Process and steps for site selection

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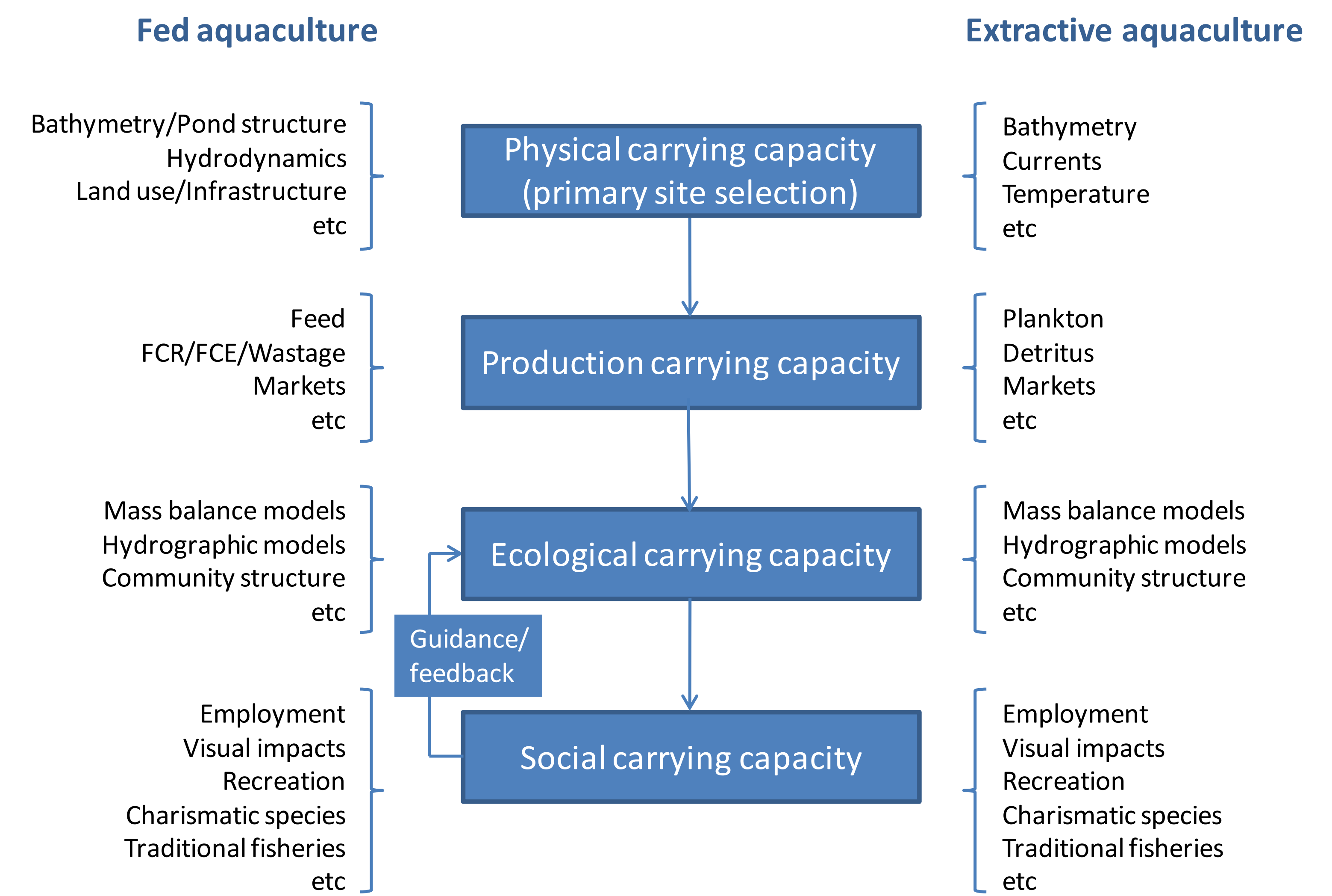
Outline

