



REFAMED OFF-SHORE TECHNOLOGY

Darko Lisac
REFAMED Italy
www.refamed.com

1977 : First fish cages in Mediterranean in Croatia.

Yugoslavia farm grows seabass in 150 cages

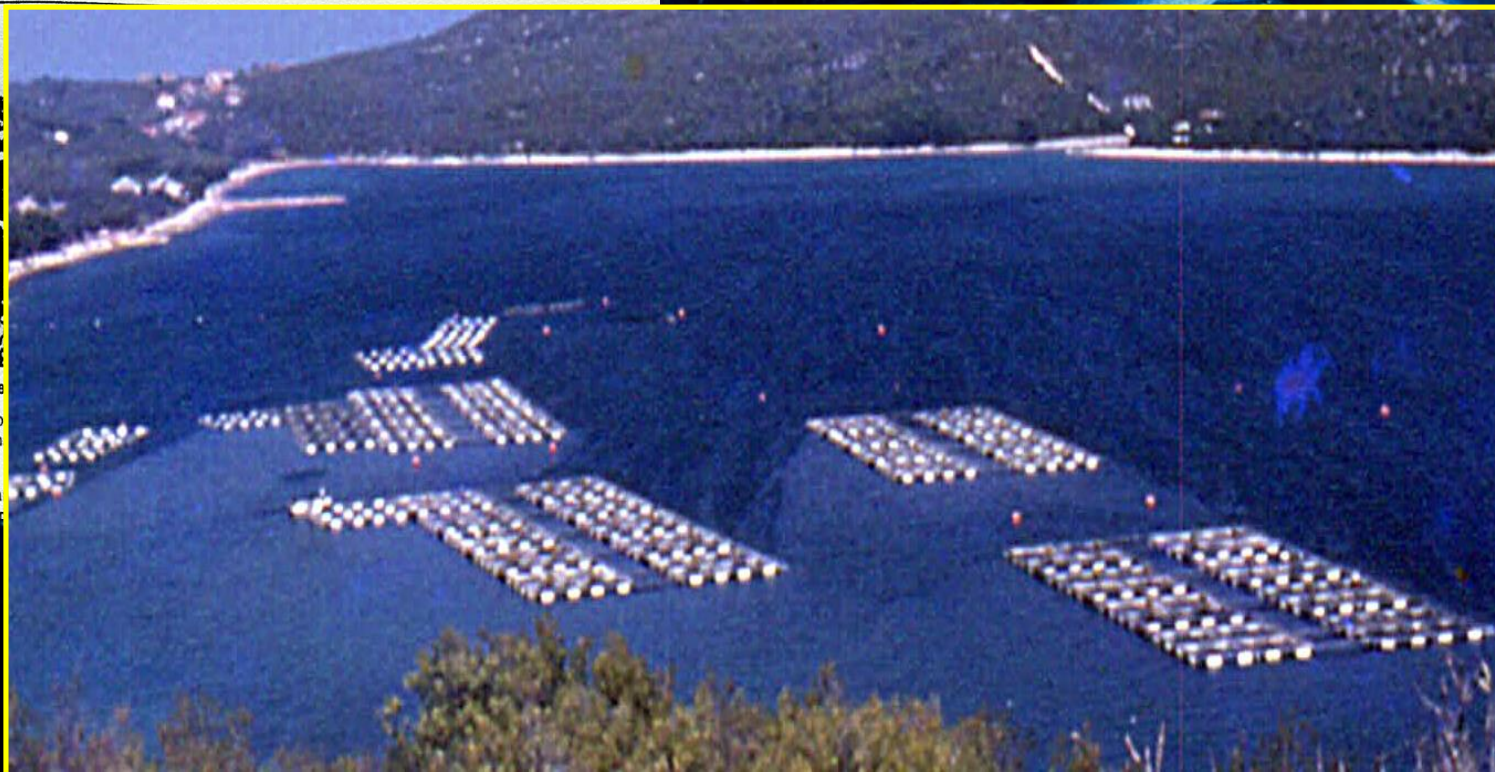
SEABASS was probably the first marine species to be cultured successfully from eggs to market size in the Mediterranean region, though considerable work was needed to develop the process into a viable commercial operation. One of the first companies to achieve this was Cenmar, a relatively young Yugoslavian firm. Its experiences with seabass provide an interesting example of some of the problems involved in rearing fish from the egg stage up to a marketable product, writes hatchery manager DARKO LISAC.



Gene

YUGOSLAVIA'S first trials in rearing seabass began in 1976, when the Institute of Biotechnology in Zadar began working with imported hatchery fry.

The need for a local hatchery quickly became apparent, and a temporary company which was to be the predecessor of Cenmar was set up to build the facility at

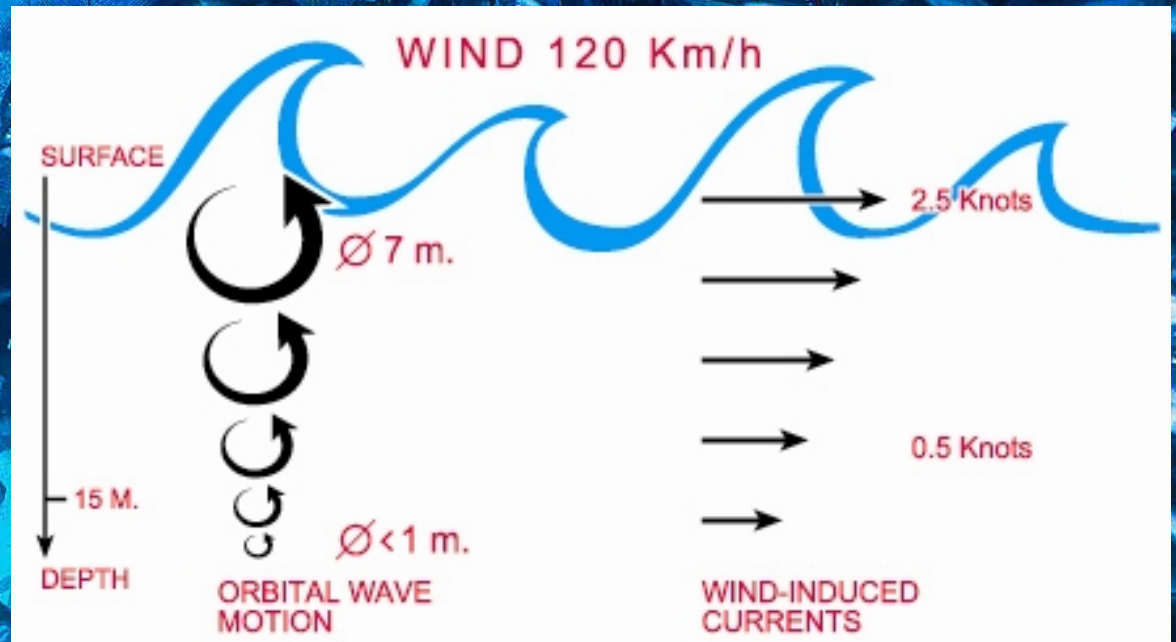




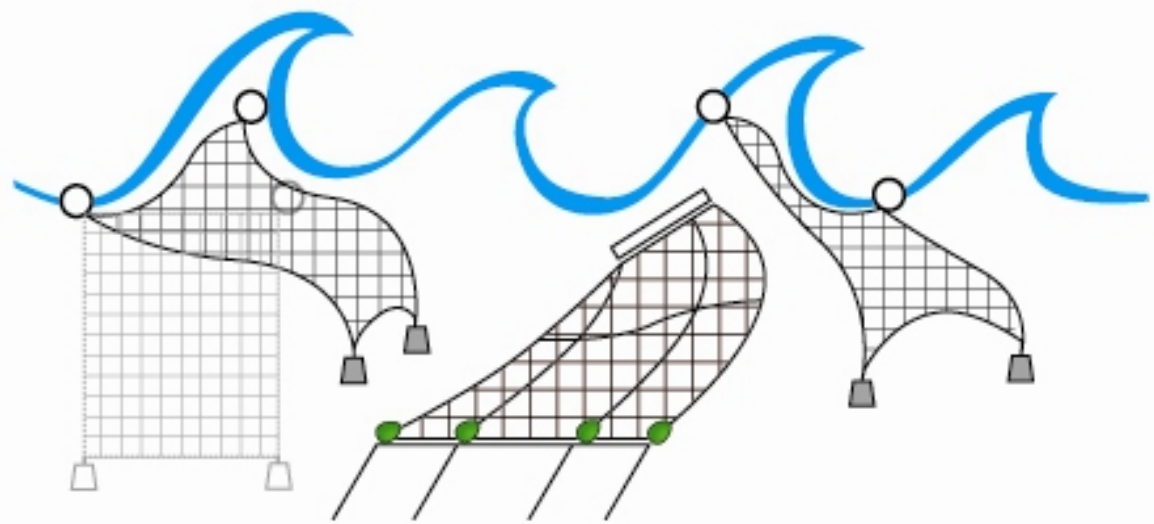
TLC : an Unique Cage Concept Proven in Open Sea Aquaculture

TLC cages exploit the dynamics of wave energy dispersion in the sea.

Instead of opposing the marine forces, they move in synergy with the waves almost like seaweed.



