



From Outcomes to Inputs: What is Required to Achieve the Ecological and Socio-Economic Potential of Marine Protected Areas?

Nathan Bennett and Philip Dearden

A working paper of Project IMPAACT and the Marine Protected Areas Research Group



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Marine Protected Areas Research Group

The Marine Protected Areas Research Group focuses on all aspects of the establishment and management of marine protected areas within the context of integrated coastal management. We believe that interaction amongst committed individuals from different backgrounds and perspectives provides an enriched environment for advancing knowledge regarding MPAs. The group undertakes research on all aspects of MPAs, ranging from institutional assessments and social surveys through to basic biogeographical studies on marine and coastal ecosystems. Active research programs have been or are currently underway in Canada and throughout much of the developing world including Southeast Asia, Africa, and Latin America. For more information on the Marine Protected Areas Research Group, please visit <http://mparg.geog.uvic.ca/>.

Project IMPAACT

The Andaman Bioregion of Thailand is one of the most abundant and diverse marine ecosystems in the world and is home to 18 marine protected areas. The region is a centre of tropical marine biodiversity, but the reefs and other key ecosystems are deteriorating due to a wide range of pressures. This year (2010) witnessed the most severe coral reef bleaching ever and climate change will have an increasing impact on marine ecosystems in the future. At the same time there are many communities that are dependent upon marine and coastal resources for their livelihoods. These dependencies range from traditional and commercial fishing activities through to more recent dependence on coastal tourism. These activities will also see significant changes as coastal ecosystems change. The goal of Project IMPAACT is to provide further understanding of likely climate-change induced changes in coastal ecosystems and communities and suggest interventions that can increase the resilience of ecosystem conservation and the adaptive capacity of livelihood dependent communities in the future. The IMPAACT acronym stands for Improving Marine Protected Areas on the Andaman Coast of Thailand. IMPAACT is a project of the [Marine Protected Areas Research Group](#) at the University of Victoria, Canada. For more information about Project IMPAACT or this publication please visit <http://projectimpaact.asia> or contact:

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From Outcomes to Inputs: What is Required to Achieve the Potential Ecological and Socio-Economic Potential of Marine Protected Areas?

by Nathan Bennett¹ and Phil Dearden²

Abstract: Marine protected areas (MPAs) are one tool that has been shown to be effective for achieving marine conservation objectives. MPAs might also result in beneficial social and economic outcomes for local communities through, for example, increasing fish abundance and the resultant spillover into surrounding fisheries or the creation of alternative livelihoods. Yet the percentage of MPAs that might be considered “successful” on ecological and/or socio-economic accounts is debatable. MPA scholars and conservation organizations alike have suggested that much remains to be understood about what the requirements are for successful implementation and operation of MPAs. It is on this problem that this paper focuses through asking: “What inputs are required to achieve the potential ecological, social, and economic outcomes of marine protected areas?” In this paper, we discuss the potential positive and negative outcomes of MPAs and explore the inputs required to achieve balanced and beneficial outcomes while giving consideration to the implications of local and macro contexts. Moreover, we suggest that a tripartite approach to MPA implementation and operations that gives appropriate and contextualized attention to governance, management, and development is more likely to lead to successful MPA outcomes as there are inherent feedbacks between the three inputs.

Keywords: marine protected areas, development, management, governance, success

Introduction

The importance of marine conservation cannot be understated. The world’s oceans are of global importance for oxygen production and carbon absorption, climatic regulation and processes, and food and medicine provision (Thorne-Miller, 1999). Yet the health of the world’s oceans at the global scale is threatened due to loss of biodiversity, declines in important marine habitats, increasing pollution and eutrophication, chronic overfishing and overexploitation of resources, unsustainable marine and coastal development, and shifting climatic conditions (Allsopp, Page, Johnston, & Santillo, 2009; Holland & Pugh, 2010). At a local level, the ocean provides important ecosystem services such as climate regulation, shoreline protection, cultural and spiritual meaning, building materials, and recreation/tourism. Much of the world’s coastal population also relies on the marine environment for the commercial and subsistence harvest of fish, seafood, and other natural resources (e.g., Loper et al., 2008). However, many of the world’s fisheries are in sharp decline due to increasing pressure on the resource, chronic overfishing and overexploitation, use of destructive fishing gear, lack of stewardship, and mis-management (Longhurst, 2010; Sobel & Dahlgren, 2004a). Important areas of biodiversity and critical marine habitats, such as coral reefs, mangroves, estuaries, and sea grasses, are also threatened (Allsopp et al., 2009; Blaber, 2009).

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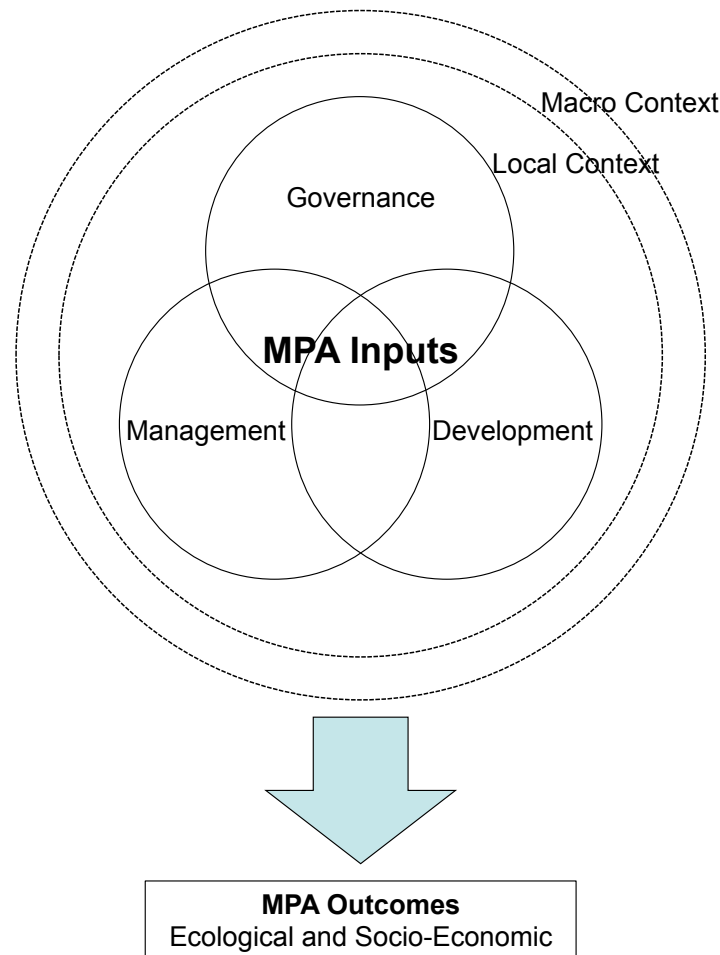
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Marine Protected Areas (MPAs) have come to be promoted as one effective tool for managing fisheries, conserving species and habitats, maintaining ecosystem functioning and resilience, preserving biodiversity, and protecting the myriad of human values associated with the ocean (Agardy, 1997; Murray et al., 1999; Salm, Clark, & Siirila, 2000a; Sobel & Dahlgren, 2004a). According to the World Conservation Union (IUCN), an MPA is “[a]ny area of the intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment” (Kelleher, 1999). MPAs can vary significantly in size and function, level of protection and use, and legal status. Historically, the primary mandate of MPAs was conservation. The result is that earlier MPAs were formed in a similar manner to their terrestrial conservation counterparts, with little consideration of the local populations who depended on the contained area or resources for livelihoods or survival (Noel & Weigel, 2007). Localized impacts stemming from lack of consideration, lack of inclusion, and even physical displacement has often lead to a problematic relationship between MPAs and local communities (Diegues, 2008; Prasertcharoensuk, Shott, Weston, & Ronarongpairee, 2010; Sunde & Isaacs, 2008; Paige West, Igoe, & Brockington, 2006). Consideration should be given to the “human dimension” and local development, it is argued by many proponents of MPAs, since local perceptions of MPAs and the success of livelihood strategies are important determinants of success (Agardy et al., 2003; Christie et al., 2003; Christie et al., 2005; Pollnac, Crawford, & Gorospe, 2001; Torell, Crawford, Kotowicz, Herrera, & Tobey, 2010; Heck & Dearden, 2012). Others suggest that there are a myriad of perceptions that need to be addressed in order for MPAs to be deemed successful and to be supported over the long term (Brechtin, Murray, & Mogelgaard, 2010; Murray, 2005). Moreover, in recent decades, the mandates and goals of MPAs have shifted away from a priority on conservation, with importance also given to recreational and scientific values, to the recognition of a plurality of goals including sustainable development (Noel & Weigel, 2007).

A growing body of literature suggests that MPAs can have beneficial outcomes for the environment and for local communities. Ecologically, MPAs can protect habitats and ecosystems – including their structure, function, and integrity – and lead to increases in species diversity, richness, and numbers (e.g., Lester et al, 2009; Angulo-Valdes & Hatcher, 2010). From a socio-economic perspective, it has long been theorized that the creation of MPAs, particularly no-take-zones (NTZ), can lead to beneficial outcomes for local fisheries through the replenishment of commercially valuable and depleted stocks leading to the “spillover” of adult fish into surrounding waters (Bohnsack, 1998; Roberts & Polunin, 1993; Salm et al., 2000a). Authors have also suggested that socio-economic and conservation outcomes might be balanced through the development of tourism (Agardy, 1993; Dharmaratne, Yee Sang, & Walling, 2000; Dixon, Scura, & Hof, 1993) and also through the promotion of other alternative livelihood strategies (Elliott, Mitchell, Wiltshire, Manan, & Wismer, 2001b; Pollnac et al., 2001). The general hypothesis has become that MPAs both *can* but also *should* lead to win-win outcomes for conservation and development thus satisfying the needs of conservationists, governments, fishers, tourism operators, and local communities (Roberts, Hawkins, & Campaign, 2000; Salm et al., 2000a). However, the successful achievement of this dual social and ecological mandate is more complex in reality than in theory. Indeed, many authors and reports have questioned how effective MPAs have been at achieving either social or ecological outcomes (e.g., Burke et al, 2002; Christie, 2004; Lowry et al, 2009) which leads us to the question: “What inputs are required to achieve the potential ecological and socio-economic outcomes of marine protected areas?” We concur with several other authors in arguing that more attention needs to be given to “how?” to achieve successful outcomes for local communities and conservation (Agardy et al., 2003; Christie et al., 2003; Mascia, 2003). As noted by Gjertsen (2005a, p. 199) “Disentangling the factors that contribute to effective conservation and improved human welfare is difficult, but necessary for understanding when these win-win scenarios are likely to emerge”.