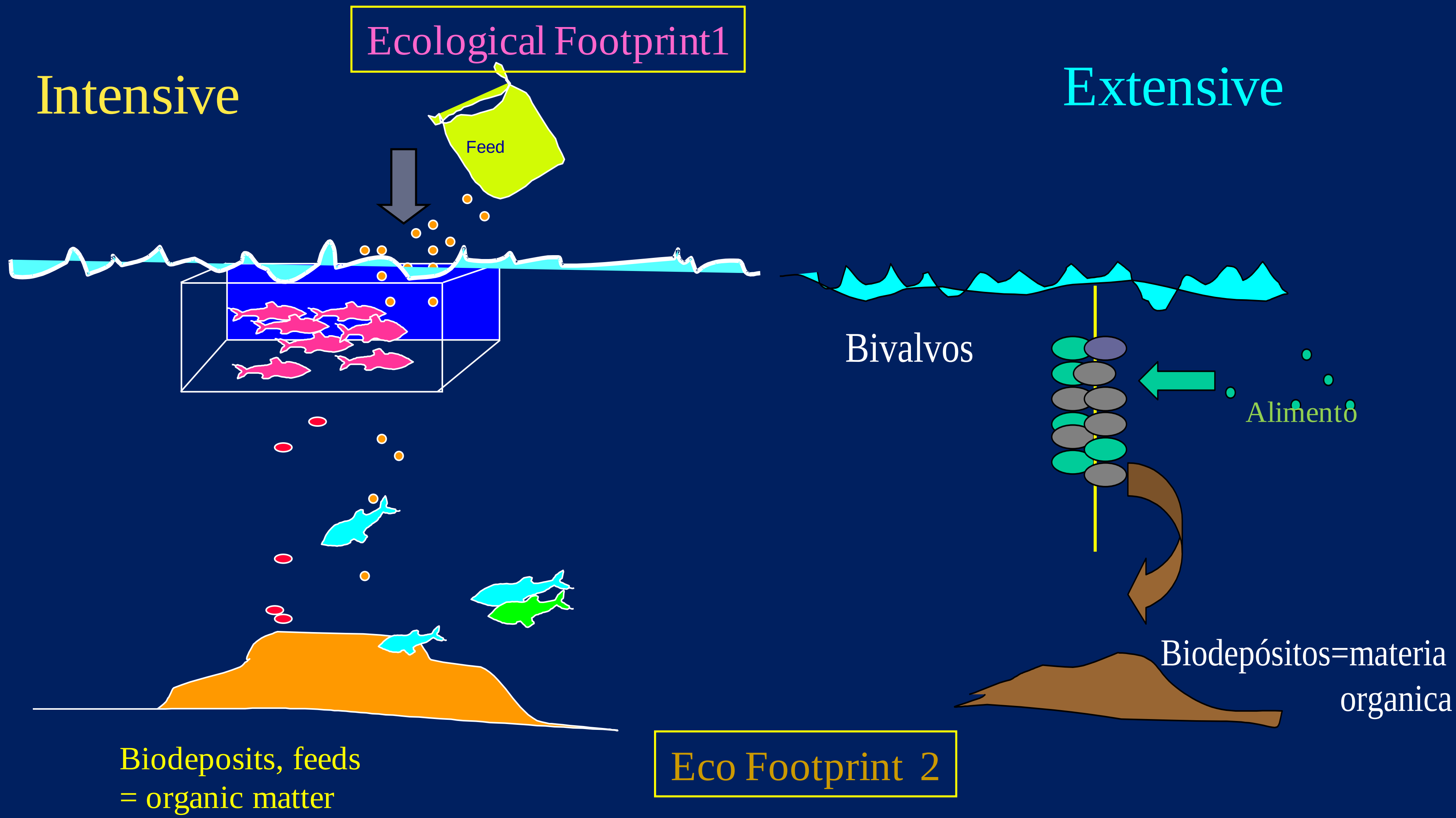
- The different categories / dimensions of the carrying capacity
- Site selection process / specific areas
- Estimation of carrying capacity
- Relationship with SEIA and SEIAS (and environmental impact assessment systems and strategic environmental impact assessment).

The site selection process normally

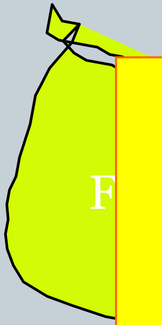
- Leads to a licensing for a specific site (and often is linked to a production volume)
- There could be multiple licenses or clusters
- Same process used for the broader zonification as appropriate

The four dimensions of carrying capacity




Ecological Footprint1
Intensive
Extensive
Feed
Bivalvos
Alimento
Biodepósitos=materia organica
Biodeposits, feeds = organic matter
Eco Footprint 2

Aquaculture as a production process



HOW MUCH IS COMING IN (and source)
AND HOW MUCH IS GOING OUT (and where is going, this includes diseases)

Therefore **<u>ecosystem considerations</u>** are needed from the early planning process

Intensive

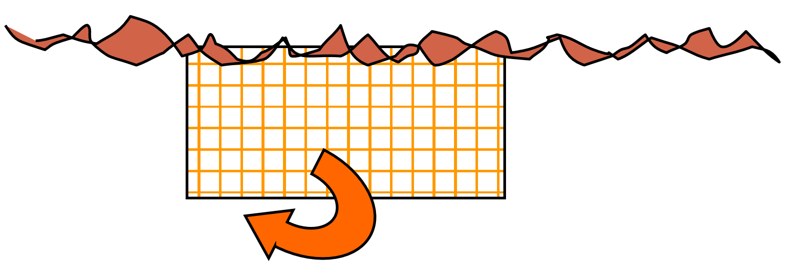
Carnivorous

- Salmonids
- Seabream
- Seabass
- Mullets
- Flatfish
- Shrimp

Herbivorous (not exclusively)

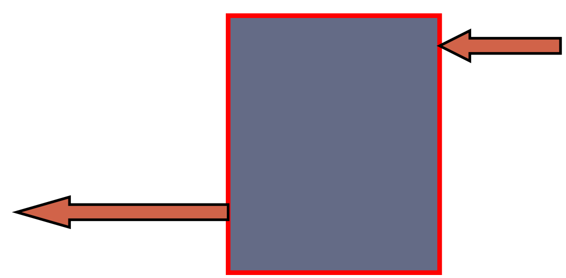
- Tilapia
- Carps
- Abalone
- Etc.