Conventional surface cage net deformation

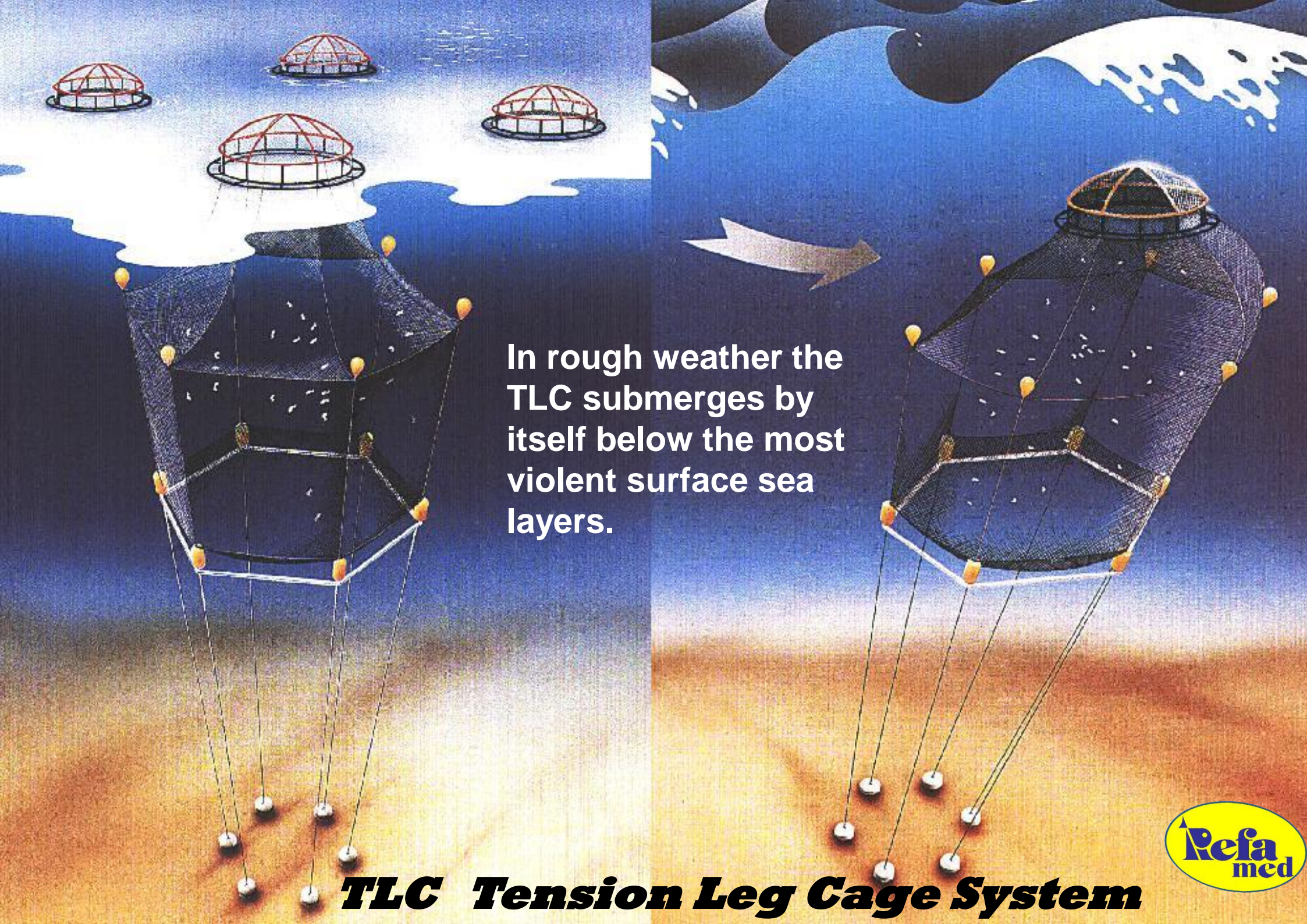




The TLC is our
speciality product for
the most demanding
open sea environments

TLC Tension Leg Cage System





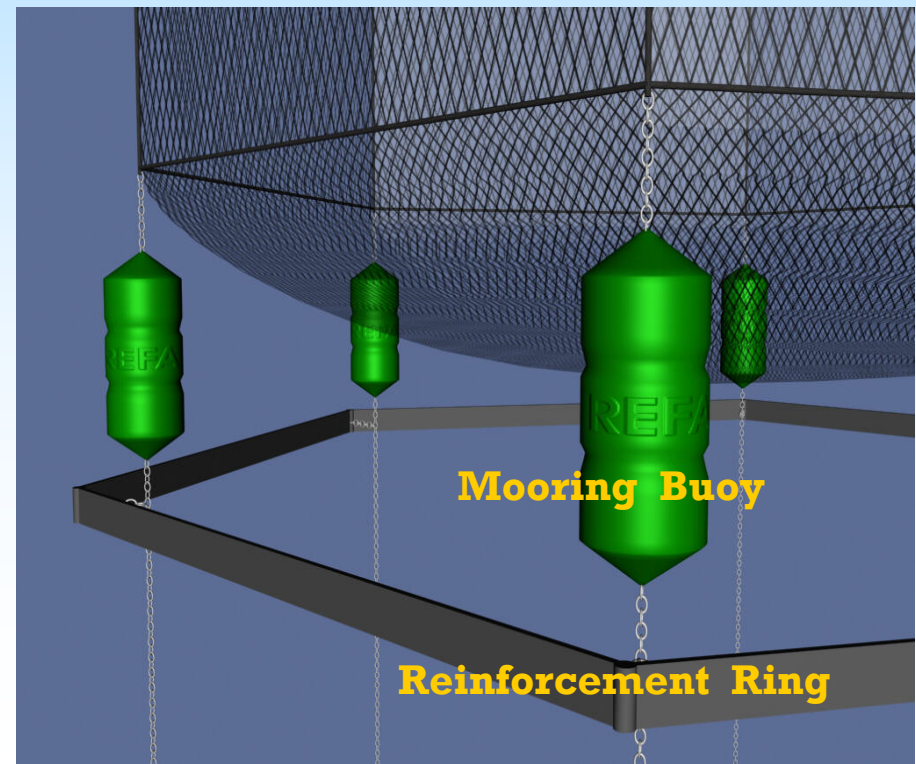
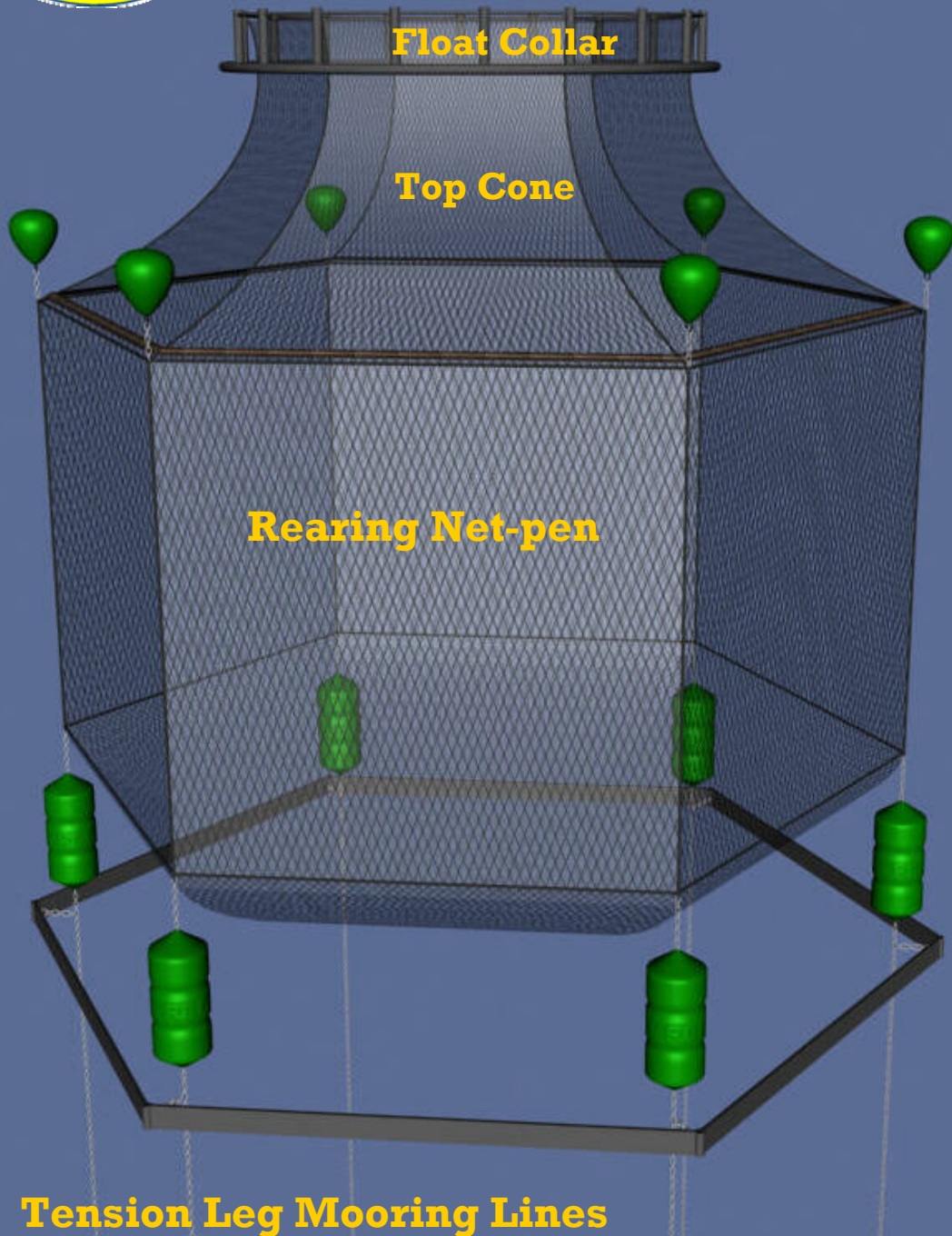
In rough weather the TLC submerges by itself below the most violent surface sea layers.

TLC Tension Leg Cage System





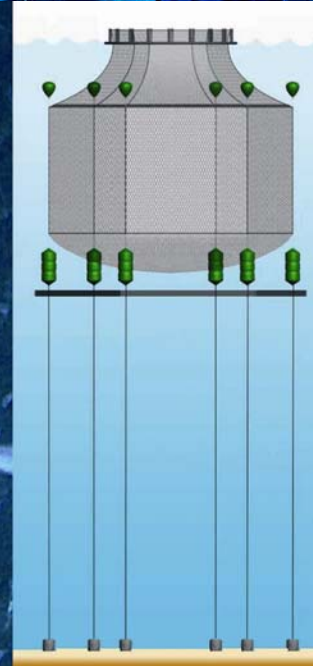
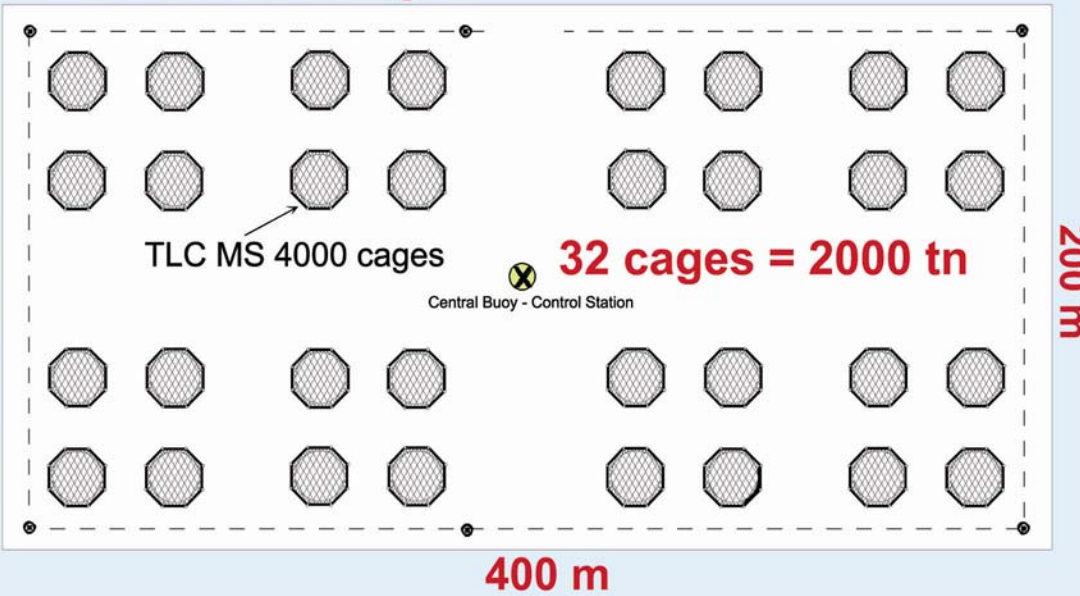
T L C Main Components





The Tension Leg Cage occupies a minimal area since its moorings do not extend laterally.

