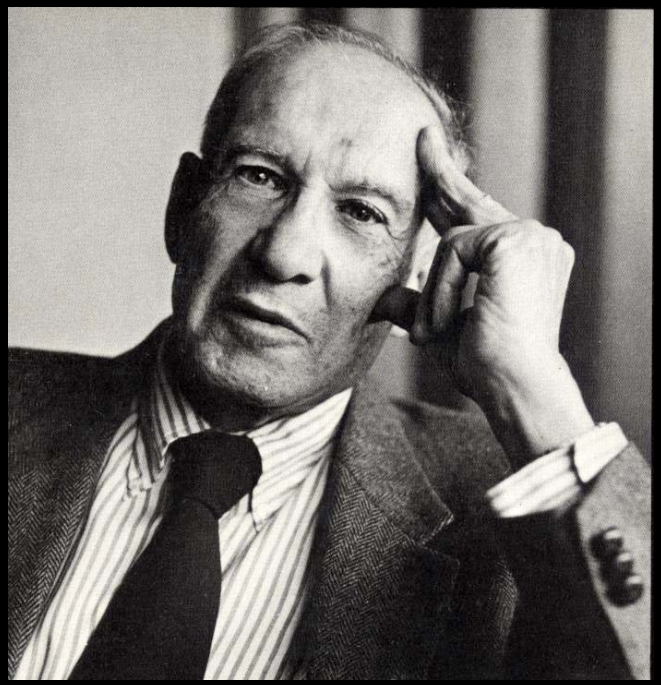
Cultivo Offshore:
Soluciones posibles

"Aquaculture, not the internet,
represents the greatest investment opportunity
of the 21st century."

~Peter Drucker~

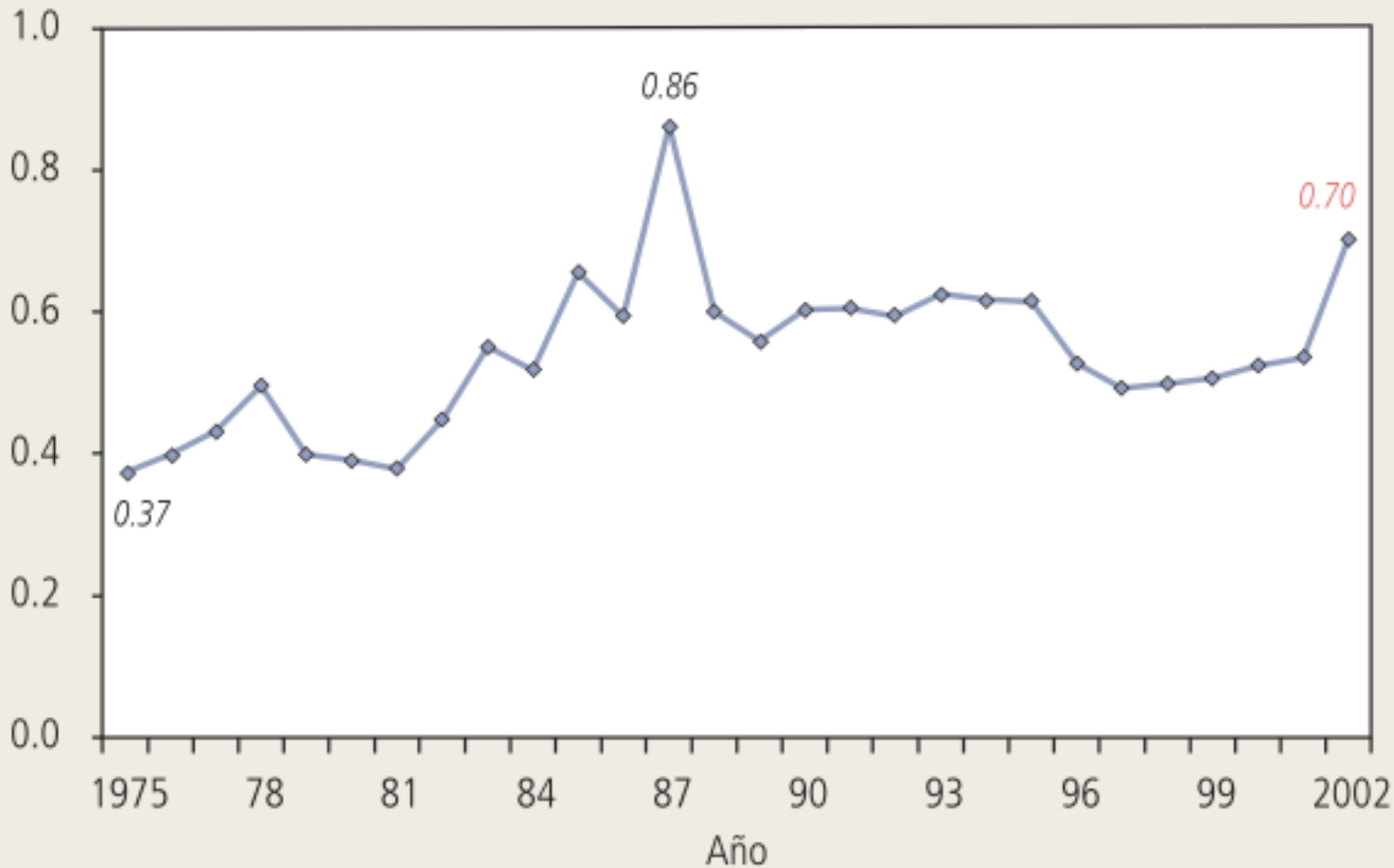


PERSPECTIVAS DE LA ACUICULTURA MUNDIAL EN LOS PRÓXIMOS DECENIOS: ANÁLISIS DE LOS PRONÓSTICOS PARA 2030 DE LA PRODUCCIÓN ACUÍCOLA DE LOS PRINCIPALES PAÍSES

¿Tiene cada país la aspiración de ampliar su sector acuícola para satisfacer la demanda mundial pronosticada y son sus proyecciones realistas?

Innovación en Chile

Chile, Evolución del Gasto en I+D como Porcentaje del PIB, 1975-2002



Fuente: Conicyt (2004).

Indicadores de I+D (Datos más recientes)[a]

País	Gasto en I+D (como % del PIB)	Financiamiento de la I+D según fuente		
		Empresas	Gobierno	Otro*
Chile	0.70	34.5	53.9	11.5
Argentina	0.41	26.3	68.9	4.9
Brasil	1.04	38.2	60.2	1.6
México	0.39	29.8	59.1	11.1
Finlandia	3.46	69.5	26.1	4.3
Nueva Zelanda	1.16	37.1	46.4	16.5
Irlanda	1.13	67.2	25.2	7.7
EE.UU.	2.60	63.1	31.2	5.7
Israel	4.90	69.6	24.7	5.6
Suecia	4.27	71.9	21.0	7.2
Japón	3.12	73.9	18.2	8.0
Corea del Sur	2.64	74.0	23.9	2.1
Singapur	2.15	49.9	41.8	8.3
Turquía	0.66	41.3	50.6	8.2
Polonia	0.59	31.0	61.1	8.0
Hungría	0.95	30.7	58.0	11.1
República Checa	1.34	51.4	41.8	6.8
Portugal	0.94	31.5	61.0	7.2
España	1.03	48.9	39.1	12.0

Fuentes: OECD MSTI (2004), RICYT (2003) y Conicyt (2004).

Dotación en Capacidad Científico-tecnológica

	Ph.D. Graduados en Ciencia (por millón de hab. 1996-1999)	Científicos e Ingenieros en I+D (por millón de hab. 1990-2000)
EE.UU.	91	4,099
Finlandia	177	5,059
Irlanda	82	2,184
Israel	88	1,563
Suecia	197	4,511
Nueva Zelanda	n.d.	2,197
Corea del Sur	49	2,319
Singapur	n.d.	1,653
Chile	3	370

Fuente: Tokman y Zahler (2004).

MINISTERIO DE ECONOMIA,
FOMENTO Y TURISMO
SUBSECRETARIA DE PESCA
FPR/JAK/vdc

DIVISION JURIDICA

Ministerio de Economía, Fomento y Turismo
Subsecretaría de Pesca

Ministerio de Economía, Fomento y Turismo
al usuario (acuicultura)
5/11/10

APRUEBA CONTRATO DE EJECUCION DE PROYECTO DIAGNOSTICO Y DEFINICIÓN DE ESTANDARES DE CALIDAD Y SEGURIDAD PARA LA CERTIFICACIÓN DE ESTRUCTURAS DE CULTIVO Y SUS FONDEOS CELEBRADO CON NAVTEC DIVISIÓN ACUICOLA LIMITADA

R. EX Nº 3354 /

VALPARAÍSO, 04 NOV 2010

VISTOS: Ley Nº 20.407, de Presupuestos Generales de la Nación para el año 2010; La Ley 19.886, de Bases sobre contratos administrativos de suministro y prestación de servicios, y su Reglamento aprobado por Decreto Nº 250 del Ministerio de Hacienda, publicado en el Diario Oficial con fecha 24 de septiembre de 2004 y sus modificaciones posteriores; la Resolución Nº 1600 de 2008 de la Contraloría General de la República, Ley Nº 20.238 que norma sobre la protección de los trabajadores y la libre competencia en la provisión de bienes y servicios a la Administración del Estado, Resolución Exenta Nº 2558 Aprobatoria de Bases de fecha 23 de Agosto de 2010 y Resolución Exenta Nº 3083 de Adjudicación de fecha 8 de octubre de 2010.

CONSIDERANDO:

Que, esta Subsecretaría de Pesca, licitó la ejecución del proyecto ***"DIAGNOSTICO Y DEFINICIÓN DE ESTANDARES DE CALIDAD Y SEGURIDAD PARA LA CERTIFICACIÓN DE ESTRUCTURAS DE CULTIVO Y SUS FONDEOS".***

Que, dicho requerimiento se publicó con el ID Nº 4728-40-LE10 en Mercado Público.

Que, la propuesta fue adjudicada a la NAVTEC DIVISIÓN ACUICOLA LIMITADA, R.U.T Nº 76.055.840-0, según consta la Resolución Exenta Nº 3083 de fecha 8 de octubre de 2010.

Que, la Subsecretaría de Pesca dispone de los fondos necesarios para contratar los servicios requeridos.

GRS

InnovaChile
CORFO

RESOLUCIÓN EXENTA

CORFO
OFICINA DE PARTES
16.09.09 000965
SANTIAGO

APRUEBA CONVENIO CON LA EMPRESA NAVTEC DIVISIÓN ACUÍCOLA LIMITADA PARA EJECUCIÓN DEL PROYECTO DENOMINADO SISTEMA DE COMPACTACIÓN Y TRANSPORTE DE REDES INTEGRADO A UN MODELO DE BIOSEGURIDAD EN LA INDUSTRIA ACUÍCOLA Código N°09IERI-5562.

1580

MIDUIRA

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PELIGRO

ACUICULTURA OCEANICA

Un caso de estudio para CHILE

14 Octubre Puerto Montt - 21 Octubre Santiago

www.acuiculturaoceanica.com

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FARMING THE DEEP BLUE

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Marine Institute

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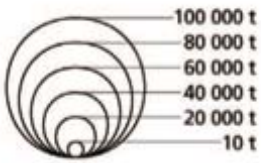
Cage aquaculture: a global overview

Cage aquaculture production 2005

Data were taken from fisheries statistics submitted to FAO by the member countries for 2005. In case 2005 data were not available, 2004 data were used.



freshwater

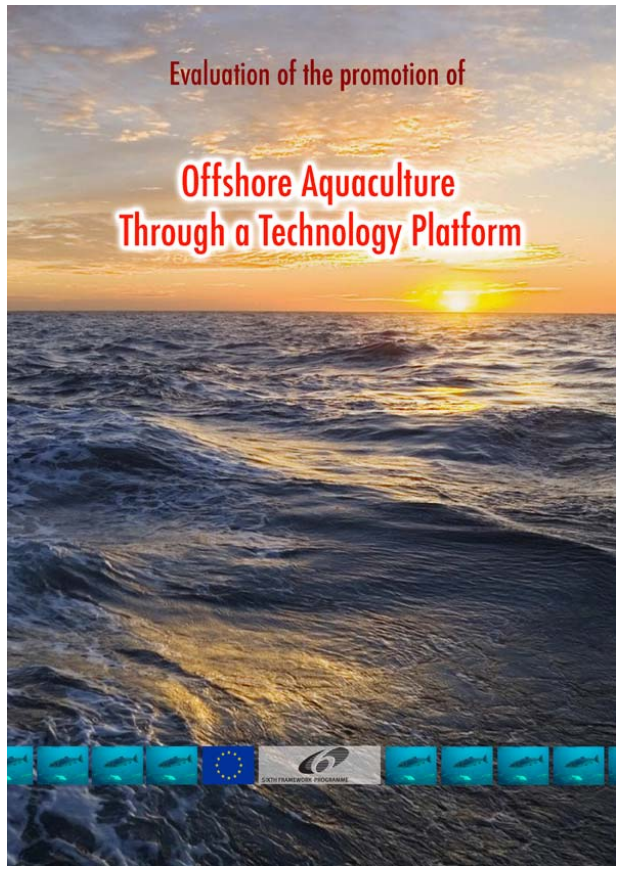
marine and brackishwater

Map background image *Blue Marble: Next generation* courtesy of NASA's Earth Observatory

Que entendemos por Acuicultura Offshore ?

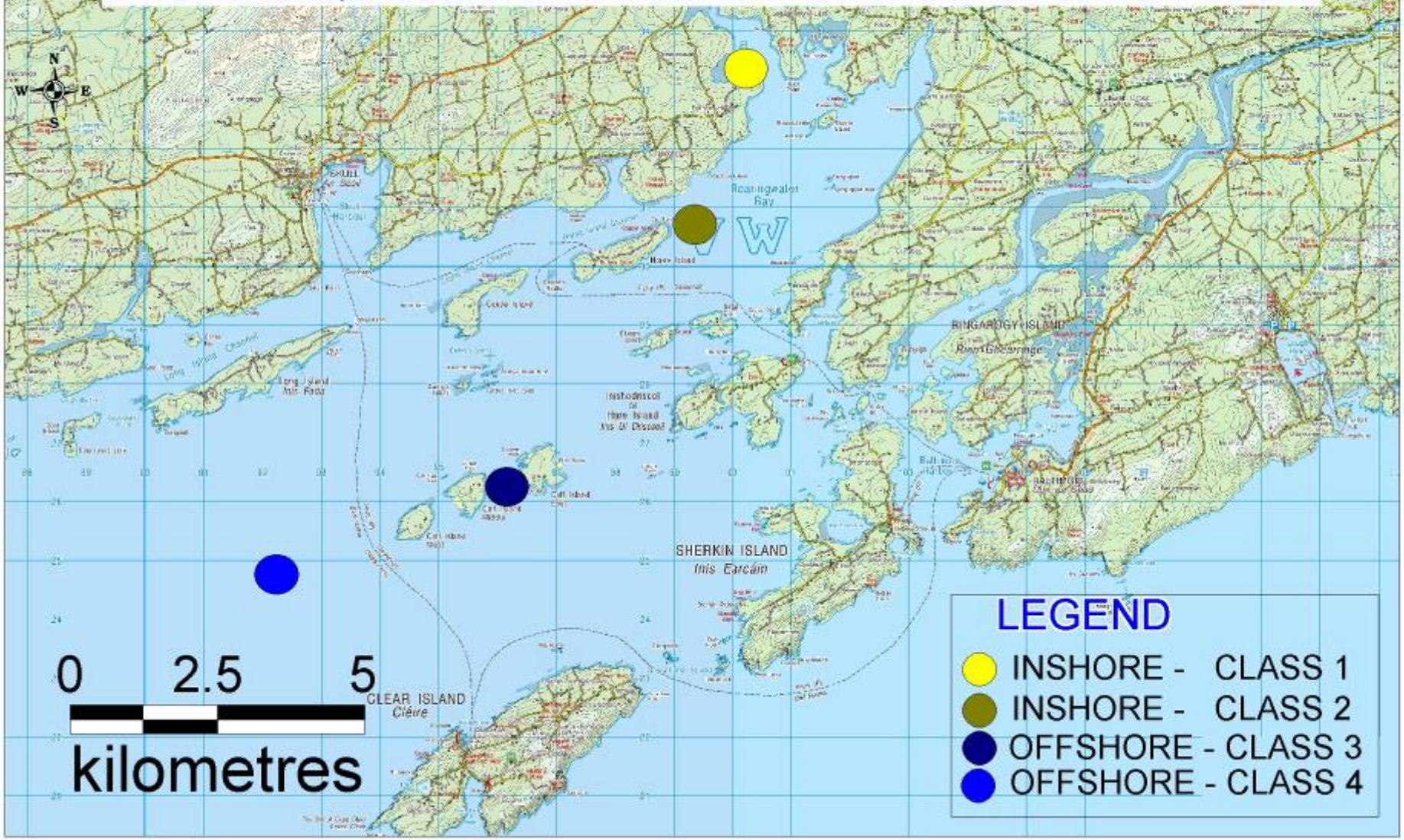
Que se entiende por Acuicultura Offshore ? OATTP

En general Acuicultura Oceanica u Offshore, puede ser definida como **un lugar en el oceano abierto** con **un alto grado de exposición a la acción de corrientes,vientos y olas**, y donde es requisito fundamental contar con un equipamiento y barcos de servicio especiales para **mantener y operar durante severas condiciones de mal tiempo** de vez en cuando.



