

National overview of biological monitoring in New Zealand's Marine Protected Areas



Department of Conservation
Te Papa Atawhai

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Kim Westerkov.

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Executive summary

This report provides a national overview of biological monitoring that has been undertaken or is in progress for 25 Marine Protected Areas and Applications (MPAAs) in New Zealand—16 marine reserves (MR) and the Sugar Loaf Islands Marine Park (SLIMPA) and 8 marine reserve applications (MRA). MPAAs have been established since 1975, however, most MPAAs (22) have only been established or the applications lodged in the last 10 years.

There have been a total of 41 baseline surveys and monitoring programmes undertaken in 19 of the 25 MPAAs since 1975.

About half the MPAAs (15) in New Zealand have had a baseline survey conducted near to the establishment of the MR or the application of a MRA. Many of these baseline surveys were not used to establish monitoring programmes. Most of the baseline surveys included habitat surveys. Generally habitat monitoring has not been continued.

Eighteen MPAAs have had monitoring programmes undertaken. There are 9 programmes currently running that are formally planned to continue beyond June 2000. Most monitoring programmes that have been undertaken or are currently underway focus on examining changes in population abundance and size structures of selected key species especially reef fish species, rock lobster, paua and kina.

A total of 52 monitoring reports have been produced to date, with a further 9 in the process of being produced. Where possible, all existing reports on biological monitoring to date (November 2000) were obtained and forwarded to the Northern Regional Office, Department of Conservation (DOC).

The overview has shown that marine survey and monitoring work has not been well co-ordinated in the past. It is recommended that biological monitoring should be nationally co-ordinated. Benefits arising from this would include, assistance with obtaining funding and other necessary resources, assessment and standardisation of baseline surveys and monitoring programmes, centralised storage of data and reports, and the development of protocols of what and how to monitor. However, much of this work is currently underway with the development of a Standard Operating Procedure for survey and monitoring in marine reserves.

There are also a number of issues relating to raw data, including intellectual property rights, ownership and storage and access, which need to be resolved. It is essential that raw data is recovered and centralised where possible, so it can be used to assess condition and trends in marine reserves over time. It is **recommended** that the Marine Survey and Monitoring Advisory Group (MSMAG):

- obtains the raw data held within DOC and by external contractors,
- develops a storage system for the raw data, and
- decides how it will be used to determine condition and trends in marine reserves.

The conservancy information in Appendix 1 provides an inventory of marine biological monitoring and it is **recommended** that this be electronically updated annually.

Background

The Department of Conservation (DOC) is charged with protecting the intrinsic, natural and cultural values of the marine areas it manages, in particular marine reserves. This mandate is derived from the Conservation Act 1987 and the Marine Reserves Act 1971. Specific directives are prescribed in the Strategic Business Plan for 1998/2002 (Department of Conservation, 1998) e.g. Objective 1.2.2¹.

The Northern Regional Office (NRO) of DOC, is the lead regional office for developing procedures to standardise marine monitoring (refer Department of Conservation, in prep.), and for ensuring that the condition of marine areas managed by DOC, and the biological trends that may be occurring within them, can be accurately assessed. A critical component of developing standardised approaches to monitoring is to obtain a national overview of all biological monitoring which has been carried out in marine areas managed by DOC.

Although the NRO has identified most of the monitoring being undertaken and holds many of the monitoring reports, it appears that some conservancies have, over the years, contracted or carried out their own monitoring work, and in some cases this information has been retained within that particular conservancy. This has made it difficult to track all marine biological monitoring programmes that have been undertaken.

The DOC files show that there have been prior attempts to summarise biological surveys and monitoring programmes for marine areas managed by DOC, in particular marine reserves. However, these various internal reports and the report by Pugsley & Turnbull (1994), did not contain sufficient detail for the purposes of implementing the objectives in the Strategic Business Plan.

The purpose of this report is to give a national overview of the current status of biological monitoring in existing marine reserves, marine reserve applications and the Sugar Loaf Islands Marine Protected Area in New Zealand.

Once a complete set of monitoring reports has been collated, DOC will be in a position to assess the condition of marine areas managed by DOC from places where monitoring has occurred, and evaluate biological trends that may be occurring in marine reserves. The Marine Survey and Monitoring Advisory Group (MSMAG)² will then be able to make recommendations for further monitoring programmes and standardised survey and monitoring methods.

¹ Natural Heritage Goal 1.2 Marine Environment, Objective 1.2.2 p. 37 — 'Effectively manage all marine protected areas by: monitoring condition and trends; compliance promotion; and intervening where necessary to protect ecosystem health and quality.' Objective 1.2.2 Outcome Targets—'Implement the priority elements of the standardised approach to monitoring and reporting of marine reserves conditions and trends, as resources and capacities permit, by December 2001.'

² The Marine Survey and Monitoring Advisory Group (MSMAG) comprises marine specialists from DOC who are able to provide relevant advice to conservancies on survey and monitoring within marine reserves. The terms of reference for MSMAG can be found in Appendix 1 of the Standard Operating Procedure for Survey and Monitoring of Marine Reserves (Department of Conservation, in prep.)

Scope of the report

An overview of each biological monitoring programme³ occurring in established marine reserves (MRs) and marine reserve applications (MRAs) has been provided for each conservancy. Information on the Sugar Loaf Islands Marine Protected Area (SLIMPA)⁴ has also been included because it is currently monitored by DOC. In this report, marine reserves, marine reserve applications and SLIMPA have been collectively termed Marine Protected Areas and Applications (MPAAs).

Although Tawharanui and Mimiwhangata Marine Parks are Marine Protected Areas (MPAs)⁵ in which DOC has some involvement, they are managed by other agencies and DOC does not have any monitoring programmes in these MPAs. Consequently, summaries of monitoring from these two MPAs have not been included in this report.

Tawharanui Marine Park is managed by Auckland Regional Council and the Ministry of Fisheries. Auckland Regional Council provides on site interpretation at Tawharanui Marine Park and helps with fishing regulations compliance and law enforcement. The fishing regulations essentially protect the marine life of the area and therefore it is effectively a marine reserve. Monitoring has been conducted in the park over a number of years (e.g. Grace 1979, 1980, 1981, 1982, 1983, 1989, 1991; ARC 1994). DOC has not carried out any marine biological monitoring in the park.