As an introduction to this review paper's central question, we will review the literature on the potential benefits and negative consequences of MPAs and the relationship between MPAs and *local* community socio-economic development through focusing on livelihoods and well-being. The literature ultimately shows that the purported and desired benefits of MPAs are a manifesto of potentials rather than a given result of MPA formation. Thus the majority of this paper is devoted to a discussion of the inputs required to lead to beneficial socio-economic and ecological outcomes from MPAs in consideration of both macro and local contexts. In conclusion, we suggest that an equivalent amount of attention needs to be paid to three aspects of MPA implementation and operation - management, development, and governance – as there are inherent feedbacks between each facet. A visual heuristic of this paper's argument is provided in *Figure 1*. The discussion presented in this paper is likely more relevant to MPAs in a Low Development Country (LDC) context; however, the lessons explored and recommendations made herein also have implications for MPA creation and management in HDCs.

Figure 1 – A heuristic for understanding the inputs required to achieve beneficial MPA outcomes



Outcomes: The Potential Benefits and Consequences of MPAs

One recent paper to explore the benefits of MPAs provides a list of 99 specific benefits that fall within nine categories including fishery, non-fishery (other harvesting, recreation/tourism, alternative employment), management, education/research, cultural, process, ecosystem, population, and species benefits (i.e., Angulo-Valdés & Hatcher, 2010). The list proposed by these authors follows after a

burgeoning literature focusing on the potential benefits of MPAs that also specify similar classifications of benefits (e.g., Agardy, 1993; Jones, 2002; Kenchington, Ward, & Hegerl, 2003; Samonte, Karrer, & Orbach, 2010). For example, Sobel (1996) suggests there are three categories of non-fisheries benefits of MPAs: 1) protecting ecosystem structure, function, and integrity, 2) increasing knowledge of marine ecosystems, and 3) encouraging non-consumptive uses. In general, lists of benefits fall into two broad categories: benefits to natural systems and benefits to human communities or society. Yet, the simple act of declaring or creating an MPA does not guarantee these purported nor even locally desired benefits. Many empirical studies have been conducted that show that the creation of MPAs can have both positive and adverse effects on local livelihoods and wellbeing and may not result in positive ecological outcomes. These literatures are explored below.

Outcomes: Environmental and ecological benefits of MPAs

Angulo-Valdes and Hatcher (2010) provide a succinct overview of the benefits of MPAs “to nature” including process benefits, ecosystems benefits, population benefits, and species benefits (see *Table I*). No-take reserves, in particular, have been shown to result in beneficial environmental outcomes. A recent global review of no-take reserves affirms that no take MPAs have resulted in average increases in biomass of 446%, species density of 166%, in species richness of 21%, and in size of organisms of 28% (Lester et al., 2009). The authors comment that these results are not an artifact of location or climate and that even smaller areas seem to have significant biological benefits. Claudet et al (2008) find that larger reserve size does lead to greater overall density of reserve fish but that larger buffer zones result in decreases. Lester and Halpern (2008) also show that partially protected areas may result in some benefits but that there is a significant difference between no-take areas and partially protected areas in terms of overall benefit and density of organisms. No-take MPAs have also been demonstrated to lead to significant spillover of adult species into surrounding areas (Halpern et al., 2009). When well managed, MPAs can lead to the protection of critical habitats, such as coral reefs, mangroves, and seagrass beds (Salm et al., 2000a). For example, individual MPAs and networks may lead to improvements in coral cover, reef ecology, and structural integrity through limiting the effects of fishing and destructive fishing practices on coral reefs (Christie, 2005; McClanahan & Arthur, 2001; McClanahan, Muthiga, Kamukuru, Machano, & Kiambo, 1999) and through increasing coral reef resilience to climate change (Keller et al., 2009; McClanahan, Cinner, Graham, Daw, Maina, Stead, Wamukota, et al., 2009).

Many of the potential ecological benefits of MPAs are threatened by broader environmental conditions (e.g., Keller et al., 2009), levels of management in the broader seascape (Charles & Wilson, 2009; Christie & White, 2007; Sanchirico et al., 2002), and impacts of current and future development. For example, McClanahan et al (2006) demonstrate that neither national parks, nor co-management, nor traditional management arrangements were particularly effective at reducing hard coral cover loss in Papua New Guinean or Indonesian MPAs. MPA related tourism development, if left unmanaged, can potentially lead to increased pollution, waste, and sedimentation from nearshore construction (e.g., Agardy, 1993). Documented negative impacts of recreational impacts in MPAs have related to trampling in intertidal and subtidal areas, anchoring in reefs and sea grass beds, and damaging corals from SCUBA diving (see Milazzo, Chemello, Badalamenti, Camarda, & Riggio, 2002 for a review). Increases in marine-based tourism may also result in negative impacts on mega fauna such as whales (Young, 2003) or whale sharks (Ziegler, 2011; Ziegler, Dearden & Rollins, 2012). Similarly, if aquaculture is allowed in MPAs this can potentially lead to pollution and increased pressure on natural habitats and fish populations (Tung, 2003). Finally, though environmental benefits are possible the number of MPAs that are managed effectively may be in the minority. For example, Burke et al (2002) estimate that 14% are effectively managed in SE Asia and Lowry et al (2009) estimate that less than 20% of 1100 MPAs in the Philippines are managed effectively. Globally, only 24% of protected areas are managed ‘soundly’

(Leverington et al., 2010). These figures lead to serious questions about the actual number of MPAs that are achieving their ecological potential or environmental objectives.

Table 1 – The benefits of MPAs to nature (Angulo-Valdes & Hatcher, 2010)

Process benefits	Ecosystem benefits	Population benefits	Species benefits
<ul style="list-style-type: none"> • Allow for suitable nutrient cycles • Protect from coastal erosion • Provide physical refuge • Maintain global climate regulation • Avoid physical damage to habitats • Sustain evolutionary processes • Protect critical habitats • Maintain biological diversity • Allow for the transformation, detoxification, and sequestration of pollutants 	<ul style="list-style-type: none"> • Eliminate second order impacts • Maximize ecosystem resilience • Preserve natural communities composition and functioning • Ensure biodiversity protection • Prevent cascading ecosystem effects • Maintain trophic structure and food web • Maintain key areas (reproductive, nursery, feeding) • Allow for ecosystem recovery 	<ul style="list-style-type: none"> • Protect natural population structure and functioning • Protect genetic resources and diversity • Restore population size and age structure • Protect spawning populations (commercial and non-commercial) • Increase survival rates for juveniles and adults • Increase natural recruitment • Allow recovery of depleted populations • Increase reproductive outputs 	<ul style="list-style-type: none"> • Protect keystone and dominant species • Prevent loss of vulnerable species • Sustain species presence and abundance • Prevent loss of rare species • Protect long-lived species (sea turtles) • Protect slow-growth species • Protect low-reproductive species • Allow for complete species interaction • Protect migratory species • Restore species abundance and biomass • Restore species diversity

Outcomes: Improved Livelihoods?

The concept of livelihoods is a useful proxy or surrogate for development outcomes in local communities, particularly given that local people often rely on the sustainability of natural resources that are going to be contained in MPAs. Fishing and subsistence harvesting of other marine resources is the primary, or even only, livelihood strategy for many coastal people (Loper et al., 2008). Proponents have long argued that MPAs will benefit local fishers through the spillover of fish and other harvestable species from marine protected areas (Salm et al., 2000a). Empirical and modeling based studies have confirmed that, when well managed, MPAs can lead to fisheries benefits for local communities through increased catch and increased catch per unit effort (Gell & Roberts, 2003; Halpern, Lester, & Kellner, 2009; Jiang et al., 2008; Roberts, Bohnsack, Gell, Hawkins, & Goodridge, 2001; Russ, Alcala, Maypa, Calumpong, & White, 2004; Sanchiroco & Wilen, 2002). Larger scale commercial fisheries, too, may benefit from the creation of no take zones; however, since spillover tends to occur at smaller spatial scales (on average up to 800 meters) the provision of benefits to larger commercial fisheries would most likely require creation of larger MPAs or extensive networks (Gell & Roberts, 2003; Halpern et al., 2009). Perceptual studies have generally concurred that no-take reserves can lead to fisheries benefits outside their boundaries (e.g., Aswani & Furusawa, 2007a; Leisher, van Beukering, & Scherl, 2007). However, fisheries benefits may be unequally shared among groups within and between communities (Mascia, Claus, & Naidoo, 2010; Walker & Robinson, 2009). Given the potential for MPAs to contribute to fisheries, they have been referred to as a beneficial fisheries subsidy and insurance against management failure (Bohnsack, 1998; Cullis-Suzuki & Pauly, 2010). Though MPAs do appear to benefit fisheries in the long term when well managed, in the short term compensation or alternative livelihood options need to be considered since displacement of rights to access can lead to short-term

hardships (Shankar Aswani & Takuro Furusawa, 2007a; Brondo & Woods, 2007; Jiminez-Badillo, 2008). Diversification into alternative livelihoods may also reduce overall pressure on fisheries and the resource base (Ellis & Allison, 2004).