WHAT IS OFFSHORE?

OFFSHORE AQUACULTURE - CLASSIFICATION BASED ON SITE EXPOSURE



Clasificación Offshore

Table 1. Key distinctions of offshore aquaculture (Muir, 1988)

Characteristics	Coastal (inshore)	Offshore aquaculture
Location/hydrography	05-3 km, 10-50 m depth; within sight, usually at least semi-sheltered	2+ km, generally within continental shelf zones, possibly open-ocean
Environment	Hs <=3-4 m, usually <=1 m; short period winds, localized coastal currents, possibly strong tidal streams	Hs 5 m or more, regularly 2-3 m, oceanic swells, variable wind periods, possibly less localized current effect
Access	>=95% accessible on at least once daily basis, landing usually possible	Usually >80% accessible, landing may be possible, periodic, e.g., every 3-10 days
Operation	Regular, manual involvement, feeding, monitoring, etc.	Remote operations, automated feeding, distance monitoring, system function

Site Class	Significant Wave Height (m)	Degree of Exposure
1	<0,5	Small
2	0,5-1,0	Moderate
3	1,0-2,0	Medium
4	2,0-3,0	High
5	>3,0	Extreme

LIMERICK Irlanda 2003

FARMING THE DEEP BLUE

Site Class	1 Sheltered Inshore Site	2 Semi-exposed Inshore Site	3 Exposed Offshore Site	4 Open ocean Offshore Site
Cage Type Used	Surface Gravity	Surface Gravity	Surface Gravity Anchor Tension	Surface Gravity Anchor Tension Surface Rigid Submerged

Exposición de acuerdo con Norsk Standard (NS 9415.E)

Wave classes	Hs (m)	Tp (s)	Designation
A	0,0 - 0,5	0,0 - 0,2	Light exposure
B	0,5 - 1,0	1,6 - 3,2	Moderate exposure
C	1,0 - 2,0	2,5 - 5,1	Heavy exposure
D	2,0 - 3,0	4,0 - 6,7	High exposure
E	> 3,0	5,3 - 18	Extreme exposure

- Extreme exposure to Wave

Current classes	Vc (m/s)	Designation
a	0,0 - 0,3	Light exposure
b	0,3 - 0,5	Moderate exposure
c	0,5 - 1,0	Heavy exposure
d	1,0 -1,5	High exposure
e	> 1,5	Extreme exposure

- Heavy exposure to Current

Que se está haciendo hoy en AO ?

La National Oceanic and Atmospheric Administration (NOAA) presentó las principales características del proyecto de ley para una acuicultura oceánica en los Estados Unidos.

[2005-06-08]

La National Oceanic and Atmospheric Administration (NOAA) presentó –en conferencia de prensa– las principales características del proyecto de ley para una acuicultura oceánica en los Estados Unidos. Esta iniciativa se enmarca en el "U.S. Ocean-Action Plan", presentado en diciembre del 2004 al Congreso estadounidense por el Presidente George W. Bush y que tendría por objetivo delinear las acciones en el mediano y largo plazo para proteger los recursos marinos y oceánicos de dicho país.

Según explica The New York Times en su edición de del 7 de junio, la propuesta de la NOAA (división del Departamento de Comercio de los Estados Unidos) implica el desarrollo de regulaciones que permitan el cultivo en aguas federales (entre las tres y 200 millas mar adentro), así como la incorporación de especies para el cultivo, tales como bacalao (Gadus morhua), halibut (Reinhardtius hippoglossoides) y atún (Thunnus thynnus). Hasta la fecha, la acuicultura estadounidense está restringida a las aguas estatales, es decir, hasta tres millas a partir de la costa.

De acuerdo con el proyecto, que pretende quintuplicar la producción acuícola para el año 2025, los recursos oceánicos serían divididos en concesiones acuícolas renovables cada diez años.

DEVELOPMENT OF A POLICY FRAMEWORK FOR OFFSHORE MARINE AQUACULTURE IN THE 3-200 MILE U.S. OCEAN ZONE

Prepared by:

Biliana Cicin-Sain, *University of Delaware*
Susan M. Bunsick, *University of Delaware*
Rick DeVoe, *South Carolina Sea Grant Consortium*
Tim Eichenberg, *Legal Consultant, San Francisco*
John Ewart, *Delaware Aquaculture Resource Center*
Harlyn Halvorson, *University of Massachusetts*
Robert W. Knecht, *University of Delaware*
Robert Rheault, *Moonstone Oysters, Rhode Island*

Center for the Study of Marine Policy
University of Delaware

the European Aquaculture Technology Platform

Let's make it happen together.....

- Create a technology platform enabling European aquaculture to maintain its world leadership
- Develop a Vision of the Future, and a Strategic Research Agenda
- Invest in aquaculture oriented research, technology development and innovation

Offshore Aquaculture Technology Platform

Smart Growth

INNOVATION	EDUCATION	DIGITAL SOCIETY
Key facts	**Key facts**	**Key facts**
• R&D spending is below 2%, compared to 2.6% in the US and 3.4% in Japan; our smaller share of high-tech firms explains half of the gap with the US • Google spends more on information and com--munication technologies R&D than the EU FP7 does	• Less than 1 person in 3 aged 25-34 has a university degree, compared to 40% in the US and over 50% in Japan • 1 in 7 young people drop out of school, and 1 in 4 have poor reading skills	• The world market in information and com--munication technologies is worth € 660 billion and employs 1/3 of research workforce: EU firms make up only 23% of this • 56% of households have a broadband connection, but many users have doubts about safety and financial transactions on the internet
Possible EU flagship:	Possible EU flagship:	Possible EU flagship:
EU Innovation Plan	***Youth on the Move***	***EU Digital Agenda***

EATIP

So, what is stopping us?

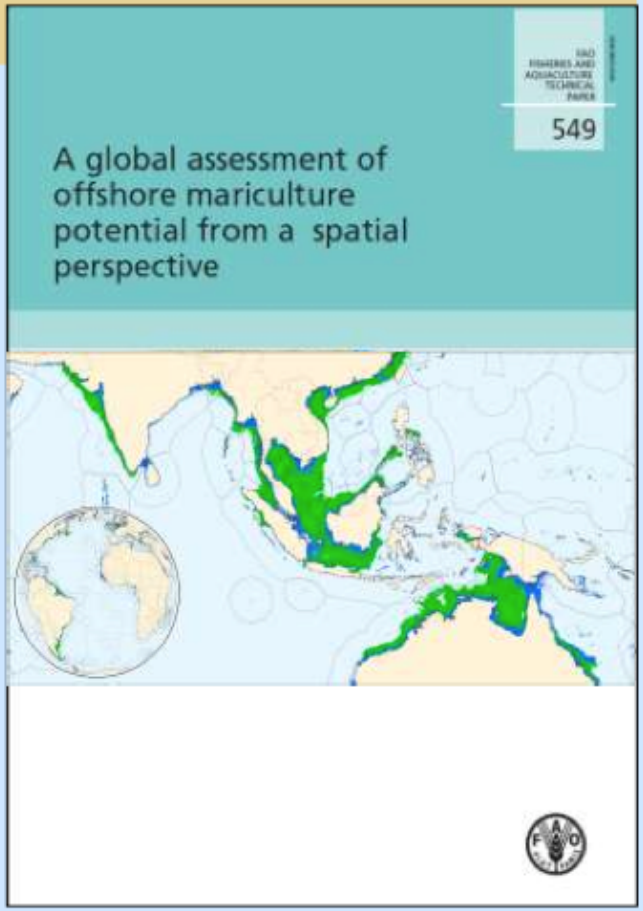
Offshore Mariculture 2010,
Hilton Imperial Hotel, Dubrovnik, Croatia, 16-18 June, 2010

Torgeir Edvardsen
Board Director EATIP – Coordinator of Thematic Areas
Special Advisor, SINTEF Fisheries and Aquaculture, Norway

SPACE

Global Assessment

Kapetsky, J.M., Aguilar-Manjarrez, J. & Jenness, J. 2012. A global assessment of potential for offshore mariculture development from a spatial perspective. FAO Fisheries and Aquaculture Technical Paper No. 549. Rome, FAO.



1. Global assessment
2. Based on three species (Cobia, Atlantic salmon and blue mussel)
3. Assumption 1: OM will take place within EEZs
4. Assumption 2: near future OM will employ species already cultured inshore
5. Grow-out criteria: suitable temperature ranges and chlorophyll-a concentrations
6. Culture system (long-lines and cages): suitable depth and current speeds thresholds (based on mariculture practice and manufacturer's specifications)

Que barcos se usan ?

www.gripfisk.no

Vessel concept 2: Marin Design MD240cat

Vessel data: Length 24 meters. Standard cranes, winches and capstans.

Summary and conclusions

- Future developments:
  - Some larger service vessels with greater carrying- and lifting capacity
  - Increased specialization: More specialized vessels outfitted for specialized tasks.

Biotrål: 14.99 meter specialized vessel for net cleaning.

FSV Group: 24.6 meter Solstrand Trading design. First vessel will be finished in spring 2013.

Service vessels in Norwegian aquaculture

- Service vessels have not grown with the components they are expected to operate, but remained under 15 meters in length, due to regulations.

2000

Generic work/
Service vessel
Length 12 meters
Crane: 10 tm

2003

"Æge"
14,95 x 7,5 m
Crane: 32 tm

2007

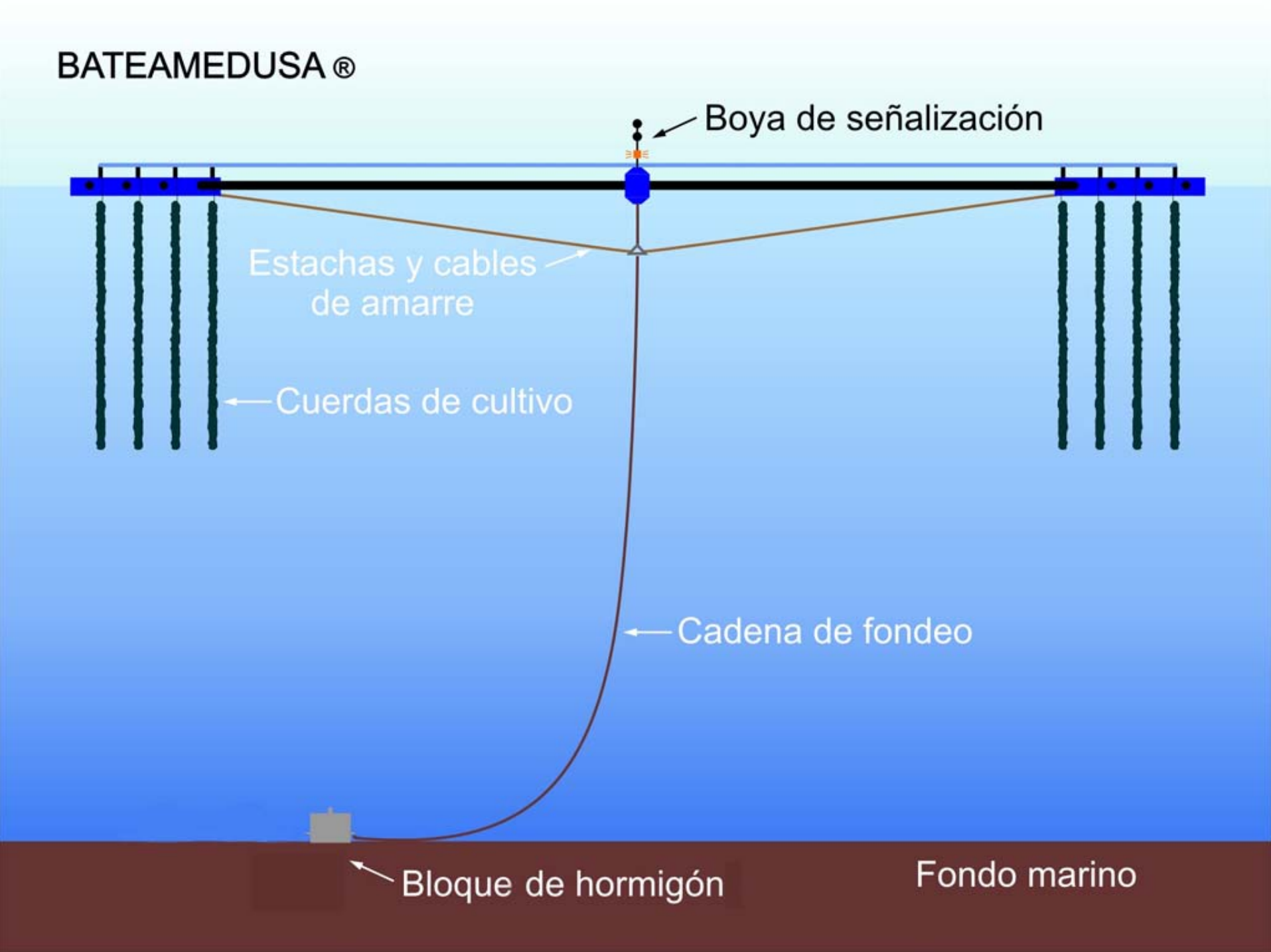
"Fosnakallen"
14,95 x 9,5 m
Crane: 37 tm