Mimiwhangata Marine Park is managed by the Ministry of Fisheries and DOC. DOC provides on site interpretation at Mimiwhangata Marine Park and helps with fishing regulations compliance and law enforcement (Piet Nieuwland, pers. comm.). DOC has not carried out any marine biological monitoring in the park. However, monitoring was conducted there during the 1970s and 1980s (e.g. Ballantine et al. 1973; Grace 1985).

No other types of MPAs are included in this report.

Every effort was made to obtain all relevant monitoring information for each marine reserve, marine reserve application and SLIMPA within the term of the contract. However there are some gaps where information could not be obtained or was not supplied, or where reports could not be located. Information provided in this report was the best available at the time of writing. In addition, no attempt has been made to critique the quality of the survey methods used or the quality of reports.

³ For the purposes of this report 'biological monitoring programme' refers to any monitoring, as defined by Kingsford & Battershill (1998) p. 284, that has been undertaken with the intention or potential of establishing ongoing monitoring, or has been ongoing.

⁴ The Sugar Loaf Islands were declared a marine protected area under a special Act of Parliament in 1991. Management of the Sugar Loaf Islands Marine Protected Area is shared by Ministry of Fisheries and DOC. Specific Fisheries Regulations and fisheries resources, as defined under the Fisheries Act 1996, are the responsibility of the Ministry of Fisheries, while the foreshore, seabed, sea water, bird life and marine mammals are the responsibility of DOC. From Fechney (1997).

⁵ Marine protected areas (MPAs) are defined by the World Conservation Union (IUCN) as: 'areas of the marine environment which are specifically dedicated to the protection and maintenance of marine biological diversity and managed through legal or other effective means' (IUCN 1999).

Introduction

The main body of this report comprises relevant information on biological monitoring⁶ in each marine reserve, marine reserve application and SLIMPA for each conservancy. This information is provided in four sections in **Appendix 1: Conservancy MPAA monitoring information**, for each conservancy.

Section 1: Marine biological monitoring programme descriptions

A brief description of each biological monitoring programme (if any) per MPAA, where information was available. This includes notes on any relevant information (e.g. who conducted the monitoring, timing/intervals of monitoring, how raw data is stored, any reports, any specific recommendations that may have been made in monitoring reports, and the future of the monitoring programme).

Section 2: Marine biological monitoring programme timelines

A timeline for each monitoring programme occurring in each MPAA.

Section 3: Relevant site survey and biological monitoring reports summary table

A table that lists, by MPAA in each conservancy, all relevant site surveys and biological monitoring documents which have been prepared by external groups (such as Universities and Polytechnics), DOC or submitted by external contractors to DOC. This includes published and unpublished reports, interim status reports⁷ from external contractors, thesis's and scientific papers.

The site survey reports listed in the tables only include reports that have been used as baseline studies⁸ for existing and/or proposed monitoring programmes or where they may be able to be used as baseline studies in the future.

The tables do not include the site survey reports, which can be found in the Conservancy Coastal Resource Inventories and Areas of Significant Conservation Value documents, and in the marine reserve application documents. Information contained in these documents generally does not provide sufficient information to form baseline surveys.

⁶ Monitoring—'sampling in time with adequate replication to detect variation over a temporal range from short to long time periods; done at more than one location.' From Kingsford & Battershill 1998, pp. 19, 40 and 284.

⁷ Interim status reports are supplied by some contractors at various intervals during their contract. These reports provide an account of the progress of the project and may contain some preliminary results and information. They do not contain final results, analysis or conclusions. For this reason, they are not considered to be monitoring reports.

⁸ Baseline study—'data collected to define the present state of an assemblage.' From Kingsford & Battershill 1998, pp. 19, 40-41 and 281.

The monitoring reports⁹ included in the tables cover all reports on data obtained from monitoring programmes including interim status reports and scientific papers.

Where possible, the location of the raw data¹⁰ and the format it is in has been identified. In the case of external contractors, the access (if any) DOC has to that data has been established and recorded. Details of this are also given in Appendix 2.

Section 4: Site survey and biological monitoring references

A list of the references used in the previous three sections.

This report summarises the information contained in Appendix 1, and covers issues and recommendations arising from the collation of the information.

Information for this report was obtained from a number of sources. These included: DOC files, library searches, existing reports (published and unpublished) and the 'DOC March 2000 Monthly Topic—marine reserves and marine mammals regional summaries'. Most importantly information was supplied and checked by personal communications with key DOC staff and external contractors.

In addition to this report, copies of monitoring reports and raw data not held at the NRO prior to this overview were subsequently supplied to NRO, where these could be obtained.

⁹ Monitoring reports in this overview are considered to be reports that present an analysis of the data collected. This may be at the completion of a monitoring programme or at intervals during a monitoring programme.

¹⁰ The term raw data in this report covers raw data in all forms including, photographs, video footage, field notes, hand-written sheets, photocopied divers slates or unanalysed computer files of data.

Summary of conservancy monitoring information

This overview reports on monitoring programmes that have been undertaken in a total of 25 MPAAAs (16 marine reserves, eight marine reserve applications and SLIMPA). The MPAAAs are located in 11 DOC conservancies. Figure 1 shows the location of New Zealand's marine reserves, marine reserve applications and SLIMPA as at November 2000.

Only four of the MPAAAs have been established for more than 10 years. Table 1 provides a summary of MPAAAs by conservancy. The longest established MPAA, Cape Rodney to Okakari Point Marine Reserve (CROP), has been operational for 25 years. The newest MPAAAs (Te Tapuwae o Rongokako and Pohatu marine reserves) have been operational for about one year.

Three conservancies, Wanganui, Otago and West Coast, do not have marine reserves, however, Wanganui and Otago Conservancies have marine reserve applications. The West Coast Conservancy has no MPAs, or formal marine reserve applications pending. However, the West Coast Conservancy is conducting preliminary surveys and research that will support the identification of potential marine reserve sites, concentrating on the South Westland Area. The Conservancy has no dedicated biological monitoring programmes at potential marine reserve sites. For this reason the Conservancy is not covered further in this report.

Table 2 provides a summary of baseline surveys, monitoring programmes and control sites for MPAAAs. Fifteen of the 25 MPAAAs have had at least one baseline survey undertaken close to the establishment of the MPA or close to the time when an MPA application was lodged. Eighteen of the 25 MPAAAs have had at least one monitoring programme undertaken with control sites. There has been a total of 41 baseline surveys and monitoring programmes undertaken in 19 of the MPAAAs.