The development of alternative livelihood programs is an often-advertised benefit of MPA creation that is somewhat problematic. The most often suggested alternative livelihood strategy is tourism, in the form of SCUBA diving, snorkeling, boating, wildlife viewing, historical and cultural tourism, eco-voluntourism, and even recreational fishing (Agardy, 1993; Cooke, Danylchuk, Danylchuk, Suski, & Goldberg, 2006; Davis & Tisdell, 1995; Dearden, Bennett, & Rollins, 2006; Hoyt, 2005; Lemelin, Koster, Woznicka, Metansinine, & Pelletier, 2010). Tourism has significant potential as an MPA financing mechanism (Arin & Kramer, 2002; Dharmaratne et al., 2000; Ransom & Mangi, 2010; Wielgus, Balmford, Lewis, Mora, & Gerber, 2010) and may lead to economic benefits at a broader scale; however, the level of local community benefit from and involvement in tourism is an area of some debate. Some MPAs, such as the Great Barrier Reef MPA in Australia (Driml, 1999), Mendes Island MPA in the Mediterranean (Merino, Maynou, & Boncoeur, 2009), and Tsitskamma National Park in South Africa (Oberholzer, Saayman, Saayman, & Slabbert, 2010), have resulted in significant increases in tourism visitation and revenue (see also Badalamenti et al., 2000; Leisher et al., 2007). A recent global study of 78 coral reef MPAs found that 75% of tourism jobs were retained locally; however, a lack of testing for additionality does not ensure that these benefits are causally related to the MPA and not just mirroring outside changes (Hargreaves-Allen et al., 2011). For many MPAs, though, the level of local involvement in tourism may be minimal due to outside ownership, centralization and leakage of profits, outside hiring, lack of mechanisms for benefit sharing, and lack of local capacity (Brondo & Woods, 2007; Dixon et al., 1993; Gjertsen, 2005b; Govan et al., 2009; Mallerat-King, 2000; Young, 2003). If local communities are not benefiting from tourism, it cannot be considered a viable alternative and it may even lead to increased fishing. Though tourism has seen some success as an alternative livelihood strategy, it seems that few other alternative livelihood programs or strategies have shown long-term promise for supporting local communities or marine conservation (Gillett et al., 2008; Govan et al., 2009; Leisher et al., 2007; Torell et al., 2010). Potential alternative livelihood strategies that have been proposed or tried include: agriculture, raising livestock, aquaculture, mariculture, seaweed farming, beekeeping, handicrafts, tree nurseries, and pearl farming (Fencl, 2005; Gjertsen, 2005b; Govan et al., 2009; Koczberski, Curry, Warku, & Kwam, 2006; Torell et al., 2010; Tung, 2003). Finally, tapping into ecosystem service markets could also provide an incentive for local conservation while providing an alternative livelihood option. Potential markets can include species-based markets (Ferraro, 2007; Gjertsen & Niesten, 2010), carbon markets (Nellemann & Corcoran, 2009; Yee, 2010), bio-prospecting markets (Govan et al., 2009), biodiversity markets (Wetlands International, 2009), and tourism PES markets (Barr & Mourato, 2009; Chavez, 2007). MPAs can also contribute to local livelihoods through direct employment in the management of the area; however, this livelihood option is rarely discussed in the literature leading to questions about how often locals are employed in this stead.

Outcomes: Human Well-being

MPAs and the aforementioned livelihood strategies have also resulted in quite mixed outcomes in terms of human well-being. Various studies have shown that MPAs can result in increased food security, wealth and household assets, and levels of employment (particularly from tourism), diversified livelihoods, improved governance, greater access to health and social infrastructure, revitalized cultural institutions, strengthened community organization, greater participation in natural resource management, increased empowerment of women, and reinvigorated common property regimes for local communities (Aswani & Furusawa, 2007; Dixon et al., 1993; Govan et al., 2009; Hind, Hiponia, & Gray, 2010; Leisher et al., 2007; Mallerat-King, 2000; Mascia et al., 2010; Oberholzer et al., 2010; Russ et al., 2004; Samonte et al., 2010; Svensson, Rodwell, & Attrill, 2010; Tobey & Torell, 2006; Webb, Mailiao, &

Siar, 2004; Weiant & Aswani, 2006; White, Courtney, & Salamanca, 2002). Ecological services, such as coastal protection, may also lead to reduced vulnerability and improved household security. Yet MPAs and related developments can also lead to contrary socio-economic outcomes, including increased conflict and political struggle, exacerbated vulnerabilities, negative socio-cultural change, increased restrictions, decreased levels of power and alienation in natural resource management processes, forced migration, loss of assets, increased social tension, loss of social and educational facilities, inequitable distribution of benefits, further marginalization of marginalized groups, loss of tenure, as well as decreased food security in the short term and for some groups (Aswani & Furusawa, 2007; Bavinck & Vivekanandan, 2011; Brondo & Woods, 2007; Bunce, Brown, & Rosendo, 2010; Christie et al., 2003; Diegues, 2008; Dixon et al., 1993; Fabinyi, 2008, 2010; Gjertsen, 2005b; Govan et al., 2009; Hind et al., 2010; Mallerat-King, 2000; Mascia & Claus, 2009; Ngugi, 2000; Oberholzer et al., 2010; Prasertcharoensuk et al., 2010; Ransom & Mangi, 2010; Samonte et al., 2010; Sanchirico, Cochran, Emerson, Defense, & Rader, 2002; Sunde & Isaacs, 2008; Tobey & Torell, 2006; Walker & Robinson, 2009; Weiant & Aswani, 2006; Young, 2003). Rather than engaging in an extended discussion of this topic, the case-by-case positive vs negative binary that has been shown by socio-economic impact studies can be simply demonstrated in a table from Mascia and Claus (2009; see *Table 2*). As Mascia & Claus recognize, the creation of an MPA necessarily reallocates individual rights or bundles of rights, which can lead to a combination of benefits and negative consequences for the various stakeholders involved.

Table 2 - The potential socio-economic outcomes of MPA and related developments (after Mascia & Claus, 2009)

Governance	decreased/increased resource control
	property lost/gained
	use rights lost/gained
	conflict resolution mechanisms weakened/strengthened
Economic well-being	employment lost/gained
	income lost/gained
	assets lost/gained
	consumption reduced/increased
	benefits distributed equitably/inequitably
Health	health diminished/enhanced
	food availability reduced/increased
	nutritional status diminished/enhanced
	psychological well-being diminished/enhanced
	health services reduced/increased
Education	public services lost/gained
	human capital lost/gained
	education opportunities lost/gained
Social capital	social networks degraded/increased
	social status lost/gained
	partnerships/alliances lost/increased
	trust lost/gained
	marginalization increased/gained
Culture	cultural space lost/gained
	local knowledge lost/gained
	sense of place diminished/enhanced
	norms and values undermined/reinforced
	traditional management systems undermined/reinforced

In summation, the previous review presents a small fraction of a long and ongoing discussion on both the potential benefits and costs associated with the creation of marine protected areas. Yet, none of the 99 benefits mentioned by Angulo-Valdes & Hatcher (2010) are guaranteed results of MPA formation particularly since such a small percentage of MPAs may be managed effectively. Furthermore, many previous studies such as Leisher et al (2007) or reports such as Samonte et al (2010) do not provide a generalizable picture of the benefits of MPAs as they provide deliberately chosen samples and thus a skewed image of the impact of MPAs on communities. Thus these previous discussions represent a manifesto of potentials rather than a given result of MPA creation. Yet these studies suggest that MPAs can contribute to positive outcomes in certain contexts and given the right inputs. Given that the purported benefits remain within the realm of the possible, the most important questions to ask might be: ‘Under what conditions can MPA benefits be maximized?’ and ‘What inputs are required in what contexts to achieve beneficial outcomes?’. The remainder of this paper will delve into some of the contextual factors and inputs that are more likely to lead to beneficial socio-economic and ecological outcomes from MPAs.

Back to Inputs: Development, Management, and Governance

Ultimately, in order for MPAs to be considered successful, both substantive outcomes and procedural inputs need to be taken into account. For example, it is a constant tenet of conservation that the success of MPAs relies on the consideration of local populations needs, values, aspirations, and the provision of alternative livelihoods (Agardy et al., 2003; Christie et al., 2003; Christie et al., 2005; Pollnac et al., 2001; Torell et al., 2010). Studies have shown that MPA-related development has the potential to contribute to local livelihoods and to lead to beneficial socio-economic outcomes. Yet at times too much attention has been given to local livelihood development at the expense of the MPA environment upon which the livelihoods rely. This is the case, for example, on the Andaman coast of Thailand where the MPA-related coral reef dive tourism industry is potentially overshooting environmental limits (Dearden, Bennett & Rollins, 2006). Benefiting economically from MPAs through tourism, fishing, or accessing non-use or PES markets over the long term requires maintenance of environmental quality and ongoing management of development activities. As Tobey and Torell (2006, p. 835) state “well managed and productive marine and coastal ecosystems are a necessary condition for sustainable development and poverty reduction”. Moreover, the relationship between environmental conservation cum management and local livelihoods and socio-economics is not linear with improvements in one resulting in the other (or vice versa). The complex interdependency between conservation and development demands that both are addressed simultaneously while also confronting governance considerations. The effectiveness of governance institutions and processes, for example, is a necessary procedural consideration for achieving a broader array of desired socio-economic and ecological outcomes through management and development. The inherent feedbacks between development programs, resource governance processes and structures, and resource management practices that are implied in the previous paragraph are shown in *Figure 2*. These feedbacks will be further explored in the discussion of this paper.

The following section will examine through a review of the literature what considerations are required for each of these three inputs - governance, management, and development – to contribute to beneficial MPA outcomes. For the most part, the literature converges around a number of key themes in each of these three areas. Where opinions diverge, this will be noted. First, it needs to be acknowledged that the success of both conservation and development are influenced by the local and macro social, economic, and ecological contexts within which the MPA operates.