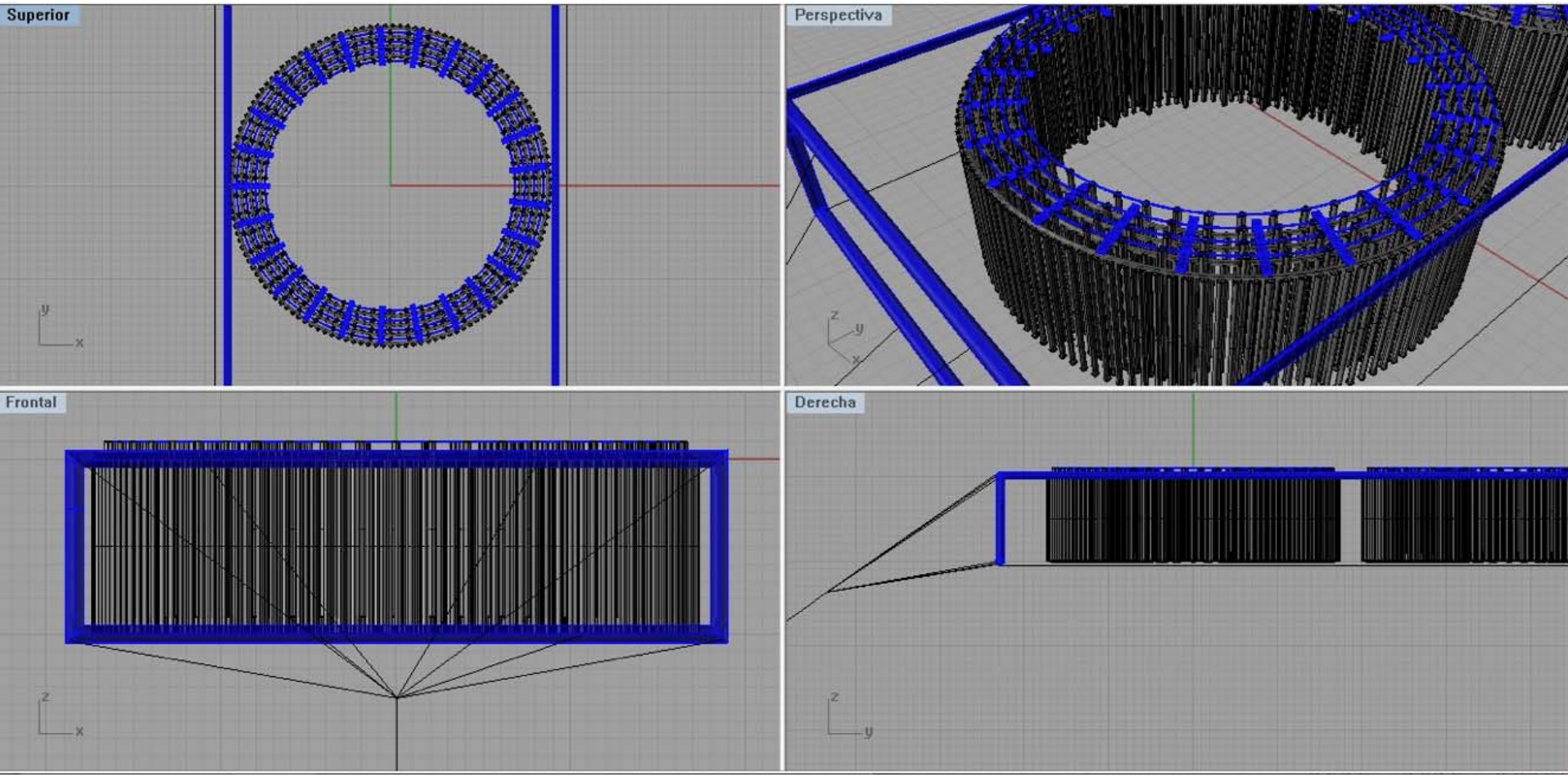
2012

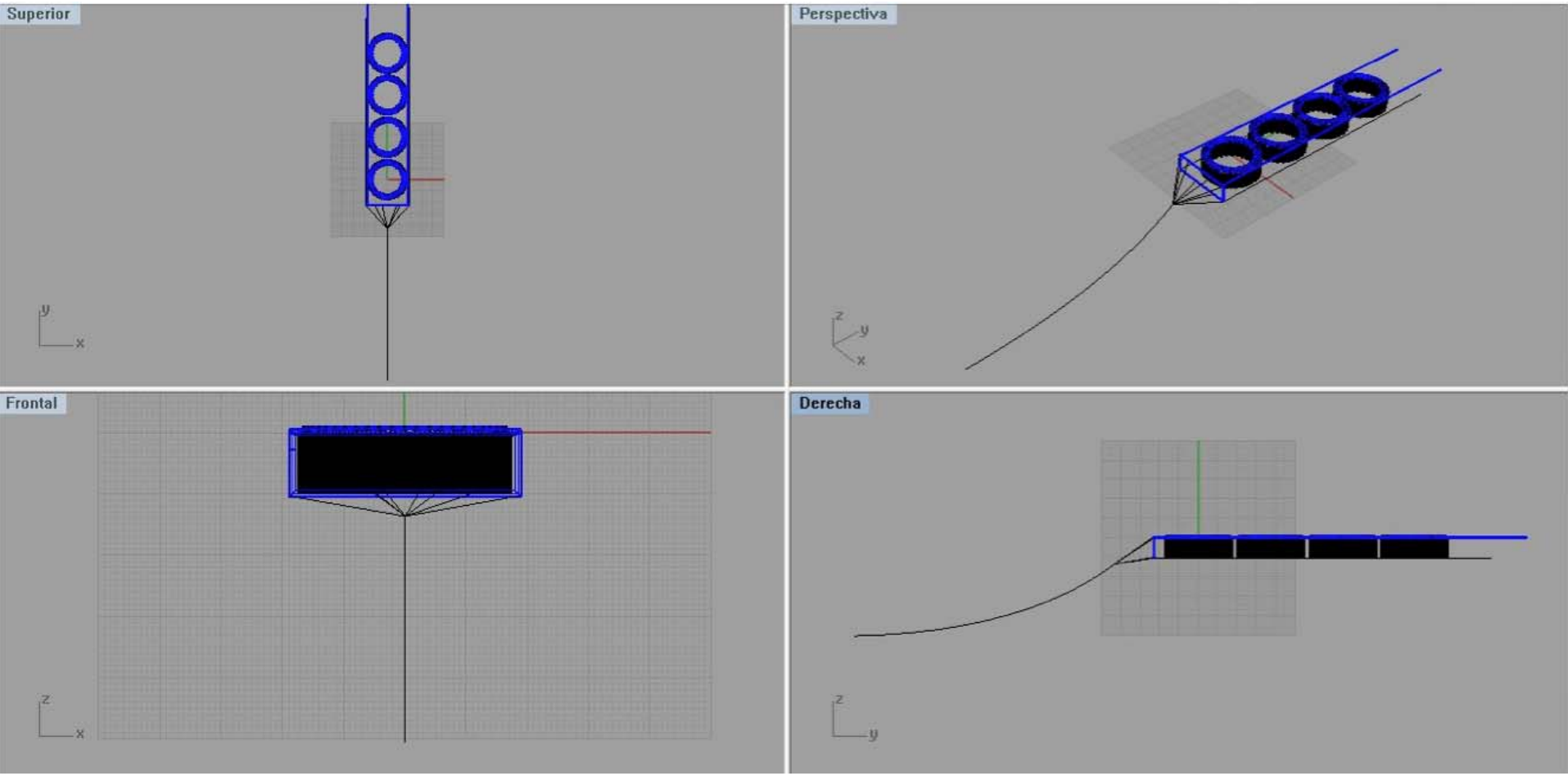
"Barents Ocean"
14,9 x 12 m
Crane 1: 145 tm
Crane 2: 65 tm

CB6949
OLIVER
2 12:51PM

Y de los mejillones ?


BATEAMEDUSA ®
Boya de señalización
Estachas y cables de amarre
Cuerdas de cultivo
Cadena de fondeo
Bloque de hormigón
Fondo marino


Superior
Perspectiva
Frontal
Derecha

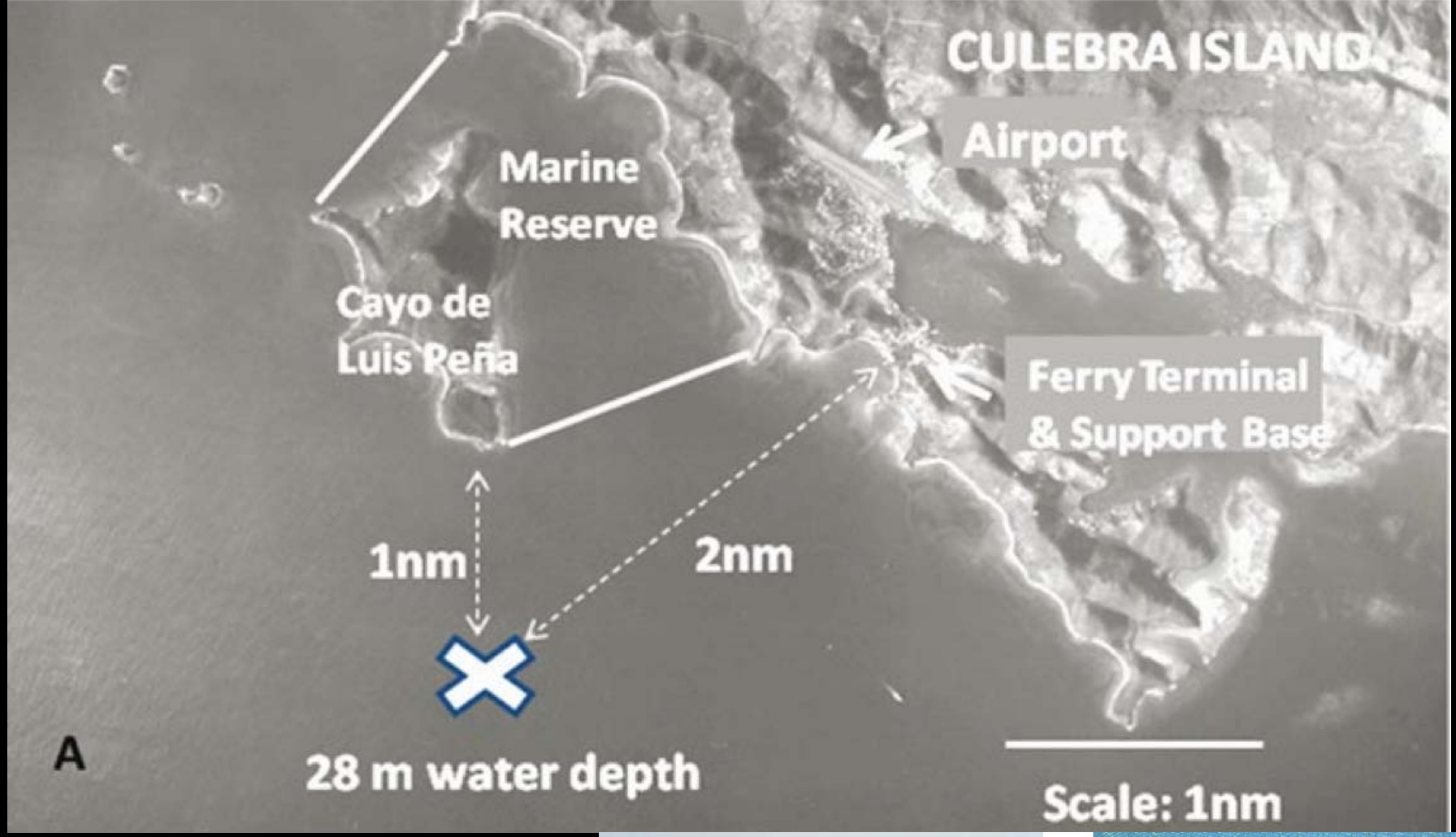

Superior
y
x
Perspectiva
z
y
x
Frontal
z
x
Derecha
z
y

Quiénes están hoy en AO

Introduction

Existing operations

- USA
- Bahamas
- Korea
- Turkey
- Australia
- Ireland
- ...
- Mediterranean
- Norway
- Chile
- ...


CULEBRA ISLAND
Airport
Marine
Reserve
Cayo de
Luis Peña
Ferry Terminal
& Support Base
1nm
2nm
A
28 m water depth
Scale: 1nm

Puerto Rico

fish farming international

An IntraFish Publication

MARCH 2008, Vol 35, No 3

THE FISH FARMER'S PAPER

Sustainable fish feed

www.biomar.com

Wellboat proves worth page 4

Strep vaccine feasible page 10

Feature Aqua Sur & Chile page 12

Florida show success page 24

FARM SHRIMP NEWS
FISH VET'S DIARY
MUSSEL TALK
GOOD BUSINESS
SHELLFISH SCENE

THESE UNDERWATER photos show some of the massive growth in coral which has taken place at Israel's Ardag Fish Farm, located in the northern part of the Red Sea in the Gulf of Eilat.

Corals at the farm site have a growth rate three times that of a control group at a Red Sea coral reserve, according to fish farm manager and aquaculture consultant Dudi Gada, who took the photos ... worker ... Befo... establi... few co... becaus... bed did ... chance ... growth ... Howe... were in... and the young coral had something to settle on – ropes, moorings, polyethylene pipes, concrete weights, nets, etc – the coral grew, and beside them other life started to flourish, thanks also to the rich environment around the cages.

Coral thrives alongside farms

Panamanian venture starts as:

OFFSHORE COBIA FARM TAKES OFF

A US$5 MILLION brand new farming venture will start to put juvenile cobia (*Rachycentron canadum*) in submersible offshore growout cages in the next few months in a business which aims to make Panama the envy of the world in aquaculture", reports KENNY McCAFFREY.

The venture is the brainchild of Roger Shingleton, who has spent years supplying farm systems around the world with harvesting equipment from his US company Environmental Technologies Inc.

He has used that experience to form a new farming venture, Pristine Oceans SA, which is registered in Panama, and with backing resulting from a chance meeting with Panamanian president, Martin Torrijos Espino.

"I told him I was going to ... the highest technology ... farm in the world in Panama, and make it the ... of the world in aquacul...

interest shown in the venture by the Panamanian business community. "We found the investors relatively easily," said Shingleton. "We raised the $5 million and are now in the process of buying the equipment."

That equipment includes nine offshore submersible cages – six SeaStations of ...

Technologies – an innovative underwater feeding system, harvesting pump system and ancillary 85ft workboat.

In addition, Pristine Oceans intends to build a new marine hatchery and nursery facility that will supply not only cobia, but also other marine species that the company plans to ...

12km long by 3-4km wide offshore for much larger operations than initially planned.

Around 30,000 juveniles will be stocked in each offshore cage, and when the venture is in full swing of its initial phase it plans to harvest around 10 tonnes of cobia, three times a week ...

never frozen" to the US cities of Miami, Chicago, Huston, Dallas, Los Angeles, San Francisco and Seattle, reveals Shingleton.

Pristine Ocean is targeting around 25 to 50 high-end restaurants in each of these cities with demand for security of consistent supply and quality ...

no more than ... hours," he said.

From there the ... may develop i... species, using sim... tions on the Pacif... Panama (cobia is ... to the Atlantic side ... may grow yellowta... and snook ('r... Spanish).

"It really is a gre... farming," said S... "The water temp... ideal: no more t... 28°C on the Carib... and similar on t... side – although ... some cold swells ... there.

"They also don... ence any hurrican... area."

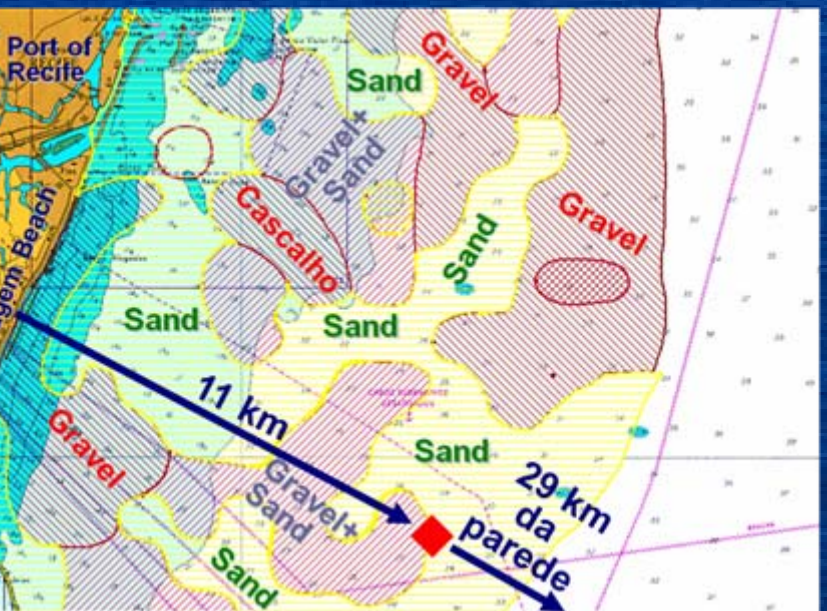
Other benefits ... he cites include ba... ble government, a ... linked economy, ... ability of educated ... vated, cost-effect... ers, and that "aqu... a supported ...

Acuicultora panameña integra empresa global

Temas:: Open Blue Sea Farms, Pristine Oceans S.A., José Raúl Arias, Richard Pretto Jr., Brian O'Hanlon, tecnología, Acuicultura, Fusiones y Adquisiciones, Panamá

Ocean Spar, LLC Sea Station 6,400 m^3 cages deployed off the Caribbean Coast of Panama (photos courtesy of Open Blue Sea Farms LLC). These cages are submergible and are only raised to the surface for cleaning, servicing and harvesting.

BRASIL


Port of Recife
Sand
Gravel
Gravel+ Sand
Cascalho
Sand
Gravel
Sand
Sand
11 km
Gravel
Sand
Gravel+ Sand
29 km da parede
Sand

Offshore sea farming (sea bass & sea bream)

Offshore (1 to 1.5 km from shore) cages in Zhanjiang, China, culturing mostly cobia and giant grouper.

Kona Blue expands into Mexico

PLANS for expanding production of Kona Kampachi (*Seriola rivoliana*) into Mexico should lead to greater efficiencies in production and distribution, and a reduced carbon footprint for US Hawaiian-based Kona Blue, says company co-founder and president, Neil Anthony Sims.

Kona Blue has already acquired a deep water farm site 'concession' over a 1 km square area. The site is around 5 miles from shore in the Bay of La Paz, in the southern Sea of Cortez.

Prospects for Kona Kampachi in Mexico are "highly encouraging", says Sims. Fingerlings air-freighted from the Kona Hawaiian hatchery to La Paz suffered less than 1% mortality over the 28 hour trip. Subsequent nursery and grow-out trials showed "spectacular" growth rates and high survival, Sims reports.

According to Sims, La Paz is an ideal site for expansion beyond Hawaii, because of its proximity to the world's largest seafood market – the USA - the ability to scale grow-out, and the production efficiencies gained by tapping into established grow-out technologies for seabass, seabream and salmon worldwide.

The company plans to truck harvested fish to the US market at costs below $0.20/pound. Distribution costs from Hawaii are around $1.80/pound.

