Anderson Marine Surveys Ltd

Established in 1998, AMSL provides cost-effective design, management and implementation of inshore marine surveys and related Environmental Assessment and modelling studies.

Environmental survey capability includes:

- seabed grab and corer surveys for chemical and biological parameters
- effluent and water sampling and analyses
- bathymetric and sidescan sonar surveys
- hydrographic surveys (e.g. dye release, drogue tracking, current meter deployments)
- diving surveys
- ROV and camera inspections

Field survey work is often used to support modelling studies, and AMSL has particular expertise in dispersion modelling for coastal and freshwater discharges. Environmental Assessment requires a multi-disciplinary approach, and AMSL can provide the range of necessary skills for data collation (including GIS development), interpretation and impact assessment in the marine environment.

Consultancy services are also available to assist clients with regulatory issues, including consent applications under COPA, FEPA and IPC. AMSL has extensive experience in developing collaborative studies with academic and research institutes.

Previous clients in the water, distilling, civil engineering, oil and aquaculture industries, and government departments include:

- United Distillers & Vintners
- North of Scotland Water Authority
- Scottish Water
- Highland Council
- Lighthouse of Scotland
- Lakeland Marine Farm
- Scottish Sea Farms
- William Grant & Sons
- Glenmorangie plc
- Allied Distillers
- Highland Distillers
- Malt Distillers Association of Scotland
- Montgomery Watson
- Department of Trade and Industry
- Enterprise Oil

Seabed Biology and Video Surveys

Seabed sampling can be carried out using a variety of sampling gear, including Van Veen grab (1), Day and Shipek grabs, and Gilson corer (2).

Digital still photograph of brittlestar (*Amphuira*) population, Shetland

Video capture of seabed, Firth of Clyde

Using established sub-contractors, AMSL can provide analyses of a wide range of physical and chemical parameters, e.g. granulometry; organic carbon and nitrogen; metals; trace organics; hydrocarbons; stable isotopes. Seabed still photography and video surveys (above right) provide a rapid and cost-effective assessment of benthic conditions and community composition.

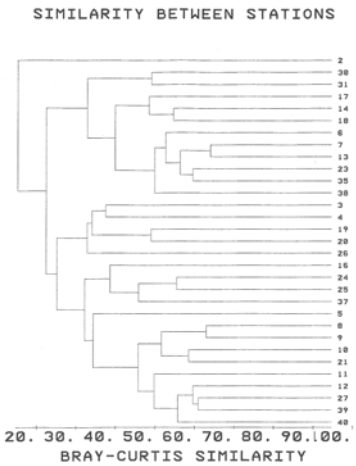
Sidescan sonar surveys are typically used to locate seabed features and debris. In addition, sidescan can be used for wide area habitat surveys, and to interpret sediment dynamics, e.g. for assessment of the likely movement of particulate contaminants.

The use of sidescan in shallow water is challenging, due to a combination of factors, and AMSL has particular experience in this application.

Visual investigations, using divers, camera systems and Remotely Operated Vehicles (ROVs) can also be undertaken.

Statistical analysis of biological community structure
A number of univariate and multivariate statistical methods can be used to interpret variability in community structure, and to distinguish effects due to disturbance or pollution. AMSL has specialist expertise in benthic ecology, in habitats ranging from intertidal estuarine mudflats to water depths >1000m.

The example (below) shows a cluster analysis of the similarity of macrofaunal community structure between stations, Firth of Clyde.



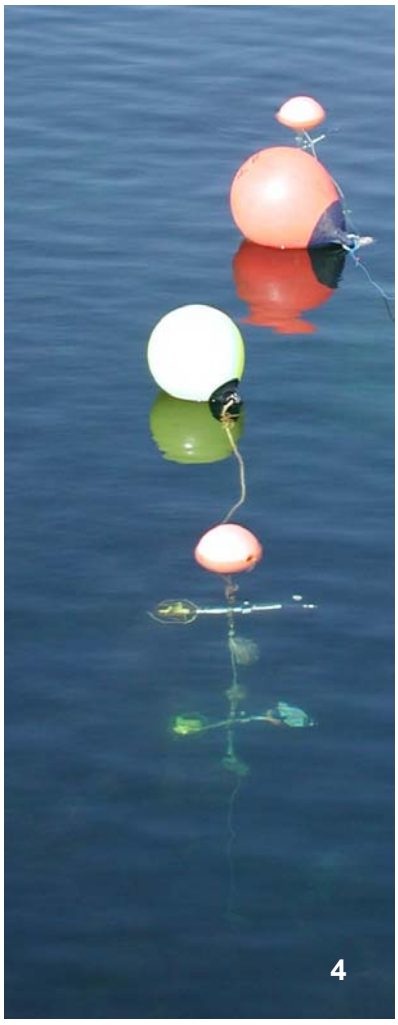
Hydrographic Surveys

Bathymetric, hydrographic and water quality surveys carried out by AMSL include:

