Marine Protected Areas

ECONOMICS, MANAGEMENT AND EFFECTIVE POLICY MIXES

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Chapter 2.

The benefits and costs of marine protected areas

This chapter highlights the need to better understand the benefits and costs associated with marine protected areas (MPAs). It then provides a review of the valuation literature on marine protected areas, drawing on studies from around the world. It concludes with a brief overview on how cost-benefit analysis can be used to inform MPA decision making.

The benefits and costs of marine protected areas

Prior to making a decision on whether or not to create a particular marine protected area (MPA), it is important to have an understanding of the estimated benefits of the particular ecosystem, the effect of the spatial protection measure on the delivery of ecosystem benefits and other related socio-economic benefits, as well as the estimated costs of establishing and maintaining the MPA. This information allows decision makers to evaluate the net economic benefits to society from investing in an MPA. It can also provide insights on how these values are distributed, i.e. over time, at different levels of scale and between different user groups, which is important for understanding the distributional implications of MPAs, and thus how they can best be managed. Finally, understanding the costs associated with MPAs enables planners to budget and to help secure adequate finance for the effective long-term management of MPAs (see Chapter 4).

MPAs can provide a wide variety of benefits, ranging from the conservation of whole areas that harbour important biodiversity, serving as nursery grounds for fisheries, protecting habitats that buffer the impacts of storms and waves, as well as removing excess nutrients and pollutants from the water, and providing more sustainable tourism and recreational benefits, among others. These benefits fall under the various components of the total economic value (TEV), which is the sum of all the use values (direct, indirect and option) and non-use values for a good or service (Box 2.1). The direct use values can include market values of traded goods and services as well as non-market use values (e.g. recreational values), which may be captured by users' willingness to pay.

Box 2.1. The total economic value of marine protected areas

- Direct use values: raw materials, services and products that can be consumed, traded or enjoyed on site, e.g. fish, building materials.
- Indirect use values: maintenance of natural and human systems through, for example, coastal protection, storm control and for provision of habitat for economically important species caught off-site.
- Option values: the value of maintaining the area to allow for potential, but currently unknown, future uses, e.g. tourism, pharmaceutical uses, industrial activities.
- Non-use values: the intrinsic value of the area accruing to people who may not use the site, based on existence, bequest and altruistic motives, and sometimes including components of social, such as cultural, scientific and heritage, values.

The costs associated with MPAs can be divided into three categories, namely direct (resource) costs, other indirect (resource) costs and opportunity costs.

Direct costs cover both establishment and operational costs, where establishment costs include capital outlays – for example boats, offices, site delineation, planning activities, licence buybacks, land purchases and gazetting; operational costs include administration, supplies, maintenance, fuel, training and employment, monitoring, and enforcement (Ban et al., 2011; Butardo-Toribio, Alino and Guiang, 2009). Recurrent capital costs (e.g. purchases of vessels and replacements) may also be considered ongoing annual operational costs (Ban et al., 2011). A clear distinction is often difficult, as some establishment activities may continue into the operational phase, and vice versa (Butardo-Toribio, Alino and Guiang, 2009).

Other indirect costs refer to costs that are not directly related to the MPA design and management but that may arise as a result. These can include, for example, possible congestion costs to fishers if they are displaced to other areas and alternative livelihood training and vocational programmes. Concerns held by these affected groups may also increase social resistance or create other conflicts (Emerton, 2003; Butardo-Toribio, Alino and Guiang, 2009), and thus increase direct costs by requiring more outreach to build support, legal actions or responses, increased enforcement to counter illegal fishing, and so forth. The impacts of increased numbers of visitors, infrastructure developments or populations of certain species may also cause indirect costs (WWF, 2005).

Opportunity costs refer to the value of the next-best alternative that must be foregone, such as foregone commercial fishing income, or foregone tourism or recreation revenues from activities such as charter diving or fishing (CFA, 2003; Cook and Heinen, 2005; Emerton, 2003), or other foregone (non-market) benefits that are not realisable if the MPA is established. In general, it is difficult to estimate these costs, due in part to difficulties in establishing the counterfactual. It has been suggested that opportunity costs to industry, e.g. fishing losses, rerouting of shipping lanes, or mine closures, can constitute the largest proportion of MPA costs (Ban and Klein, 2009; Gravestock, Roberts and Bailey, 2008). However, in several cases they have found to be negligible (see below). Table 2.1 summarises the major benefits and costs.

Benefits of marine protected areas

A number of valuation studies have been undertaken to estimate the benefits of MPAs.[1] Table 2.2 highlights the objective of the studies and illustrates the types of services, the values and the methods used across several MPA valuation studies. Very few, if at all any, studies conduct comprehensive estimation of the change in total economic value as a result

of an MPA but rather estimate components thereof. Estimating components of the TEV of MPAs, ideally those that are presumed to be the largest, can often be sufficient to make the case for an MPA, when compared with the estimated costs associated with them.

Table 2.1. **Major benefits and costs of marine protected areas**

Benefits	Costs
Biodiversity conservation: marine protected areas (MPAs) can lead to the: – recovery of exploited species in reserves – increased species diversity and improvements in habitat. These changes are expected to lead to greater resilience of populations to environmental perturbations, reducing the likelihood of local extinctions.	Direct costs, including costs of: – establishment – administration – employment – monitoring and enforcement.
Regulating services: protection of habitats such as reefs provides protection against storms and coastal erosion, and increases assimilative capacity for pollutants.	Other indirect costs: other costs that may be associated with MPAs, for example: – possible congestion costs to fishers if displaced to other areas (at least in short run) – alternative employment packages – infrastructure costs of increasing tourism as a result of an MPA – displaced communities, if relocated.
Fishery enhancement: after some time lag, the results of protection include larger, more valuable and variable fish species within the reserve, with transfer of benefits to fishing areas through adult spillover and larval export. Habitat protection increases production in reserves. Stock protection reduces the likelihood of fishery collapse.	Opportunity costs: value of foregone alternative, for example: – short-term fishery revenues – revenues from other activities forbidden in the MPA, such as coral mining, shell extraction and blast fishing – large-scale tourism and resort development – industrial and infrastructure development – recreational benefits lost if the MPA is closed to the public (and other non-market values).
Tourism and recreation: better opportunities for tourism and recreation is a major objective of many MPAs. Enhancement of fish stocks in reserves and the associated habitat protection increase appeal for tourism. This creates employment opportunities directly linked to the reserve (e.g. tour guides, wardens) and could stimulate a multiplier effect through the local economy (e.g. hotels, restaurants, infrastructure, taxi services, etc.).	
Biochemical informational services: there are potential gains from pharmaceutical bioprospecting – future discoveries of important medicinal components.	
Education and research: MPAs provide opportunities to learn about processes from "undisturbed" regions. Non-use values, including cultural and heritage values.	

Source: Adapted from CFA (2003), *Conservation Finance Guide*, www.conservationfinance.org/guide/guide.

Table 2.2. **Examples of marine protected area valuation studies**

Site	Objective	Type of service	Value	Method	Source
Bahamas	To identify the potential presence and relative importance of ecosystem services within the proposed protected areas	Indirect values of key habitat functions	USD 11 million	Benefits transfer	Clavelle and Jylkka (2013)
Marine protected area (MPA) network in Scottish offshore and territorial waters	To estimate the economic value arising from the designation of three theoretical networks of MPAs in Scottish territorial and offshore waters	Direct and indirect values (not option values)	GBP 6.3-10 billion over 20 years	Benefits transfer	Links Economics Forum (2012)
Scottish waters MPA	To estimate willingness to pay (WTP) for additional MPAs in the Scottish deep sea	Existence value for deep-sea species and option use values for future medicinal purposes	WTP GBP 70-77 for "best" option	Choice experiment and contingent valuation	Jobstvogt, Watson and Kenter (2014)
Lundy marine nature reserve, United Kingdom	To estimate the non-market recreational benefits arising from the marine nature reserve	Recreational benefits	Estimated consumer surplus GBP 359-574 per trip	Travel cost method	Chae, Wattage and Pascoe (2012)
Network of marine conservation zones (MCZs), United Kingdom	To estimate benefits, measured in terms of anticipated increases in the value of ecosystem goods and services provisioned by MCZs, relative to the counterfactual, i.e. no designation	Seven categories of ecosystem goods and services	GBP 10-23 billion for a 20-year time period	Benefits transfer	Hussain et al. (2010)

Table 2.2. **Examples of marine protected area valuation studies** (*continued*)

Site	Objective	Type of service	Value	Method	Source
Network of marine conservation zones, United Kingdom	To estimate the non-market benefits derived by UK residents from the conservation of ecosystem goods and services resulting from implementation of proposed marine conservation zones under the UK Marine and Coastal Access Bill (2008)	Non-market benefits of ecosystem services	WTP to halt loss of marine biodiversity and environmental benefits GBP 21 billion and GBP 16 billion respectively	Choice experiment	McVittie and Moran (2010)
Hon Mun MPA, Viet Nam	To compare management with "no management" scenario	Fishery, aquaculture and other (tourism)	USD 54-73 million	Travel cost method production function Contingent valuation	Kankh and van Beukering (2005)
Seychelles	To estimate tourists' WTP for visits to Seychelles marine national parks	Recreational benefits	WTP USD 12 20 Consumer surplus USD 88 000	Contingent valuation	Mathieu (1998)
Network of MPAs, Colombia	To estimate economic value of carbon sequestration provided by a proposed network of MPAs	Carbon sequestration	EUR 43-300 million depending on exogenous variables, for 2013-20	Based on market prices of carbon	Zarata-Barrera and Maldonado (2015)
MPAs along Garden Route, South Africa	To estimate costs and benefits associated with MPAs and how estimates might change under different scenarios of MPA size and management intensity	Fishing, recreational, existence	PV 600-800 million rand	Value per fish Travel cost method Contingent valuation	Turpie, Clark and Hutchings (2006)