Left: A diver inspecting the bottom of one of Kona Blue's Ocean Spar cages

Far left: Neil Sims holding a Kona Kampachi

2-ranked tuna sales in the US worth over $600 million annually."

"We have been producing a sashimi-grade product that commands a premium as "fresh", on the most isolated archipelago on the planet" says Sims. "We can both reduce our costs of distribution, and reduce our carbon footprint through this expanded production."

Sims says that Kona Kampachi represents a more scalable, more sustainable alternative to blue-fin tuna. "There is tremendous investor interest in bluefin tuna farming," says Sims, "but as an investment opportunity, and as an environmentally-sound exemplar of open ocean aquaculture, Kona Kampachi is better than bluefin."

currently are made up of 70% sustainable agricultural products," Sims explains. Kona Kampachi has a feed conversion efficiency (FCE) of around 1.4:1. Bluefin tuna, which in most farms only take wet fish, are reported to have FCEs of over 20:1.

Kona Kampachi are marketable within 12 months of hatching, at 2kg. The product has over 30% fat content, which makes for superb sashimi, yet has no detectable mercury, at testing sensitivity levels over 50 times the FDA's allowable limit for unrestricted consumption, according to Sims.

By contrast, bluefin tuna takes three to four years to reach marketable size. "There are few animals – in

the "nucleus estate" model to encourage more Mexican national participation.

Kona Blue produced and sold over 1 million lb (around 454 tonnes) of Kona Kampachi in 2008, worth around $6 million at wholesale. Monterey Bay Aquarium's Seafood Watch Programme also ranked "US farmed yellowtail" (Kona Kampachi is the only example) as a "Good Alternative". This is the first time that MBA has ranked any ocean-grown fish as anything other than 'Red – Avoid, says Sims.

KikkoNet

Neil Sims of Kona Blue is in the middle of testing KikkoNet - a semi-rigid monofilament cage netting resembling chain-link fencing – which is emerging onto the international scene after nearly 30 years of success in Japanese waters.

According to KikkoNet, Sims says that he is expecting to find it more effective for algae control and abatement, reasoning that the monofilament will not tolerate insinuations of algae as it does a multi-fiber strand.

The smooth hard surface

will submit to in situ abatement completely removing all traces of algae and the surface is especially suitable for robotic cleaners.

KikkoNet also better resists deformation in rough seas or fast moving currents which serves to reduce stress on the fish population.

Masaru Kasutani, owner of KikkoNet Manufacturing Co, says that he is proud of the netting's unblemished 28 year record of zero predator break-ins and zero escapes in Japanese waters. Australian farmers have successfully proved and are purchasing KikkoNet as a preferred system for protecting barramundi from sharks and sea-going crocodiles.

KikkoNet International, the world market arm of KikkoNet Manufacturing Co, is managed out of the USA by Wierson Ventures.

For use on Aquaculture nets
FLEXGARD

fish farming international

JUNE 2007, Vol 34, No 6

THE FISH FARMER'S PAPER

Innovation?

Look for the 3 fish

www.provimi-aqua.com

SA's new hatchery opens page 10

Water Quality & Recirc page 12

Faroes fights back page 24

Handling & Harvesting page 28

MEAL REPORT page 4
FARM SHOWS NEWS page 8
MUSSEL TALK page 36
FISH VET'S DIARY page 41
GOOD BUSINESS page 45
SHELLFISH SCENE page 46

'Green' filters to help SA take off

NICK LOUBSER, general manager, aquaculture at Irvin and Johnson Ltd's Danger Point Abalone Farm near Gansbaai on South Africa's southern Cape coastline, holds some green algae, or ulva – a product of an innovative system that is using seaweed as "green" filters to clean aquaculture waste water for recirculation. The I&J project is expected to be an important development in helping the South African aquaculture industry finally take off, and leads this month's annual feature on Water Quality & Recirculation.

■ Full report – page 12

CHILE GOES OFFSHORE

first farm operational by year-end – page 3

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REPUBLICA DE CHILE
COMISION REGIONAL DEL MEDIO AMBIENTE
REGION DE COQUIMBO

MAT.: Califica ambientalmente favorable el proyecto "Centro de engorda off shore de peces salmónidos, Bahía Barnes, Sector Oeste IV Región".

MARCELO GAMBOA AGÜERO
Director Regional CONAMA Región de Coquimbo
Secretario COREMA Región de Coquimbo

RCL/PFC/MGA/KFS/CPH/PPT.-

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Archivo COREMA, Región de Coquimbo.
Expediente DIA "Centro de engorda off shore de peces salmónidos, Bahía Barnes, sector oeste, IV Región".

Inshore V/s Offshore

Table 2. A comparison of a number of relevant parameters between inshore (traditional) and offshore cages (Chen et al., 2006).

	Traditional	Offshore
Survival rate of fish (%)	70	>90
Cage volume (m^3)	<100	>1,000
Capacity against wind (km/hr)	<100	>110
Capacity against current (m/s)	<1	<1.5
Capacity against wave-height (m)	2	>6
Life span of cage (year)	<3	>10
Suitable site	Sheltered inshore areas	Offshore
Yield (kg/m^3)	Around 5	>20

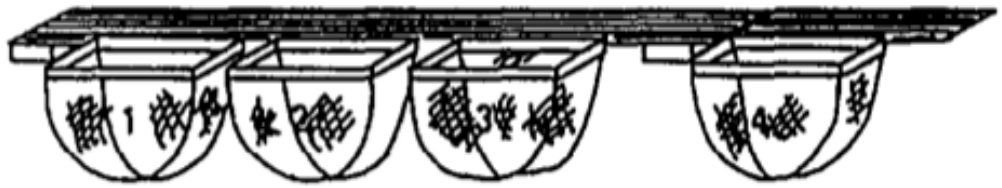
Inshore Versus Offshore Farming

Tore L. Sveälv

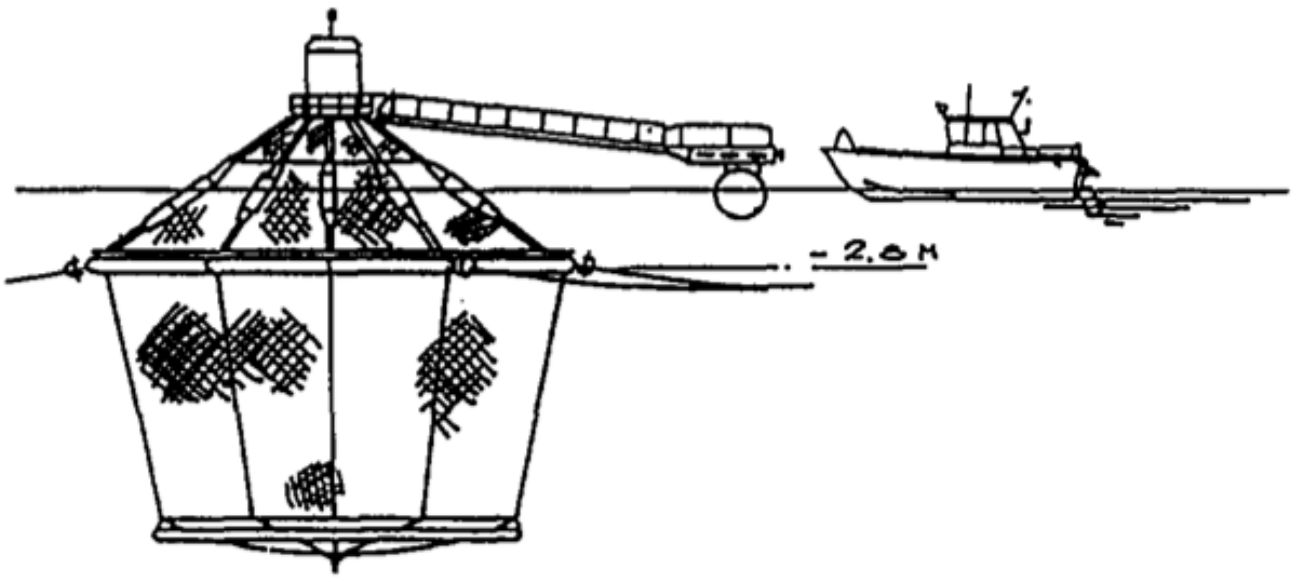
Farmocean AB, Datavägen 14 A S-436 32 Askim, Sweden

(Received 9 September 1987; revised version received 23 December 1987; accepted 22 February 1988)

Syst. A



Syst. B



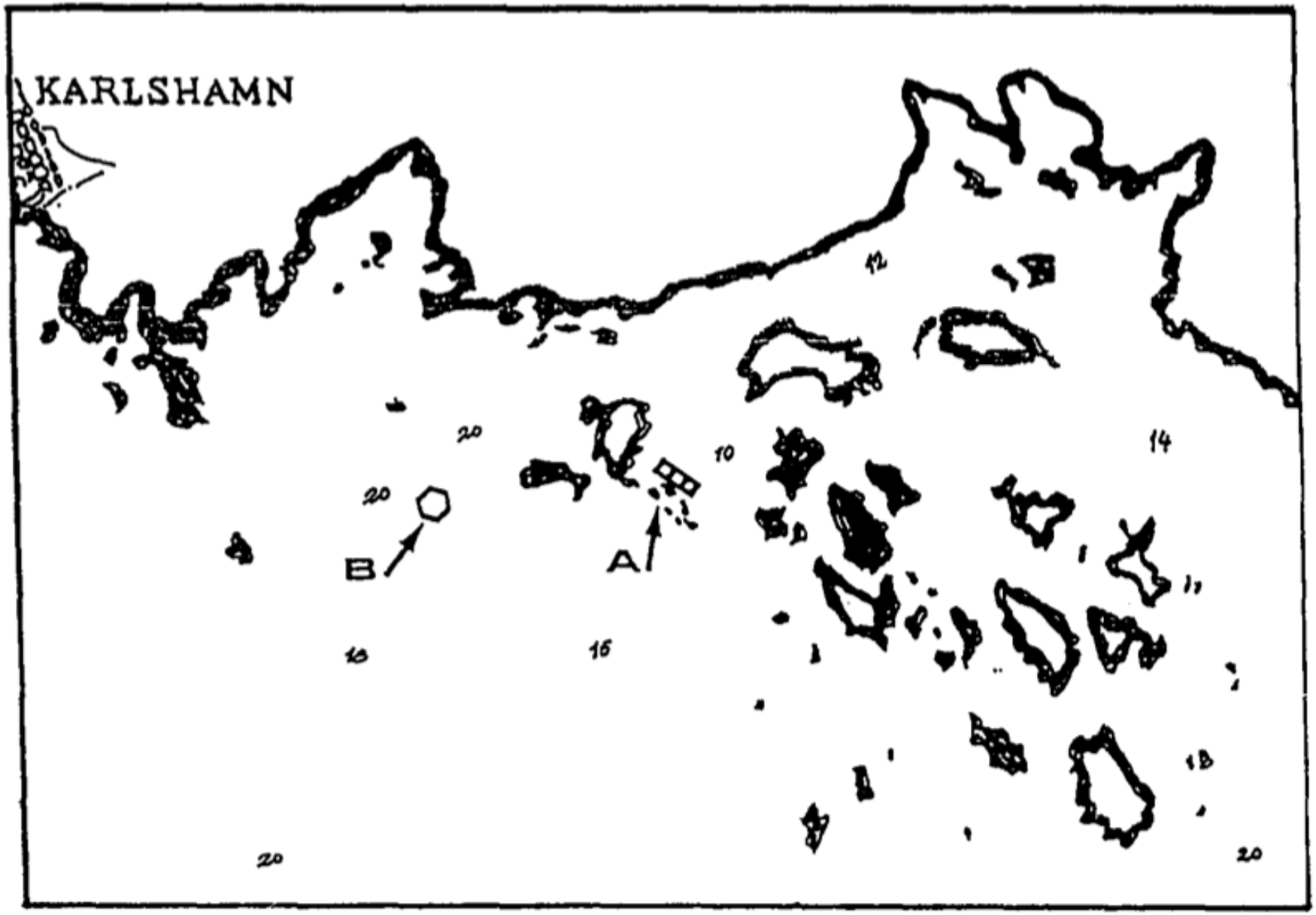


Fig. 1. The location of the two test sites, site A and B in the Bay of Pukavik, southern Sweden. Soundings in metres.

Conclusiones

1. Existe una relación directa entre un ambiente Offshore y una alta calidad de los peces.

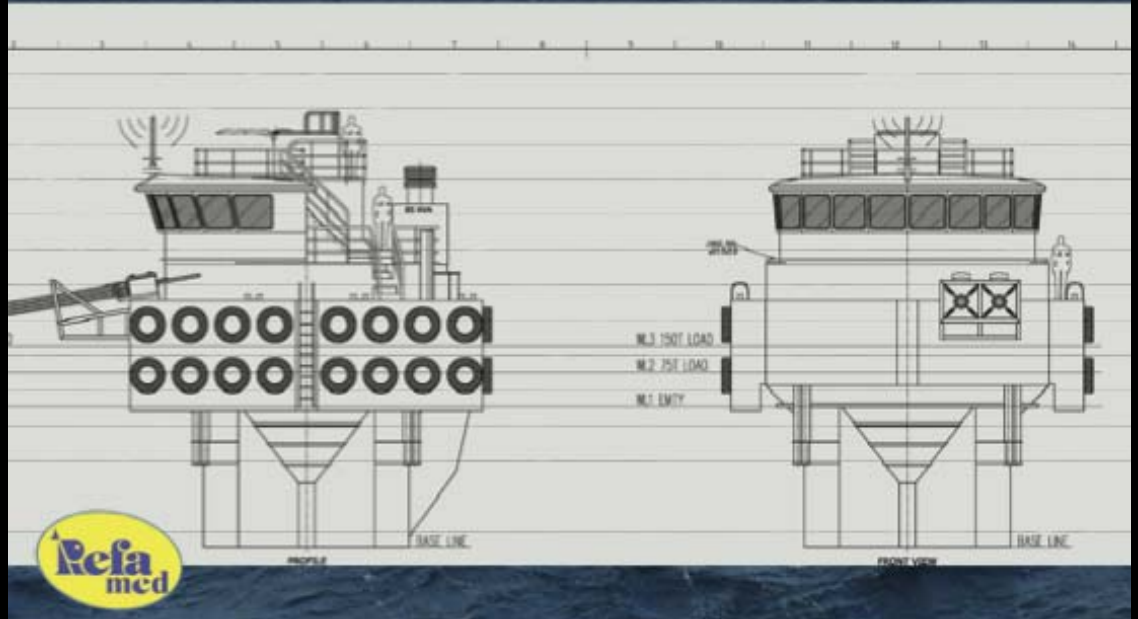
2. Reducción de la Mortalidad en mas de un 50%

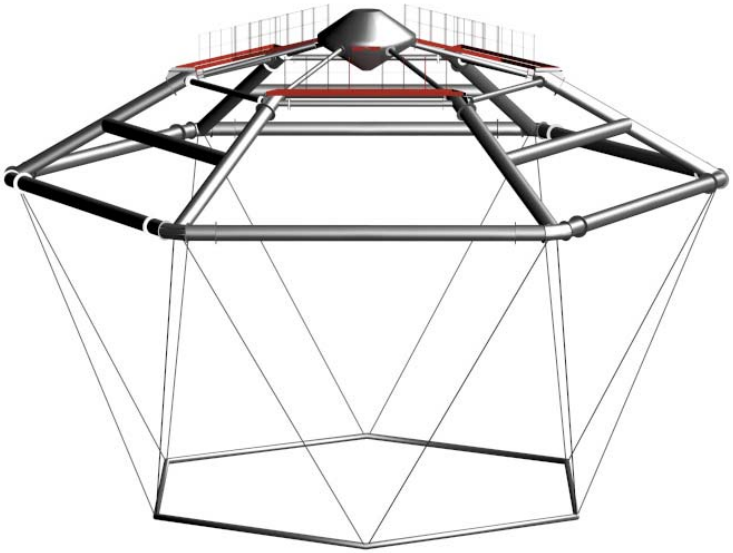
3. El Incremento en la actividad dado el ambiente offshore, le dio a la trucha arcoiris un aspecto más saludable y calidad muscular.