- dissolved oxygen, temperature and salinity profiles
- direct-reading, and recording current meter deployments
- drogue tracking

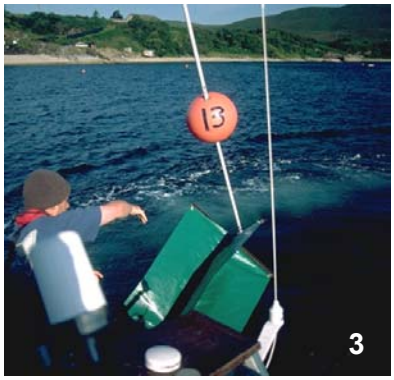

1


2


4

Hydrographic studies are often carried out to support discharge consents, for example:

(1) shallow-water bathymetric survey
(2) deployment of direct-reading electromagnetic current meter with combined salinity, temperature and dissolved oxygen sensors
(3) drogue tracking
(4) current meter deployment
(5) combined dye release and drogue deployment


3


5

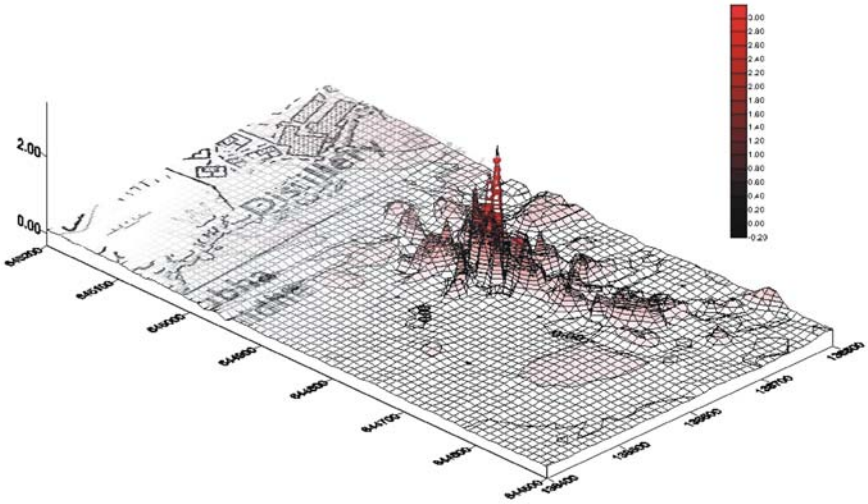
AMSL specialises in difficult *access situations– for example unsurveyed, shallow-water, icebound location below.*

Dye Dispersion Studies

Dye releases, typically of rhodamine, are used in predictive studies to assess the likely dilution and dispersion of effluents in the marine environment; or post-commissioning, to verify that outfall design criteria have been met.

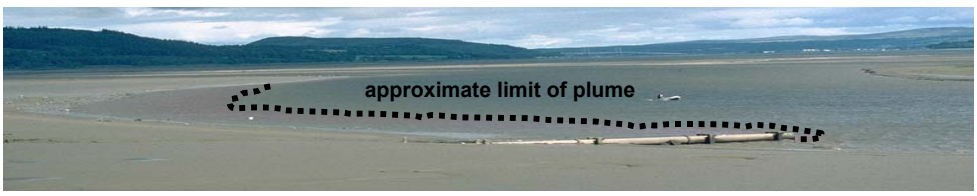
Dye releases can be monitored visually, or quantitatively using *in-situ* or sample fluorometry.

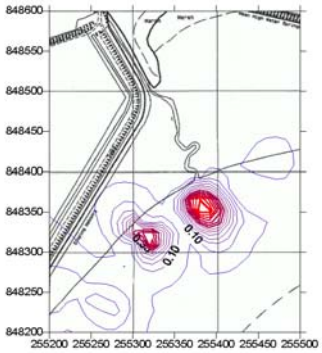
A variety of release methods can be employed, including continuous gravity feed (far left), continuous pumped discharge via temporary pipe (middle left) and batch or continuous discharge via existing outfall (above)



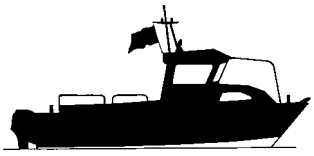
Contour plots (below) and composite surface plots (left), are derived from a number of transects across the dye plume, and can be used to indicate the variation in dispersion patterns throughout the tidal cycle.