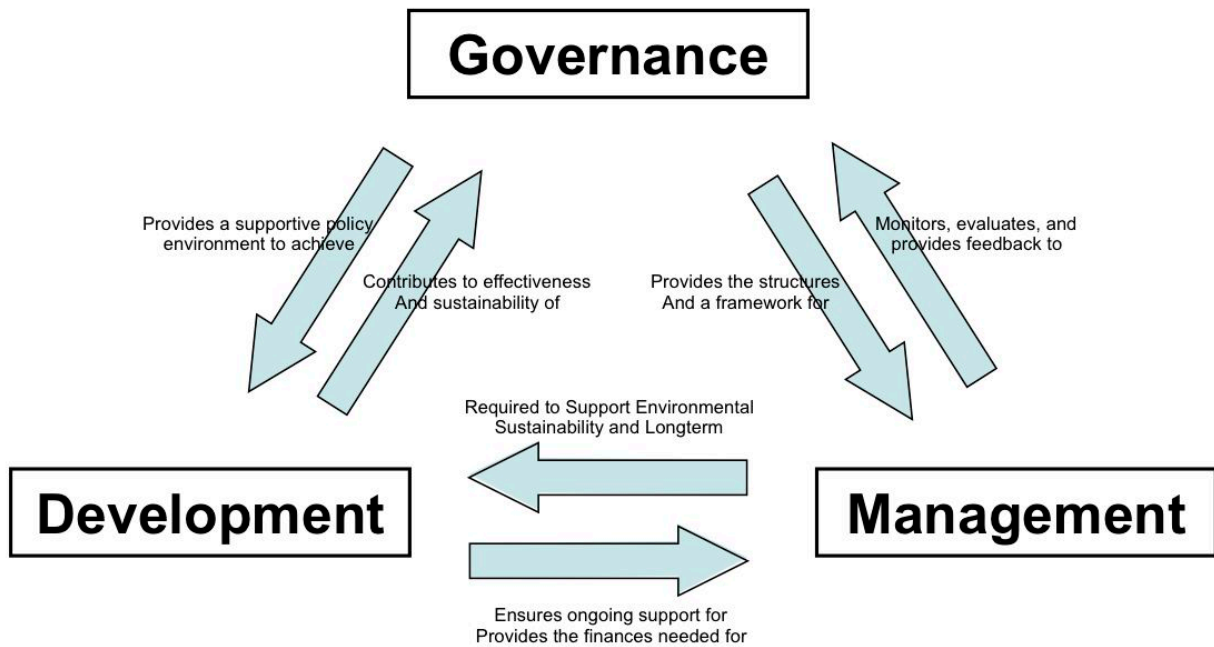


Figure 2 - The interactions between governance, management, and development in achieving beneficial outcomes in MPAs

A Note on Context: Micro to Macro Considerations

Context is an important determinant of the nature and extent of the outcomes related to MPA establishment. No MPA can be disassociated from either the local social, cultural, economic, political, and environmental context nor macro level contextual factors, such as history, politics, policies, macro-economics, environmental shocks, climate change, demographic shifts, and technology. These contextual factors can be differentiated from inputs in that they may be difficult or even impossible to predict, control, or change. This is particularly true for macro level factors. One macro level factor that is of particular concern for both ecological and human aspects of MPAs is the far-reaching impacts of climate change. Rising atmospheric and oceanic temperatures, extreme weather events, and increasing ocean acidification can all have detrimental consequences for MPA ecosystems, such as coral reefs (Bellwood, Hughes, Folke, & Nystrom, 2004; Burke & Maidens, 2004; Burke et al., 2002), and as a result on humans who rely on local ecosystem services for livelihoods for survival (Whittingham, Campbell, & Townsley, 2003; Wilkinson, 2004). Climate change can also lead to increased vulnerability and decreasing ability to adapt to new livelihoods. The increasing engagement of communities with globalized market economies and their inherently whimsical nature may also present challenges for developing alternative livelihoods (O'Brien & Leichenko, 2000). The operationalization of resilience in both the social and ecological aspects of MPAs, through for example embracing adaptive management and development processes (discussed later), thus becomes an essential input for mitigating against and adjusting to a rapidly changing world (Marshall et al., 2009; McClanahan et al., 2008).

Though contextual factors at the macro level are less controllable, local level factors should be incorporated directly into development, management, and governance approaches and inputs (Christie et al., 2003; Lejano & Ingram, 2007). Micro-level contextual factors that can influence outcomes include assets (i.e., natural, social, financial, physical, political, and human capital), underlying norms and values, pre-existing social and political structures, cultural practices, ecosystem health and population

dynamics, resources utilized, and methods of practice. The underlying assets in a community might be a particularly important focus for designing MPA-related development interventions as assets form the basis of livelihood options and adaptability, the choice of livelihoods, cultural norms, strength of institutions, levels of compliance, and choices of gear/use of destructive gear (e.g., Silva, 2006; Tobey & Torell, 2006, see also sustainable livelihoods literature – e.g., Carney, 1998; Cattermoul, Townsley & Campbell, 2008). The localized biology and ecology of an area may also influence the level of fisheries or tourism benefits that are achievable from MPA creation (Hilborn et al., 2004). Though a more extensive discussion of the role of both the social, political, economic, and ecological contexts in determining outcomes is beyond the scope of the current paper, suffice it to say that the importance of considering context in the design of governance, management, and development for MPAs cannot be overstated. Otherwise, there is a “risk of misfit” to the context (Jentoft, van Son & Bjørkan, 2007). This is a theme that will re-emerge in the following discussion.

It is also worth noting that MPAs may not be suitable management solutions and may not be successful in all contexts (Halpern, Lester & McLeod, 2010; Hilborn et al, 2004). MPAs cannot protect against all threats to the marine environment (Kearney, Buxton & Farebrother, 2012) and may not be effective for protecting all types of fish stocks (Hilborn et al, 2004). Hargreaves-Allen et al. (2011) suggest that MPAs are unlikely to be successful if there are high levels of conflict, numerous uncontrollable external stressors, or alternative forms of development and livelihoods are not possible. Common pool resources theory might be drawn on here to determine whether a system is likely to meet the pre-requisites for sustainability or whether it is possible to overcome impediments prior to the establishment of MPAs (Ostrom, 2009).

Governance: Institutions, Processes, and Structures

Governance is the structural, institutional, ideological, and procedural umbrella under which development programs and management practices operate. According to Graham et al (2003), natural resource governance can be defined as “the interactions among structures, processes and traditions that determine how power and responsibilities are exercised, how decisions are taken, and how citizens or other stakeholders have their say” (p. 11). Natural resource governance is influenced by “the formal and informal arrangements, institutions, and mores which determine how resources or the environment are utilized; how problems and opportunities are evaluated and analyzed, what behaviour is deemed acceptable or forbidden, and what rules and solutions are applied to affect the pattern of resource and environmental use” (Juda, 1999, p. 90). Attention to governance is important as it determines how and whether the *interactions* of structures, processes, and institutions coalesce “to solve societal [and environmental] problems and create societal opportunities [which] involves the formulation and application of principles guiding those interactions and care for institutions that enable them.” (Kooiman & Bavinck, 2005 cited in Plummer & Fennell, 2009, p. 153). Thus governance can be seen as good or bad based on whether it solves problems or creates opportunities – in short, whether it effectively supports the achievement of MPA outcomes. The principles of so-called “good” governance include legitimacy, transparency, accountability, inclusiveness, fairness, integration, capability, and adaptability (Graham et al., 2003; Lockwood, Davidson, Curtis, Stratford, & Griffith, 2010). The importance of these guiding principles is generally supported by the recent literature on MPA governance, management, and development. The following section will explore three often discussed aspects of governance that are required to establish a solid base for management and development and the achievement of beneficial socio-economic and environmental outcomes from MPAs: 1) the creation of an enabling institutional and organizational environment; 2) the process of implementation and design of MPAs; and, 3) the choice of management structures and MPA formats.

An Enabling Institutional and Organizational Environment

The concept of *institutions* often refers to both “soft” and “hard” institutions such as norms, rules, policies, and laws (after North, 1990). Institutions are made manifest in formalized organizations (e.g., governmental, non-governmental, and community based organizations) and structures (e.g., co-management and MPA format) as well as in the interactions between these bodies. Institutions and organizations can act as drivers, constraints, or supports to effective MPA management and local development depending on the level of institutional linkage, congruence, coordination, and cooperation across scales (Adger, Brown, & Tompkins, 2005; Govan et al., 2009; Prasertcharoensuk et al., 2010). The harmonization of legal frameworks and mandates, policies at various levels, local rules and regulations, cultural norms and individual attitudes is both an incredible challenge and an imperative for enabling effective management and development. Without harmonized institutions, MPAs can have conflicting and counterproductive results. For example, in Thailand the Constitution (2007) and Biodiversity Policy (2009) include provisions for participation in conservation and natural resource management but ministerial frameworks and mandates – i.e., National Park Act (1961), National Conserved Forest Act (1964), and Fishery Act (1947) - retain very top-down approaches to local MPA management. These acts were last updated at a time when central government control was emphasized and, according to Prasertcharoensuk et al (2010), community-managerial conflicts, limited benefits, and other problems arise from this inconsistency in Had Chao Mai National (Marine) Park in Thailand. As Camargo et al (2009, p. 953) state when “policy-making is dispersed and ambiguous along regional and national scales [this] generates conflicts or difficulties when executing policy at local levels”.

Clear legal and policy mandates are required for cross-jurisdictional and governmental agency cooperation and the achievement of desired MPA outcomes (Christie & White, 2007; Govan et al., 2009; Prasertcharoensuk et al., 2010; Rodríguez-Martínez, 2008). A few specific policies that may be required to support effective management and natural-resource dependent livelihoods include clear rules of access and territorial rights, recognition of title/tenure, laws to support enforcement, legal mechanisms to support and guarantee meaningful participation in design and implementation, and clarity of MPA objectives (Beger, Harborne, Dacles, Solandt, & Ledesma, 2004; Brondo & Woods, 2007; Camargo et al., 2009; Charles & Wilson, 2009; Christie & White, 2007; Jiminez-Badillo, 2008; Rodríguez-Martínez, 2008; Rudd, Tupper, Folmer, & Kooten, 2003; Singleton, 2009). Congruence is also required between formal regulations, informal rules, and customary norms and practice (Rudd et al., 2003), which can be overcome through policies that support the incorporation of local management systems and rules into MPA management and regulations (Cinner, Fuentes, & Randriahmahazo, 2009). Finally, the presence of local norms that support conservation and restraint in resource harvesting is a requirement of sustainable management of common pool resources such as MPAs (Ostrom, 1990; Rudd et al., 2003).

Successful alternative development schemes also rely on enabling institutional and policy environments. The use of market mechanisms such as Payments for Environmental Services (PES), for example, requires clarity of land tenure, ability to legally enter contracts, local rights to the resource, and legal frameworks that support market mechanisms (Petheram & Campbell, 2010). The lack of these enabling policies may prevent the successful use of PES in areas with state control. Naturally, PES programs require local support and willingness to participate (Barr & Mourato, 2009; Petheram & Campbell, 2010). Benefits from tourism may also require negotiation of local access rights, policies that ensure benefits are accrued locally, and policies that do not undermine local land ownership (Brondo & Woods, 2007; Fabinyi, 2008; Young, 2003). Macro level normative and policy support for sustainable development in MPA communities is needed both in national governments and in international conservation organizations (Brandon & O'Herron, 2004; Gjertsen, 2005b; Prasertcharoensuk et al., 2010).