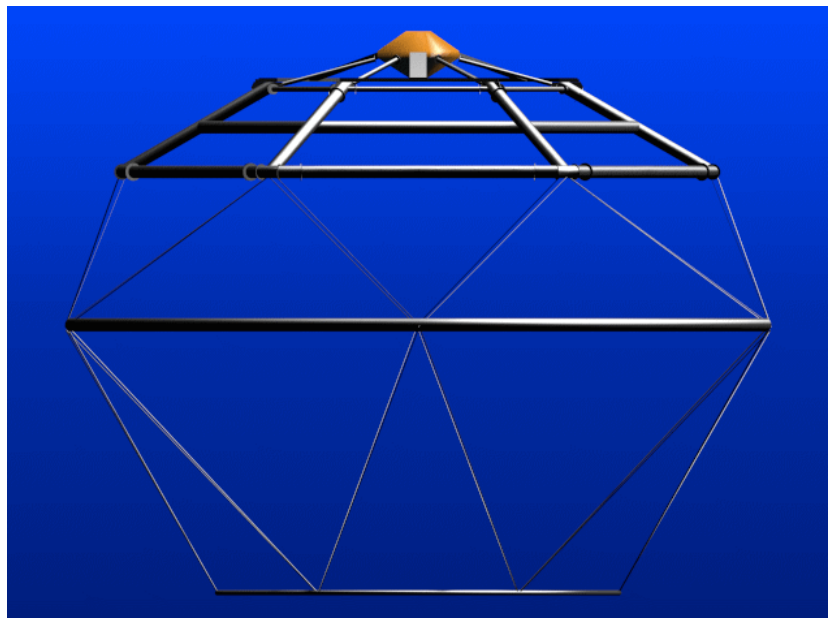
¿Qué es Revolución?
"Revolución es: sentido del momento histórico;
es cambiar todo lo que debe ser cambiado;
es igualdad y libertad plenas; es ser tratado
y tratar a los demás como seres humanos;
es emanciparse por nosotros mismos
y con nuestros propios esfuerzos;
es desafiar poderosas fuerzas dominantes dentro
y fuera del ámbito social y nacional;
es defender valores en los que se cree al precio de cualquier sacrificio;
es modestia, desinterés, altruismo, solidaridad y heroísmo;
es luchar con audacia, inteligencia y realismo;
es no romper jamás ni violar principios éticos;
es convicción profunda de que no existe fuerza en el mundo
capaz de aplastar la fuerza de la verdad y las ideas.
Revolución es unidad, es independencia,
es luchar por nuestros ideales de justicia para cuba y para el mundo,
que es la base de nuestro patriotismo,
nuestro socialismo y nuestro internacionalismo."

Alternativas actuales

FC Forfláte
150 tonn
150 ton Off-shore Feed Barge
FEED CONTROL a/s


M.3 150T LOAD
M.2 75T LOAD
M.1 EMTY
BASE LINE
BASE LINE
Refa med





HVALPSUND NET
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- challenging the offshore...

HVALPSUND NET

Professional Fishing Outfitter

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- All HDPE cages

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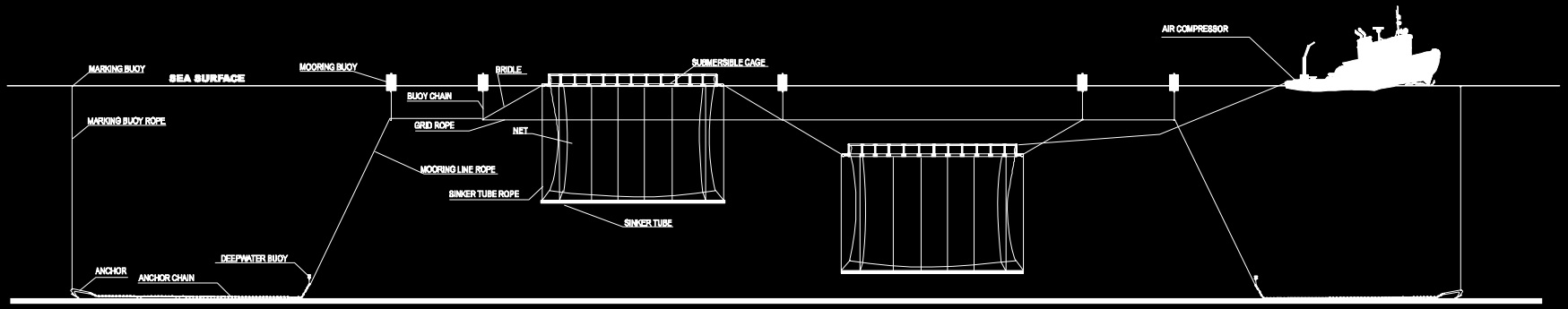
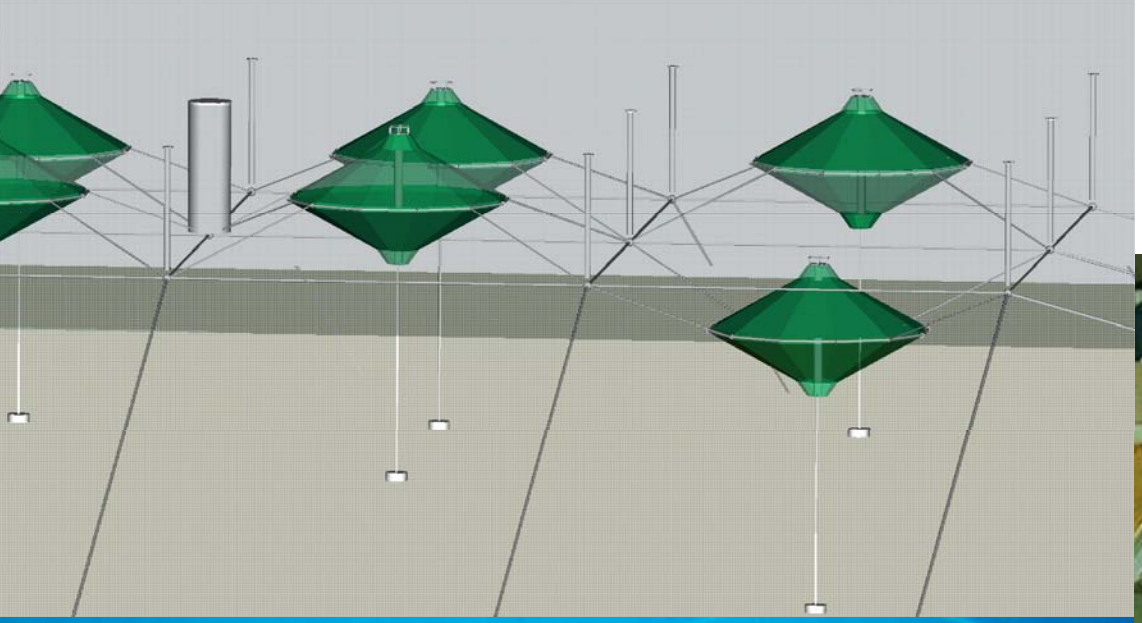
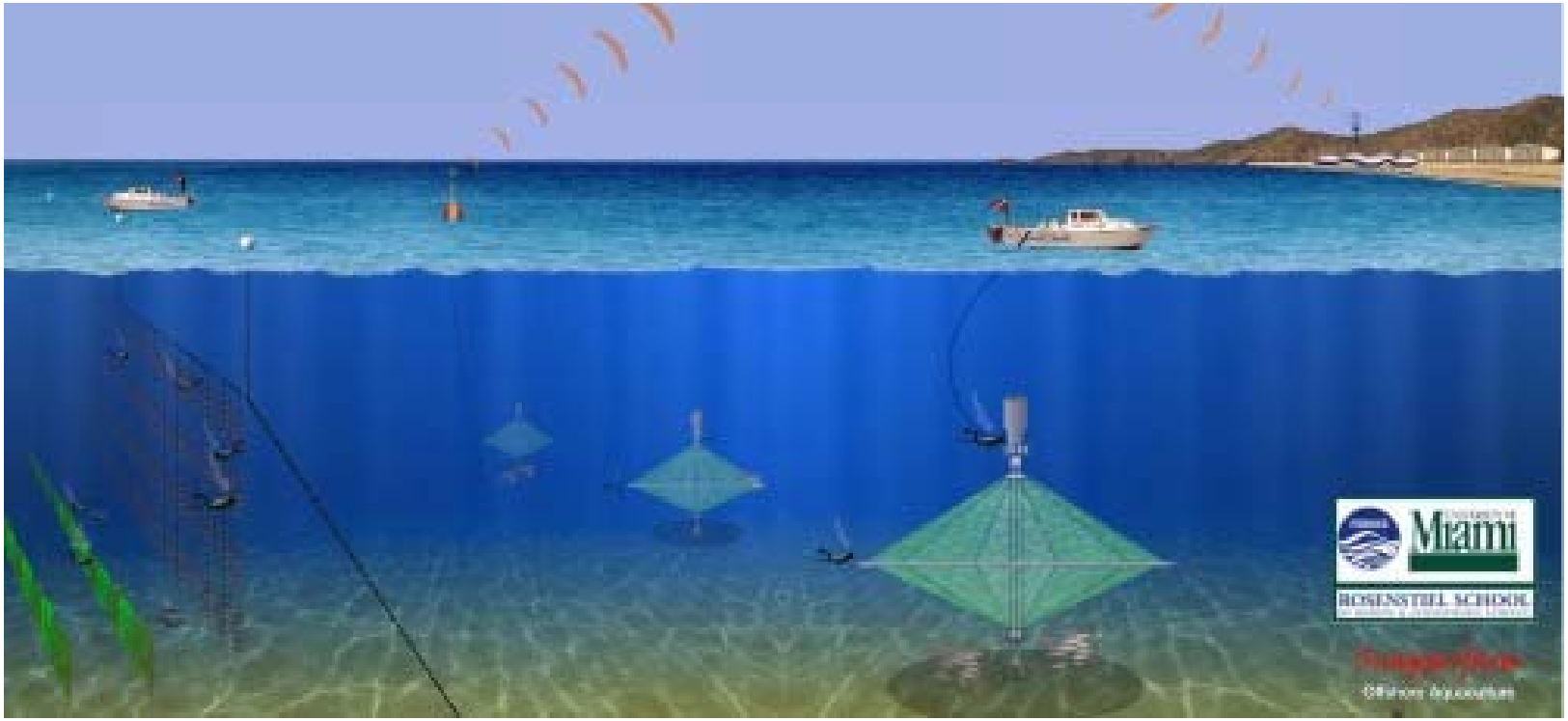


Side view of a mooring gris system: "UNDERWATER AND FLOATING POSITION OF A SUBMERSIBLE CAGE"





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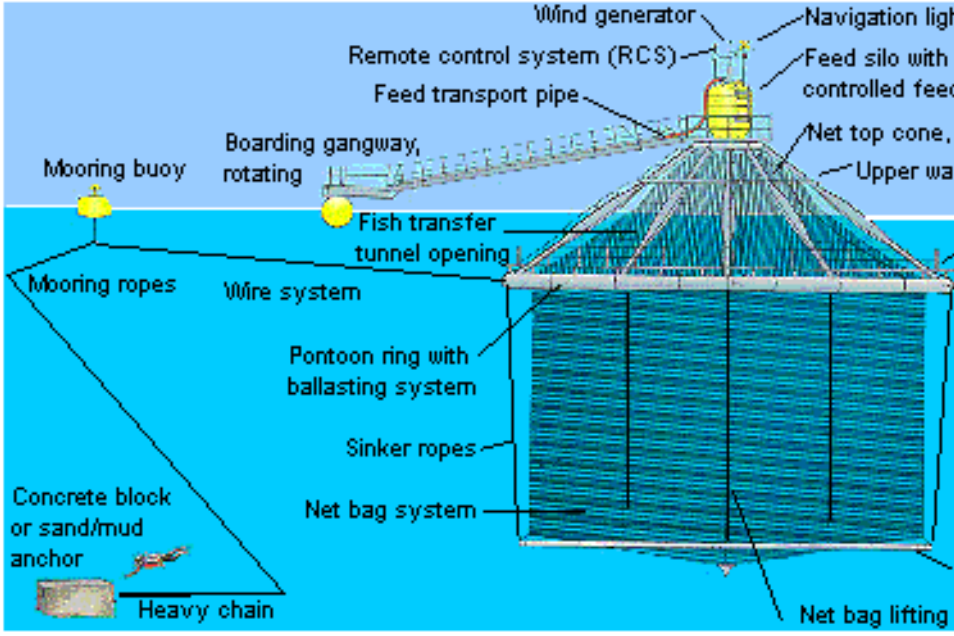
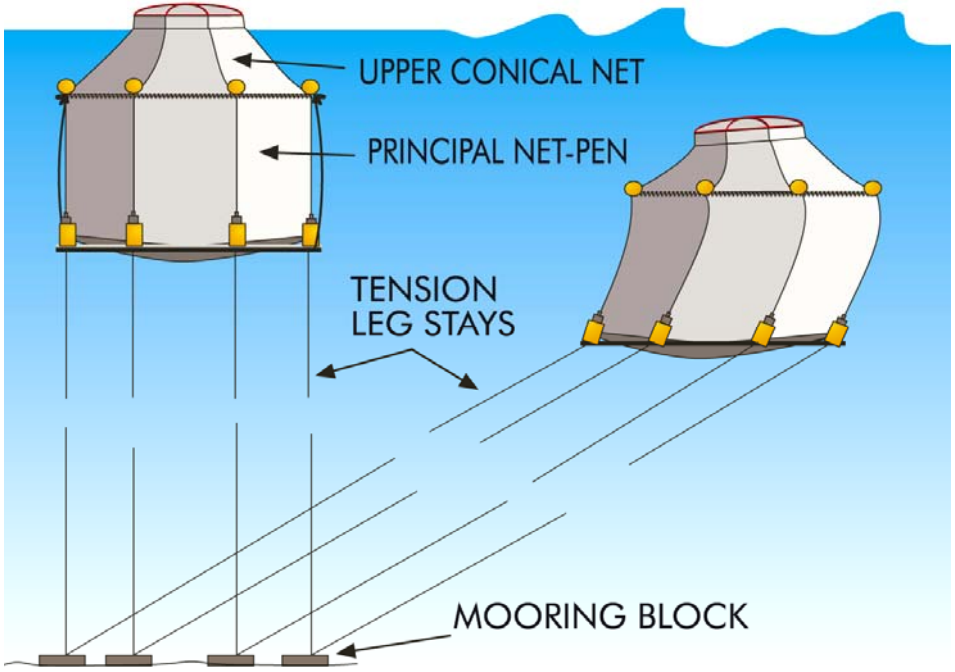
OceanSpar Installations

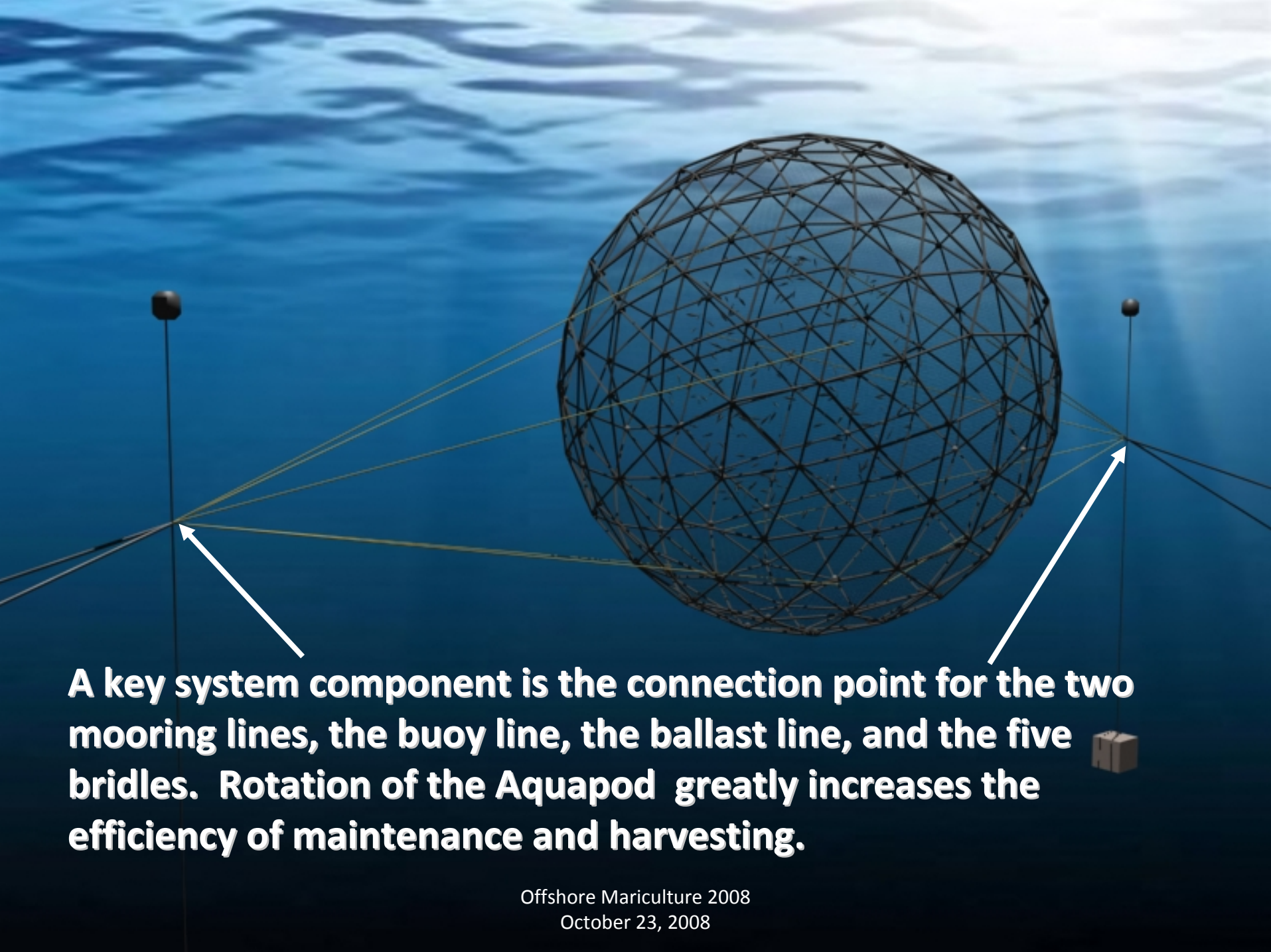
- **Over 70 offshore fish pens installed**
- **14 active clients in 8 countries**
- **Over 20 species successfully cultivated**
- **Fish pen capacities up to 50,000 m^3**
- **Site capacities designed for over 200,000 m^3**