Qualitative visual descriptions of plume dispersion are also used (below left).

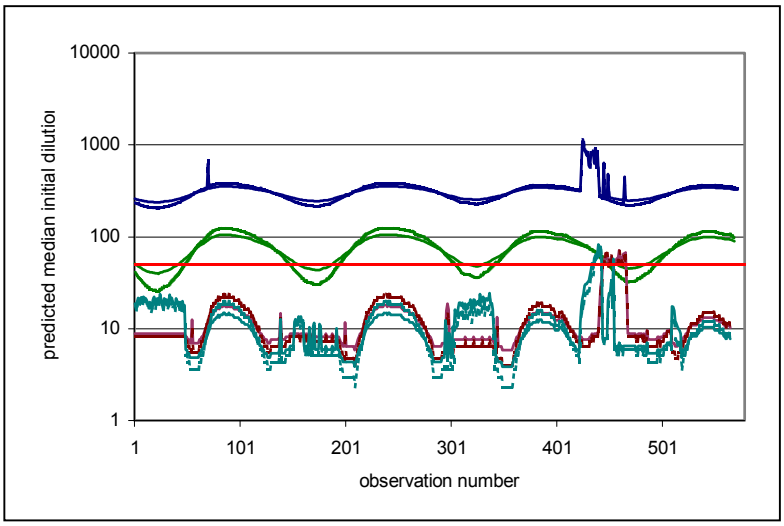




Dispersion Modelling Studies



Modelling of the dispersion of effluent plumes, and of organic particulates, is frequently needed to support the consenting of marine discharges. Modelling may involve simple empirical systems, such as the prediction of plume initial dilution below, or more complex systems.



The simplest approach to prediction of initial dilution is the use of empirical equations describing the variation of dilution with discharge rate, water depth, ambient current velocity and density.

The example shown (left) describes variation in predicted dilution at alternative outfall locations throughout spring and neap tidal ranges.

AMSL has particular expertise with two more sophisticated modelling systems:

CORMIX

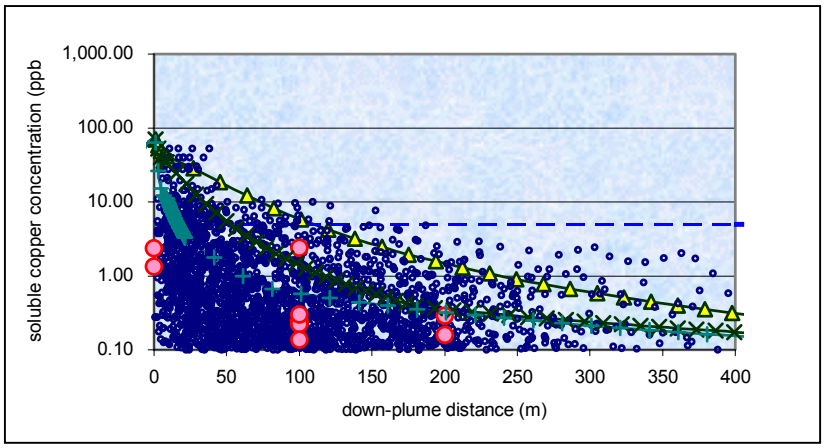
CORMIX (Cornell Mixing Zone Expert System) is a length scale model suitable for use in situations with a complex hydrodynamic regime.

CORMIX predicts both the qualitative features (e.g. flow classification) and the quantitative aspects (e.g. dilution ratio, plume trajectory) of the hydrodynamic mixing processes resulting from different discharge configurations and in a range of ambient water bodies.