Table 2.2. **Examples of marine protected area valuation studies** (*continued*)

Site	Objective	Type of service	Value	Method	Source
Seven marine areas in New Zealand	To review the ecosystem services provided by the marine environment in New Zealand, by analysing their supply, demand and value in New Zealand's marine and coastal environment and the current MPA network	Ecosystems goods and services	Areas generated an average ES value of NZD 403 billion per year for 2010	Benefit transfer	Van den Belt and Cole (2014)
Port-Cros National Park, France	To estimate the additional benefits in services as a result of the MPA	Some use values, distinguished between market and non-market values (ecosystem recreation services, carbon storage, effect on fishing resources) and a global non-use value	Total present value EUR 14 658 million (on 20-year window, 68% of which is the non-use value), compared to investment and management costs of EUR 161 million	Various methods including contingent valuation, visitor spending and travel cost method	Hamade (2013)
Guadeloupe National Park, France	To estimate the additional benefits in services as a result of the MPA	Some use values, distinguished between market and non-market values (ecosystem recreation services, carbon storage, effect on fishing resources) and a global non-use value	Total present value EUR 1 444 million (on 20-year window, 89% of which is the non-market value of recreation), compared to investment and management costs of EUR 149 million	Various methods including contingent valuation, visitor spending and travel cost method	Hamade and Hetier (2013)

Notes: PV: present value; ES: ecosystem service.

Source: Author's own work.

Challenges that can be encountered in conducting these studies include the attribution of benefits to specific MPAs (see OECD, 2014).[1] In an *ex ante* case study on benefits valuation of the Eastport MPAs in Canada, for example, a science assessment was undertaken to assess the abundance of American lobster within the MPA, and at comparable "control" sites outside the MPA over a 15-year time frame. Despite observed differences in the size structure of lobster populations, no definitive differences in abundance indices were found. As a consequence, there were no quantitative benefits to be valued in economic terms. For the Eastport MPA, the results could in part be attributable to the small size of the MPA, making it difficult to isolate the effects of the MPA from other factors affecting the lobster population in the area (DFO Canada, 2014).

A limited number of studies have estimated the global benefits of MPAs. Heal and Rising (2014) estimate global benefits of MPAs for harvested fish stocks. They find that on average, a 1% increase in protected area results in an increase in the growth rate of fish populations by about 1%. Brander et al. (2015) estimate that the total ecosystem service benefits of achieving 10% coverage of MPAs are in the range USD 622-923 billion over the period 2015-50, and for 30% coverage range between USD 719 billion to USD 1 145 billion. The ecosystem services covered include coastal protection, fisheries, tourism, recreation and carbon storage provided by coral reefs, mangroves and coastal wetlands. Variation in benefits across scenarios is largely due to differences in the provision of services from coral reefs.

Costs of marine protected areas

Direct costs

As discussed, direct costs cover both establishment costs and operational costs. McCrea-Strub et al. (2011) conducted one of the few available studies on establishment costs of MPAs. The 13 MPAs examined varied in size, ranging from less than 1 km² to more than 360 000 km^2; location, including near and offshore in both developed and developing countries; objectives; and degree of protection. Establishment costs ranged from USD 20 518 to USD 34 800 000 (2005 USD), with variation in MPA start-up costs shown to be most significantly related to MPA size and the duration of the establishment phase.

The pre-establishment and establishment costs have also been estimated for the Taputeranga Marine Reserve (TMR) in New Zealand (Rojas-Nazar et al., 2015). The TMR pre-establishment and establishment process cost was approximately NZD 508 000 and NZD 353 000, respectively. The study also highlighted how volunteer effort helped to considerably reduce the monetary cost of the TMR pre-establishment process.

A much larger number of studies are available that examine the operating costs of MPAs (see Annex 2.A1 for a summary). MPA operating costs depend on several variables, particularly design, location, configuration, socio-economic context and zoning (Ban et al., 2011). Balmford et al. (2004) analysed operating costs for 83 MPAs worldwide with sizes ranging from less than 0.1 km^2 to more than 300 000 km^2. They found that annual expenditure ranged from zero to more than USD 28 million per km^2, with a median of USD 775 per km^2 (year 2000 equivalent), and that the cost of MPAs in developed countries were significantly higher than those in developing countries (USD 8 976 per km^2 vs. USD 1 584 per km^2).

In general, smaller MPA sizes, proximity to inhabited land and low purchasing power parity are associated with higher operating costs per unit area, as larger MPAs are able to take advantage of economies of scale even though overall operating costs may somewhat increase (Balmford et al., 2004; Ban et al., 2011). For example, a minimum number of people may be required to manage an MPA regardless of size, but the same number of people may also be able to manage much larger areas (up to a reasonable limit), with only a few additional expenses such as fuel (Ban et al., 2011). Multiple zones also raise operating costs compared to uniform zoning, mostly due to increased surveillance requirements (Ban et al., 2011; Hunt, 2013). For example, zoning enforcement represented 32% of the total expenditure in 2004 of the Great Barrier Reef Marine Park (McCook et al., 2010).

Estimates for the Sulu-Sulawesi Seas Marine Eco-region indicate a total cost of approximately USD 32 million annually for an area of almost 13 000 km^2, and USD 17.4 million for full implementation of existing management plans and new MPAs, although cost reductions of 40-90% per square kilometre for law enforcement could be achieved by combining individual MPAs into a collaboratively managed network (ADB, 2011; MSR, 2012). This is particularly notable in projected management costs for the Coral Sea Marine Reserve (CSMR), where model estimates considering the CSMR a stand-alone MPA were almost double estimates assuming Great Barrier Reef management arrangements would be extended to the CSMR (Ban et al., 2011: Table 2.4).

In a regional study of MPAs in the Mediterranean, official data from 14 countries show that total available resources for MPAs of nearly EUR 52.8 million per year, or EUR 18 500 per km^2 per year on average (Binet, Diazabakana and Hernandez, 2016). Interestingly, it is also the first assessment of financing needs and gaps for the effective management of MPAs in the Mediterranean and for the achievement of Aichi Target 11. For effective management, they estimate a financing need of EUR 700 million a year, and for achievement of the Aichi Target, they estimate a need of EUR 7 billion until 2020.

Other indirect costs

Indirect costs can be difficult to quantify, especially with respect to incremental increases in funding and personnel for outreach or for programmes to build community support. However, transitional payments,[2] which often form a large proportion of the government budgetary cost of establishment, can be analysed. For example, reef fishermen in the Soufriere Marine Management Area in St. Lucia lost 35% of their original fishing grounds when an MPA was created. Compensation of USD 150 per month was therefore paid to 20 of the most dependent fishermen for the first year, and after six years, commercial fish biomass had increased fourfold inside the reserve and threefold in adjacent fishing grounds, leading to general support for the MPA (WWF, 2005).

Transitional payments, however, have also been noted to be far greater than the actual opportunity costs. Payments for the 2004 expansions of Great Barrier Reef no-take areas totalled over AUD 200 million, more than five times the affected gross value of production (GVP) of AUD 43 million. Similarly, compensation payments for the 2012 creation of the Coral Sea Marine Reserve were expected to be in the order of AUD 20 million for GVP impacts of AUD 3.5 million (Hunt, 2013).

Opportunity costs

Opportunity costs vary widely depending on the possible activities in place. In the Kisite-Mputungi Marine National Park, Kenya, opportunity costs were higher by a factor of ten than operating expenditures (Emerton, 2003). Gleason et al. (2013) estimated that the maximum potential net economic losses to fishermen of establishing California's MPA network ranged 1-29% of revenue depending on the fishery, with the final MPA network proposal reflecting a maximum loss of 6.3% for eight fisheries. A socio-economic assessment of the Cod Grounds MPA in Australia (Schirmer, Casey and Mazur, 2004) found that fishers would lose 5-70% of gross commercial fishing income; that fishing co-operatives would lose 3-5.5% of currently landed catch; and that alternative fishing areas would be subject to higher pressures. However, it should be noted that the proposed Cod Grounds area was 3.1 km^2, supporting up to 14 owner-operator fishing businesses, meaning that these results were highly specific.

In contrast, estimated costs to the Scottish fisheries sector from establishing an MPA network were considered minimal, ranging from GBP 0.05 million to GBP 4.97 million, or 0-2% of gross value added output, under worst-case scenarios (Government of Scotland, 2013). In the Tortugas Ecological Reserve in Florida, impacts to commercial fisheries were expected to be negligible, approximately 1.16% of harvest revenue, although impacts to charter boat operators were 12-13% of revenue (Cook and Heinen, 2005).

The opportunity costs associated with MPAs can be minimized, however, through careful MPA design and zoning. Using the spatial prioritisation software Zonation, Leathwick et al. (2008) found that MPA siting models for New Zealand that controlled for both conservation and minimum fishing opportunity costs would deliver conservation benefits nearly 2.5 times greater than those implemented at the request of fishers, and at a lower cost to them[3] (see Chapter 3 for further discussion).

