Journal of Marine Science: Research & Development
ISSN: 2155-9910

Case Report Open Access

Reef's Ability to Provide Ecosystem Services Lead to Suboptimal Allocations

Tim Stebin*

Department of Marine Science and Oceanography, University of Essex, United Kingdom

Abstract

To be more specific, estimates of total value are generally only of use if seeking to describe the current state of affairs e.g. that tourism is a more significant generator of incomes in the Great Barrier Reef catchment than is fishing or if seeking to address management/policy questions, such as What losses would the region suffer if the entire reef ceased to exist? We now have a reasonably good understanding of the relative contribution of different industries to the catchment's economy, and in most cases, managers are not faced with such all or nothing choices. So methodological approaches that generate estimates of total value may be somewhat less relevant than they were when Great Barrier Reef valuation research was in an embryonic stage. Instead, managers/policy makers are, nowadays, more likely to need answers to questions, such as what losses would the region suffer if reductions in water quality reduced the reef's ability to provide certain ecosystem services? Or would a relocation of resources from one sector to another improve overall welfare? Importantly, for questions like these, it is marginal, not total values that one needs. Specifically, one needs information about the value of changes.

Keywords: Total value; Tourism; Fishing; Management; Policy questions; Economic contribution; Methodological approaches; Ecosystem services; Water quality

Introduction

As highlighted in the State of knowledge sub-section, most Great Barrier Reef studies that have sought to estimate the value, or financial impact, of changes, has focused on changes in water quality and impact on the tourism sector i.e. recreational aspects of cultural services. But there is relatively little information available on the likely impact of other non-water quality changes to other non-recreation services. There is a clear need for research of this type, but given the vast array of potential changes that could affect any number of ecosystem services, it will be important to develop some mechanism for prioritizing the changes to be investigated. The Outlook Report has recently highlighted cli-mate change, water quality, and loss of coastal habitats as the main threats to the reef. A better understanding of changes to ecosystem services as a result of these drivers is critical, and such research is increasingly taking place. It will be important to extend investigations to cover all ecosystem services and not just focus on the recreational and provisioning services. Third, it is clear that we do not just need information about total or marginal values, but we also need information about the social, temporal, and spatial distribution of those values. The substantive body of Input-Output work done by groups, such as Access Economics has given us a reasonably good base of information about the way in which the financial benefits of the fishing and tourism sectors are distributed throughout other industries within the Great Barrier Reef. Nonetheless, more detail about the relative importance of those values to different stakeholder group's e.g. different types of households, or individuals and the distribution of impacts within smaller regions, would be useful. One way of attempting to identify and compare the relative importance of absolute levels or changes in different ecosystem services to different individuals or stakeholder groups is via formal valuation work. However, willingness to pay the basis of most valuation work is, necessarily, a function of ability to pay. Consequently, monetary valuation methods produce estimates that are essentially weighted average, the weights that are used are a function of income, so that the priorities or values of the wealthy are given more voice than the priorities of the poor. Other nonmonetary methods are available, but only a few have been trialled in the Great Barrier Reef catchment area [1-5].

Discussion

More work on these approaches in this region would be welcome particularly given the vast disparities in incomes between, for example, indigenous and nonindigenous householders. Moreover, without information about the social, spatial, or temporal distribution of values, it will be difficult to determine who or what is likely to win or lose from different policies and/or incentive mechanisms. As such, it will be difficult to design appropriate policy. This issue is particularly important in the context of the rising popularity of payments for environmental services, one needs accurate information about the distribution of costs and benefits associated with environmental services if one is going to design equitable, and efficient, payment systems. Information on the temporal and spatial distribution of ecosystem services would also be beneficial when revisiting the Great Barrier Reef Zoning Plan. This would allow for a design that would try to optimally configure the zones on the basis of a variety of ecosystem services. Finally, the discussion of the flow of ecosystem services between adjacent ecosystems section highlighted the importance of taking a broader systems view when considering the value of ecosystem services. Just as the reef provides ecosystem services to humans and to other ecosystems that adjoin the Great Barrier Reef, so too does the reef receive a variety of services from adjoining systems. It was not the intention of this article to provide a comprehensive review of literature relating to the ecosystem services of these adjacent ecosystems. However, it is clear that the regionally relevant literature lacks information on the value of ecosystem services that are provided from systems adjacent to the Great Barrier Reef. Subsequent terrestrial investigations may therefore wish to extend

