

## chapter three



Potential benefits of marine  
protected areas

A review of the international literature indicates that marine protected areas can have a range of ecological, social, cultural and economic benefits. Some of these are described in the sections below. The extent to which these can be achieved in practice is largely dependent on the location, design and on-going management of the area.

It is difficult to predict what the precise effects of protecting an area might be, for a number of reasons. Globally, relatively few marine protected areas have been in existence for long enough to allow a full understanding of their socio-ecological benefits. Even fewer have been the subject of thorough data gathering which allows a proper before and after comparison to be undertaken.<sup>1</sup>

Furthermore, data derived from existing marine protected areas can only be of limited assistance. The ecological communities to be protected at any given site are subject to unique environmental conditions and histories, which set the context in which responses to conservation measures can emerge.<sup>2</sup> The complexity of the many linkages and feedbacks that make up a socio-ecological system is such, that we can never predict with certainty, what the exact response will be to any intervention in the system. As a result, the effects of marine protection can sometimes be disappointing or even surprising.

For example, scientists originally believed that highly mobile species such as snapper would not benefit from the establishment of marine reserves in New Zealand, because they were too wide-ranging to be protected in one small area. Nevertheless, it was discovered that snapper display complex small-scale movement patterns during some stages of their life cycle, effectively adopting a 'home range'. This enabled them to remain protected from fishing in relatively small reserves.<sup>3</sup>

The current uncertainty and contestation around the impacts of marine protected areas highlights the urgent need for better monitoring systems. This is essential, so that current experience can help inform the better design of marine protection tools in the future.

## **Protection of biodiversity**

Experience from New Zealand and overseas indicates that individual marine protected areas can provide significant benefits for the biodiversity contained within them. There is strong scientific evidence to indicate that where extractive activities are prohibited, the abundance of previously exploited marine species

can increase dramatically, and that this can occur within relatively short periods of time.<sup>4</sup>

For example, densities of yellowtail snapper within sanctuary zones established in Florida were found to have increased 15-fold only four years after the protection measures were implemented. After nine years of protection, scallops in New England protected areas became 25 times more abundant.<sup>5</sup> At Cape Rodney-Okakari Point marine reserve near Leigh, which was established in 1975, snapper large enough to be legally caught were roughly fourteen times more abundant inside the reserve than outside it by 2002.<sup>6</sup>

## **Increased productivity**

An increase in the abundance of previously fished species can have positive flow-on effects throughout the food web. For example, the increase in snapper and rock lobster within the Cape Rodney-Okakari Point marine reserve was associated with a marked decrease in the abundance of kina or sea urchins (on which snapper and rock lobster prey), and a regeneration of kelp beds (on which the sea urchins prey). This, in turn, is likely to increase overall biodiversity and productivity within the marine reserve as kelp forests support a much richer faunal community than the ‘urchin barrens’ which occur when sea urchins are present in large numbers.<sup>7</sup>

## **Increased resilience and maintenance of ecosystem services**

We are only just beginning to understand the complexity of the interactions that link the oceans to the Earth’s processes and the ways in which we are reliant on their effective function.<sup>8</sup> For example, the oceans regulate our climate and provide the oxygen we breathe, and fish contribute to nutrient recycling as well as providing protein for human consumption. Coastal habitats provide shoreline protection, water filtration, and biodiversity habitat. All these functions have a value to society, whether individually or as a part of the larger whole.

Societies depend on these ‘ecosystem services’<sup>9</sup> for their existence, and value their ability to pass them on to future generations, although their importance is rarely explicitly recognised.<sup>10</sup> Despite an enduring public discourse which

erroneously pits the health of the economy against the health of the marine environment, this new understanding is contributing to calls for a greater focus on ensuring the *resilience* of marine systems. This refers to their ability to withstand poor management, cumulative damage and catastrophic natural events and still retain their basic function, including the delivery of the ecosystem services upon which we rely.<sup>11</sup> Healthy ecosystems are able to absorb and adapt to stresses (up to a point), because they are complex systems, which by their very nature provide some buffering against change.

However, our current approach to natural resource management fails to take into account the manner in which ecosystems respond to change. In many instances our actions reduce the ability of these systems to respond normally. Management measures rarely take into account the impact that activities will have on the entire ecosystem, and the failure to do this, means that the system can become increasingly vulnerable to shocks and disturbances. For example, individual fish stocks are managed with only limited reference to the role of the species in the wider ecosystem.<sup>12</sup> More broadly, the cumulative impacts of the range of extractive activities that occur in the marine environment, are rarely considered at all.

