

**Factors Influencing the
Choice of any Proposed
Coastal Marine Fish
Cultivation Site and
Recommended Survey
Programme**

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SUMMARY

Site evaluation is complex and lengthy and following an initial paper survey to reject those evidently untenable a detailed on-the-ground assessment is required.

An indication of the more important parameters affecting site selection is given together with a survey programme lasting twelve months.

1. INTRODUCTION

The following is an outline of the physical, topographical and biological factors that need to be examined in a survey to determine the suitability of any proposed marine cultivation site. The points mentioned are applicable to both finfish and shellfish cultivation based either in on-shore tanks or off-shore in floating cages, submerged cages, sublittoral enclosures, littoral barrier ponds or in on-bottom systems. Although much of the comment is directed to conditions at present existing on the west coast of Scotland the criteria and survey programme are of relevance to the U.K. as a whole.

All the points for consideration are inter-related and decisions on any one of them bears on the others. It cannot be over-emphasised that unless careful research is done on every pertinent factor prior to commencing installation, severe troubles or even failure can easily result.

The following factors would apply to a possible site which at first assessment appears to offer the need for a detailed survey. Some sites can be quickly classified, by the use of maps, charts and available literature, as untenable and the need for a detailed survey unnecessary. Such a service is available through the Authority's Management and Design organisation.

2. FACTORS INFLUENCING THE CHOICE OF SITE

2.1 Shore Base

2.1.1 Land Availability:

An area of well drained flat land adjacent to the sea which can be purchased outright or a long lease obtained (see 2.1.6 and

2.1.7). Short term leases and renting land with crofting interests should be avoided (see 2.1.10). Proximity to market outlets and fishing port should be considered (see 2.1.11 and 2.1.12). Sufficient land for initial accommodation + 50% should be acquired with options on adjacent plots to allow for subsequent expansion. The ground should be suitable for the construction of site roads capable of taking 12 tonne lorries and if sea water is to be pumped on-shore, the elevation above the high water mark should be as low as possible.

2.1.2 Access:

The land site should be situated as close to a public road as the operators' other requirements for proximity and access to the sea base will allow.

2.1.3 Fresh Water Supply:

The availability of a County provided piped supply is to be ascertained as well as access to other fresh water sources near at hand. (This can prove to be a considerable obstacle to many sites.)

2.1.4 Electricity Supply:

Proximity to mains 440V 3 phase supply is a necessity - especially if on-shore tank installation is required. Reliance on generators is not recommended.

2.1.5 Telephone:

The proximity to G.P.O. telephone lines should be determined.

2.1.6 Drainage/Sewerage

A site with good natural ground drainage is preferred (2.1.1) and the soil material and surface slope should, if possible, permit unaided tank drainage and sewerage discharge away from sites of proposed pump inlets or sea installation - reference to be made to tidal streams and prevailing winds (see sections 2.2.1 and 2.2.4).

2.1.7 Sea Water Access

The height above sea level (see section 2.1.1) and proximity to areas of high quality sea water should be determined. Unless the sea base is required to adjoin the land base, boat access to the land site is advantageous but not essential, providing there is good road access to a jetty which is conveniently situated for access to the sea base.

2.1.8 Disease/Predation:

If salmon or trout are contemplated areas of heavy natural infection of UDN and IPN should be avoided for both on and off-shore holdings - similarly infected stock should not be introduced into non-affected areas, the incidence and control of several diseases now being controlled by the Ministry of Agriculture, Fisheries & Food and the Department of Agriculture & Fisheries for Scotland under the provisions of the Disease of Fish Order 1973 relevant to the Diseases of Fish Act 1937.

Several shellfish diseases are similarly contagious and the movement of stock is strictly controlled by the Sea Fisheries Act (Shellfish) 1967.

2.1.9 Local Labour Availability and Staff Housing:

The proximity to the local population and the nearest towns and the likelihood of attracting local labour and obtaining housing for incoming staff should be noted.

2.1.10 Common Grazing/Right of Way, etc:

In the crofting counties of Scotland, to ensure the site's security, locations with no township rights such as grazings or public rights of way are to be preferred. Comment as to the present land use should be made.

2.1.11 Proximity of Market:

Should be considered in order to reduce distribution and packaging costs.

2.1.12 Proximity to Port:

Should be considered in order to reduce the transport cost of capital items and to aid the supply of fish food (trash fish etc.). Also the likelihood of cold storage facilities, etc.

2.2 Sea Base

2.2.1 Natural Shelter:

An adequate degree of natural shelter is of paramount importance. Shelter cannot be easily judged from O.S. maps and Admiralty Charts and requires to be examined in detail at the location with a prior knowledge of the local wind pattern. Wave barrier systems are costly and should not be considered in the first instance.