Floating open systems



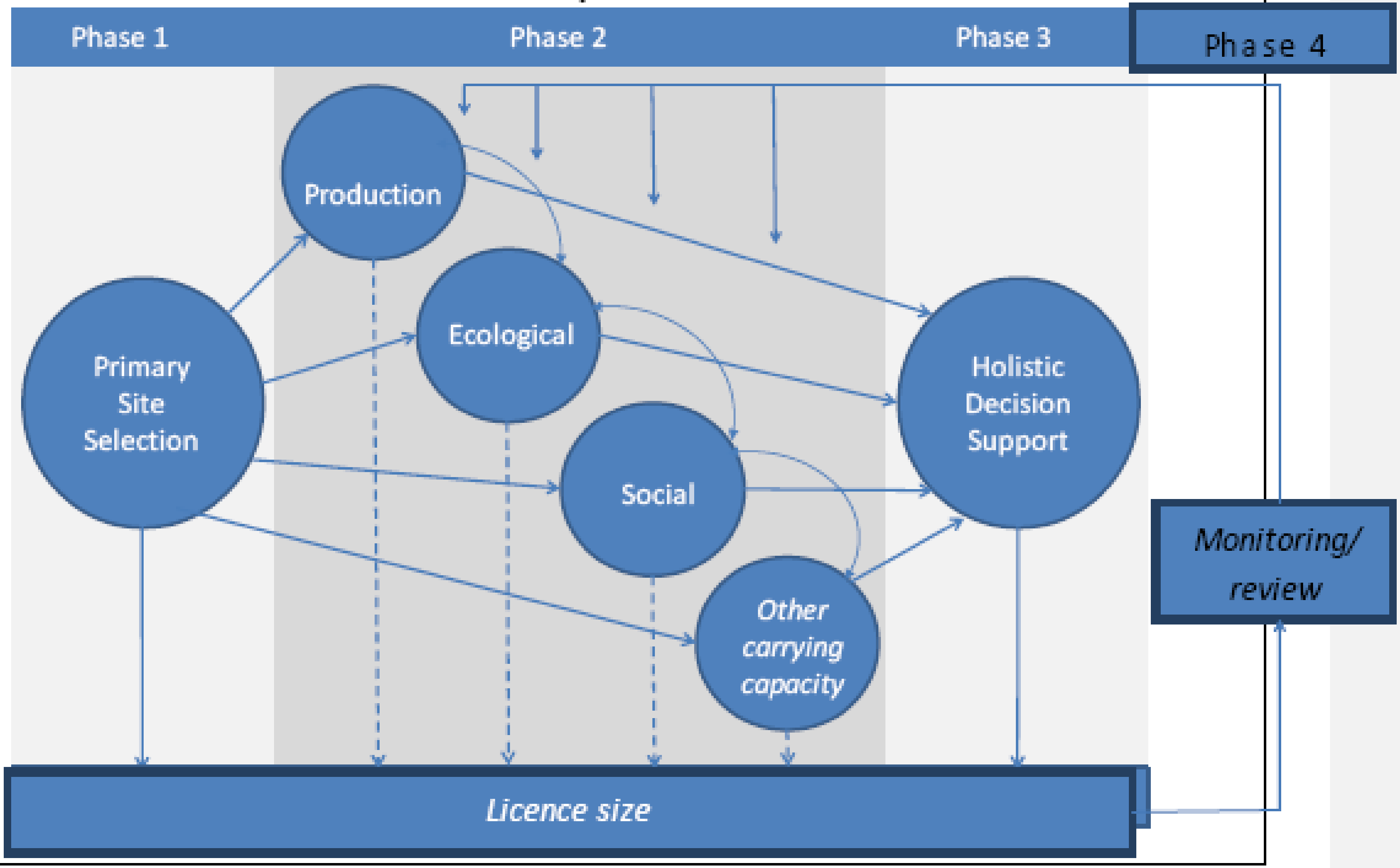
Low control of environmental risks

Closed or semiclosed Land based systems



Better control efluents

Fig. 3. Schematic approach to the relationships and possible sequencing of the different carrying capacity categories, showing the range of end-points in the decision process.



- Although the various categories are treated as hierarchical or nested sub-sections of the wider carrying capacity objective for a specific area, each category can still be assessed individually, whilst being part of the overall picture.
- Each category is integral to an understanding of what can be achieved in a specific area in terms of aquaculture and each will play a role in defining the acceptable levels of change an area can tolerate sustainably.

Site selection: *Phase 1*

- *Step 1. Scoping*
  - Definition of the ecosystem boundary (spatial, social and political scales)
  - Identify over-riding policy, legislation (such as land and sea rights) and regulations (such as ecosystem quality standards, water quality standards).

- *Step 2. Identification of issues to determine criteria for site selection*
  - Geology, bathymetry, physical variables (physical carrying capacity)
  - Exclusion zones and buffers, green areas, to sensitive ecosystems
  - Current policies and normative framework that potentially applied to the preselected area (water rights, land rights, access, sea bottom use rights, water quality normative etc.)
  - Local climatic conditions and exposure
  - Identification of other users and relevant stakeholders, potential conflicts
  - Access and transport
- Step 3. Selection of the site according to the prioritization of the criteria

For example; one of the criteria could be to protect posidonia beds

Phase 2: estimating carrying capacity

- The selection of the site could also require some indicators of carrying capacity when we have decided before hand the biomass we want to produce
- Often the final decision on the total production is taken after having estimated insitu the carrying capacity of a site