The protection of biodiversity is one important way in which the resilience of ecosystems can be bolstered.<sup>13</sup> As the Royal Society of New Zealand notes, the relationship between biodiversity and resilience is complex, but “*[e]cosystem functions, such as nutrient regulation, are provided by the traits of organisms within that ecosystem. Greater genetic diversity provides a greater reservoir of traits that can replace traits lost if particularly important species are lost. More diversity also provides more opportunity for functions to operate across a broader range of conditions. In this way, biodiversity provides the insurance value that future environmental changes will not reduce services.*”<sup>14</sup>

Well-designed marine protected areas can help to protect biological variation across habitats and species, and the maintenance of genetic variation within species, through protecting different populations across their geographic range.<sup>15</sup> They can protect parts of the marine environment from stressors which are spatial in nature (i.e. the activity can be prohibited in protected areas) and have localised impacts.<sup>16</sup>

However, the establishment of marine protected areas cannot address those stressors which are large scale (such as climate change), outside the marine environment (such as sediment run-off), or which are not excluded by spatial boundaries (such as marine pollution). A broader, ecosystem-based management

plan, into which marine protected areas are embedded, is required to address those issues.<sup>17</sup>

## **Benchmarking of environmental health**

The complexity of marine ecological dynamics makes it hard for scientists to assess the impact of anthropogenic pressures on the marine environment. It can be difficult to separate natural and anthropogenic disturbance and the direct effects of one activity over another.<sup>18</sup> Modelling can assist, but cannot provide all the answers. The establishment of areas in which damaging activities are excluded, can play an important role in providing 'benchmarks' or 'controls', against which human impacts and management of the rest of the marine area can be evaluated. This enables scientists to assess the effects of pressure from human activities in the context of prevailing environmental conditions.<sup>19</sup>

## **Fisheries spill-over**

It is possible that properly designed marine protected areas can benefit commercial and recreational fishers by helping to repopulate fish stocks outside the protected area. Much has been made of this potential, with proponents of marine protection seeking to use it to bolster their cause. Conversely, fishers often deny that marine protected areas are necessary or useful in the management of fish stocks, and resent the potential decrease in size of their fishing grounds. Clearly, marine protected areas will only directly benefit a fishery if harvestable-size stock moves from the closed area to open areas where they can be caught, or if eggs and larvae cross the boundary and establish outside the closed area.

The likelihood of 'spill-over' from a marine protected area into the fishable area depends on the mobility and habits of the species concerned, conditions inside and outside the marine protected area, and the area's design (for example, longer edges enhance the likelihood of spill-over).

The extent of spill-over is also dependent upon factors such as prevailing currents and spawning patterns. For example, studies of the Georges Bank protected area on the north-west coast of the Atlantic ocean, found that spill-over was enabled because fish larvae were transported out of the protected area by a well-established ocean current, an effect which was relatively easy to track.<sup>20</sup>

Some spill-over effects may be localised around the area adjacent to the protected area.<sup>21</sup> This has been documented in many areas, for example at Sumilon Island marine sanctuary in the Philippines,<sup>22</sup> the Su Pallosu<sup>23</sup> and Columbretes Islands<sup>24</sup> marine reserves in the western Mediterranean, the Soufriere marine management area in St Lucia and the Merritt Island national wildlife refuge in Florida.<sup>25</sup> The effect is most easily illustrated by the presence of fishers around the edges of the protected area. For example, satellite tracking of vessels off the Georges Bank shows that commercial trawlers now concentrate much of their activity on the borders of closed areas.<sup>26</sup> Similarly, in New Zealand, cray pots often line the reserve boundaries around the marine reserve at Leigh.<sup>27</sup>

Where recruitment is below the maximum possible outside the marine protected area, spill-over may be most apparent. Thus the most significant effects have been observed in locations where protected areas have been implemented in highly overfished ecosystems, particularly where the stock is heading towards extinction.<sup>28</sup>

Arguments about the effectiveness or otherwise of marine protected areas in improving fish stocks should be kept in perspective, as marine protected areas are valuable for many other reasons, and improving fish stocks is not usually the prime reason for their establishment.

## **Protection of geological processes**

Marine protected areas can be used to protect geological features and processes identified as particularly unique or typical. This may be closely interlinked with the protection of the biodiversity they support. For example, seamounts are valued both as rare geological features and for the unique ecological communities which are dependent on them.

