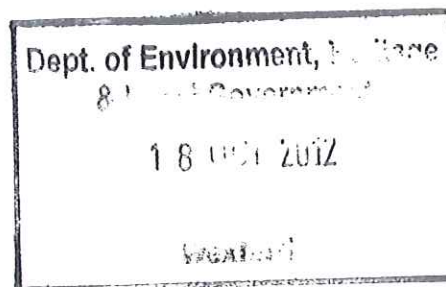# AQUAFACT

AQUAFACT INTERNATIONAL SERVICES LTD.

Proposal to monitor biological parameters at mechanical Kelp harvesting sites in north Galway Bay and the southern approaches to Bertraghbui Bay

Introduction.

5 locations on the north coast of outer Galway Bay and a further 5 locations on the southern approaches to Bertraghbui Bay, have been identified as areas where Kelp will be harvested on an annual rota basis. It is proposed that from each region only one of the proposed harvest sites will be utilised in any one season and under this arrangement a rotation system spanning 5 years will be implemented (See attached maps for co-ordinates and location of proposed harvest sites). The areas of each proposed annual harvest area ranges from 237 to 140ha in the southern Bertraghbui area and from 485 to 311ha in the outer Galway Bay region (See attached appendices). In addition to an assessment of kelp biomass a baseline study will be performed in the first zone to be harvested and the post harvesting assessment for subsequent years will be compared with this baseline study. The initial review will be carried out in Spring and Autumn; however, after the first year, it is envisaged that an annual assessment will be sufficient.

Monitoring Programme

1. Fauna

Invertebrates – A subtidal survey of a harvest site and a control location will be carried out by experienced marine scientific divers using SCUBA. The BACI (Before-After-Control-Impact) protocol will be employed, wherein a baseline survey will be conducted at selected areas prior to commencement of harvesting. Post-harvest surveys will be carried out in a subset of these areas. The transect area will be approx. 75m x 5m and a standard swimming speed (*ca* 0.5m 1 sec^{-1}) will be used. Diver entry and exit points for each dive will be logged with GPS. It is planned to replicate transects by selecting locations with similar depth profiles. Depending on the size of each harvest block, the total number of transects will vary from 4 – 6 plus an additional control site. Invertebrate species lists will be compiled *in situ* by the divers and digital still photographs will be taken for detailed post-survey examination. The SACFOR (Superabundant, Abundant, Common, Frequent, Rare) scale will be used to semi-quantify the assemblages.

Primary parameters:
- Inventory and bundance of macro/epifauna (sufficient seasonal and spatial extent) pre- and post-harvest.
- Harvest and non-harvest areas will have replicate transects stratified by depth.
- Epifauna including fauna attached to kelp and holdfasts as well as to rock in under-story will be inventoried and quantified.

Relative abundance of some species e.g. urchins post-harvest may not become obvious for at least one year. It should be considered to examine harvested sites on an annual basis solely for this reason.

Fish –Three survey methods are proposed to record fish species. The first will be carried out while doing the invertebrate transects; the larger,"over canopy" fish species will be counted and logged. For the smaller "under canopy", cryptic species, a stationary technique will be used. A 5 m line will be laid out at selected sites forming a visual cylinder which will be visually surveyed for ca 10 mins and species and species numbers will be logged. The third sampling method will be with a fyke net. This will be deployed on one day and recovered 24 hours later. The catch will be counted, identified, measured and where possible scales will be collected for later analysis.

Birds – Bird species will be identified and enumerated from the survey vessel while the SCUBA transects are being carried out. Due to seasonality of some species (Lesser Blackbacked Gull, tern species), it is proposed that the Spring survey will not be carried out until these species are present.

2. **Flora** - These surveys will be carried out at the same time as the invertebrate surveys and in post-harvest surveys will include recovery rates. In pre and post-harvest surveys, SACFOR estimates of species will be determined.

Experimental design

The experimental design will focus on four main elements – biomass assessment, replication, appropriate control sites and selection of species that are suitable for monitoring purposes.

1. With regard to biomass assessment and replication, permanent, marked lead lines will be put in place during the first survey and both video and still photography will be used to document flora and fauna along the length of each transect. Each transect will be marked with GPS for relocation during future surveys. Kelp densities will be assessed from these transect lines and assessments made of abundance and biomass.

2. In relation to controls, it is imperative that selected sites are as similar as possible to the area being harvested. Both biological and physical characteristics will be considered when such controls are being considered. Stratification according to broad physical characteristics (e.g. depth and substrate/habitat type) may be necessary when selecting suitable sampling

locations and it may be necessary to focus on one particular type in order to fulfil replication requirements (for test and control locations).

3. Kelp forests are species-rich and include many small and cryptogenic and epiphytic/epifaunal taxa that live within hold fasts and under/on rocks and stones. When selecting species suitable for monitoring, many of these type of species will not be considered. Large taxa such as the laminarians and sponges *e.g. Pachymatisma, Cliona*, decapods such as *Cancer* and echinoderms such as *Echinus, Asterias* and *Holothuria* are likely candidates for long term monitoring. Attention will also be given to the selection of taxa representing different functional groups *e.g.* epiphytic, epifaunal, mobile, grazers, filter feeders, predatory. The focus upon indicator species covering a range of functional groups as opposed to whole community analysis is considered a more practical approach considering the difficulties of quantitatively sampling in this habitat type, i.e., the fact that full analysis is very time consuming, non-destructive sampling is possible and that the response to the kelp removal (pressure) of non-motile faunal can be measured against those of motile fauna which might be expected to vacate barren areas.

4. Selection of these indicators allied with suitable replication will provide a sufficiently robust data set such that large scale changes can be identified and recovery tracked over the period of the sampling program. It is considered that a system-wide approach is more suitable for this type of study than a site/species-specific one and for this reason, adequate replication is required to understand how the system reacts to harvesting (see Section 1. above).

In terms of likely responses to removal of the canopy, it is well understood that seasonal changes in kelp canopy are limited to minor frond removal during stormy periods. Where individual *Laminaria* stipes are lost, colonisation by such opportunistic species as *Saccorhiza* occurs. This is an annual species and sporelings of this taxon and both *Laminaria* and *Saccorhiza,* will compete to dominate the macrophyte forest. Harvesting of all laminarians will therefore give rise to recolonisation and it is presumed that the opportunistic *Saccorhiza* will be the primary Stage I colonising species. Some sporelings of the other laminarians will settle also and it is hypothesised that in subsequent years, these will successfully out-compete *Saccorhiza.* Exposure of large areas of reef will alter the microscale physical oceanographic conditions that occur on the seabed.

The statistical analyses will be carried out primarily using PRIMER and will include univariate (number of species, comparison of different depths of transects) and multivariate (species presence/ absence, comparison of different depths of transects, comparison of inter-year variability) analyses. Visual presentation of the data (Multi-Dimensional Scaling) will allow a trajectory of community recovery to a steady state to be documented.

A survey period of 3-years is planned consisting of a pre harvest (assessment (baseline/background) and (initially) 2/3 years post-harvest to monitor short and long-term impacts and recovery at the first site to be harvested. It is intended to review and refine programme after the year 1 post-harvest survey.