TLC MS 4000 cages



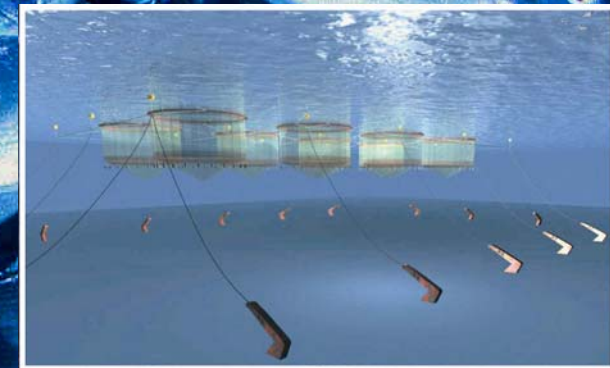
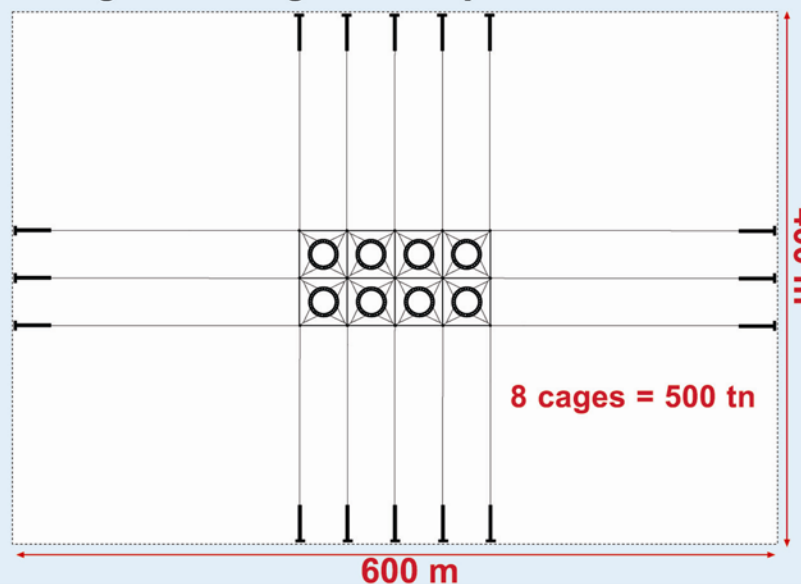
Each TLC cage is an independent, freely-moving unit, with no connection to neighbouring cages.

At 55 m depth, 8 PE cages + moorings require 440.000 m², TLC area remains the same.

At 35 m depth, 8 PE cages + moorings occupy 400 m x 600 m = 240.000 m² area.

In the same space we can install 96 TLC

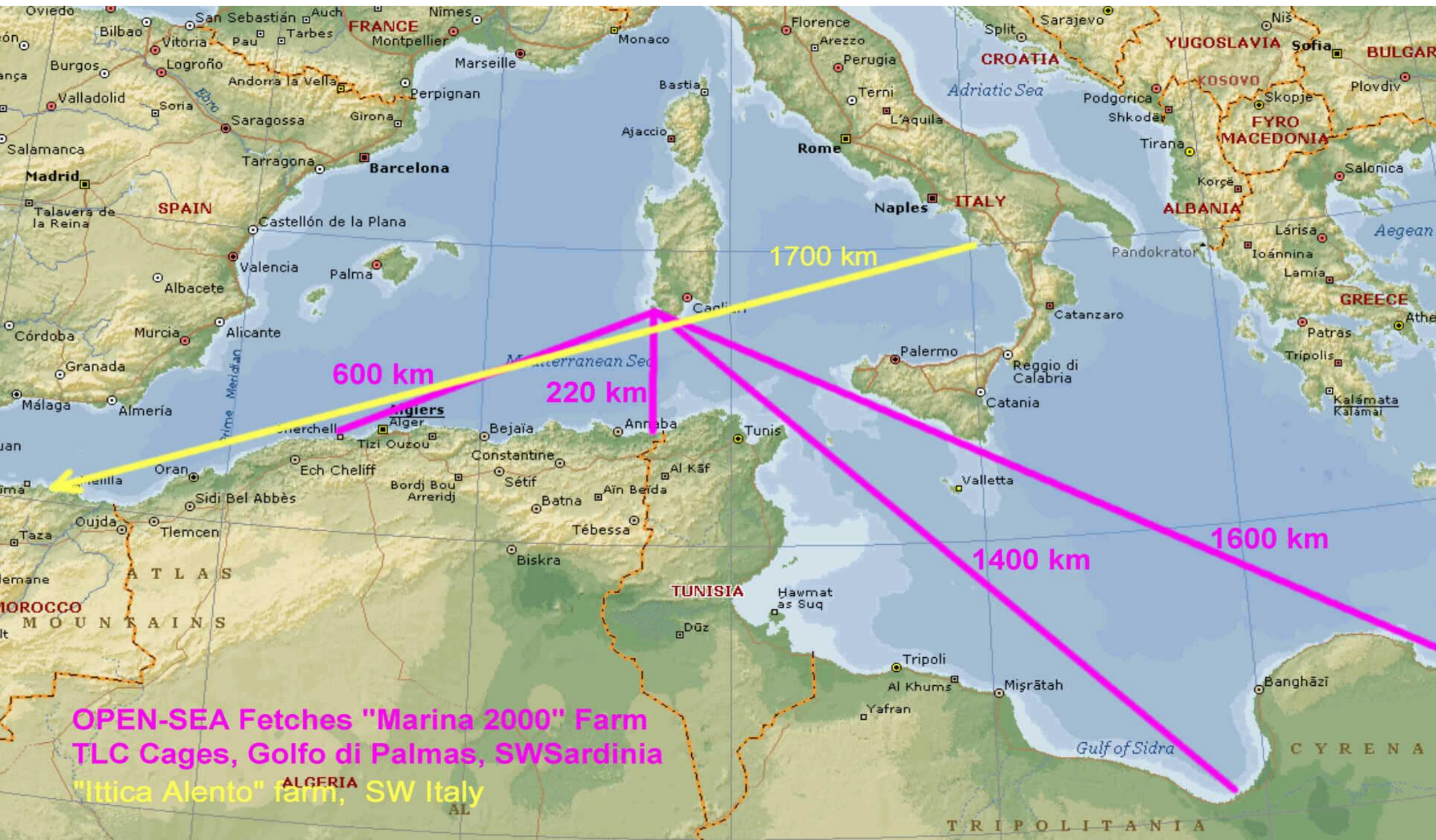
PE Cages & Mooring at 35 m depth



TLC Farms In Italy



All these TLC cage farms are subject to an open-sea fetch ranging from 1000 to 1800 km, and waves 7-12 m high





T L C Farms in the Atlantic

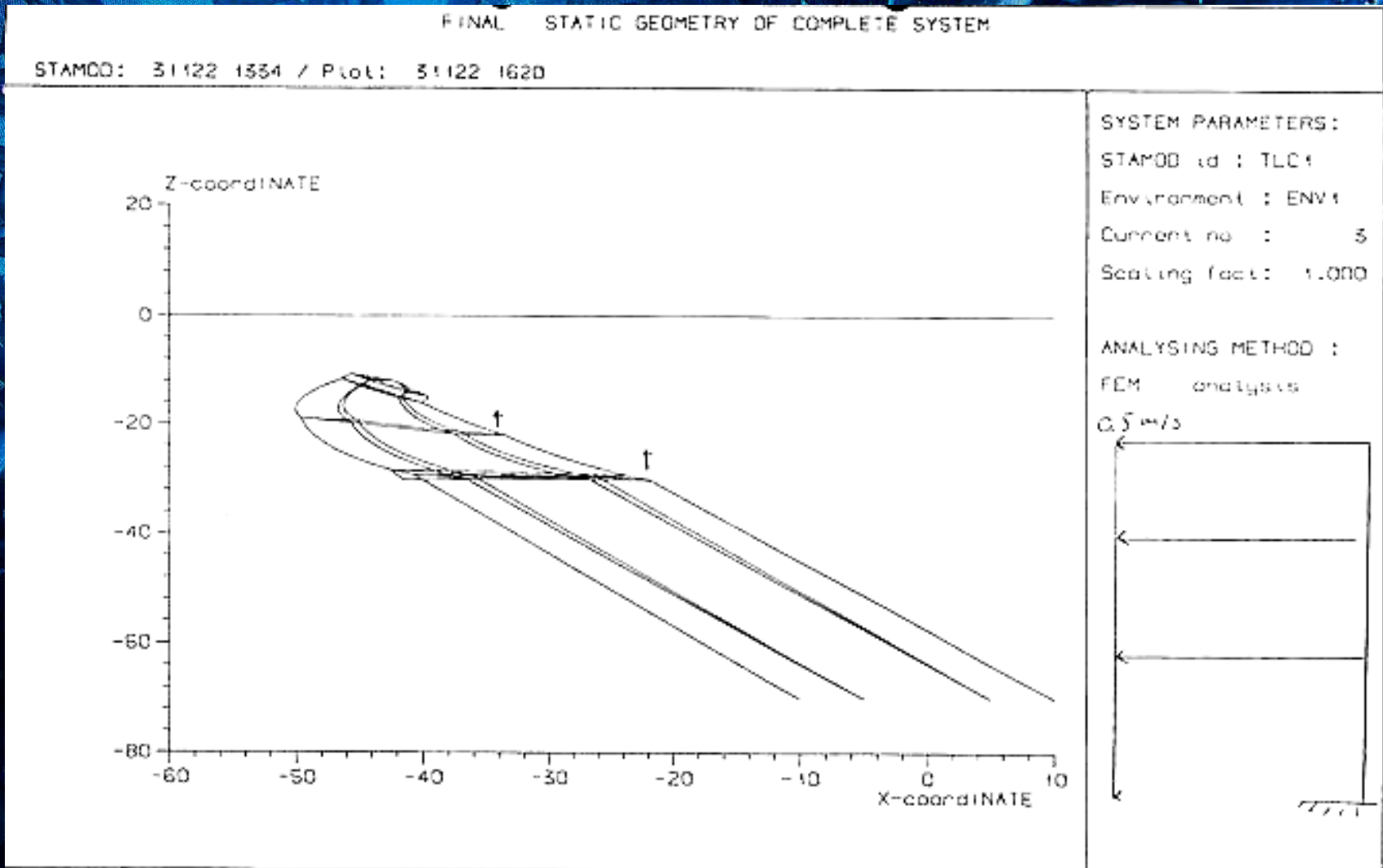




The TLC is a **HIGHLY ADAPTABLE** Cage System

We can :

Tune it's buoyancy for optimum response to local conditions



SINTEF

+ TLC-prototype
+
+

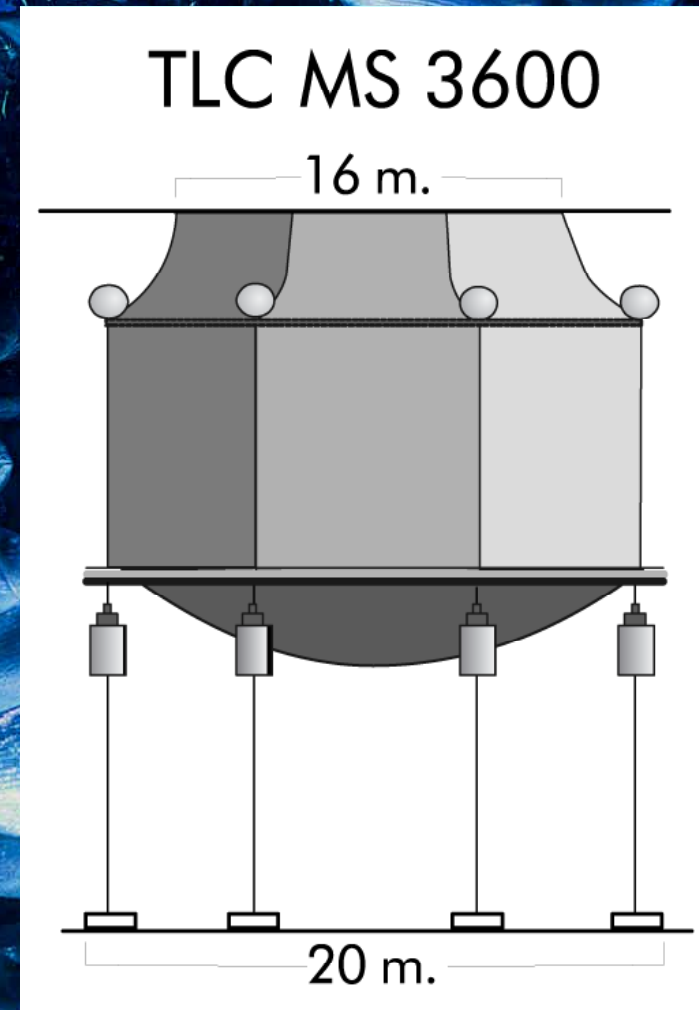
RIFLEX



The TLC is a **HIGHLY ADAPTABLE** Cage System

We can :

