National Marine Baseline Survey 1995

Littoral Cell 10
Bardsey Sound to Great Orme

ENVIRONMENT AGENCY

Report NC/MAR/016 Part 12 of 17

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Foreword

In recent years we have carried out National Baseline Surveys of the coastal zone which have involved analysis of samples taken at specific locations in coastal waters around England and Wales for a wide range of determinants. These data have been supplemented by further continuous analysis from the Coastal Survey Vessels and by spatial data from airborne remote sensing operations.

The dissemination of information from these data in an easily digestible form has proved to be a difficult task. To try to overcome this problem the data for the 1995 surveys have been distilled into a summary for each littoral cell.

The information in these summaries is meant to reflect the main features of the littoral cell. More extensive data as well as data collected in previous surveys are held at the National Centre and can be made available on request.

David Palmer

DAVID PALMER
MANAGER, NATIONAL CENTRE

Introduction

The object of this report is to present an overview of the results of the four 1995 surveys in a compact form. The report is accompanied by the full laboratory analysis results and a catalogue of image data stored on CD-ROM and video. In total there are seventeen parts to the report, and those parts included in this pack are listed at the end of this section.

The coastline has been divided into coastal cells, known as littoral cells using the procedure developed by HR Wallingford (Motyka and Brampton, Report SR 328, January 1993). A map of the divisions between these cells is shown in Figure (i). The rationale of these cells means that any changes within a cell should not affect adjacent cells. In addition each cell has a significantly different character to adjacent cells, in terms of geology or biology. The divisions were defined principally for coastal defence construction, but the position of boundaries have implications on water quality variations. For example, effects from effluent outfalls should not be transferred across boundaries.

The water chemistry results for each cell have been reviewed for each season. In particular the nutrient results have been investigated for high concentrations in Summer which may be linked to anthropogenic sources, and which may result in eutrophic waters. In parallel with this the chlorophyll-*a* concentrations have been studied for any increases which are linked to high nutrient values, by two techniques. Firstly, the individual samples have been investigated, and secondly, maps of the entire coastal zone have been produced to allow spatial estimates of eutrophic waters to be made.

The absolute concentration of chlorophyll-*a* is compared with a concentration of 10 µg/l. This is the level suggested as representative of a bloom event by the Department of the Environment in their document "Criteria and Procedures for Identifying Sensitive Areas and Less Sensitive Areas" which was produced as a response to the EC Urban Waste Water Treatment Directive. Although this level signifies the presence of a phytoplankton bloom, it must be associated with other indicators to show that waters are effected by eutrophication.

Dissolved metals concentrations have been investigated in terms of their relation to the Environmental Quality Standard (EQS) levels. These levels are established in response to the EC Dangerous Substances Directive. The definition of the EQS level is as an annual mean. This has been calculated for any sites in which an individual sample exceeds the EQS. Organic contaminants have also been compared with EQS levels where they exist.

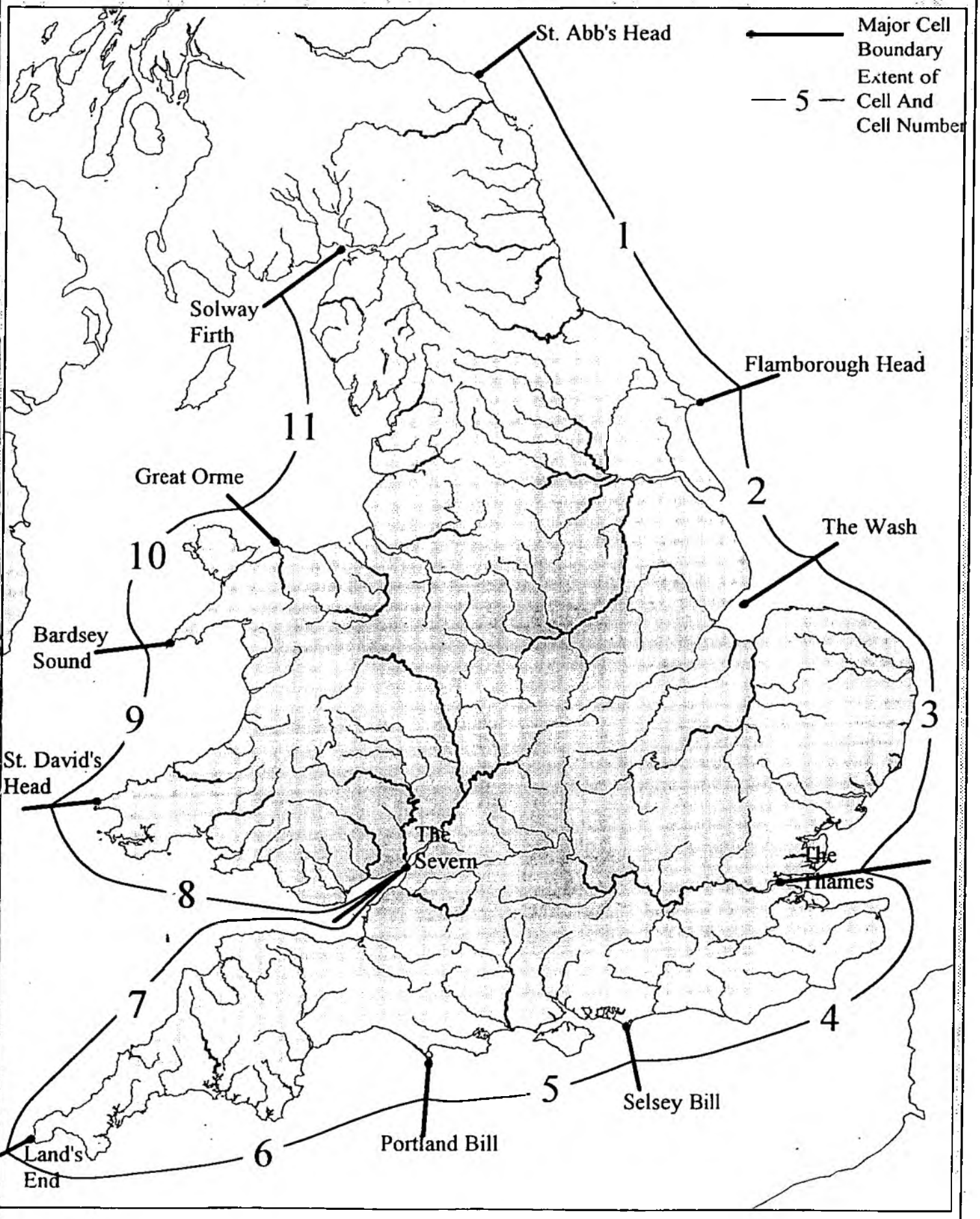
Consideration has been given to the position of the baseline sampling sites in relation to estuaries or major oceanographic features.

The image data and underway data have been investigated for major oceanographic features and changes in water quality. These may be manifested in the image data in two ways. Features are seen in the CASI imagery if they result in an alteration in the ocean colour signal. This usually requires a change in the amount of light scattered or absorbed by particles in the water column. Features such as estuarine plumes have higher particulate matter loading which increases the ocean colour sighal. Phytoplankton blooms increase the absorption of light in selected wavebands and moreover result in fluorescence being detected in other wavebands. Some features do not record a CASI signal but have a difference in water temperature. The thermal video systems used in the baseline survey record only the surface temperature of the water, but clearly show features such as effluent discharges and outfalls from power station cooling systems, in addition to river plumes.

The underway data illustrates changes in temperature, salinity, dissolved oxygen, transmission and fluorescence. The longitudinal profiles from the underway systems have been investigated for major changes which may be associated with estuarine inputs or fronts between different water bodies. Data from the Skalar continuous monitoring nutrient analyser have been investigated to determine the geographical extent of elevated samples in the laboratory analyses.

