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## Technology used for offshore mariculture in Spain

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**SUMMARY** – As in other Mediterranean countries, Spain is now observing the rapid expansion of its aquaculture production, particularly in the marine sector. Marine fish farming, which was developed in earth ponds and tanks, is nowadays moving from inshore protected locations to offshore conditions. This paper provides information about the technology in use and being developed in Spain for offshore aquaculture. Although designs used in Spain have originated from a variety of sources, the majority of marine cage farms use "Polar Cirkel" type plastic ring cages (Corelsa) and most recently, platform structures (MSI). Most cage farms have been located at either inshore or semi-offshore sites and are now being located in increasingly exposed environments. Sea bream and sea bass farms are located along the Mediterranean coast and in the Canary Islands.

**Key words:** Spain, cages, platforms.

**RESUME** – "Technologie utilisée pour l'aquaculture en mer ouverte en Espagne". Comme beaucoup d'autres régions d'Europe, l'Espagne voit aujourd'hui une expansion rapide de sa production aquacole. La pisciculture marine a été développée dans des étangs et des bassins, et plus récemment sur le littoral ou à proximité des côtes. Actuellement, l'aquaculture intensive se déplace vers la mer ouverte dans des sites de plus en plus exposés. Cet article fournit des informations sur la technologie en usage, et sous développement en Espagne pour l'aquaculture en mer ouverte. Bien que les conceptions utilisées en Espagne dérivent d'une gamme d'origines, la majorité des fermes marines utilisent des cages plastiques circulaires "Polar Cirkel" (Corelsa) et plus récemment des structures de plate-forme (MSI). La plupart des fermes de cages a été localisée en sites protégés ou semi-exposés, et maintenant elles sont localisées en environnements de plus en plus exposés. Les fermes pour la daurade et le bar sont localisées le long de la côte méditerranéenne et parmi les îles Canaries.

**Mots-clés :** Espagne, cages, plates-formes.

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### Introduction

The development of the aquaculture in Spain, as in many other parts of Europe, has been accelerated by the relatively rapid growth of the marine aquaculture sector, particularly involving the cage culture of seabass and seabream. The production record of the sector, and its trends, have been described earlier. A key feature of this is the development of capacity in relatively exposed coastal areas, both along the mainland coast, and in the Canary Islands. Although cage culture designs in Spain have originated from a variety of sources, including experience gained from salmon cage culture in Galicia and from research experience in large inland water bodies, the majority of cage fish farms of the Spanish mariculture sector use "Polar Cirkel" type cages and most recently platform structures. As earlier noted most cage farms have either been located in inshore or semi off-shore locations, and nowadays in increasingly exposed environments.

The following sections describe the technology currently in use in the marine fish culture industry in Spain, and the experience gained to date, both in imported technologies and those developed nationally.

### Cages

Most farms use cages built by a Spanish firm, *Corelsa*, now widespread along the Mediterranean coast as well as the Canary islands in different inshore, semi-offshore and offshore conditions. These

cages are circular and range from 10 to 30 m diameter, the most common being 12 to 16 m, more recently developed to 19 m. The cages have two collars of high density polyethylene (HDPE) pipes from 200 to 300 mm diameter, usually filled with flotation material (polystyrene); normally with a handrail. This Spanish company produces mainly cages for sea bream and sea bass, for Mediterranean culture; although it does manufacture some for salmon culture in Galicia, and for tuna (50 m diameter) in the Mediterranean. The nets, also provided by this company, are either imported or made by the firm with imported material (polyamide). Although not commonly used at the moment, antifouling treatments are becoming more common (Fig. 1).



Fig. 1. Close-up of a typical Corelsa floating cage (<http://www.corelsa.com>).

*Corelsa* is also engaged in developing cages for on-growing of turbot (EAS, 1997), with technical support from organizations related with the Galician government. These square cages measure 12 by 12 m, and are subdivided into four internal units of 5 m each. For on-growing, flat bottomed nets of 4 m depth are fitted to the internal cages, and a second net of 2 m depth may also be placed over the other. This Spanish firm is also working on the design of new cage systems for octopus.