Box 2.2. Global costs of marine protected area expansion and models to predict establishment and management costs at a marine protected area

Global costs of marine protected area expansion

Based on operating costs, Balmford et al. (2004) estimated that a global marine protected area (MPA) network covering 20-30% of the world's seas would cost between USD 5-19 billion a year. More recently, Brander et al. (2015) estimated that the total cost of achieving 10% global coverage of MPAs is in the range of USD 45-47 billion over the period 2015-50 and the total costs of achieving 30% coverage are in the range USD 223-228 billion.[1] The cost categories included in these estimates are the set-up and operating costs of MPAs and the opportunity costs to commercial fisheries.

Models to predict marine protected area establishment and management costs

Based on the MPA data collected, McCrea et al. (2011) and Balmford et al. (2004) developed models to predict MPA establishment cost and management cost, respectively. These are:

- log (establishment cost) = 3.73 + 0.28 t (years) + 0.26 log (a, km^2)
- log (annual cost) = 5. 62 – 0.72log (protected area area, km^2) – 0.0002 (distance, km) – 0.30 (PPP)
- where all logarithms are of base ten.

The latter model, for example, states that the cost of managing a marine protected area is a non-linear function of the size of the proposed protected area, distance of area from land, and the purchasing power parity of the nation. Klein (2010) used this model to predict the management costs of MPAs in each ecoregion in the Coral Triangle and Ban et al. (2011) applied the model to estimate management costs of a proposed Coral Sea MPA in Australia. In the case of the Coral Sea MPA, the results were not considered realistic as the Balmford et al. (2004) model does not differentiate between no-take and multiple zone MPAs. Further applications of this approach are merited to assess the validity of the models, as would the development of alternative models that factor in MPA zoning.

Note: 1. All monetary values are expressed as present values computed over the period 2015-50 using a discount rate of 3% in USD at 2013 price levels.

Using cost-benefit analysis to inform marine protected area decision making

Cost-benefit analysis provides an organisational framework for identifying, quantifying and comparing the costs and benefits (measured in monetary terms) accruing to society as a whole of a proposed policy action.[4] In the case of MPAs, a cost-benefit analysis compares the benefits of protection with the costs of protection, including the costs and benefits which are "unpriced".[5] As benefits and costs flow over time rather than in just one period, discounting this flow gives the net present value (NPV) of an MPA, i.e. the discounted sum of all future costs and benefits (Hanley and Barbier, 2009).

In theory, an MPA should be considered when its NPV exceeds that of an alternative use:

NPV of MPA – NPV of alternative use > 0
or
PV of benefits > PV of costs

Examples of cost-benefit analysis studies of MPAs are highlighted in Box 2.3.

In a global study, Brander et al. (2015) examine the net benefits of protecting marine habitats through expanding the coverage of no-take MPAs. Using a baseline of 3.4% MPA coverage, they examine the benefits under scenarios increasing coverage to 10% and 30%. Two criteria are used to determine the spatial allocation of MPAs, namely: 1) marine biodiversity; 2) exposure of marine ecosystems to human impacts. Global data on species biodiversity were obtained from www.aquamaps.org and data on human impact on marine ecosystems were obtained from Halpern et al. (2008). The results of the cost-benefit analysis show that all six scenarios for expanding MPAs to 10% and 30% coverage are economically advisable. The ratios of benefits to costs are in the range 3.17-19.77. More specifically, under a 10% scenario targeting high biodiversity and low human impact, yields a benefit-cost ratio of 19.77, and under a high biodiversity, high human impact yields a ratio of 15.02.

In general, methodological issues that need to be considered when conducting a cost-benefit analysis are (UNEP-WCMC, 2011): the treatment of risk and uncertainty; avoiding the risk of double counting; scale dependence of values for certain services; and dealing with cumulative impacts.[6] Another issue that needs to be considered is the definition of the baseline, and the MPA designation scenario (i.e. "with" and "without" policy intervention), as well as the choice of the discount rate to be used.

Box 2.3. Examples of cost-benefit analysis of marine protected areas

Taka Bone Rate Marine Protected Area, Indonesia

The quantifiable net benefits of managing the Taka Bone Rate Marine Protected Area, Indonesia, as a protected area were estimated to be between USD 3.5 million and USD 5.0 million in net present value terms, at a 10% discount rate over 25 years. The creation of marine protected areas (MPAs) allowed fish stocks and yields to recover, and stopped destructive fishing practices (Cesar, 2002).

Designation of the second tranche of marine conservation zones in the United Kingdom

The impact assessment carried out by the United Kingdom for the second tranche of marine conservation zones in 2015 summarises the costs and benefits of expanding the area. The best estimate of total costs (present value) is GBP 31.4 million. Due to uncertainty concerning the scale of benefits, the present value of total benefits is not presented. The assessment does provide quantitative estimates of various benefits and presents these for illustrative purposes.[1]

Cost-benefit analysis in Sweden

In the programme of measures within the Marine Strategy Framework Directive for Sweden, the costs and benefits for an increase of the current 6.3% MPA coverage to the goal of 10% have been estimated (i.e. an increase of 570 000 hectares), together with the benefits of reaching "good environmental status". The main costs are establishment costs (i.e. inventory: SEK 240 million), followed by annual maintenance and management costs (SEK 30 million), and surveillance costs (SEK 7.8 million). Estimates of other costs (e.g. loss of income to fishing fleet) are still preliminary as the geographic siting of the additional MPAs has not yet been decided. The benefits estimated are those for commercial fishing and for tourism and recreation, and amount to SEK 200 billion (Risinger, 2015).

The Hecate Strait and Queen Charlotte Sound Glass Sponge Reefs Marine Protected Areas Regulations in Canada

The regulatory impact analysis statement provides both quantitative and qualitative information on the costs and benefits associated with the designation of the MPA. While most of the benefits discussed are qualitative and non-monetary, it considers that theses would greatly outweigh its costs, given the relatively small direct impact on the industry.[2]

Notes: 1. www.gov.uk/government/uploads/system/uploads/attachment_data/file/492534/mcz-second-tranche-consult-ia.pdf. 2. www.gazette.gc.ca/rp-pr/p1/2015/2015-06-27/html/reg6-eng.php.

While cost-benefit analysis should in theory be undertaken any time the establishment of an MPA is being considered in a particular location, very few seem to have been undertaken in practice. Though cost-benefit analysis can be time and resource intensive, it provides information that is crucial to ensuring that resources are allocated most effectively and can help to inform whether an MPA should be established in one particular site versus another. Notably, the 2008 EU Marine Strategy Framework Directive requires cost-benefit analysis prior to the introduction of any new measure.[7] Under Article 13, Programmes of Measures, the directive states: "…Member States shall ensure that measures are cost-effective and technically feasible, and shall carry out impact assessments, including cost-benefit analyses, prior to the introduction of any new measure".

Similarly, Canada's federal regulatory policy requires a detailed cost-benefit analysis of all regulatory proposals including the designation of MPAs under the Oceans Act. Cost-benefit analysis can also help to inform the more complex network design processes, including the possible MPA locations/configurations. These issues are examined in Chapter 3. While cost-benefit analysis is not a frequent requirement in MPA design, other countries seek for cost-effectiveness in the MPA network design (i.e. to minimise costs while attaining the conservation objectives), or prefer to use multi-criteria analysis (e.g. France).

Notes

1. Forty-six valuation studies are listed under the heading of "marine parks", for example, in the *Marine Ecosystem Services Partnership (MESP) Database*: http://marineecosystemservices.org. Another database with valuation studies is www.esvaluation.org.

1. Further information is available at: www.oecd.org/gov/regulatory-policy/framework-for-regulatory-policy-evaluation.htm.

2. It is important to note that, in economic terms, transitional payments are transfer payments, and should therefore not be included in a cost-benefit analysis.

3. For 96 demersal fish species.

4. In contrast, a financial evaluation is generally conducted from the perspective of an individual firm or agency.

5. Some of these costs and benefits can be difficult to measure, whereas they may be a core motive to implement an MPA. As for those that can genuinely not be measured, they should be drawn to decision makers' attention alongside the results of the cost-benefit analysis of those benefits and costs that can be measured (Australian Treasury, 2015).

6. How these issues can be addressed is described in UNEP-WCMC (2011). Further discussion here lies beyond the scope of this report.

7. In the EU Natura 2000, MPA designation is carried out in accordance with the provisions and criteria established under the Birds and Habitats Directives.

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Chapter 4.

Sustainable financing of marine protected areas

A frequently cited challenge for more effective management of marine protected areas (MPAs) has been their inability to secure sufficient and sustainable financing. This chapter examines the various financing instruments and approaches that are available, ranging from traditional government budget and donor funding to user fees, taxes and fines, and payments for ecosystem services, among others. The chapter concludes with a discussion on the need to develop finance strategies for MPAs, drawing on examples from different countries.

While the number and coverage of marine protected areas (MPAs) has increased over the last few decades, a frequently cited challenge has been their inability to secure sufficient and sustainable financing. This significantly undermines their ability to achieve their management objectives and MPAs have therefore sometimes been described as "paper parks" (Gelcich et al., 2013; Thur, 2010).[1] For an MPA to be effective, it is important to understand the financing needs associated with their design and implementation (see discussion in Chapter 2 on the costs of MPAs), to identify the possible sources of finance that may be available to support the MPA, and consequently to develop sustainable financing strategies that will be able to mobilise sufficient resources in both the short and longer term.