Summaries have been produced for each littoral cell which provide a statement on the water quality of the region recorded by the baseline survey. The key local oceanographic features are also summarised.

Figure i. The Major Littoral Cells of England and Wales, After Motyka and Brampton; 1993.



* Motyka, J.M. and Brampton, A.H. (1993), "Coastal Management, Mapping of Littoral Cells", HR Wallingford.

Littoral Cell 10: Bardsey Sound to Great Orme

Executive Summary

This littoral cell extends from Bardsey Island to Great Orme, and includes the coastline of the Isle of Anglesey and the Menai Strait.

No dissolved metals concentrations were in excess of Environmental Quality Standards, and no organic determinands were detected at concentrations above the minimum reporting value of 0.001µg/l. Chlorophyll-*a* concentrations showed a seasonal cycle with highest concentrations in Spring. Elevated concentrations were seen at Great Orme in Summer, with corresponding high nutrient levels, but these were not above 10 µg/l.

Spatial chlorophyll-*a* results, both from the aircraft and the underway fluorimeter showed no areas within this littoral cell with chlorophyll-*a* concentrations in excess of 10 µg/l. Thus these waters were not subject to eutrophication at the time of the Summer survey.

The major oceanographic processes evident in this region were associated with sediment movement. Although concentrations were low, variability is high and as such is evident in the CASI imagery. Thermal video imagery revealed the extent of the outfall of cooler water from Wylfa power station, and also marked the presence of a coastal front across Malltraeth Bay, which may have implications on water quality within the bay.

1. Introduction

This littoral cell extends from Bardsey Island, off the Lleyn Peninsula in the south to Great Orme off the coast of North Wales at Llandudno, and includes the coastline of the Isle of Anglesey (see Figure 1). This represents approximately 1200 km^2 of water within the coastal zone for which the Environment Agency has responsibility for controlled waters, of which 105 km^2 are estuarine waters. Four vessel surveys for the collection of water samples for laboratory analysis and continuous data were carried out by Coastal Guardian and Vigilance. These took place in early Spring (March), late Spring (early June), Summer (July) and Autumn (September).

The vessel track passes around the north of Anglesey and does not include the Menai Strait. Two aircraft campaigns were undertaken in July and September/October. These covered the entire coastline, including inside the Menai Strait.

2. Water chemistry results

2.1 Background

There are ten baseline sampling points in this littoral cell, with in two cases extra sampling points added adjacent to the baseline sites for sampling in differing tidal conditions. The positions are marked in Figure 1.

2.2 Nutrients and chlorophyll-*a*

2.2.1 Total Oxidised Nitrogen (TON)

Total oxidised nitrogen (TON) concentrations recorded a maximum of 145 µg/l N in early Spring at Holyhead (162), with lower concentrations in Spring and Summer, typically less than 50 µg/l N. Red\Wharf Bay (164) recorded a concentration of 586.6 µg/l N in Summer. Geographically, the maximum concentration for this cell is found at the Holyhead (162) sampling station in early and late Spring and Autumn, with elevated concentrations relative to neighbouring sites found here in Summer.

2.2.2 Silicate

Silicate concentrations are low in comparison to national figures for each survey, but concentrations are highest during the early Spring and Autumn surveys. The maximum concentration was 189 µg/l Si at Dylan (159). Concentrations of silicate follow no clear geographical pattern, although elevated concentrations are seen at Holyhead (162) and Red Wharf (164) Bay in each survey.

2.2.3 Orthophosphate

Orthophosphate concentrations were consistently highest in the early Spring survey, with a maximum concentration of 22.2 µg/l P at Red Wharf (164). Late Spring concentrations were generally lower, but with a maximum of 33.9 µg/l P at Holyhead (162). In Summer most sites recorded concentrations less than 10 µg/l P, with concentrations rising once more in Autumn, to a maximum of 27.1 µg/l P at Red Wharf (164).

2.2.4 Total Ammoniacal Nitrogen (Ammonia)

Ammonia concentrations were highest in Summer, with maxima at Great Orme (165) equal to 90 µg/l N and Lynas Point (163.1) equal to 86 µg/l N. Great Orme (165) also showed a high concentration in late Spring, equal to 58 µg/l N.

2.2.5 Nitrite

Nitrite concentrations were low for the entire cell at all seasons, with concentrations seldom exceeding the laboratory MRV of 1 µg/l N. The highest concentrations were recorded in Autumn, with a maximum concentration of 12.5 µg/l N at Dylan (159).

2.2.6 Chlorophyll-a

Chlorophyll-*a* concentrations were low throughout the early Spring survey, with all concentrations less than 1.6 µg/l. The range of concentrations was much greater in late Spring, with values from 0.7 µg/l to 17.5 µg/l, the higher values being found between Middle Mouse (163) and Great Orme (165). In total four sites had concentrations above 10 µg/l which signifies the presence of a phytoplankton bloom. However, as none of these

blooms were persistent throughout the Summer, there is little evidence for eutrophication. One sampling point, Great Orme (165), showed elevated concentrations in Summer of 6.4 µg/l, and this site was again the highest in Autumn, but with a concentration of only 3.6 µg/l.

2.2.7 Nutrients/chlorophyll-a Summary

Nutrient results showed a seasonal cycle, with the highest values generally recorded in early Spring and the lowest in late Spring and Summer, which is consistent with the Spring phytoplankton bloom having passed prior to the survey, depleting nutrient stocks. The nutrient concentrations were not high at any season compared to other areas of the English and Welsh coastline.

Holyhead (162) which showed elevated concentrations of nutrients at all seasons did not show high chlorophyll-*a* concentrations. No phytoplankton blooms were recorded as persisting through the Summer.

2.3 Suspended solids

Suspended solids concentrations were low at all seasons. In early Spring concentrations recorded in this cell were on average only 4 mg/l, with a maximum of 16 mg/l at the Bardsey (156) sampling site. In Spring and Summer concentrations were generally below 2 mg/l, rising again in Autumn to a maximum of 8 mg/l in Autumn.

2.4 Metals

2.4.1 Total Mercury

Total mercury concentrations were all below the EQS of 0.3 µg/l Hg, with many sites recording concentrations less than the laboratory MRV of 0.008 µg/l Hg. The maximum concentration was recorded at Holyhead (162), in Autumn, equal to 0.2 µg/l Hg.

2.4.2 Dissolved Cadmium

Dissolved cadmium concentrations were highest between Penrhos (161) and Middle Mouse (163), at all seasons, with maxima at either Penrhos (161) or Holyhead (162). The maximum concentration of 0.064 µg/l Cd, recorded at Penrhos in Summer, was greatly below the EQS level of 2.5 µg/l Cd.

2.4.3 Dissolved Copper

Dissolved copper concentrations were highest at two sites throughout the year: Holyhead (162) and Red Wharf (164), with higher concentrations found in early Spring. In late Spring and Summer many concentrations were below the laboratory MRV of 0.2 µg/l Cu. The maximum concentration was 1.36 µg/l Cu compared with an EQS level of 5 µg/l Cu.

2.4.4 Dissolved Lead

Highest lead concentrations were recorded in Autumn, with a maximum concentration of 0.269 µg/l Pb at Aberffraw (160), compared with an EQS level of 25 µg/l Pb. Concentrations at other seasons were low, with many sites recording concentrations less than the laboratory MRV of 0.04 µg/l Pb.

2.4.5 Dissolved Arsenic

Dissolved arsenic concentrations were low at all times, with concentrations in early Spring, late Spring and Summer below the laboratory MRV of 2 µg/l As. The concentration at Middle Mouse (163) was 2.6 µg/l As, compared to an EQS level of 25 µg/l As.