## Platforms

Besides cages, another system is being used for offshore mariculture in Spain. This consists of large rigid floating structures that emulate the concepts of oil-rig design. Three platforms are currently used having being built by a Spanish firm, Marina System Iberica (MSI), and are already operating in the Spanish Mediterranean coast (Barcelona, Tarragona and the Gulf of Algeciras). A fourth platform is now being finished and an additional one is under project. Besides these cage platforms, MSI is also working in the design of smaller working platforms (Fig. 2).



Fig. 2. View of a Platform of MARINA SYSTEM IBERICA operating in Arenys de Mar (CULTIMAR S.A. farm), Barcelona (<http://www.come.to/msi>).

These platforms are large metallic (steel tubular) structures of about 2500 m<sup>2</sup>, either hexagonal or square. As for the square platforms, the sides are 50 metres in length, and the vertical legs 11.5 metres high, of which 9 to 10 metres are below water level, giving the possibility of accommodating 9 (3 x 3) cultivation cages of about 12 m diameter and 8 m depth (7 cages in the hexagonal platforms). The height of the main deck is variable, according to the ballasting and deballasting of the platform legs, reaching 5.5 m above sea level, though operating at this level will significantly reduce cage volume. Freeboard of the platform can be changed easily to adapt it to the different sea climates, using the ballasting system of its vertical columns. Apart from accommodating the cages there is also room for surface working areas, where 4 cubicles are installed: the power generator, the biological laboratory, the feeding warehouse and the crew dormitory. The structure also allows the establishment of cages around it, which benefit from platform facilities and increase the production capacity of the farm.

Platforms are typically moored in open sea, just around two miles from the shore, using two lines from each corner of the structure. Mooring lines are formed with a polymer rope of 68 mm diameter and 80 tonne strength, a stretch of chain 27 m long of 3 tonne weight, a 2 tonne concrete dead weight, a further stretch of chain of identical characteristics and an anchor weighing 2 tonnes. In this way, the mooring is provided by the anchor, linked to the concrete dead weight by both lengths of chain. This arrangement provides a flexible but secure holding system which can also be lifted from the bottom on occasions if needed.

Platform production capacity is about 250 tonnes; however, by placing other cages (normally 16 m "Polar Cirkel" type) around the farm, production may be of about 400 tonnes and upwards. As regards production densities, the final levels used within the platforms can go up to 15-20 kg/m<sup>3</sup>, which are slightly higher than the most commonly used densities in cage farms (15 kg/m<sup>3</sup> for sea bream, and 10 kg/m<sup>3</sup> for sea bass).

## Service platform

In addition to the above mentioned fish farm platforms, Marina System Iberica has more recently developed a smaller service platform. The sizes of this platform are: 15 m x 15 m length and width, 8.5 m high and freeboard 1.5 m – >4.5 m. With this size, the deck accommodates the electricity generator to supply the fish transport pump, the fish counter and the automatic feeder. There is also room for a shed that can be used as office and laboratory. The central column is used as a feed silo with a 7-day feed stock capacity (75 tonnes). The platform (4 m) is safe and when fish are moved, harvested and/or counted, the freeboard can be lowered down to 1.5 m, weather permitting. The platform is anchored offshore with concrete blocks and stakes.

## Equipment

As regards the use of equipment, Spanish produced units are not so common or widespread as that of the cages, and thus most of the equipment used is imported. However, the *Corelsa* company besides producing cages also manufactures workboats (i.e., catamarans) and other equipment for aquaculture such as fish graders, net washing machines, etc.

Other companies work as distributors of imported equipment (for example: oxygen meters, drum filters, etc.). Some of these currently have their own projects to design certain equipment, such as *Valenciana de Acuicultura* who are working on the design of an automatic feeder, or *HT2* who are working on oxygen generation equipment.

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