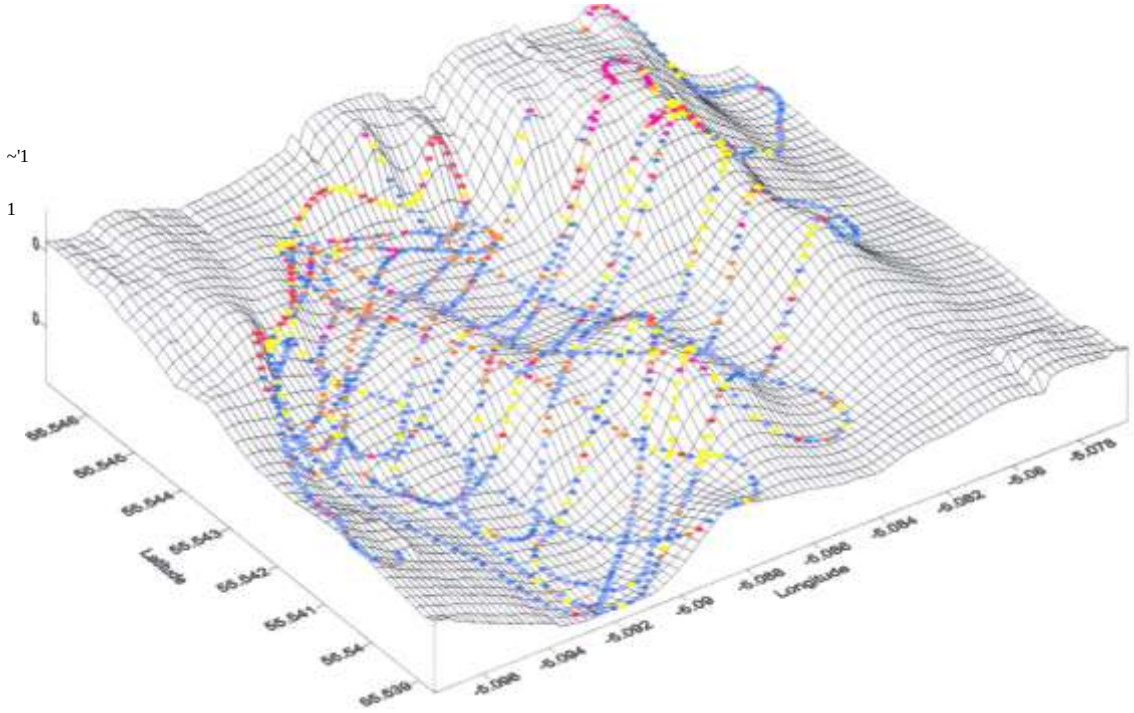
Marine Survey to Identify Maerl Beds: Lamlash Bay long Sea **Outfall**



Scottish Water Solutions Ref Num: SWS/FW/2004-0427 -01

University Marine Biological Station

June 2004

Marine Survey to Identify Maerl Beds: Lamlash Bay Long Sea Outfall

Scottish Water Solutions Ref Num: SWS/FW/2004-0427-01

N.A. Kamenos, P.G. Moore and T.D.I. Stevenson

University Marine Biological Station Millport, Isle of Cumbrae, Scotland, KA28 OEG

June 2004

BACKGROUND

Maerl is a carbonate-rich type of marine sediment deposited by loose-lying photosynthetic calcified algae (Rhodophyta, Corallinales) (Giraud and Cabioch, 1976). Maerl deposits build up over thousands of years in areas characterised by strong water movement (tidal and / or wave action) in the photic zone (Grall and Hall-Spencer, 2003). A maerl deposit is typically composed of fossil layers of maerl within the substratum overlain by a live layer at the surface which is often referred to as a maerl bed / ground or a coralline algal gravel. Varying in area from tens to 1000s m2, maerl grounds occur from the tropics to polar waters and form a gravel composed of high numbers of usually monospecific thalli (Woelkerling, 1988). Maerl deposits occur in a variety of facies classified by the degree to which maerl occurs in a deposit with other substrata such as gravel. Maerl deposits composed solely of maerl forming algae do occur. However they are not common, certainly not in the Clyde Sea area.