2.4.6 Dissolved Zinc

Dissolved zinc concentrations were highest in early and late Spring, with a maximum concentration of 10.7 µg/l Zn at Penrhyn Colmon (157) in Spring. Concentrations were generally less than 5 µg/l Zn, compared with an EQS level of 40 µg/l Zn.

2.4.7 Dissolved Chromium

Only one sample recorded a concentrations above the MRV of 2 µg/l Cr for dissolved chromium for all four surveys, this being at Bardsey (156) in early Spring, equal to 2.73 µg/l Cr.

2.4.8 Dissolved Nickel

Dissolved nickel concentrations were low concentrations in all surveys, with all concentrations below 1µg/l Ni compared with an EQS of 30 µg/l Ni.

2.4.9 Metals Summary

Dissolved metals concentrations were generally low for this littoral cell, in comparison both with EQS levels and national average concentrations. Dissolved arsenic concentrations were, however, high in comparison to national averages, with one sample in excess of 2.6 µg/l As.

2.5 Organic Determinands

Water samples were analysed for twenty three trace organic determinands at six baseline sites within this littoral cell. In the national survey, with the exception of a few PCBs, only γ-HCH and α-HCH gave positive analyses. The other 22 determinands were not detected at their laboratory MRVs of 0.001 µg/l for the entire survey.

No samples recorded positive analyses for any organic determinand within this cell.

3. Spatial chlorophyll-*a* results

The CASI imagery has been used in combination with the laboratory baseline samples and the underway fluorimeter to produce maps of chlorophyll-*a* concentration of the coastal zone. The technique used involves calculation of the Fluorescence Line Height (FLH) of the imagery and correlation of the three measuring techniques.

Figure 2 shows the chlorophyll-*a* concentration during Summer 1995 for this littoral cell, as derived from the FLH technique. There is little variation in the chlorophyll-*a* concentrations with all areas having a concentration broadly between 2 and 4 µg/l. The figure shows an increase to the east of Great Orme Head.

Figure 3 shows the chlorophyll-*a* concentration determined from the calibration of

underway fluorimeter data. This map shows slightly more variability, with more spatial pattern. Concentrations from northern Anglesey eastward are between 4 and 6 µg/l, whereas those to the south are more typically between 2 and 4 µg/l. In addition there is a further region of higher concentration to the north of Bardsey Sound. No area shows concentrations in excess of 10 µg/l at the time of sampling.

4. Local oceanographic descriptions

Underway measurements have been investigated in order to show which areas within this littoral cell show most variability in the underway parameters measured, namely temperature, salinity, fluorescence, transmission and dissolved oxygen. In addition the imagery has been studied for variation in ocean colour signal and temperature signal, or where discrete bathymetric and oceanographic features are visible during either the July or September surveys. These areas will be discussed in more detail below, in terms of results from remote sensing imagery, laboratory sampling and underway measurements. This will provide an overview of the results for this section of coastline. The areas are as follows.

1. Bardsey Sound
2. Malltraeth Bay
3. Holyhead
4. Wylfa Power Station
5. Beaumaris
6. Conwy and Great Orme

4.1 Bardsey Sound

CASI imagery from Bardsey Sound, off the tip of the Lleyn Peninsula, shows the presence of a coastal front in July, between waters higher in suspended solids, thus having a brighter ocean colour signal towards the coast, and those lower in suspended solids to the west. This feature extends around the headland, enclosing an area of higher suspended solids along the coast towards Penrhyn Colmon (Plate 1, upper image). Imagery from September does not show this front, with instead a streak of higher reflectance marking a similar position (Plate 1, lower image).

Underway measurements in this region are collected within Bardsey Sound. Little variation is seen in the transmission results, which is due to the low concentrations of suspended solids in this region, as recorded by laboratory samples. A variation in both the temperature and salinity is recorded to the east of Bardsey Island in each of the surveys, which suggests that this is the extension of the front to the south east as shown in the July imagery. Temperature is higher and salinity lower within the high suspended solids region close to the coast, as is expected with a coastal front.

The variability in the presence of the front in the imagery may be explained by the varying tidal state between the two images. In July, the tidal stream direction is towards

the north. This northward flow is forcing the coastal water against the headland, and around to the north. In September this flow is reversed, towards the south. This is allowing the coastal water to mix with the offshore water, with some sign of this coastal water visible in the streak of sediment.

The laboratory sampling site for this area is located approximately half way between Bardsey Island and the mainland, marked X 156 on the images. Thus its location is within the frontal region, which may have implications on the results, particularly for suspended solids. This is clearly seen in the Winter survey, which records the highest concentration of suspended solids for this littoral cell. Dissolved metals results in Winter, in particular those for dissolved chromium and dissolved zinc, record elevated concentrations with respect to other sampling sites along the coastline of this littoral cell. Concentrations are similar to those recorded at Porth Ceiriad (155), which is also within this region of higher suspended solids.

The variability in the position of this feature means that there is exchange of dissolved and particulate matter between coastal and offshore waters, which would potentially result in the entrapment of pollutants in the coastal zone. This feature therefore has less implications on the water quality of the local area than a more permanent structure.

4.2 Malltraeth Bay

CASI and thermal imagery records the position of a distinct coastal front across Malltraeth Bay on the West coast of Anglesey on 13th July 1995 (Plate 2). Waters within the bay are warmer with a higher reflectance signifying higher suspended solids concentrations. The underway data from Coastal Guardian for July also shows this change with an increase in temperature, a decrease in salinity and a slight decrease in transmission, signifying higher suspended solids.

CASI data for September 29th does not show a clear front across the bay, although a general increase in reflectance is seen (Plate 3). The underway data does not detect any significant changes during this survey. The tidal stream is similar between this imagery and that recorded in July, thus tidal factors are not controlling the formation of the structure. Weather conditions were, however, variable between the two images, with a strong wind parallel to the coast in July, and an offshore wind in September. This offshore wind would promote mixing of the two water masses, and lead to the breakdown of the frontal structure.

There are two possible sources of the high suspended solids water within the bay in July. Firstly, it may be originating from the Menai Strait which also shows raised levels of suspended solids and subsequently being trapped within Malltraeth Bay. Alternatively the higher area of solids may be due to the flow of sediment off Malltraeth Sands. The decrease in salinity shows that the second scenario is the more likely explanation, as the salinity of Menai Strait is similar to that of coastal waters.

If entrapment of water from the Menai Strait were occurring this could have implications on the water quality of Malltraeth Bay as the Menai waters would carry higher nutrient loadings, as a result of the discharge of sewage into the Straits.

4.3 Holyhead

The baseline imagery from 1995 shows evidence of the variation of water quality in the inland seas separating Holy Island from mainland Anglesey. The tidal currents in this region are thought to have an effect on the siltation of these water bodies. At present the flight lines extend only as far as the most northern area of water, which is seen to have a higher reflectance, which may signify either high suspended solids or underlying bathymetry (see Plate 4).

4.4 Wylfa Power Station

Plate 5 shows thermal video imagery of the north Anglesey coast, off Wylfa Head. The Wylfa power station is clearly shown as a cooler series of buildings in both July and October. In addition a discharge of warmer than ambient temperature water is seen on both occasions. On both dates the flow of water is westwards. In July the warmer water extends down the coast until Harry Furlongs Rocks, the position of which is marked on the Plate. These rocks appear to act as a barrier to further flow, at least at the surface.

In July the image was taken at three hours before High Water at Holyhead, when water is flowing towards Holyhead. The flow is contrary to the major tidal stream, which at this time is directed eastward. The indented nature of this coastline means that tidal currents play a minor role in determining the direction of flow, with most embayments acting as independent units. In October, the image was taken close to High water at Holyhead, which partially accounts for the smaller influence of warmer water. In addition, the differential temperature may be less during October, when the ocean temperature has increased through the summer months. This means that the thermal effects of the discharge are less clearly seen.

