

Fish Culture Engineering

4- Sea Cages

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Introduction

cage represents a delineated volume in the body of water where the aquatic organisms can be farmed

a large variety of species are grown in cages today and include seawater, freshwater and diadromous species

Therefore today cages are used worldwide in the sea, in lakes and large rivers

The main differences are in the size and construction for withstanding waves and currents

There are a number of approaches to designing a cage and also classifying the various cage systems

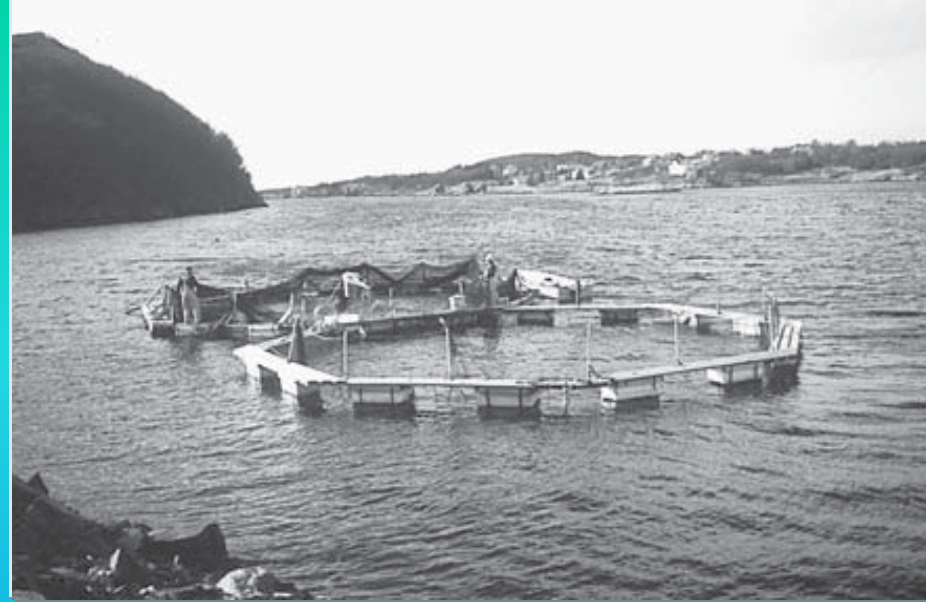
One classification is based on where in the water column the cage floats. Three categories can be used: floating, submerged, or submersible

The last two types consist of a frame that can float on the surface and that maintains its shape when lowered below the water surface.

the focus is on open floating sea cages which are those most used for intensive aquaculture.

The following list can be used to help when establishing a new sea cage farm

- 1- Choose a site that is suitable for farming
- 2- Describe and calculate the environmental conditions on the site
- 3- Choose farming systems, i.e. the cage and mooring system, adapted to site conditions
- 4- Design the cages (normally done by the cage manufacture) and mooring system
- 5- Set out the cages and mooring system
- 6- Establish requirements for operational control of the system



Site selection

Selecting a good site is of major importance for the future economic viability of the cage farm. A suitable site for cage farming must fulfill a number of requirements

- 1-water quality (temperature, salinity and oxygen content)
- 2-water velocity (100 cm/ second- 1000 cm/second)
- 3- Sites must be far away from pollution resources
- 4- Sites must be far away from transportation
- 5- Sites must be far away from strong wind and high waves
- 6- water depth a distance of more than 5m from the bottom of the net to the sea bottom is recommended.
Depths above 100m will greatly increase the costs of the mooring system because long mooring lines will be needed

Waves

Waves are normally the limiting factor for site selection for cage aquaculture. If the wave height is too great it is very probable that this will affect the cage structure

Knowledge of the wave climate on the site will also be an important tool in choosing the correct cage technology and mooring system to avoid later breakages in cages and moorings

Several factors may create waves but the most important are:

- Wind
- Human activity, such as shipping
- Special natural phenomena such as earthquakes, land slips and underwater volcanic
- **Tide**; waves with extremely long wavelengths are created

Current

Water current is normally the dominant environmental force on a sea cage farm. Several factors may create a current in the water, including

1- Wind 2- Tide

3- Local water flows, such as rivers

4- Large global oceanic currents or coastal streams

Currents create both horizontal and vertical movements in the water. In fish farming the focus is normally on the horizontal currents

There are large variations in the current from site to site

Breakwaters

On sites exposed to waves, breakwaters may be used to reduce wave height and impact

Breakwaters may be constructed in different ways

One method is to use concrete blocks or a steel construction fixed to the bottom; however, these are expensive to install and little used for protection of sea cages in deep water, although they may be used in shallow water

Most usually a breakwater made of rubber tyres is used. Old tyres from trucks or cars are tied up with wire to form a fleet

Mooring systems

The function of the mooring system is to keep the farm in a fixed position and to avoid transfer of excessive forces to the cages, especially vertical forces

Mooring system contains three major parts:

- (1) Mooring lines which include the point of attachment to the cages
- (2) Buoys
- (3) Anchors

In well protected seawater sites and freshwater sites the environmental loads transferred to the cages are reduced and a smaller mooring system can be used. However, the same basic principles can be used for design and construction

Design of the mooring system

The design used for the mooring system depends on the type of cages to be moored: these may be as follows

- Single cages
- System for mooring several single cages
- Single cages with walkway
- Single cages with walkway and landing
- Group of cages – platform cages
- Ocean cages
- Cages lying on sway.