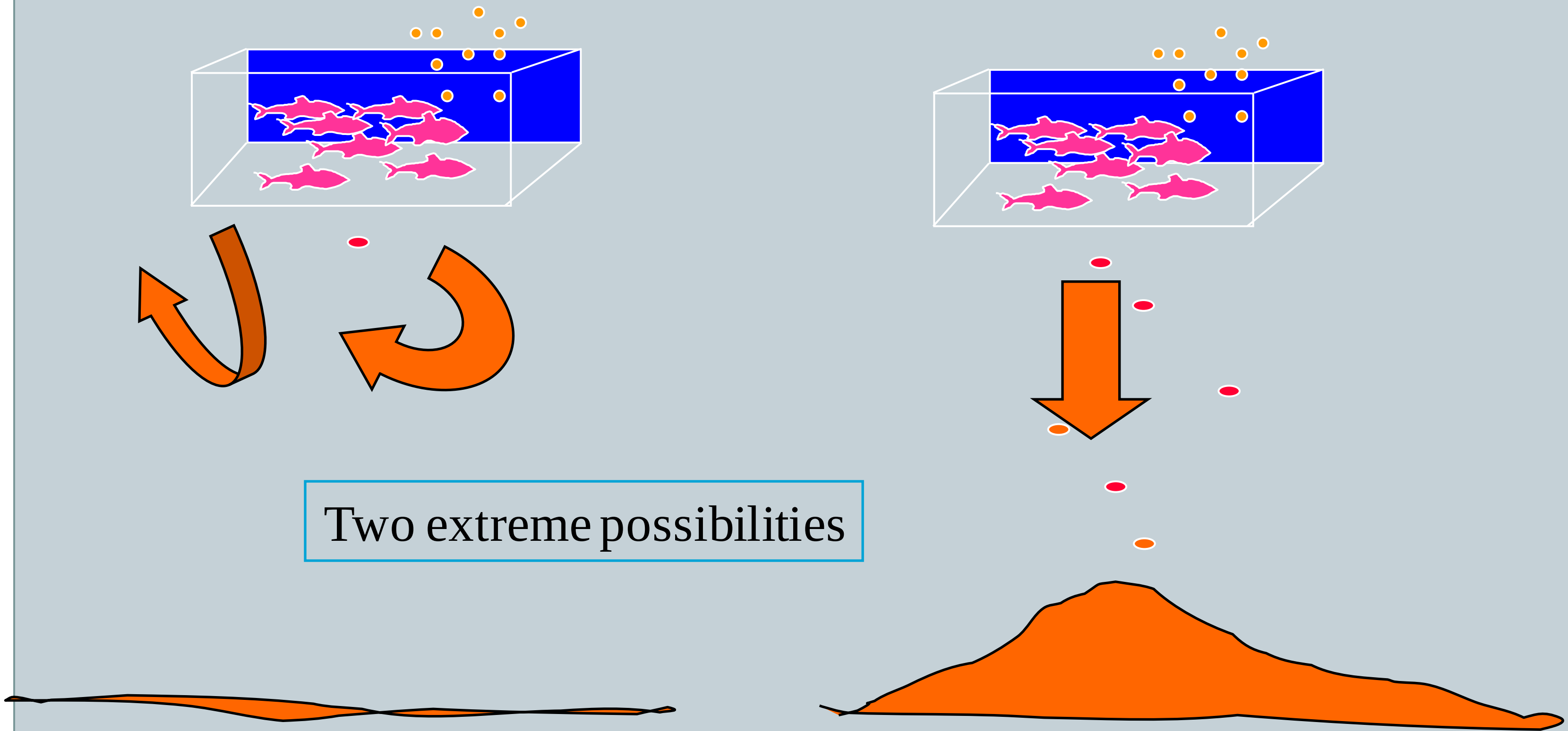
Fase 2. Estimating carrying capacity

- Identify and prioritize the key criteria related to Cap C (production, ecological and social).
- Identify models and indicators for the analysis of capacity (production, ecological and social).
- Identify data sources
- Collect data and background information
- Perform capacity estimation for the 3 categories (production, environmental and social)
- Conduct analysis of decision support
- Estimate the sustainable carrying capacity (Usually based on indicators) and use as a basis for maximum output for licensing

Estimating ecological carrying capacity

- Can not be estimated with great accuracy since the variables that influence it are diverse and controlled by complex processes and mechanisms
- In the water column the maximum load capacity depends usually of the limiting factor for productivity
- In sediments it depends on the ability to process organic and inorganic matter and oxygen availability
- Carrying capacity related to diseases and biosecurity; which is the maximum fish biomass allowable (and distance between sites)
- in an area to avoid diseases

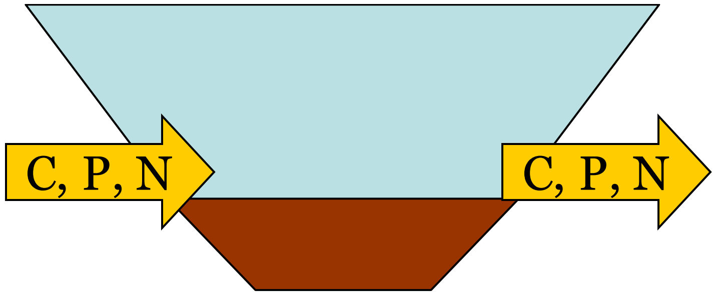
We need to evaluate the destiny of the organic and inorganic matter produced by the farming



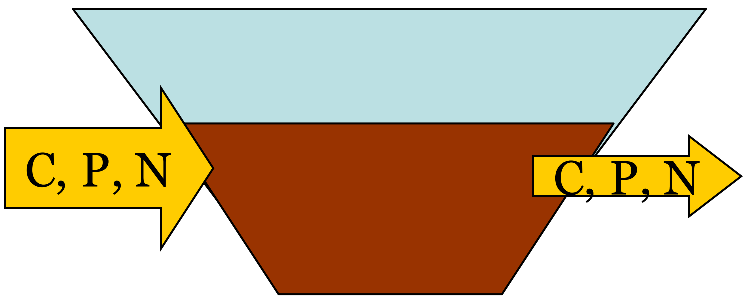
All organic matter and debris
Disperse and locally "disappears"