The underway data does not shows the presence of this discharge in the continuous temperature profile. This indicates that the effects are localised and coastal, and that no significant warming occurs of waters more than 0.5 km offshore. The thermal video system records only the surface temperature of the water. The full extent of influence of the power station outfall could only be assessed using vertical temperature profiles.

4.5 Beaumaris

Complex structures are shown up in the CASI and thermal imagery of the Beaumaris region on the 13th July 1995. Two anticlockwise gyres are seen extending from close to the shore of the mainland across towards Beaumaris, being deflected close to the position of the deeper water channel (see Plate 6(i)). These gyres have a higher temperature and are evident on the CASI imagery as the circulating water has a different suspended solids concentration to surrounding waters. This situation is repeated on 26th July 1995 and 10th October 1995, although the images from these days do not illustrate the features with such clarity (see Plate 6(ii) and (iii)).

The persistence of these features suggests that they are linked to bathymetric features, or are related to a permanent point source on land, although imagery from adjacent flight

lines shows that neither of the features have an obvious terrestrial source. In addition, this region is dominated by mud flats, with little variation in the bathymetry. The varying degree to which the features are seen is linked to the tidal state, with the image from 26th July having a much lower tidal stream velocity. This suggests that less mixing is occurring. The direction of the tidal stream is similar, although the image from the 26th July is approaching slack water. The weather conditions also vary between the images, with higher rainfall, and stronger winds on the days in which the feature is more marked.

The information collected to date does not account for the complexity in spatial patterns seen in this imagery. There are no underway measurements in this region, as the baseline track does not pass up the Menai Strait. Similarly, the nearest laboratory sample sites are located at Great Orme (165) and Red Wharf (164) Bay and would therefore not show any variation due to these features.

Although it is unlikely that the gyres of this magnitude would affect water quality in the region, there are potential implications for the positioning of effluent outfalls. It is clear from the imagery that circulation is complex and that pollutants discharged to this region would no be directly flushed out into more open waters. An understanding of the processes determining the flow in this region would therefore be beneficial. This may be achieved by the coordination of local surveys with the National Baseline Survey.

4.6 Conwy

The most easterly point of this littoral cell is Great Orme Head which is a drift divide, with littoral flow being towards Anglesey and Liverpool Bay. However it has been noted previously that tidal effects may result in flow from west to east around Great Orme. CASI imagery of the region in July suggests an eastward flow of sediment as shown in Plate 7.

The water high in suspended solids originates from Conwy Harbour, as shown in Plate 8. The Conwy River input is most clearly seen in the thermal video imagery which shows a plume of warmer water emanating from the harbour.

Underway data starts to show the effects of Liverpool Bay at Great Orme, with a general steady decrease in salinity and an increase in temperature. Transmission results show a decrease towards the east as suspended solids increase.

The Great Orme baseline sampling site (165) shows elevated concentrations of ammonia in Spring and Autumn. The site is located just off the headland, and may feasibly be affected by anthropogenic inputs from Llandudno to the east if flow were as shown in the imagery. Chlorophyll-*a* concentrations at this site are higher relative to other sites in the cell throughout the year. Samples in Spring exceed 10 µg/l indicating the presence of a bloom, but this bloom does not appear to persist throughout the summer months.

5. Conclusions

The water quality of this region was high during the 1995 survey, with low concentrations of dissolved metals, nutrients, and organic contaminants. No samples collected during 1995 were above the EQS levels for dissolved metals or organic contaminants. A clear geographical pattern was however seen, with higher concentrations of dissolved metals recorded in samples from sites between Holyhead and Great Orme, which was more industrialised than the coastline of the Lleyn Peninsula. Higher concentrations of nutrients were also seen here, which may represent the higher population density, if they are not resulting from agricultural runoff.

Spatial chlorophyll-*a* results showed that no areas within this littoral cell have chlorophyll-*a* concentrations in excess of 10 µg/l at the time of the survey.

The presence of the Isle of Anglesey at the centre of this littoral cell is the major contributor to variation in water flow and bodies of differing water characteristics. Generally, the waters from the Lleyn Peninsula to Menai Strait experience a north eastward flow, with more complex flows around the north of Anglesey. CASI imagery indicates complex flow patterns at the eastern end of the Menai Straits which may warrant further investigation.

The outfall of cooling water form the Wylfa power station is clearly seen in both aircraft surveys. The effects are confined to the coastal zone and appear to have a limited geographical extent. Further study over a full tidal cycle would allow an assessment to be made of the influence of the outfall.

Figure 1.

Littoral Cell 10*, From Bardsey Sound to Great Ormes Head.

* *After Motyka, J.M. and Brampton, A.H. (1993), "Coastal Management, Mapping of Littoral Cells".*

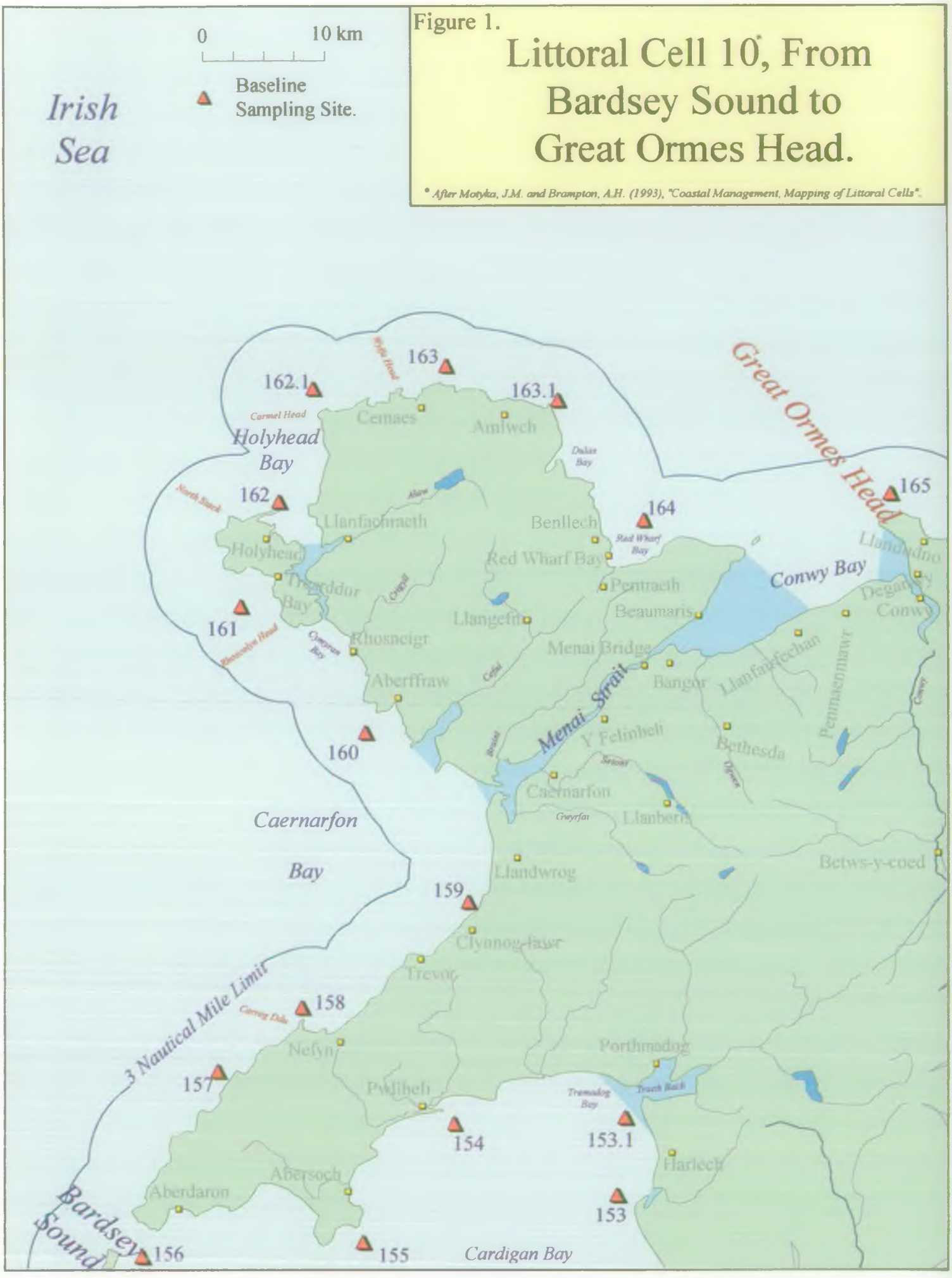


Figure 1.

