



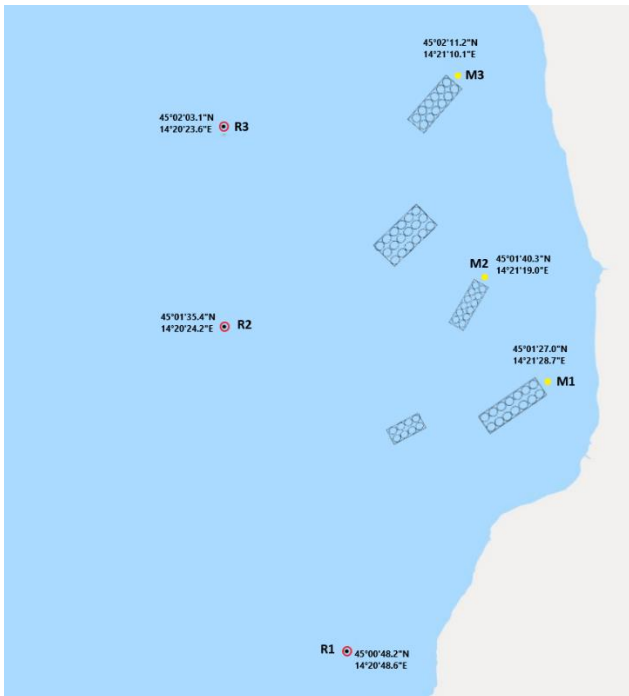
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## **ENVIRONMENTAL IMPACT ANALYSIS FARMS OSOR and VELI BOK (Cres)**



**FARM OSOR**






**FARM VELI BOK (CRES)**

Zagreb, 15.12.2020.  
ADRIA KVALITETA d.o.o.  
Pavle Koprivanac, dipl. ing.


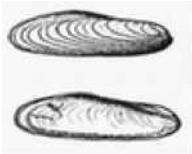
## Identification of proximity to critical, sensitive or protected habitats and species

ENDANGERED ANIMAL SPECIES:


SNAILS:

	prugasta mitra ( <i>Mitra zonata</i> )
	puž bačvaš ( <i>Tonna galea</i> )
	tritonova truba ( <i>Charonia tritonis sequenza</i> )



SHELLFISH:

	plemenita periska ( <i>Pinna nobilis</i> )
	prstac ( <i>Litophaga litophaga</i> )

## SEA TURTLES

	sedmopruga usminjača ( <i>Dermochelys coriacea</i> )  glavata želva ( <i>Caretta caretta</i> )  golema želva ( <i>Chelonia mydas</i> )
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## SEA MAMMALS

	sredozemna <u>medvjedica</u> ( <i>Monachus monachus</i> )
	obični <u>dupin</u> ( <i>Delphinus delphis</i> )  dobri <u>dupin</u> ( <i>Tursiops truncatus</i> )

All whales (Cetacea) found in the Adriatic are most strictly protected, as well as seahorse (Hippocampus), red coral (*Corallium rubrum*) and four species of sponges - large quartz (*Geodia cydonium*), sea orange (*Suberites domuncula*), starfish (*Axinellapolypoides*) and soft croissant (*Axinella cannabina*).

Red list of endangered plants and animals of Croatia. URL: <http://www.dzrp.hr/publikacije/crvene-kniige/crveni-popis-ugrozenih-biliaka-i-zivotinja-hrvatske-396.html>. (11.09.2015.)

### **Areas that have been identified as HCVAs**

The farm is located outside the protected coastal area (ZOP).

### **Areas that have been identified as important for conservation/biodiversity**

There have been no identified important areas for conservation or biodiversity.