All organic matter and waste is deposited
beneath the cages

According to the first law of thermodynamics, matter is neither created nor Destroyed, only transformed

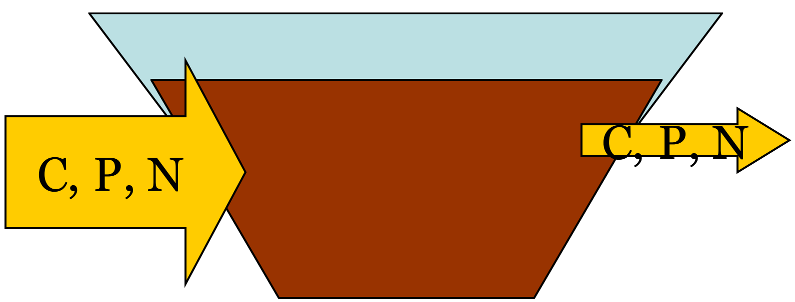


Incomes and exports are equal :
ie there is a balance and it is possible that nutrients are being used with a positive impact, even for fishing



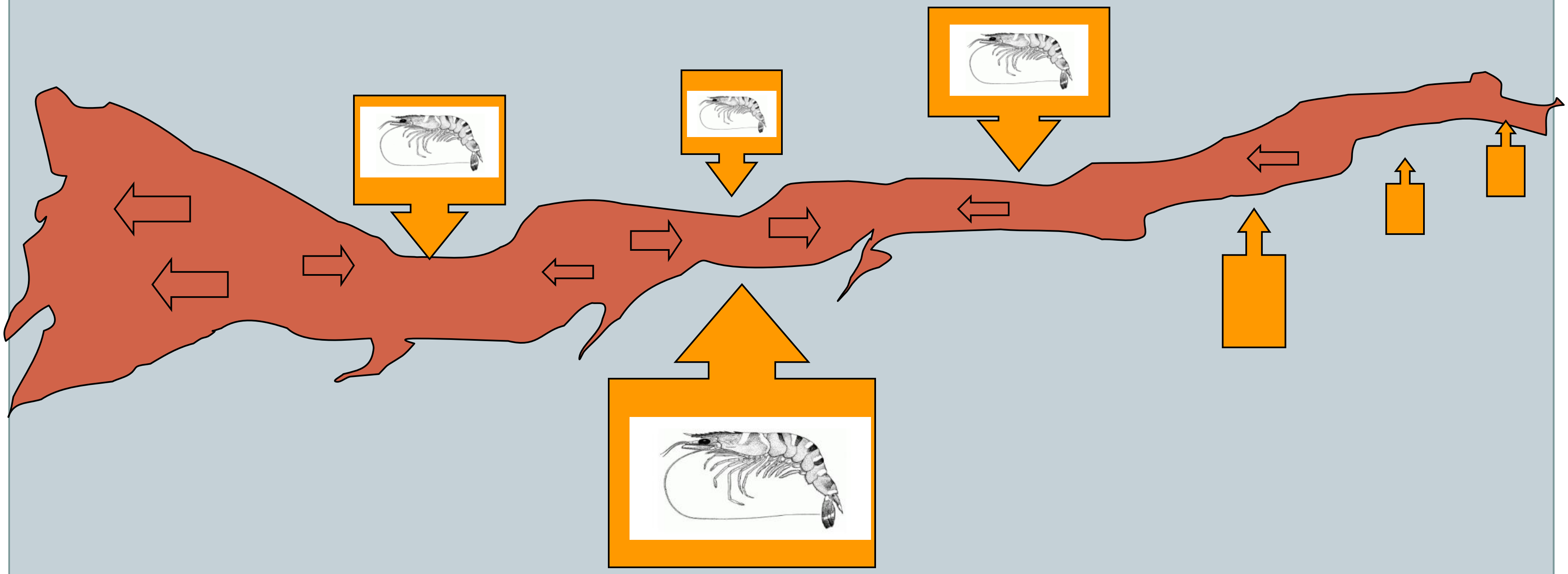
Nutrients accumulate

What is the acceptable maximum



There is an excess accumulation

Often the assessment of individual income effluent (eg farms) does not account for the situation of the whole receiving water body



It is relevant to understand which are the equilibrium points in this waterbody

Estimating social carrying capacity

- Considering the existing communities and social structure we must ask what changes they are willing to experience
- It is necessary to prevent changes and social pressures during the construction phase of aquaculture projects, during the operation stage and also during abandonment
- This is a participatory process!
- The EAA requires a balance! Economic cost / benefits

Phase 3: Holistic decision support

- Considering all the criteria for selection of sites and the estimated carrying capacity we proceed to the decision and provide licenses
- We must ensure that there is a supporting legislation or normative system for proper implementation and enforcement

Phase 4: monitoring, evaluation and framing adaptive management measures

- Monitoring and Evaluation
  - Establishing the threshold values for key indicators (ecological, social, productive) of carrying capacity status
  - Permanent monitoring such indicators and regular analysis and interpretation of the information

- Aplication of corrective measures when appropriate

- THERE IS NO POINT IN ESTABLISHING CARRYING CAPACITY AND MAXIMUM BIOMASS IF THERE IS NO FOLLOW UP MONITORING. This is because the Ccap is “estimate”!!!!!

