Interacción entre estuario y estanques de marisma adyacentes

Procesos de producción primaria en sistemas acuáticos gestionados e inundados con agua procedente del estuario.

Caso particular en Veta la Palma.

José Pedro Cañavate. IFAPA Centro El Toruño.

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Inundación controlada

Condiciones favorables para crecimiento de "inóculo" procedente del estuario

Productividad limitada

Presencia de comunidad de fitoplancton en baja densidad

En estudio

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Modelo global de producción

Papel esencial de la estructura de la comunidad de fitoplancton

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Importancia especial del fitoplancton en ecosistemas acuáticos

1) Phytoplankton community composition
2) Salt marsh elevation and plant health
3) Size distribution of aquatic organisms

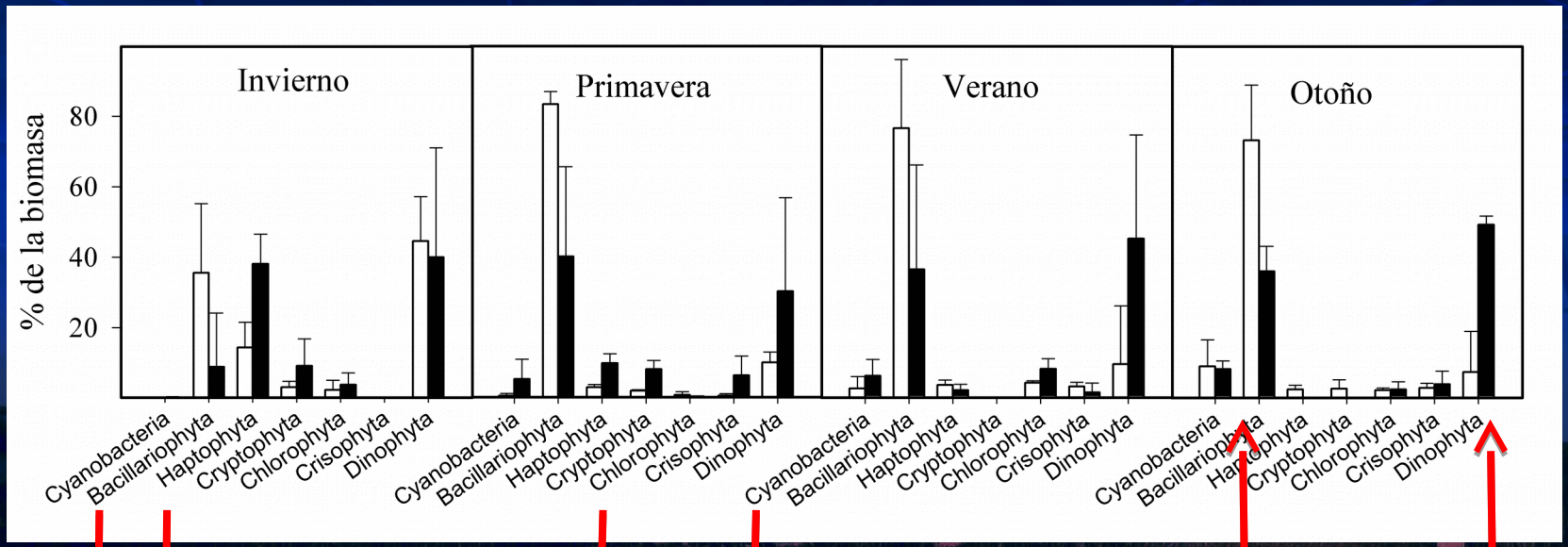
Dependencia de:
Carga y relación entre nutrientes
Estacionalidad (luz, temperatura)
Hidráulica

Salinidad
Turbidez
Interacciones biota

Proveedor principal de nutrientes esenciales para el desarrollo.

40 especies identificadas y agrupadas

Distribución estacional de principales grupos taxonómicos de fitoplancton en estanques de VLP sometidos a dos tipos de regímenes hidráulicos.