## Species and presence of sea grass meadows

The identified taxa in sediment on OSOR and VELI BOK (Cres) fish farms are:

<u>Alvania sp.</u>	<u>Mangelia attenuate</u>
<u>Antalis sp.</u>	<u>Mangelia sp.</u>
<u>Bittium reticulatum</u>	<u>Nassarius sp.</u>
<u>Capitella capitata</u>	<u>Nucula sp.</u>
<u>Chamelea striatula</u>	<u>Parvicardium sp.</u>
<u>Epitonium sp.</u>	<u>Polititapes aureus</u>
<u>Hiatella arctica</u>	<u>Raphitoma sp.</u>
<u>Kurtziella plumbea</u>	<u>Saccella commutate</u>
<u>Macropipus depurator</u>	<u>Turritella communis</u>

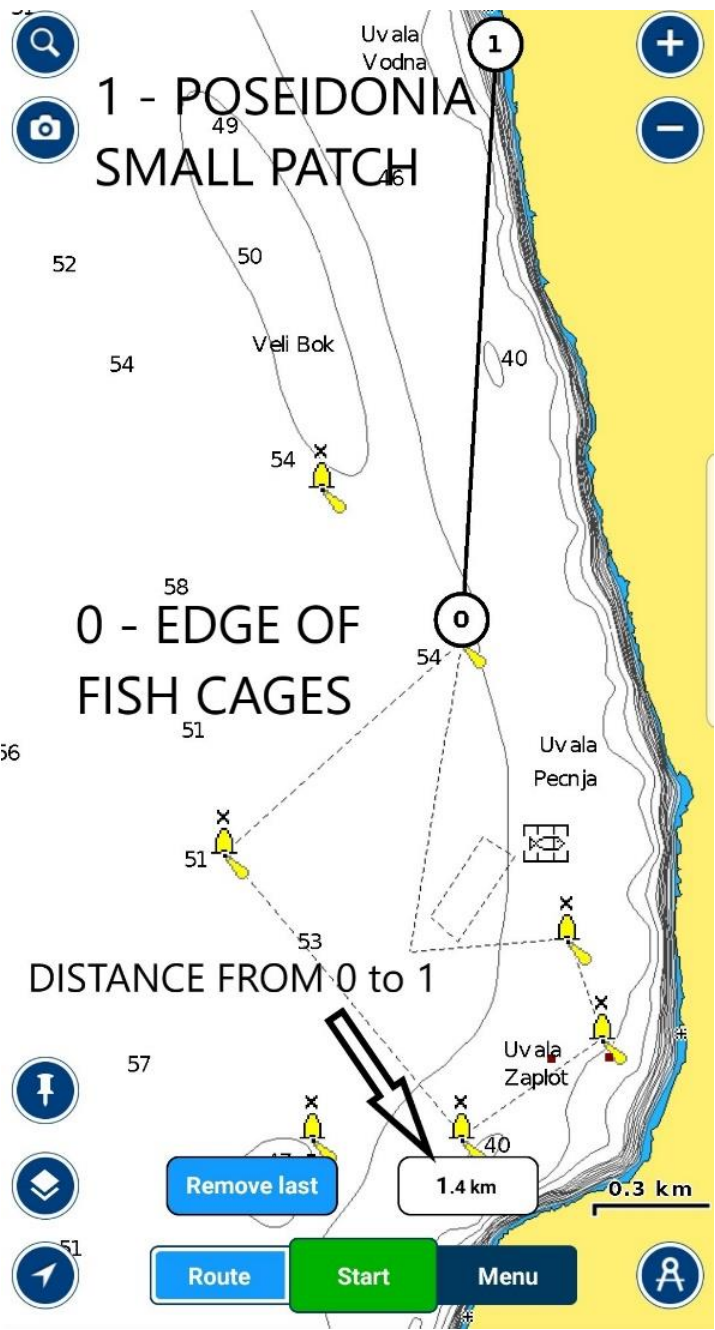
The most represented taxonomic group were mollusks (gastropods with 22 taxa and bivalves with 9 taxa). Other groups were present only with a few taxa, such as Scaphopoda, Polychaeta and crustaceans. Gastropod *Turritella communis* was the most abundant species.

