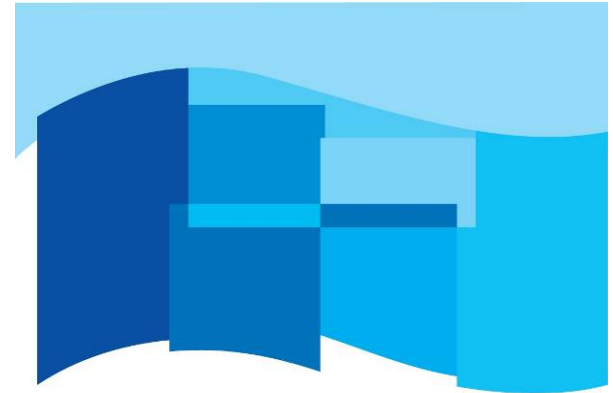


INFOMAR & Irish Hydrographic Data



INFOMAR

Integrated Mapping for the
Sustainable Development
of Ireland's Marine Resource



The Nautical Institute, Rinaskiddy

8th November, 2007

Dr. Fiona Fitzpatrick, INFOMAR Programme, Marine
Institute



Marine Institute
Eolas na Mara



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Integrated Mapping for the
Sustainable Development
of Ireland's Marine Resource

Presentation overview

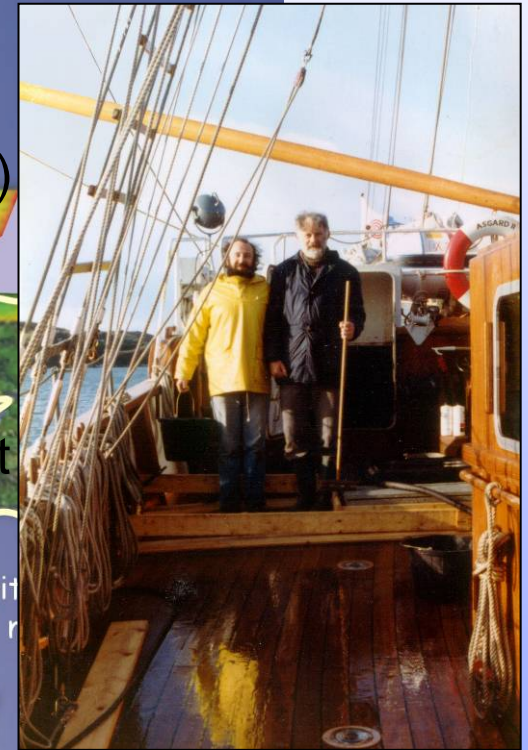
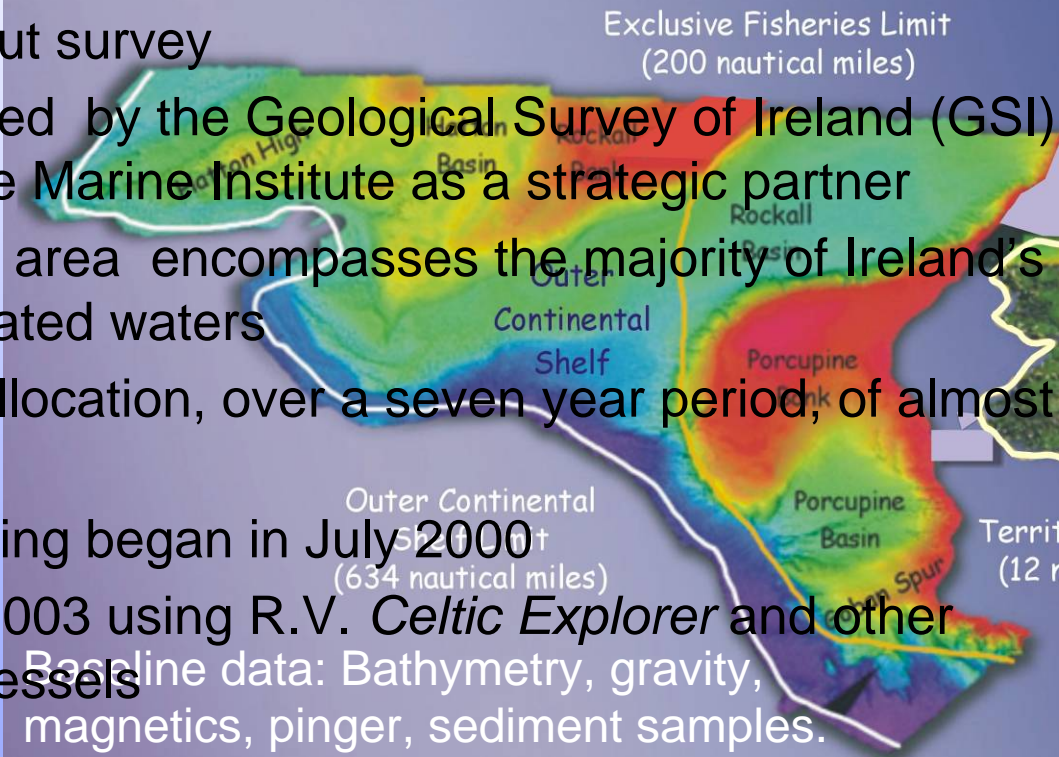
- Irish National Seabed Survey
- Requirement for a National mapping programme
- INFOMAR Objectives
- Programme Structure & design
- INFOMAR Hydrographic data
- Current Work Programme
- Habitat mapping
- JIBS

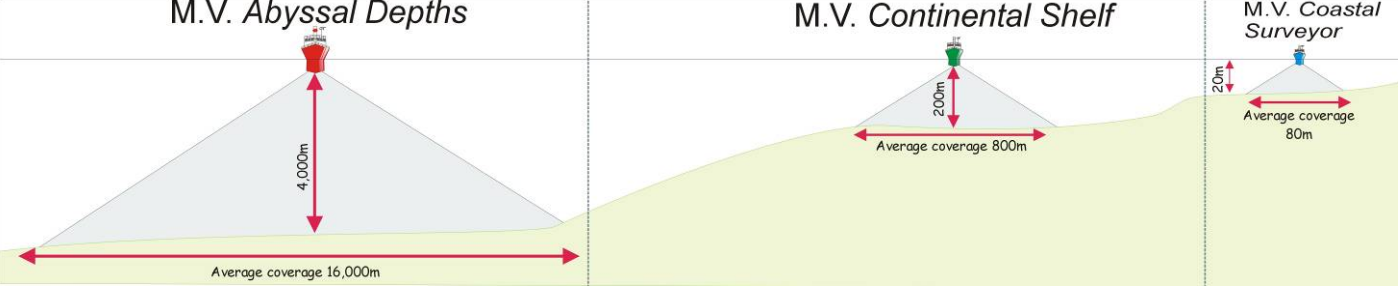


Irish National Seabed Survey (INSS) 1999 - 2005

- 1999 - Government decision to allocate funds to carry out survey
 - Managed by the Geological Survey of Ireland (GSI) with the Marine Institute as a strategic partner
 - Project area encompasses the majority of Ireland's designated waters
 - Total allocation, over a seven year period, of almost €32m
 - Surveying began in July 2000
 - From 2003 using R.V. *Celtic Explorer* and other state vessels
- Baseline data: Bathymetry, gravity, magnetics, pinger, sediment samples.

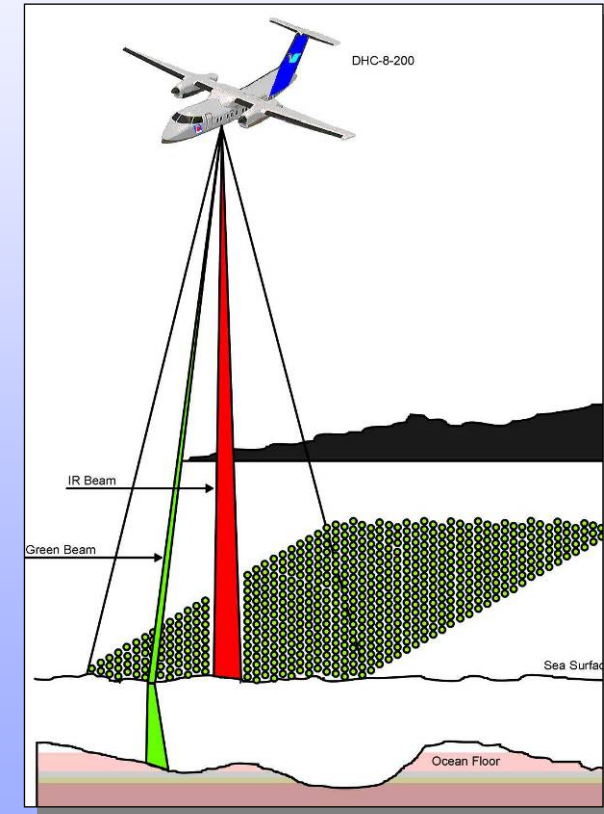
Also: some seismic (reflection & refraction), ROV





Survey Tools

- Multibeam echo sounder – water depth
- Sub bottom profiler – penetrating into the seabed
- Marine magnetic and gravity data
- Laser Airborne survey - water depth
- Deep Seismic Project Hatton Area (HADES)
- Salinity and temperature profiles - oceanography
- Seabed samples – geologists, chemists & biologists
- Ancillary surveys.....



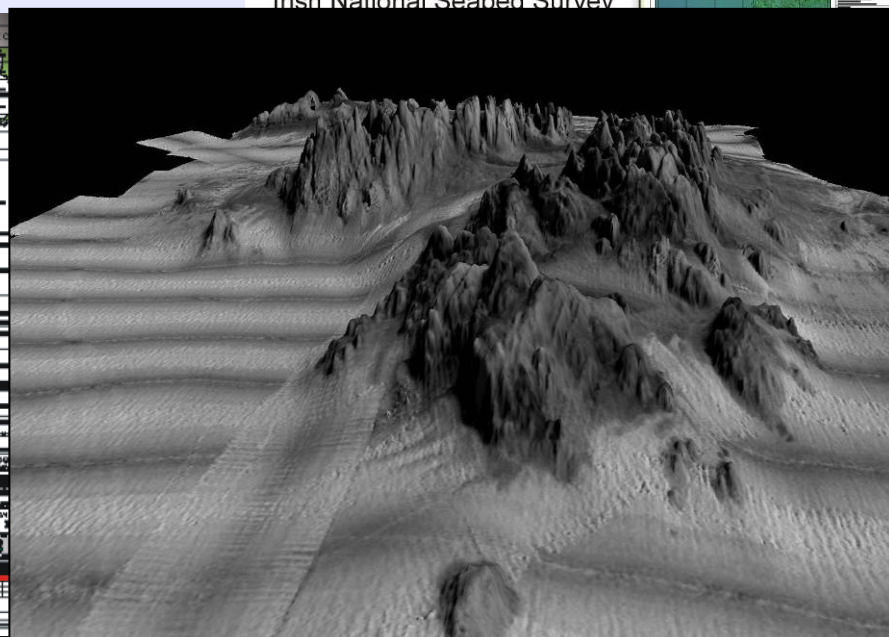
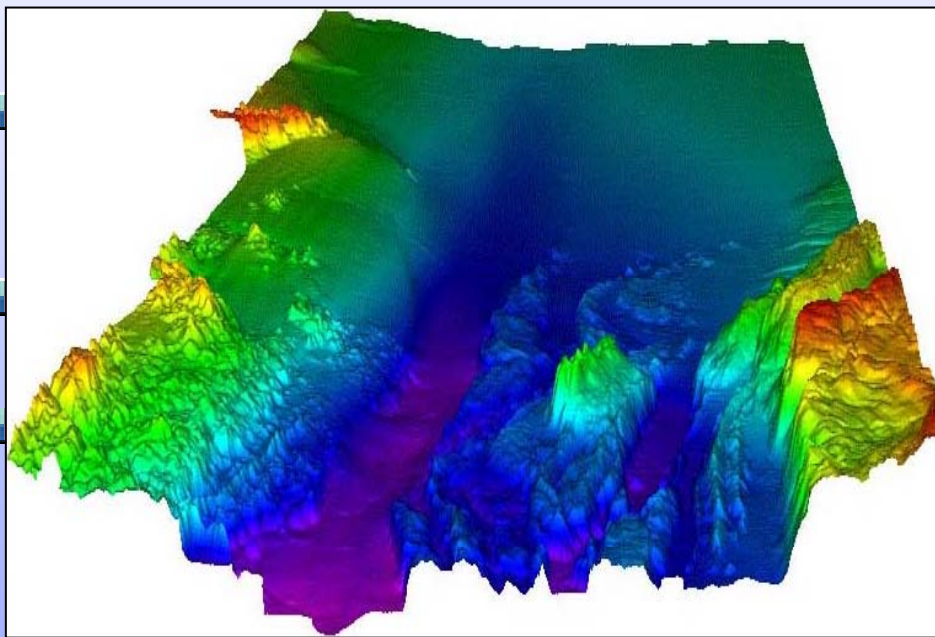


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Irish National Seabed Survey (INSS) 1999 - 2005

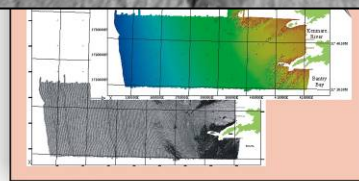
The INSS established an essential national asset:



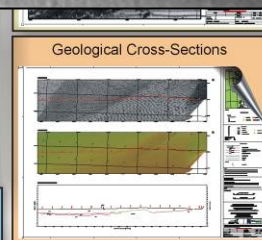
Baseline Deliverables
Irish National Seabed Survey



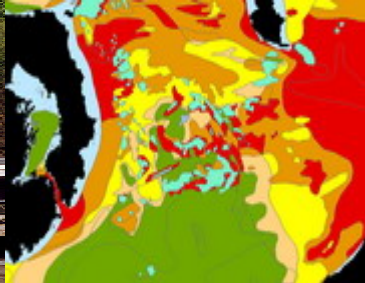
The body of knowledge required to design, procure, build and operate the largest Exclusive Economic Zone (EEZ) survey conducted so far in the world.