Mínima presencia de especies de bajo valor nutricional

Dominancia de diatomeas, haptofitas y dinofitas en invierno

Importancia del flujo de agua

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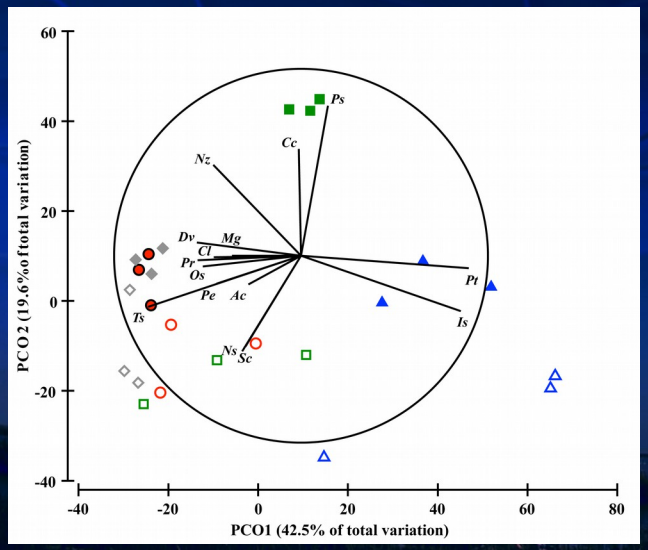
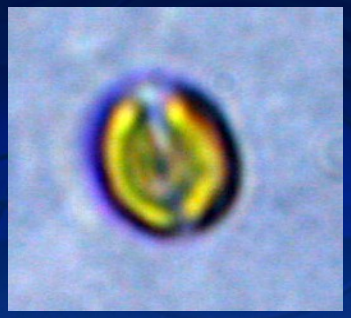
Sistema con elevada capacidad para conducir nutrientes y energía hacia posiciones tróficas superiores

Hidráulica 19.6%



Estacionalidad 42.5%



Especies de máximo valor trófico, con crecimiento normal en agua de mar

Marcada diferencia con ecosistemas dulceacuícolas, típicos de Doñana

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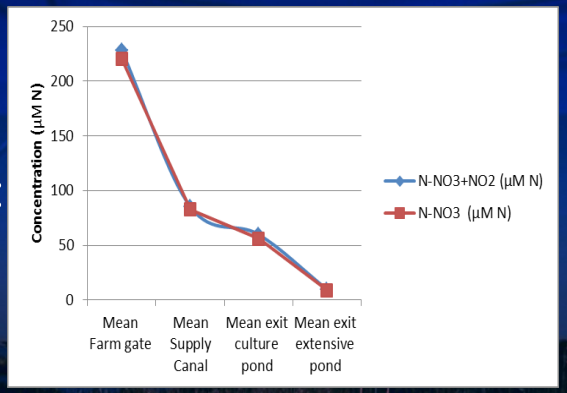
Estanques reconstruidos en Isla Mayor

Nutrientes en salida:
1-25 µM N
0,2-5 µM P

Nutrientes en entrada:
50-250 µM N
0,5-5 µM P



Aprox. 96% retención

Canales perimetrales
Engorde de lubina con pienso

Plataforma central agua somera
Alta productividad bentónica.
Accesible para aves

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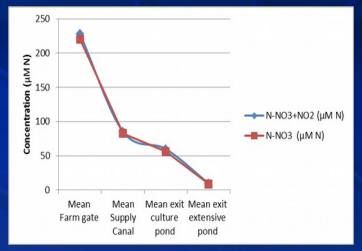
Evaluación de servicios ecosistémicos

Estima del balance de nutrientes y su reciclaje en biomasa



Retención annual de N:
150 kg/Ha

→ Sobre 1.8 Tm BS/Ha

≃ 0.8 Tm BS/Ha

Flamencos y anátidas
principales consumidores

Recursos acuícolas

Apoyo alimentario a
recursos pesqueros

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Integración de nutrientes en acuicultura