Such coralline algal gravels support an extremely diverse fauna and flora (BIOMAERL team, 2003; Steller *et* a/., 2003) and have significantly greater structural heterogeneity than common adjacent substrata (Kamenos *et* a/., 2003). This is perhaps to be expected, as high heterogeneity equates to high biodiversity in many marine systems (Purvis and Hector, 2000; Tilman, 2000; Sala, 2001). However, maerl is slow-growing, fragile and easily damaged and a single impaction event, such as with hydraulic fishing gear or scallop dredges significantly reduces the heterogeneity of maerl thalli by breakage, killing the thalli due to burial (Hall-Spencer and Moore, 2000; Hauton *et a/.,* 2003; Kamenos *et* a/., 2003), changing a live maerl ground into a dead maerl ground (Kamenos *et* a/., 2003). Maerl is subject to international conservation legislation provisions (Donnan and Moore, 2003).

METHODOLOGY

Surveys were carried out on the 17th and 18th June 2004 using UMBSM's R.V. Aora and diving tender in the area of the proposed pipeline as detailed in *SWS/FW 12004-0427-01.*

Site of proposed pipeline:

The site of the proposed pipeline and 50 m either side of it were surveyed using 3 SCUBA transects perpendicular to the proposed pipeline as indicated in Figures 1 & 2 during which visual observations were made and photographic evidence taken.

Site of proposed pipeline outflow and outfall area:

Proposed outflow and likely outfall areas were surveyed remotely by ship using acoustic ground discrimination techniques (QTC View Series V; Quester Tangent Corporation) and subsequently ground-truthed (using a Baird grab). Substrata possessing similar reflective properties were grouped by colour and subsequently colour classes were ground-truthed. No interpolation was added due to the 'discrete class' nature of the data *1* substrata.

RESULTS

Site of proposed pipeline:

Visibility at the time of the diving survey was good (est. - 15m) so that a much larger area was visible than that swum over.

Dive Transect 1: Substratum composed of 85-95% live (pink colour) and 15-5% dead (white / cream colour) maerl along the transect (Figure 3 & 4). White tips on live maerl are indicative of growth, indicating the thalli to be healthy. Some of the live maerl is obscured by macroalgae and algal mats in Figure 4. High invertebrate macro-benthic numbers and diversity (assessed visually) usually associated with maerl in pristine condition were present.

Dive Transect 2: Substratum composed of 20-40% live and 60-80% dead maerl, which appeared not to be anthropogenically impacted (Figure 5). Some of the live maerl is obscured by macroalgae and algal mats in Figure 5.

Dive Transect 3: Substratum composed of 10-30% live and 70-90% dead maerl, which appeared not to be anthropogenically impacted (Figure 6). Some of the live maerl is obscured by macroalgae and algal mats in Figure 6.

Site of proposed pipeline outflow and outfall area:

Directly West and southeast of the outflow there are expanses of 30-50% live 'open matrix' maerl (open matrix indicates live maerl of high heterogeneity that has not been smothered). Such maerl is present in several patches between -5 to -10 m CD to the East and West of the proposed outflow from 204800E to 205800E (Figure 2). The areas likely to be affected by any outfall from the proposed pipeline are composed primarily of 5-15% live maerl / gravel facies characterised by a more closed matrix indicative of substratum smothering or re-working (Figure 2). That area is also punctuated by areas of 30-50% live, open matrix, maerl and sandy mud / muddy sand patches.

