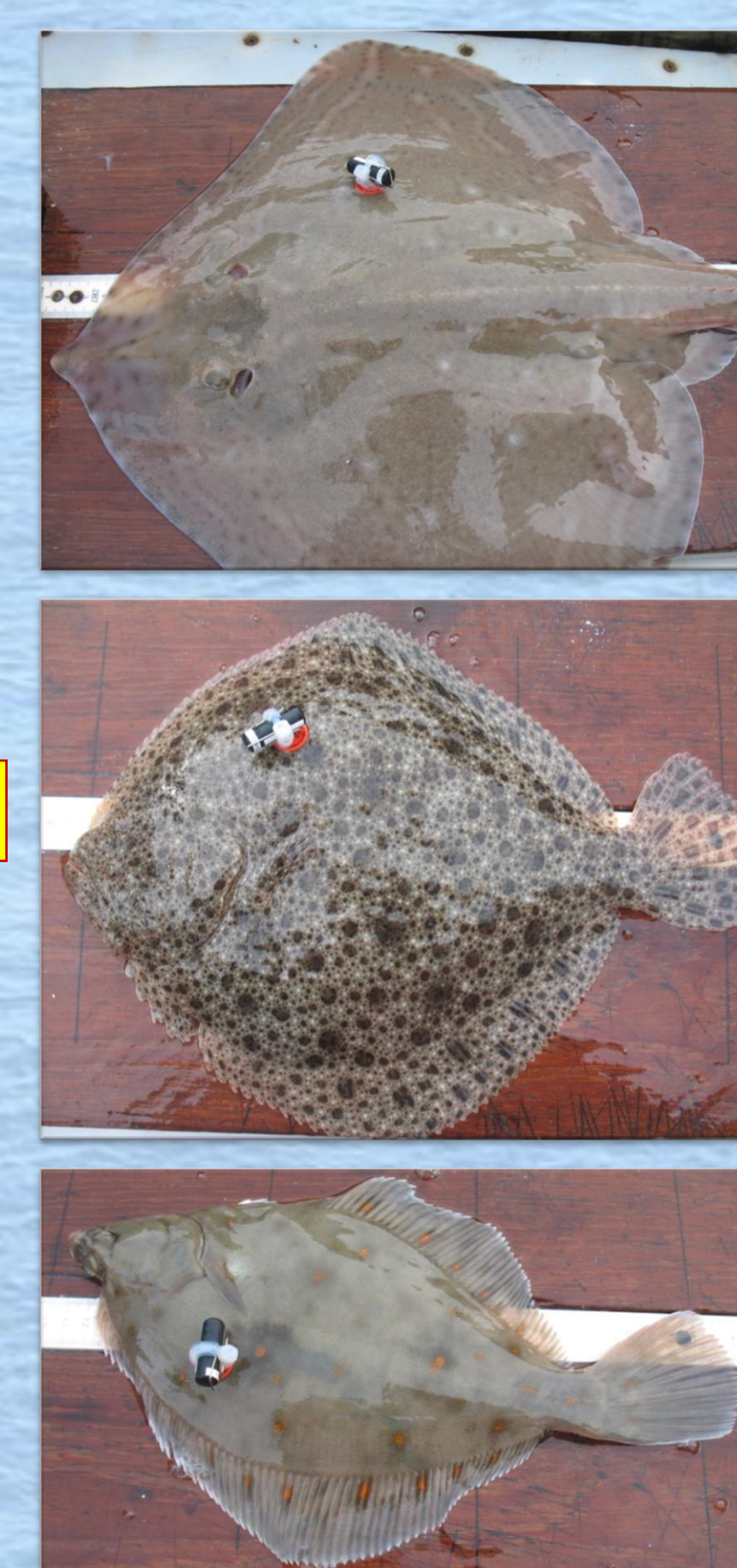
The array consists of 6 seabed mounted fish tracking and recording devices without topmarks at the following locations (WGS 84 Datum).