Littoral Cell 10*, From Bardsey Sound to Great Ormes Head.

* After Motyka, J.M. and Brampton, A.H. (1993), "Coastal Management, Mapping of Littoral Cells".

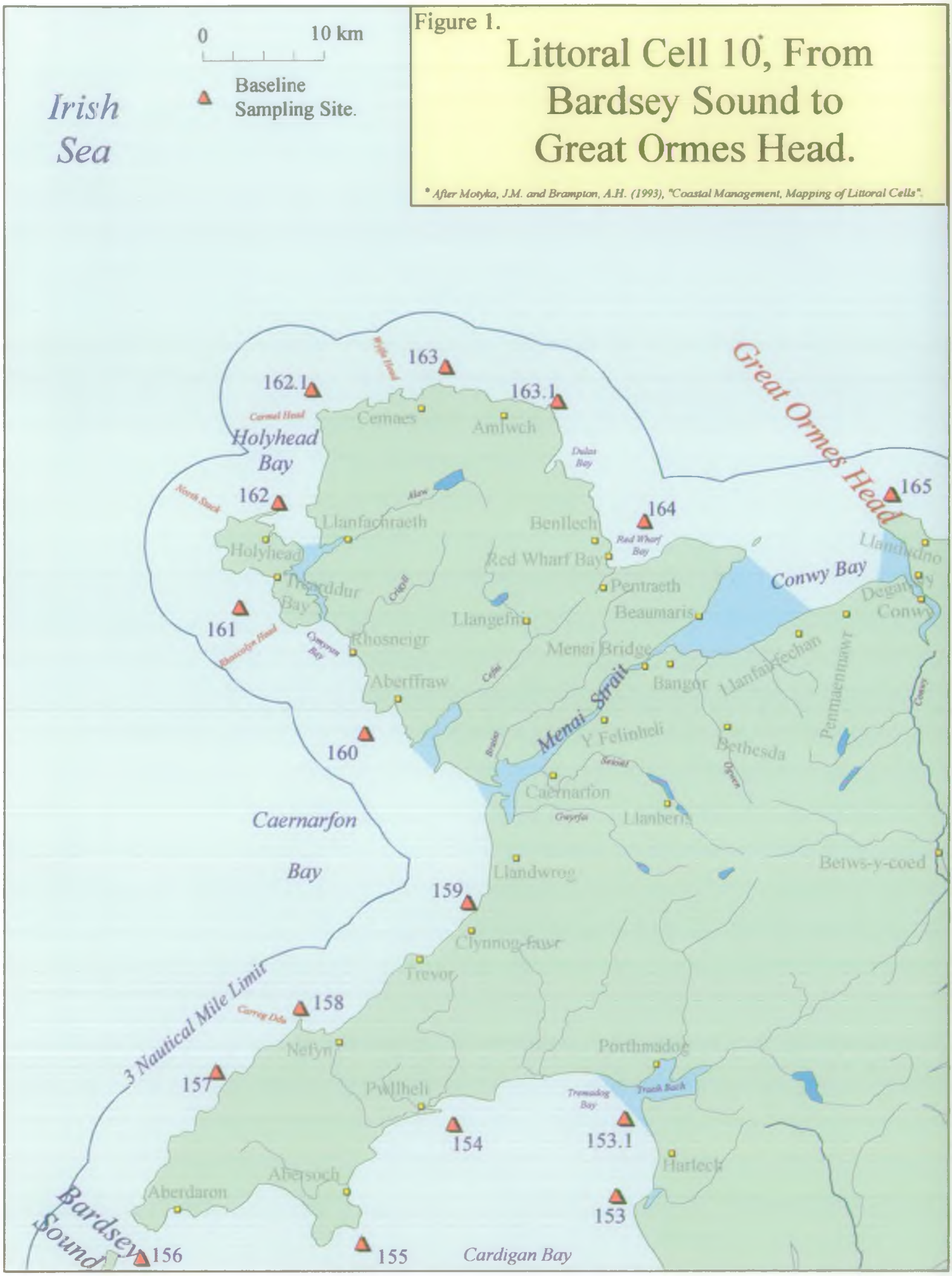
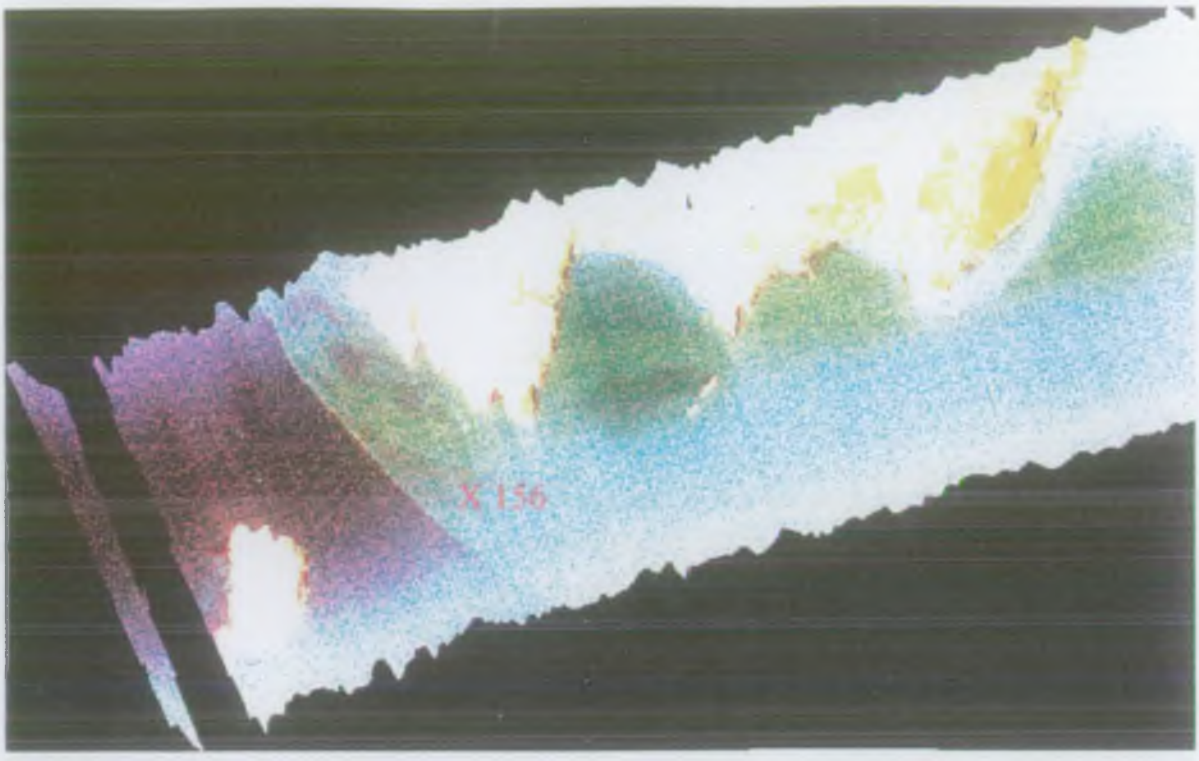


Figure 2.