Reduce it's visual impact at the sea surface (MS model)



View of Farm from Land



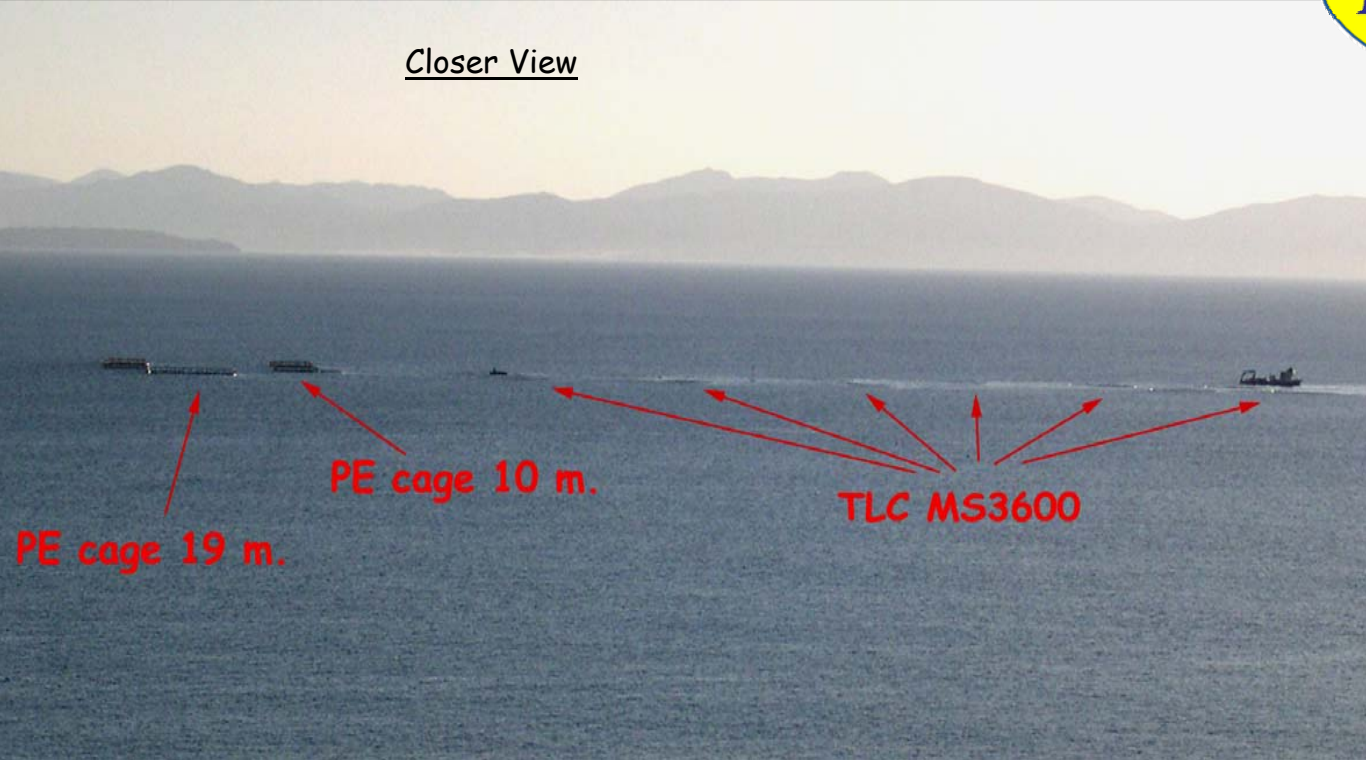
The TLC adapts to the waves

TLC MS LOW VISUAL IMPACT



TLC MS 3600

Closer View



On the Farm

TLC MS cages

PE cage





The TLC is a **HIGHLY ADAPTABLE** Cage System

We can :

Incorporate a lateral zipped door for easy fish transfer,

Equip it for easy towing with fish inside,

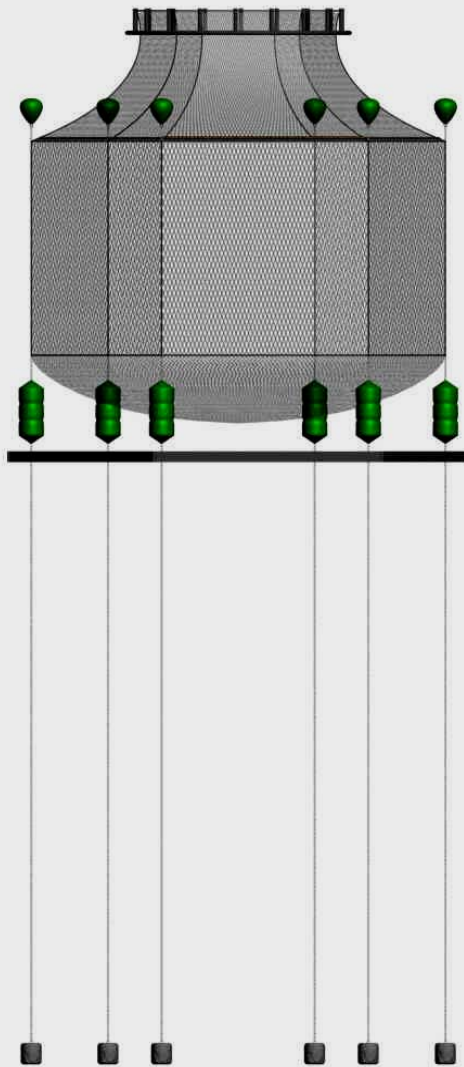
And satisfy most other operational demands to meet the specific requirements of each project.



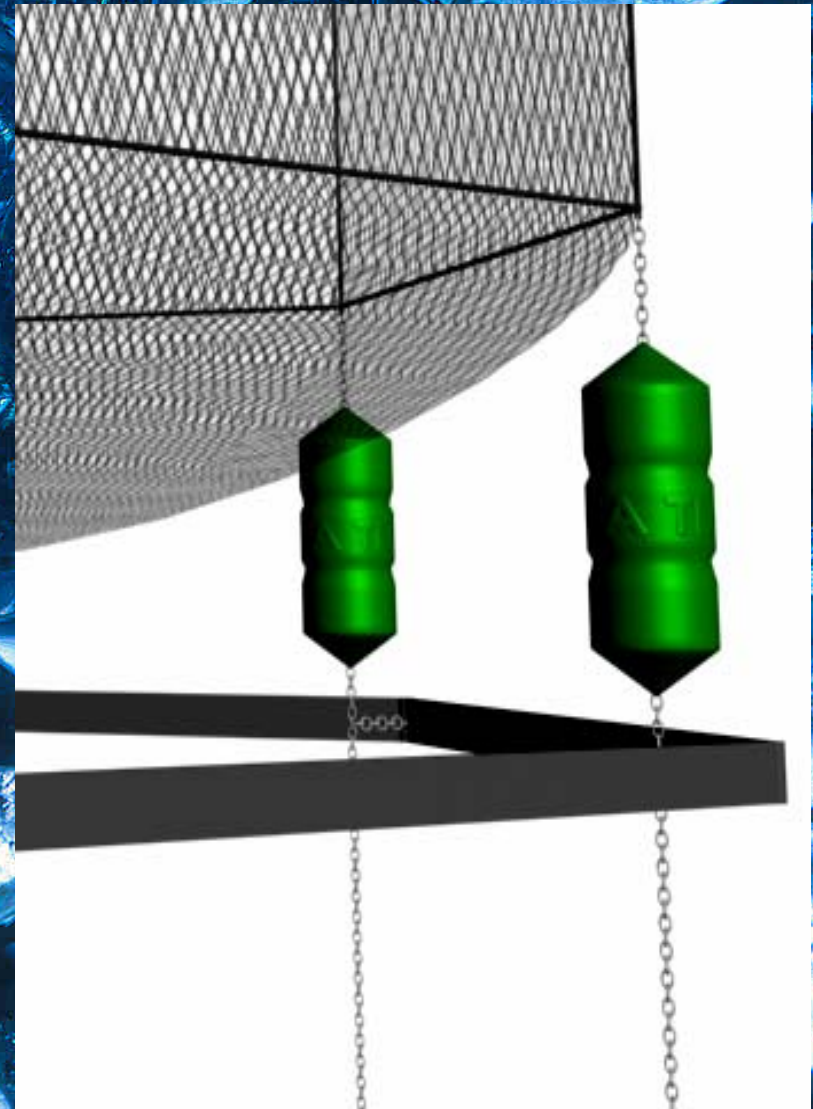
The TLC is a **HIGHLY ADAPTABLE** Cage System

It can :

Transform into a fully SUBMERGED cage



By simply
shortening the
vertical
mooring lines





Submerged TLC

**TLC can be used
permanently
SUBMMERGED**



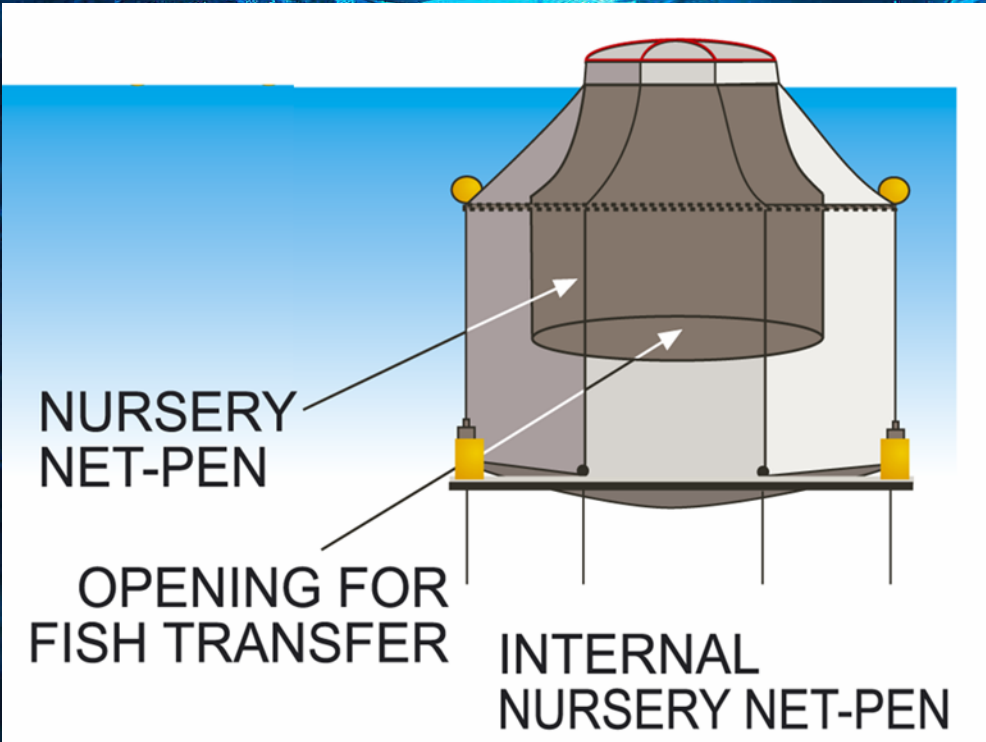
Based on the proven Tension Leg Cage design
for specific site & species requirements