REVIEWS IN Aquaculture

Reviews in Aquaculture (2013) 5, 158–171 doi: 10.1111/raq.12011

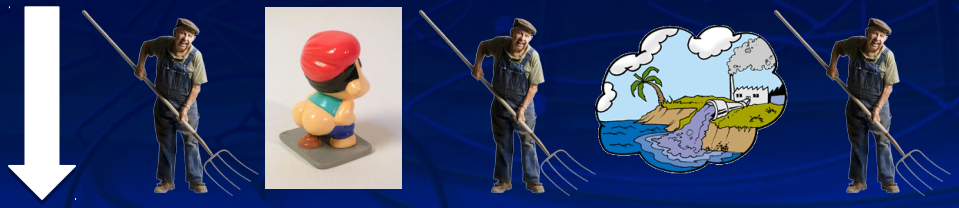
Nutrient discharge from aquaculture operations in function of system design and production environment

Marc C. J. Verdegem

Department of Animal Sciences, Aquaculture and Fisheries Group (part of Wageningen Aquaculture), Wageningen University, Wageningen, The Netherlands

N: 0.9%

P: 2.3%



Enfoque ecosistémico de la acuicultura

Promovido desde 2005 por la FAO

Dentro de la estrategia para la acuicultura sostenible en la UE desde 2002

Mantenimiento de servicios y plasticidad del ecosistema

Conservación de recursos para la sociedad

Cumplimiento nacional de normativa y fines de la UE

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Acuicultura en humedales reconstruidos en entornos con elevado contenido en nutrientes.

Carga de nutrientes en estuarios de ríos grandes muy elevada.

Concentración muy alta y focalizada

Guadalquivir ≈ 18.000 Tm N año

Tajo: 14.000 Tm N año
Ebro: 12.000 Tm N año

El correcto reciclado de nutrientes depende del desarrollo de comunidades de fitoplancton con el adecuado valor trófico

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Evaluación de servicios ecosistémicos

Contribución en conservación de especies amenazadas

Especies en lista roja IUCN

Cerceta pardilla
(*Marmaronetta angustirostris*)

Anguila europea (*Anguilla a*

Gaviota picofina
(*Larus genei*)

Los humedales permanentemente inundados representan un refugio crucial para algunas especies amenazadas

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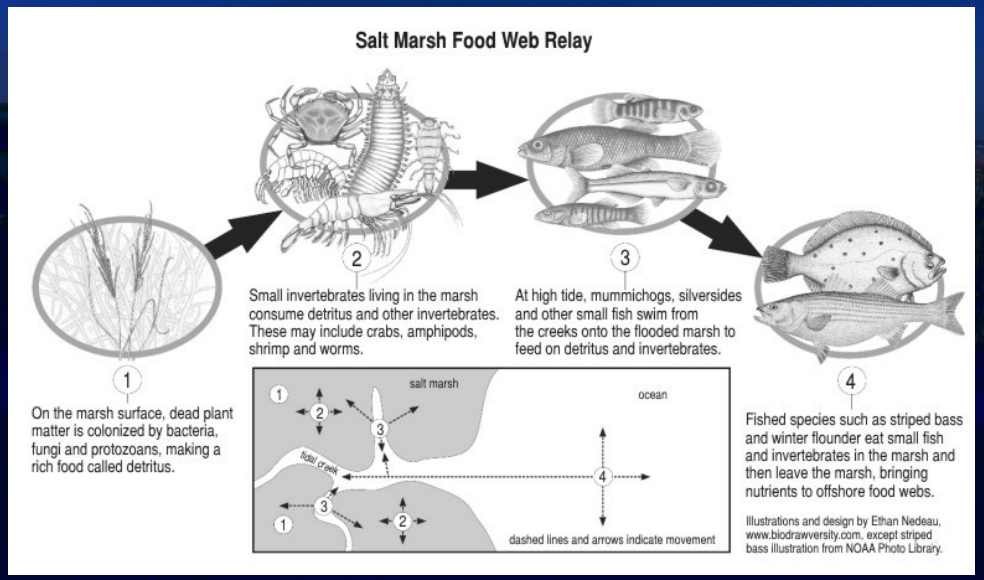
Evaluación de servicios ecosistémicos

Provisión de refugio para alevinaje y reclutamiento



From: The Gulf of Maine Times. Volume 9(2). 2005

Amplio apoyo científico

Alimento y refugio

Evaluación de servicios ecosistémicos

Disminución de eutrofización costera

Ecosystems (2011) 14: 144–155
DOI: 10.1007/s10021-010-9400-z

ECOSYSTEMS

Wetlands as Sinks for Reactive Nitrogen at Continental and Global Scales: A Meta-Analysis

Stephen J. Jordan,[1]* Jonathan Stoffer,[2] and Janet A. Nestlerode[1]

[1]Gulf Ecology Division, U.S. Environmental Protection Agency, 1 Sabine Island Drive, Gulf Breeze, Florida 32561, USA; [2]Department of Marine Biology, Texas A&M University, 5007 Avenue U, Galveston, Texas 77553, USA

Impacto severo de rios caudalosos e hipereutróficos en ecosistemas costeros……..