BenOss

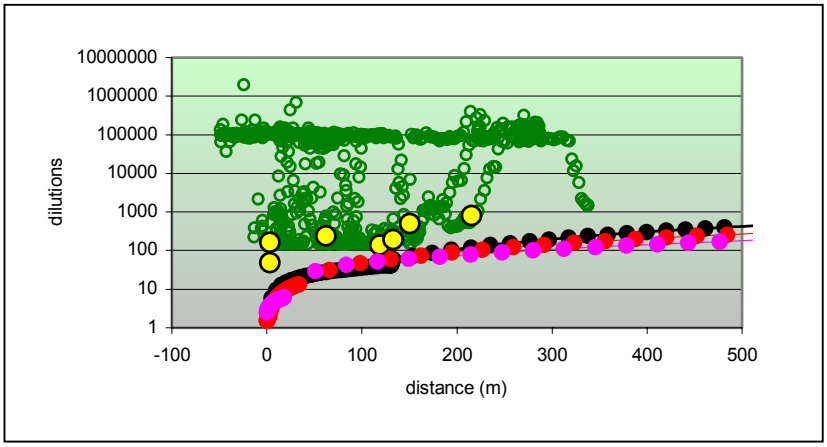
BenOss is a Lagrangian particle tracking model, intended to provide a scientific basis for studies under the Urban Waste Water Treatment Directive. BenOss was developed in a collaborative research project funded by the UK water industry operators and regulators.

BenOss consists of four main modules: grid generation, particle tracking, resuspension and carbon degradation and a benthic module which predicts changes in benthic community structure.

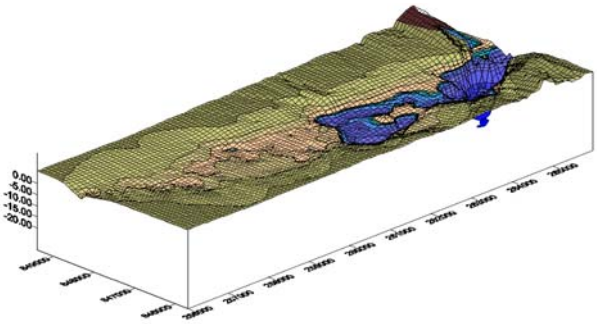


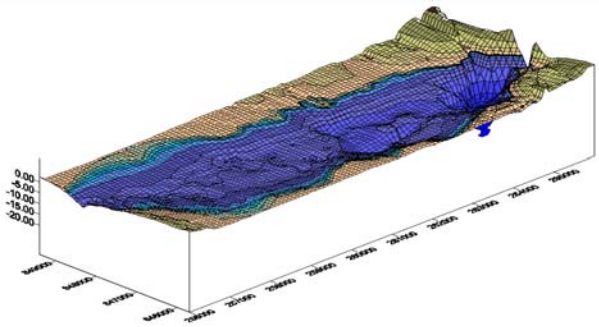
The example above shows CORMIX predictions of soluble copper concentration in a distillery effluent plume, compared with concentrations estimated from dye dispersion studies (blue symbols) and directly measured in the field (pink symbols).

The example below shows CORMIX predicted dilution from a surface discharge, validated against an envelope of in-situ fluorometry dye dispersion data (green symbols) and sampled data (yellow symbols)



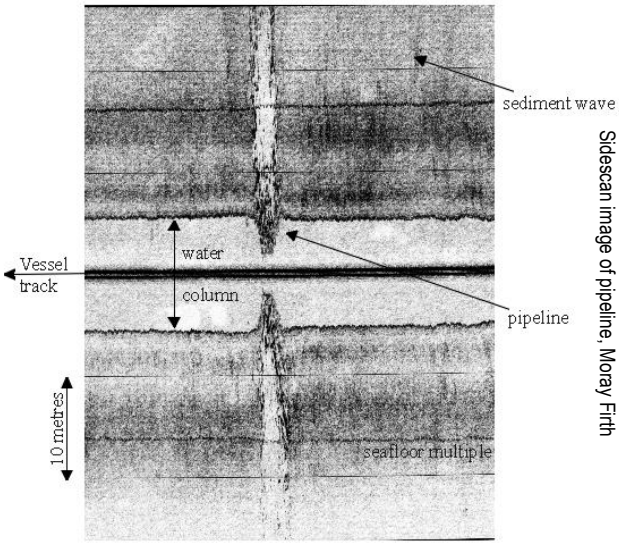
Survey examples





Bathymetric study, Beauly Firth at Lowest Astronomica Tide (left) and Mean High Water Springs (right)