Underway, oceanographic and meteorological data



1:250,000; 1:60,000; 1:30,000



Who benefits

■ Marine Industries

- Fishing
- Oil and Gas exploration, exploitation
- Cable Routes
- Marine Engineering and Infrastructure
- Offshore Aquaculture
- Marine Aggregates
- Renewable energy developments

■ Research Groups

Universities & Institutions

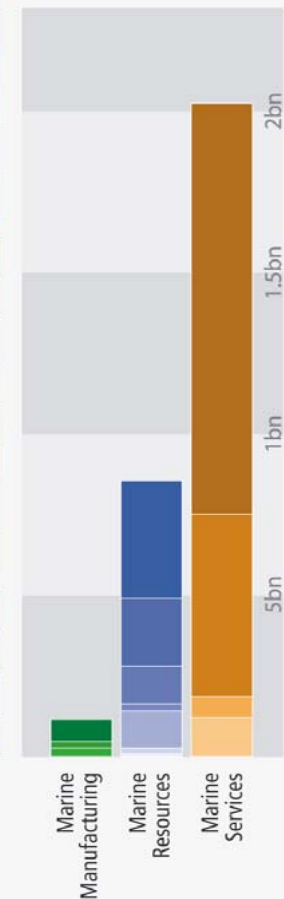
■ Marine Heritage

■ Marine Policy Makers

Irish Marine Sector €3 Billion

Marine Services	2,028bn
Shipping And Maritime Transport	1,275bn
Water-Based Tourism	566m
International Cruise	66m
Other Marine Services	121m
Marine Resources	857m
Fish Processing	366m
Fish Landings	210m
Aquaculture	117m
Oil Exploration	22m
Gas Production	115m
Offshore Renewable Energy	18m
Seaweed	9m

Marine Manufacturing	116m
Marine Manufacturing	69m
Marine Manufacturing	20m
Marine Manufacturing	27m





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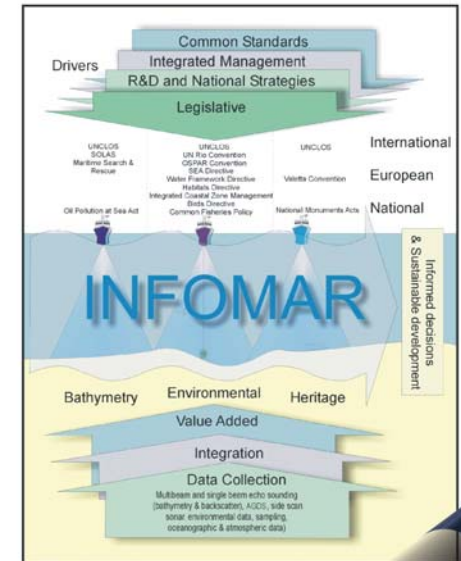
Integrated mapping FOR the sustainable development of Ireland's **MA**rine Resource

(INFOMAR)

A successor to The Irish National Seabed Survey

History – Inshore Mapping Strategy

- 2002 Steering Group (BIM, Irish Lights, DCMNR, Irish Navy, Dúchas, GSI, MI, EPA)
- Questionnaire & stakeholder workshop February 2003
- Draft document WGI
- Specific inputs sought and received from GSI, DCMNR (Engineering Division), MI, Dúchas (NPWS) and Commissioners of Irish Lights on draft inshore mapping priorities
- 2004 WGI Report – recommended 20 Bays
- 2004 MI produced Inshore Mapping consultative report – 26 Bays & 4 Areas
- 2005 MI & GSI directed by DCMNR to prepare strategy
- May 2005, independent consultants CSA and Swiftsure Spatial Systems
- July 2005 – INFOMAR memo to Govt



June 2005



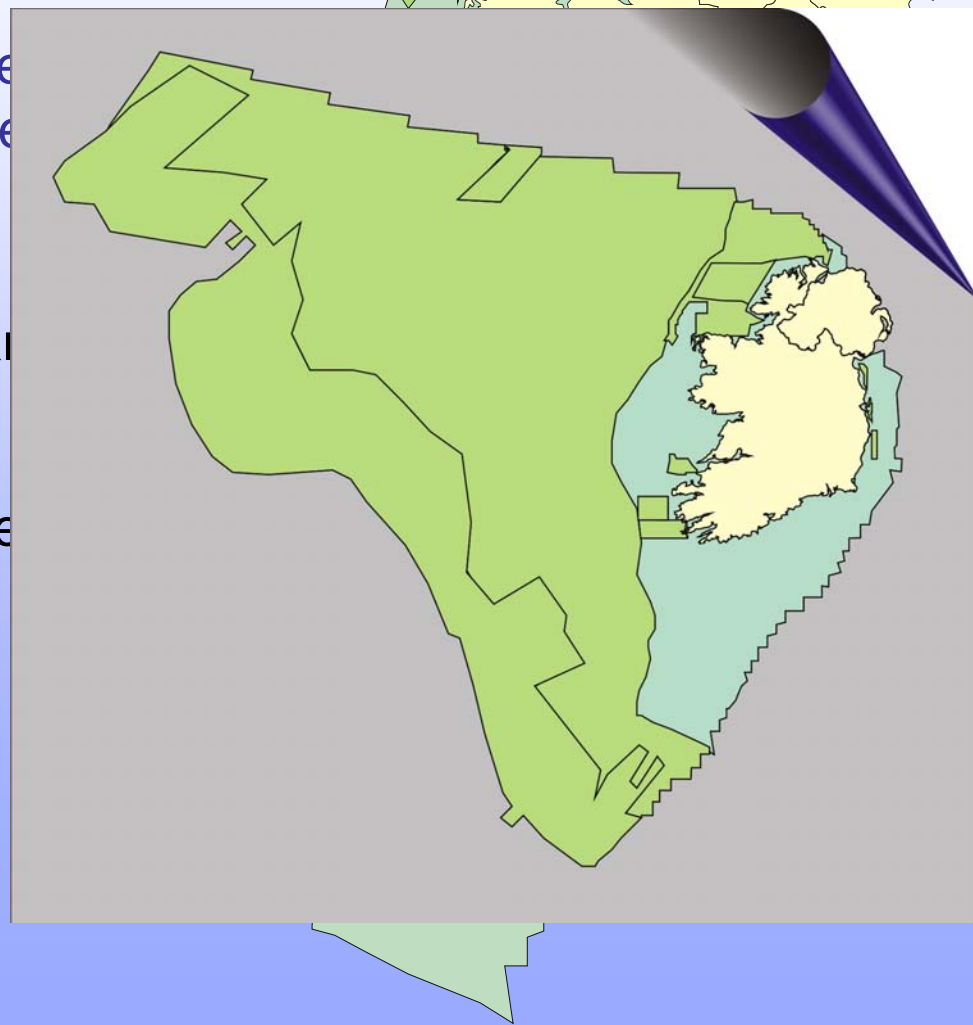
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of Ireland's Marine Resource

Where we were by the middle of 2005

Department of Communications, Marine
Natural Resources (DCMNR) requirements
INSS follow on programme:

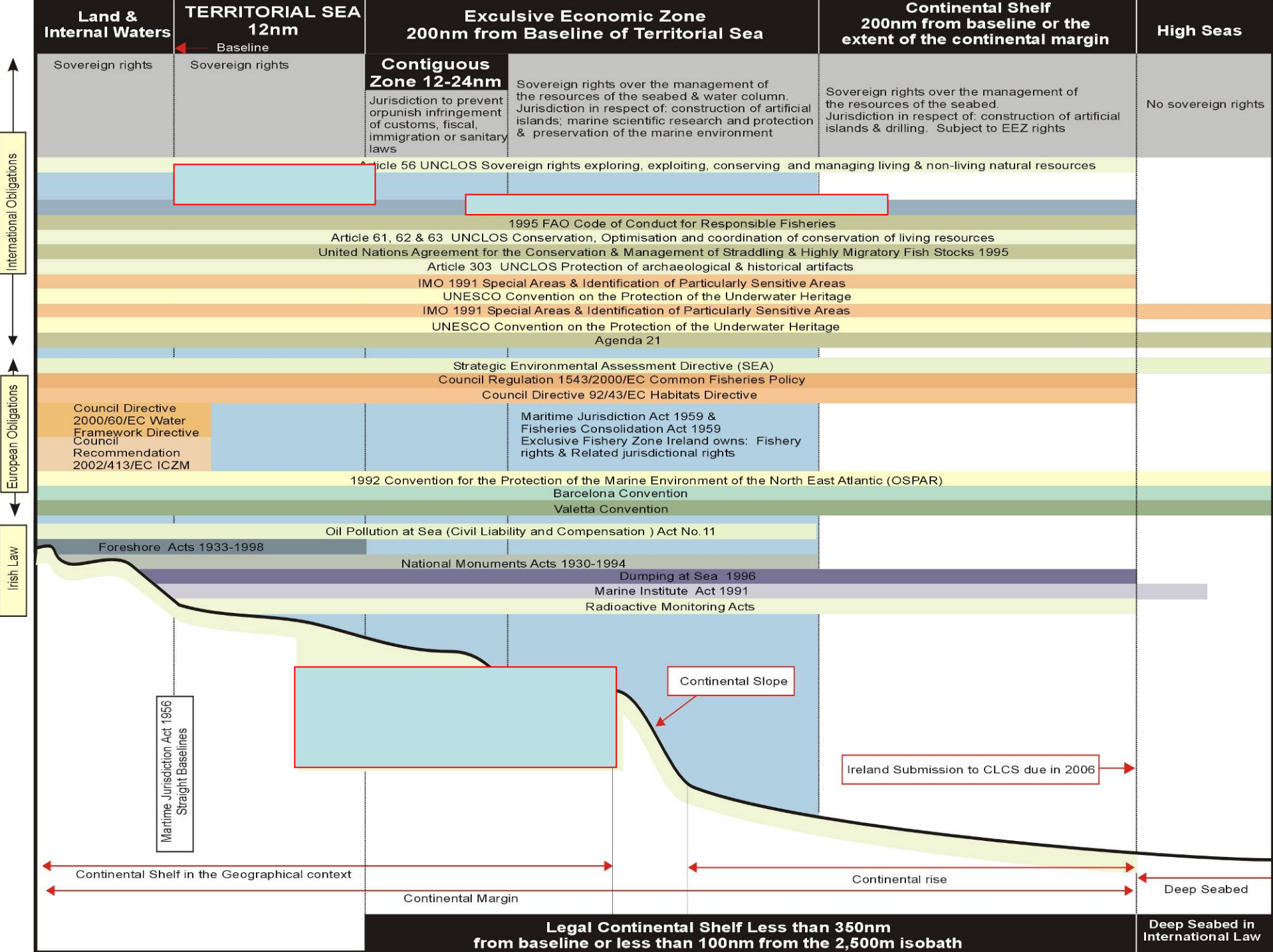
- <200m strategy (Zone 1 & 2)
- >200m (Zone 3) – data evaluation and
ground-truthing/seismic strategy
- Incorporate elements of, or derive
data from, other national programmes
- Data products/services & release
policy
- Hydrographic charting
- Aim to have State surveys to be
conducted to defined Guidelines
- Ancillary projects
- Seabed Observatories





Legislative requirements and obligations

- UNCLOS – Umbrella Convention
- SOLAS, the International Convention for the Safety of Life at Sea (operates under the IMO)
- Marine Environment
- Habitat Mapping & Biodiversity, OSPAR Biodiversity Strategy
- Underwater Cultural Heritage
- Water Framework Directive
- European Green Paper
- Marine Spatial Planning
- SEA Directives



Land & Internal Waters

TERRITORIAL SEA 12nm

Exclusive Economic Zone 200nm from Baseline of Territorial Sea

Continental Shelf 200nm from baseline or the extent of the continental margin

High Seas

International Obligations

European Obligations

Irish Law

Sovereign rights

Sovereign rights

Contiguous Zone 12-24nm

Jurisdiction to prevent or punish infringement of customs, fiscal, immigration or sanitary laws

Sovereign rights over the management of the resources of the seabed & water column. Jurisdiction in respect of: construction of artificial islands; marine scientific research and protection & preservation of the marine environment

Sovereign rights over the management of the resources of the seabed. Jurisdiction in respect of: construction of artificial islands & drilling. Subject to EEZ rights

No sovereign rights

Article 56 UNCLOS

Sovereign rights exploring, exploiting, conserving and managing living & non-living natural resources

1995 FAO Code of Conduct for Responsible Fisheries
 Article 61, 62 & 63 UNCLOS Conservation, Optimisation and coordination of conservation of living resources
 United Nations Agreement for the Conservation & Management of Straddling & Highly Migratory Fish Stocks 1995

Article 303 UNCLOS Protection of archaeological & historical artifacts

IMO 1991 Special Areas & Identification of Particularly Sensitive Areas

UNESCO Convention on the Protection of the Underwater Heritage

IMO 1991 Special Areas & Identification of Particularly Sensitive Areas

UNESCO Convention on the Protection of the Underwater Heritage

Agenda 21

Strategic Environmental Assessment Directive (SEA)