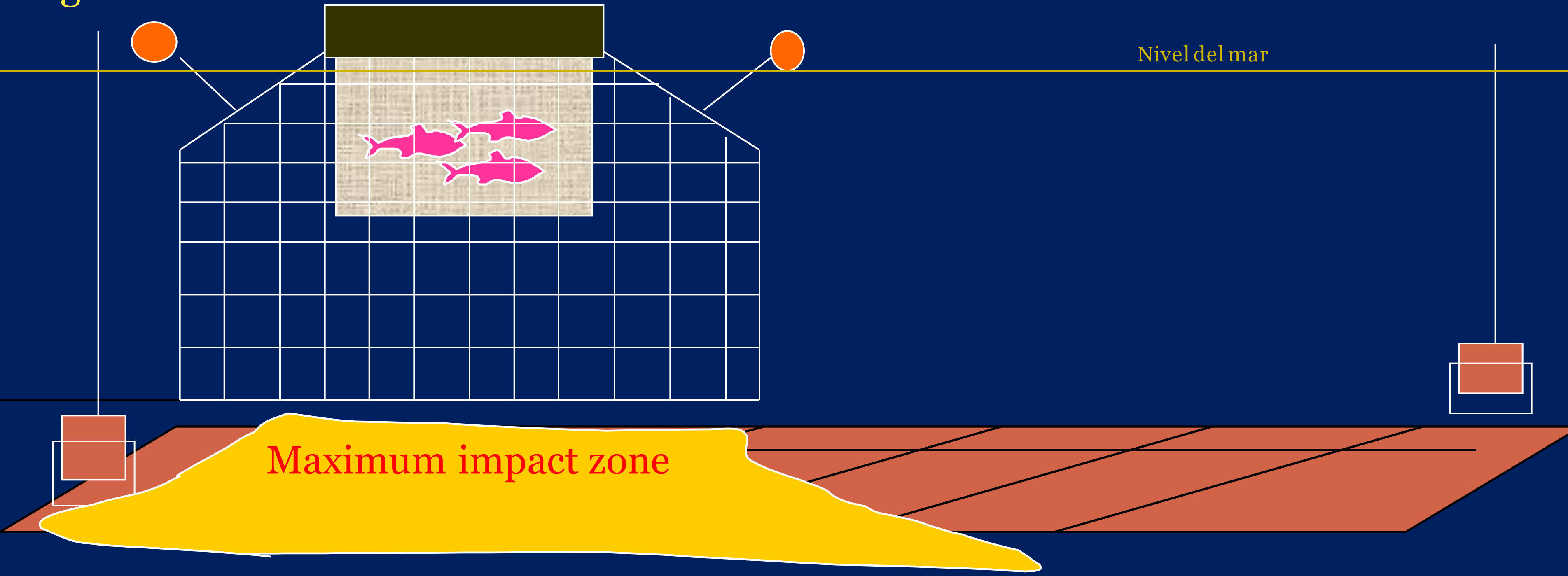
Monitoring and evaluation

- Integrated monitoring is a must!!!
- The monitoring programme should allow to understand the development of the environmental and sanitary conditions, identify trends and potential threats to aquaculture
- It will tell us if we are approaching carrying capacity!
- A “water body or neighborhood“ authority is needed to facilitate decision making and to implement decisions

Sediment sampling

Cage

Control



Example


Islotes Pochas
Isla Laurel
slotes Gemelos
Islote Sin Nombre
Isla La Garza
Isla Elvir
Islas Carimonei
Islote El Amortajado
Islas Cadenas
Isla Amita
Isla Yack
Isla Ovalada
Isla Bobe
Isla Gusanillo
Isla Concoto
Islas Gusano
Isla Perro
Isla Sánch
Archipiélago de Los Chonos
Isla Verdugo
Isla Serrano
Islas de Seguro
Isla Navarro
Isla Aguayo
Isla Lagarto
Isla Ponto
Isla Las Carceles
Isla García
Isla del Bajo
Isla Pical
Isla Valverde
Isla Barranco
Isla Arbolito
Isla Job