The TLC is a **HIGHLY ADAPTABLE** Cage System

It can :

Incorporate an internal nursery cage,

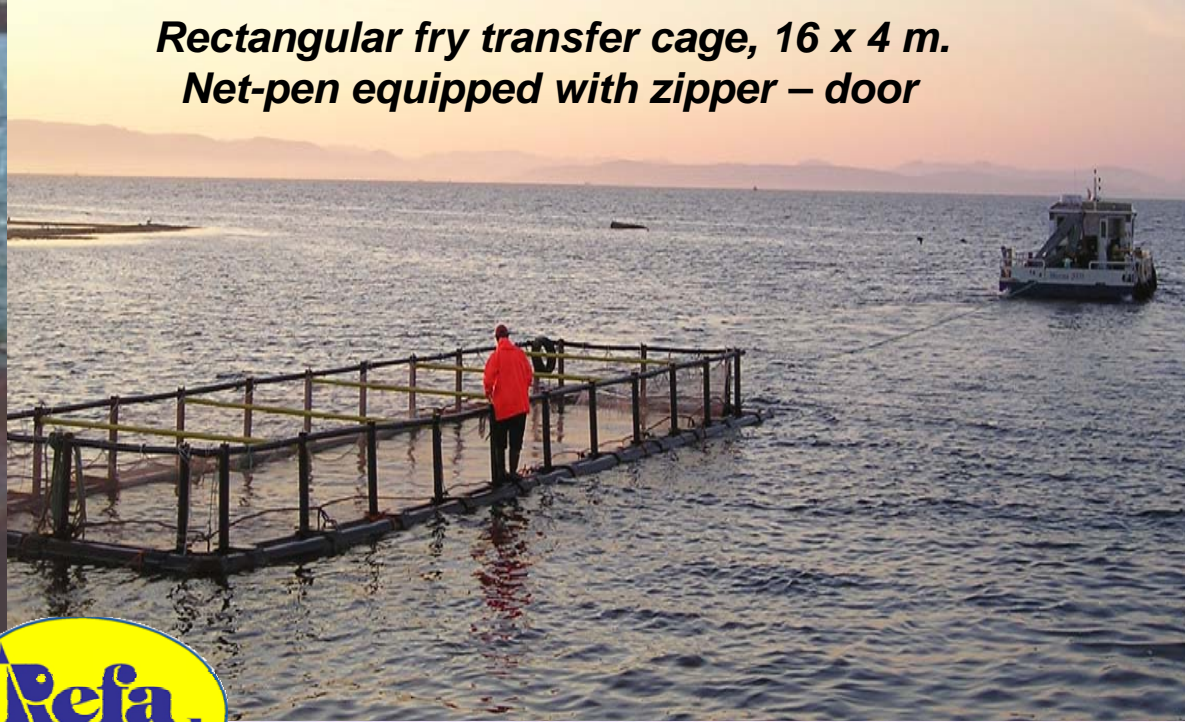


Examples of Work Procedures for fish transfer with TLC Cages

Stocking fry into TLC cage attached to surface float collar, & towing to site



**Rectangular fry transfer cage, 16 x 4 m.
Net-pen equipped with zipper – door**



Installing surface collar



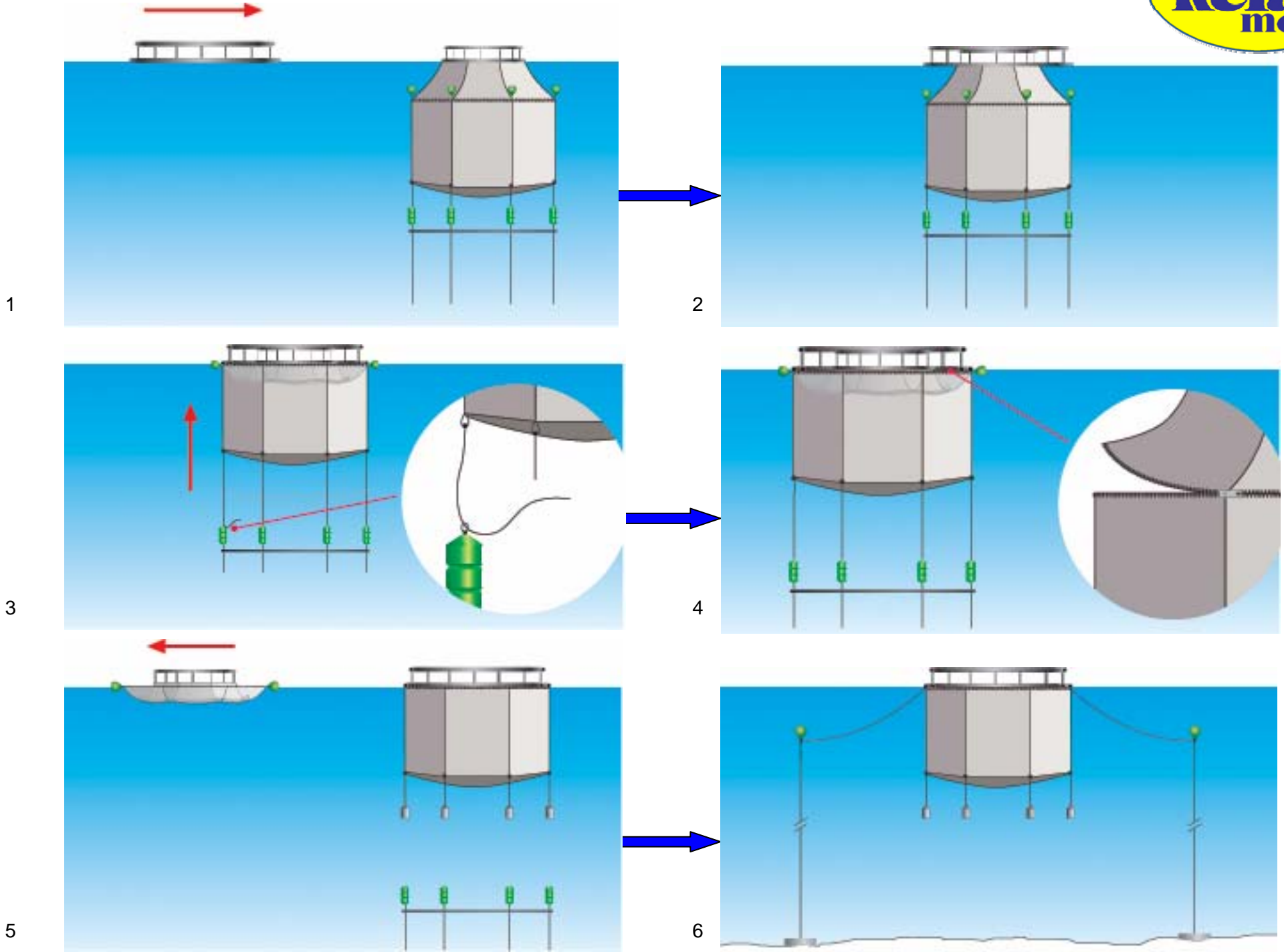
Fish transfer in progress

Harvesting options

- With Sweep-net inside TLC cage
- Raising the main net to surface, and attaching to big float collar
- Batch transfer to smaller floating cages



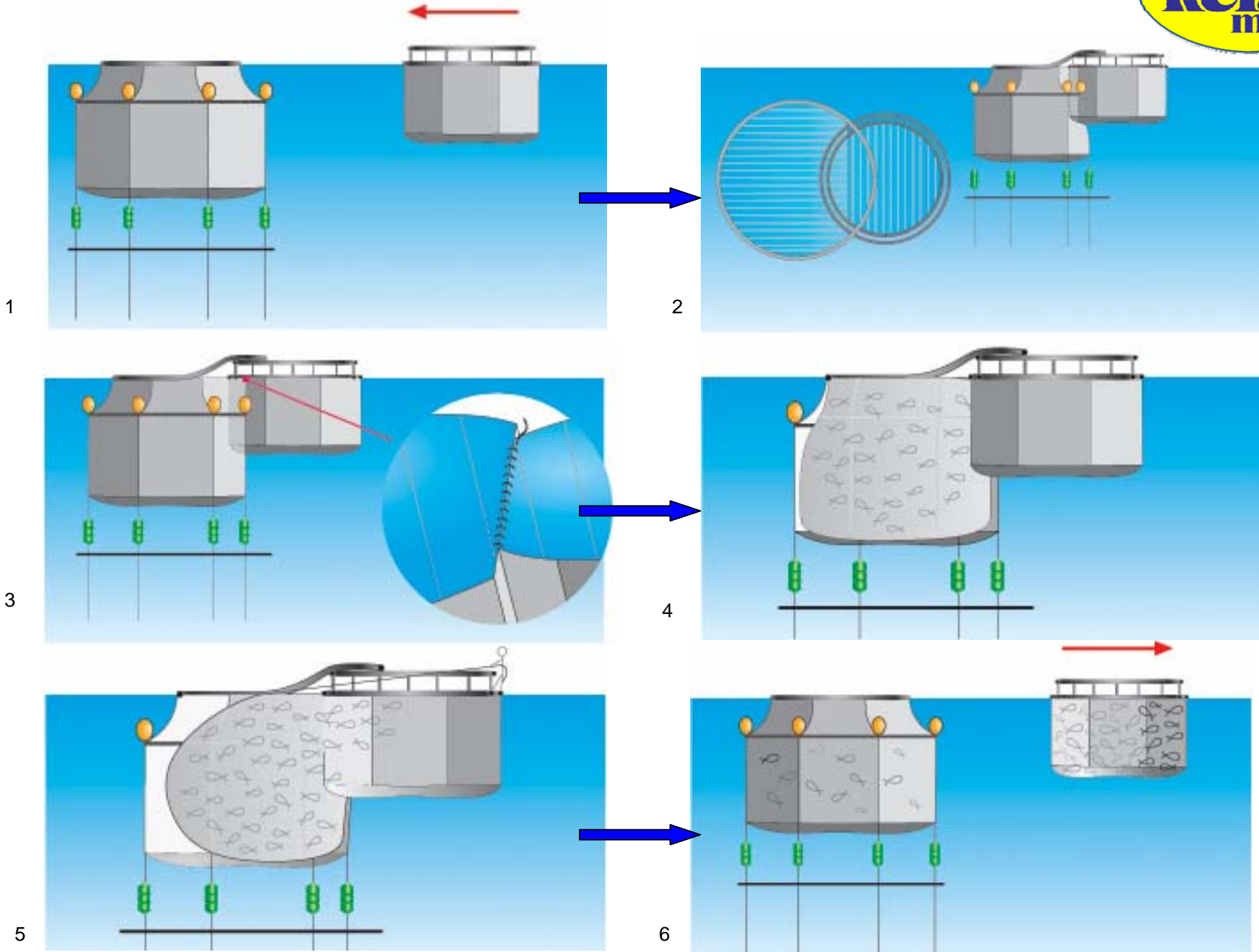
HARVEST METHODS: Lifting the TLC to surface