***Corresponding author:** Tim Stebin, Department of Marine Science and Oceanography, University of Essex, United Kingdom, E-mail: timstebin@cardiff.ac.uk

Received: 01-Jan-2024, Manuscript No: jmsrd-23-122256; **Editor assigned:** 03-Jan-2024, Pre-QC No: jmsrd-23-122256 (PQ); **Reviewed:** 17-Jan-2024, QC No: jmsrd-23-122256; **Revised:** 24-Jan-2024, Manuscript No: jmsrd-23-122256 (R); **Published:** 31-Jan-2024, DOI: 10.4172/2155-9910.1000433

Citation: Stebin T (2024) Reef's Ability to Provide Ecosystem Services Lead to Suboptimal Allocations. J Marine Sci Res Dev 14: 433.

this important avenue of investigation, since failure to acknowledge the external benefits of the services that these terrestrial ecosystems provide, serves to undervalue their status within a larger system, and may, in turn, lead to suboptimal allocations of such land uses. That it is important to take such steps is clearly emphasized in the Great Barrier Reef Marine Park Authority's Outlook Report, which notes that the effectiveness of management is challenged because complex factors that have their origin beyond the Great Barrier Reef region, namely climate change, catchment runoff, and coastal development, cause some of the highest risks to the ecosystem. If it were possible to explicitly incorporate assessments of the value of changes to ecosystem services delivered to the Great Barrier Reef by adjoining ecosystems into a decision support framework and if one were able to clearly identify winners and losers from activities and actions that seek to improve the flow and status of ecosystem services as per Pagiola examples in a rainforest setting, then it would be possible to align economic incentives with conservation objectives. In other words, one would be able to design systems that capitalize on, rather than fight against, economic incentives, thus increasing the chance of affecting positive change. That it is essential to progress beyond the realm of simply estimating the total value of individual ecosystem services and onto the process of assessing the impacts of potential changes to ecosystem services so that it is possible to alter incentives, is clearly argued by Heal. That it is possible to design systems that are capable of affecting such changes across a broad range of ecosystem services spanning multiple ecosystems is illustrated by the Costa Rican system outlined in Turner and Daly. It must, however, be noted that effective management across marine and terrestrial systems requires institutional structures that are able to manage these multiple, linked ecosystems. Studies that help draw attention to the value of individual ecosystem services, to the value of entire ecosystems, or to the value of cooperative trans-system goals are but one part of the story. It is not possible to capitalize on the opportunities that such studies identify, if the institutions that govern our behaviours are unable to respond accordingly, for example, by altering incentives so as change behaviours. As such, more research on alternative institutional structures and on the costs of building up the supporting infrastructure for such institutions could be of significant benefit to this vitally important world heritage area. As highlighted in the value of the Great Barrier Reef's ecosystem services section, a substantive body of literature supports the argument that the ability of the Great Barrier Reef to provide a range of ecosystem services is being eroded. We identify, and briefly discuss, some of the research underpinning four key supporting services, one of the major features of the coastal zone is that part of its sea floor receives a significant amount of sunlight and can therefore sustain benthic primary production by sea grasses, macro algae, micro-phyto-benthos, and corals. The degree to which this primary production can occur is dependent on the amount of light penetration. Numerous studies have been involved in calculating this primary production. For example, Chisholm quantified the primary production of four species of crustose coralline algae and therefore their contribution to the organic production of reefs on the Great Barrier Reef, and Johnson calculated the effect of replacement of coral by algae on the carbon flux. Herbivore, predation, and competition are key processes responsible for maintaining coral reef ecosystem function, structure, and resilience. Much of the research leading this field comes out of the Great Barrier Reef. Carbon and nitrogen sediment storage and microbial activity has been investigated in the northern Great Barrier Reef. The role of structural complexity in providing community structure, in maintaining diversity, and in maintaining a productive fishery is gaining recognition. Mangroves and the connection between them and the rest of the coral reef system are important nursery and feeding areas for fish. Their rich invertebrate faunas render them productive feeding areas, while their shallow waters and structural complexity provide sanctuary habitats at a variety of scales. While coastal protection is often categorized as a regulating service providing protection from storms to our coastal farms and properties, it is also a supporting service in that it provides protection to coastal mangrove and sea grass ecosystems allowing them to provide us with continued provisioning services [6-10].