In England, legislation providing for the creation of ‘marine conservation zones’ provides for their designation for the purpose of conserving features of geological or geomorphological interest, amongst other things.<sup>29</sup>

## **Protection of cultural values**

The protection of marine space can be of considerable cultural value. For example, the establishment of the Whanganui A Hei – Cathedral Cove marine reserve was supported by Ngāti Hei, because the area included tapu sites associated with tribal massacre.

Ngāti Hei believed that the establishment of the reserve enhanced its mana. Likewise, the Sugar Loaf Islands marine protected area includes tapu sites for at-sea burials.

## Increased recreational and tourism opportunities

Marine protected areas can contribute significantly to tourism and recreational opportunities in the marine space and coastal area. The extent of these benefits varies, depending on the location of the protected area. Clearly, accessible coastal locations may provide the most significant benefits in this regard. The increased abundance and range of species, as well as the larger size of individuals, which results from many marine protected areas can be attractive to scuba divers and snorkelers. In New Zealand, as overseas, the opportunity to dive in a marine reserve is a draw-card in itself, as protected areas are generally associated with good diving. This creates additional market opportunities for businesses associated with recreational diving and undersea viewing.

Studies of the impacts of marine reserves in New Zealand have shown a range of tourism and recreation benefits. For example, the establishment of the Tonga Island marine reserve adjacent to the Abel Tasman National Park increased the recreational value of the area. This in turn attracted greater numbers of visitors to the area. In response, new accommodation enterprises have established, and there are growing numbers of water taxi operators. There has also been a significant growth in the number of kayak companies, from the two operating prior to the establishment of the marine reserve, to at least 13 currently.<sup>30</sup>

A recent study estimated the value of marine recreation in the Hauraki Gulf at \$550 million. Nature-based tourism in the Gulf was estimated to be worth \$1,672 million, whilst recreational fishing was worth \$104 million.<sup>31</sup> Similarly, the establishment of the Great Barrier Reef Marine Park in Australia has made a significant contribution to recreational opportunities and tourism revenue. The Park generates an estimated “[AU]\$2.8 billion a year in tourism and the local growth it supports in lodging, restaurants, transport, retail fishing gear, boat hire, charter fishing and guide businesses, scuba businesses and so forth.”<sup>32</sup>

At the Tonga Island marine reserve, it was reported that a majority of the local community was opposed to the reserve prior to its establishment, fearing impacts on commercial and recreational fishing and doubting that any significant benefits could arise. After its establishment, many changed their minds, having seen significant benefits in terms of recreation opportunities and new tourism

businesses, and having discovered that the feared negative impacts were not nearly as bad as expected.<sup>33</sup>

Similar benefits have been experienced from the Cape Rodney - Okakari Point marine reserve. An economic impact analysis undertaken in 2008 identified an estimated 375,000 annual visits to the reserve and the contribution of \$18.6 million a year into the local economy. This was compared to the cost to the Department of Conservation of managing the reserve of around \$70,000 per year.<sup>34</sup>

## Conclusion

Marine protected areas can potentially provide a range of benefits. Some of these benefits, such as biodiversity protection, are well-established by scientific research. Others, such as fisheries spill-over, are still subject to dispute and may vary according to local circumstances.

Fishers have often argued that the application of fisheries management tools, such as the quota management system, is sufficient to protect the marine environment and that additional tools, such as marine protected areas, are not required. However, it needs to be recognised that fisheries managers have been slow to apply ecosystems-based approaches to their management task. Fisheries management tools may be the most appropriate means by which to manage fish stocks in the short term, but marine protected areas are a vital tool to protect marine biodiversity and ecosystems, thereby sustaining fisheries in the longer term.

### ***Figure 3.1: Summary of potential benefits of marine protected areas***

- Protection of biodiversity
- Increased productivity of ecosystems
- Increased resilience of the marine environment to damage from human activity, thereby safeguarding ecosystem services
- Provision of 'benchmarks' against which the impacts of human activities in other parts of the marine environment can be compared
- Improved fisheries through spillover of eggs, larvae and adult fish
- Protection of geological processes
- Protection of cultural values
- Increased opportunities for tourism and recreational activities and maintenance of New Zealand's 'green' international image

# Endnotes

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6. Willis T *et al*, 2003
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8. Beaudoin Y and L Pendleton (eds), 2012
9. See Study of Critical Environmental Problems, 1970, in which the term was first introduced (then known as 'environmental services').
10. Walker B and D Salt, 2006, 7
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12. This is recognised in the Ministry of Fisheries, 2005. Recently developed 'fisheries plans' aim to manage fish stocks with greater reference to their environmental context, but do not constitute a fully developed ecosystem-based approach to fishery management
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