Ecological Economics 108 (2014) 115–123

Contents lists available at ScienceDirect

Ecological Economics

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

Analysis

Perceptions of the services provided by pond fish farming in Lorraine (France)

Thierry Blayac [a], Syndhia Mathé [a,b,*], Hélène Rey-Valette [a], Pascal Fontaine [c]

[a] Université Montpellier 1, CNRS, UMR Lameta, Avenue Raymond Dugrand, CS 79 606, 34960, 34960 Montpellier Cedex 2, France
[b] CIRAD, UMR Innovation, TA C-85/15, 73 Rue Jean-François Breton, 34398 Montpellier Cedex 5, France
[c] Université de Lorraine, UR AFPA, USC INRA 340, Campus Victor Grignard, Boulevard des aiguillettes, BP 239, 54506 Vandœuvre-lès-Nancy Cedex, France

ARTICLE INFO

Article history:
Received 8 October 2013
Received in revised form 25 September 2014
Accepted 19 October 2014
Available online 30 October 2014

Keywords:
Ecosystem services
Fish farming
Lorraine
Pond
Social perceptions

ABSTRACT

This article discusses a study of the perceptions of ecosystem services in pond fish farming in the Lorraine region, one of the principal pond fish farming regions in France. In total, 668 people were surveyed from four types of population: fish farmers, economic and institutional stakeholders, pond users and inhabitants of villages located close to the ponds. A typology of perceptions was established using a principal component analysis associated with an ascending hierarchical ranking. It shows differentiated perceptions of the categories of ecosystem services by population type. Age and education affect these perceptions. In addition, econometric modeling (a multinomial logit model) showed the importance of regulating and supporting systems for fish farmers, stakeholders and pond users. The preferences of local residents are more evenly spread across service categories, although it may be noted that educational level tends to increase the choice of supporting and regulating services.

1. Introduction

Having grown rapidly in recent decades, aquaculture systems must now meet new challenges posed by sustainable development. Farms are now confronted with highly-constraining environmental standards and in many countries their expansion is limited by the difficulties encountered in accessing new sites. One of the main challenges that the industry is currently facing is its territorial integration. The issue is no longer only to control discharges and impacts but to address all the interactions between fish farms, ecosystems and the areas where they are located. In this context, the ecosystem service framework developed by the Millennium Ecosystem Assessment (MEA, 2005) is helpful. This framework constitutes a watershed in the representation and analysis of interactions between society and the environment. By linking ecosystem services to social welfare, it provides a positive vision for the protection of these services. Four service categories are defined depending on whether they (i) contribute to providing for society, (ii) furnish cultural services, (iii) provide regulating services and (iv) support fundamental ecological process and biodiversity maintenance.

This approach to the interactions between ecosystems and socio-systems provides a functional and operational framework for a territorially-based approach to sustainable development. Applied to aquaculture, it also provides an exhaustive analytical matrix of the interactions between aquaculture and aquaculture areas and more generally with society. It may also help to improve the image of an activity whose negative ecological impacts are often highlighted. Different types of farming have been criticized for discharges, fish meal consumption or impacts on the landscape. Yet the industry has made considerable efforts to improve these aspects of fish farm performance. If certain services are taken into account, pond fish farming can be considered not only as a productive activity but also as an instrument for territorial development. Depending on the context, it could contribute to cultural heritage, flood regulation, landscape maintenance, tourist attractiveness, and wetland and biodiversity conservation. However, the managers and the populations of these areas must first be made aware of these services and of their direct and indirect roles. An important first step is to examine the actors' and populations' perceptions of these services. This identification phase plays a major part in the acknowledgment of these services and the design of public policies. According to Balmford et al. (2002), this phase is essential for an understanding of all the reasons underlying the interest to conserve ecosystems. It can also help to identify the territorially-adapted management measures that may be required to strengthen these services or to ensure that they are acknowledged. The most representative example is the installation of information panels to promote the cultural service of raising environmental awareness or of nature discovery.

* Corresponding author at: CIRAD, UMR Innovation, TA C-85/15, 73 Rue Jean-François Breton, 34398 Montpellier Cedex 5, France.
E-mail addresses: blayac@lameta.univ-montp1.fr (T. Blayac), syndhia.mathe@cirad.fr (S. Mathé), helene.rey-valette@univ-montp1.fr (H. Rey-Valette), p.fontaine@univ-lorraine.fr (P. Fontaine).

http://dx.doi.org/10.1016/j.ecolecon.2014.10.007
0921-8009/

This is one of the major services provided by pond fish farming. However, the identification of perceptions has been the subject of relatively little research compared with the numerous approaches dealing with the valuation of these services or the methods of payment in support of, or in compensation for, them (Costanza et al., 1997; Beaumont et al., 2007; TEEB, 2010; De Groot et al., 2012).

This paper aims to characterize the perceptions of ecosystem services in the case of pond fish farming in Lorraine using surveys carried out in the "Saulnois" area (in the southern part of the Moselle department). Lorraine is one the largest pond fish farming regions in France, based on extensive polyculture with very few added inputs, unlike intensive pond culture relying on feed inputs. The data come from surveys of all the stakeholders involved in pond fish farming: fish farmers, industry operators (including non-farmer owners), institutions, service users and resident populations living near the ponds. As recommended by many research studies (Hein et al., 2006; Cocklin et al., 2007; Quétier et al., 2009; Zhang and Lu, 2010), the aim was to take account of the diversity of viewpoints by type of actor in order to identify all the issues related to these services. Having reviewed in the first part the pond fish farming context in Lorraine and the types of service that it provides, the paper then presents the survey protocols and statistical analyses used. The third and fourth parts present the results concerning the typology of perceptions and their determining factors. Finally, parts 5 and 6 discuss these results.