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HARVEST METHODS: Batch transfer to small harvest cage



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Feeding the Fish



**Manually, in the
Centre of the Cage**



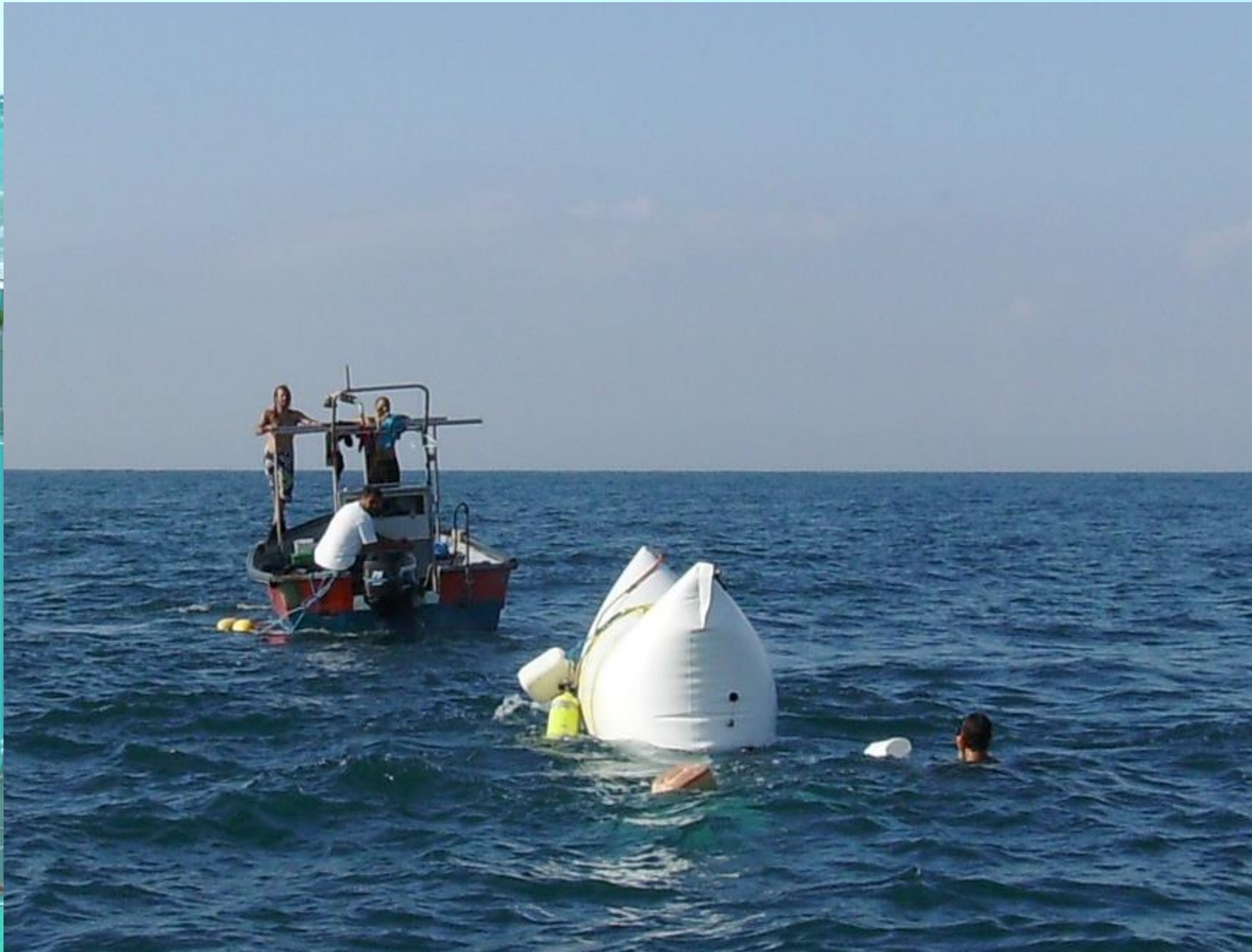


TLC Farm in East Mediterranean



2011: TLC 3600 – 8
2013: 3 x TLC 3600 - 8
+ Harvest Cage

2014: Awaiting approval
of new site lease to
expand the farm.