© 2012 Cnes/Spot Image
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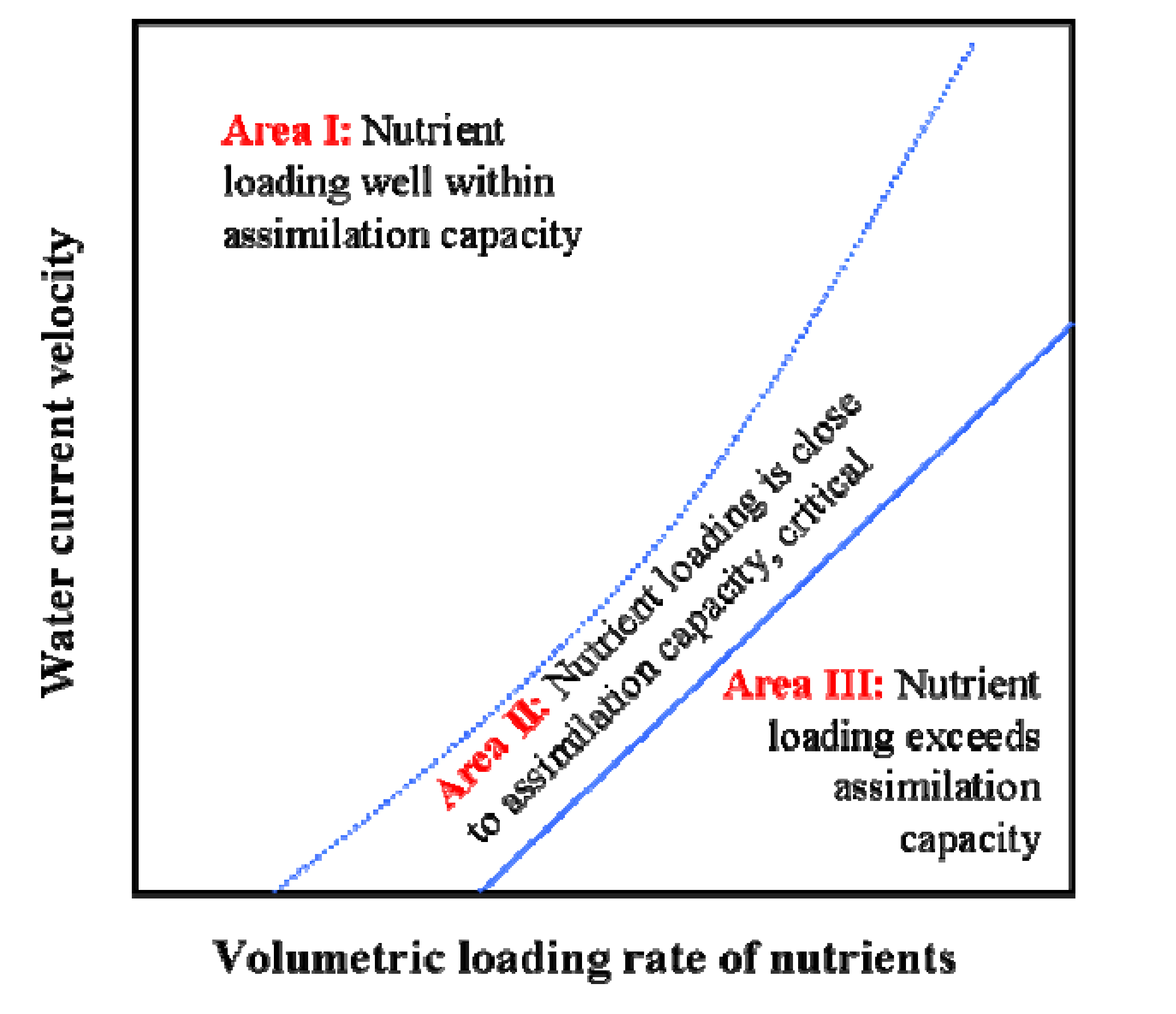
44°10'30.49" S 73°40'04.73" W elev 121 m
Google earth
Eye alt 7.10 km

Scoping

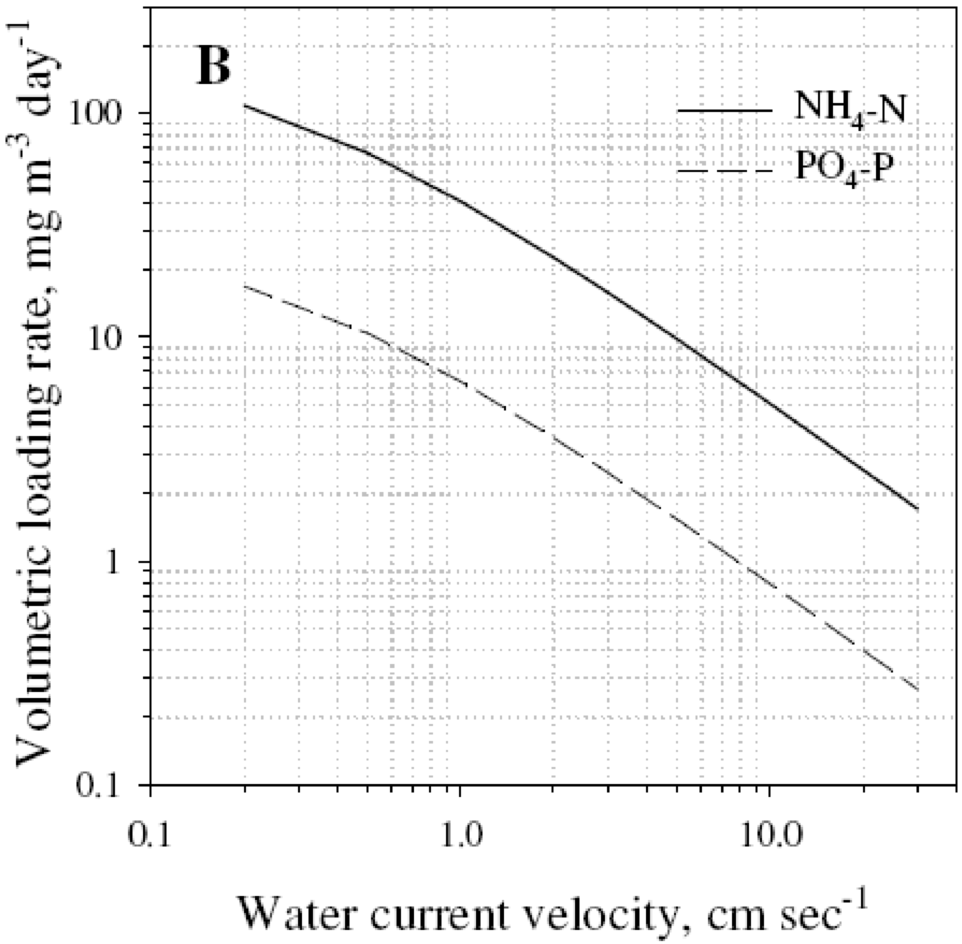
- Isolated area, transportation and limited access
  Average depth 50 m, salinity 30
  small coastal communities and withdrawals, scarce labor
  Artisanal fisheries present relevant but seasonal
  Job for localities in the region but something more withdrawals
  Pristine environment, high biodiversity and coastal benthic

Identify and priorize the main issues /element for the selection criteria

- Depth, currents and salinity etc.
- Preserving biodiversity and coastal aquatic
- Challenging to attract workforce
- No infrastructure (will need to build / provide housing services)
- Create social and support services
- Diseases!!!!!!!