BASELINE SURVEYS

With respect to marine reserves, 13 of the 16 have had at least one baseline survey set up just before or just after the establishment of the reserve (see Table 2). Some of these provide the basis from which monitoring programmes have been established e.g. Pollen Island, Tuhua, Te Angiangi, Te Tapuwae o Rongokako, Long Island - Kokomohua, and Tonga Island marine reserves. A baseline was completed for Pohatu Marine Reserve in July 2000, which will form the basis of the proposed ongoing monitoring programme. The baseline and monitoring programme at Pollen Island Marine Reserve was established to monitor the potential impacts of constructing a motorway interchange unlike the others which were established to monitor biological trends after full protection.

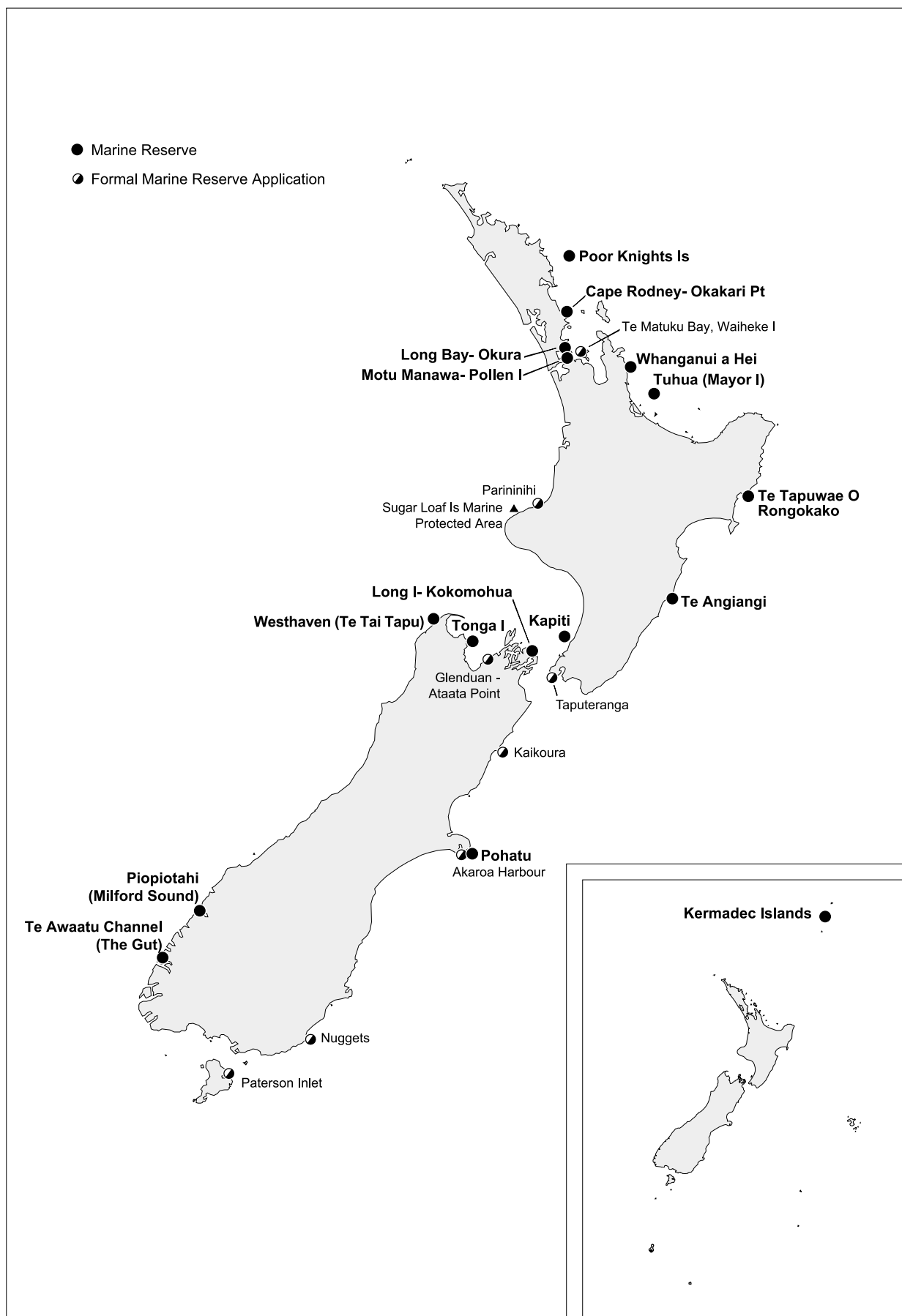


Figure 1. Location map of New Zealand marine reserves, marine reserve applications and the Sugar Loaf Island Marine Protected Area (SLIMPA) as at November 2000.

TABLE 1. MARINE RESERVES, MARINE RESERVE APPLICATIONS, AND SLIMPA BY DOC CONSERVANCY AS AT NOVEMBER 2000. THERE ARE 25 MARINE PROTECTED AREAS AND APPLICATIONS (MPAAS).

CONSERVANCY	MARINE RESERVE/S AND SLIMPA	MARINE RESERVE APPLICATION/S ¹	YEAR ESTABLISHED OR APPLICATION LODGED	OPERATIONAL (YEARS)
Northland	Poor Knights Islands		1981	19
		None	N/A	N/A
Auckland	Cape Rodney to Okakari Point		1975	25
	Kermadec Islands		1990	10
	Long Bay - Okura		1995	5
	Motu Manawa - Pollen Island		1995	5
		Te Matuku Bay	1998	N/A
Waikato	Te Whanganui a Hei		1992	8
		None	N/A	N/A
Bay of Plenty	Tuhua (Mayor Island)		1992	8
		None	N/A	N/A
EC/HB	Te Angiangi		1998	2
	Te Tapuwae o Rongokako		1999	<1
		None	N/A	N/A
Wanganui	SLIMPA		1986	14
		Parininihi	1995	N/A
Wellington	Kapiti		1992	8
		Taputeranga	2000	<1
N/M	Long Island - Kokomohua		1993	7
	Tonga Island		1993	7
	Westhaven (Te Tai Tapu)		1994	6
		Kaikoura	1992	N/A
		Glenduan - Ataata Point	1999	N/A
West Coast	None		N/A	N/A
		None	N/A	N/A
Canterbury	Pohatu		1999	1
		Akaroa Harbour	1996	N/A
Otago	None		N/A	N/A
		Nugget Point	1992	N/A
Southland	Te Awaatu Channel - The Gut		1993	7
	Piopiotaahi		1993	7
		Paterson Inlet	1994	N/A
16 marine reserves 1 marine protected area		8 marine reserve applications		
Total number of MPAAs = 25				

¹ Formal marine reserve applications awaiting ministerial decisions.