The level and quality of vertical and horizontal interaction between governmental, non-governmental, scientific, private sector, and community-based organizations also influences the effectiveness of management and development programs (Adger et al., 2005; White et al., 2002). As Prasertchaoensuk et al (2010, p. 67) write: “[when] there is a lack of co-ordination, co-operation and integration between the various organizations and agencies related either directly or indirectly to the management of marine and coastal resources and biodiversity, [this] leads to, at best, inefficient and incoherent, and, at worst, conflicting and counterproductive implementation at the local level”. Cooperation, coordination, and consolidation of roles is required within and between governmental agencies, NGOs, geographical communities, and various user groups, since all of these organizations have important roles to play in MPAs (see, for example, White et al., 2002, p. 9). Cooperation at various scales is increasingly recognized as a means to ensure the success of tourism as it may result in increases in the breadth of the decision making base, reduction of conflicts, and pursuit of shared goals (Plummer & Fennell, 2009). Collectives of regional and international NGOs might be more effective at supporting both conservation and development since this results in increased coordination of on-the-ground actions (Brandon & O’Herron, 2004). Linkages to decision-making bodies at local, regional, and national levels influences a community’s ability to adapt to change and to self organize for management or development purposes (Cinner et al., 2009). Having links with an outside organization that plays an “honest broker”, such as an NGO or university, may also help in mediating differences between and within communities. National level grassroots organizations, such as Pamana in the Phillipines (see Añabieza, Pajaro, Reyes, Tiburcio, & Watts, 2010), may be perceived as the most legitimate and as a result might be in the best position to support community outcomes in MPAs, through networking at various scales, advocating for communities nationally and internationally, and empowering communities through on the ground actions. Lastly, levels of social capital may be an important indicator of the quality of collaborative interactions (Rudd et al., 2003). For example, various authors emphasize the importance of having forums and networking opportunities for creating trust, building relationships, facilitating communication and co-learning, and creating greater awareness and knowledge amongst partners (Camargo et al., 2009; Cinner et al., 2009; Crabbe et al., 2010; Vierros, Tawake, Hickey, Tiraa, & Noa, 2010). Social capital is also facilitated by effective information sharing between the regional and local level, which requires institutional capacity and consistent and varied forms of engagement between community groups, NGOs, and various levels of government (Mills et al, 2010).

The MPA Implementation and Design Process

A key factor that seems to influence the success of MPAs is the process of design and implementation since this is a time when local support can be gained or lost (Charles & Wilson, 2009; Christie et al., 2003). Three main themes cut across the literature on MPA implementation and design. First, the establishment of support requires attention to the initial entry into communities. Particular attention needs to be paid to the need to establish trust and build relationships at this stage (Koczberski et al., 2006; Singleton, 2009; White et al., 2002). Environmental education on ecosystem functioning and ecology, the impacts of human activity and how to mitigate the negative impacts of these activities, and the rationale behind MPAs should be done prior to MPA consultations if this knowledge is not already present (Beger et al., 2004). Often there is a lack of local understanding of the definition and implications of MPAs (Oracion, Miller, & Christie, 2005); however, also important not to create overzealous expectations as these can be detrimental (Agardy et al, 2011). The strategic linking of communities with other communities and outside organizations at this stage allows for the sharing of knowledge, experiences, resources, and responsibility and creation of social networks and alliances in support of the MPA (Horigue et al, 2012).

The two other main themes emerging from the literature are the importance of broader participation and stakeholder engagement and the incorporation of social, economic, environmental, and institutional contextual factors into MPA design, management, and local development. As Charles &

Wilson (2009) urge, the consultation of relevant stakeholders should be done at all stages of MPA design, implementation, and in ongoing management: “involvement builds the confidence of people to manage their own resources and encourages results that are long lasting” (White et al., 2002, p. 5). The rationale behind participation is that it encourages information exchange, encourages collaboration, builds confidence and empowerment in community groups, increases management effectiveness, and facilitates the development of mutually acceptable solutions (Camargo et al., 2009; Charles & Wilson, 2009; Mangi & Hattam, 2009; Pomeroy, Parks, & Watson, 2004). Early and meaningful participation may also reduce conflict among user groups and thus long term enforcement costs (Clifton, 2003; Jones, 2002). One important rationale for initial participation is the development of clear objectives for the MPA (Charles & Wilson, 2009; Jones, 2002). There seems to be some divergence of opinion, however, around whether objectives need to be determined by consensus (i.e., Charles & Wilson, 2009; Jones, 2002) and whether MPA objectives should recognize the heterogeneity of communities and multiplicity of broader values and perspectives on MPAs (i.e., Brechin et al., 2010; Murray, 2005). Murray (2005) suggests that full participation is required to identify and address the full range of divergent and overlapping objectives in MPA creation (see also Heck, Dearden, & McDonald, 2012). The multiplicity of perspectives present may be able to be reconciled through the creation of multiple use MPAs (Agardy et al., 2003). In order for participation to be effective, there is a need to recognize the heterogeneity of communities and stakeholder groups, recognize the potential impacts of institutions and entitlements on the ability of certain groups to participate, consider potential equity issues and asymmetries, and make efforts to incorporate marginalized groups (Singleton, 2009).

Effective mechanisms for participation may also lead to a more complete understanding and incorporation of the social, economic, cultural, political, and environmental context within which the MPA is going to operate. This understanding is essential for designing programs of resource management, conservation, and development that “fit” the local context since “even the most cherished models...run aground when exported to other settings” (Berkes, 2007; Lejano & Ingram, 2007, p. 20). MPAs must be “adapted to the exigencies of local situations, recognizing that each location has its unique social, cultural, and ecological contexts that influence the trajectory of MPA implementation and impact” (Christie et al., 2003, p. 24). Traditional knowledge and management mechanisms (such as species taboos, gear restrictions, and closures), customary tenure, local norms and rules of use, and traditional and current resource use patterns should be incorporated into MPA design and implementation (Christie & White, 2007; Ferse, Manez-Costa, Manez, Adhuri, & Glaser, 2010; Gell & Roberts, 2003; Gerhardinger, Godoy, & Jones, 2009; Govan et al., 2009; Koczberski et al., 2006; Walker & Robinson, 2009) when it is determined that they are effective and sustainable (Johannes, 1998; Jones, 2002; Lunn & Dearden, 2006). Through incorporation of these factors, MPAs can result in the strengthening and reinvigoration of traditional mechanisms and cultures (Vierros et al., 2010). However, these considerations should also be combined with broader contextual considerations stemming from the proactive use of social, economic, political, and natural scientific methods, tools, and approaches to design MPAs (Charles & Wilson, 2009; Klein et al., 2008; Lundquist & Granek, 2005; Perera & de Vos, 2007). For example, Aswani & Lauer (2006) show how MPA networks can be designed using a combination of anthropological and natural scientific methods to merge traditional knowledge and use patterns in GIS. Ban, Picard and Vincent (2009) compare the use of Marxan planning software with a community-based approach to MPA planning on the west coast of Canada. Both methods produced similar results, which also suggests that “traditional ecological knowledge may serve as a reasonable proxy for scientific approaches in selecting areas of ecological value” (p 899). Moreover, careful site selection based on a variety of social considerations and ecological factors “might be the most important things that MPA managers can do” (Warner & Pomeroy, 2012, p. 931).

Choice of Management Structure and MPA Design

Two formal structures that are the most directly impacted by the interaction between institutions and context are the management structure adopted and the MPA format chosen. Formats for the management of MPAs can be visualized as top-down (i.e., centralized management), bottom-up (i.e., community-managed or common property regimes), or cooperatively managed (i.e., community-based, co-management) which is anywhere on the continuum between the two extremes. Every management approach comes with potential risks and benefits; however, consensus seems to be converging around co-management as the most effective and acceptable approach (Cinner et al., 2009; Clifton, 2003; Govan et al., 2009; Jones, 2002; Oracion, Miller, & Christie, 2005). Though a top-down approach may be suitable where there is no resident population, centralized management has often been criticized for alienating local people, increasing local conflict, resulting in limited levels of local benefit, and even resulting in failure (Clifton, 2003; Diegues, 2008; Govan et al., 2009; Prasertcharoensuk et al., 2010; Rodríguez-Martínez, 2008): “The unpopularity of the top-down regime [lies] in its failure to respect local sensibilities” (Hind et al., 2010, p. 60). Though a bottom up approach may be more acceptable than top-down approaches (see Beger et al., 2004), this approach may also have issues with corruption and changes in the local government may result in the end of an MPA (Hind et al., 2010; Russ & Alcala, 1999).

Co-management is the “sharing of power and responsibility between governments and communities” (da Silva, 2004, p. 419), which brings the strengths, knowledge, powers and resources of both parties together. The attributes of co-management include the incorporation of traditional and scientific knowledge into management, the pivotal role played by local stakeholders leading to increased empowerment for local communities and reduced enforcement costs, and the creation of partnerships across organizations at various scales which helps to mitigate against local and macro level uncertainties (Plummer & Fennell, 2009; Samonte et al., 2010). Legitimacy and support are gained through the sharing of power and participation (Jentoft et al., 2007). Yet co-management also faces challenges related to increased bureaucracy, funding uncertainty, time commitments, local capacity and willingness to participate, and achievement of an appropriate balance of governmental and community input and control (Clifton, 2003; Rudd et al., 2003; da Silva, 2004). McConney and Pena (2012) recommend that attention is paid to building and supporting the capacity for co-management. Co-management could be seen as a critical response to the failures of the top-down regime. Yet Singleton (2009, p. 422) notes the potential irony of the current focus on creating systems of co-management when she comments “It would be unfortunate if the search for an alternative to one-size-fits-all, top-down regulatory styles resulted in rigidly proscribed processes of incorporating diverse actors into MPA processes — a sort of new orthodoxy of collaborative practice”. Institutional diversity and a mixture of top-down, bottom-up, and community-based incentive approaches, Jones, Qiu and De Santo (2011) suggest, are the most effective approach to MPA governance.

Where communities are involved there is also a general convergence around the creation of a multiple-use MPAs that incorporate a no-take zone (Agardy et al., 2003; Diegues, 2008; Noel & Weigel, 2007; White et al., 2002). Since the creation of strict no-take MPAs is often met with opposition by affected fishers, Perera and de Vos (2007) suggest that high levels of resource dependency in the developing world may make the creation of exclusive reserves untenable. However, no-take zones may be a necessary part of providing the full extent of ecological and socio-economic benefits to the individuals whose livelihoods depends on the quality of the natural base (Sobel & Dahlgren, 2004b). In order to achieve the most benefit for different user groups and to reduce conflict, the creation of zones for different user groups may also be required (Lunn & Dearden, 2006; Merino et al., 2009; Salm, Clark, & Siirila, 2000b). In spite of the general convergence around co-management and multiple-use MPAs containing no-take areas, there are scenarios where other formats such as privately owned and managed reserves or Entrepreneurial MPAs (see Bottema & Bush, 2012; Svensson et al., 2010) or marine

extractive reserves (see Diegues, 2008) may produce the most successful outcomes for both conservation and communities within a particular context.