Wind generator
Navigation ligh
Remote control system (RCS)
Feed silo with
controlled feed
Feed transport pipe
Net top cone,
Boarding gangway,
rotating
Upper wa
Mooring buoy
Fish transfer
tunnel opening
Mooring ropes
Wire system
Pontoon ring with
ballasting system
Sinker ropes
Concrete block
or sand/mud
anchor
Net bag system
Heavy chain
Net bag lifting

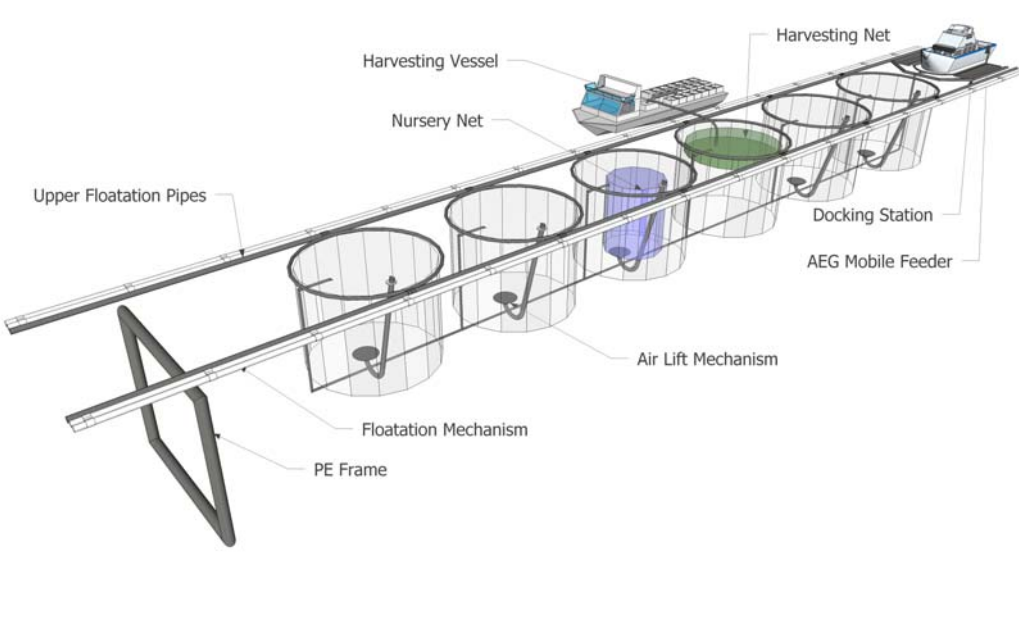
All these TLC cage farms are subject to an open sea fetch ranging from 1000


UPPER CONICAL NET
PRINCIPAL NET-PEN
TENSION
LEG STAYS
MOORING BLOCK

The
It requires additional
structures to optimise
harvest operations.
23.10.2008



A key system component is the connection point for the two mooring lines, the buoy line, the ballast line, and the five bridles. Rotation of the Aquapod greatly increases the efficiency of maintenance and harvesting.



SUBFLEX

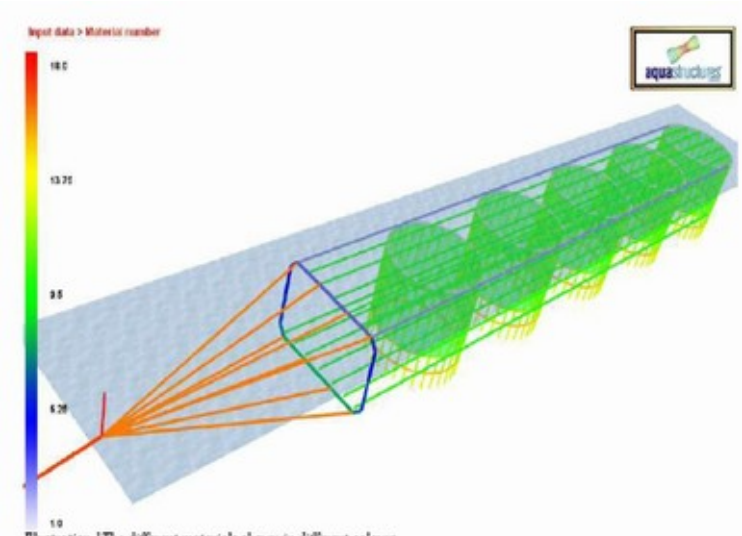


Illustration 1 The different materials shown in different colours

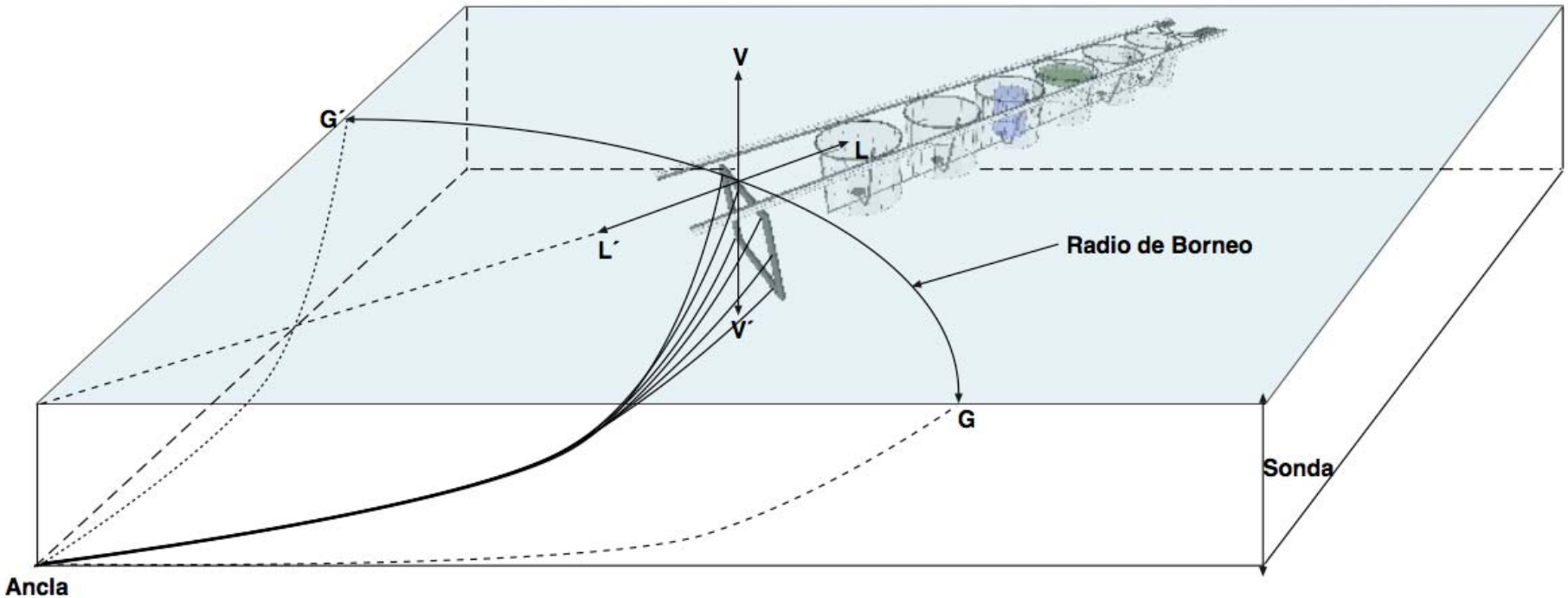
Haifa, 12 January 2009

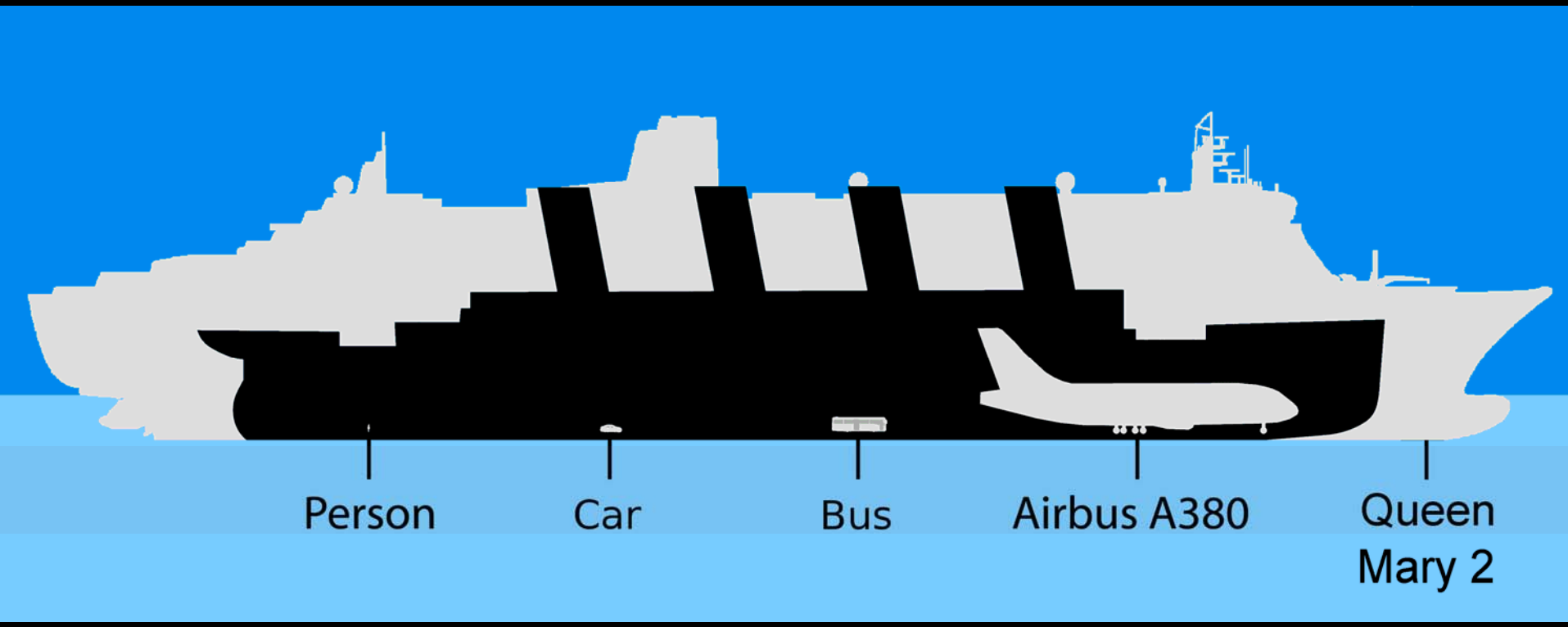
Design Conditions for SUBFLEX Systems offshore Ashdod at Submerged State

Extreme Significant Wave Height	Hs	= 9.0 meter
Typical Peak Period	Tp	= 16.3 seconds
Extreme Maximum Wave Height	Hmax	= 16.2 meter
Extreme Current	Vmax	= 1.2 m/sec

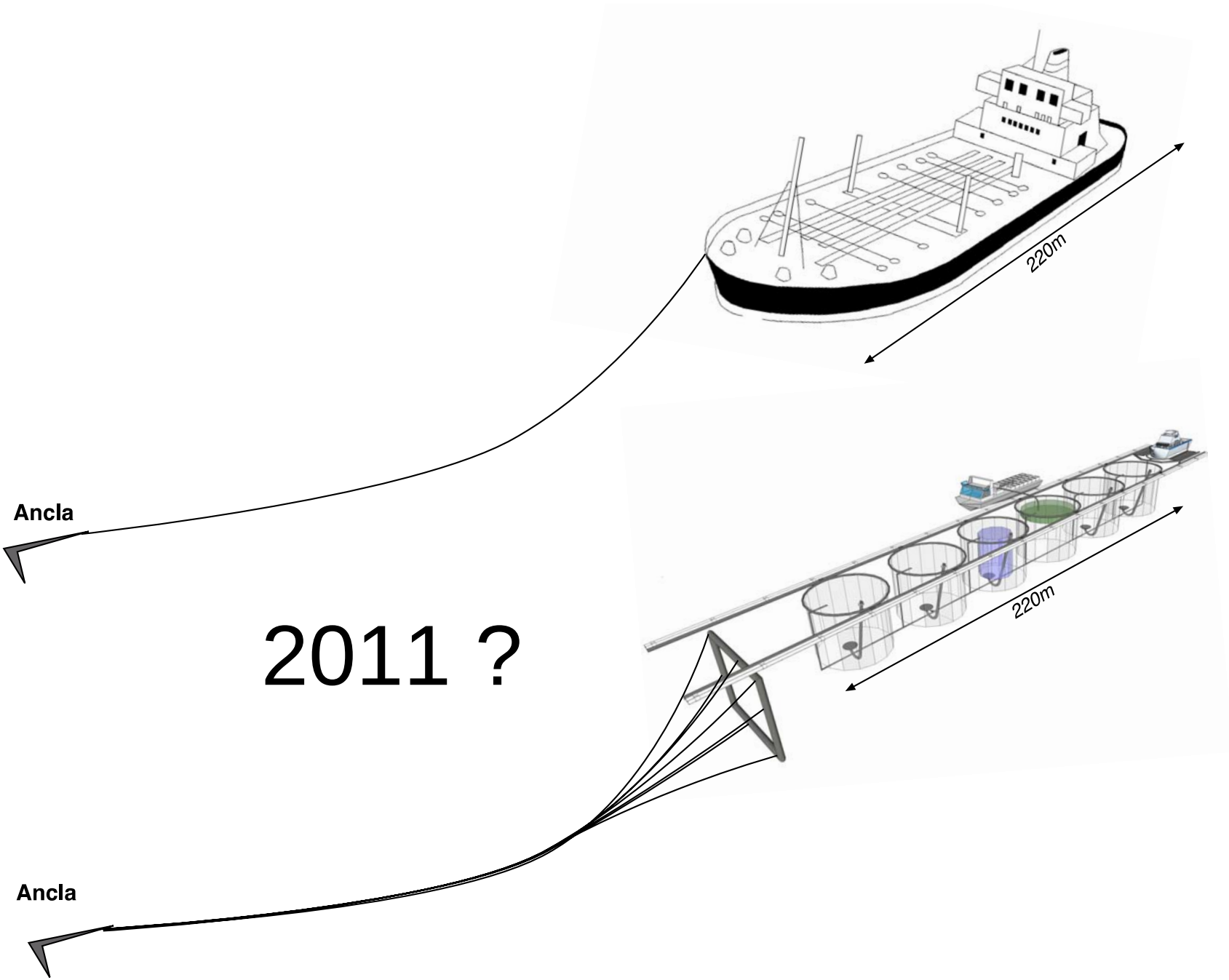
NAMCO – Naval and Mechanical Engineering Co. Ltd.