Financing instruments and approaches

Domestic government budgets and international donor assistance have formed the bulk of protected area financing worldwide (Emerton, Bishop and Thomas, 2006). This holds true when looking only at MPAs as well (Table 4.1). Other sources of finance include user fees, fines, debt swaps, biodiversity prospecting, trust funds and donations. More novel financing sources either underway or being explored include marine payments for ecosystem services (PES), marine biodiversity offsets and blue carbon finance. Each of these is discussed below.

Government budgets

National government funding tends to be the primary source of finance for MPAs in developed countries. In developing countries, government funding also plays a major, albeit perhaps smaller, role, as governments often have more pressing priorities (Thur, 2010). Government budget allocations for MPAs are, however, often insufficient to cover total costs. A 2012 report to the Auditor General of Canada, for example, stated that budget cuts and "insufficient resources" impede Canada's ability to meet its MPA targets (OAGC, 2012). In Australia, in 2002 the Great Barrier Reef Marine Park Authority estimated that actual management costs were approximately twice the budget (Ban et al., 2011). Similarly, the US Papahanamokukea Marine National Monument Management Plan provided funding estimates for desired outcomes, but noted that these estimates are "sometimes substantially above current budget allocations" (Papahanamokukea, 2008). Sabah Parks in Malaysia received 80% (4.2 million Malaysian ringgits) of its funding from the state government to manage four marine parks (Table 4.1), but still reported a 13% (740 000 ringgit) gap between revenues and expenditures in 2009 and a predicted shortfall of 10 million ringgits over the following five years[2] (PE Research, 2010). In the Caribbean, most governments are subject to chronic budgetary shortfalls,[3]

and the most financially secure MPAs do not primarily depend on government grants (Reid-Grant and Bhat, 2009).

Table 4.1. **Financing of marine protected areas: Selected examples**

Marine protected area	Financing sources
Mariana Trench, United States McCrea-Strub et al. (2011)	Government allocations (91%) National non-governmental organisation (NGO) donors (6%) Local NGO donors (3%)
Papahanaumokuakea, United States McCrea-Strub et al. (2011)	Government allocations (95%) National NGO donors (4%) Local NGO donors (1%)
California MPA network, United States (establishment) Gleason et al. (2013)	NGO donors (51%) State government allocations (49%) Over a seven-year process. Does not include staff or in-kind contributions.
4 MPAs, Mexico González-Montagut (2003)	National Commission of Protected Areas (55%) Other public and international sources, civil society, academia, private industry (24%) Protected Areas Fund (12%) European Commission (5%) Entrance fees (3%)
Seaflower, Colombia McCrea-Strub et al. (2011)	Multilateral donors (33%) Regional government allocations (19%) International NGO donors (11%) National voluntary donations (6%) National NGO donors (2%) Bilateral government donations (1%) Government allocations (1%) Local voluntary donations (26%) Local NGO donors (< 1%)
Saba, Netherlands Antilles (establishment) McCrea-Strub et al. (2011)	Government allocations (69%) National NGO donors (21%)
Saba, Netherlands Antilles (operating) Morris (2002)	Entry fees (50%) Souvenir sales (32%) Local voluntary donations, etc. (17%)
Menai Bay, Tanzania Lindhejm (2003)	NGO donors (90%) Government allocations (10%)
Misali, Tanzania Lindhejm (2003)	International donors (NGOs, foreign development agencies, etc.) (84%) Entry fees (15%) Government allocations (1%)
Chumbe Island, Tanzania (establishment) McCrea-Strub et al. (2011)	Private investment (49%) Bilateral government (26%) Bilateral voluntary donations (24%) Multilateral donors (< 1%) International NGO donors (< 1%)
Chumbe Island, Tanzania (operating) Lindhejm (2003)	Tourism entrance fees (90%) International donors (10%)

Table 4.1. **Financing of marine protected areas: Selected examples** (*continued*)

Marine protected area	Financing sources
Mnemba, Tanzania Lindhejm (2003)	Entry fees (85%) Government allocations (15%)
Jozani Chwaka, Tanzania Lindhejm (2003)	International donors (Global Environment Facility, foreign agencies, NGOs) (70%) Entry fees (25%) Government allocations (5%)
Nha Trang Bay, Viet Nam McCrea-Strub et al. (2011)	International donors (52%) Bilateral government donations (38%) Government allocations (6%) Local voluntary donations, etc. (5%)
4 MPAs, Sabah, Malaysia PE Research (2010)	Government allocations (80%) International donors (11%) Fees and charges (8%) Fines (< 2%, no data)
Sugud Islands (SIMCA), Malaysia PE Research (2010)	NGO donors (46%) Entry fees (30%) Concessions (25%)
Pilar, Philippines Butardo-Toribio, Alino and Guiang (2009)	Municipality (59%) Outside grants (37%) Barangay (2%) Community (1%) MPA collections (1%)
Villahermosa, Philippines Butardo-Toribio, Alino and Guiang (2009)	Community (30%) Outside grants (28%) Barangay (27%) Municipality (8%) NGA (Bureau of Agriculture and Fisheries Resources, etc.) (4%) Province (2%) MPA collections (1%)
Bibilik, Philippines Butardo-Toribio, Alino and Guiang (2009)	Municipality (46%) Outside grants (44%) Barangay (5%) Province (3%) NGA (Department of Natural Resources, Coast Guard, etc.) (2%)
Tambunan, Philippines Butardo-Toribio, Alino and Guiang (2009)	Municipality (59%) Outside grants (37%) NGA (Department of Natural Resources, Coast Guard, etc.) (2%) Barangay (1%)
Talisay, Philippines Butardo-Toribio, Alino and Guiang (2009)	Outside grants (59%) Community (36%) Municipality (4%) Barangay (2%)
MISTTA, Philippines Butardo-Toribio, Alino and Guiang (2009)	Municipality (59%) Outside grants (30%) Barangay (8%) NGA (3%)

Table 4.1. **Financing of marine protected areas: Selected examples** (*continued*)

Marine protected area	Financing sources
Port-Cros National Park, France	Government allocations (72.5%) Donations and philanthropy (2.3% Fiscal revenues (Barnier tax[1]) (4%) Self-financing (service delivery sales) (21%)

Note: 1. This tax, created in 1995 ("Barnier Law"), applies to maritime transport passengers when they purchase a ticket to travel across the national park. The tax amounts to 7% of a "one-way" ticket price before tax and cannot amount to more than EUR 1.57. The tax is currently being collected in Port-Cros and Calanques National Parks. For practical reasons, its implementation has been delayed in the Guadeloupe National Park.

Conservation budgets in both developing and developed countries have tended to stagnate or decrease in recent years, especially when the government is under strain (Emerton, Bishop and Thomas, 2006; Thur, 2010; Hunt, 2013). Given the public good characteristics associated with many marine ecosystem service benefits, national government funding should continue to be an important contributor to MPA budgets in both developed and developing countries. Valuation studies and cost-benefit analysis should help to make the case to Ministries of Finance that greater investment in MPAs is needed. However, broader finance portfolios for MPAs should be developed, including revenue-generating instruments that are based on the polluter-pays approach.

Donor funding

Many MPAs in developing countries rely on bilateral and multilateral development assistance for financial support, including from national foreign aid agencies, multilateral banks and agencies such as the Global Environment Facility (GEF) and the World Bank. Additional funding can come from private donors, philanthropic foundations, non-governmental organisations (NGOs) and communities. Donor funding is normally part of a wider portfolio of finance, and tends to support establishment costs, training and other forms of capacity building necessary to set up an MPA, as well as to put frameworks in place for them to become financially self-sufficient. Donor funding is generally not intended to support ongoing, long-term expenses of MPAs (Emerton, Bishop and Thomas, 2006; Erdmann et al., 2003; McClanahan, 1999).

The GEF, for example, contributes about USD 100 million annually to the protection of marine ecosystems (Reid-Grant and Bhat, 2009) and has supported more than 1 000 MPAs worldwide. In Samoa, for example, a GEF grant was used to establish a sequence of multiple district-level MPAs. Revenues from charges and fines were used post-grant to seed a trust fund (WWF, 2005). Funding such as that by the GEF is clearly limited, however,

(donors pledged USD 1.3 billion towards the biodiversity focal area for the GEF-6 replenishment period) and for protected areas is targeted to those areas that are globally significant, based on vulnerability and irreplaceability criterion (GEF, 2014). Philanthropic foundations have also engaged in MPAs, such as Pew's Global Oceans Legacy, including partners such as Bloomberg and the Lyda Hill Foundation.

Trust funds and debt-for-nature swaps

Several MPAs have established trust funds to help ensure a more long-term sustainable, source of finance. Three types of trust funds exist: endowment funds, which maintain a capital base while paying only interest; sinking funds, which use both capital and interest and are thus eventually extinguished; and revolving funds, which are designed to be continuously replenished.