Council Regulation 1543/2000/EC Common Fisheries Policy

Council Directive 92/43/EC Habitats Directive

Council Directive 2000/60/EC Water Framework Directive
 Council Recommendation 2002/413/EC ICZM

Maritime Jurisdiction Act 1959 & Fisheries Consolidation Act 1959
 Exclusive Fishery Zone Ireland owns: Fishery rights & Related jurisdictional rights

1992 Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR)

Barcelona Convention

Valetta Convention

Foreshore Acts 1933-1998

Oil Pollution at Sea (Civil Liability and Compensation) Act No. 11

National Monuments Acts 1930-1994

Dumping at Sea 1996

Marine Institute Act 1991

Radioactive Monitoring Acts

Maritime Jurisdiction Act 1956
 Straight Baselines

Continental Slope

Ireland Submission to CLCS due in 2006

Continental Shelf in the Geographical context

Continental rise

Deep Seabed

Continental Margin

Legal Continental Shelf Less than 350nm from baseline or less than 100nm from the 2,500m isobath

Deep Seabed in International Law



SOLAS

- The traditional mandate of hydrography has been
- to collect, and compilation of hydrographic data
 - publication, dissemination and keeping up to date of all nautical information necessary for safe navigation
 - Hydrographic surveying is adequate to the requirements of the Safety of Life at Sea (SOLAS) convention administered by the International Maritime Organisation (IMO)
 - prepare and issue nautical charts, sailing directions, etc, satisfying the needs of safe navigation
 - Establishment and maintenance of such aids to navigation



State of Irish Charting

- In the inshore area, the majority of Irish charts are currently based on 19th century lead line surveys
- It has been estimated that 75% of charts for Irish waters are deficient, by:
 - 52% of data (calculated by chart area) were collected before 1860
 - over 10% of the data points sampled showed water depths greater than those marked on the charts
 - approximately 100 areas show significant difference between the chart and modern ships data
 - significant variations were also identified between chart depth and measured depth during the INSS mapping



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Integrated Mapping for the Sustainable Development of Ireland's Marine Resource

1999 **Delivered by INSS** 2005

- Fisheries
- Oil & Gas
- Environmental Monitoring / Conservation
- EEZ

Bathymetric maps
 Multibeam sonar data set
 Seabed classification maps
 Gravity maps
 Magnetic maps
 Seafloor geotechnical properties
 Seafloor geochemical properties
 Seafloor biological analysis
 Shallow geological interpretation
 Wreck identification
 Data management protocols

- Oil & Gas
- Cables/pipeline installation
- Coastal Zone Management
- Renewable Energy
- Aquaculture
- Aggregates
- Coastal Engineering
- Foreshore Licensing
- Inshore Fisheries
- Port Security & Safety
- Environmental Monitoring / Conservation
- Shipping / Navigation

Potential Deliverables

Modeling oceanographic data
 Habitat mapping
 Input to ecosystem approach to fisheries management
 Input to EIS for coastal zone infrastructure
 Input to climate change modeling
 Modeling deep sea seismic data
 Gas Hydrates

2015

Proposed Deliverables

Continued evaluation of aggregate resource
 Modeling gravity/magnetic data
 Lidar waveform analysis
 Cetacean distribution maps
 Hydrodynamic modeling for pollution
 Geohazard identification
 Geohazard maps for cable industry
 Bathymetric maps
 Multibeam sonar data set
 Seabed classification maps
 Gravity maps
 Magnetic maps
 Seafloor geotechnical/geochemical properties
 Seafloor biological analysis
 Shallow geological interpretation
 Wreck identification
 National Survey Protocols
 National Data management protocols



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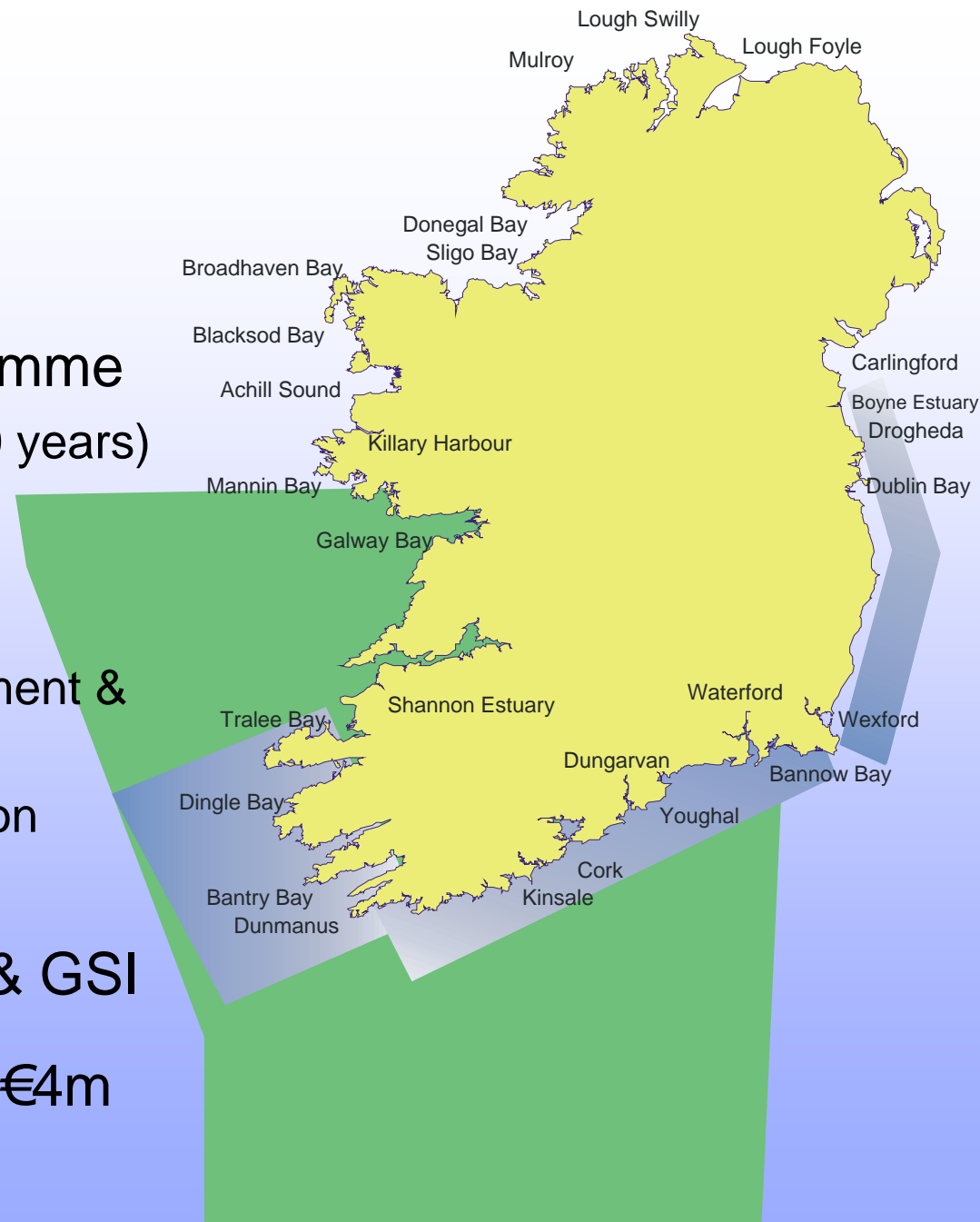
■ 2 Phase, 20 Year Programme
26 Priority Bays & 3 Areas (10 years)
Remaining Areas (10 years)

■ 3 Programme Areas

1. Data acquisition, management & interpretation
2. Data exchange & integration
3. Value added exploitation

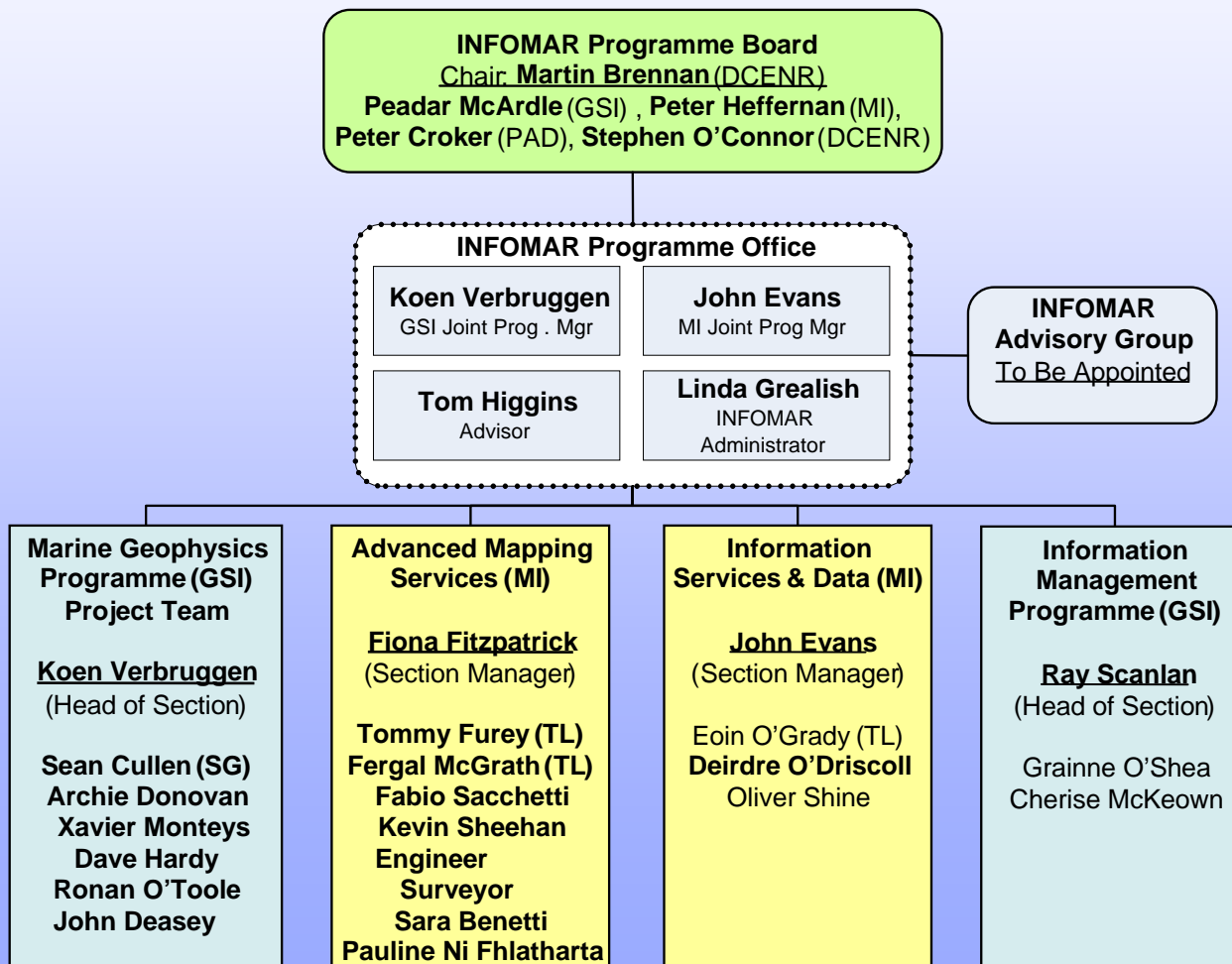
■ Partnership between MI & GSI

■ Initial 3 year approval @ €4m p.a.