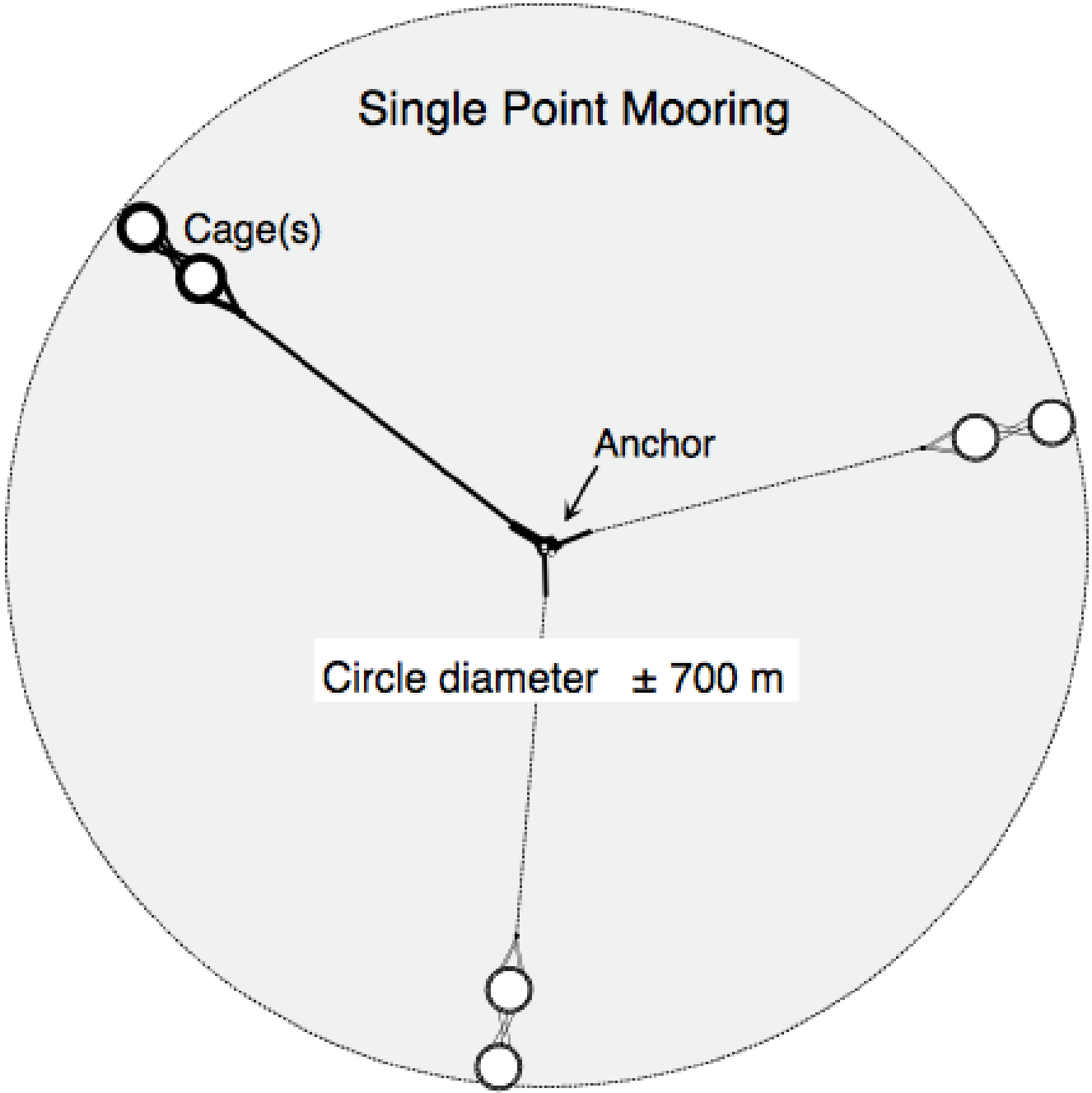
Dr. Nitai Drimer


V
G´
L
L´
Radio de Borneo
V´
G
Sonda
Ancla


Person
Car
Bus
Airbus A380
Queen Mary 2

Length: 397 meters
Beam (width): 56 meters
Depth: 30 meters
Capacity: 1,000 forty-foot reefer containers, AND 11,000 twenty-foot containers.
Cost: Unknown, private information. But a marine engineer who comments at the link above guesses it is around U.S. $150 million.