Conclusion

These aspects of an ecosystem ensure the continued provision of nutrient cycling, habitat provision, and coastal protection, and are in turn maintained by those same services i.e. a healthy system provides services and the maintenance of services ensures a healthy system. Coral disease is coming to the fore as a serious problem on the Great Barrier Reef, and has been shown to be correlated with warm temperature anomalies. The natural bacterial communities of corals are severely altered during stress, which suggests a potential mechanism for the link between diseases and stresses arising from global warming. A key question in understanding population dynamics and hence whether and how populations will be replenished is how far the larvae of marine organisms disperse. Considerable progress has been made within the Great Barrier Reef in understanding the role of connectivity in terms of self-vs. Long distance recruitment. Resilience refers to the ability of a system to endure a disturbance and retain its previous state; essentially it provides insurance against ecological uncertainty. Empirical indicators of the cornerstones of coral reef resilience have been put forward. These indicators include functional group approaches, diversity, and trophic composition, which, while it may not be possible to measure or predict resilience, these process orientated metrics capture ecosystem dynamics improving marine stewardship.

Acknowledgment

None

Conflict of Interest

None

References

1. Glencross DA, Ho TR, Camina N, Hawrylowicz CM, Pfeffer PE (2020) Air pollution and its effects on the immune system. Free Radic Biol Med 151:56-68.
2. Guo Q, Lee DC (2022) The ecology of COVID-19 and related environmental and sustainability issue. Ambio 51:1014-1021.
3. Hinchliffe S, Manderson L, Moore M (2021) Planetary healthy publics after COVID-19. Lancet Planet Health5:e230-e236.
4. Luke M, Somani P, Cotterman T, Suri D, Lee SJ (2021) No COVID-19 climate silver lining in the US power sector. Nat. Commun12:4675.
5. Lurie N, Keusch GT, Dzau V (2021) Urgent lessons from COVID-19: why the world needs a standing, coordinated system and sustainable financing for global research and development. Lancet397:1229-1236.
6. Robbins SJ, Song W, Engelberts JP, Slaby BM, Boyd J, et al. (2021) A genomic view of the microbiome of coral reef demosponges. ISME J 15: 1641-1654.
7. Samuel RB, James AF, Brian CM, Peter CW (2019) Reef fish functional traits evolve fastest at trophic extremes. Nat Ecol Evol 3: 191-199.
8. Mardi MN, Jennifer F, Luke DN, Alan PR, Jody MW, et al. (2021) Inter-reef Halimeda algal habitats within the Great Barrier Reef support a distinct biotic community and high biodiversity. Nat Ecol Evol 5: 647-655.
9. Benjamin MM, Kosmas H, Robin SW, Hoppner MP, Carole CB, et al. (2019) The evolution of microendemism in a reef fish (Hypoplectrus maya). Mol Ecol 28: 2872-2885.
10. Madeleine HO, Bongaerts, Pedro F, Lesa MP, Sarah EB, et al. (2018) Adaptation to reef habitats through selection on the coral animal and its associated microbiome. Mol Ecol 27: 2956-2971.