Seven communities were observed in the wider area of the project: F.4.2.1. Supralittoral rocks, G.2.4.1. Biocenosis of the upper mediolittoral rocks, G.2.4.2. Biocenosis of the lower mediolittoral rocks, G. 3.6. 1. Biocenosis of infralittoral algae, G. 3. 5. 1. Biocenosis of settlements of the species *Posidonia oceanica*, G. 4. 2. 2. Biocenosis of coastal detrital bottoms and G. 4. 5. 4. 1. Fish farms - Circalittoral community below maricultural interventions. According to the insight and recorded biocenological composition on transects VB1 and VB3, common communities for this part of the Adriatic were observed and these transects do not differ in composition and recorded species, nor do they show indications of impact from the farm. . The influence of farms was observed under the cage structures and the G community was developed in that area. 4. 5. 4. 1. Fish farms - Circalittoral community under maricultural interventions which is not common for this area but develops exclusively under cage structures under the influence of increased inflow organic matter conditioned by the operation of the farm and is common below other farms in the Adriatic, located above the area of circalittorals.

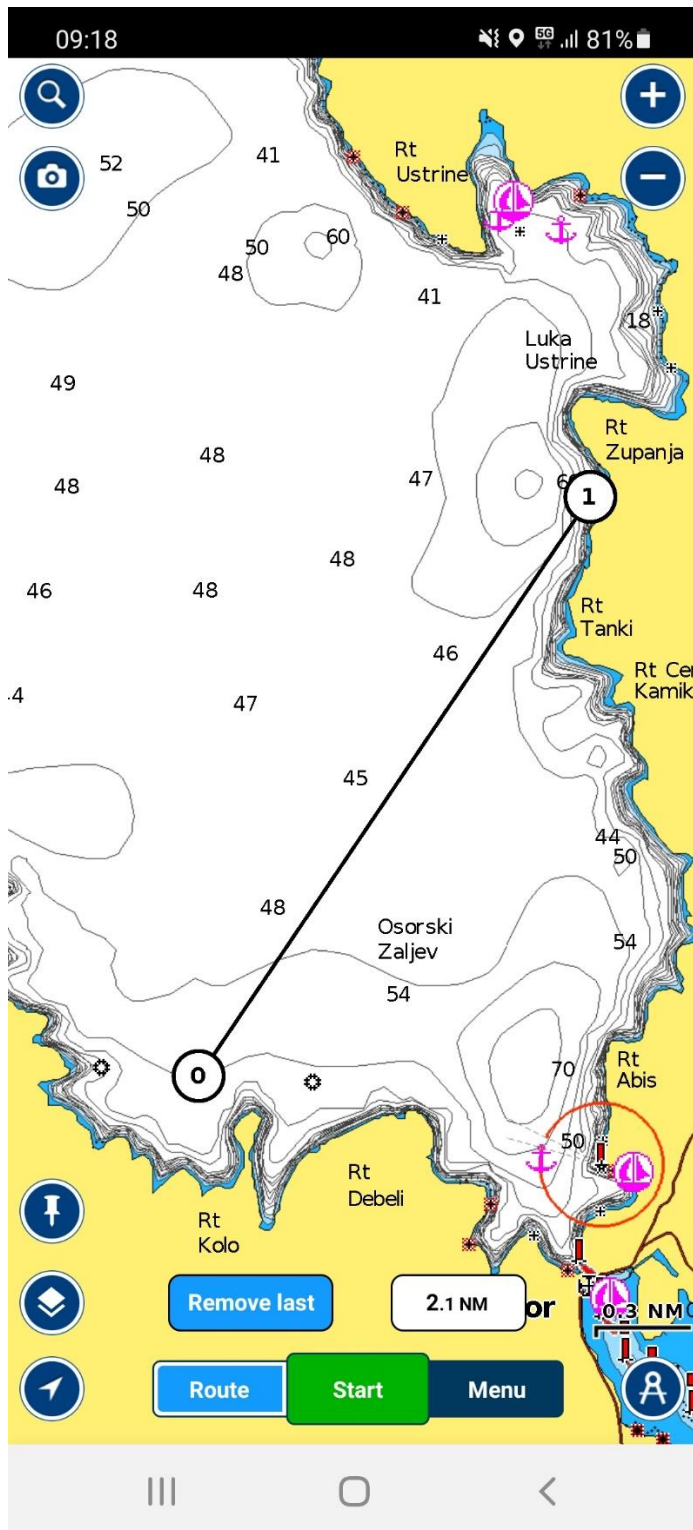
Biocenosis of settlements of the species *Posidonia oceanica*