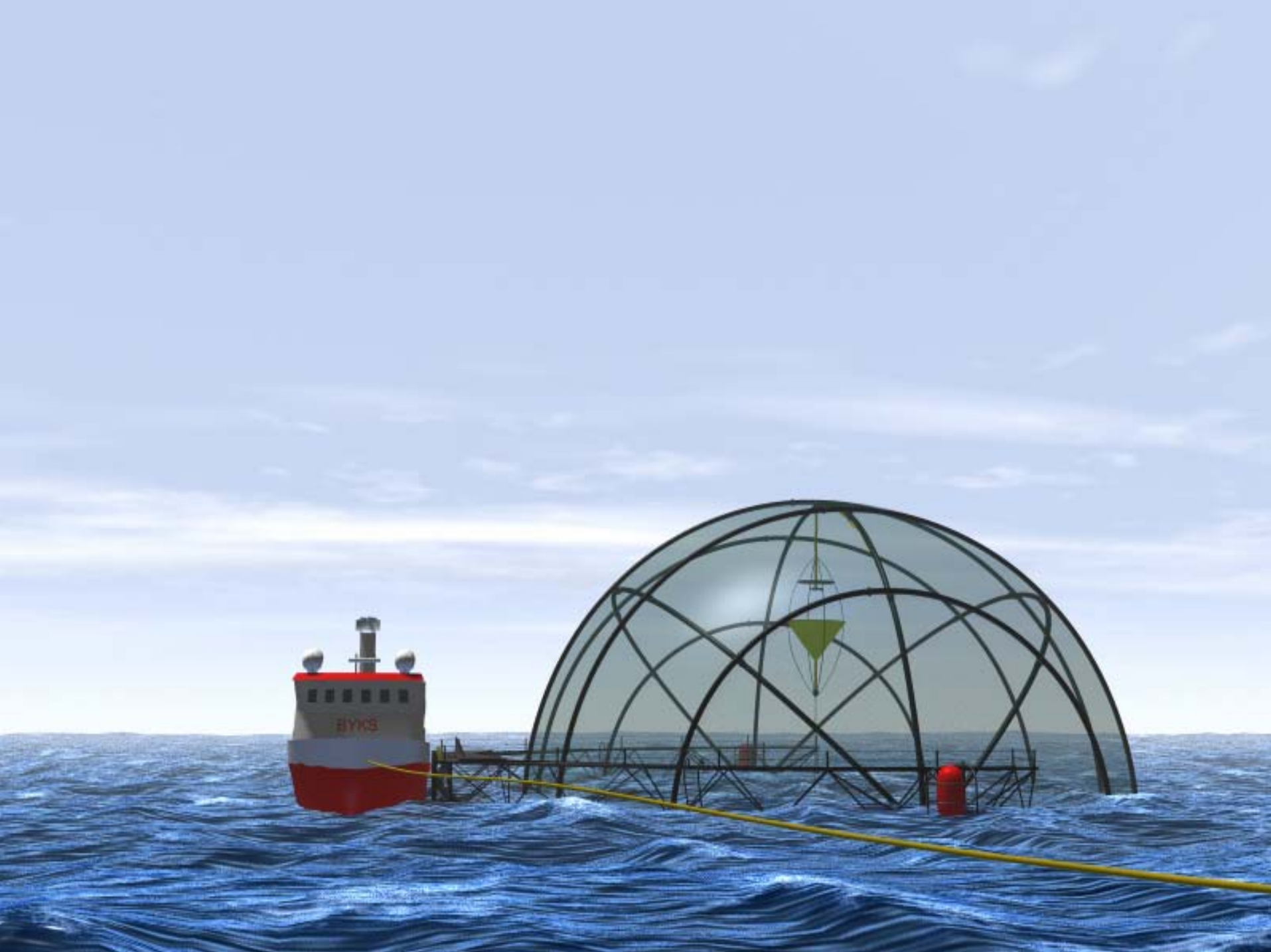

220m
Ancla
2011 ?
220m
Ancla

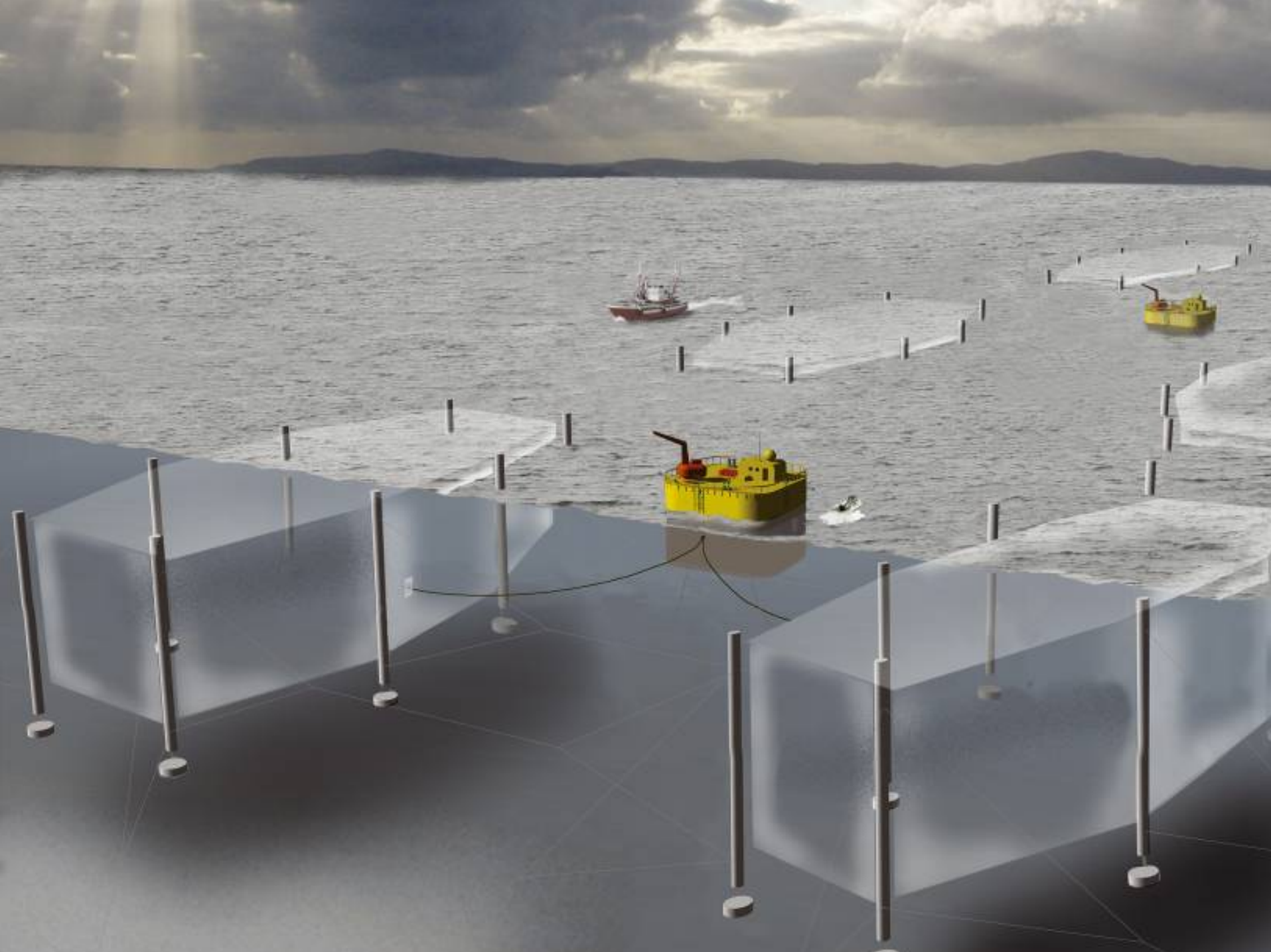

Single Point Mooring
Cage(s)
Anchor
Circle diameter ± 700 m

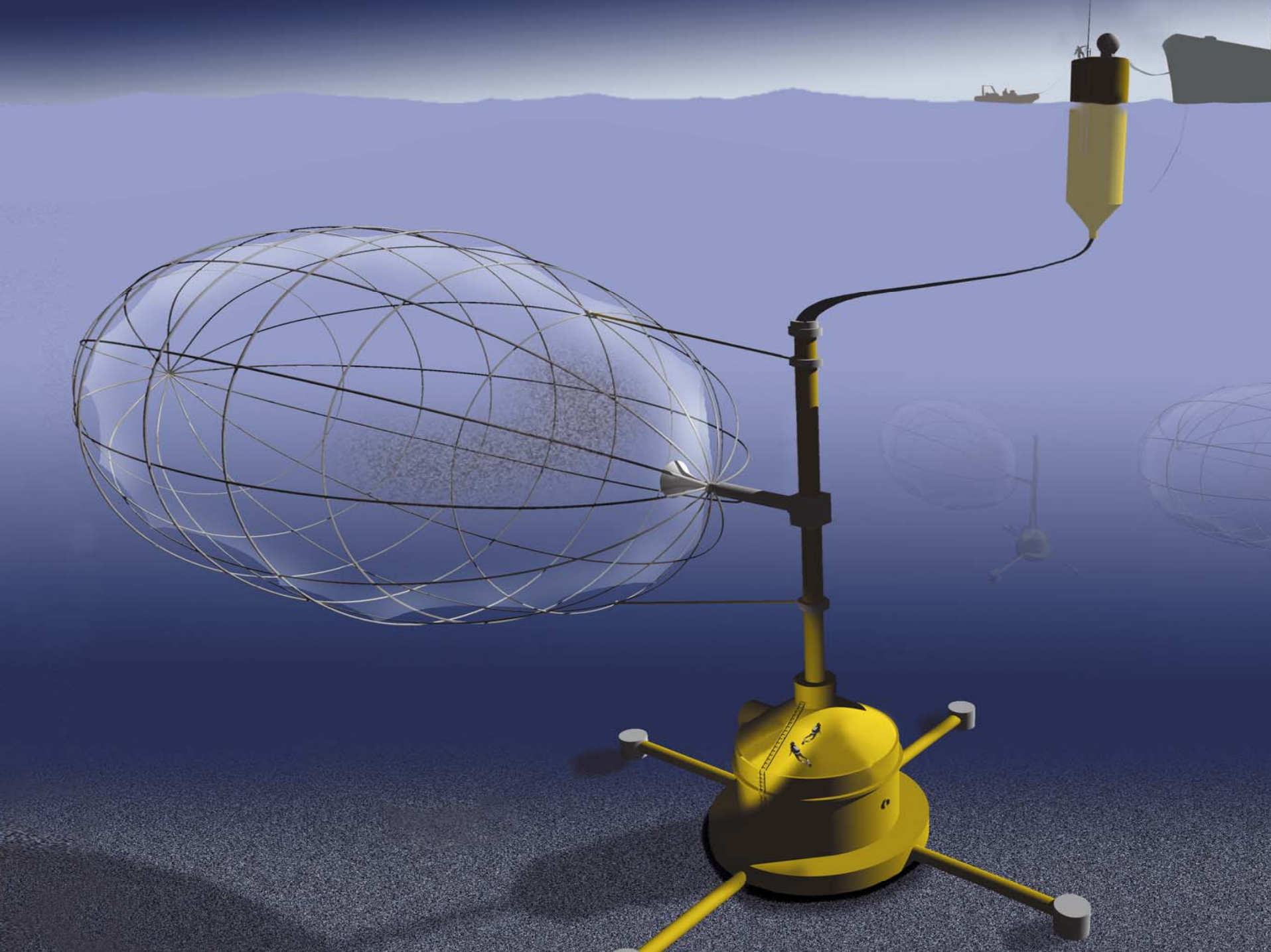
15 Ton.
24148
US 2210

35

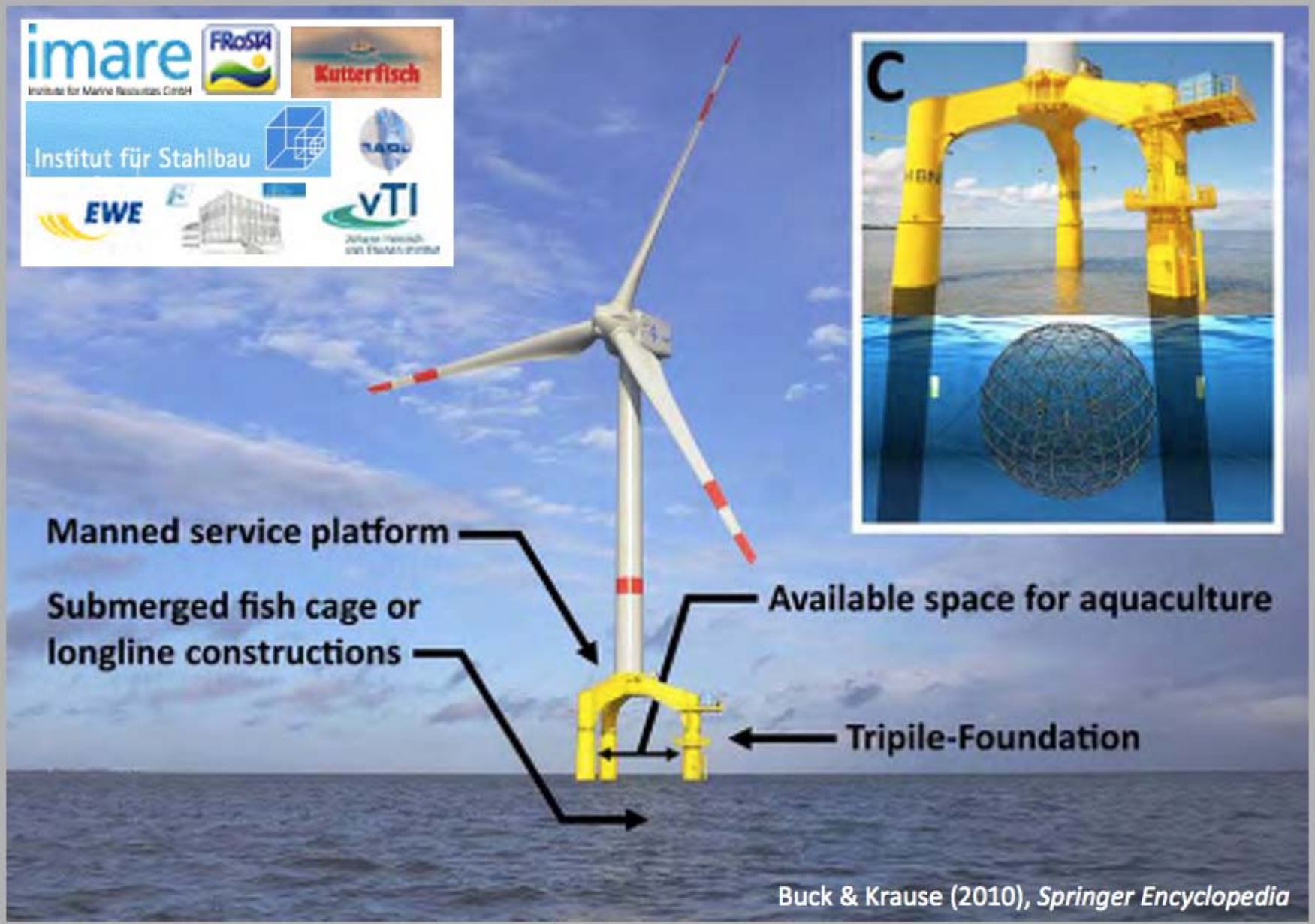
El futuro


BYKS



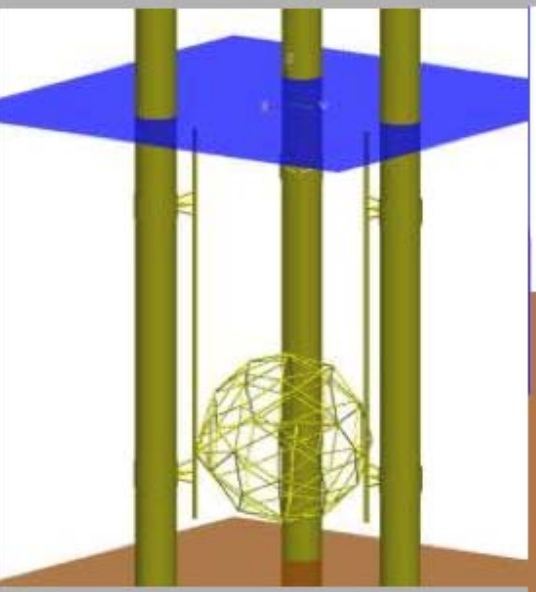


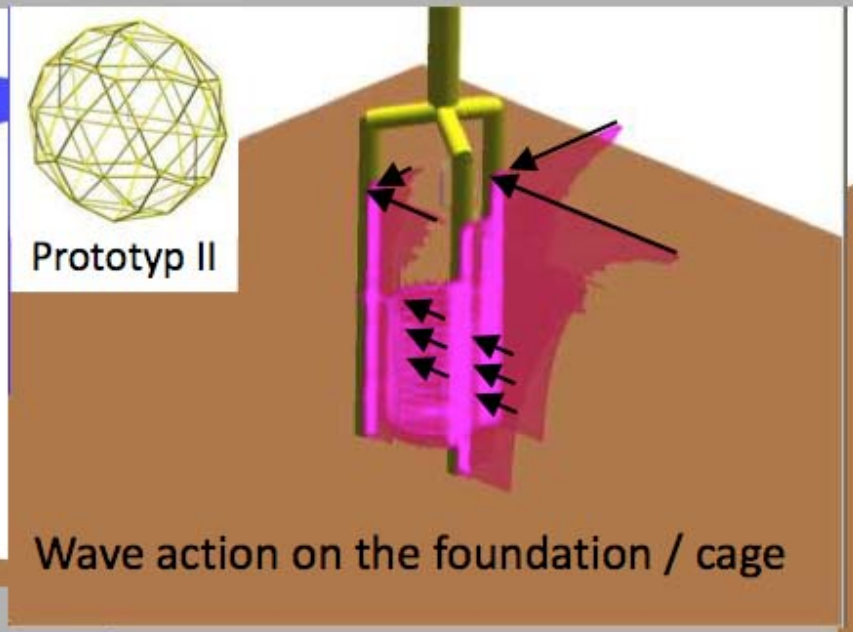
Laufende Projektplanungen

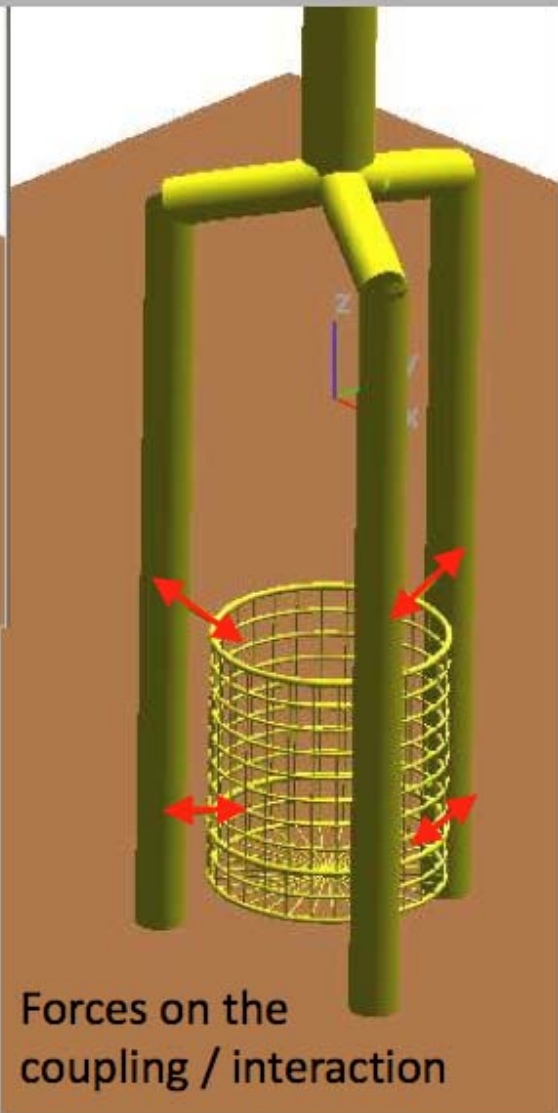


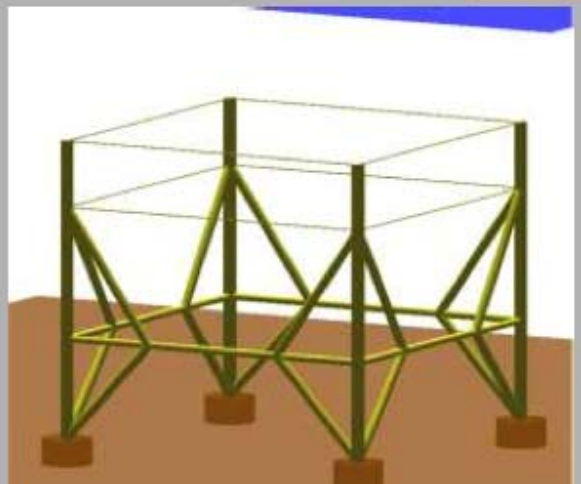
Buck & Krause (2010), *Springer Encyclopedia*

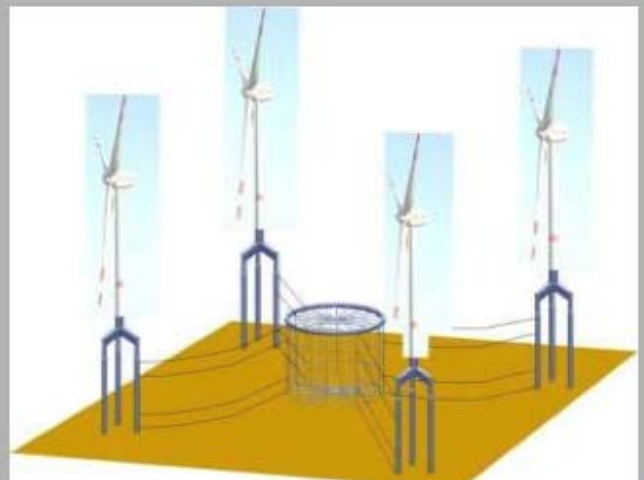
Simulation of forces on the total system







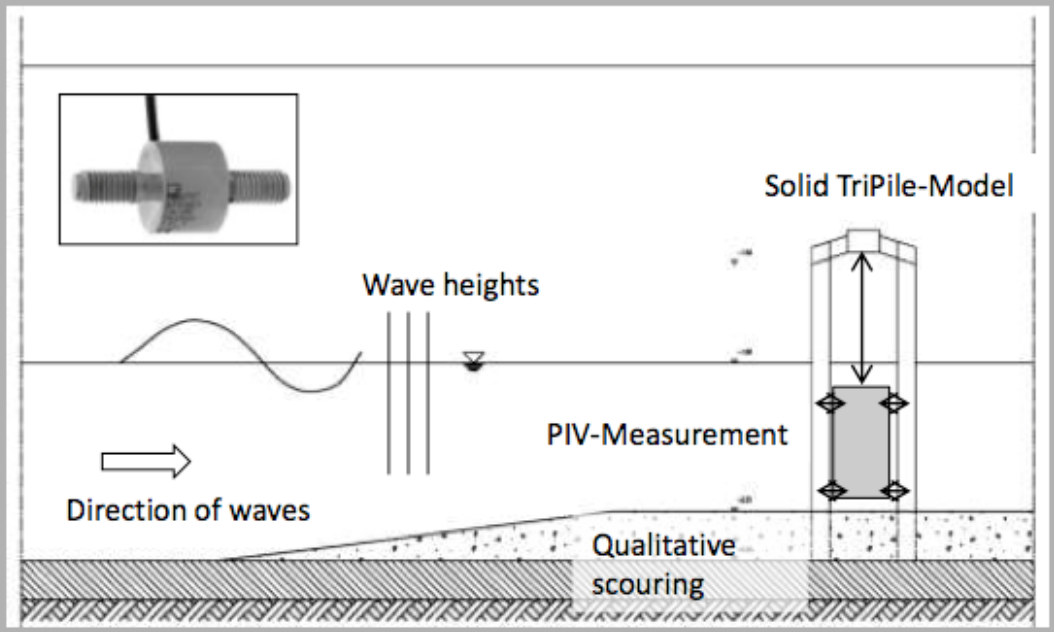




Hydraulic modelling in the wave flume

Experimental setup

- Analysis of flow velocities/forces/qualitative scouring
- Length scale 1 : 40
- Wave parameter:
  - Medium wave: T = 6 s, Hs = 1,5 m
  - Maximum wave: T = 14 s, Hs = 11 m
- Variation of fish cage design
  - Cylinder / Sphere

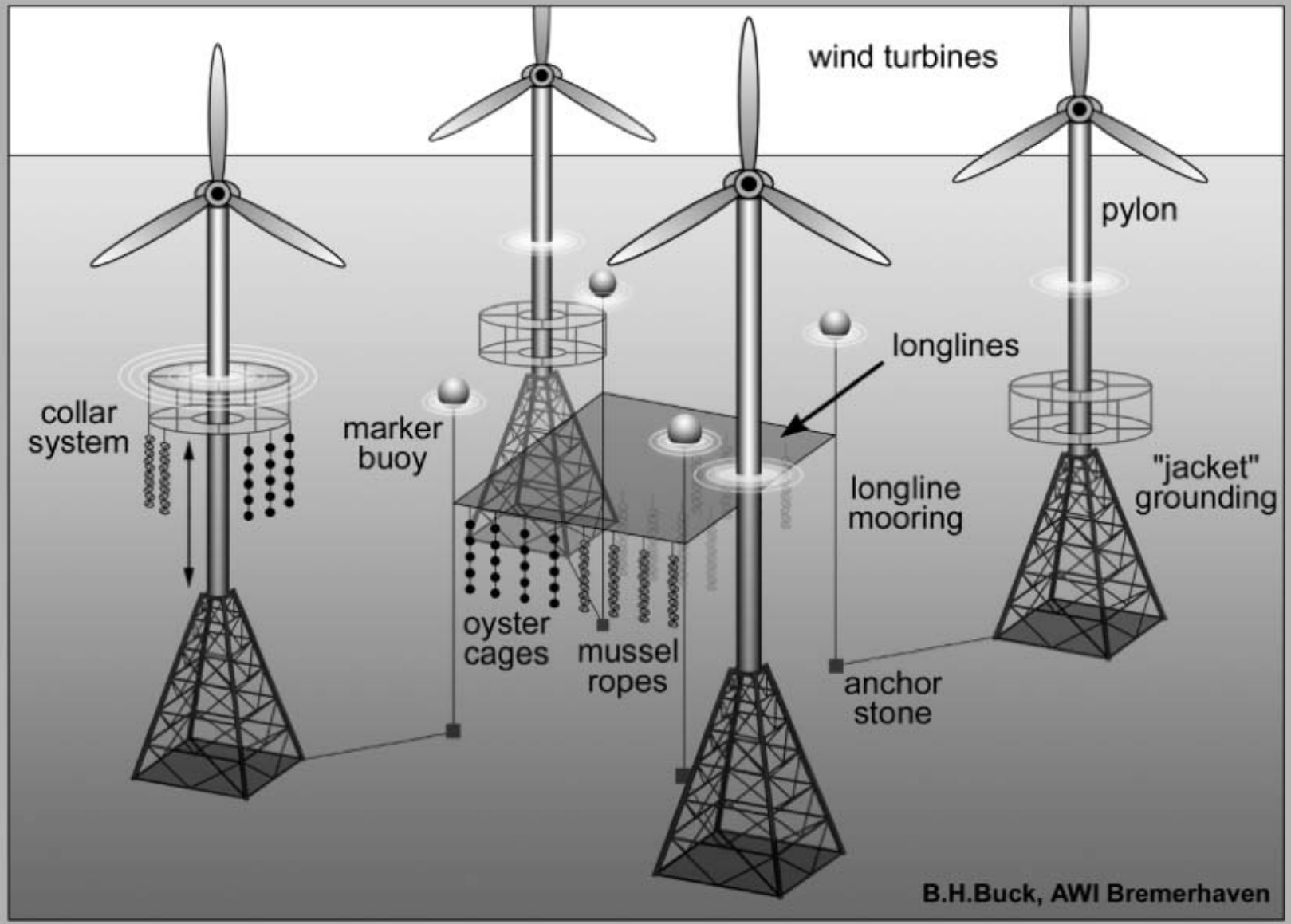


imare
Institute for Marine Resources GmbH

Offshore Wind Farm

AWI

Multi-Use Concept



Buck et al. (2004), *Ocean & Coastal Mgmt.*

INNOVACION + DESARROLLO

Conclusiones

1. Los posibles impactos ambientales de la acuicultura se pueden gestionar y minimizar a través de la comprensión de los procesos, la gestión responsable y la ubicación adecuada de las explotaciones.

2. Los problemas potenciales de la sociedad para el desarrollo sostenible de la acuicultura se pueden prevenir con una visión integral de los elementos esenciales a considerar en la selección del sitio y los procesos de gestión del sitio.

3. La acuicultura puede ser, no sólo ser ambiental y socialmente sostenible, sino también probar que la proteína animal más viable el sistema de producción

aechevarria@aex-group.com

Alonso Echevarría U.