Programme Structure





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Integrated Mapping for the
Sustainable Development
of Ireland's Marine Resource

Programme 1 – Data Acquisition, mgmt & interpretation

Multi Platform/Multi-dataset Acquisition

National Research Vessels, Inshore vessels, LIDAR

XYZ Data, Magnetics, Gravity, Seabed Samples (physical, chemical, biological)

Data Products

XYZ, Shaded Relief, Backscatter, Survey Leg GIS, PDF Charts, Magnetic and Gravity background corrected charts, Seabed Classification (Supervised and/or unsupervised) with sample descriptions, Sub Bottom profiles, Sample Database, Wreck Database

Protocols

Survey Standards, Data Standards



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Programme 1 – Data Acquisition, mgmt & interpretation

Improved Data Storage

Off site storage for INSS/INFOMAR data at GSI
Duplicate data set in MI (currently being loaded)

Data Delivery

Web Mapping Services
Interactive Web Mapping Service

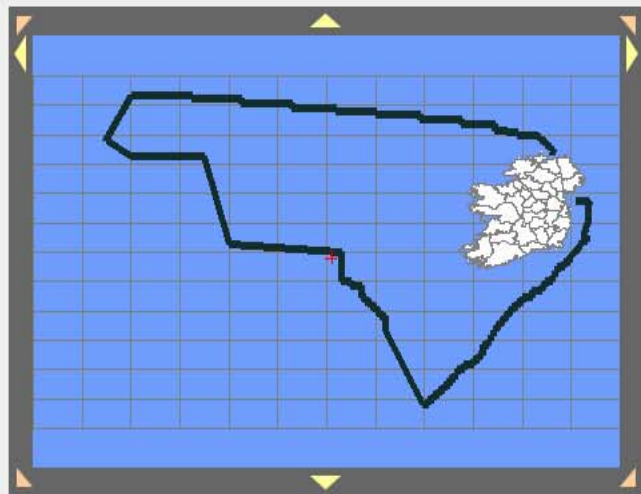


Interactive Web Data Delivery System—Home

[GSI Mapping](#)
[MI Mapping](#)
[Contact us](#) | [Help](#)

Data available for download from Geological Survey of Ireland archives

Map Control



Additional Layers

InfoMar data coverage



Lat Long Rectangle

N Lat
W Long E Long
S Lat

Use decimal degrees (example 137.821)

Quick Start

1:250k map sheet

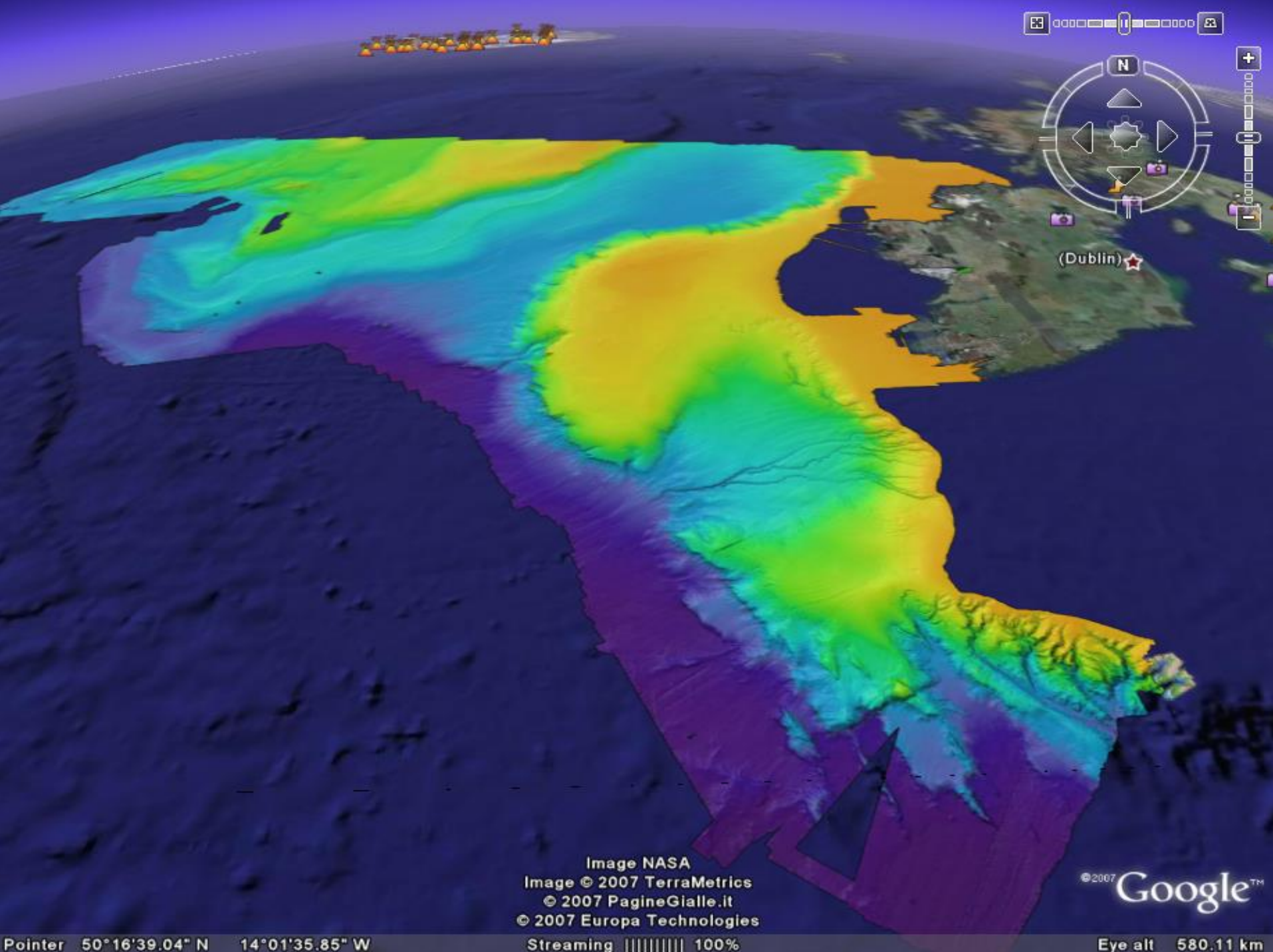
Basic Instructions

Option 1
In the map at the left of the window, drag a rectangle to define your area of interest.
Your extents automatically appear in the **Lat Long Rectangle**.
Choose **Proceed to download** to view the data available for your area of interest.

Option 2
Enter the extents of your area of interest in **Lat Long Rectangle**.
Use decimal degrees (for example, 137.821).
Choose **Proceed to download** to view the data available for your area of interest.

Option 3
Use the **Quick Start** drop-down list to select an area of interest based on a 250k map sheet.
The extents of the sheet automatically appear in the **Lat Long Rectangle**.
Choose **Proceed to download** to view the data available for your area of interest.

More information
[Detailed IWDDS help](#)



ES [Progress Bar] [Zoom In] [Zoom Out]



(Dublin) ★

Image NASA
Image © 2007 TerraMetrics
© 2007 PagineGialle.it
© 2007 Europa Technologies

©2007 Google™

Pointer 50° 16' 39.04" N 14° 01' 35.85" W

Streaming [Progress Bar] 100%

Eye alt 580.11 km



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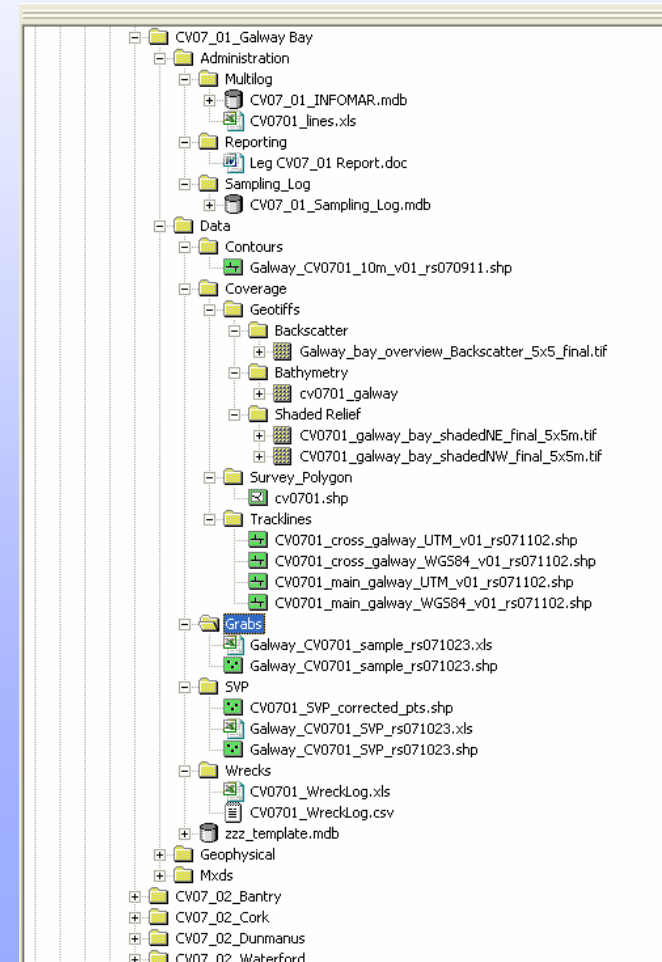
Programme 2 - Data Exchange and Integration

- Develop mechanisms for Data Integration & Exchange
- Reuse and promote the Irish Spatial Data Exchange
- Develop data model implementations for data sets
- Align with Sea Change vision of “National Coastal and Marine Information Infrastructure - A Marine Knowledge, Research & Innovation Strategy for Ireland 2007-2013 ”



INFOMAR GIS and Data Management

- Surveys generate huge datasets requiring effective management
- Data is organised in
 - a standard structure
 - by survey
- Data required for charting and further analysis in GIS is extracted and organised to allow
 - Easy transfer between ship and shore
 - Planning and charting
 - Use on webGIS facility





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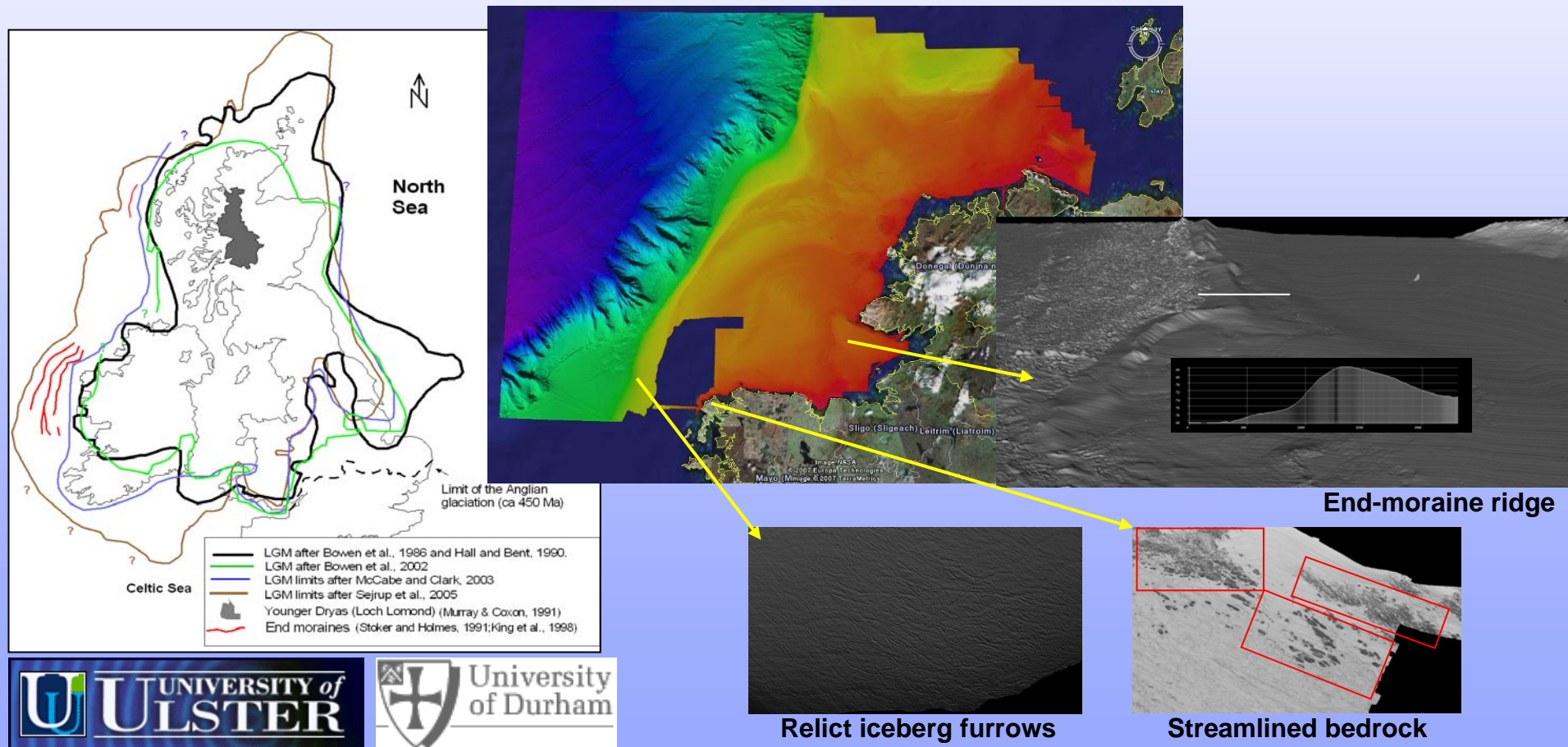
Programme 3 – Value Added

- Seek opportunities to maximise value of INFOMAR, and deliver INFOMAR products through other programmes
- Reuse of data – INFOMAR data being integrated to navigation charting software





research project: Reconstruction of the extent and dynamics of the British-Irish Ice Sheet on the continental margin off northwest Ireland





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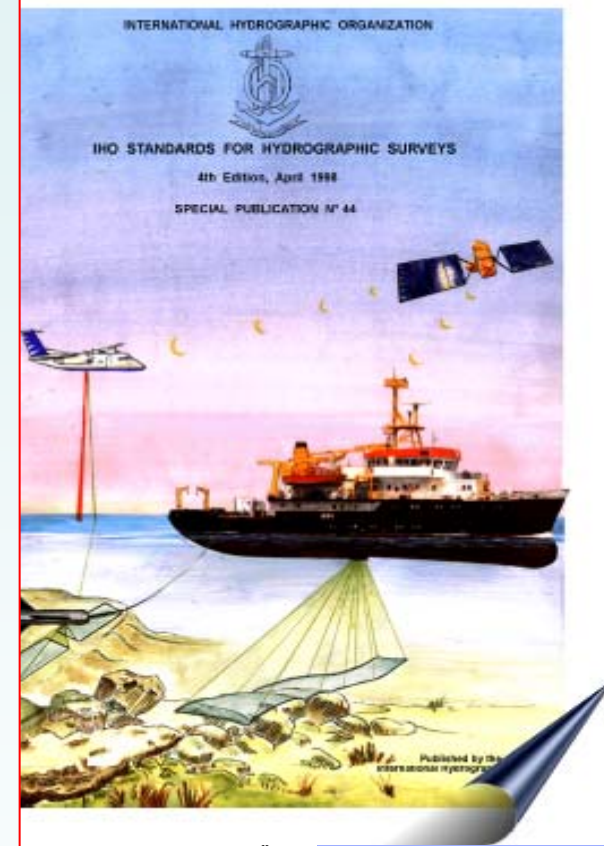
a = sum of all depth-independent errors.
b = sum of all depth-dependent errors, expressed as a fraction of water depth

Hydrographic Data 2nd Order – S44 4th edition

International Hydrographic Organization (IHO) standards for hydrographic surveys (S44) (1957, 1998). Their standards are:

To specify minimum standards for hydrographic surveys in order that hydrographic data collected in accordance with these standards is sufficient for the safe navigation of all vessels and that the spatial uncertainty of the data is adequately quantified to be satisfactory for all users of the data (commercial, military, recreational) as primary user information.