TLC Farm in Israel

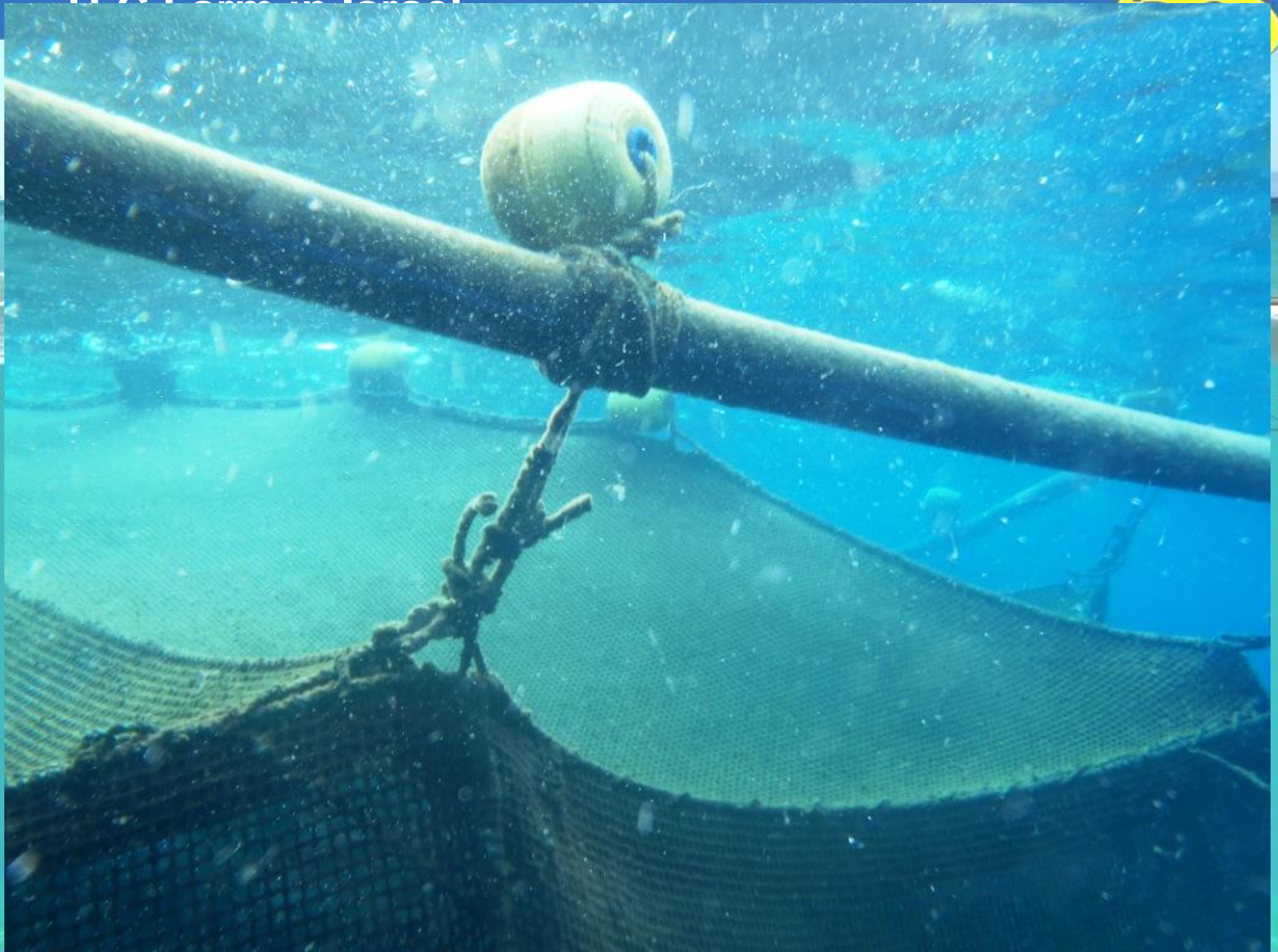
OPEN SEA FARMING TECHNOLOGIES



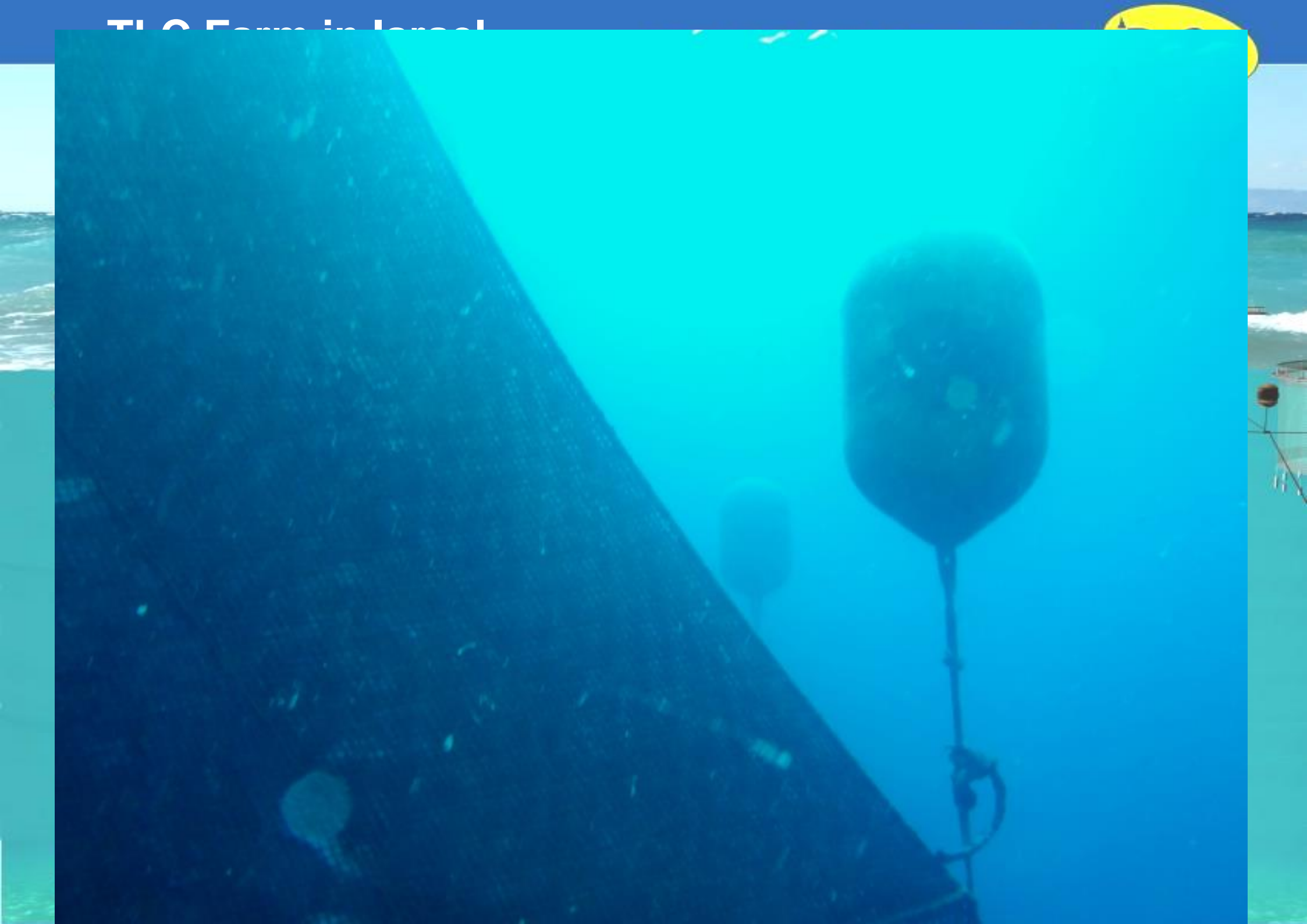


The Farm in Israel





1.2 Form in Level



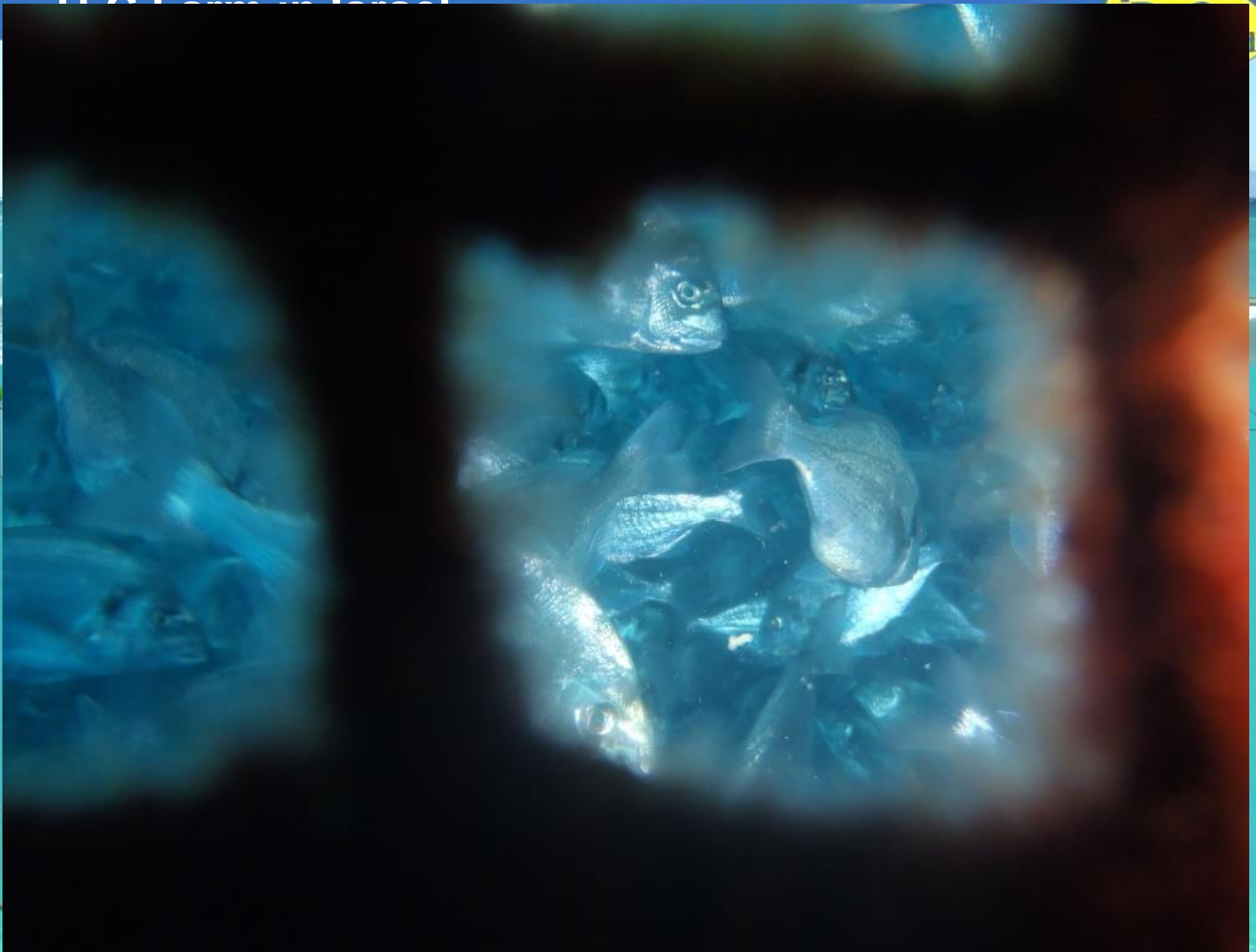
1.2 Form in level



11.2 Form in Level



The Farm is here!



**TLC Farm View
with surface harvest cages**

→ Integration of technologies





TLC Farm with Centralised Feed Barge

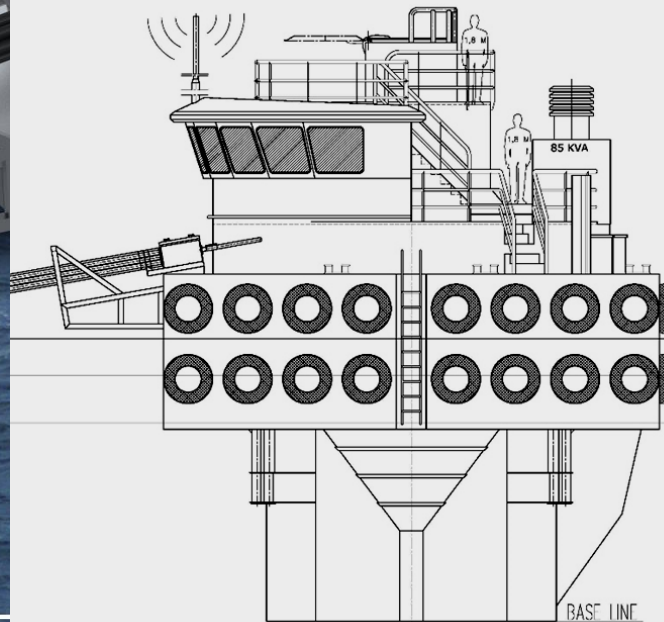


**70 Ton Feed
Cone Barge**

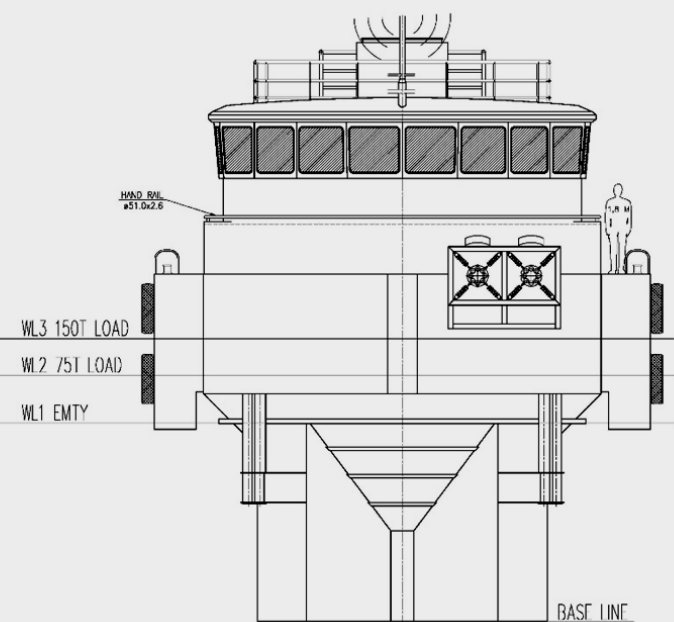


FC Forflåte

150 tonn



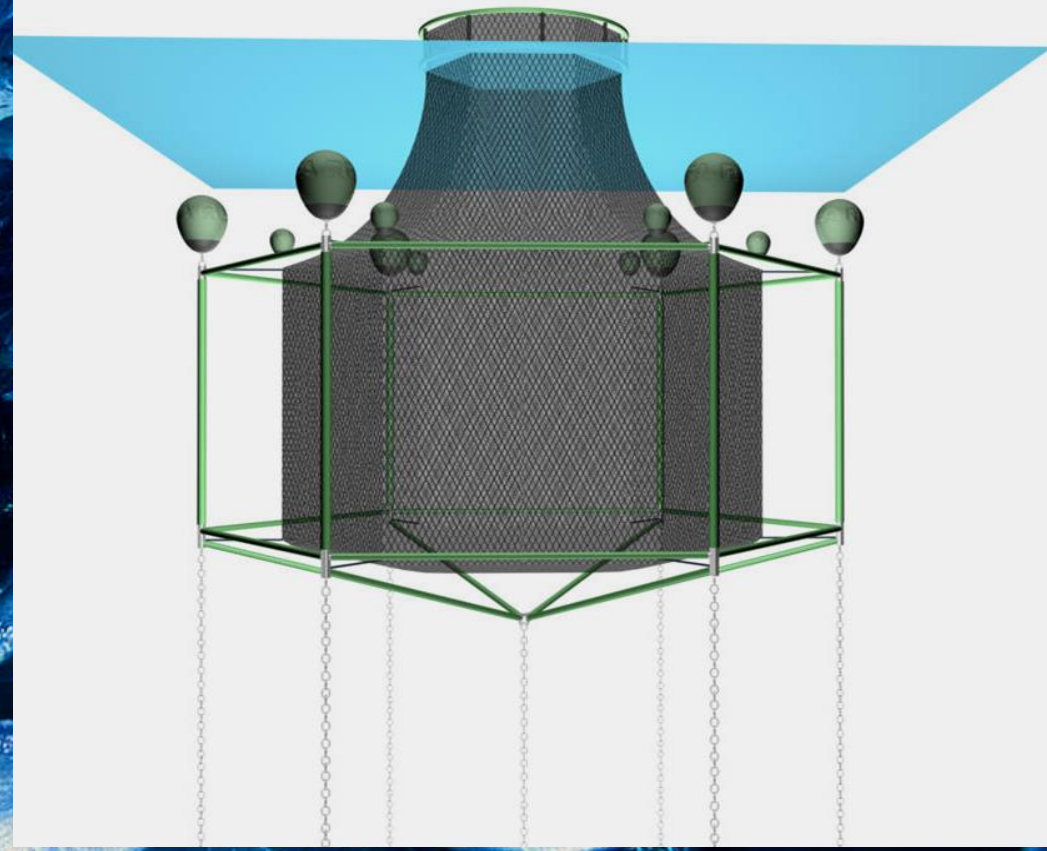
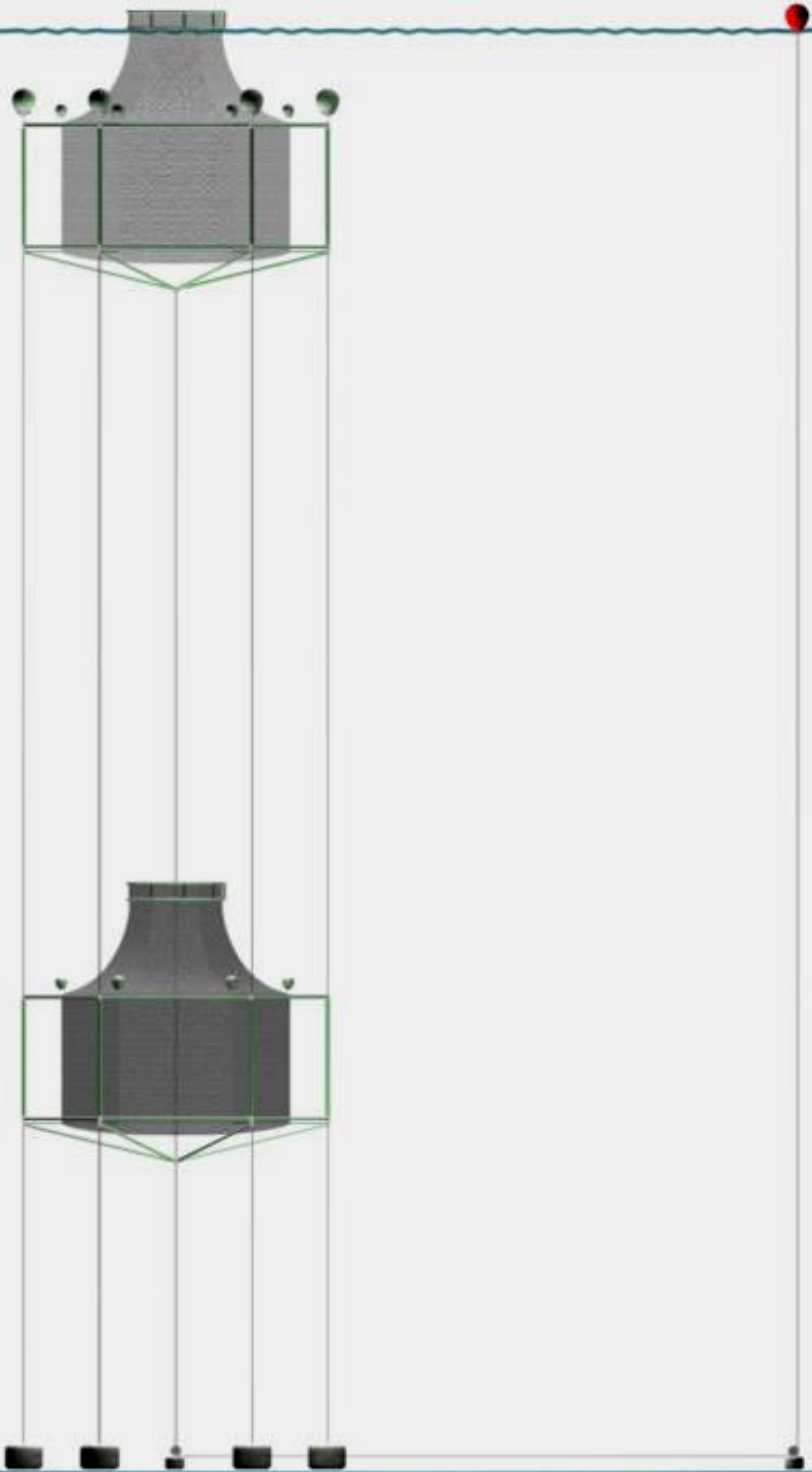
PROFILE