At a depth of 10 to 15 meters, on surfaces where the mosaic alternates between rocky and sandy bottoms, smaller settlements of the sea flower *Posidonia oceanica* were developed. The settlements are natural and equal density, with the usual fouling of epiphytes on *posidonia* leaves. Within this community they have been spotted characteristic species for this community: green alga *Flabellia petiolata*, trp *Holothuria tubulosa*, *Halocynthia papillosa* and *Pinna nobilis*.

This community covers smaller areas more than **1400 meters** from the farm (AZE). It is widespread along the Adriatic. The community is on the list of endangered and rare habitat types in the Republic of Croatia.



# FARM OSOR



0-EDGE OF FISH CAGES

1- POSEIDONIA PATCH

## Impacts during farm operation

The most significant impact of the farm on the marine environment comes from the microbiological decomposition of organic matter which in particle form sinks through the water column and settles to the seabed. In doing so, the greatest impact

from the feces of farmed fish, while the impact of uneaten food is negligible (Cromeey et al. 2000) in the emissions chapter).

Dispersion and deposition of particles emitted from the farm to the seabed depends on the amount and disintegration

particles emitted from the farm, the rate of sinking of the particles, and the currents and depths of the sea at

subject area.

According to Magill et al (2006), the impact on the seabed directly below the cage is greater in the case of sea bass farming,

while at greater distances from the farm there is a greater impact than fennel farming (due to the fact that feces

sea bass sinks faster than fennel feces - the average rate of sinking of sea bass feces is 0.7 cm / s, while for

sea buckthorn average sinking rate 0.48 cm / s).

Different values of organic matter yield can have different impacts on the bottom. It depends on the properties

location (bottom current, bottom type, temperature, etc.) and age of the farm. According to Sowles

(1994), at higher levels of organic matter yield to the bottom, the rate of benthos degradation is higher in the first year

cultivation, after which it slows down as the organic sediment is covered with new sediment. In the elderly

farms such as Veli Bok, under which a dynamic balance has already been established (meaning that there is no new accumulation of organic matter), the impact will be smaller due to the increase in

production in the first

years than in the case of a new farm. Various authors cite different values of carbon inflow to the bottom

in which there is an impact on the macrofauna (benthos). The results of various studies show that

limit of acceptable carbon yield due to which there will be no reduction of oxygen around 2.5 gC / m<sup>2</sup> / day

throughout the year (Sowles et al, 1994). On the other hand, various authors for the influx of carbon up to 16

gC / m<sup>2</sup> / day under different farms show impacts ranging from small to large (The Salmon aquaculture review, 1999).

## **Protection measures during the operation of the farm**

Carry out regular and nutritionally balanced nutrition with minimal use of drugs, so as to achieve the best ratio between the growth of fish and the emission of substances in the environment minimal.

Carry out daily monitoring of the condition of fish, and timely removal of dead fish. Special attention to the condition of sea bass after thunder and lightning at night, when possible increased mortality.

Inspect the system of anchors and mooring ropes and replace worn and worn parts equipment, especially equipment exposed to increased wear.

Mark the cages and the concession area with appropriate markings, in accordance with the applicable regulations and conditions prescribed by the competent port authorities.

Municipal waste generated by the operation of the farm is disposed of through a utility company or a concessionaire authorized to collect and dispose of municipal waste.