…….y en sus recursos asociados

Pesca

Anoxia fondos?

Zonas muertas

Turismo

De: Smetacek & Zingone. 2005. Green and golden seaweed tides on the rise. Nature 504

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Reciclaje de nutrientes en alimentos de calidad marina

Consumo directo

Materia prima para procesado








Diversificación oferta con productos nuevos

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Difusión de resultados

Science of the Total Environment xxx (2014) xxx–xxx

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journal homepage: www.elsevier.com/locate/scitotenv

ELSEVIER

Flow regime in a restored wetland determines trophic links and species composition in the aquatic macroinvertebrate community

E. González-Ortegón [a,b,*], M.E.M. Walton [a], B. Moghaddam [a], C. Vilas [b], A. Prieto [b], H.A. Kennedy [a], J. Pedro Cañavate [b], L. Le Vay [a]

[a] School of Ocean Sciences, Bangor University, Menai Bridge LL59 5AB, UK
[b] IFAPA Centro El Toruño, Camino Tiro de Pichón s/n, 11500 El Puerto de Santa María, Spain

HIGHLIGHTS

- Flow regimen is a major determinant of physicochemical habitat of a wetland.
- Water exchanges wetland-estuary modify its aquatic community and trophic links.
- Omnivory and physiological tolerance key in the resistance of a wetland community.
- Trophic niche of *P.varians* seems not to be shrunk by the presence of *P.macrodactylus*.
- The shrimp *P. varians* has a key role in the stability of the aquatic faunal community.

ARTICLE INFO

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Stable isotope analysis
Food webs
Invasive species

ABSTRACT

In a restored wetland (South of Spain), where different flow regimes control water exchange with the adjacent Guadalquivir estuary, the native *Palaemon varians* coexists with an exotic counterpart species *Palaemon macrodactylus*. This controlled m\acrocosm offers an excellent opportunity to investigate how the effects of water management, through different flow regimes, and the presence of a non-native species affect the aquatic community and the trophic niche (by gut contents and C-N isotopic composition) of the native shrimp *Palaemon varians*. We found that increased water exchange rate (5% day^{-1} in mixed ponds *vs.* 0.1% day^{-1} in extensive ponds) modified the aquatic community of this wetland; while extensive ponds are dominated by isopods and amphipods with low presence of *P. macrodactylus*, mixed ponds presented high biomass of mysids, corixids, copepods and both shrimp species. An estuarine origin of nutrients and primary production might explain seasonal and spatial differences found among ponds of this wetland. A combined analysis of gut contents and isotopic composition of the native and the exotic species showed that: (1) native *P. varians* is mainly omnivorous (2) while the non-native *P. macrodactylus* is more zooplanktivorous and (3) a dietary overlap occurred when both species coexist at mixed ponds where a higher water exchange and high abundance of mysids and copepods diversifies the native species' diet. Thus differences in the trophic ecology of both species are clearly explained by water management. This experimental study is a valuable tool for integrated management between river basin and wetlands since it allows quantification of wetland community changes in response to the flow regime.

