

## **TEHNOLOGY OF MUSSEL (*MYTILUS GALLOPROVINCIALIS*) AND OYSTER (*OSTREA EDULIS*) FARMING IN BOKA KOTORSKA BAY**

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### **TEHNOLOGIJA UZGOJA DAGNJI (*MYTILUS GALLOPROVINCIALIS*) I KAMENICA (*OSTREA EDULIS*) U BOKOKOTORSKOM ZALIVU**

#### *Apstrakt*

Razvoj marikulture u Crnoj Gori je jedno od strateški važnih pitanja u programima proizvodnje hrane za domaće tržište i za izvoz. Program podrazumijeva proizvodnju, odnosno uzgoj nekoliko vrsta školjaka i riba, dok je u planu i uzgoj rakova. Marikultura je sve značajnija privredna grana u svijetu jer nadoknađuje smanjene potencijale hrane iz prirodnih izvora.

I pored naglašenog značaja marikulture, izuzetnih bioloških i ekoloških karakteristika priobalnog mora Crne Gore, naučnog-stručnog znanja, moramo konstatovati da je uzgoj morskih organizama na navedenom području tek u inicijalnom začetku, čak i kada se radi o uzgoju školjaka, čija je sadašnja proizvodnja oko 200 t. godišnje, što ostvaruje 16 uzgajivača u Bokokotorskom zalivu- uglavnom u Kotorskom i Tivatskom dijelu. Dakle, cijela marikultura u Crnoj Gori koncentrisana je na područje Bokokotorskog zaliva, dok je otvoreno more, u tom smislu, ostalo potpuno neiskorišćeno.

U davna vremena način uzgoja školjaka bio je vrlo jednostavan. Grane hrasta, trešnje, masline i ostalog raspoloživog materijala su se sakupljale i bacale u more. Na tako bačene grane hvatala se mlađ školjaka (kamenica i dagnji), a nakon tri godine i nekoliko faza uzgoja proces je bio kompletan, školjke su se vadile iz mora, te otpremale na tržište.

Cilj ovog rada je da damo svojevrсни pregled, počevši od prvih istraživanja mogućnosti uzgoja dagnji i kamenica u Bokokotorskom zalivu do današnjeg stanja i pravaca u kojima bi marikultura trebala da se razvoja u Crnoj Gori.

*Ključne riječi: tehnologija uzgoja školjki, razvoj marikulture, Bokokotorski zaliv*

*Keywords: technology of bivalve farming, development of mariculture, Boka Kotorska Bay*

## INTRODUCTION

First investigation on the possibility of mussel (*Mytilus galloprovincialis*) and oyster (*Ostrea edulis*) farming in Boka Kotorska Bay goes back to the early seventies of the last century. Farming process implied three stages of cultivation for oysters and two phases of mussels farming. Bundles of branch, so-called "fašine", were placed in the sea, and young oysters were caught on them after six months. Then oyster fries were extracted from the sea for second phase. Second phase implied processing and beam forming braids with diluted branches. The third phase involved the removal of branches, cementing and interference in the final braids.

Mussel farming was somewhat easier compared to oyster farming, and it was implied of two stages – collecting young on old ropes, so-called "kadena" that were placed horizontally below the surface. Collecting the fries was followed by a second phase - the removal of young mussels from "kadena" and involvement in braids, which have been positioned on the floating park in the space of 35-40 cm. Breeding parks and piers were a steel structure, and these experimental parks were placed in positions with a very shallow depth (5-10 m).

Total time of oysters growing lasted from 28-30 months, while mussel reaching market size in 2-3 years, depending on the size of the individual (Stjepčević, 1974).

Today, the farming technology of mussels and oysters in the Boka Kotorska Bay uses floating buoys and ropes, which proved that it meets all the necessary conditions for safe production (Mandić, 2008).



**Figure 1.** Boka Kotorska Bay and locations that are used for shellfish (red dots), fish (yellow dots), as well as sites that are designed to be favorable for aquaculture program (green dots).

In Boka Kotorska Bay (Fig 1) currently there are 16 mussel farms, one oyster farm and two fish (sea bass and sea bream) farms.