TABLE 2. SUMMARY OF BASELINE SURVEYS, MONITORING PROGRAMMES AND CONTROL SITES FOR MARINE PROTECTED AREAS AND APPLICATIONS (MPAAS) AS AT NOVEMBER 2000 (ADAPTED FROM WALLS, IN PRESS).

CONSERVANCY	MARINE RESERVES (MR), MARINE RESERVE APPLICATIONS (MRA) AND SLIMPA	BASELINE SURVEY/S ¹	MONITORING PROGRAMME/S	CONTROL SITES ²	CURRENT MONITORING ³	NUMBER OF SURVEYS ⁴
Northland	Poor Knights Islands MR	Y	Y	Y	Y	3
Auckland	Cape Rodney to Okakari Point MR	Y	Y	Y	N	4
	Kermadec Islands MR	N	N	N	N	0
	Long Bay-Okura MR	Y	Y	Y	N	1
	Motu Manawa - Pollen Island MR	Y	Y	Y	N	1
	Te Matuku Bay MRA	N	N	N	N	0
Waikato	Te Whanganui a Hei MR	Y	Y	Y	N	5
Bay of Plenty	Tuhua (Mayor Island) MR	Y	Y	Y	N	1
EC/HB	Te Angiangi MR	Y	Y	Y	Y	1
	Te Tapuwae o Rongokako MR	Y	Y	Y	Y	1
Wanganui	SLIMPA	Y	Y ⁵	Y ⁵	N	4
	Parininihi MRA	N	N	N	N	0
Wellington	Kapiti MR	Y	Y	Y	Y	4
	Taputeranga MRA	N	Y	Y	Y	2
N/M	Long Island - Kokomohua MR	Y	Y	Y	Y	1
	Tonga Island MR	Y	Y	Y	Y	1
	Westhaven (Te Tai Tapu) MR	N	Y	Y	N	1
	Kaikoura MRA	N	N	N	N	0
	Glenduan - Ataata Point MRA	N	N	N	N	0
West Coast	None	N/A	N/A	N/A	N/A	N/A
Canterbury	Pohatu MR	Y	Y ⁵	Y ⁵	N	1
	Akaroa Harbour MRA	N	N	N	N	0
Otago	Nugget Point MRA	Y	N	N	N	1
Southland	Te Awaatu Channel - The Gut MR	N	Y	Y	Y	2
	Piopiotaahi MR	Y	Y	Y	N	4
	Paterson Inlet MRA	N	Y	Y	N	3
Total number of MPAAs = 25						
Total number of MPAAs with baseline survey/s		15				
Total number of MPAAs with monitoring programme/s			18			
Total number of MPAAs with control sites				18		
Total number of MPAAs with current monitoring programmes					8	
Total number of baseline surveys and monitoring programmes						41

¹ Baseline surveys conducted or commissioned by DOC or conducted by external groups, just before or shortly after the marine reserve/SLIMPA was established or the marine reserve application was lodged.

² Control sites outside the marine reserve, marine application area, or SLIMPA.

³ Monitoring programme/s currently underway that are funded by DOC and are planned to continue past June 2000.

⁴ Number of baseline surveys and monitoring programmes that have been conducted.

⁵ Proposed monitoring programme (preliminary surveys completed).

A number of these surveys have not been used to develop formal monitoring programmes by DOC. These include surveys at the: Poor Knights Marine Reserve (e.g. Schiel 1984), CROP (Ayling 1978), Long Bay - Okura Marine Reserve (Green 1991—ARC has continued monitoring from these earlier surveys), Te Whanganui a Hei Marine Reserve (Coffey & Grace 1990; Bay of Plenty Polytechnic 1991), Kapiti Marine Reserve (Battershill et al. 1993) and Piopiotahi Marine Reserve (Turnbull 1993).

In some of these cases, surveys using previous baseline data have been conducted. For example, Mendoza et al. (1995) compared paua and rock lobster with results obtained by Battershill et al. (1993) at Kapiti Marine Reserve.

No baseline surveys have been undertaken close to the time of establishment of the Kermadec Islands, Westhaven (Te Tai Tapu), or Te Awaatu Channel or marine reserves. However, some of the surveys conducted at these reserves may be able to be used as baseline surveys (e.g. Schiel et al. 1986; Davidson 1990; Grange 1990), although these surveys may not enable the full extent of any changes that may have occurred since the marine reserve was established to be demonstrated.

A baseline survey was conducted at Sugar Loaf Island Marine Protected Area (SLIMPA) (New Plymouth Underwater Club, 1989), although this was not used to continue monitoring. However, a comprehensive monitoring proposal is currently being developed and processed through MSMAG for SLIMPA (Department of Conservation 2000). A pilot study, which will be used to determine the baseline and monitoring programme, has been completed and is currently being written up (Rosemary Miller, Wanganui Conservancy, pers. comm.).

Of the eight marine reserve applications, only Nugget Point has a baseline survey undertaken close to the time the application was lodged. Blue Package funding has been allocated to establish a baseline survey for Parininihi Marine Reserve Application. Site surveys and habitat mapping that have been conducted at the Parininihi Marine Reserve Application area, may form part of the habitat baseline monitoring (e.g. Battershill & Page 1996; Foster & MacDiarmid 1997).

MONITORING PROGRAMMES

Of the 25 MPAAAs, 18 have had or currently have monitoring programmes with control sites. At present there are eight DOC funded monitoring programmes running in MPAAAs that are planned to continue past June 2000 (See Table 2 and Table 5).

Of the 16 marine reserves, 15 have had at least one monitoring programme undertaken with control sites. A number of these are monitoring programmes that have recently been established. There has been no monitoring conducted at the Kermadec Islands Marine Reserves. A monitoring proposal is currently being developed and processed through MSMAG for Pohatu Marine Reserve.

