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Green growth in fisheries ☆

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ABSTRACT

Climate change and economic growth have gained a substantial amount of attention over the last decade. Hence, in order to unite the two fields of interest, the concept of green growth has evolved. The concept of green growth focuses on how to achieve growth in environment-dependent sectors, without harming the environment. Fishery is an environment-dependent sector and it has been argued that there is no potential for green growth in the sector owing to global overexploitation, leaving no scope for production growth. The purpose of this paper is to explain what green growth is and to develop a conceptual framework. Furthermore, the aim is to show that a large green growth potential actually exists in fisheries and to show how this potential can be achieved. The potential green growth appears as value-added instead of production growth. The potential can be achieved by reducing overcapacity, investing in the rebuilding of fish stocks and a coordinated regulation of marine activities that interact with fisheries. Incentive-based regulation of fisheries that counterbalances services of the ecosystems is an important instrument to achieve green growth.

1. Introduction

"Green growth" is often perceived as shifting the sources of energy production from fossil fuel, such as oil and coal, to renewable energy, such as wind and solar power. As a consequence, an increase in public funding, private investment and use of labour in the renewable energy sector is regarded as "green growth". In line with this perception, international policymakers have in recent years focused on promoting selected green investment as a mean for addressing climate change [1,2].

However, such policy may not necessarily be the most efficient option. The reason is that it might be possible to reach the same environmental goals more efficiently (cheaper) using the production factors, capital and labour, in other sectors. Increased investment and use of labour in sectors perceived *as* "green" can induce growth in these sectors, but if this is not the most efficient way of reaching an environmental goal, a loss to society emerges due to an inefficient allocation of production factors. An increase in employment or investment in sectors which are perceived as "green" might fulfil a political purpose, but it also represents a cost, implying that more "green" employment or investment is not always desirable. From an economic point of view, an industry as such cannot be defined as "green", however, an environmental goal of reducing the impact of an industry can be "green". Using production factors most efficiently is in the best interest of society, because an efficient use of the resources will give society the opportunity to maximize total welfare. Key concepts like efficiency, growth, optimality and sustainability are defined in Appendix A.

The purpose of this paper is to explain what green growth is from an economic perspective. Furthermore, the purpose is to introduce a conceptual framework for achieving growth through improved regulation in one environment-dependent sector, the fishery, whilst meeting the requirements for sustainability (being green). Green growth is defined and discussed on the basis of different approaches to both growth and sustainability. In the current paper, green growth in fisheries is understood as the additional and sustainable growth in welfare generated by improved regulation that increases the value added from fisheries and the value of environmental goods and services of the marine areas related to fishery activities. The aim is to achieve maximum green growth in the long run, i.e. corresponding to environmental purposes being obtained in the cheapest and most efficient way for society. Employment is not considered. If considerations about keeping employment at a certain level are included, then the potential green growth is reduced. A focus on the long run is used to identify the green growth potential after full adjustment of implemented policy changes. The adjustment path is therefore ignored. In a practical policy setting, a purpose of achieving maximum green growth needs to be counterbalanced against other policy purposes.

The question is how improved regulation of ecosystem services[1] and externalities[2] can contribute to green growth in an industry

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[1] An ecosystem service is a benefit to humankind through resources and processes supplied by the existence of ecosystems. Food in the form of fish is one example, clean drinking water is another [3].

[2] A negative externality exists when the activity of a firm affects the welfare of other firms or agents negatively without compensation being paid.

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which interacts with the environment. In the current paper; "the answer to this question is through simultaneous regulation of all ecosystem services using – as far as possible – incentive-based regulatory systems such as user fees, taxes and individual transferable quotas". The new contribution of this paper is that it combines several issues into a coherent framework which have previously been handled separately.

The issue of green growth is high on the international agenda focusing on decoupling economic growth from environmental and natural resource degradation. The Organization of Economic Cooperation and Development (OECD) has a green growth strategy which emphasises the use of market instruments to correct market failures as a key element of effective policy design [4]. This includes proper "pricing" of natural resources, including fish stocks, where both private costs and costs of externalities are taken into account. Pricing can take place directly through taxes or user fees for the exploitation of natural resources, but also through individual transferable quotas where pricing takes the form of purchasing quotas. The instruments lead to socio-economic optimal behaviour, provided that transaction costs are small [5]. However, if transaction costs are large, the costs of regulatory changes can affect the efficiency of different instruments. Instruments based on cooperative behaviour, community-based management, working through social norms and sanctions might then induce lower transaction costs [6]. Hence, the inclusion of transaction costs is needed when evaluating socio-economic optimality of different regulatory instruments. Improved use of these types of regulations might, although dependent on the situation, induce green growth. Therefore, a conceptual framework for addressing market failures in marine ecosystems with proper regulation is needed. In the current paper, the focus is on market-based instruments.