ORDER	Special
Examples of Typical Areas	Harbours, berthing areas, and associated critical channels with minimum underkeel clearances
Horizontal Accuracy (95% Confidence Level)	2 m
Vertical Accuracy for Reduced Depths (95% Confidence Level)	$a = 0.1 \text{ m}$ $b = 0.0075$
100% Bottom Search	Compulsory
System Detection Capability	Cubic features > 1 m
Maximum Line Spacing	Not applicable, as 100% search compulsory





INFOMAR Hydrographic data

- IHO 2nd Order
- Primary lines should be acquired, depending on sea conditions, contour parallel.
- Tie lines will be at approximately 10 times the line spacing and surveyed approximately orthogonal to the primary lines.
- 100% Bottom coverage, with sufficient overlap to meet the accuracy requirements:
 - Positioning accuracy must be better than 5 metres + 5% of depth for Order 1 (95% confidence level).
 - All depths must be accurate to within 1.54% of water depth.
 - Solution density no sparser than 5% of water depth, both along and across track.
 - Ability proven to resolve all geomorphic features with horizontal dimensions over 10% of the local water depth.
 - All data must be corrected for tides.
 - Check lines must be completed.



What we do offshore

- Kongsberg Simrad EM1002 multibeam echosounders, hull mounted on the vessels 93khz to 95 kHz. Upgrade to EM3002 in 2008
- Vessel heading and attitude is input to the EM1002 from the Seapath 200 to correct bathymetric data in real time. Fugro HP
- Decide angular coverage (@63-64 degrees), mode, beam spacing
- SVP, MVP
- Draught corrections
- Angles of internal consistency (tie lines)
- Depth Accuracy across swath width
- Data density
- Swath to Swath Area Coverage



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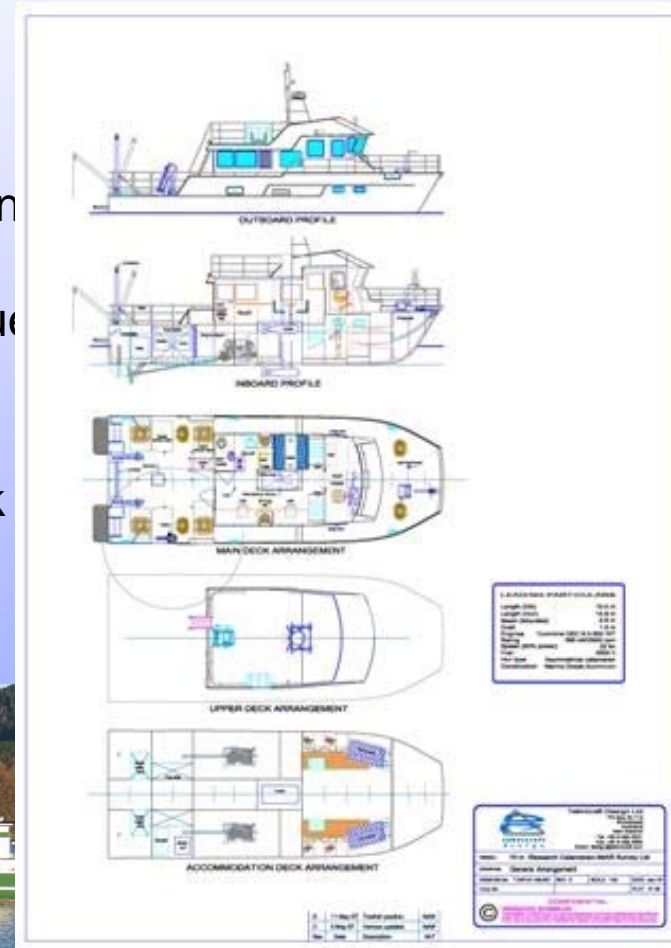
- R.V. *Celtic Explorer* 65.5m length, 15m beam
- R.V. *Celtic Voyager* 31.4m, 8.5m
- Gross tonnage 2425 (340 GT)
- Accommodation 19 scientists (6-8 scientists)

Vessels

- Weather fax, Navtex, Mini-M
- Seapath, Fugro HP DGPS signals or Fugro SPOT



sound
frequ
back





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Deck Operations

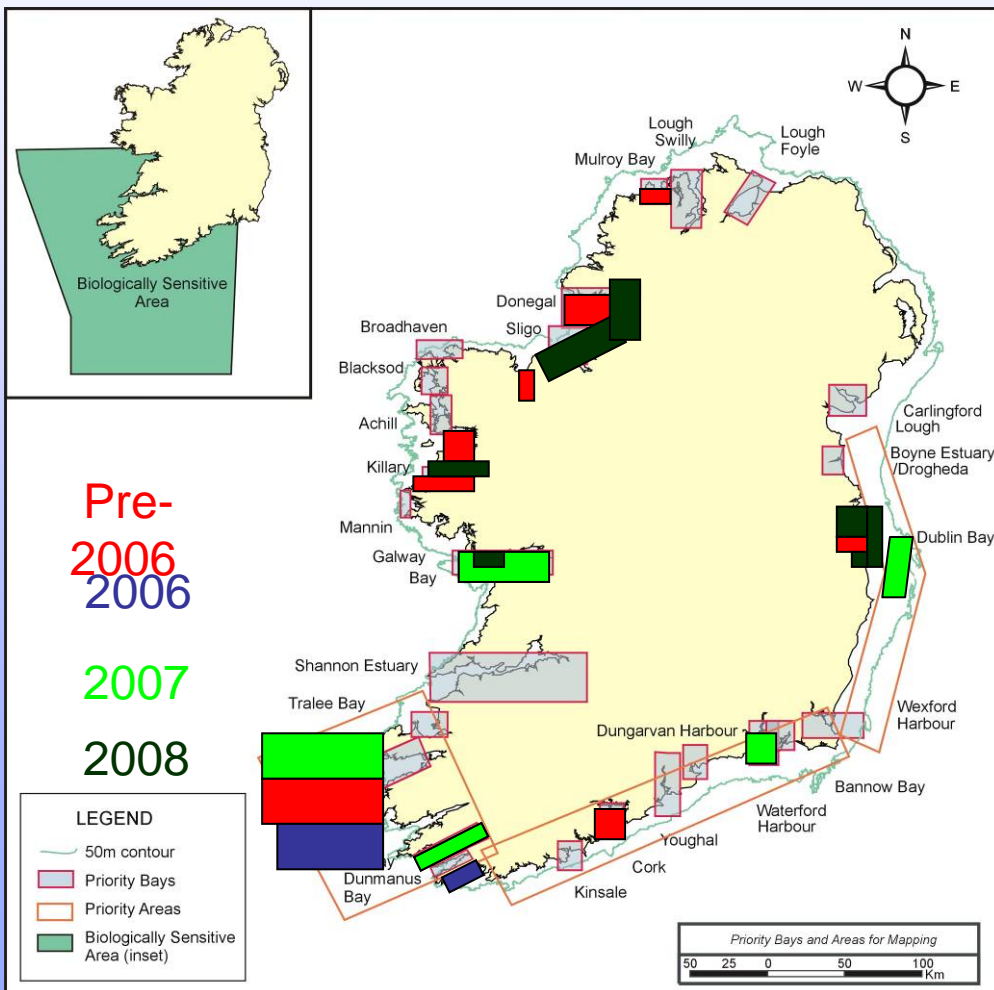




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2006 -2008 Work Programme

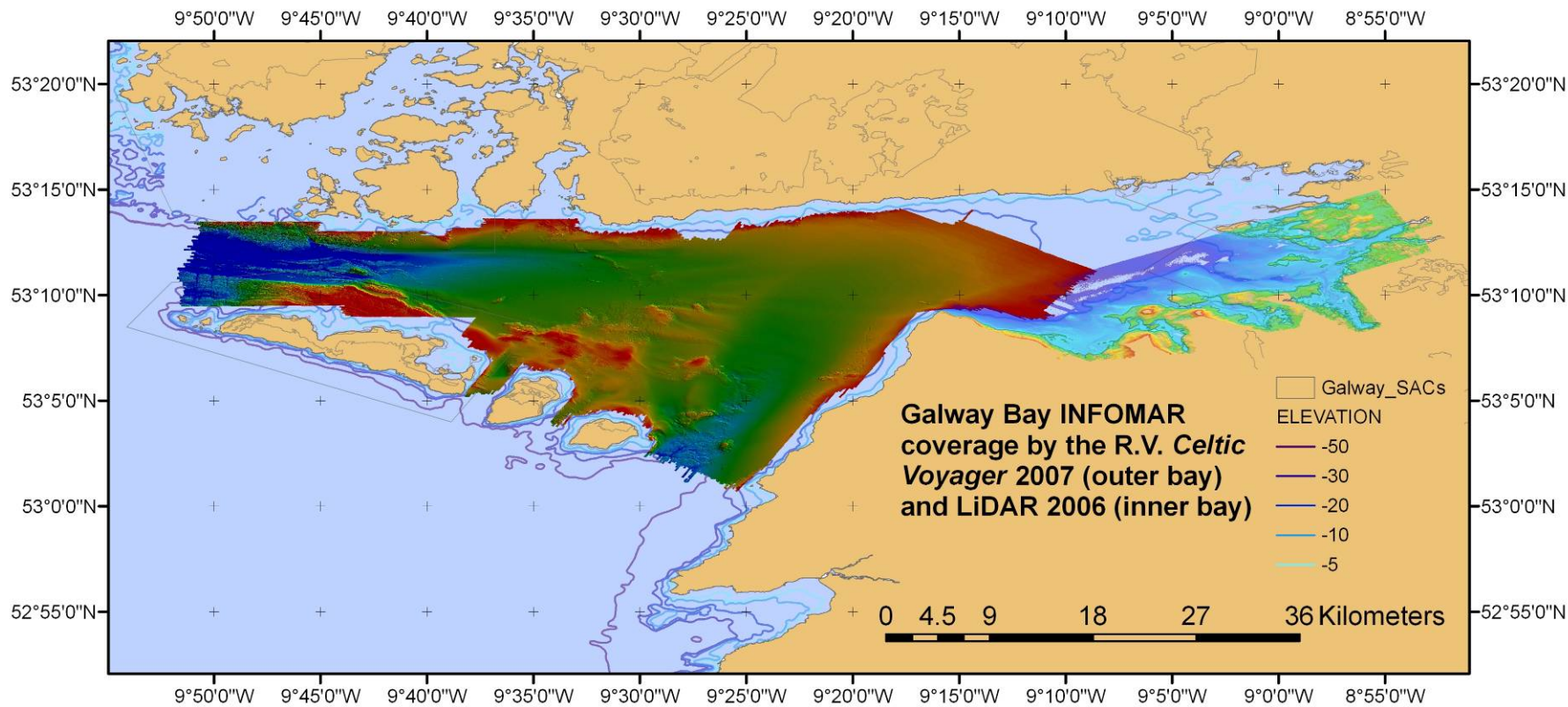
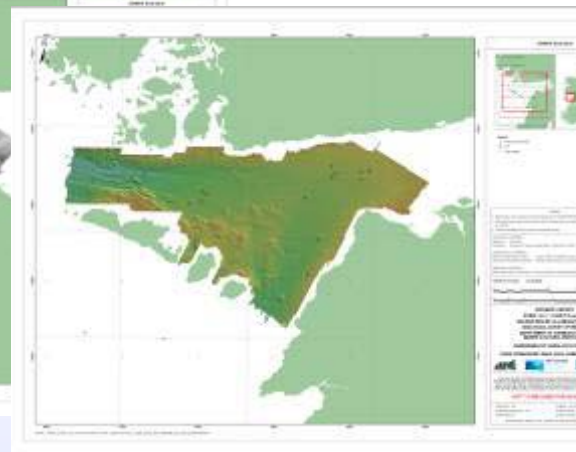
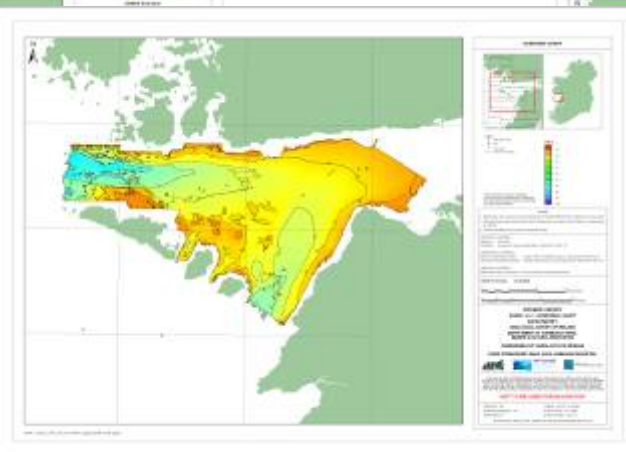
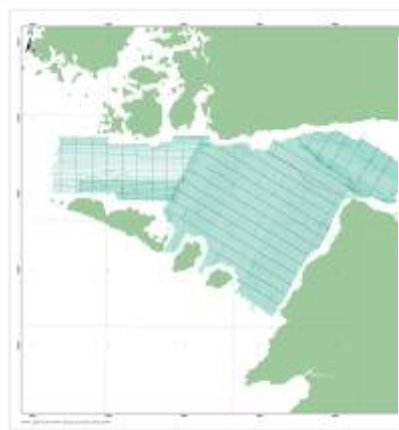