In Belize, a Protected Area Conservation Trust (PACT) was established in 1996, funded principally via a conservation fee on visitors to Belize upon departure and a 20% commission from cruise ship passengers (Drumm et al., 2011). In Mexico, a remnant worth USD 16.5 million from a USD 25 million GEF grant was used to capitalise a Protected Areas Endowment Fund in 1997. This grew to USD 42 million in 2003 following several donations. Interest from the fund, along with federal allocations, entrance fees and an EU grant, was channelled annually to various protected areas, including four marine parks (González-Montagut, 2003). In Mauritania, an endowment fund BACOMAB was established in 2009 to finance the conservation of the Banc d'Arguin and other Mauritanian coastal and marine protected areas. Its capital will be invested for perpetuity on capital markets and only the interest will be used to finance marine and coastal protected areas. The Mauritanian government made an initial contribution to BACOMAB during 2010-11 by mobilising EUR 1.5 million of revenues from the fisheries agreement with the European Union. French Development Agency and French Facility for Global Environment have contributed an additional EUR 2.5 million and EUR 1 million respectively. BACOMAB's funding objective was to reach EUR 35 million by 2016. Other funding sources to be explored include:

- Contributions from the oil and gas sectors through voluntary compensations or fees attached to concessions.
- Fiscal mechanisms such as a share of fines for fishing infractions or of fishing licences; part of tourism-related taxes; environmental fees or licences for industries with possible impacts on marine ecosystems; or a tax on the use of ecosystem services.

- Carbon finance, in particular related to the sequestration of carbon in marine ecosystems such as seagrass beds in the Banc d'Arguin ("blue carbon") (French Facility for Global Environment, 2013).

The Mesoamerican Barrier Reef (MAR) Fund[4] is an example of a pooled fund, with contributions from Belize, Guatemala, Honduras and Mexico. Its central focus is on 14 MPAs in the Mesoamerican Reef ecoregion, which contains the largest barrier reef system in the western Atlantic.

In Kiribati, the government's approach to ensuring the long-term financing of the Phoenix Islands Protected Area (PIPA) is based on the purchase of "reverse fishing licenses" by charitable donors. The goal is to capitalise an endowment fund, at a level that would generate an income stream sufficient to cover the operating and management costs of the trust, and the foregone revenues from fishing associated with the closure or restriction of activities within the PIPA region in Kiribati. The funding target was USD 25 million, with an interim target of USD 13.5 million by 2014, based on 25% of the PIPA area under a no-take-zone. The protected area also receives the support of the "PAS: Phoenix Islands Protected Area (PIPA)" project (GEF: USD 870 200, co-finance: USD 1.7 million) implemented by the United Nations Environment Programme. An endowment fund is also being developed for the Bird's Head Seascape in West Papua.

A Global Conservation Fund (GCF) was also established in 2001 in which about USD 13 million (of a total of USD 65 million) has been invested in important marine regions (Bonham et al., 2014). The GCF was made possible by a grant from the Gordon and Betty Moore Foundation and has leveraged more than USD 200 million.

Debt-for-nature swaps entail the reallocation of a developing country's funds from repayment of debts to natural resource protection. Debt swaps and trust funds have often been used in conjunction. The US government funded the purchase of USD 19 million of Philippine debt in 1992, of which USD 17 million was used to set up the Foundation for the Philippine Environment endowment fund (ADB, 2011). NGOs have also been active in this field. In 2015, The Nature Conservancy (TNC) brokered a USD 31 million swap between the Seychelles, its Paris Club creditors and South Africa to finance marine conservation and climate adaptation, capitalise an endowment fund and repay impact investors over a 20-year timeframe. The marine conservation component includes the creation and management of over 400 000 km^2 of new MPAs (TNC, 2015). Similarly, Jamaica was able to create a trust fund for its national parks through a direct swap with TNC, although the interest is not sufficient for all of its protected areas (Reid-Grant and Bhat, 2009).

User fees

User fees are collected from resource users, including tourists, who chose to access a service or facility. These types of fees are already being applied in a number of MPAs worldwide (Table 4.2) and are set at various levels depending on their purpose (e.g. cost recovery vs. visitor management to reduce congestion and/or ecological damage), type (e.g. general entrance fees, diving/snorkeling or research fees) and the prevailing local socio-economic characteristics of the region (e.g. number of visitors, income levels, price elasticity of demand[5]). Though tourism revenues, for example, can also be unreliable due to the inherently volatile nature of the industry, which fluctuates with the state of the global economy, natural disasters, political turmoil and other considerations (Erdmann et al., 2003; PE Research, 2010), revenues can be sizable.

Indeed, some MPAs have been mostly or entirely financed via user fees. Malaysia's Kota Kinabalu National Park, for example, raises approximately 80% of its operating expenses from user fees (ADB, 2011). The Bonaire Marine Park in the Netherlands Antilles had, as of 2010, self-financed all operations since 1992 through dive entrance fees, boat entrance fees and mooring fees (Forest Trends, 2010; Thur, 2010). A 2005 raise in Bonaire's annual fees to USD 25 and USD 10 for divers and non-divers, respectively, created a revenue stream conservatively estimated at USD 760 000, far higher than the 2002 operating budget of USD 270 000. The surplus was used for the nearby Washington-Slagbaai terrestrial park, which also provides upstream ecological benefits to the marine park (Thur, 2010). In the Philippines, the Gilotongan Marine Reserve appeared to meet all of its funding needs through tourism fees, in fact realising a profit on the order of USD 85 000 in 2012 (MSR, 2012).[6]

Scope may thus exist for wider application of user fees into MPA finance portfolios, though they must be well designed. One challenge cited for expanding the scope of user fees to other marine parks is that there are not always easily defined entry points at which to charge the fee. At the Bunaken Marine Park, a dual fee/ticket system was used which worked effectively in an open access MPA that has no single entry point. The fee is charged per person for an annual waterproof tag. Tags are individually numbered to prevent illegal resale and data from the receipts are entered into a database to help prevent corruption and to gather tourist statistics.

Social acceptability of a fee has been another issue, as there can be a perception that everyone should have access to natural areas free of charge. Visitors generally accept the imposition of entry fees if they are made aware that revenues are intended for MPA management. Raising awareness and ensuring transparency are therefore important (IUCN, 2004; ADB, 2011).

Users should be consulted to determine the level of fee they are willing to pay, sufficient user numbers must exist (ADB, 2011), and the fee should be targeted at the correct tier of visitor, e.g. international vs. domestic tourists, as the former may have a higher ability and willingness to pay. Many MPAs charge domestic residents reduced fees, or no fees at all, including Belize (Hol Chan and Half Moon Caye), Ecuador (Galápagos), Egypt (Ras Mohammed), Kenya, Netherlands Antilles (Saba), Philippines (Tubbataha and Gilutungan), Tanzania, Thailand and the United States (Hanauma Bay).

Revenues that are retained at park level are more effective at generating funding sources. In many cases, revenues collected at MPA sites are largely allocated to central agencies and do not return to the MPA, creating a disincentive for generating new revenues and increasing instability (Emerton and Tessema, 2001; Emerton, Bishop and Thomas, 2006; Reid-Grant and Bhat, 2009). For example, Malindi Marine Park in Kenya could potentially self-generate 20% of its operating costs, but revenue was returned to the Kenya Wildlife Service (IUCN, 2004), and Kisite Marine National Park in Kenya earned revenues from tourism that are more than seven times higher than its operating budget, but still suffered from a lack of sufficient finance as all revenues were centrally retained (Emerton, Bishop and Thomas, 2006). Sabah Parks' four marine parks raised approximately 2.1 million ringgits in 2009 from entrance fees, 39% of total revenues and 35% of total expenditure; however, only 20% was retained at park level, with the rest allocated to the Indonesian government, partly as compensation for security services (PE Research, 2010).

Diving or research fees are generally set higher than regular entrance fees. Divers have paid as much as EUR 120 per day in Mediterranean marine protected areas (Emerton, Bishop and Thomas, 2006). Zanzibar's Misali Island Conservation Area charged staggered entry rates of USD 5 per day for internationals, USD 20 for large boats, USD 200 for filming and USD 50 per week for research (Lindhjem, 2003). Cousin Island Special Reserve in the Seychelles also covered its 2002 operating costs of USD 209 520 through visitor revenue totalling USD 279 860; collected from daily fees of USD 25, USD 300 and USD 450 for foreign tourists, photographers and film crews respectively; and USD 800 per quarter for research crews (WWF, 2005).

Some fee increases have caused divers to move to equivalent sites outside the MPA, resulting in decreased funding to the management authority (IUCN, 2004), while others have caused visitor numbers to increase, as divers seek well-managed areas (van Beukering et al., 2006) (Table 4.2).

For MPAs in Chile, revenues from tourism are not sufficient to finance running costs and enforcement. For example, Lafken Mapu Lahual, one of the largest multiple-use MPAs in continental Chile, could only achieve

around 10% of running costs, in the most favorable conditions, under current management scenarios (Gelcich et al., 2013).

Other types of user fees also exist. Where fishing is allowed in MPA boundaries, revenue generated from license fees can be used to fund MPA management activities. In cases where licenses are not accompanied by entry limits, the fees can be set higher to appropriately capture economic rents (ADB, 2011). Berau Marine Conservation Area in Indonesia charges one-year fishing permits ranging from IDR 10 000 to IDR 109 500 for local boats, and USD 54-247 for foreign boats, depending on tonnage and the type of boat; other taxes from the fisheries sector amounted to IDR 112 million in 2006 (MSR, 2010). In Israel, for example, a marine environmental protection fee is levied on ships calling at Israeli ports and oil unloading platforms. This fee varies according to the size of the ship and the amount of oil, with the revenues going to the Marine Pollution Prevention Fund (OECD, 2011).