2. Context: Pond Fish Farming in Lorraine and the Services it Provides

Pond fish farming in Lorraine dates back to the Middle Ages. Many ponds were built as early as the 10th century at the instigation of the monasteries (Bernard, 2008). These were barrage ponds generally fed by surface water runoff and small streams. Their primary function was to supply fish on Good Friday. Over time, numerous activities developed: mills, navigation, timber floating, plant production and feed for livestock (Billard, 2010). From the 16th century these environments were blamed for causing insalubrity. This problem, together with the expansion of agriculture, led to a progressive drainage of ponds in particular in the 19th century (Billard, 2010). Nowadays, with 854 tonnes of fish and 7000 ha of water bodies, Lorraine ranks third among the French regions in terms of pond fish production (7% of the national total). There are 350 owner-operators but only 10 trader-wholesalers in the economic value chain (Fontaine and Banas, 2012). Production is evolving towards the supply of juvenile fish for restocking and recreational activities (fishing trips).

There is some research relating to the ecosystem services provided by aquaculture (Arthington et al., 2010; Engelhardt and Ritchie, 2001; Maes et al., 2009; Thiere et al., 2009; Tundisi et al., 2008; Wilson and Carpenter, 1999). However, to date, no reference list specific to aquaculture is available (Mathé et al., submitted for publication). On the other hand, the services provided by pond fish farming are partly included in the abundant literature on wetlands. Pond fish farming promotes wetland conservation by preventing the landscape closure that is often associated with ponds reserved for hunting. We therefore adapted the MEA list (2005) to the case of pond fish farming in Lorraine. This list was developed by the multidisciplinary group of partner researchers in the PISCEnLIT project drawing on the literature and their personal knowledge (Rey-Valette et al., submitted for publication). The objective was to identify a demand or an effective use for each of the MEA services (2005) given that the existence of an ecosystem service depends on the existence of such a demand or use (direct or indirect) or on the recognition of its value. The contribution to social welfare depends on this demand or use. As a result the range of uses and values and hence of ecosystem services depends on the context (Leroux et al., 2008; Boyd and Banzhaf, 2007). Table 1 presents this list of services in the Lorraine case.

Table 1
Ecosystem services relating to pond fish farming in Lorraine.

Provisioning services
Fish production (carp, common perch, pike-perch, pike and juveniles for restocking)
Fresh water reservoir for irrigation purposes
Fiber production
Medical and veterinary resources
Fertilizer supply for agriculture
Regulating services
Local climate regulation
Water regulation (**groundwater replenishment and water storage**)
Human and animal disease regulation
Pollution retention and depollution
Protection against fires/storms/floods
Cultural services
In connection with religion, local culture, traditions
Source of inspiration for artists and sentimental value
Know-how acquisition
Raising awareness of the environment
Hunting and fishing
Tourism and ecotourism
Leisure
Landscape and attractiveness
Supporting services
Plankton production (phytoplankton and zooplankton)
Sanctuary and nesting zones for migratory birds
Spawning and reproduction grounds for aquatic animals and plants
Biodiversity conservation
Participation in natural nutrient cycles (nitrogen, carbon, phosphorus…)
Soil formation and maintenance
Wetland conservation

In bold are the services from the reduced list for surveys of the population and users, cf. *infra*.

3. Materials and Method

3.1. Questionnaire Design and Survey Protocols

Four surveys were undertaken in order to include all the relevant populations. Questionnaires and survey methods were adapted to the population concerned. The questions relating to the perception of services constituted a core module in all questionnaires. The other modules were specific to the type of population. In the case of fish farmers, the aim was to address the structural and functional characteristics of farms, the innovative factors, the conflicts, the professional networks and the biodiversity status around and near the ponds while in the case of economic and institutional stakeholders,[1] the focus was on their involvement in aquaculture development. The questionnaires for users and local populations were much shorter, the main aim being to characterize the nature and intensity of their uses.

Table 2 summarizes the characteristics of the sampling protocols and how questionnaires were completed. In all, 668 people were interviewed.

Special attention was paid to the formulation of the questions on perceptions of ecosystem services. Having reviewed the literature (Kaplowitz, 2000; Kaplowitz and Hoehn, 2001; Kumar and Kumar, 2008; Quétier et al., 2009), we selected, as recommended, two series of questions: open and spontaneous questions on perceptions of the activity and of the ponds and closed questions to weight the importance of certain services in the proposed list (Table 1) [2] The complete list of

[1] (1)Decentralized State services (22%), (2) local authorities (22%), (3) associations/consultancy firms/chambers of commerce, industry and agriculture (38%), (4) regulatory agencies (9%) and (5) upstream and downstream value chains (9%).

[2] So as not to influence spontaneous perceptions, the closed questions came after the open questions which were asked at the start of the questionnaire in order to avoid suggestivity. In accordance with the literature (Kaplowitz and Hoehn, 2001), a comparison of the range of services identified by a question type showed that using a list to rank these services allowed for a larger set to be taken into account, especially supporting and regulating services with a wider territorial dimension.