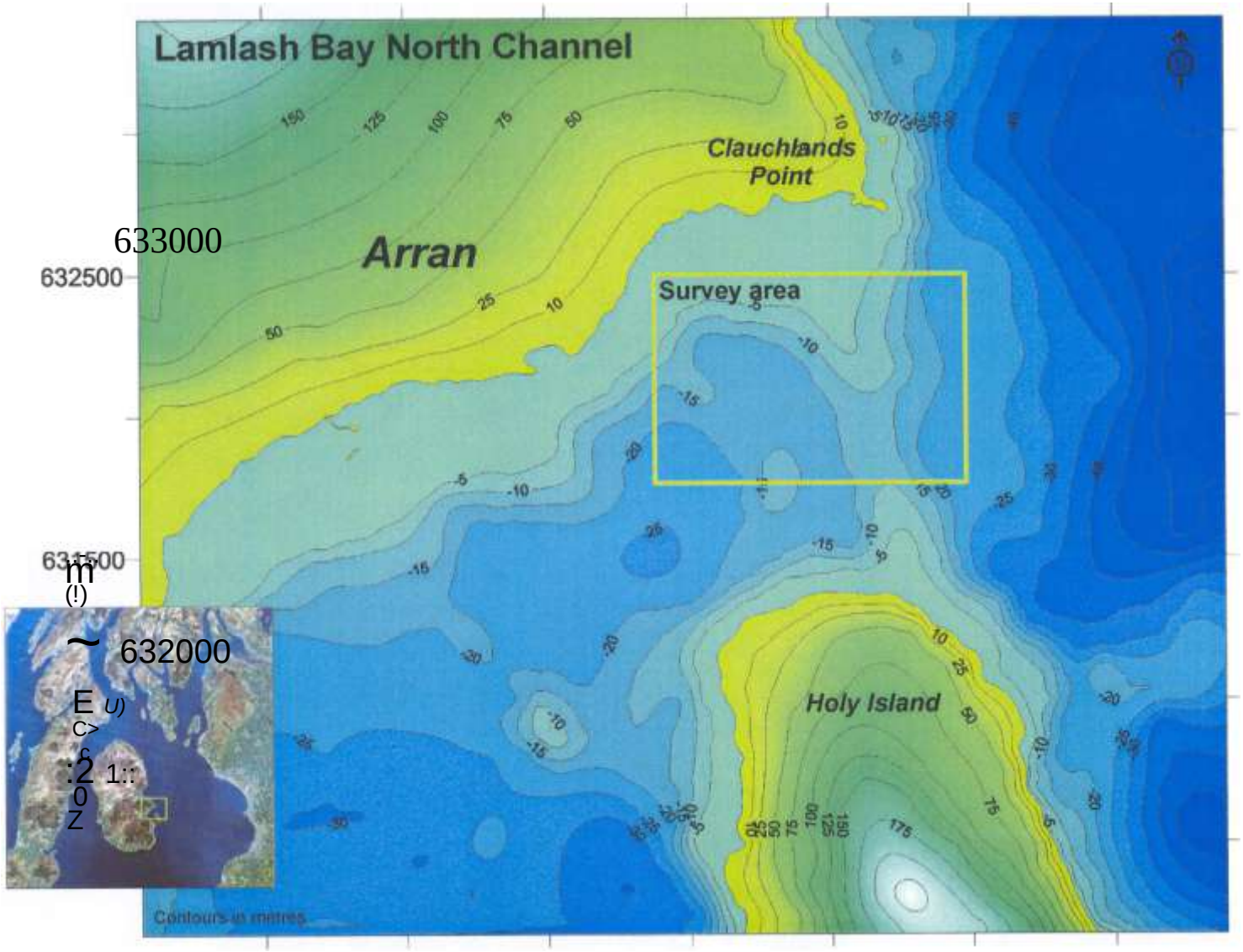

Lamlash Bay North Channel
Clauchlands Point
Arran
Survey area
Holy Island
633000
632500
631500
632000
Contours in metres

Figure 3: Live maerl from Transect 1 against gloved diver's hand

Figure 4: Photo-quadrat from Transect 1

Figure 5: Photo-quadrat fromTransect 2

Figure 6: Photo-quadrat from Transect 3

15cm

IMPACT ASSESSMENT

Site of proposed pipeline:

Direct impacts: Running a pipeline through live maerl will result in crushing and burial of the Maerl lying directly below the pipe and concrete cap. Maerl recovery from such impact is not possible.