In most fisheries, production growth is unlikely in the short run, since most fish stocks are already fully exploited or overexploited. This situation implies that the potential production growth in fisheries is limited, which leads to the impression that the potential green growth is largely non-existent. However, this view overlooks that overcapacity exists, providing room for cost reductions and thereby green growth. Furthermore, because many stocks are overexploited, investment in the rebuilding of fish stocks can induce green growth in the long run. Finally, a coherent regulation to handle externalities in ecosystems, and in the broader marine environment, is also a source of green growth. One example is the optimal coordinated regulation of discharges from land-based activities, which could prevent biological degradation in coastal zones, thereby being beneficial to fisheries [7,8]. Another example is the optimal coordinated regulation of bottom-trawling, which would take the damage to the sea floor into account or regulate the access to marine areas [9]. The opinion of a largely non-existent green growth potential in fisheries, owing to the bad state of global fish stocks, makes the development of a coherent framework even more important.

The paper proceeds as follows. In Section 2, a conceptual framework for understanding green growth is introduced and assessed. In Section 3, it is analysed how to achieve green growth in fisheries starting with a single species context and extending it to a multi-species and marine food web setting. Section 4 concludes the paper.

2. The conceptual framework of green growth

Economic growth is defined as an increase in production value over time, and it is often measured as an increase in per capita gross domestic product (GDP). Economic output expressed as GDP is created by input factors consisting of labour and capital as well as by technological progress. Growth in particular sectors might be expressed as the growth of total value in production, but the growth in value added by the sector is a more appropriate measure of the contribution of welfare from the sector in question.

According to traditional exogenous growth theory, growth depends on the saving rate and productivity of capital [10,11]. Solow [12] and Swan [13] further find that growth depend on exogenous technological progress. More recently, the exogeneity of technological progress has been criticised [14–16]. Technological progress, it is argued, can be affected and is determined endogenous by human capital, innovation and knowledge, which again can be affected by research and development investments. Hence, growth is endogenous, not exogenous.

The use of GDP as an indicator of development and improved living conditions has been criticised for not providing a full picture of the progress of human welfare. This is because GDP ignores the negative impacts on the environment and disregards sustainability aspects [17]. Therefore, a closer look at the sustainability concept and its relationship with green growth is required.

The concept of sustainability has been broadly used over the past decades, however a single definition has never been agreed upon. Sustainability is concerned with intergenerational equity and it captures the trade-offs between economic growth and the environment. A widely used description of sustainable development was proposed by the World Commission on Environment and Development from 1987 [18], "The Brundtland Report", which states that: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The aim is to ensure non-declining human welfare over time. This definition of sustainable development is relatively vague, and different paradigms of sustainability have emerged over the last two decades in order to operationalize the concept. The different interpretations of sustainability can, in general terms, be categorised into three types: The capital approach, the ecological approach, and the three-pillar approach [19].

The capital approach to sustainability has its origin in neoclassical economics and incorporates concepts from the physical sciences, e.g. ecology and geography. In contrast to the three-pillar approach described below, the capital approach focuses on intergenerational equity whereas contemporaneous equity is reserved for political decisions. The approach has however generated several different definitions of sustainable development that can be divided into the concepts of *weak* and *strong* sustainability [19–22]. Both weak and strong sustainability can be described as non-falsifiable as they rely on assumptions and claims about the future [22]. Therefore, the preference for one or the other rests on ethical considerations, the perception of risks and uncertainty or on assumptions regarding the possibilities of substitution between different types of capital as explained in the following.

Weak sustainability is achieved if the wealth of society, expressed as the total amount of capital per capita at constant prices, is maintained or increases. The total capital consists of man-made, human and natural capital[3]. Natural resource stocks, land and ecosystems are considered capital assets, hence the term natural capital. The natural capital is calculated as the discounted flow of net benefits (market and non-market) originating from these resources. With respect to fisheries this means the discounted flow of resource rents [24]. The underlying logic is that if the total stock of capital per capita is maintained, non-declining welfare over time can be obtained. An appropriate indicator of weak sustainability is the concept of genuine savings, which must be non-negative [17,21]. The underlying assumption of weak sustainability is that substitutability between different forms of capital or different kinds of welfare exists, so that a declining stock

[3] The types of capital are sometimes specified even further into; financial, produced, natural, human, social and health capital [23].