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

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

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Rewards will be paid for the recovery of tagged fish



Pre-deployment liaison, statutory Consents and public announcements

49 locally caught fish tagged from 7 important species



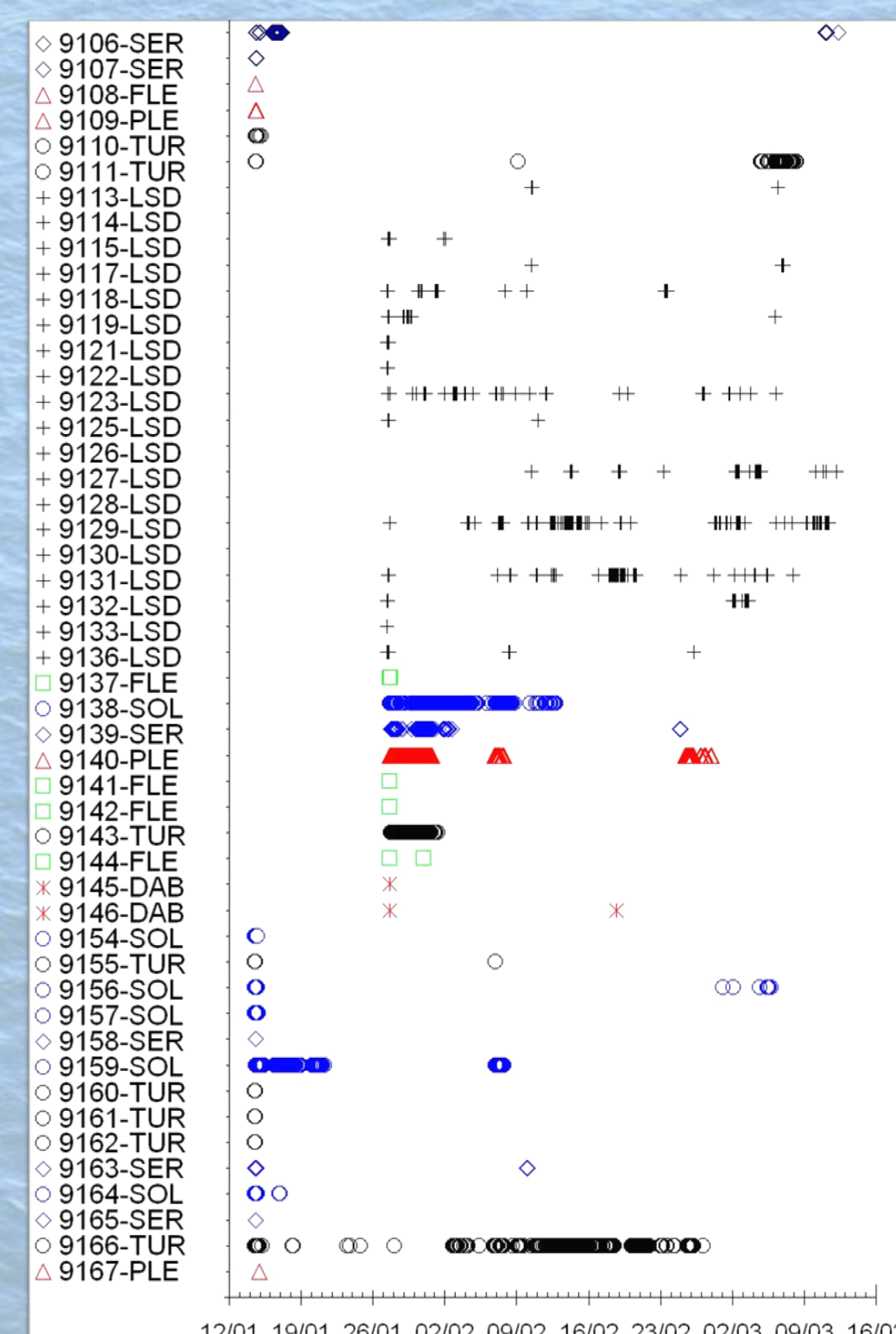
6 landers onboard *Plymouth Quest*



Deployed with NOC release

Initial results:

- Between 14 Jan and 12 Mar 2010 (60 days), 11,086 pings were logged by 5 landers (L1 so far uncommunicative) 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
- 3 fish and tags (1 flounder, 1 plaice and 1 turbot) so far returned for rewards (via M&FA / MMO)



Summary:

Applying a mixture of survey, engineering and analysis tools, building on extensive experience and historical data, means we can study population level movements of fishes at fine-scales and over extended time periods. Data upload is ongoing and further tagging and expansion of the array is in hand. Deployment at the WHDA is planned.

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