Table 4.2. **Examples of marine protected area user fees**

Site	Fee	Notes	Reduced visitation
State marine protected areas, Australia	USD 2/day, max USD 6	Opposition by tourism industry due to lack of notification	Yes, at local use sites in Tasmania
Abrolhos & Fernando de Noronha, Brazil	USD 4.25/day	Retained by environmental agency; 50% to parks	No
Ras Mohammed, Egypt	USD 5 (foreigners) USD 1.20 (locals)		No
Red Sea, Egypt	USD 2/day (diving, snorkelling)	Initial fee USD 5, lobbying reduced to USD 2	Yes, caused shift to nearby non-fee areas
Bunaken, Indonesia	USD 0.20/day (locals) USD 5/day (foreigners) USD 17/year (foreigners)	80% park, 10% each local/national governments	No
Koror State, Palau	USD 15/fortnight (diving)	Raises USD 1million/year, enough for all costs	
Soufriere, St. Lucia	USD 4/day, USD 12/year (diving) USD 1/day (snorkelling)	Support has increased	No, numbers increased

Source: Adapted from Van Beukering, P. et al. (2006), "The economic value of the coral reefs of Saipan, Commonwealth of the Northern Mariana Islands".

Mooring buoy fees are another potential source of revenue (WWF, 2005). Reid-Grant and Bhat (2009) suggest that the Montego Bay Marine Park in Jamaica could realise significant savings by passing through the costs of deployment and maintenance of mooring buoys to hoteliers and other individuals that use the buoys.

Taxes and fines

Taxes and fines are another means of raising finance for MPAs. Taxes have been defined as compulsory unrequited payments to general government[7] (OECD, 2009), though revenues from taxes can also be earmarked. Belize, for example, charges all departing visitors a USD 3.75 fee and takes a 20% commission on all cruise ship passenger fees, both of which are applied to the Protected Areas Conservation Trust (PACT, 2010). Recreational operations such as cruise ships, tourism and local industries are logical initial targets. In 2001, Switzerland's Hotelplan group established a EUR 3 fee for patrons of their Mediterranean tourism packages to support cetacean and seaturtle conservation projects in the region (Emerton, Bishop and Thomas, 2006), and the US Dingell-Johnson Sport Fish Restoration Program charges excise taxes on a variety of fishing equipment (10% on fishing supplies; 3% on electric outboard motors; and an additional tax on small boat fuel) to fund sport fishery projects throughout the nation (TNC, 2012). Such taxes can also be partially earmarked to MPAs if appropriate. In France, the 1995 Barnier Act has set up a tax on maritime passenger ships that are destined to natural protected areas, and revenue is earmarked for these areas.

In response to declining salmon stocks, Iceland implemented levies on both rod and commercial salmon fishing licenses in 2006. Revenue (USD 16.6 million in 2008) is invested in wild salmon management programmes for stock and habitat improvement (WWF, 2009). In Alaska, salmon fishermen in some areas have voted to institute a 2% or 3% tax on themselves through the state budget to fund stock enhancement programmes. Proceeds are returned to regional aquaculture associations, incorporated as private non-profits, which operate hatcheries for stock supplementation (Knapp, Roheim and Anderson, 2007). Where MPAs are expected to create spillover effects or to improve the health of fish stocks, this approach could be replicated, with tax revenues being directed to MPA management.

MPAs with nearby boat traffic may also generate revenue by collecting fines from ships violating restrictions by, for example, running aground on reefs (MSR, 2012) or fishing illegally. Apo Reef Natural Park in the Philippines collects fines from apprehended fishing vessels, which are deposited into the Integrated Protected Areas Fund, though their contributions to MPA management costs have not been quantified.

Subsidies

MPAs often enhance fisheries by either explicitly protecting fish stocks or the biodiversity that stocks depend on, resulting in increased fish yields, increased sustainability of extractive activities and increased recreational quality (Cook and Heinen, 2005). For example, average annual fisheries benefits of the two largest MPAs in the Seychelles were estimated to be

approximately USD 200 000 each (Cesar et al., 2004).[8] MPA costs can thus be considered a subsidy to fisheries (Cullis-Suzuki and Pauly, 2010). Financial support could be diverted from direct fisheries subsidies to MPAs under this assumption, including by converting jobs from the fisheries sector to MPA management. This would also aid in reducing financial stress in the fishing community (Gell and Roberts, 2003), thereby increasing political acceptability.

However, many of the subsidies received by fisheries may also be environmentally harmful, such as non-taxation of transport fuels. This leads to less efficient fishing methods and operations. In OECD countries, the fisheries sector has received approximately USD 6.4 billion a year in transfers from the government (OECD, 2006). The majority of this support is for management services, R&D and infrastructure, the effect of which is ambiguous, but it also includes support to inputs such as for bait, gear and fuel which can be environmentally harmful when they lead to increases in fishing effort due to lower marginal costs (Van Winkle et al., 2015; Borello et al., 2013).

A tax credit system can also be developed, in which private entities' payments towards conservation can be claimed against their tax payments (ADB, 2011).

Payments for ecosystem services, including blue carbon

Payments for ecosystems[9] (PES) programmes in the context of marine and coastal ecosystems are also being introduced. Based on the beneficiary-pays approach, those who would benefit from the enhanced provision of ecosystem services (i.e. above that of the status quo) can pay resource owners or managers to change their management practices so as to incentivise higher (or additional) ecosystem service provision.[10] Some particular challenges may arise in the context of applying PES in the marine environment: marine resources, particularly fish, are mobile and hard to monitor, and property rights are often poorly defined and insecure, increasing the difficulty of programme uptake (IIED, 2012). As PES programmes are based on the beneficiary-pays approach (rather than polluter pays), they may be more appropriate when the existing resource users are poorer population groups.

Potential buyers may include the fishing, tourism, recreation and marine renewable energy industries; municipalities and governments; and so forth (Lau, 2013; IIED, 2012; Forest Trends, 2010). For example, local hotels and tourism operators could pay for reef conservation due to the benefits associated with decreased beach erosion and species conservation (e.g. for scuba divers). Castano-Isaza et al. (2015) examine PES options for Colombia's Sunflower MPA, the largest MPA in the Caribbean. PES has

been used for seaturtle conservation efforts in Kenya, Tanzania and the Solomon Islands (Ferraro, 2007) and more recently, Binet et al. (2013) conclude that the European Union-Mauritania fisheries agreement, which allocates part of Europe's financial contribution to the conservation of marine ecosystems located within the Banc d'Arguin National Park, can be regarded as the first international PES of its kind.

PES programmes also show potential for involving local communities. The Luis Echeverria community in Mexico is protecting about 48.5 km^2 of grey whale habitat in exchange for USD 25 000, used to finance small-scale development and alternative income generation (IIED, 2012), and the government of Seychelles, with co-funding from the GEF, instituted a buyout and retraining programme for tortoiseshell artisans prior to banning commercial sales (Lau, 2013). Tanzania's Marine Legacy Fund derives revenues from commercial fishing licences, marine ecotourism revenue sharing, and oil and gas taxation that is used to pay coastal communities for conservation and to finance some operational expenses (Forest Trends, 2010).

Marine and coastal ecosystems also have climate mitigation potential. Coastal ecosystems such as salt marshes, seagrass beds and mangroves all store sizable amounts of carbon, creating potential for usage with UNFCCC mechanisms under developing "blue carbon" programmes. This would constitute an international PES and could be useful for MPA financing in cases where MPAs include coastal zones. Loss by conversion from marshes, mangroves and seagrasses can imply a release of 0.15-1.02 billion tonnes of carbon dioxide (Lavery et al., 2013). Mangroves and seagrasses support fish habitats and increase fish production, stabilise shorelines, filter land-based pollution, and influence and shelter the fish populations of nearby reefs, and reefs in turn act as wave and current breakers and erosion protectors for coastal ecosystems. In Kenya, for example, the Mikoko Pamoja community-based mangrove conservation project has been certified for entry into the voluntary carbon market, and it is expected that one-third of funds generated – about USD 4 000 – will be used for mangrove conservation (AGEDI, 2014).

Studies are also beginning to investigate the carbon sequestration capacity of marine species (Lutz and Martin, 2014). Sea otters, predators of sea urchins which are grazers, therefore maintain and increase the health and carbon storage capacity of seagrass and kelp beds; marine vertebrates, especially large ones, stimulate phytoplankton production, fish productivity and carbon uptake; and food chain processes transport carbon away from the surface of the ocean. The carbon service value of sea otter influence on kelp beds has been estimated at USD 205-408 million (one-time payment), or USD 16-33 million (one-time payment invested at 8% return) (Wilmers et

al., 2012), while that of marine life in the high seas has been estimated at USD 148 billion (Lutz and Martin, 2014; Rogers et al., 2014).

Marine bioprospecting

The biological diversity of reefs and of marine environments may provide opportunities for collecting marine bioprospecting fees, especially under the Convention on Biological Diversity's Nagoya Protocol on Access to Genetic Resources. In 1992, the US National Cancer Institute paid the Coral Reef Foundation USD 2.9 million for reef samples to be used in cancer research (Spurgeon and Aylward, 1992). Costa Rica's National Biodiversity Institute (INBio) is permitted to undertake bioprospecting in protected areas in collaboration with academia and private enterprise, with the stipulation that 10% of research budgets and 50% of any future royalties be donated to the Ministry for Conservation. In 2006, INBio entered into an agreement to be paid USD 6 000 per year by a biotech company for two natural resource-based materials, one of which was a protein derived from a marine organism (WWF, 2009). Similarly, a USD 30 000 agreement between a pharmaceutical company and Fiji's Verata District helped to sustain marine conservation work in the area (WWF, 2005).