Recently begun (i.e. 1999/2000) marine reserve monitoring programmes approved by MSMAG include:

1. Fish surveys at
 - CROP (DOC external contract NRO/02/02—1-year project completed June 2000).
 - Te Whanganui a Hei Marine Reserve (DOC external contract NRO/02/04—1-year project completed June 2000).
 - Te Tapuwae o Rongokako Marine Reserve (DOC—internal).
2. Rock lobster surveys at
 - CROP (DOC external contract NRO/02/06—1-year project completed June 2000).
 - Te Awaatu Channel (DOC external contract, then DOC conservancy funded),
 - Piopiotahi Marine Reserve (DOC conservancy funded—programme future not confirmed).
3. Habitat surveys at
 - CROP (DOC external contract NRO/02/01—1-year project completed June 2000).
 - Long Bay - Okura Marine Reserve (DOC external contract—6-months project completed June 2000).
 - Te Whanganui a Hei Marine Reserve (DOC external contract NRO/02/03—1-year project completed June 2000).
 - Te Tapuwae o Rongokako Marine Reserve (DOC—internal).

Taputeranga marine reserve application has a baseline survey (established two years before the application was lodged) and a DOC funded monitoring programme currently running. Paterson Inlet marine reserve application has ongoing monitoring programmes, which were established some time after the proposal was formally lodged. No other marine reserve applications have monitoring programmes.

TYPES OF MONITORING PROGRAMMES

Biological monitoring undertaken in MPAAAs includes:

- Habitat—Monitoring features, flora and fauna of the MPA. Examines changes in habitats and communities (e.g. the extent of seagrass beds within an estuarine environment, kelp forest in a rocky coastal environment).
- Selected key species—Monitoring the effect of preservation on population abundance patterns and size structures of selected species (e.g. rock lobster, paua and kina).
- Impact—Monitoring the effect of human activity on the MPA (e.g. species, populations and habitats).

There has not been any formal bio-security surveillance monitoring established in any MPAA, i.e. monitoring for exotic introductions such as *Undaira* or monitoring the extent of exotic organisms such as the spread of *Spartina* in estuarine areas (Rachel Garthwaite, Science and Technical Centre, Department of Conservation, pers. comm.). However, Nelson/Marlborough Conservancy carries out occasional inspections for *Spartina* in Westhaven (Te Tai Tapu) Marine Reserve.

Table 3 summarises the types of monitoring programmes that have been undertaken in New Zealand's MPAAAs. Thirteen of the MPAAAs have had habitat surveys undertaken. However, most of these were set up as part of the baseline survey and have not been continued. Most of the monitoring is focused on

TABLE 3. TYPES OF MONITORING PROGRAMMES IN MARINE PROTECTED AREAS AND APPLICATIONS (MPAAs) AS AT NOVEMBER 2000. INCLUDES COMPLETED AND CURRENT MONITORING PROGRAMMES.

CONSERVANCY	MARINE RESERVE/S (MR), MARINE RESERVE APPLICATION/S (MRA) AND SLIMPA	HABITAT ¹	SELECTED KEY SPECIES ²	IMPACT ³
Northland	Poor Knights Islands MR	✓	✓	
Auckland	Cape Rodney to Okakari Point MR	✓	✓	
	Kermadec Islands MR			
	Long Bay - Okura MR	✓	✓	
	Motu Manawa - Pollen Island MR Te Matuku Bay MRA			✓
Waikato	Te Whanganui a Hei MR	✓	✓	
Bay of Plenty	Tuhua (Mayor Island) MR	✓	✓	
EC/HB	Te Angiangi MR	✓	✓	
	Te Tapuwae o Rongokako MR	✓	✓	
Wanganui	SLIMPA	✓ ⁴	✓ ⁴	
	Parininihi MRA			
Wellington	Kapiti MR	✓	✓	
	Taputeranga MRA	✓	✓	
N/M	Long Island - Kokomohua MR	✓	✓	
	Tonga Island MR	✓	✓	
	Westhaven (Te Tai Tapu) MR	✓		
	Kaikoura MRA			
	Glenduan - Ataata Point MRA			
West Coast	None	N/A	N/A	N/A
Canterbury	Pohatu MR	✓ ⁴	✓ ⁴	
	Akaroa Harbour MRA			
Otago	Nugget Point MRA			
Southland	Te Awaatu Channel - The Gut MR	✓	✓	✓
	Piopiotaahi MR		✓	
	Paterson Inlet MRA		✓	
Total number of MPAAs = 25				
Completed and current monitoring programmes		13	14	2
Proposed monitoring programmes		2	2	0

¹ Habitat—monitoring features, flora and fauna of the MPA. Examines changes in habitats and communities (e.g. the extent of seagrass beds within an estuarine environment, kelp forest in a rocky coastal environment).

² Selected key species—monitoring the effect of preservation on population abundance patterns and size structures of selected species (e.g. rock lobster, paua, kina).

³ Impact—monitoring the effect of human activity on the MPA (e.g. species, populations, habitats).

⁴ Proposed monitoring programme (preliminary surveys completed).

selected key species. These are the programmes that have tended to be most regularly monitored and continued.

There have only been two impact monitoring programmes. The impact of constructing a motorway interchange has been studied at Pollen Island Marine Reserve (e.g. Kingett Mitchell & Associates 1999), and the potential negative impact of divers on red coral was monitored at Te Awaatu Channel Marine Reserve (e.g. Miller & Mundy 1999). However, there have been three other research studies examining human impacts on MPAAAs. Two of the studies examined the impacts of visitors on marine habitats in CROP—human trampling (Brown 1996; Brown and Taylor, 1999) and the operation of a glass bottomed boat (Jeffs 1993). The other study was a one-off survey conducted to monitor the effects of a rat poison operation on marine life in Kapiti Marine Reserve (Cole & Singleton 1996).

Table 4 shows the monitoring programmes that are most commonly undertaken. They are generally programmes that monitor conspicuous previously harvested species (e.g. reef fish, rock lobster, paua and kina). As stated above, programmes designed to monitor trends of benthic communities have generally been set up as part of the baseline survey, but few are monitored on a regular basis.

Table 5 shows the 9 monitoring programmes funded by DOC that are currently running.

MONITORING REPORTS

Table 6 summarises the number of monitoring reports by conservancy. To date 61 monitoring reports (excluding interim status reports, theses and scientific papers and monitoring proposals) have been produced or are in the process of being produced (6 in preparation, 2 in draft and 1 undergoing DOC review in preparation for publication).