Dye release study, Kyle of Sutherland



Sidescan image of pipeline, Moray Firth

Hydrographic survey, Lagavulin Distillery

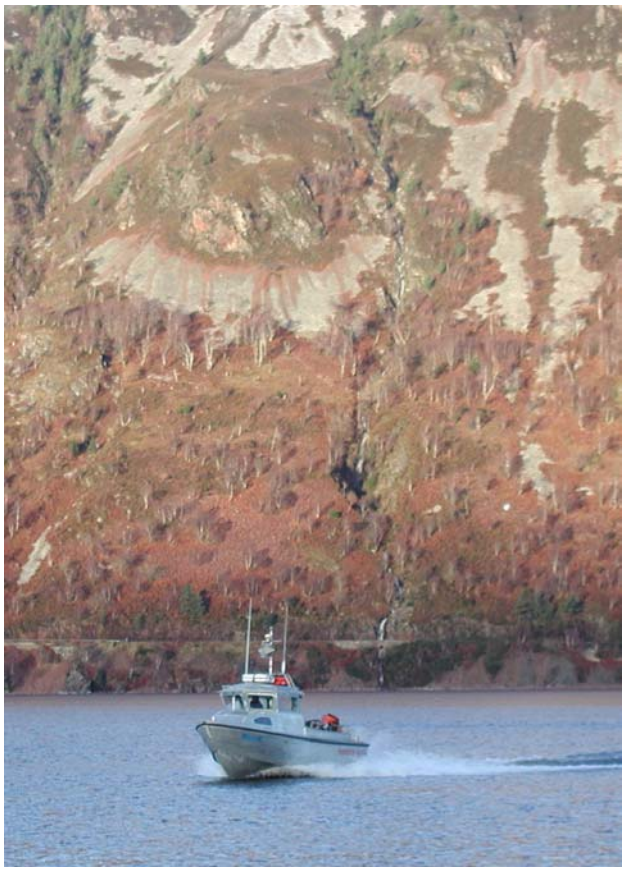
Hydrographic survey, Ardbeg Distillery

Hydrographic survey, Loch Sunart

Hydrographic survey, Dornoch Firth

Survey examples (continued)