Pre-2006 partial coverage

2006 SW & W

2007 W & S

2008 NW & Dublin

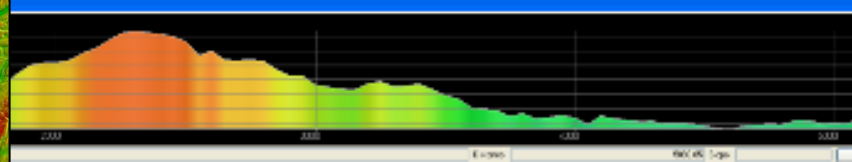
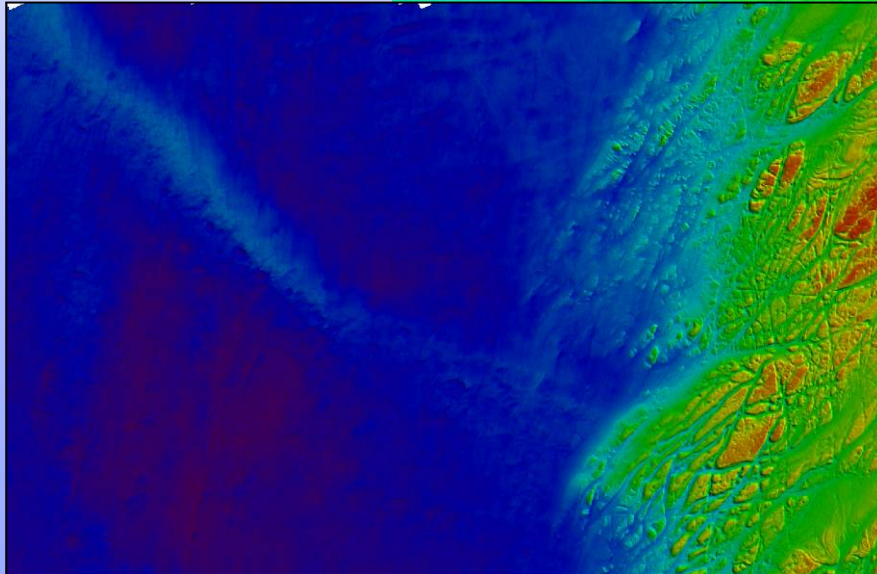
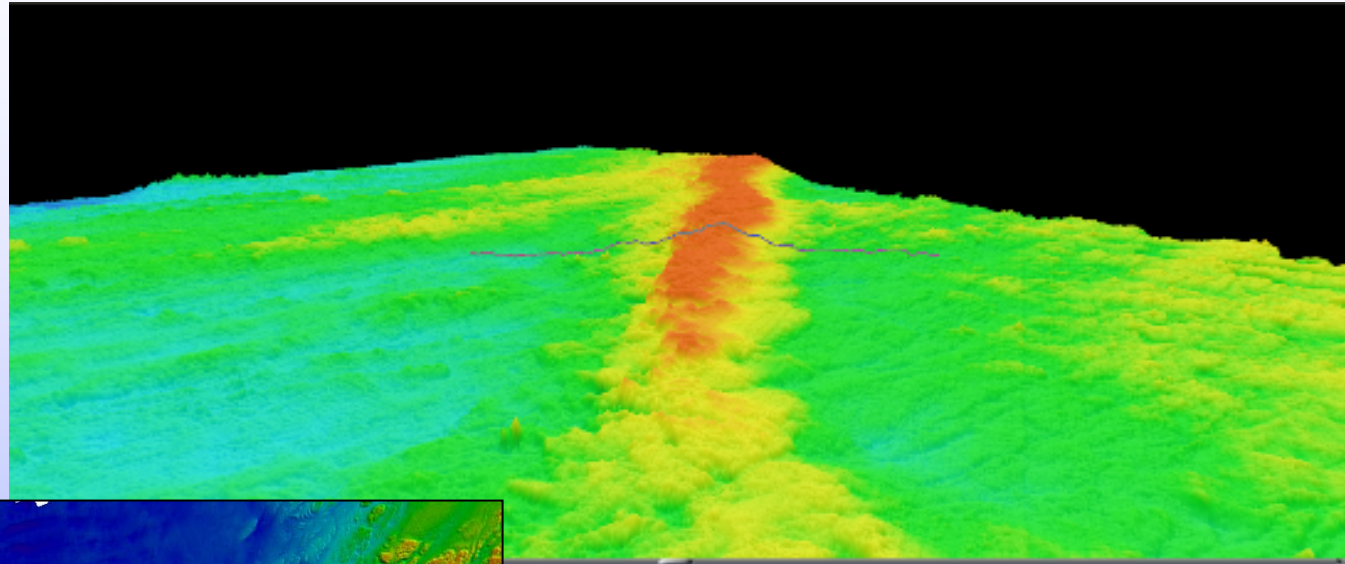
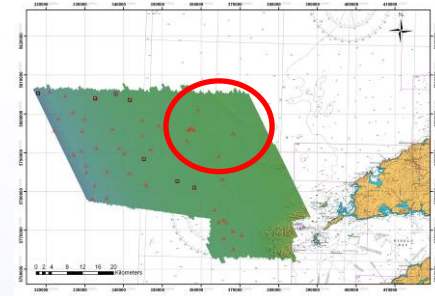




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Possible end moraine feature standing 5 meters above the surrounding seabed and extending over 15 km long outside of the survey area. It has a SE-NW curvilinear direction

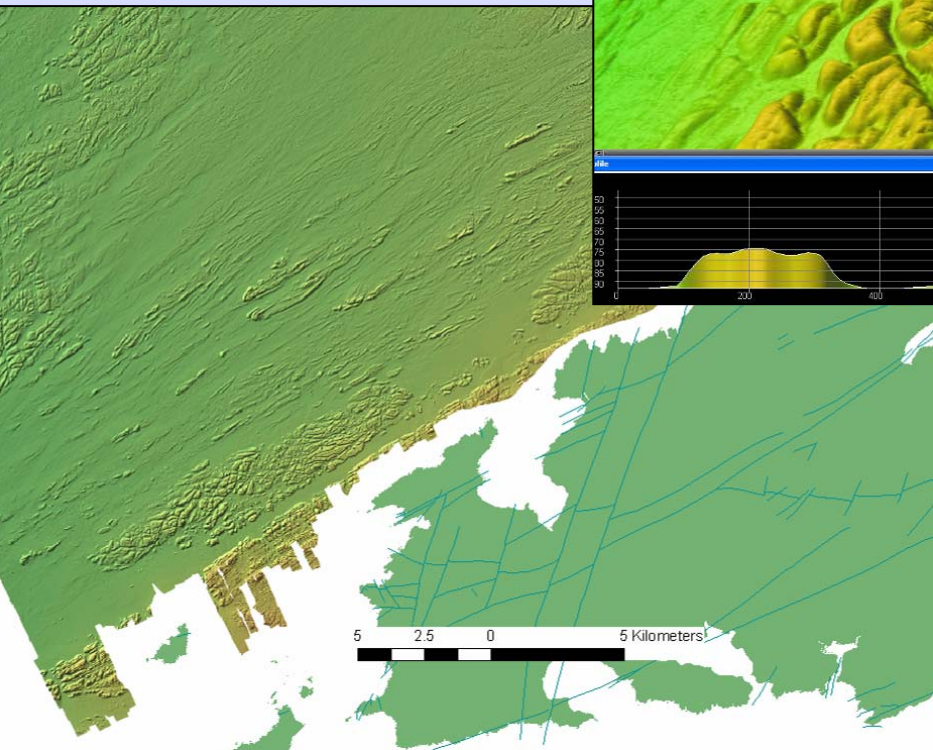
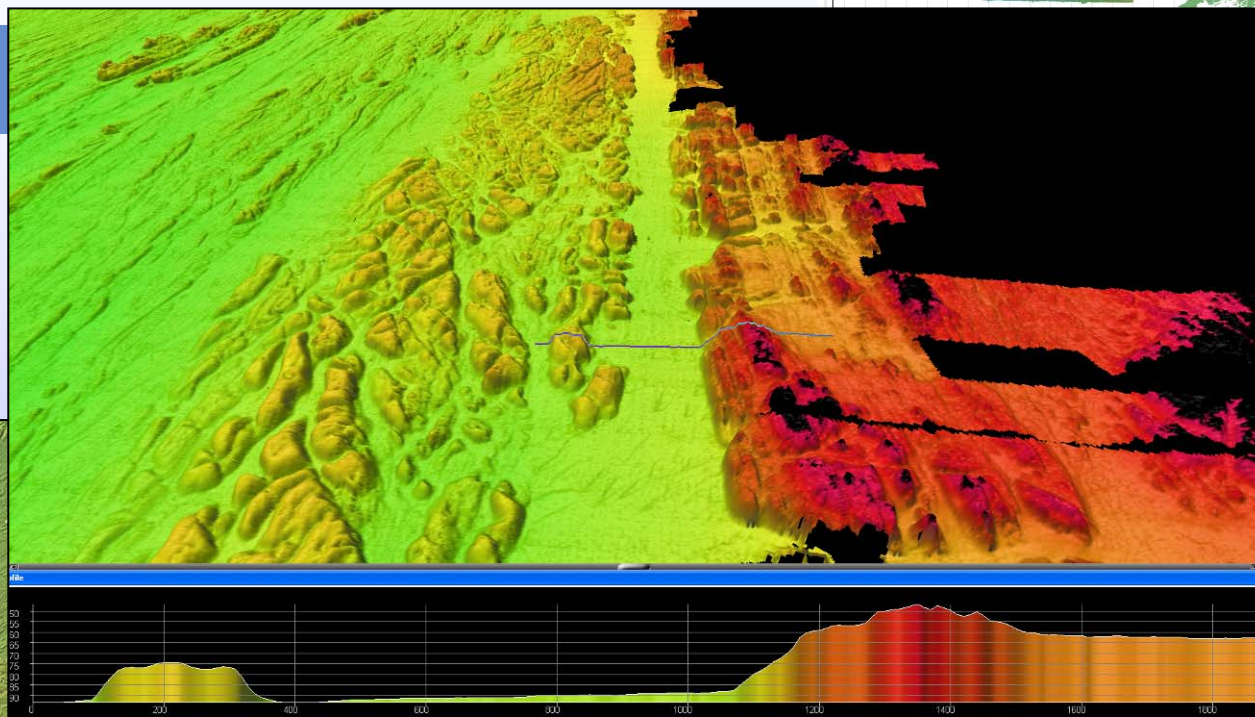




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Image from Fledermaus 3D visualisation software, showing oblique view east along Trench and vertically exaggerated cross section, indicating width of over 400m, relief of 30m on southern scarp and 20 m on north.



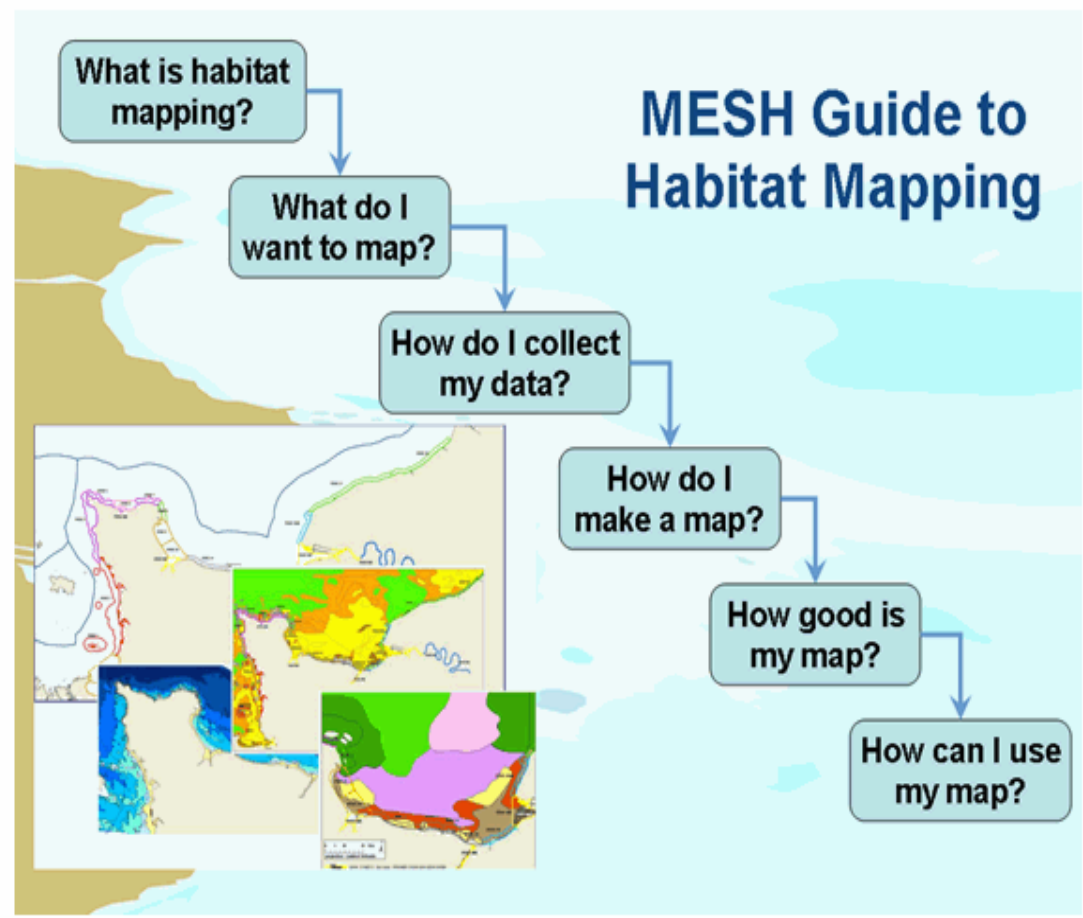


Habitat Mapping Policy drivers

- Habitats Directive
 - Selection of SACs, assessment of Favourable Conservation Status
- Water Framework Directive
 - Monitoring programmes, hydromorphological assessments, ecological assessments
- EIAs and SEAs
- State of the Seas assessments
 - Distribution, extent and quality of seabed habitats
- Marine Spatial Planning
 - Planning and regulation of activities in relation to seabed resource
- European Marine Strategy
- Marine Framework Directive and more...