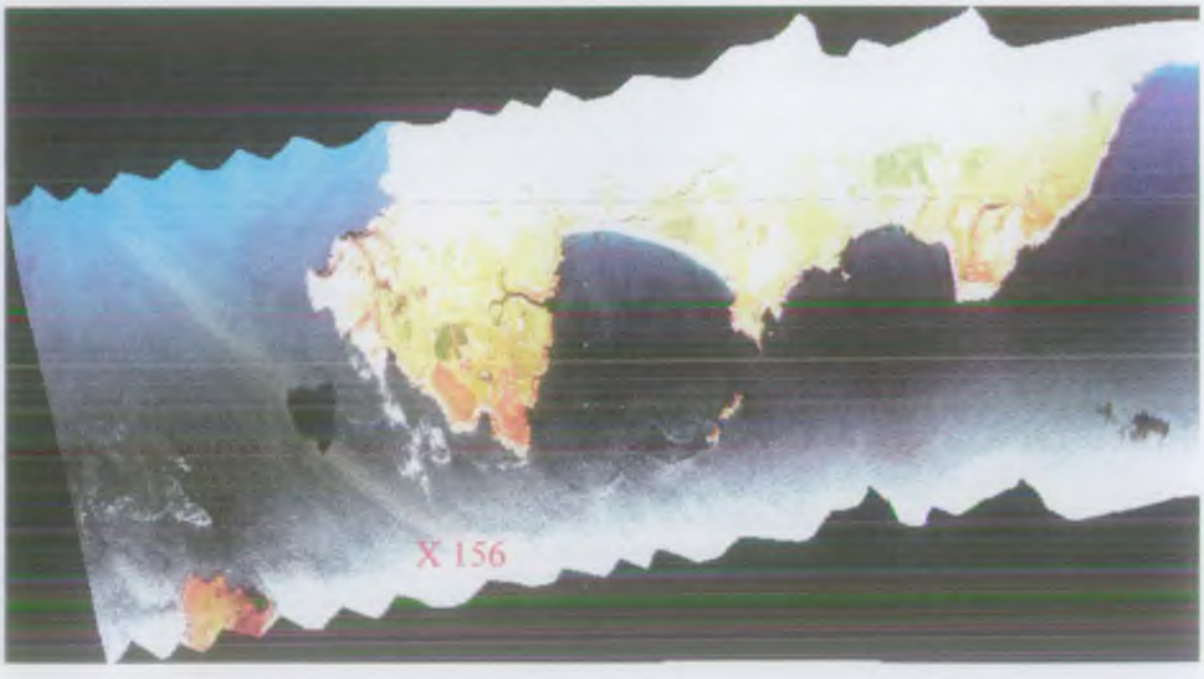
Calibrated CASI Fluoresence Line Height Image, Summer 1995.

Figure 3.

Calibrated Continuous Track Fluorimeter, Summer 1995.

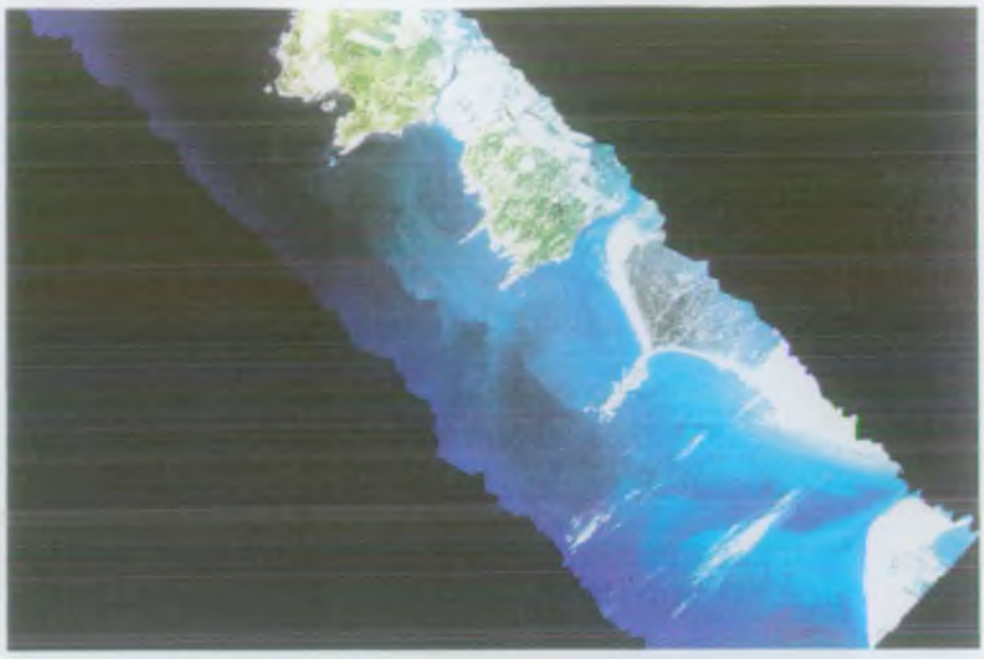


21st July 1995, 16:01 GMT



29th September 1995, 12:20 GMT

Plate 1: Bardsey Sound
CASI enhanced true colour composite images
The baseline sampling site is marked as a red cross