Indirect impacts: Substratum disturbance during the laying of the pipeline will lead to high amounts of re-suspended sediment, which will smother maerl adjacent to the pipeline on settlement. Probability of maerl recovery post smothering events is unpredictable and would depend on hydrographic turbulence caused ego by storms.

Site of proposed pipeline outflow and outfall area:

Outflow: As above

Outfall: Deposition from the outfall will be governed by the local hydrography. large expanses of maerl (with varying degrees of % live) around the outflow make it likely that the proposed outfall may impact that maer!. Any increase in ambient water particulates will increase sedimentation rates increasing the probability of maerl smothering. Additionally, any increase in POM may also lead to maerl smothering by excessive phytoplankton or epiphyte growth. Any reduction of ambient water clarity will reduce light penetration through the water possibly resulting in reduced maerl condition and *I* or death due to lower photosynthetic capacity.

ECOLOGICAL ASSESSMENT OF POTENTIAL IMPACT

Ecological Functionality: Maerl grounds have been observed to act as nursery areas for commercially and non-commercially important species including queen scallops *(Aequipecten opercular is)* and edible sea urchins *(Psammechinus miliaris)* as well as increasing the carrying capacity of multi-substratum inshore nursery areas for juvenile cod *(Gadus morhua),* saithe *(Pollachius vir ens)* and pollack *(Pollachius pollachius)* by providing a high biomass of food (Kamenos *et a/.,* 2004a; Kamenos *et a/.,* 2004b; Kamenos *et a/.,* 2004c). A significant part of its ecological functionality may be attributed to live maerl's high heterogeneity (Kamenos, 2004). Impacts addressed above are likely to reduce the deposit's heterogeneity and thereby significantly impact on its ecological functionality as a nursery area. This may lead to a reduction of juveniles recruiting into adult populations affecting local marine population dynamics, including commercial species.

Biodiversity: Live maerl grounds are known to have high biodiversity attributable to their high complexity (BIOMAERL team, 2003; Steller *et a/.,* 2003). Impacts leading to damage or death of the ground are likely to lead to long-term reduction in biodiversity as well as alteration of the *K-selected* community (slow growing, long-lived and fragile species) to an *r* selected on (opportunistic and short-lived species) (Kamenos, 2004).

Maerl representation in the Clyde Sea area: Clyde Sea area maerl beds characteristically contain only between 5-10% live maerl thalli due to the extensive impacts of scallop dredging (Hall-Spencer, 1999). Parts of the surveyed maerl bed were >90% live. In terms of the Clyde Sea this is highly unusual and damage of that deposit may be damaging one of, if not the last, >90% live maerl bed in the Clyde Sea area.

In our expert view, we would strongly advise that this site be avoided by any development, which impacted on the sea bed.

LITERATURE CITED

BIOMAERL team 2003. Conservation and management of northeast Atlantic and Mediterranean maerl beds. *Aquatic Conservation: Marine and Freshwater Ecosystems,* 13: 565-576.

Donnan, D. W., and Moore, P. G. 2003. International workshop on 'The conservation and management on maerl'; Conclusions. *Aquatic Conservation: Marine and Freshwater Ecosystems,* 13: S77 -S78.

Giraud, G., and Cabioch, J. 1976. Ultrastructural study of the activity of superficial cells of the thallus of the Corallinaceae (Rhodophyceae). *Phycologia,* 13: 405-414.

Grall, J., and Hall-Spencer, J. M. 2003. Problems facing maerl conservation in Brittany. *Aquatic Conservation: Marine and Freshwater Ecosystems,* 13: S55-S64.

Hall-Spencer, J. M. 1999. Effects of towed demersal fishing gears on biogenic sediments: a 5-year-study, pp 9-23. In *Impact of trawl fishing on benthic communities.* Ed. by O. Giovanardi. Istituto centrale per la ricerca scientifica e tecnologica applicata al mare, Rome.