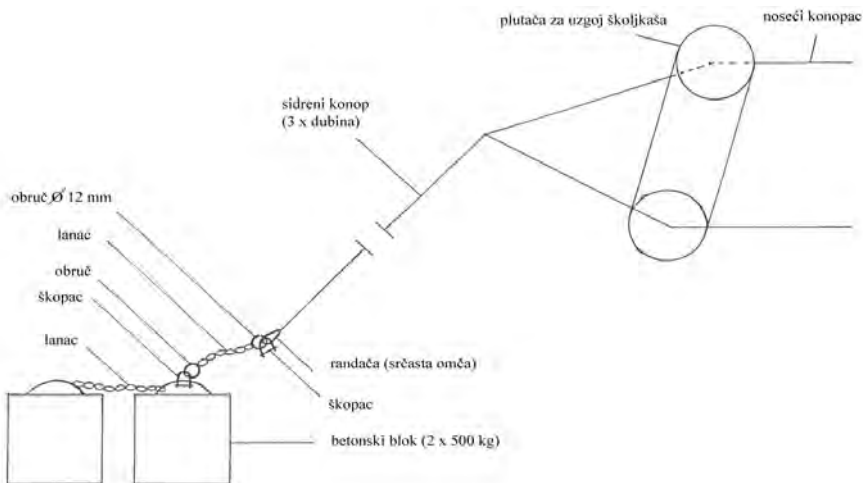
The total annual production of mussels in Montenegro is about 200 tons, while the amount of oysters is still too early to say since the first commercial farm these shells started working in 2009, and the first consumer oysters were on the market during the 2012. The entire farming of both species takes place on floating parks, and therefore that technology will be described in this paper.

## MATERIAL AND METHODS

Technical solution for floating parks

To build a floating parks need the following items:

- Plastic buoys - polyethylene buoys with the size of 80 -160 liters (smaller or bigger are also appropriate, depending on the ecological conditions on the locality)
- Polypropylene rope 0, 6, 12 and 16 mm;
  - Braids or so-called "pergolar", or mesh in the form of sleeves made of synthetic material, 2 m long, 20 cm in diameter, with a mesh size of 2-3 cm (for the first phase of treatment) and 3-5 cm (for the second phase of treatment);
  - anchorage of reinforced concrete weighing 500 to 1000 kg.



**Figure 2:** Schematic presentation of anchor line (Teskeredžić *et al.*, 2004)



**Figure 3.** Installation of the line of the park.

#### Technology of oyster farming

Oyster is very sensitive and delicate seashell, and these characteristics for its cultivation require large power consumption, which causes, together with the meat quality, its high price (Dujmušić, 1992). For technological processes of control breeding of oysters a floating line for mussels is required (eg 10 buoys at a distance of 10 m - total length 100 m, 3 m security fence to side and end) with anchoring equipment, collectors to accept younger oysters as well as ropes and / or boxes for the cultivation of oysters.

Depending on the wishes of producers, farm on an area of 1 ha can be partly used for the cultivation of mussels, and partly for the cultivation of oysters.

Cementing of oyster is the traditional method in the Adriatic Sea. Comparative studies on quality of consume oysters reared on braids, in plastic boxes or ropes have shown that the best ones are cemented, but their percentage of mortality is greatest. Specifically, oysters are unprotected and exposed to predators and the substantial amount of fouling, but the growth, the overall weight and condition index are the best using this technology of farming.

The most common period for oyster cementing is late August or early September, in order to have oysters ready for the market next year.

## DISCUSSION

From the period of the first experimental studies on the possibilities of mussel and oyster farming in the Boka Kotorska Bay until today, studies of water quality and potential localities for cultivation showed that the bay area is very favorable for the cultivation, not only of these species, but for other edible shellfish (Mandić *et al.*, 2001). The fact that this relatively small bay in the early seventies of the last century was participated with 6.6% of all mussels production in the former Yugoslavia, shows that little has been done on the development of mariculture, especially if mention that the open part of the Montenegrin coast remained completely unused in this regard .

One of the biggest obstacles to increase production are predators (*Sparus aurata*, *Diplodus puntazzo*, *Diplodus sargus*) that make huge damage on the farms by feeding on shells. One of the priorities in the development of this sector in Montenegro is to protect farms from predators, increase production and to introduce new native species in the process of growing.

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