Northland Conservancy has 1 report, Auckland Conservancy 30, Waikato Conservancy 7, Bay of Plenty Conservancy 3, East Coast/Hakwe's Bay Conservancy 2, Wellington Conservancy 2, Nelson/Marlborough Conservancy 5, Canterbury 1 and Southland Conservancy 10 monitoring reports.

Not all of the reports on monitoring were commissioned by DOC. Ten are related to monitoring commissioned by external organisations at Long Bay Marine Reserve, and there are a few others that have been completed by teaching institutions (e.g. Mendoza et al. 1995; Shears & Babcock 1997 and Mae 1998). In some of these cases the research has been part funded by DOC or DOC has provided logistical assistance.

Nearly half (21) of the reports relate to human impact monitoring programmes. Sixteen of these are related to the impact monitoring conducted at Pollen Island Marine Reserve, four reports at Te Awaatu Channel Marine Reserve and one at Kapiti Island.

Of the 18 MPAAAs which have had monitoring programmes, only 3 do not have any monitoring reports produced or currently in preparation.

A list of the monitoring reports is provided in **Appendix 3**.

TABLE 4. COMMONLY MONITORED ORGANISMS IN MARINE PROTECTED AREAS AND APPLICATIONS (MPAAS) AS AT NOVEMBER 2000. INCLUDES COMPLETED AND CURRENT MONITORING PROGRAMMES, AND THOSE THAT ARE PROPOSED TO BE UNDERTAKEN.

CONSERVANCY	MARINE RESERVE/S (MR), MARINE RESERVE APPLICATION/S (MRA) AND SLIMPA	SELECTED REEF FISH SPECIES	ROCK LOBSTER	PAUA	KINA	SELECTED ALGAL SPECIES	OTHER SELECTED INVERTEBRATE SPECIES
Northland	Poor Knights Islands MR	1,2	1		1	1	1
Auckland	Cape Rodney to Okakari Point MR	1	1	1	1	1	1
	Kermadec Islands MR						
	Long Bay - Okura MR				1	1	1
	Motu Manawa - Pollen Island MR						
	Te Matuku Bay MRA						
Waikato	Te Whanganui a Hei MR	1	1	1	1	1	1
Bay of Plenty	Tuhua (Mayor Island) MR	1	1	1	1	1	1
EC/HB	Te Angiangi MR	1,2	1,2	1,2	1,2		1,2
	Te Tapuwae o Rongokako MR	1,2	1,2				
Wanganui	SLIMPA	3	3		3	3	3
	Parininihi MRA						
Wellington	Kapiti MR	1,2	1,2	1,2	1,2	1,2	1,2
	Taputeranga MRA	1,2	1,2	1,2	1,2	1,2	1,2
N/M	Long Island - Kokomohua MR	1,2	1,2	1,2	1,2	1,2	1,2
	Tonga Island MR	1,2	1,2		1,2		
	Westhaven (Te Tai Tapu) MR						
	Kaikoura MRA						
	Glenduan - Ataata Point MRA						
West Coast	None	N/A	N/A	N/A	N/A	N/A	N/A
Canterbury	Pohatu MR	3	3	3			
	Akaroa Harbour MRA						
Otago	Nugget Point MRA	1	1	1	1	1	1
Southland	Te Awaatu Channel - The Gut MR		1,2				1
	Piopiotaahi MR	1	1	1	1	1	1
	Paterson Inlet MRA	1		1	1		
Total number of MRs, MRAs and SLIMPA = 25							
Completed monitoring		13	13	10	13	10	12
Current monitoring		7	7	4	5	3	4
Proposed monitoring		2	2	1	1	1	1

¹ Monitoring that has been completed.

² Monitoring programme/s currently underway that are funded by DOC and are planned to continue past June 2000.

³ Proposed monitoring programmes (preliminary surveys completed).

TABLE 5. CURRENT DOC FUNDED MONITORING PROGRAMMES AS AT NOVEMBER 2000.

CONSERVANCY	MPAS WITH MONITORING PROGRAMME/S CURRENTLY UNDERWAY THAT ARE FUNDED BY DOC AND ARE PLANNED TO CONTINUE PAST JUNE 2000	MONITORING PROGRAMME
Northland	Poor Knights Islands MR	Selected Key Species—Demersal fish. (DOC external contract SIN 3270).
EC/HB	Te Angiangi MR	Selected Key Species. (DOC—internal, Conservancy funded.)
	Te Tapuwae o Rongokako MR	Selected Key Species. (DOC—internal, Conservancy funded.)
Wellington	Kapiti MR	Selected Key Species. (DOC external contract SIN 2535).
		Selected Key Species. (DOC external contract—NIWA. Part funded by Blue Package and non-financial assistance provided by Wellington Conservancy. Field assistance provided by DOC staff.)
	Taputeranga MRA	Selected Key Species. (DOC external contract SIN 2535).
N/M	Long Island - Kokomohua MR	Habitat & Selected Key Species. (DOC external contract—Davidson Environmental Ltd. Funded by Nelson/Marlborough Conservancy, diving support and logistic assistance provided by DOC staff).
	Tonga Island MR	Habitat & Selected Key Species. (DOC external contract—Davidson Environmental Ltd. Funded by Nelson/Marlborough Conservancy, diving support and logistic assistance provided by DOC staff).
Southland	Te Awaatu Channel - The Gut MR	Selected Key Species—rock lobster. (DOC external contract—Shane Kelly, Coastal & Aquatic Systems Ltd. Blue Package funding. To be funded and continued by Southland Conservancy).

TABLE 6. NUMBER OF MONITORING REPORTS (EXCLUDING INTERIM STATUS REPORTS, THESES AND SCIENTIFIC PAPERS OR MONITORING PROPOSALS) BY CONSERVANCY AS AT NOVEMBER 2000, AND THE NUMBER OF MONITORING REPORTS HELD AT NORTHERN REGIONAL OFFICE.

Of the total 61 reports, 52 monitoring reports have been produced, 1 is undergoing SRU review, 2 are in draft form and another 6 are in preparation.