Hall-Spencer, J. M., and Moore, P. G. 2000. Impact of scallop dredging on maerl grounds, pp 105-117. In *Effects of fishing on non-target species and habitats: biological, conservation and socio-economic issues.* Ed. by M. J. Kaiser, and S. J. de Groot. Blackwell Science, Oxford.

Hauton, C., Hall-Spencer, J. M., and Moore, P. G. 2003. An experimental study of the ecological impacts of hydraulic bivalve dredging on maer!. *ICES Journal of Marine Science,* 60: 381-392.

Kamenos, N. A., Moore, P. G., and Hall-Spencer, J. M. 2003. Substratum heterogeneity of dredged vs un-dredged maer! grounds. *Journal of the Marine Biological Association of the United Kingdom,* 83: 411-413.

Kamenos, N. A., 2004: The role of maerl grounds as nursery areas for commercially important species with emphasis on the queen scallops *(Aequipecten opercular is* (L.)), University Marine Biological Station, University of London, Millport. 257 pp.

Kamenos, N. A, Moore, P. G., and Hall-Spencer, J. M. 2004a. Attachment of the juvenile queen scallop *(Aequipecten opercularis* (L.» to maerl in mesocosm conditions; juvenile habitat selection. *Journal* of *Experimental Marine Biology and Ecology,* 306: 139-155.

Kamenos, N. A, Moore, P. G., and Hall-Spencer, J. M. 2004b. The nursery area function of maerl grounds for juvenile queen scallops *(Aequipecten opercularis)* and other invertebrates. *Marine Ecology Progress Series,* In press.

Kamenos, N. A, Moore, P. G., and Hall-Spencer, J. M. 2004c. The small-scale distribution of juvenile gadoids in shallow inshore waters; what role does maerl play? *ICES Journal* of *Marine Science,* **61:** 422-429.

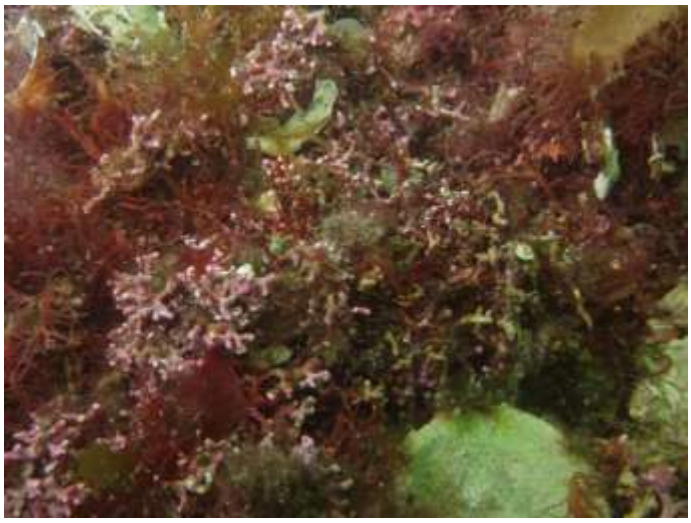
Purvis, A, and Hector, A 2000. Getting the measure of biodiversity. *Nature,* 405: 212-219.

Sala, E. O. 2001. Ecology: the price put on biodiversity. *Nature,* 412: 34-36.

Steller, D. L., Riosmena-Rodriguez, R., Foster, M. S., and Roberts, C. A 2003. Rhodolith bed diversity in the Gulf of California: the importance of rhodolith structure and consequences of disturbance. *Aquatic Conservation: Marine and Freshwater Ecosystems,* 13: S5-S20.

Tilman, D. 2000. Causes, consequences and ethics of biodiversity. *Nature,* 405: 208-211.

Woelkerling, W. J. 1988. *The red coralline algae: an analysis* of *the genera and subfamilies* of *nongeniculate Corallinacea.* Oxford University Press, New York. 268 pp.



lamlash Bay long Sea Outfall