- home
- MESH Guide to Habitat Mapping
 - What is habitat mapping?
 - What do I want to map?
 - How do I collect my data?
 - How do I make a map?
 - How good is my map?
 - What can I do with my map?

The MESH Guide aims to provide a methodological framework for marine habitat mapping so that future mapping studies will produce high quality data and maps which are inter-compatible and their outputs can be assimilated into common, harmonised maps.



The MESH Guide has six sections explaining the steps to producing and using seabed habitat maps.

What Is Habitat Mapping?

Describes concepts of habitats and habitat mapping, and outlines the main issues end-users need to understand to ensure the products are fit for purpose.



Standards & Protocols

Standards apply to **data** and ensure:

- 2nd iteration published in September 2006
- quality assurance
- common terminology and formats,
- Final version published February 2007
- compatibility of data between different techniques
- compatibility of data between different techniques
- Remote sensing techniques

Protocols apply to **methods** and ensure:

- consistency in survey methodology,
- *In situ* techniques
- consistency in data interpretation and
- Video & imagery facilities
- common methods for extrapolation.

Review of standards and protocols for seabed habitat mapping



February 2007



Review of standards and protocols for seabed habitat mapping



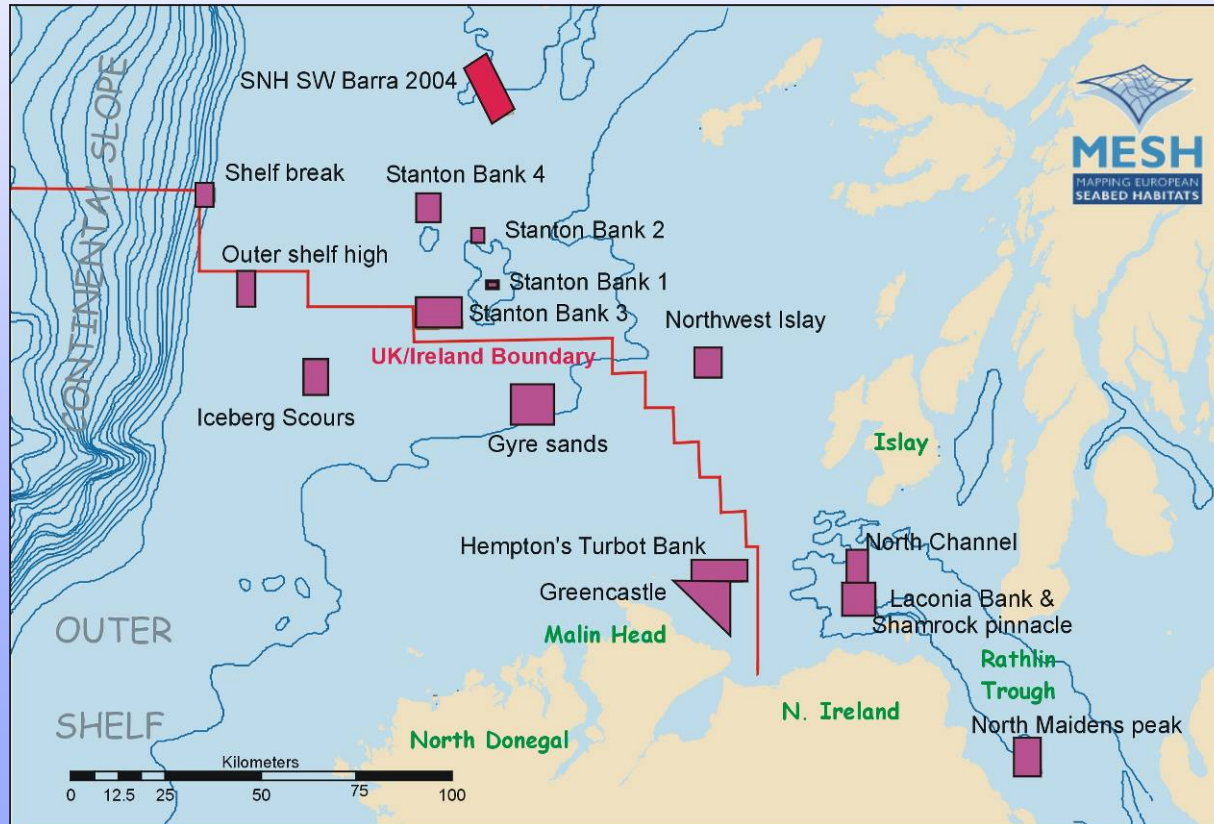
Recommended Operating Guidelines

- Pre installation checks
 - Power and space requirements
 - Weight check
 - Transport requirements
 - Temperature ratings should be noted.
 - Mobilisation protocols and vessel storage requirements
- Test and verification protocols
 - Calibration – time and other equipment
- Operation guidelines
- QC procedures
 - What should you check
 - How frequently
- Data storage & backup recommendations
- Recommended logging information
- Demobilisation notes









Consortium



2004

-  R.V. *Celtic Explorer* & R.V. *Loch Foyle* – geophysical survey, sampling & UWTV – Hempton Bank

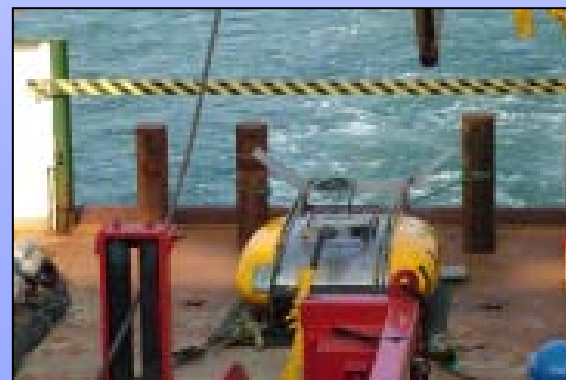
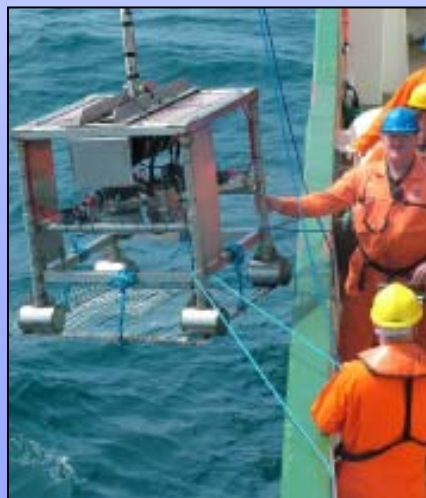
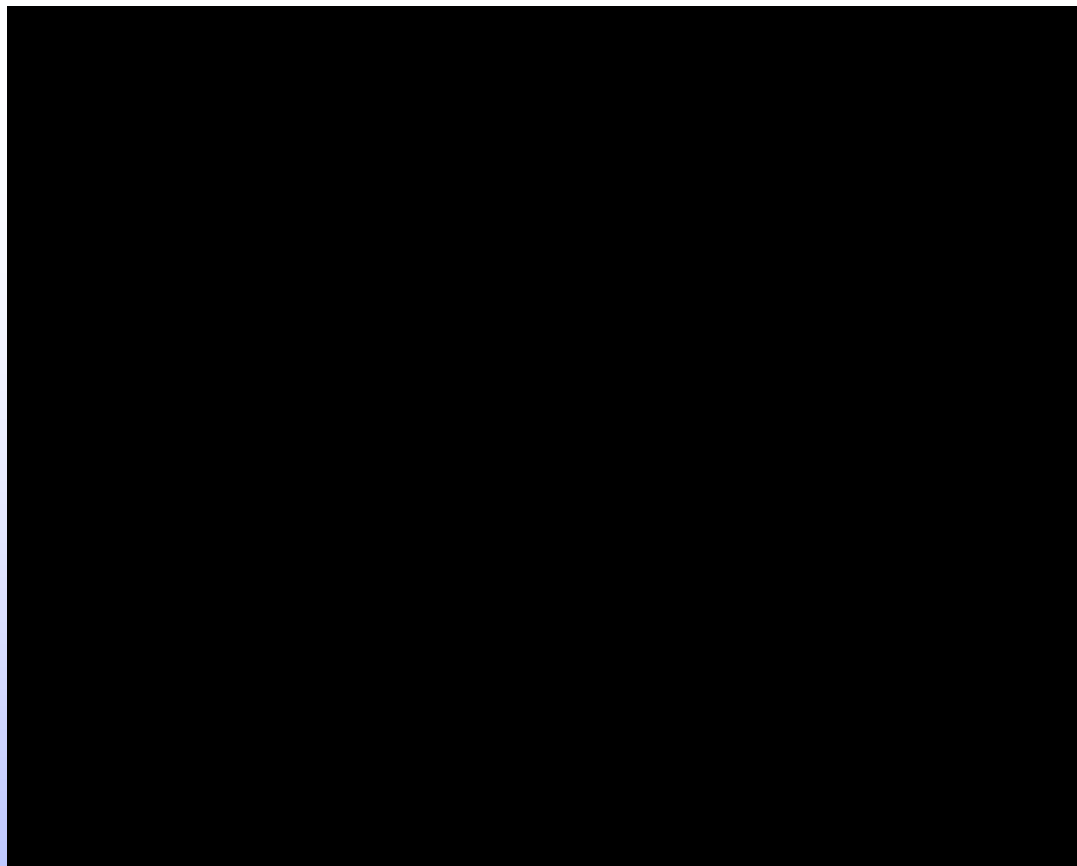
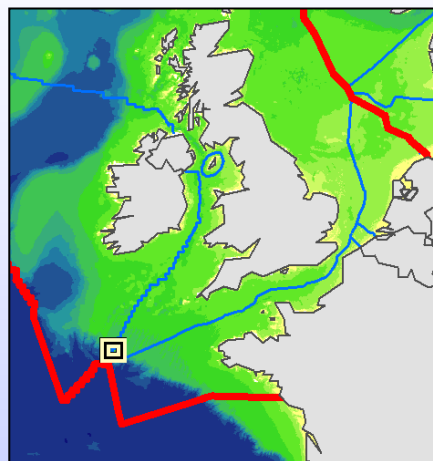
2005

-  R.V. *Corystes* sampling and UWTV
-  R.R.S *Charles Darwin* seismic survey
-  R.V. *Celtic Voyager*, geophysical survey, sampling, UWTV



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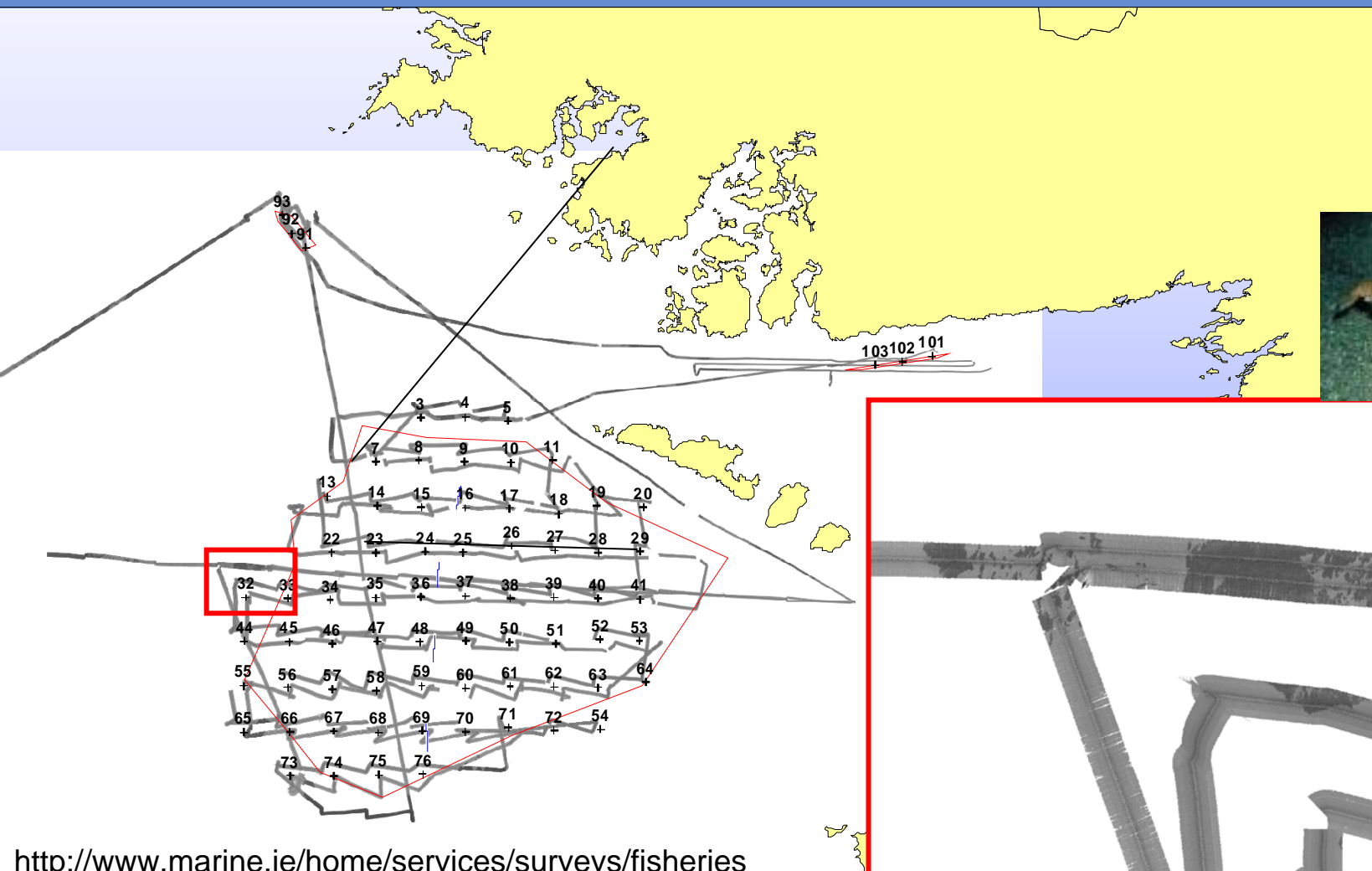
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- Aran Grounds
- Celtic Sea
- Irish Sea (MI / AFBI)