Hydrobiologia (2015) 744:15–33
DOI 10.1007/s10750-014-2051-x

PRIMARY RESEARCH PAPER

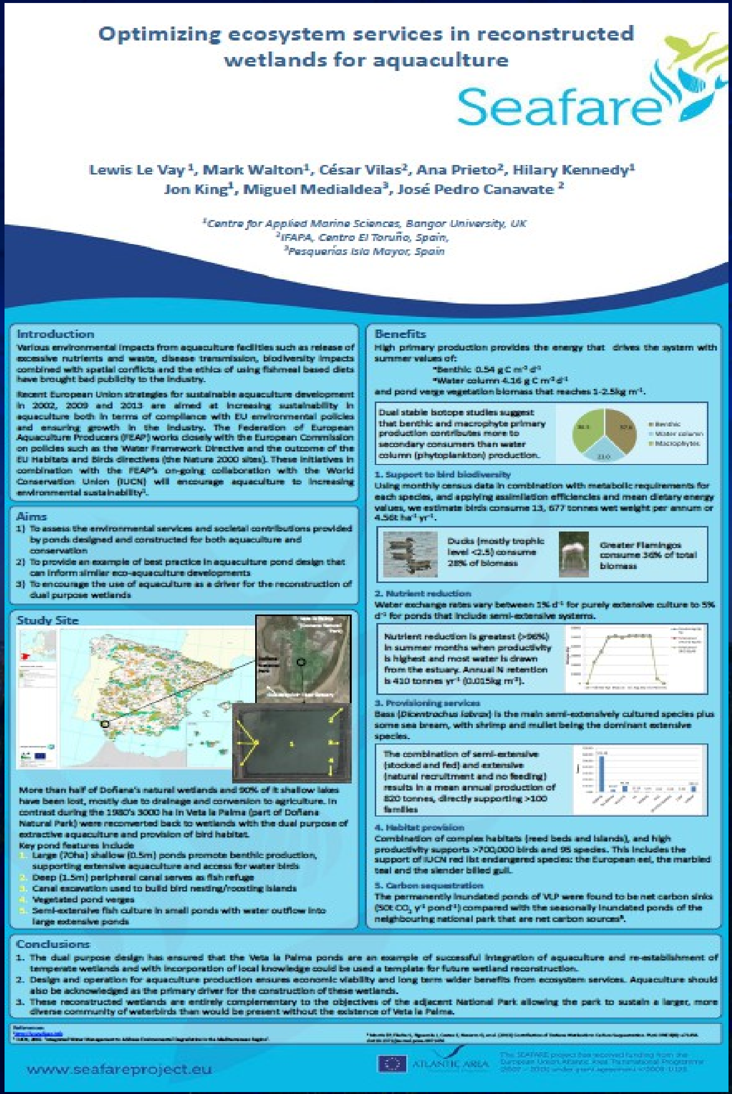
Flushing-related changes of phytoplankton seasonal assemblages in marsh ponds of the warm temperate Guadalquivir river estuary (SW Spain)

José Pedro Cañavate · Carmen Pérez-Gavilan · Narciso Mazuelos · Manuel Manchado

Received: 19 June 2014 / Revised: 19 September 2014 / Accepted: 20 September 2014 / Published online: 26 September 2014

Abstract The effect of controlled flushing on natural phytoplankton communities in brackish estuarine water ponds of Doñana Natural Park (Guadalquivir marshes, SW Spain) was evaluated throughout a year cycle by 16S chloroplast rDNA metagenome analysis. Multivariate analysis of phytoplankton assemblages based on the abundance of 30 main identified microalgae included in seven different phyla revealed pond flushing accounted for 19.6% of total data variation, a value far below the 42.5% variability explained by seasonality. Microalgae species biovolume was a better descriptor explaining phytoplankton assemblages in comparison to species relative abundance. also enhanced by low water flushing, but only during winter and spring. Two main haptophytes seasonally succeeded each other exhibited opposed response to hydrology with *Isochrysis* sp. showing negative response to increased flushing and *Diacronema vlkianum* showing a positive reaction. Both species represented a permanent and relevant haptophytes contribution to phytoplankton assemblages in marsh ponds previously undescribed in the area.