FRONT VIEW

Controlled Submersion T L C Cage

**Lifting & lowering
Speed < 1 m/min**



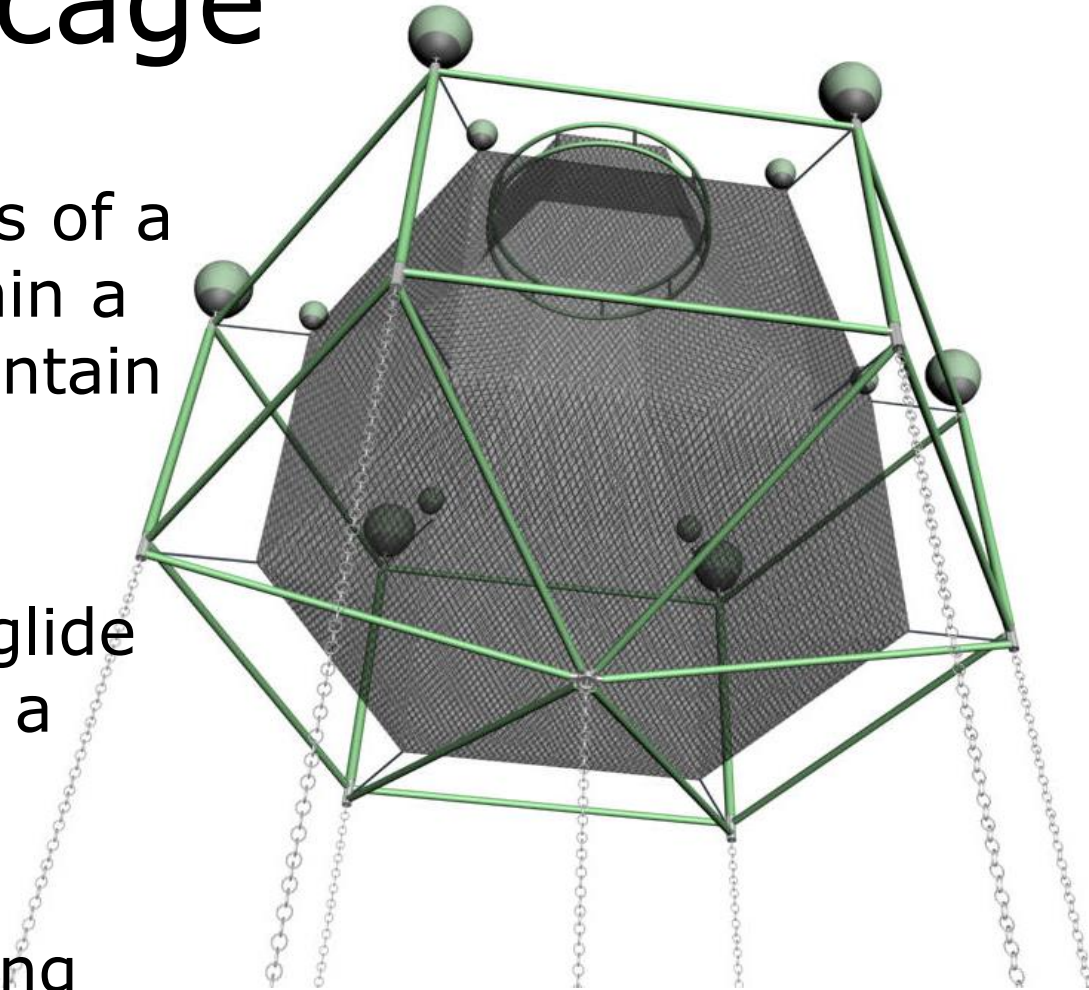
Installation, operation and evaluation of a submersible cage at 55 m depth in Crete for the rearing of red porgy *Pagrus pagrus*

N. Papandroulakis, P. Anastasiadis, D. Lisac, M. Asderis, H. Bakolias, P. Divanach, M. Pavlidis

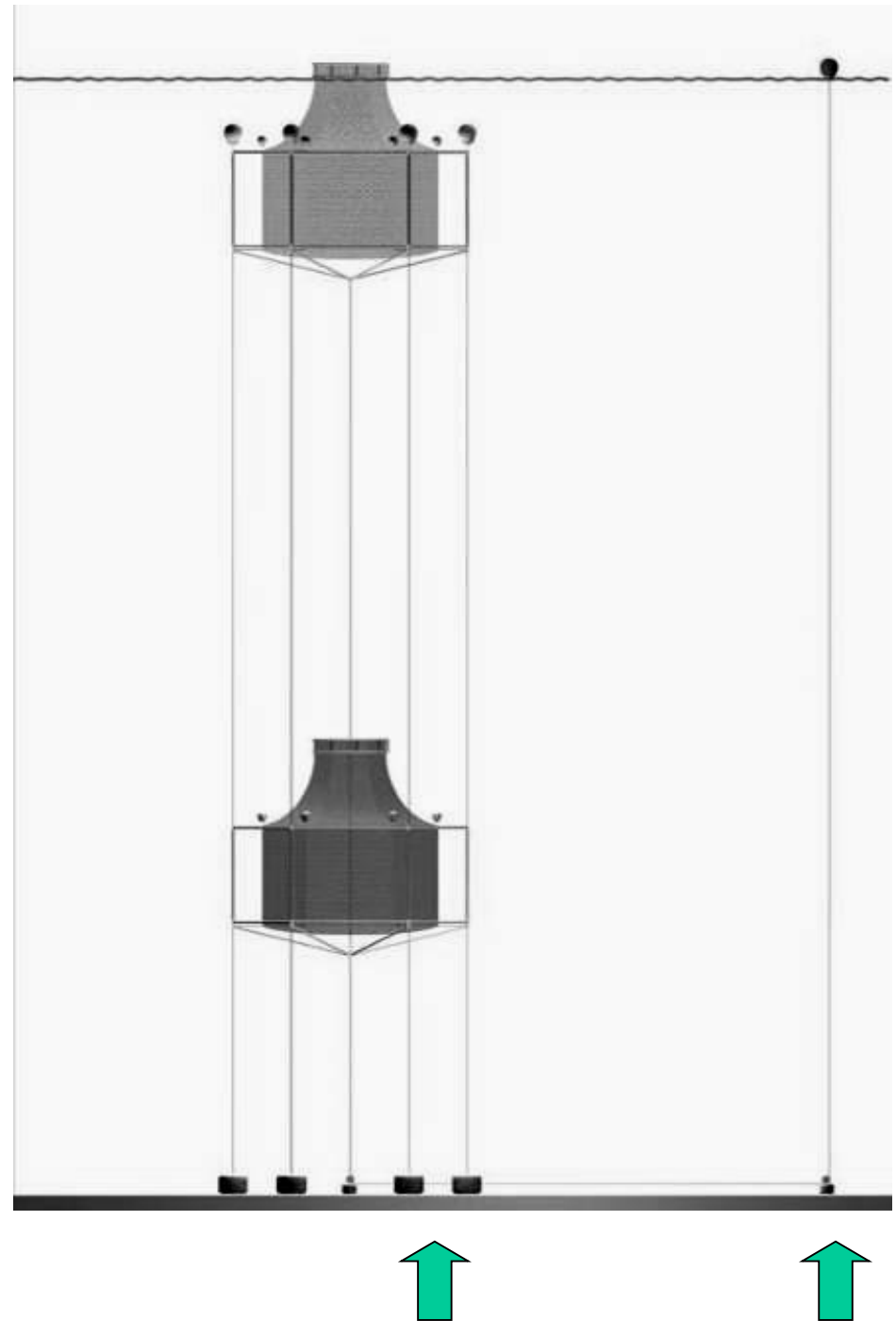
**Institute of Aquaculture, Hellenic Center for Marine Research Greece
RefaMed SRL., Italy
Zenon SA. Greece
Biology Dept, University of Crete, Greece**

The cage

- The cage-net module consists of a nylon net-pen contained within a hexagonal rigid frame to maintain the shape of the net
- Vertical beams of the frame glide over 6 tension legs placed in a circle
- Tension legs consist of mooring block, chain and flotation buoy, permanently installed



- The controlled submersion of the cage, is performed with an electric winch and rope – pulley system
- The pulleys are installed on 2 concrete blocks.



operation

- The cage is submerged to 40 m at the installation site. The hauling up of the cage is done with a velocity below 1m min^{-1}
 - 1st day: 2 hauling up 8m each with an interval of 3 hours
 - 2nd day: 2 hauling up 8m each with an interval of 3 hours
 - 3rd day: 1 final hauling up of 8m
- The operation of the cage is supported by a floating platform
- Solar panels provide power (320 W) connected to batteries that can supply almost 50Ah over 4 days (max period without sun during February)





Refa Med focuses on developing technical solutions to overcome the environmental and operational constraints our clients face.

We do not offer a standard, off-the-shelf product.

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REFA MED Italy
www.refamed.com

Thank You !