Italian Journal of Animal Science

ISSN: (Print) 1828-051X (Online) Journal homepage: https://www.tandfonline.com/loi/tjas20

The use of alternative energies in hatcheries: an application of Life Cycle Analysis

G. Centoducati, R. Roma, A. De Boni, N. Iaffaldano & G. De Blasi

To cite this article: G. Centoducati, R. Roma, A. De Boni, N. Iaffaldano & G. De Blasi (2005) The use of alternative energies in hatcheries: an application of Life Cycle Analysis, Italian Journal of Animal Science, 4:sup2, 580-582, DOI: 10.4081/ijas.2005.2s.580

To link to this article: https://doi.org/10.4081/ijas.2005.2s.580

Published online: 03 Mar 2016.

The use of alternative energies in hatcheries: an application of Life Cycle Analysis

G. Centoducati[1], R. Roma[2], A. De Boni[2], N. Iaffaldano[3], G. De Blasi[2]

[1] Dipartimento Sanità e Benessere degli Animali, Università di Bari, Italy

[2] Dipartimento Studio delle Società Mediterranee, Università di Bari, Italy

[3] Dipartimento Scienze Animali Vegetali e dell'Ambiente, Università del Molise, Italy

Correspondig author: Gerardo Centoducati. Dipartimento Sanità e Benessere degli Animali. S.P. per Casamassima km. 3, 70010 Valenzano, Italy – Tel: +39 080 5443919 – Fax: +39 080 5443925 – Email: g.centoducati@veterinaria.uniba.it

RIASSUNTO – Uso di energie alternative nelle avannotterie: applicazione del Life Cycle Analysis. *Scopo principale del lavoro è stato quello di valutare, attraverso l'applicazione dell'analisi del ciclo di vita del prodotto (LCA), l'impatto ambientale provocato dalla produzione di avannotti di spigola in allevamenti intensivi. Identificate le categorie di impatto più significative ed i relativi processi coinvolti, si è evidenziata la necessità di individuare fonti energetiche, alternative alla convenzionale, da utilizzare per soddisfare gli elevati fabbisogni di questo tipo di attività. Sono state confrontate, dal punto di vista ambientale, le avannotterie alimentate con impianti elettrici convenzionali, ad ipotetiche avannotterie che utilizzano impani fotovoltaici e eolici. Questi ultimi sono risultati i meno impattanti.*

Key words: LCA, fry production, environmental impact.

INTRODUCTION – Fish production requires great efforts and energies and causes different impacts/effects on the ecosystems. The development of aquaculture is possible, in the medium and long term, only if this is done responsibly, and if the production is reached from both an economic and environmental point of view. In our study we have worked on fry production using 1.5 g sized *Dicentrarchus labrax* obtained rearing larvae for 120 days after the hatching of the eggs.

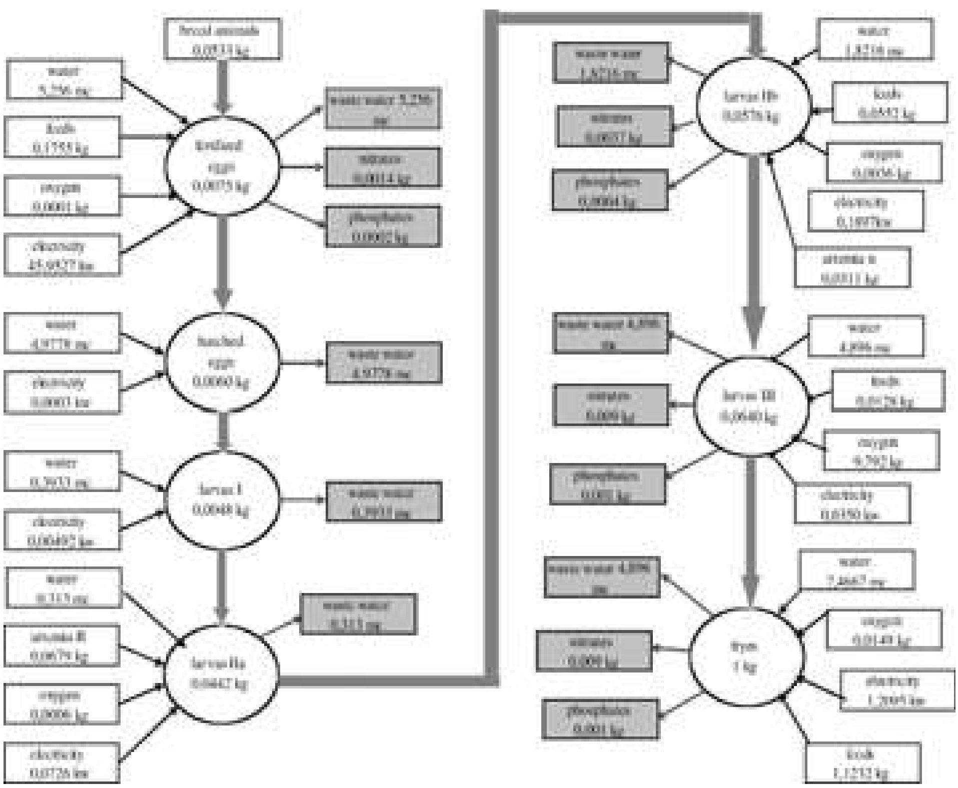
Reproduction is strongly influenced by photoperiod and temperature. In nature sea basses emit gametes in winter period. In industrial scale fry production, it is absolutely necessary to obtain fertilized eggs all through the year. In order to achieve this process, a great amount of energy is required to condition the physical characteristics of water in every season. Life Cycle Analysis (LCA) has been used to quantify the environmental impact of this kind of production.