2.2.2 Topography:

Depending on the system envisaged, i.e. surface or bottom cages, sublittoral enclosures or littoral ponds, etc., water depth can be critical. Generally speaking a steep-to shore leading to a flat bottom in 2-4 metres at E.L.W.S.T. is ideal for cages, floating rafts and sublittoral enclosures. For on-bottom culture of oysters a large flat area between E.L.W.S.T. and M.L.W.N.T. is preferred, dependent on climatic conditions.

Sitings with shallow sills and deep pits should be avoided, and in fiordic locks a position inshore of the 1st or 2nd sill (depending on their nature) would be inadvisable due to the lack of water interchange with the sea over the sills, resulting in hydrographic problems.

2.2.3 Hydrography:

Water "quality" in terms of temperature, salinity, dissolved oxygen, turbidity, pollution and heavy metal content needs to be "good", i.e. well within the natural tolerances of the farm animals. It should be remembered that various species differ in this respect.

2.2.4 Tidal Movement:

(a) Rise and fall (range) affects the design and siting of in-sea structures and can also place limitations on on-shore pump installations due to increased pumping heads. Generally speaking a greater range indicates a better water exchange rate which is more suitable for high density exploitation of floating cages and rafts: lower ranges are more suitable for the cheaper sublittoral enclosure construction.

(b) Tidal current and prevailing tidal streams require long-term assessment and determine the siting of stock holdings, pump inlets and also point of pump discharge, land drainage and sewerage outfall (see 2.1.6).

2.2.5 Bottom Condition:

A firm, sandy substrate is to be preferred, as mud is indicative of low water exchange and consequent inability to support high density culture, whilst rocky bottoms create anchorage problems. On-bottom culture of shellfish, however, is practicable on most types of substrate providing it is stable and not subject to movement or gross sedimentation.

2.2.6 Fresh Water Run-off:

Affects surface salinities, turbidity and increases the likelihood of large concentrations of heavy metals. Sites should be situated away from such points.

2.2.7 Pier/Jetty Availability:

Existing access piers/jetties are to be preferred, the need being dependent on the farming system envisaged.

2.2.8 Seabed Rights:

In many areas of Scotland the seabed is owned and private oyster beds exist. Throughout the whole U.K. areas of the seabed are protected by Several Orders for Shellfish Cultivation and use of the littoral fringe is granted by the Crown Commissioners. Renting or purchase of such rights is advisable. Obstruction to natural salmon and sea trout runs are to be avoided.

2.2.9 Poaching/Human Interference:

Popular anchorages and sites near to large urban areas are to be avoided. The nature of the site would preferably be one where policing would be possible.

2.2.10 Predation:

Seals, otters, sea birds and wild fowl all present hazards and positioning near a colony is not advised.

3. SURVEY PROGRAMME

The survey outlined below is considered to be the minimum requirement needed to provide sufficient information for a decision to be made on the suitability of a proposed coastal marine cultivation site. The more time and effort spent on further survey procedures the more complete an assessment would be made.

3.1 Data to be Obtained

3.1.1 Topography:

(a) Land availability, area, drainage, nature, elevation, existing access.

(b) Services - availability of piped fresh water, mains 440V electricity, telephone and postal service, scavenging and sewerage, sea water access. Measurement of water flow from other available sources.

(c) Situation - proximity to areas of natural disease occurrence and predatory colonies, markets and ports. Existence of common grazings/rights of way, local labour and staff housing.

Existence of seabed rights and salmon runs.

(d) Sea site mapping and charting, assessment of bottom conditions.

3.1.2 Meteorology:

(a) Measurement of minimum and maximum air temperature, precipitation, wind speed and direction, including literature search for past records.

(b) Calculation of local fetches and maximum wave heights, estimation of exposure.

(c) Measurement of catchment areas if necessary for fresh water supply.

3.1.3 Hydrography:

(a) Temperature, salinity and dissolved oxygen levels at selected sites at varying depths.

(b) Chemical analysis of sea water adjacent to sources of fresh water run-off and possible sources of pollution.

(c) Current measurement and turbidity at selected sites at varying depths and at different tidal states.

(d) Wave amplitude and frequency.

(e) Diving survey for 3.1.1(d) above, sedimentation or erosion and existing faunal/floral assessment (indicates productivity of the area and enables assessment of future changes due to the farm).

(f) Shore survey for biological exposure and faunal variety.

3.2 Frequency of Observation

It is recommended that the survey staff should remain on site for two periods of a fortnights duration, one during October to March, the other between June and September. Certain measurements of a non-technical nature require regular daily recording (about $\frac{1}{2}$ hour) and could be undertaken on a part time basis by local labour. These would include items identified under 3.1.2(a) 3.1.3(d) surface temperature and salinity in one place only, and the measurement of fresh water flows if required.