Area I: Nutrient loading well within assimilation capacity
Area II: Nutrient loading is close to assimilation capacity, critical
Area III: Nutrient loading exceeds assimilation capacity
Water current velocity
Volumetric loading rate of nutrients



B
NH4-N
PO4-P
100
10
1
0.1
0.1
1.0
10.0
Volumetric loading rate, mg m-3 day-1
Water current velocity, cm sec-1

Models to estimate Carrying cap

Local scale models based on fish fisiology and mass balances.

- -farmed species and their physiology: growth rates, food assimilation, excretion.
- Productive Regime : initial weight and harvest density per unit crop.
- Type of food: composition and rations.
- Physical and chemical conditions of the water: variability in temperature, dissolved oxygen and nutrient concentrations.

2. Models based on bethic conditions

- - Batimetría del área de ubicación del cultivo.
- - Régimen de corrientes y circulación en el área.
- - Tipo de alimento y tasa de alimentación de los peces.
- - Factor de conversión y tasas de asimilación de los peces.
- - Tasas de sedimentación de partículas: pellets de alimento y fecas.
- - Acumulación de materia orgánica en el fondo.
- - Granulometría del sedimento.
- - Niveles de oxígeno disuelto en el agua sobre el fondo.
- - Metabolismo del bentos: demanda de oxígeno para metabolizar materia orgánica acumulada.
- - Balances de oxígeno y amonio: en sedimento y agua suprayacente.
- - Condición del bentos: presencia-ausencia, abundancia y/o diversidad de infauna bentónica.

4. Broader hydrodynamic models

- - Batimetría y topografía de la cuenca de estudio (fiordo, canal, estuario).
- - Régimen de circulación (forzamiento por mareas, viento y aportes de agua dulce).
- - Ingreso de nutrientes (ríos, estuarios, escorrentía, descargas humanas, y cultivos de camarones, peces).
- - Ingreso de oxígeno (ríos, mezcla vertical inducida por viento o forzamiento oceánico).

INFORMATION NEEDED

Farming System	Physical Carrying capacity	Production Carrying capacity	Ecological Carrying capacity	Social Carrying capacity
System 1 Coastal Marine cages	Wind Waves Currents Depth Temperature Salinity Infrastructure	Temperature Salinity Diet type Feed regime Investment costs Markets etc	Critical habitats Biodiversity EIA Visual impact etc	Land ownership Marine site rights Access to capital Beneficiaries Visual impact etc
System 2 Ponds	Water quantity Water quality Slope Soils Rainfall Evaporation Infrastructure	Temperature Diet type Feed regime Infrastructure Investment costs Markets	Critical habitats Biodiversity EIA Visual impact etc	Land ownership Riparian rights Access to capital Beneficiaries etc
System 3 Freshwater cages	Wind Waves Currents Depth Temperature Salinity Infrastructure	Temperature Infrastructure Investment costs Markets etc	Critical habitats Biodiversity EIA Visual impact etc	Land ownership Riparian rights Access to capital Beneficiaries etc
System 5 Mollusc and aquatic plant culture	Wind Waves Currents Depth Temperature Salinity Infrastructure etc	Temperature Salinity Primary productivity and nutrient levels Investment, costs Markets etc	Critical habitats Biodiversity EIA Visual impact etc	Marine site and shore rights Access to capital Beneficiaries Visual impact, etc

Category (pillar)	Indicators	Measures / approaches	Models / tools
Physical	Water availability Water access Water quality Hydrography Hydrodynamics	Inventory of aquaculture Site selection Zoning Water management ICZM, climate change Risk Assessment Transboundary waterbodies / watersheds	GIS. e.g.: • Arc-info (ESRI®), • IDRISI™ (Clark Labs) • Mapinfo™ (Pitney Bowes) • GRASS (grass.fbk.eu) Google Earth (earth.google.com) Surfer™ (Golden Software)
Production	Intensity of production Yield Investment Market value Economic indicators	Optimisation Management Area Management Cluster management	POND (www.longline.co.uk) FARM (www.longline.co.uk) Winshell (www.longline.co.uk) INVESTMENT (FAO model) Many proprietary model options (e.g. operated by aquaculture companies)
Ecological	Waste dispersion Habitat deterioration Dissolved nutrients Eutrophication Benthic hypoxia	Monitoring Risk assessment Biodiversity and Exotics Resource (e.g. habitat) mapping	DEPOMOD (Cromey et al., 2002[a],b) STELLA™ (www.iseesystems.com) Vensim® (www.vensim.com) Powersim™ (www.powersim.com) GIS (see above)
Social	Space conflict Employment Livelihood Acceptability Value to the community Developed: regulation Developing: flexibility	Participatory Transparency Advocacy Identify stakeholders	PRA Based on perceptions May be non-quantitative