Launching *Mollie B*, Loch Ness

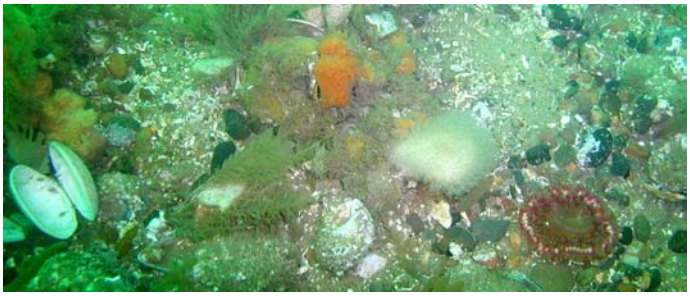


Mollie B, Loch Ness

Box corer and camera deployment, offshore North Sea

Sea pens (*Pennatula* and *Virgularia*), Fladen Ground, North Sea

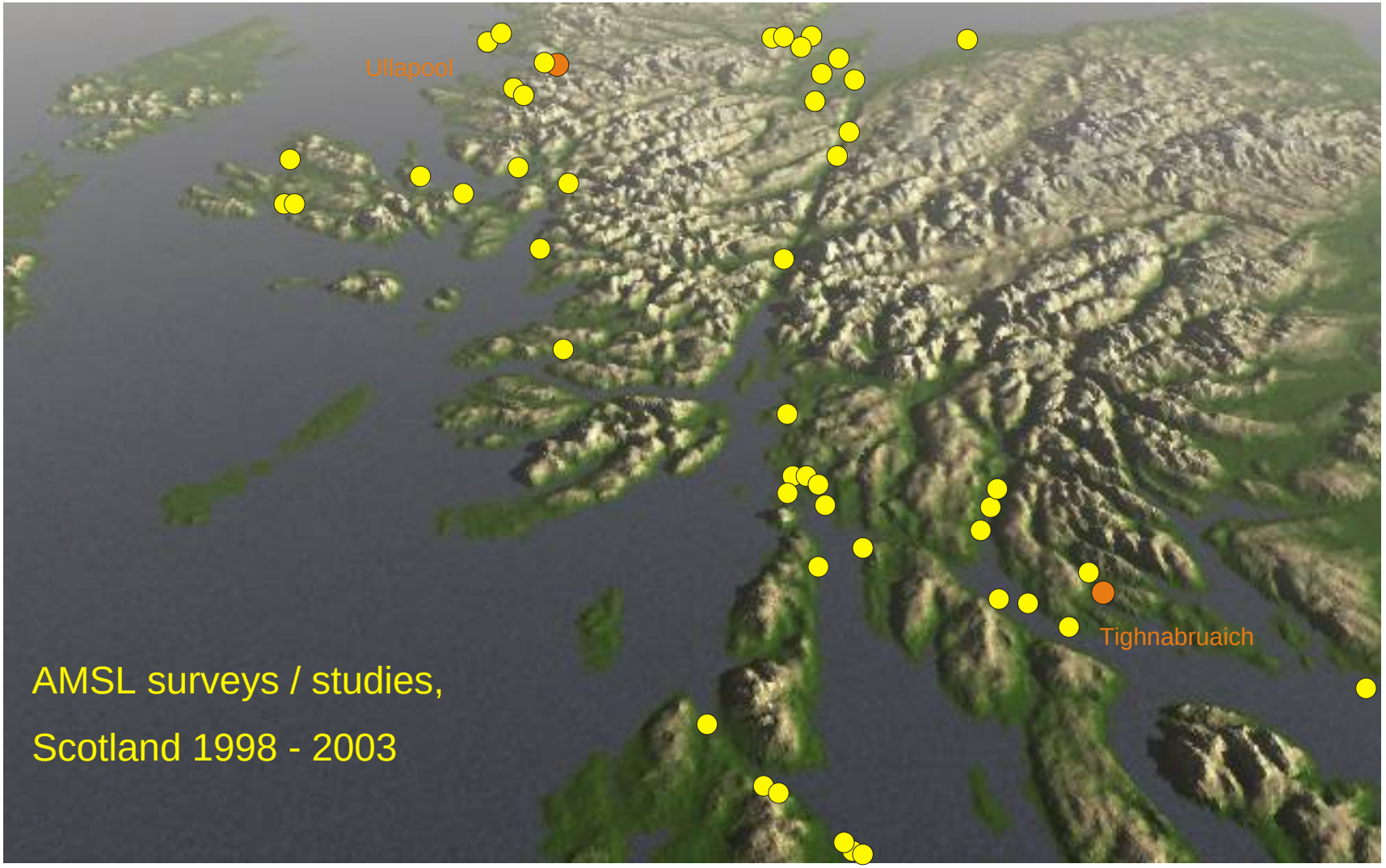
Dispersion study, Loch Ness



Epifauna, Dogger Bank, North Sea

Anemometer deployment, 60 knot wind, 23 January 2002

Offshore southern North Sea

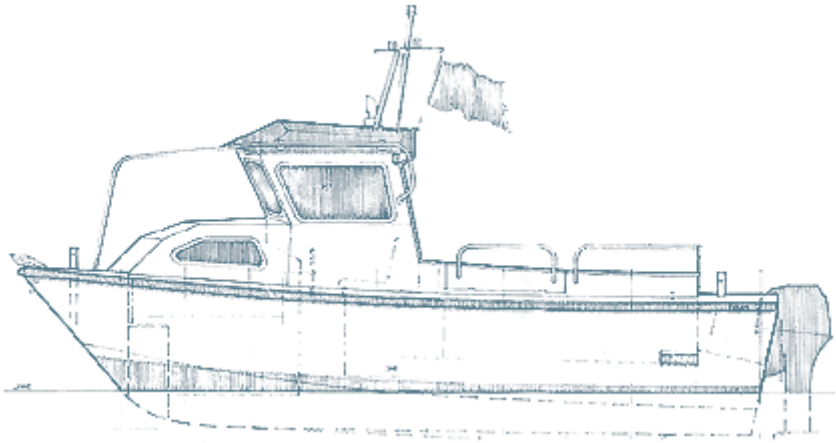

Ullapool
Tighnabruaich
AMSL surveys / studies,
Scotland 1998 - 2003

'Mollie B'

AMSL's new, purpose-designed and built 6.7m survey vessel *Mollie B* has been designed specifically to meet Marine Safety Agency requirements for workboat operations in category 3 waters (open waters, up to 20 miles offshore) and to provide a fast, stable platform for inshore survey activities. Aluminium construction provides a robust hull for shallow-water work. Twin 55hp outboards provide a maximum performance of 23 knots.

Mollie B has sufficient deck space for equipment handling and sample processing, with a low pressure seawater supply for sieving benthic faunal samples. Below-deck bench space is available for instrumentation. *Mollie B* carries a full range of safety and communication equipment together with a Trimble AgGPS differential GPS system and Furuno CV108 colour echosounder.

Mollie B can be trailed and therefore allows cost-effective mobilisation to anywhere in the UK.



For further details, contact ***Douglas Anderson*** **:**

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