CASI enhanced true colour composite image

Thermal video image composite

Plate 2: Malltraeth Bay, Anglesey
13th July 1995, 10:00 GMT

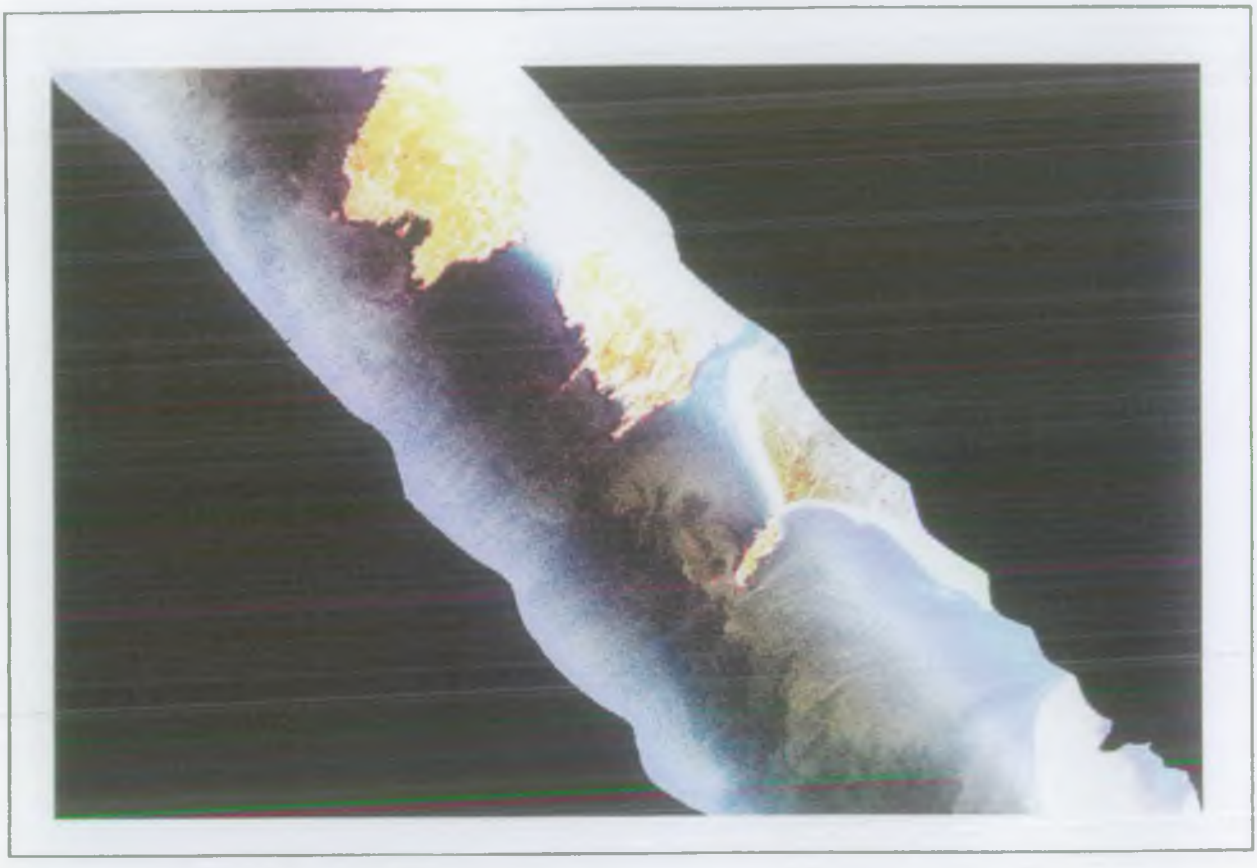
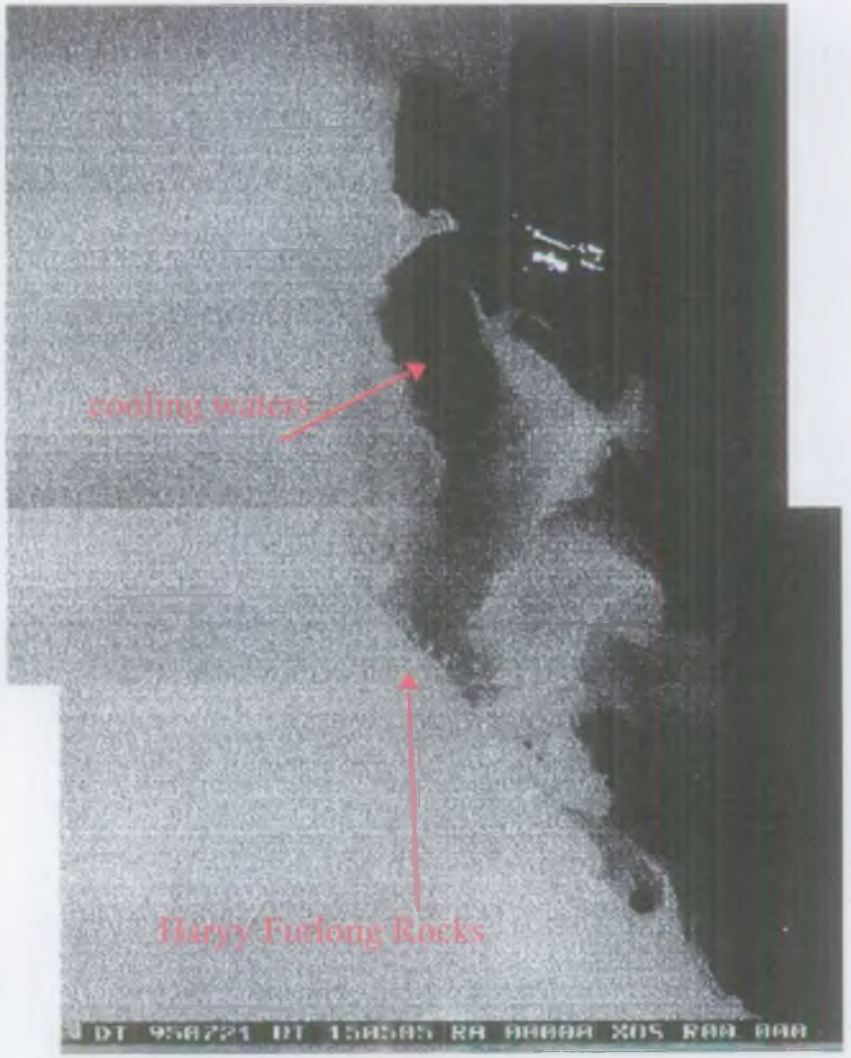


Plate 3: Malltraeth Bay, Anglesey
CASI enhanced true colour composite image
29th September 1995, 12:40 GMT

Plate 4: Holyhead Harbour
CASI enhanced true colour composite image
13th July 1995, 10:14 GMT



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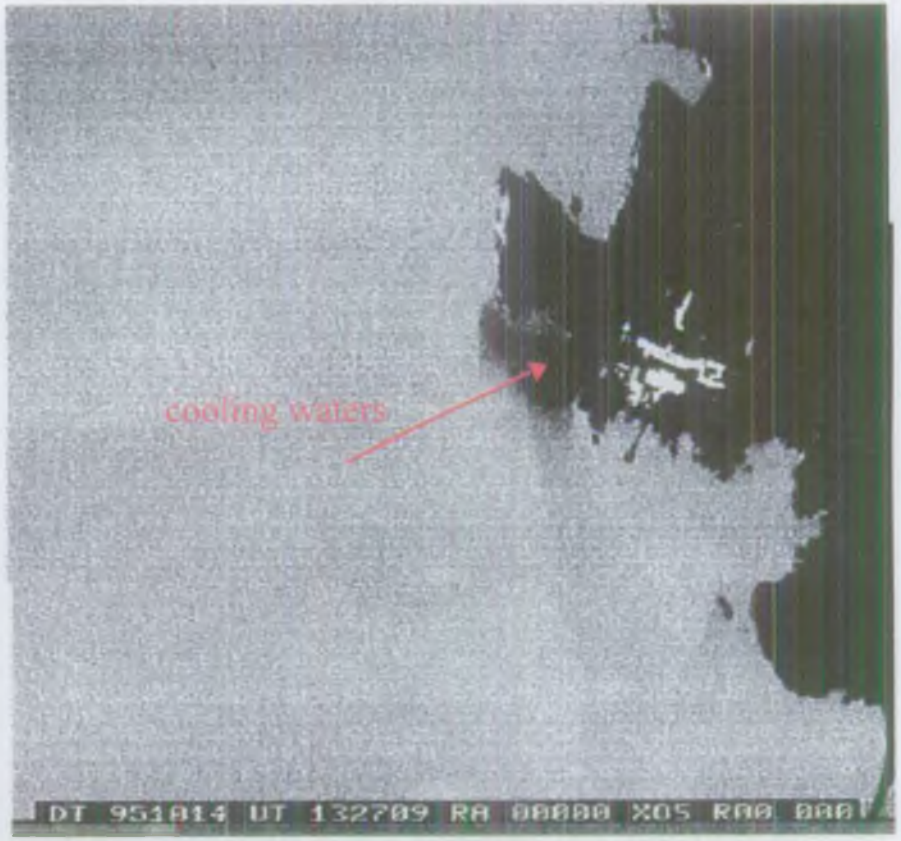
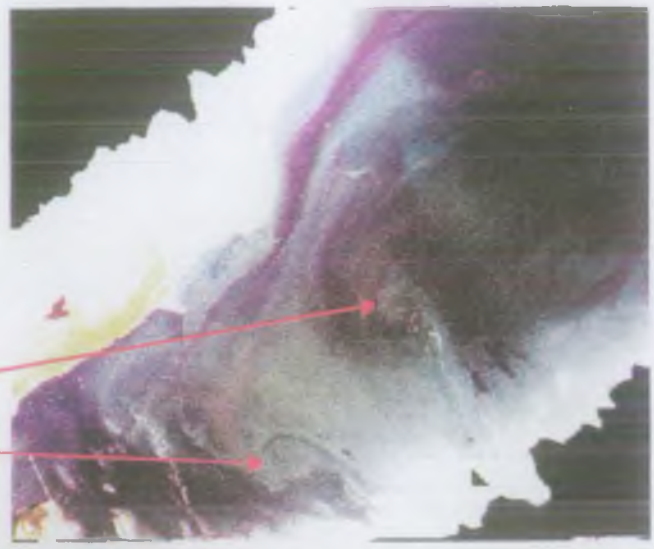