CONSERVANCY	MARINE RESERVE/S (MR), MARINE RESERVE APPLICATION/S (MRA) AND SLIMPA	NUMBER OF MONITORING REPORTS	NUMBER OF MONITORING REPORTS AT NRO
Northland	Poor Knights Islands MR	1	0 (under-going SRU review)
Auckland	Cape Rodney to Okakari Point MR	6	4 (1 DOC Lib request, 1 held in DOC Lib)
	Kermadec Islands MR	0	N/A
	Long Bay - Okura MR	8	2 (6 held in Auckland Conservancy)
	Motu Manawa - Pollen Island MR	16	7 (9 held in Auckland Conservancy)
	Te Matuku Bay MRA	0	N/A
Waikato	Te Whanganui a Hei MR	7	6 (1 Kauaeranga Field Centre)
Bay of Plenty	Tuhua (Mayor Island) MR	3	1 (2 Tauranga Area Office)
EC/HB	Te Angiangi MR	1 (draft)	1 (draft)
	Te Tapuwae o Rongokako MR	1 (draft)	1 (draft)
Wanganui	SLIMPA	0	N/A
	Parininihi MRA	0	N/A
Wellington	Kapiti MR	2	2
	Taputeranga MRA	0	0
N/M	Long Island - Kokomohua MR	3	2 (1 in prep.)
	Tonga Island MR	2	1 (1 in prep.)
	Westhaven (Te Tai Tapu) MR	0	N/A
	Kaikoura MRA	0	N/A
	Glenduan - Ataata Point MRA	0	N/A
West Coast	None	N/A	N/A
Canterbury	Pohatu MR	1	0 (1 in prep.)
	Akaroa Harbour MRA	0	N/A
Otago	Nugget Point MRA	0	N/A
Southland	Te Awaatu Channel - The Gut MR	6	5 (1 in prep.)
	Piopiotaahi MR	3	2 (1 in prep.)
	Paterson Inlet MRA	1	0 (1 in prep.)
Total monitoring reports		61	

Conclusions and Recommendations

There have been a total of 41 baseline surveys and monitoring programmes undertaken in 19 of the 25 MPAs since 1975.

About half (15) the 25 MPAs in New Zealand have had a baseline survey conducted near to the establishment of the MPA or the application of a MPA. Thirteen of these baseline surveys were undertaken in marine reserves. Many of these baseline surveys were not used to establish monitoring programmes. Eighteen MPAs have had monitoring programmes undertaken, and 9 currently have DOC funded monitoring programmes running that are planned to run beyond June 2000.

Many baseline surveys included habitat surveys. Generally habitat monitoring has not been continued. Most monitoring programmes that have been undertaken or are currently underway focus on examining changes in population abundance and size structures of selected key species especially reef fish species, rock lobster, paua and kina.

There is a total of 61 monitoring reports, of which 52 have been produced to date, 1 is undergoing SRU review, 2 are drafts and another 6 are in preparation.

A number of issues with biological site surveys and monitoring programmes were identified during the collation of information for this report. These include:

- 1. Baseline data:** There is concern about the quality of baseline data and what constitutes a baseline survey. Many surveys have been conducted without the specific objective of establishing a baseline. There is also a lack of pilot studies in most marine reserves. If previous pilot studies have been carried out (e.g. lobster sampling methodology) these are often not referred to as a justification for the current study.

It is **recommended** that MSMAG assess existing baseline surveys and any other surveys which could assist in obtaining baselines. On the basis of this assessment a plan for utilising these surveys should be prepared, prioritised and implemented (see also recommendations below on standardisation).

- 2. Standardisation:** There has been a lack of standardised methodology in monitoring programmes. However, development of a standardised methodology for monitoring programmes, report writing and data storage is being prepared (see SOP, Department of Conservation, in prep.).

Monitoring

- All monitoring plans/proposals initiated by DOC need to provide relevant context including what has been done in the reserve before and how the new monitoring plan fits into past surveys/research. For example, the biological survey and monitoring plan developed for SLIMPA, (Department of Conservation 2000), makes no reference to previous work conducted in the area or whether these studies could be partially used or not. Providing relevant context would assist in making prioritisation decisions.

- Conservancies need to maintain better records of their marine reserve monitoring activities (and marine reserve research). This needs to include storage of data, access to data, and regular reporting (e.g. there should be annual up-dates provided to MSMAG).
- Existing monitoring programmes need to be carefully evaluated before decisions are made to discontinue or modify them (see Department of Conservation, in prep.).

Monitoring reports

- Authorship needs to be clear—for all parties (e.g. If raw data only has been provided, then that person should be formally acknowledged—‘.....express gratitude to X for their advice and for permission to use their unpublished data’ or if the input is more significant then co-authorship may be appropriate).
- Monitoring reports should put the monitoring results in context—e.g. what the programme is set up to examine, what’s been done before, who funded the work, project number, dates (sampling and overall programme). MSMAG needs to provide standardised reporting procedures (See Department of Conservation, in prep.)
- The quality of reporting is also variable.
- Copies of all monitoring status, progress, and final reports should be forwarded to MSMAG.
- A copy of the final monitoring reports should also be lodged with the relevant Conservancy Office, and the DOC Library.

It is **recommended** that MSMAG assess completed and proposed monitoring programmes to ensure that standards are applied to all programmes. On the basis of this assessment a plan for utilising these programmes should be prepared, prioritised and implemented.

It is **recommended** that the report conservancy MPAA monitoring information contained in Appendix 1 be used as a data base for marine biological monitoring and they are electronically updated annually.

3. **Data:** There are also significant issues in terms of how data is dealt with and who owns that data. For example, many contractors and DOC staff have retained raw data, which has not been included in their monitoring reports (See Appendix 2). In some cases raw data has not been written up.
- There appears to be no clear DOC policy stating who owns and can use raw data if DOC partly or fully funds or assists in its collection.
 - Contracts need to state where, what and how to deal with raw data (e.g. who owns it, who it is to be provided to and in what format etc.).
 - Existing raw data needs to be recovered, where possible, for future storage in the DOC system and for subsequent use in assessing the condition and trends in marine reserves over time.
 - MSMAG should investigate a method of electronic storage of data, which could be incorporated into the DOC system. Identifying the need for external organisations to gain access of the database by may be useful.

It is **recommended** that MSMAG:

- Develops a storage system for the raw data.
- Decides how it will be used to determine condition and trends in marine reserves.

4. Monitoring programmes: Certain types of monitoring programmes are more popular than others and appear to be based on selected key species that have been subject to harvesting before the MPA was established.