Marine biodiversity offsets

Coastal development, such as urban expansion, port development to support exporting industries and the development of seabed mining, can adversely impact biodiversity and habitats. Biodiversity offsets in the marine context could be explored in such cases. Based on the polluter-pays approach, any excess damage caused after the application of the mitigation hierarchy would need to be compensated by restoration elsewhere. Such restoration efforts could be targeted to areas where new MPAs need to be developed. An example of an offset programme applied in the coastal context can be found in the Australian province of Queensland that instituted a fish habitat offsetting policy in 2002 (Queensland Government, 2002).[11] Other examples exist often involving coastal habitats such as eelgrass and intertidal reefs (Dickie et al., 2013), and a voluntary blue carbon offset programme, called SeaGrass Grow, has been established by the Ocean Foundation in the United States to restore seagrass meadows, which are among the most effective natural ecosystems for sequestering carbon.

Dickie et al. (2013) and Dickie (2014) suggest further applications, for example allowing marine development such as a pipeline or cable to be placed in a sensitive area to avoid an expensive re-routing, and compensating any residual damage by recreating habitat several times greater than that damaged for a much lower cost. Marine renewable energy installations, such as for tidal and wave generation, may also be appropriate

candidates for offsets, especially as attention to the ocean's potential for renewable energy generation continues to increase. Similarly, offsets could be applied to oil and gas drilling and exploration, or to deep seabed mining, and sections of coral reefs expected to be damaged by development could be removed, stored and then transplanted to protected areas, or funding could be directly allocated to reef restoration.

Belize has recently produced a framework for marine and coastal offsets (Belize Coastal Zone Management Authority & Institute and Australia-Caribbean Coral Reef Collaboration, 2014).

Private sector partnerships

Partnerships with the private sector may take several forms, ranging from direct corporate social responsibility-based investments to collaborations between private entities and NGOs or protected area management bodies, although it should be noted that the private sector may not always offer long-term funding (Erdmann et al., 2003).

In the Philippines, a corporation partnered with an NGO to fund parts of a management programme for the Verde Island Passage MPA network (ADB, 2011), while in Indonesia, Misool Eco Resort established and maintains a 1 220 km^2 MPA, including two separate no-take areas totaling 828 km^2, through tourism revenue, institutional donors, and partnerships with local communities and other industries (Misool Baseftin, n.d.; Forest Trends, 2010).

MPAs can also earn revenues by charging concession fees for the sole right to operate inside their boundaries, thereby delegating some aspects of management to the private sector or NGOs. Alternatively, private sector entities with an economic interest in preserving the MPA – e.g. tour operators depending on MPA quality – may consider cost-sharing arrangements with the publicly funded MPA management body. These approaches can aid in day-to-day operations by providing patrol and monitoring assistance, maintenance, or other day-to-day duties that can be completed at lower cost by tour operators, in return for service improvements or concessions from the management body (Emerton and Tessema, 2001).

To ensure transparency and long-term security, public-private partnerships may formalise their legal and financial agreements, such as was done in California for the Marine Life Protection Initiative through a binding agreement and a jointly managed endowment fund (Living Oceans Society, 2012). Private operators have also become involved in the management of the Great Barrier Reef MPA through a variety of mechanisms: resorts provide rangers, commercial fishers pay mooring fees, dive operators monitor illegal fishing, and so forth (CFA, 2003). The Great Barrier Reef Marine Park Authority administers the Eye on the Reef

monitoring and stewardship programme in collaboration with scientists, tourism operators, park rangers and other users (Great Barrier Reef Marine Park Authority, 2014), and tourism operators are building their capacity to undertake starfish management through diver training, in conjunction with the Australian government's Reef Trust Program (Government of Australia, 2014). Similarly, protection for the Jardines de la Reina national park in Cuba was supported by a public-private venture between the government of Cuba and a private company operating a catch-and-release fishing camp, whose best interest was to ensure the area remained pristine (Morris, 2002).

Several similar agreements exist in the Sulu-Sulawesi Seas Marine Ecoregion. The Gilutongan Marine Sanctuary in the Philippines entered into an agreement with a private firm in 2007 to market and manage the sanctuary's 20-metre buffer zone, in which the local municipality was entitled to receive a total of 18 million Philippine pesos over three years. The agreement was renewed in 2011, and was still in place as of 2012 (MSR, 2012). In Malaysia, the Sabah Wildlife Department has outsourced the management of an MPA to a private company, in which the firm pays the state 60 000 ringgits per year and is required to invest in conservation and protection, in exchange for tourism rights (PE Research, 2010). Lastly, in Indonesia, the North Sulawesi Watersports Association provides in-kind support to the Bunaken Marine National Park. Dive operators have sponsored a range of programmes aiding park management, including education scholarships for locals, handicraft sales that create extra sources of income and conservation education activities. Operators also regularly participate in beach and reef cleanups, fish monitoring, enforcement activities and other management operations, resulting in significant savings for the management authority (Erdmann et al., 2003).

In some cases, the private sector may be able to drive the creation of new MPAs (Box 4.1).

Engaging industries such as oil and gas, or others aiming to meet corporate social responsibility requirements, is another option for sourcing funding for MPAs (MSR, 2012; PE Research, 2010). For example, in 2008 the Malaysian infrastructure conglomerate YTL Corporation Berhad donated more than MYR 700 000 (Malaysian ringgits) raised from a climate change fundraising event to Reef Check Malaysia, a reef monitoring non-profit. In 2010, it launched a fellowship of USD 2 million to be donated from 2010 to 2014 for community-based conservation programmes in Asia. In its first year, it identified 22 outreach campaigns in the Coral Triangle to be conducted by YTL fellows (YTL Community, 2010).

Developing a finance strategy for marine protected areas

Given the severe finance shortage across many MPAs, greater efforts are needed to secure the resources that are required to ensure effective MPA management. Developing an MPA financing strategy can help to identify needs and structure the required steps to do this. At a minimum, an MPA finance strategy should be composed of:

Box 4.1. Chumbe Island Coral Park, Zanzibar

Chumbe Island Coral Park, comprised of a 22-hectare coral island and part of a fringing reef, was gazetted by the government of Zanzibar in 1994 as a protected area following an investment proposal by a private entity, Chumbe Island Coral Park Ltd. (CHICOP), which was allocated management rights. Establishment costs were initially estimated at USD 200 000, with payback expected to begin after three years at an internal rate of return of 27%, but a three-year delay and unexpected administrative difficulties caused cost overruns which resulted in a final establishment outlay of USD 1.2 million, in addition to a significant amount of volunteer work. Approximately 36% of this outlay was funded by various donors, with the rest funded privately by the project initiator. CHICOP developed eco-tourism facilities which as of 2006 were sufficient to cover recurrent management costs – but not capital payback – at an occupancy rate of 30-40%.

CHICOP has pursued unconventional approaches for operational and business development goals. Local fishers were retrained as park rangers, and in addition to patrolling the island, have rescued over 160 vessels with between 2-16 fishermen each since 1994, likely saving several lives. As private employees, rangers are unarmed, and "enforce by informing" local fishers on the value of the protected area. Spillover catches have indeed been reported, enhancing local support for the park. Today, Chumbe Island is one of the most biodiverse reefs in the region.

With respect to business development, as a small company, traditional marketing costs to leverage the tourism market would have been prohibitive. Instead, CHICOP applied for and won several international environmental awards, providing marketing exposure equivalent to USD 10 million.

CHICOP's example provides insight into some enabling conditions that aid in effectively engaging the private sector, including the existence of an attractive investment climate and little competition from large, donor-funded projects. Furthermore, tourism, fishing and other uses often coexist in the same area, resulting in a need to negotiate, and CHICOP's small, local nature may have afforded it an advantage over a central authority in this regard, due to co-dependencies between it and the local communities.

Sources: Emerton, L., J. Bishop and L. Thomas (2006), "Sustainable financing of protected areas: A global review of challenges and options" https://cmsdata.iucn.org/downloads/emerton_et_al_2006.pdf; Lindhjem, H. (2003), "Sustainable financing of marine protected areas in Zanzibar", www.lindhjem.info/FinanceZan.pdf; Riedmiller, S. (2003), "Private sector investment in marine protected areas: Experience of the Chumbe Island Coral Park in Zanzibar/Tanzania".

1. an assessment of financing needs (see Chapter 2)
2. identification of stakeholders, including the polluters and the beneficiaries (and at what scale – local/regional/global)
3. assessment of different finance sources available for MPAs (see above), and which offer the greatest potential and long-term source of revenue, given the socio-economic and other characteristics in the area
4. assessment of barriers to implementation and procedures for operationalisation.

According to the French National Strategy for the Creation and Management of Marine Protected Areas, the estimated annual costs for an MPA network covering 20% of French waters will amount to around EUR 170 million by 2020 (Table 4.3). Based on current financing principles for MPAs in France, the majority of this will be financed by the government.

Table 4.3. **Estimated cost of the marine protected area network in French waters**

	Estimated annual cost for the marine protected area network (20% by 2020) million EUR
Surveillance (monitoring and control)	70.3
Studies, expert assessment	37.6
Interventions	36.3
Awareness raising	25.8
Total	170

Source: French Ministry of Ecology, Sustainable Development and Energy (2015), "National Strategy for the Creation and Management of Marine Protected Areas: Summary", www2.developpement-durable.gouv.fr/IMG/pdf/National_strategy_for_the_creation_and_management_GB_Web.pdf.