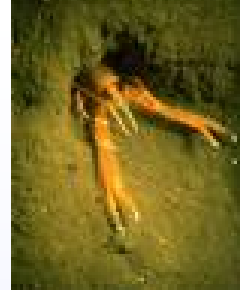
Nephrops surveys – Fisheries Management Advice



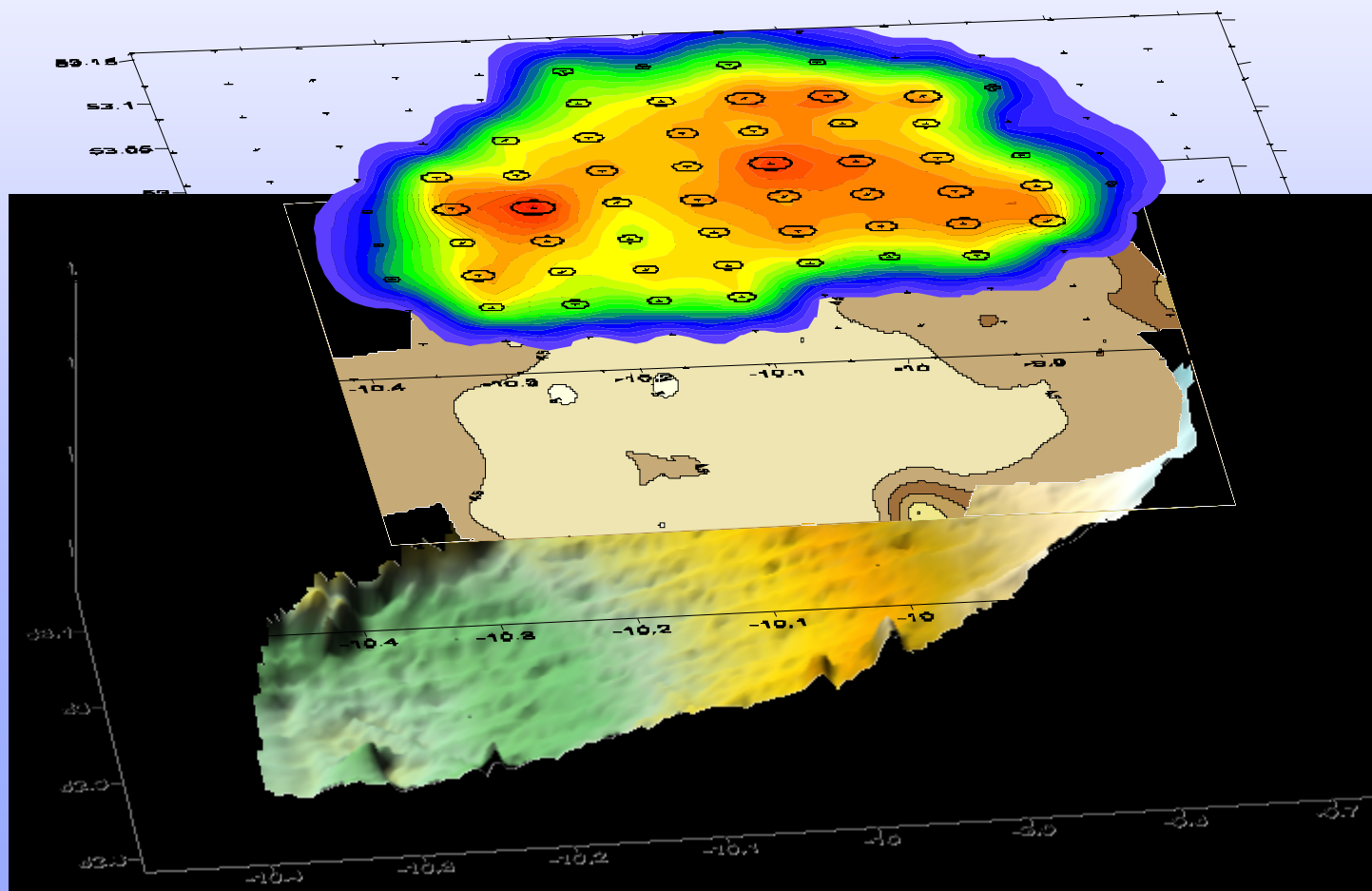


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Nephrops - Integration of physical and biological data



Density of
Nephrops
Burrows

Sediment
distribution

Bathymetry
of Aran
grounds



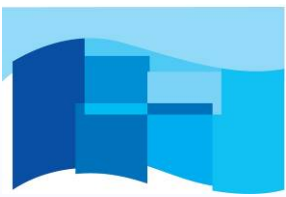
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The Joint Irish Bathymetric Survey

- To promote joint action to survey the seabed in such a way as to satisfy the needs of many organisations
- Area – The 3nm coastal strip
- Multibeam bathymetry
- Backscatter
- Seabed Texture Sheets (incl. Grabs)
- Currents, tides, temperature
- Serve up data on the internet (GSF)



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Why?

- Poor existing data (many areas Victorian vintage)
- Disparate data gathering programmes
- Cross-border knowledge transfer
- Demonstrate Good Practice
- Demonstrate efficiencies
- Show what can be done (UK Marine Bill, MDIP, demand for data, Cross-Border)



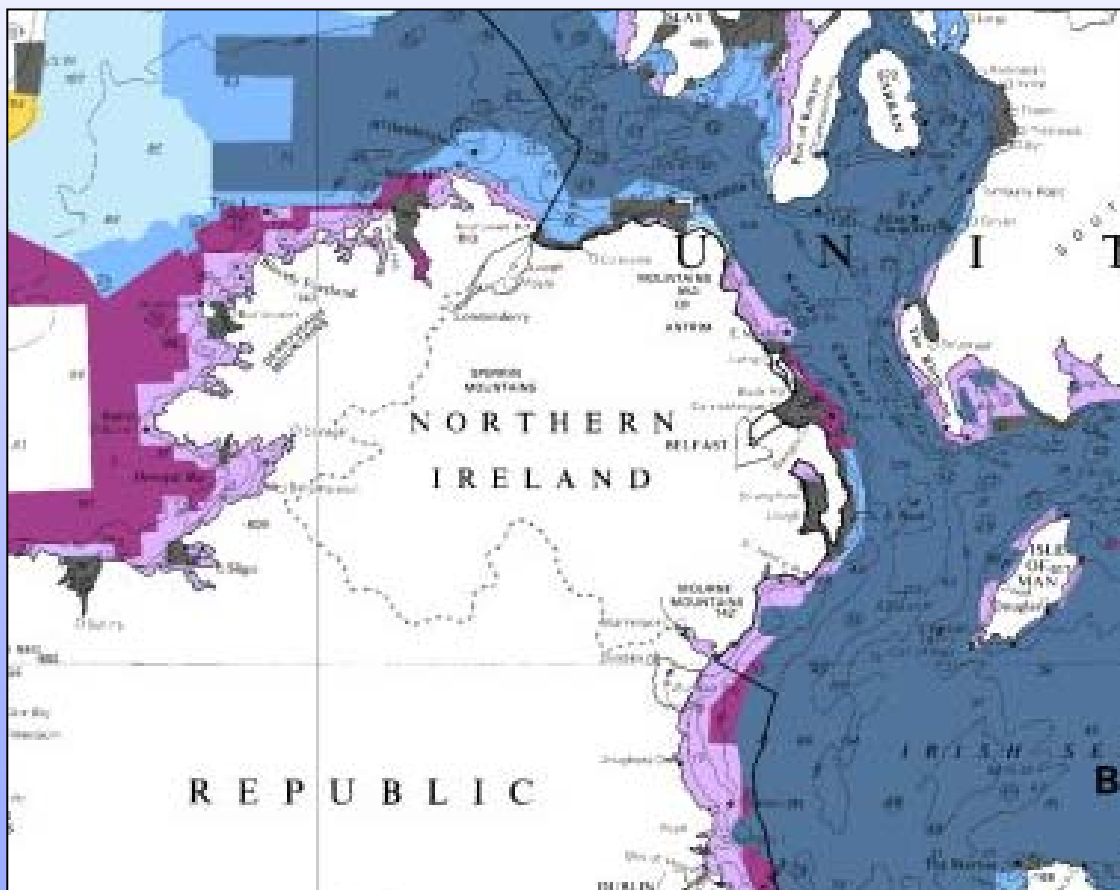
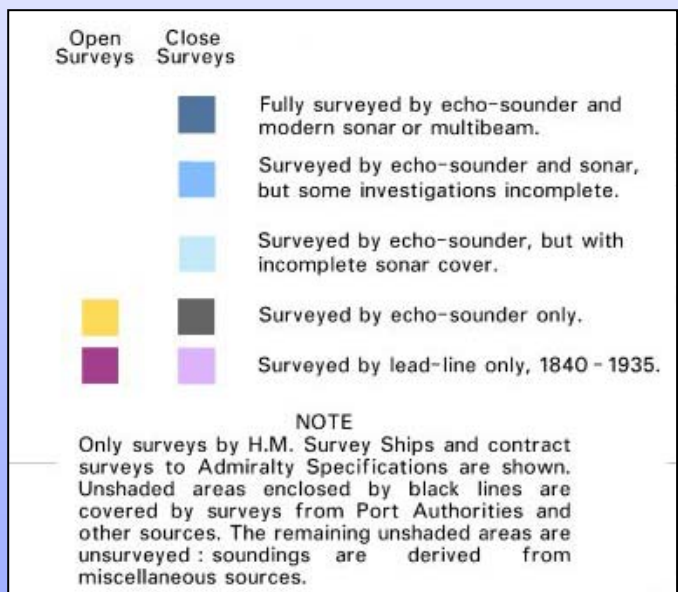
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JIBS

Joint Irish
Bathymetric
Survey

State of Play





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How We'll Do It



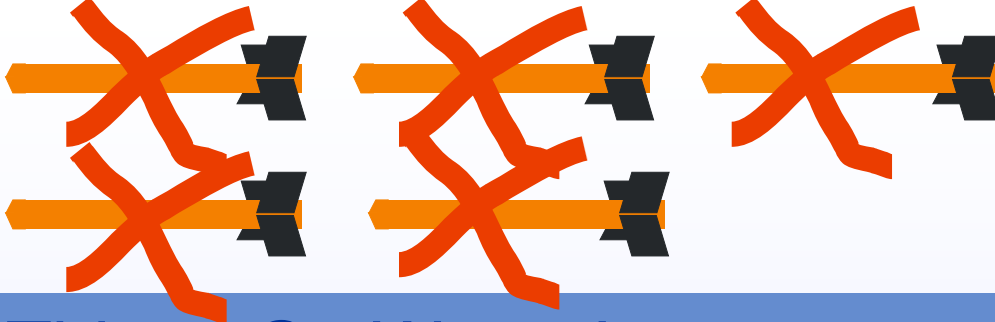
- Scoping the survey
- Undertaking the surveys
- Data interpretation
- Delivering the results
- Publicity



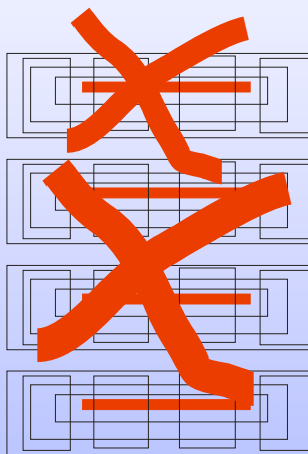


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When Things Go Wrong!

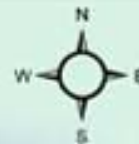




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INFOMAR and You ?

- INFOMAR has relevance to nearly all areas of Marine Survey
- Providing baseline data sets
- Making data available
- Providing a broad set of expertise
- Opportunities for collaboration

Thank you