Development: Alternative Livelihoods and Programs

Given that local populations and communities often rely significantly on the natural resources and that the creation of MPAs necessarily implies a reallocation of rights (Mascia & Claus, 2009), consideration needs to be given to mitigating localized impacts through development. The provision of alternative livelihoods, it is often suggested and shown, is required to support the effectiveness of MPAs in achieving beneficial environmental outcomes (Christie, 2005; Gjertsen, 2005b; Pollnac et al., 2001; Silva, 2006). There is, however, some divergence of opinion on what form alternative livelihoods should take and whether programs should focus on livelihood diversification or enhancement. This section will problematize the often-oversimplified relationship between alternative livelihoods and local socio-economic and conservation outcomes and then explore the processes and inputs required to achieve more successful livelihood interventions.

Alternative Livelihoods: Enhancement and Diversification

Since traditional resource users are often displaced when MPAs are created and the fisheries benefits of MPAs may take some time to occur, intermediary provisions may need to be provided. Over the longer term, at least in theory, livelihood enhancement and diversification may also stem pressure on natural resources and support conservation objectives while decreasing local poverty and vulnerabilities (Cattermoul, Townsley, & Campbell, 2008; Ellis & Allison, 2004). Enhancement of current livelihoods can refer to improving the efficiency and effectiveness of current practice to reduce waste, reducing the destructiveness of fishing and harvesting practice, and/or moving products up the value chain through processing, packaging and improved marketing (Elliott et al., 2001b; Torell et al., 2010). Livelihood diversification refers to expansion or alteration of individual or household livelihood portfolios and strategies through engaging in new or novel livelihood practices, and shifting fishing and harvesting to other areas or to a wider variety of species often using different practices. This latter category might include, for example, long lining for pelagic species using lights or using fish aggregating devices to fish for tuna (Gillett et al., 2008; Tobey & Torell, 2006). The former category of diversification, which represents the majority of the literature focusing on alternative livelihoods, can include tourism, agriculture, raising livestock, aquaculture, mariculture, seaweed farming, beekeeping, handicrafts, tree nurseries, pearl farming, and capturing PES markets.

As discussed previously, some development programs have led to beneficial outcomes for local communities suggesting only that “Alternative livelihood interventions work under the right set of circumstances” (Burks, 2006, p. 56). Yet some authors argue that the achievement of either beneficial socio-economic or conservation outcomes through livelihood enhancement, diversification, and/or the provision of livelihood alternatives has been elusive and even that the myth needs to be debunked (Christie, 2004; Govan et al., 2009; Torell et al., 2010). Torell et al (2010) suggest that the development of alternatives may be more likely to fail than enhancing current practice. Alternative livelihood programs may fail to deliver expected or desired outcomes due to a number of factors including lack of linkage between development and conservation (Brandon & O'Herron, 2004; Torell et al., 2010), local capacity barriers (Chen, 2010; Gillett et al., 2008), unaccounted for values related to traditional livelihoods (Barr & Mourato, 2009; Pugholm, 2009; Wells, Samoilys, Makoloweka, & Kalombo, 2010), and economic factors such as shifting input costs and access to markets (Gjertsen & Niesten, 2010; Govan et al., 2009; Leisher et al., 2007). Successful development of livelihood alternatives may also simply encourage in-migration (Sievanen, Crawford, Pollnac, & Lowe, 2005) or lead to the re-investment of newfound income in fishing (Gillett et al., 2008; Walsh, Groves, & Nagavarapu, 2010) which will both lead to increasing pressure on local resources. Most authors concur that focusing on a portfolio of substitutable and interchangeable resource-based and non-resource-based livelihoods is

more effective than using any single strategy (Barr & Mourato, 2009; Brandon & O'Herron, 2004; McClanahan, Cinner, Graham, Daw, Maina, Stead, Mamukota, et al., 2009; Petheram & Campbell, 2010; Torell et al., 2010; Weiant & Aswani, 2006). A focus on any single livelihood strategy may exert unsustainable pressure on specific facets of the environment while also increasing local vulnerability (Cinner et al., 2009; Ellis & Allison, 2004). Two additional topics pertinent to achieving beneficial socio-economic and environmental outcomes deserve further attention: 1) the factors that tend to lead to successful alternative livelihood programs, and 2) the need for management of development. The second point will be discussed in the following section on management.

Successful Development Programs: Process and Requirements

There are also a number of specific inputs required for each type of development intervention (i.e., tourism, aquaculture, PES, etc.); however, a discussion of these is beyond the scope of the current paper. A review of the literature on MPA and marine-based alternative livelihoods programs reveals a number of themes regarding the achievement of successful outcomes from development interventions. First, the literature addresses how development needs to adopt participatory, adaptive, and equitable processes. "Rarely are livelihoods imposed from the outside sustained," insist Pomeroy et al (2006, p. 789). As an antidote to top-down development, participatory development processes may be more likely to lead to successful outcomes through facilitating co-learning and consensus-building, empowerment, and local mobilization (Brandon & O'Herron, 2004; Charles & Wilson, 2009; Diegues, 2008; Gillett et al., 2008; Lejano & Ingram, 2007). Simple processes, such as Participatory Rural Appraisal (Chambers, 1994) or the Sustainable Livelihood Enhancement and Diversification (SLED) approach (Cattermoul et al., 2008), can be used to facilitate participation in development. Development should also adopt an adaptive process of monitoring, feedback, and learning (Plummer & Fennell, 2009; Pomeroy et al., 2006). Of course, adaptive learning also needs to be integrated into MPA-related conservation and development discourse and practice at a broader scale so that failed initiatives are not repeated and successes are recognized. Finally, since communities are not homogenous entities, conservation and development programs should address the needs of potentially marginalized groups (Walker & Robinson, 2009). Incorporating gender considerations, for example, into design of development programs and women's resource use patterns into MPA design can lead to greater benefits for households and the larger community (Fencl, 2005; Walker & Robinson, 2009; Weiant & Aswani, 2006).

Participatory processes can also lead to an improved understanding of the context from the perspective of local people which can be incorporated into the design of locally grounded and appropriate solutions (Chambers, 1984; Lejano & Ingram, 2007; Petheram & Campbell, 2010). Pre-assessments are important since assumptions about context can result in unsuccessful programs of action (Cinner, 2010). It is important to understand how micro to macro level contextual factors, such as access to markets, local capabilities, policy environments, levels of social cohesion, leadership capacity, and cultural norms, influence current marine uses and how these may facilitate or impede alternative livelihood development (O'Garra, 2007; Pomeroy et al., 2006; Pugholm, 2009; Young, 2003).

Third, authors suggest that development of alternative livelihoods often requires attention to building local capabilities through increasing financial and human capital, as well as physical assets (e.g., fishing gear, boats, basic and tourism infrastructure). Ongoing programs of education and capacity building are necessary for resource users to nurture occupational flexibility and acquire the skills necessary to engage in new livelihoods (Arceo & Granados-Barba, 2011; Chen, 2010; Cinner et al., 2009; Elliott et al., 2001b; Muthiga, 2009). Independent of the type of development, authors emphasize that particular attention needs to be given to entrepreneurship, business management, and marketing (Cattermoul et al., 2008; Chen, 2010; Gillett et al., 2008; Torell et al., 2010; Wells et al., 2010). Much attention is also given to the need for short-term seed money and/or longer term financing for supporting

alternative livelihood developments. Outside financing can sometimes be obtained for the start-up phase of a development project. However, Torell et al (2010) posit that in the long run grants are counterproductive to sustainability. Authors often suggest that money from PES markets (Gjertsen & Niesten, 2010; Petheram & Campbell, 2010), lease money from entrepreneurial MPAs (de Groot & Bush, 2010), trust funds (Govan et al., 2009; Ranasinghe, 2010), user fees (Ransom & Mangi, 2010; Wielgus et al., 2010), and micro-credit schemes (Tobey & Torell, 2006) should be funneled towards alternative livelihood development, scholarships, tourism infrastructure, or health and social infrastructure (not just towards MPA management as is often argued). Cinner (2010) makes a case that procuring funding is essential to help fishers break out of the poverty trap that necessitates their use of destructive fishing gear. Micro-credit schemes may show the most promise for empowering individuals and encouraging community ownership of development (Gillett et al., 2008; Torell et al., 2010).

Finally, the creation of an enabling institutional and organizational environment can facilitate the implementation of alternative livelihood programs in a way that ensures that benefits are maximized locally. Policies that safeguard access and that recognize tenure can be key to ensuring that local communities benefit from tourism, that community property is not sold to outside interests, and that conflict is minimized with outside interests (Brondo & Woods, 2007; Charles & Wilson, 2009; Fabinyi, 2010; Young, 2003). Development policies that restrict the scale and type of developments can also ensure that development is kept within ecologically and socially sustainable limits (Brandon & O'Herron, 2004). Many authors urge that mechanisms to ensure that benefits are shared equitably and that leakage of financial and employment benefits is minimized need to be put into place (Burks, 2006; Mallerat-King, 2000; Oberholzer et al., 2010; Oracion et al., 2005; Samonte et al., 2010; White, Rosales, & Meneses, 2002; Young, 2003). A wide variety of organizations at various scales can have important roles to play in ensuring that development programs are successful (Govan et al., 2009; Plummer & Fennell, 2009). This can include international NGOs acting as intermediaries in PES projects (Petheram & Campbell, 2010), businesses identifying development opportunities (Gillett et al., 2008), and community and user associations advocating for local people (Jiminez-Badillo, 2008). Productive relationships with private sector partners – for example, through the development of Entrepreneurial MPAs (de Groot & Bush, 2010) – may also benefit local communities through the payment of coral reef leases for diving in trade for exclusion of fishers' withdrawal and access rights and patrolling services (see also Wakatobi, 2010).