Among the tools proposed by EMAS and ISO for eco-labels and environmental certification, LCA is one of the most reliable software. It gives the opportunity to measure the environmental impacts on one entire productive cycle – on a systematic base – from the use of energy and materials, to the consumption and management of waste.

We can classify LCA in different phases: - evaluation of objectives and limits; - Life Cycle inventory; - Life Cycle assessment; - Life Cycle interpretation.

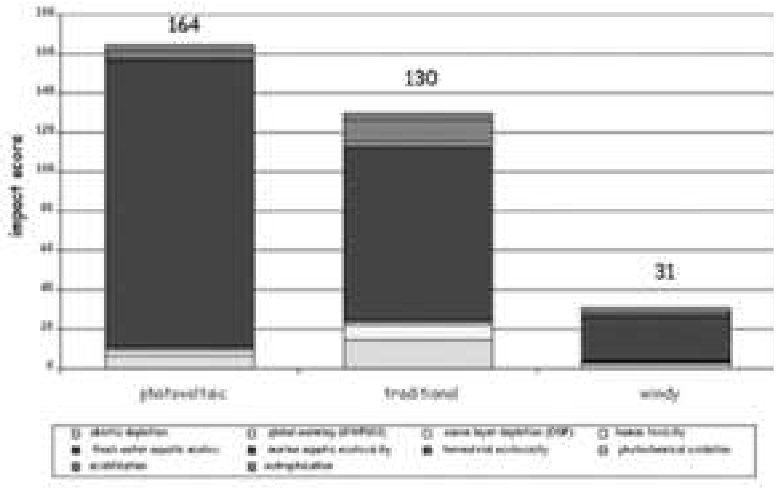
MATERIALS AND METHODS – The research has been carried out in 3 different Apulian fish farms specialized in production and sales of seabream and sea bass fry. In each farm we have listed the techniques and machineries used during one year (March 2003 – February 2004). In the same period, at least two times per week, temperature of emaciated seawater was recorded in order to calculate the energy needed to warm or to cold rearing water. Two times per month, in every fish farming area, all input/output data were calculated by means of excel sheets and scheduled as following described. Input: water, feed, oxygen, electricity, gas oil, Artemia, and animals in different life phases; Output: waste water, nitrates, phosphates, loss of animals and animals in different life phases.

At the end of trial period, data were processed through the LCA to define both the material and energy bal-



ance for producing one kg of 120 days old fry. Software in use (LCA) permits us to define the environmental impact split in the following different category of impact: abiotic depletion, fresh water and marin aquatic eco-toxicity, acidification, global warming, eutrophication, ozone layer depletion, terrestrial ecotoxicity, human toxicity, and photochemical oxidation.
LCA could be used in two different ways depending by the aims: "improving" (evaluating environmental performances may put in evidence critical process points to correct) or "comparing" (different production ways for best practice chooses). In this study LCA has been used in a comparative way, to evaluate how different sources of energies may result in different environmental impacts. The sources of energies evaluated in our research are electricity, that has been really used, photovoltaic and eolic energies that have been assumed.

RESULTS AND CONCLUSIONS – In our research we have focused on the production of sea bass fry,



we have analysed the environmental effects of this production, identified the different impacts and its critical points. Figure 1 shows the flow-chart of fry production and the material and energy I/O system.

Figure 1. Flow-chart of fry production and material and energy I/O system.

The results achieved have been compared with those obtained by postulating alternative sources of energies, since the energy consumption is the most relevant factor of environmental impact in this kind of production.
As shown in Figure 2, the use of photovoltaic energy produces the biggest impact on the environment. This great impact is specifically due to a relevant marine aquatic ecotoxicity, which is caused by the production and the casting off of solar panels. The silicon used to build the panels lasts for 10 years only and therefore, if we consider the total impact in a medium and long term, this is crucial for the environment. The data we have referred to are those of the photovoltaic systems most commonly used.
Eolic energy represents the source of energy most eco-friendly, but might become a problem for its electromagnetic and aesthetic impact, that LCA used is not able to measure.

Figure 2. Total impact of photovoltaic, traditional and windy energy systems.

ACKNOWLEDGMENTS – The authors wish thank Dr. Fabrizio Basile, Sig. Francesco Santamaria, Dr. Michele Moscato, Dr. Massimo Caggiano, Dr. Licinio Corbari, Dr. Andrea Novelli.