The identification of the polluters (i.e. those causing adverse impacts to the existing or proposed MPA) can help to determine whether mechanisms are in place to internalise the externalities and whether there is additional scope for additional taxes and fines to help address these. Part of the revenues obtained from such instruments could be earmarked for MPA management. The beneficiaries of MPAs can include a larger number of stakeholders including up to the global level. Examples include international tourism benefits from biodiversity conservation, habitat for endangered and migratory species, replenishing fish stock for commercial fisheries, carbon sequestration and mitigation of natural disasters and impacts related to

climate change. User fees and international payments for ecosystem services can be considered as additional means to mobilise finance for MPAs.

Despite the finance challenge for MPAs, few examples exist of MPA finance strategies. A few exceptions include a financing scoping exercise in the Sulu-Sulawesi Seas Marine Ecoregion, Indonesia (MSR, 2010) and a finance strategy and plan in Belize (Box 4.2).

Box 4.2. Sustainable finance strategy and plan for the Belize Protected Area System

A study was undertaken in 2011 for the government of Belize to help develop a finance strategy for the national protected area system. This consisted of the following components:

- financial analysis – needs and gaps
- review of existing financial mechanisms (e.g. PACT, government budget, development aid, debt for nature swaps)
- market analysis of revenue-generating options
- enabling conditions (e.g. legal, institutional, barriers)
- pre-feasibility of revenue-generating options
- scenario analysis (projections for revenue and expenditures)
- financial plan/strategy (including recommendations and timeline).

Source: Drumm, M.E. et al. (2011), "Sustainable finance strategy and plan for the Belize Protected Area System".

In a recent financial analysis of Mediterranean MPAs (Binet et al., 2015; see also above), where only 8% of the financing needs for effective management of MPAs are covered by current resources, the authors recommend that additional financing needs could be partly covered by local mechanisms, including local public support; and that additional financing mechanisms should be developed, such as entrance and users fees, earmarking of charges collectable under the occupation of public land, among others. They also recommend strengthening regional co-operation to achieve more complementary and joint management, optimising the consumption of resources.

Spergel and Moye (2004) have developed a list of feasibility criteria for the finance mechanisms (Box 4.3).

The IUCN-WCPA (2008) suggests several main components of sustainable financing strategies: sharing responsibilities with stakeholders to build support and ownership; building diverse funding portfolios; improving financial administration; comprehensively addressing all costs and benefits; instituting transparent governance; creating an enabling framework by overcoming market, price and policy distortions; and building capacity to use financial tools and mechanisms.

Box 4.3. Feasibility criteria for the financing mechanism

Financial

- How much money will actually be needed each year to support the particular marine conservation programmes and activities that are envisaged?
- How much revenue is likely to be generated each year by the new financing mechanisms?
- Will the revenues generated be worth the cost of setting up the new system of user fees, taxes, debt-for-nature swaps or trust funds?
- Could the revenues vary substantially from year to year depending on global and national economic, political and natural conditions?
- How will a highly variable revenue flow affect the conservation programmes that the financial mechanism is intended to pay for?
- What other sources of funds might be available, either on a long-term or a one-time basis?

Legal

- Can the proposed financing mechanisms be established under the country's current legal system? Some legal systems do not recognise concepts such as easements or development rights. In other legal systems, there may be a constitutional prohibition against earmarking tax revenues or fees for specific purposes.
- Will new legislation be required in order to establish the proposed financing mechanism?
- How difficult and time-consuming will it be to pass such legislation?
- Could the new financing mechanism be established under current legislation, by simply issuing an administrative or executive order?

Box 4.3. Feasibility criteria for the financing mechanism (*continued*)

Administrative

- In the particular country, how difficult will it be to administer, enforce, collect or implement a particular type of user fee, tax, or quota and trading system?
- Will it be too complicated or costly to administer?
- Are there enough trained people (or how difficult will it be to train enough people) to administer and enforce the system?
- Will implementing the particular user fee, tax or quota depend too much on the discretion of individual officials and therefore present too many opportunities for corruption?
- Can safeguards be devised to limit potential problems?
- How difficult will it be to collect, verify and maintain the data upon which a particular user fee, tax or trading system is based? For example, how difficult will it be to keep track of the amount of fish that are caught each day or each month by particular individuals, communities or commercial fishing vessels; or the number of people who visit a marine protected area (MPA), or who use particular products or ecological services provided by the MPA?

Social

- What will be the social impacts of implementing a particular system of generating revenues for conservation?
- Who will pay, and what is their willingness and capacity to pay?
- Will the new financing mechanism be perceived as equitable and legitimate?

Political

- Is there government support for introducing the new financing mechanism?
- Can the government be relied upon to spend the new revenues only for the purposes intended, or is there a strong likelihood that the money may end up being used for other purposes?
- Can this be monitored and ensured by the courts or the media or non-governmental organisation "watch-dog" groups or particular user groups or an independent board of directors or an international agency?

Box 4.3. **Feasibility criteria for the financing mechanism** (*continued*)

Environmental

- What will be the environmental impact of implementing the new financing mechanism? For example, for tourism-based mechanisms will the desire to increase revenues from tourism compromise conservation objectives or exceed the carrying capacity of the MPA?

Source: Spergel, B. and M. Moye (2004), *Financing Marine Conservation: A Menu of Options*, http://awsassets.panda.org/downloads/fmcnewfinal.pdf.

Table 4.4. **Financing marine conservation and sustainable use**

Financing mechanism (source of revenue)
Government revenue allocations
Direct allocations from government budgets (government budget revenues)
Government bonds and taxes earmarked for conservation (investors, taxpayers)
Lottery revenues (gamblers)
Premium-priced motor vehicle license plates (vehicle owners)
Wildlife stamps (postal customers, hunters, fishers)
Debt relief (donors, government, non-governmental organisations)
Grants and donations
Bilateral and multilateral donors (donor agencies)
Foundations (individuals, corporations)
Non-governmental organisations (NGO members and supporters)
Private sector (investors)
Conservation trust funds (multi-source)
Tourism revenues
Protected area entry fees (visitors to parks)
Diving and yachting fees (divers, boaters)
Tourism-related operations of protected area (agencies, tourism operators, tourists)
Airport passenger fees and cruise ship fees, taxes and fines (tourists, cruise lines)
Hotel taxes (hotel clients)
Voluntary contributions by tourists and tourism operators (tourism operators, tourists)
Real estate and development rights
Purchases or donations of land and/or underwater property (property owners, donors)
Conservation easements (property owners, donors)
Real estate tax surcharges for conservation (property owners, donors)
Tradable development rights and wetland banking (property developers)
Conservation concessions (conservation investors)

Table 4.4. **Financing marine conservation and sustainable use** (*continued*)

Fishing industry revenues
Tradable fishing quotas (commercial fishers)
Fish catch and services levies (commercial fishers)
Eco-labelling and product certification (seafood producers, wholesalers, retailers and end-use purchasers of ornamental tropical fish and corals)
Fishing access payments (governments, associations of and/or individual fishers)
Recreational fishing license fees and excise taxes (recreational fishers)
Fines for illegal fishing (fishers)
Energy and mining revenues
Oil spill fines and funds (energy companies, donors)
Royalties and fees from offshore mining and oil and gas (energy and mining companies)
Right-of-way fees for oil and gas pipelines and telecommunications infrastructure (private companies)
Hydroelectric power revenues (power producers)
Voluntary contributions by energy companies (energy companies)
For-profit investments linked to marine conservation
Private sector investments promoting biodiversity conservation (private investors)
Biodiversity prospecting (pharmaceutical companies)

Source: Spergel, B. and M. Moye (2004), *Financing Marine Conservation: A Menu of Options*, http://awsassets.panda.org/downloads/fmcnewfinal.pdf.

Notes

1. For example, in a study of 83 MPAs worldwide, Balmford et al. (2004) found that, on average, the funding shortfall was approximately one-half of requirements (median value of USD 2 698 per km² per year). A similar study by Gravestock, Roberts and Bailey (2008) on the financing requirements of 79 MPAs in 36 countries found that a median of 15% and 74% funding increases were required to meet minimum and ideal requirements, respectively.
2. This was partly because the parks were unable to retain a large enough proportion of revenues raised from user fees.
3. Government allocations to the Montego Bay Marine Park in Jamaica, for example, decreased from JMD 1.2 million in 1998 to less than JMD 100 000 in 2004.
4. www.marfund.org.

5. When price elasticity of demand is relatively inelastic, the percentage change in quantity demanded is smaller than that in price. Hence when the price is raised, total revenue increases. The opposite holds when price elasticity of demand is relatively elastic. Pascoe et al. (2014), for example, estimate the price elasticity of demand for dive tourism in Indonesia, Malaysia and Thailand and find this to be highly inelastic.
6. Though the authors caution that this is atypical, and that hidden and unaccounted costs may have existed.
7. They are unrequited in the sense that benefits provided by the government to taxpayers are not normally in proportion to payments.
8. Assuming high reef productivity and spillover; assuming one hectare of reef closure provides equivalent yield to three open hectares.
9. As noted earlier, France uses the term payments for environmental services to make a distinction between when payments for services should be warranted (i.e. when changes in management practices result in additional services). Additionality should in fact be a pre-requisite for any payment; see OECD (2010) for a discussion.
10. For a detailed discussion of key features that need to be considered in designing a PES programme, including establishing baselines, ensuring additionality, addressing potential leakage and ensuring permanence, see OECD (2010).
11. Absorbed into the Queensland Environmental Offsets Policy of 2014.

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