Management: Strategies, Processes, and Requirements

The effective management of MPAs is of critical importance for achieving desirable socio-economic and environmental outcomes, for ensuring local support, and for the long-term success of MPAs. Without effective management many MPAs are just 'paper' parks that have no real purpose for existence other than perhaps to protect them from highly extractive industries (McClanahan, 1999). Managing natural resources is largely about managing human interactions with the natural environment but it is also about responding to broader changes in the human and natural environment. MPA management utilizes specific resources and tools, plans and prescriptions, and actions or strategies for managing human actions, incursions, and developments at the local scale and mitigating against changes at the macro scale. The effectiveness of management is influenced by availability of resources, legislative and public support, levels of cross-scale coordination and cooperation, and a number of other governance considerations. These topics will be explored in the following section.

Management Strategies

As discussed previously, both traditional resource-based and alternative forms of development can have negative impacts on the environment. Since, the long term success of local MPA-related livelihoods, such as fishing and tourism, often relies on the health and pristine quality of the local environment there is a need for ongoing management of development: "Sustainable use approaches are

predicated on the concept that the living resources of an MPA replenish themselves naturally and can be exploited within limits” (Agardy et al., 2003, p. 358). For example, not managing tourism may threaten the longevity of the benefits that MPAs can provide (Dearden et al., 2006; Roman, Dearden, & Rollins, 2007; Herrera-Silveira, Cebrian, Hauxwell, Ramirez-Ramirez, & Ralph, 2010; Ziegler, 2011).

Management of tourism includes establishing and adhering to a local carrying capacity, limiting levels of development, establishing standards for development, creating zones for tourism, and implementing management strategies to ensure recreational impacts are avoided – i.e. from trampling, anchoring, and diving (Agardy, 1993; Brondo & Woods, 2007; Dixon et al., 1993; Ziegler, 2011). Limiting recreational impacts may include strategies such as educating tourists and experience providers, installing mooring buoys, rotating dive sites, spacing out divers, monitoring divers, and establishing and enforcing regulations (Dixon et al., 1993; Mallerat-King, 2000; Milazzo et al., 2002). Management strategies for mitigating the impacts of tourism on local communities should also be considered. Similarly, if aquaculture is deemed an acceptable MPA use, management strategies may include establishing a suitable carrying capacity, raising mainly herbivorous species, and developing a sustainable aquaculture system (Tung, 2003). A sustainable aquaculture system might include raising a combination of reef fish, shellfish, and bottom feeders to reduce waste and other potentially negative impacts.

The management of fishing, harvesting, and other resource extraction activities, such as coral mining, both inside MPAs and in the broader seascape outside MPAs is also necessary. Required management actions might include reducing levels of extraction, establishing extractive and no-take zones, shifting the focus of fishing effort, reducing destructive gear use and destructive fishing practice, controlling outside access, and effectively enforcing regulations (Clifton, 2003; Diegues, 2008; Govan et al., 2009; Lucas & Kirit, 2009; Russ et al., 2004). Effective enforcement of regulations is broadly recognized as a necessary control in any form of open or limited access pool of resources (Ostrom, 1990; da Silva, 2004). Roberts (2012, p. 446) argues that MPAs are effective tools for fisheries management but that “Benefits can be quickly dissipated by targeted fishing. Therefore, high levels of protection and resolute enforcement will produce the greatest benefits.” According to Samonte et al (2010, p. 9) the enforcement chain includes five important steps – surveillance and detection, interception and arrest, prosecution, and sanctions – and “it is only as strong as the weakest link”. Sanctions can include the confiscation of illegal gear (Silva, 2006) but these sorts of actions need to be legally supported (Perera & de Vos, 2007). Authors also emphasize that enforcement of regulations need to be done in a consistent and fair manner to be perceived as legitimate (Aswani, Albert, Sabetian, & Furusawa, 2007; Prasertcharoensuk et al., 2010; Tobey & Torell, 2006). Pro-active actions, such as clearly delineating boundaries, are also important ways to encourage compliance (Hard et al, 2012).

Education and awareness raising programs about rules, regulations, boundaries, management objectives, MPA effects, resource quality, the role of humans in impacting and improving resource quality, and even the existence of the MPA may be “softer” ways of gaining support, reducing destructive activities, and increasing compliance (Arceo & Granados-Barba, 2011; Camargo et al., 2009; Joshua Cinner et al., 2009; Elliott, Mitchell, Wiltshire, Manan, & Wismer, 2001a; Marshall, Marshall, Abdulla, & Roupheal, 2010; McClanahan et al., 1999; Oracion et al., 2005; Svensson et al., 2010). It is often the case that there is little local awareness of MPAs and without effective communication strategies, illegal fishing practices or “poaching” inside MPA boundaries may continue unabated (Clifton, 2003; Lunn & Dearden, 2006). To effectively disseminate information in many contexts, communication and education campaigns may need to incorporate both formal and creative mechanisms such as door-to-door visits, posters, workshops, and radio campaigns (Clifton, 2003). Facilitation of capacity building activities and workshops for participation in alternative livelihoods may also fall under the auspices of management.

Finally, the proactive and ongoing management of conflict between different and often competing forms of development and user groups is also necessary. Conflicts are often present, for

example, between local fishers and the tourism industry (Brondo & Woods, 2007; Fabinyi, 2008; Oracion et al., 2005). These conflicts may be overcome through education of divers about local peoples and respect for fishing gear (Lucas & Kirit, 2009), application of zoning to provide specific areas for fishers and tourists (Hind et al., 2010), and/or provisions recognizing local access and use rights. Formal albeit low-cost processes for promptly resolving persistent inter and intra-group conflicts also need to be incorporated into MPA management (Christie & White, 2007; Oracion et al., 2005; Webb, Maliao, & Siar, 2004).

In brief, the management strategies discussed previously include the following: a) implementing a carrying capacity and establishing standards for disparate forms of development, b) establishing conflict resolution strategies and zoning for multiple uses, c) increasing knowledge and awareness through education and communication campaigns, d) broader management of fishing, harvesting, and extraction activities, and e) effectively enforcing rules and regulations. Specific management actions are also required for controlling specific human impacts and livelihood activities and for adapting to the impacts of broader environmental changes. The specifics relating to these management actions are too extensive to be discussed here.

Management Processes and Requirements

Also consistent with the literature on good governance and development processes, writings on MPA management emphasize the importance of adopting integrated or nested, integrative, adaptive, transparent, and participatory management processes. To be effective in achieving their potential, MPAs should not be “islands of protection” but *nested* within Integrated Coastal Zone Management (ICZM) or Ecosystem-Based Management (EBM) regimes (Agardy et al., 2011; Balgos, 2005; Charles & Wilson, 2009; Cho, 2005; Cicin-Sain & Belfiore, 2005; Salm et al., 2000a) and/or broader networks of MPAs (Ferse et al., 2010; Green et al., 2009; Leisher et al., 2007; McKay & Jones, 2011). Both ICZM and EBM imply the incorporation of social, economic, cultural, political, and environmental considerations or values at the level of the broader land and seascape into management. For example, coral reef MPAs might be more resilient to the impacts of climate change when combined with the reduction of sedimentation and nutrient loading and land-based and marine sources of pollution (Keller et al., 2009). Networks can improve dispersal and connectivity between MPAs as well as spreading risks through replication of habitats and ecosystems (McLeod, Salm, Green & Almany, 2011; Roberts, 2001). Horigue et al (2012, p. 18) also notes that “scaling up MPAs to form networks is a means to improve management of individual MPAs, and coordinate MPA establishment through collective action and sharing of information and experiences”. Additionally, MPAs can be more effective in supporting fisheries if they are nested within a suite of fisheries management actions outside the boundaries of the MPA (Christie, White, & Deguit, 2002; Gell & Roberts, 2003; Govan et al., 2009; Jennings, Marshall, & Polunin, 1996; Russ et al., 2004).

Active implementation of *adaptive* management – that is a deliberate cycle of monitoring, evaluation, analysis, planning, and implementation – can serve to continually correct the course of MPA management strategies (Agardy et al., 2003; Ban et al, 2011; Cinner et al., 2009; Orbach & Karrer, 2010; Pomeroy et al., 2004). Adaptive management reflects a shift away from a linear view of the world and recognizes that MPAs are part of a dynamic, non-linear, and complex system (Holling, 2001). *Integrative* research stemming from various social and natural science methods and tools in combination with local and traditional knowledge should also inform both broader integration and adaptive management frameworks (Christie & White, 2007; Cinner et al., 2009; Ferse et al., 2010; Gell & Roberts, 2003; Gerhardinger et al., 2009; Govan et al., 2009; Koczberski et al., 2006; Walker & Robinson, 2009). Drew (2005), for example, reviews various examples of how folk taxonomy and systematics and local knowledge of populations and ecological relationships can be used to augment western science in MPA management.

Finally, there is widespread consensus that meaningful *participation* in decision-making and inclusion of relevant stakeholders are a necessary pre-cursor to effective management (Cinner et al., 2009; White et al., 2002). Participation offers an opportunity for information exchange, increases accountability and collaboration among stakeholders, leads to the development of mutually acceptable solutions and regulations, reduces feelings of alienation, and increases *transparency* (Charles & Wilson, 2009; Hind et al., 2010; Perera & de Vos, 2007; Rosendo, Brown, Joubert, Jiddawi, & Mechisso, 2010; Singleton, 2009). Rosendo et al (2010) suggest that participation in management will help to develop a sense of ownership and support, which ultimately may improve compliance.

Effective management requires support in the form of an enabling policy and organizational environment that supports integrated, integrative, adaptive, and participatory management processes. This topic has already been explored in the section on governance. A secure source of finances and governmental and local capacity are also required to buttress management processes and strategies ranging from participation to enforcement. Given that the “lack of income has been identified as a primary reason for [management] failure” (Gravestock, Roberts, & Bailey, 2008), the development of cost effective management structures and sustainable financing mechanisms is of great import for MPA sustainability. Initial funding for MPA establishment can often be secured through loans from multi-lateral development banks, grants and donations from a variety of public, civil and private sector organizations, debt-for-nature swaps, and government sources (Gallegos, Vaahtera, & Wolfs, 2005). Apart from some government sources, this funding is often short term. Potential sustainable solutions for financing management include PES markets, user fees from tourism, environmental trust funds, and private sector solutions such as hotel-managed marine reserves (Dharmaratne et al., 2000; Govan et al., 2009; Peters & Hawkins, 2009; Svensson et al., 2010; White et al., 2002). Finally, individual leadership is an important ingredient in the success of MPAs (Bottema & Bush, 2012).