Collect packaging waste, depending on the type of packaging, in containers and dispose of it through a person authorized to collect packaging waste or persons authorized to collect non-hazardous and municipal waste.

Dispose of animal by-products through a concessionaire authorized to collect and disposal of animal by-products.

Store waste oils separately and hand them over to an authorized collector.



## Key wild species within the marine environment around the farm

CYANOPHYTA	Codium sp.	cunctatrix
Rivularia atra	Flabellia petiolata	Spongia officinalis
RHODOPHYTA	Halimeda tuna	CNIDARIA
Amphiroa rígida	ANGIOSPERMAE	Actinio equina
Ceramium sp.	Posidonio oceánico	Aiptasia mutabilis
Corallina officinalis	PORIFERA	Anemonio sulcata
Gelidium latifolium	Agelas oroides	Balanophyllo europaea •
Laurencia obtusa	Aplysina oerophoba	Cerianthus membranoceus
Lithophylum sp.	Aplysina cavernícola	Cladocora coespitosa •
Peyssonnelia sp.	Chondrilla nucula	Condylactis aurantiaca *
PHAEOPHYTA	Chondrosia reniformis	Eudendrium sp.
Colpomenia sinuosa	Cliona celata	Leptopsammia pruvoti
Cystoseira spp. *	Cliona viridis	Phymanthus pulcher
Dictyota dichotoma	Dysidea sp.	BIVALVIA
Padina pavonica	Crambe crambe	Acanthocardia deshayesii
Sargassum sp.	Haliclona sp.	Anomia ephippium
Sphacelaria cirrosa	Hemimycale columella	Callista chione
CHLOROPHYTA	Ircinia variabilis	Chlamys sp.
Acetabularia acetabulum	Ircinia sp.	
Cladophora sp.	Petrosia ficiformis	
Cladophora prolifera	Spirastrella	
Codium bursa		

Gastrochacna dubia  
Loeivicardium  
    oblongum  
Lithophaga  
    lithophaga  
Mytilus  
    galloprovincialis  
Pinna nobilis  
Pecten jacobaeus  
Venus verrucosa  
GASTROPODA  
Bittium reticulotum  
Cerithium vulgatum  
Flabellino affinis  
Gibbulo varia  
Hexaplex trunculus  
Melarhophe  
    neritoides  
Monodonta turbinata  
Patella sp.  
Rissoa sp.  
POLYCHAETA  
Myxicola  
    infudibulum  
Sabella pavonino

Sabella spallanzanii  
Pomatoceros  
    triqueter  
Protula tubularia  
Serpula vermicularis  
CRUSTACEA  
Chthamalus  
    stellotus  
Lysmata seticaudata  
Pagurus prideaux  
Palaemon elegans  
Periclimenes  
    scriptus  
Pisidia longicornis  
Pachygrapsus  
    marmoratus  
Polybius depurator  
Xantho poressa  
BRYOZOA  
Bryozoa indet.  
Smittina cervicornis  
ECHINODERMATA  
Arbacia lixula  
Astropecten  
    auronciacus

Echinaster  
    sepositus  
Ho/othuria forskali \*  
Holothuria tubulosa  
    \*  
Marthasterias  
    glacialis  
Paracentrotus lividus  
Schizaster  
    canaliferus  
Sphaerechinus  
    granulans  
TUNICATA  
Halocynthia  
    papilloso  
Microcosmus  
    vulgaris  
PISCES  
Chromis chromis  
Chromogobius  
    zebra tus  
Coris julis  
Diplodus annularis  
Diplodus sargus  
Diplodus vulgaris

Gobius auratus  
Gobius cruentatus  
Gobius geniporus  
Mullus surmuletus  
Oblada melanura  
Pagellus mormyrus  
Parablennius rouxi  
Sarpa salpa  
Scorpaena porcus  
Serranus hepatus  
Serranus scnba  
Spicara maena  
Tripterygion delaisi  
Tripterygion  
    tripteronotus

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