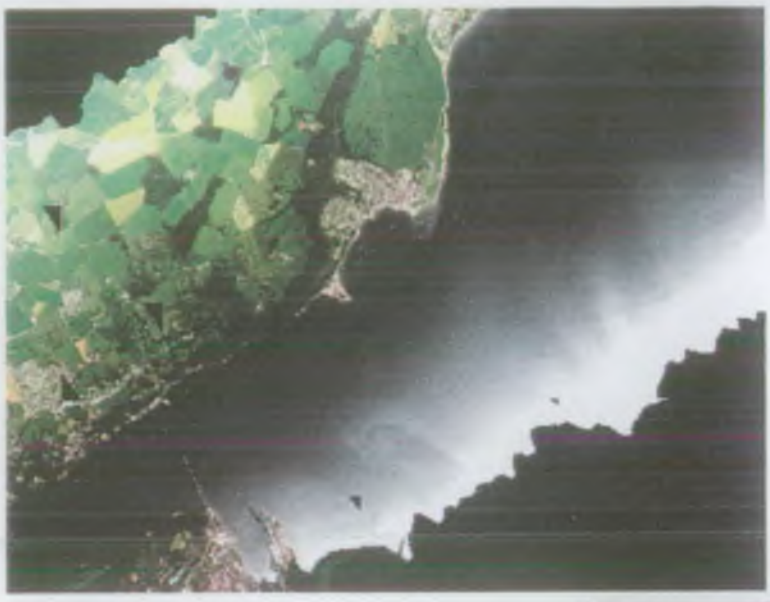
14th October 1995, 13:27 GMT

Plate 5: Wylfa power station, Anglesey
Thermal video image composites

(i) 13th July 1995, 09:46 GMT



features of interest



(ii) 26th July 1995, 09:39 GMT

(iii) 10th October 1995, 08:43 GMT

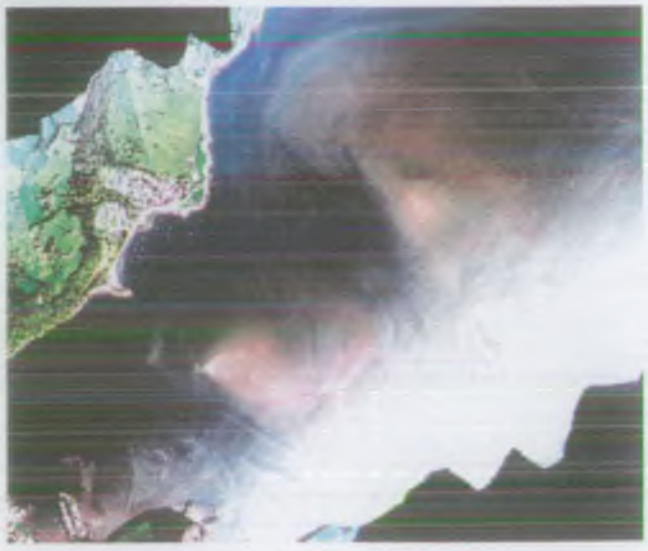


Plate 6: Beaumaris Area
CASI enhanced true colour composite images

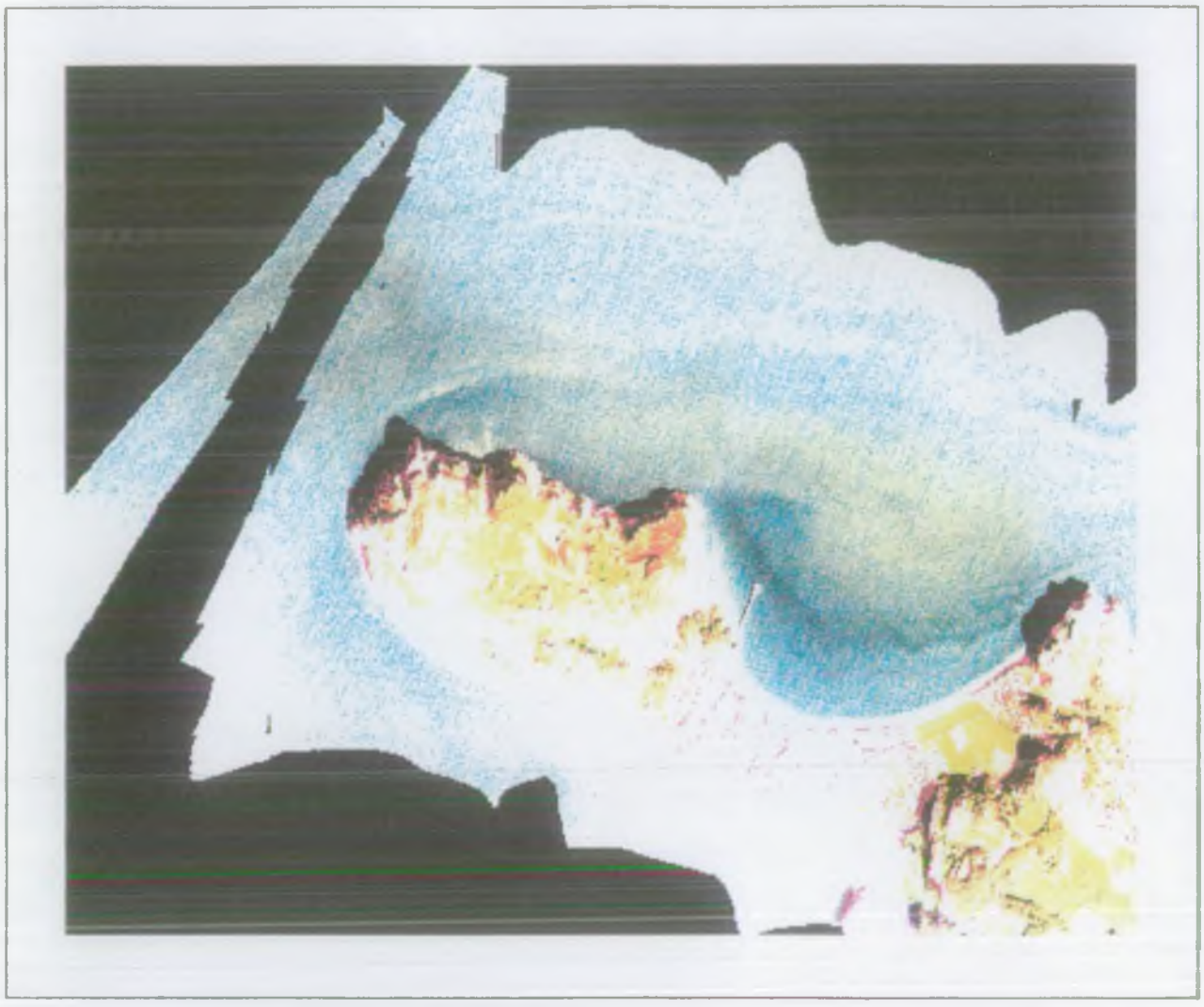


Plate 7: Great Orme Head
CASI enhanced true colour composite image
29th September 1995, 13:10 GMT

CASI enhanced true colour composite image

Thermal video composite image

Plate 8: Conwy Harbour, North Wales
29th September 1995, 12:57 GMT