Discussion: Feedbacks, Analyzing, and Operationalizing

In theory, MPAs can have a broad array of ecological and socio-economic benefits. In practice, the creation of no-take MPAs or zones in multiple use MPAs has been shown to result in beneficial ecological outcomes. Yet, the percentage of the planet’s ocean (~1.17% - Toropova et al, 2010; ~1.8% - mpatlas.org) and Exclusive Economic Zones (~2.86% - Toropova et al, 2010) that are protected is still quite low and an even smaller percentage of these are designated as no take areas. As noted previously even fewer of these areas may be managed effectively and be producing the desired ecological results. Furthermore, the relationship between MPAs and local communities has been problematic which is a concern since perceptions of benefit may be a precursor of support and ultimately success. Impact studies have shown that MPAs have often led to quite divergent socio-economic outcomes for local communities. With a few notable exceptions, the ability of MPAs to provide alternative livelihood options that will benefit local populations socio-economically and support conservation has also been questioned in this review. Moreover, the ability of MPAs to contribute to the dual agenda of development and environmental conservation more broadly is ultimately limited by the ability of MPAs to achieve successful environmental and socio-economic developmental outcomes locally.

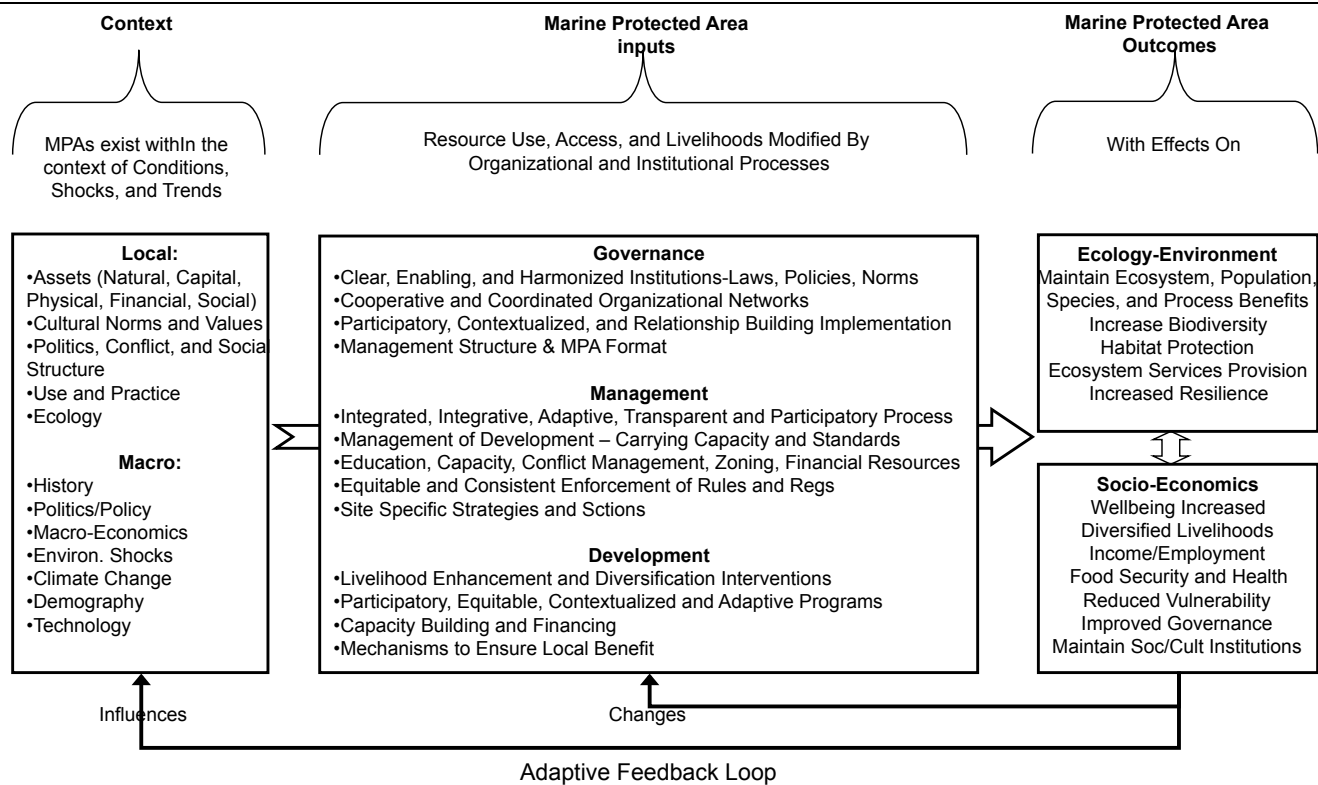


Figure 3 – Marine protected areas from inputs to outcomes as mediated by context

In this paper, we argue that the success of MPAs in achieving purported and desired outcomes locally is bounded by the ability to determine and provide the necessary governance, management, and development inputs required by micro to macro level contextual factors (Figure 3). There are a number of themes that were consistent across the literature on creating successful MPAs. For governance, the literature focused on the importance of having clear, enabling, and harmonized institutions (i.e., laws, policies, and norms), of creating cooperative and coordinated networks of organizations, and of having implementation processes that are participatory, contextualized, and that focus on building relationships of trust. There was also general convergence in the literature around the adoption of co-management, as an alternative to top-down and bottom-up management regimes, and the creation of multiple use MPAs. However, there are also examples of MPAs that adopt different management regimes and models that may be operating relatively successfully. For example, the use of entrepreneurial and hotel managed MPAs and PES-markets to achieve beneficial outcomes is an area that deserves further exploration. Yet these more recent governance models may also require a system of meta-governance. The various aspects of good governance - legitimacy, transparency, accountability, inclusiveness, fairness, integration, capability, and adaptability - can also be found throughout the literature on management and development. Previous research on development emphasizes the importance of both enhancing and diversifying livelihoods to include a mixture of natural resource-based and non-natural resource-based livelihoods and of having participatory, contextualized, adaptive, and equitable development programs. These literatures also emphasize the importance of capacity building – focusing on human, social, physical, and financial capital. In terms of financial capital, initial seed funding or ongoing financing through trust funds or micro-loan programs may be particularly helpful. It is also important to ensure that there are mechanisms that ensure local benefit from development through limiting leakage and outside employment. In addition to having site specific management strategies and actions, the literature on management highlights the importance of having processes that integrate design and management broadly into the landscape, are integrative of scientific and local knowledges, adopt adaptive monitoring

and feedback mechanisms, and are participatory and transparent. Ongoing management of MPA-related development is emphasized, particularly the establishment of standards and carrying capacity, as well as the consistent enforcement of regulations. Finally, education and awareness building programs, capacity building, conflict management, zonation, and financial resources are all emphasized as being significant contributors to the success of MPAs.

In summation, we suggest that a tripartite approach to MPA implementation and operations that gives appropriate and contextualized attention to governance, management, and development is more likely to lead to successful MPA outcomes as there are inherent feedbacks between the three aspects. The reasons why each of these aspects is necessary has been explored earlier in this paper but the feedbacks between each of these three aspects deserves further explanation. First, governance is overarching in that it provides a supportive policy environment to achieve beneficial development outcomes and provides a management structure and ultimately the format of the MPA. Governance is also responsible for establishing “good” procedures – fair, equitable, participatory, legitimate, transparent, accountable, integrated, adaptable - for development and management. Successful development is important as it provides the finances needed for both governance and management, engenders support for MPA management, and contributes to the effectiveness and sustainability of governance structures. Finally, management is required to support environmental sustainability and thus the longterm viability of MPA related development while also monitoring, evaluating, and providing feedback to governance bodies.

The conceptualization of inputs offered in this paper is a continuation of various literatures and discussions about what is required to achieve successful outcomes from MPAs. The novelty of this paper lies in bringing together these three aspects in one place. This paper might also be seen as a starting place for further thinking and discussions about how to operationalize an approach to MPA implementation that includes all three aspects – management, development, and governance – or to analyze the effectiveness of an MPA or system of MPAs. There are three final points that we would like to make. First, we feel that subsuming governance or development under the auspices of management (e.g., Pomeroy et al, 2004) does not do justice to the full complexity of governance or development nor is it fair to managers. Similarly, governance and development should be considered as separate but linked entities. Second, for each aspect different individuals or organizations may be better positioned – in terms of knowledge, skills, and affiliations – to address each aspect. For example, it is perhaps unrealistic expect someone who is managing an MPA to be responsible for creating supportive national level policies just as a policy analyst cannot be expected to understand the intricacies of community development work. So each of the three aspects need to be understood separately. And yet the three different parts should not work in complete isolation so that the work of different actors and organizations can still each inform the work of the others. A director general of parks, for example, needs to understand what supports are needed in order to effectively manage an area or to do development work. Third, the creation of a simple and comprehensive tool for measurement of all three aspects is also a topic that deserves some attention. Yet there already exists extensive literatures in each of these three areas (e.g., Management – Pomeroy et al, 2004; Governance – Lockwood, 2010; Socio Economic Development and Livelihoods – Cattermoul et al, 2008; Bunce et al, 2000) that can be drawn upon to create the sort of framework or tool that would allow for a comprehensive analysis of each aspect - management, development, and governance - for either individual MPAs or networks or systems of MPAs.

Conclusion

MPAs have the potential to produce beneficial ecological and socio-economic outcomes. This review has identified a number of inputs that can contribute to the achievement of beneficial socio-economic outcomes, in reality, it is challenging to reconcile the complexity and heterogeneity of real world MPA biophysical and community contexts and the uncontrollability and uncertainty of macro level factors. Our understanding of what combination of factors will ultimately lead to successful outcomes in the multiple contexts within which MPAs operate is still limited (Rudd et al, 2003; Basurto, 2010) and in some contexts MPAs may not be suitable management interventions (Halpern et al, 2010; Hilborn et al, 2004). Unfortunately, there is no “magic bullet” formula that can be applied to achieve beneficial socio-economic and ecological outcomes for all MPAs. Perhaps the most productive stance to take is that MPAs are policy experiments and, as Ostrom (1999) suggests, accept that policy experiments have a probability of failure. This position allows for adoption of a proactive and adaptive approach to MPA implementation and operation that is firmly rooted in context and that focuses on procedural considerations – related to governance, management, development - while never losing sight of the substance – which includes marine conservation and socio-economic benefits - that MPAs are striving to achieve.

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