Keywords Marsh pond · Hydrology · Phytoplankton assemblage · Seasonality


Optimizing ecosystem services in reconstructed wetlands for aquaculture
Seafare
Lewis Le Vay 1, Mark Walton1, César Vilas2, Ana Prieto2, Hilary Kennedy1
Jon King1, Miguel Medialdea3, José Pedro Canavate 2
1Centre for Applied Marine Sciences, Bangor University, UK
2IFAPA, Centro El Toruño, Spain,
3Pesquerias Isla Mayor, Spain
Introduction
Various environmental impacts from aquaculture facilities such as release of excessive nutrients and waste, disease transmission, biodiversity impacts combined with spatial conflicts and the ethics of using fishmeal based diets have brought bad publicity to the industry.
Recent European Union strategies for sustainable aquaculture development in 2002, 2009 and 2013 are aimed at increasing sustainability in aquaculture both in terms of compliance with EU environmental policies and ensuring growth in the industry. The Federation of European Aquaculture Producers (FEAP) works closely with the European Commission on policies such as the Water Framework Directive and the outcome of the EU Habitats and Birds directives (the Natura 2000 sites). These initiatives in combination with the FEAP's on-going collaboration with the World Conservation Union (IUCN) will encourage aquaculture to increasing environmental sustainability1.
Aims
1) To assess the environmental services and societal contributions provided by ponds designed and constructed for both aquaculture and conservation
2) To provide an example of best practice in aquaculture pond design that can inform similar eco-aquaculture developments
3) To encourage the use of aquaculture as a driver for the reconstruction of dual purpose wetlands
Study Site
More than half of Doñana's natural wetlands and 90% of it shallow lakes have been lost, mostly due to drainage and conversion to agriculture. In contrast during the 1980's 3000 ha in Veta la Palma (part of Doñana Natural Park) were reconverted back to wetlands with the dual purpose of extractive aquaculture and provision of bird habitat.
Key pond features include
1. Large (70ha) shallow (0.5m) ponds promote benthic production, supporting extensive aquaculture and access for water birds
2. Deep (1.5m) peripheral canal serves as fish refuge
3. Canal excavation used to build bird nesting/roosting islands
4. Vegetated pond verges
5. Semi-extensive fish culture in small ponds with water outflow into large extensive ponds
Benefits
High primary production provides the energy that drives the system with summer values of:
*Benthic 0.54 g C m-2 d-1
*Water column 4.16 g C m-2 d-1
and pond verge vegetation biomass that reaches 1-2.5kg m-1.
Dual stable isotope studies suggest that benthic and macrophyte primary production contributes more to secondary consumers than water column (phytoplankton) production.
1. Support to bird biodiversity
Using monthly census data in combination with metabolic requirements for each species, and applying assimilation efficiencies and mean dietary energy values, we estimate birds consume 13, 677 tonnes wet weight per annum or 4.56t ha-1 yr-1.
Ducks (mostly trophic level <2.5) consume 28% of biomass
Greater Flamingos consume 36% of total biomass
2. Nutrient reduction
Water exchange rates vary between 1% d-1 for purely extensive culture to 5% d-1 for ponds that include semi-extensive systems.
Nutrient reduction is greatest (>96%) in summer months when productivity is highest and most water is drawn from the estuary. Annual N retention is 410 tonnes yr-1 (0.015kg m-2).
3. Provisioning services
Bass (Dicentrachus labrax) is the main semi-extensively cultured species plus some sea bream, with shrimp and mullet being the dominant extensive species.
The combination of semi-extensive (stocked and fed) and extensive (natural recruitment and no feeding) results in a mean annual production of 820 tonnes, directly supporting >100 families
4. Habitat provision
Combination of complex habitats (reed beds and islands), and high productivity supports >700,000 birds and 95 species. This includes the support of IUCN red list endangered species: the European eel, the marbled teal and the slender billed gull.
5. Carbon sequestration
The permanently inundated ponds of VLP were found to be net carbon sinks (50t CO2 y-1 pond-1) compared with the seasonally inundated ponds of the neighbouring national park that are net carbon sources4.
Conclusions
1. The dual purpose design has ensured that the Veta la Palma ponds are an example of successful integration of aquaculture and re-establishment of temperate wetlands and with incorporation of local knowledge could be used a template for future wetland reconstruction.
2. Design and operation for aquaculture production ensures economic viability and long term wider benefits from ecosystem services. Aquaculture should also be acknowledged as the primary driver for the construction of these wetlands.
3. These reconstructed wetlands are entirely complementary to the objectives of the adjacent National Park allowing the park to sustain a larger, more diverse community of waterbirds than would be present without the existence of Veta la Palma.
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Muchas gracias por la atención

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