- MSMAG should develop clear protocols to assist conservancies to decide what monitoring would be of greatest benefit. In addition to the more common monitoring programmes (see Table 3), consideration should be given to biological monitoring of visitor impacts on marine reserves and the ecological roles of humans in marine communities (see McCrone 2001).
- Existing monitoring programmes need to be carefully evaluated before decisions are made to discontinue or modify them (see Department of Conservation, in prep.).

It is **recommended** that completed and proposed monitoring programmes should be assessed by MSMAG to enable the development of protocols of what to monitor.

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References

- ARC 1994: Tawharanui Marine Park monitoring programme: report of progress 1994. Auckland Regional Council, Auckland, New Zealand.
- Ayling, A.M. 1978: Cape Rodney to Okakari Point Marine Reserve: a biological survey. University of Auckland Marine Laboratory, Auckland, New Zealand.
- Ballantine, W.J.; Grace, R.V.; Doak, W.T. 1973: Mimiwhangata marine report. Commissioned by Turbott & Halstead on behalf of New Zealand Breweries Ltd.
- Battershill, C.N.; Murdoch, R.C.; Grange, K.R.; Singleton, R.J.; Arron, E.S.; Page, M.J.; Oliver, M.D. 1993: A survey of the marine habitats and communities of Kapiti Island. Report prepared for the Department of Conservation. NIWA 1993/41, Wellington, New Zealand.
- Battershill, C.N.; Page, M.J. 1996: Preliminary survey of Pariokariwa Reef North Taranaki. Report prepared for the Department of Conservation. NIWA 1996/10-WN, Wellington, New Zealand.
- Bay of Plenty Polytechnic 1991: Contribution to the selection of control sites, Cathedral Cove proposed marine reserve. Unpublished report of the Marine Studies Course 1991, Bay of Plenty Polytechnic, Tauranga.
- Brown, P.J. 1996: Effects of humans on rocky intertidal organisms. Unpublished M.Sc. Thesis, University of Auckland, New Zealand.
- Brown, P.J.; Taylor, R.B. 1999: Effects of trampling by humans on animals inhabiting coralline algal turf in the rocky intertidal. *Journal of Experimental Marine Biology and Ecology* 235: 45-53.
- Coffey, B.T.; Grace, R.V. 1990: Proposed marine reserve, Hahaione: a preliminary assessment and habitat inventory. Report prepared for the Department of Conservation by Brian T. Coffey and Associates Ltd.
- Cole, R.G.; Singleton, R.J. 1996: Monitoring of reef fish populations at Kapiti Island during aerial poisoning for rats, 1996. Report of the Department of Conservation. NIWA, Nelson, New Zealand.
- Davidson, R.J. 1990: A report on the ecology of Whanganui Inlet, north-west Nelson. *Nelson/Marlborough Conservancy Occasional Publication No. 2*, Department of Conservation, New Zealand.
- Department of Conservation 1998: Restoring the dawn chorus: Department of Conservation strategic business plan 1998-2002. Department of Conservation, Wellington, New Zealand.
- Department of Conservation 2000: Draft Nga Motu/Sugar Loaf Islands Marine Protected Area. Biological survey and monitoring plan: pilot study: summer 2000. Wanganui Conservancy, Department of Conservation. Unpublished report.
- Department of Conservation in prep.: SOP: Marine reserves—procedures for survey and monitoring. A resource for implementing best practice in biological survey and monitoring of marine reserves. Draft Version 3, 24/12/99, QD# NH 1295, Department of Conservation, Wellington, New Zealand.
- Fechney, L. 1997: Sugar Loaf Islands: conservation management plan. Wanganui Conservancy Management Planning Series 1996/3. Department of Conservation, Wanganui, New Zealand.
- Foster, G.A.; MacDiarmid, A. 1997: Seabed conditions of the proposed Parininihi Marine Reserve, North Taranaki. Report prepared for the Department of Conservation. NIWA WLG1997/30. NIWA, Wellington, New Zealand.
- Grace, R.V. 1979: Tawharanui marine monitoring programme Vol. 2, station localities and raw data 1977 to 1979. ARC report, November 1979.
- Grace, R.V. 1980: Tawharanui marine monitoring programme, report on progress 1980. ARC report, March 1980.

- Grace, R.V. 1981: Tawharanui marine report, report on progress 1981. ARC report, April 1981.
- Grace, R.V. 1982: Tawharanui marine report 1982, report on progress. ARC report, June 1982.
- Grace, R.V. 1983: Tawharanui marine report 1983, report on progress. ARC report, December 1983.
- Grace, R.V. 1985: Mimiwhangata marine monitoring programme: report on progress to 1985. Bay of Islands Historic and Maritime Park Board, Auckland, New Zealand.
- Grace, R.V. 1989: Tawharanui marine report 1989, report on progress. ARC report, April 1989.
- Grace, R.V. 1991: Tawharanui marine report 1991, report on progress. ARC report, July 1991.
- Grange, K. 1990: Unique marine habitats in the New Zealand fiords: a case for preservation. New Zealand Oceanographic Institute, Wellington, New Zealand.
- Green, B.S. 1991: Long Bay Regional Park. Baseline marine survey. Unpublished report. Auckland Regional Council, Parks Department.
- IUCN 1999: Guidelines for marine protected areas. Best practice protected area guidelines series No. 3. IUCN - the World Conservation Union, Gland, Switzerland.
- Jeffs, A. 1993: The impacts of a glass-bottom boat operation in Goat Island Bay: an independent impact assessment for the Department of Conservation on behalf of the Habitat Exploration Partnership, Auckland, New Zealand.
- Kingett Mitchell & Associates Ltd. 1999: Pollen Island benthic monitoring programme - operational phase report No. 3, January 1999. Contract report prepared for Beca Carter Hollings & Ferner Ltd (April 1999). Kingett Mitchell & Associates Ltd, Environmental Consultants, Auckland, New Zealand.
- Kingsford, M.; Battershill, C. (eds.) 1998: Studying temperate marine environments: a handbook for ecologists. Canterbury University Press, Christchurch, New Zealand.
- Mae, E. (Comp.) 1998: Analysis of paua and kina data, Tuhua (Mayor Island) Marine Reserve 1995-1998. Unpublished report, Auckland Institute of Technology, Auckland, New Zealand.
- McCrone, A. 2001: Visitor impacts on marine protected areas in New Zealand. *Science for Conservation 173*, Department of Conservation, Wellington, New Zealand.
- Mendoza, A.; Lang, S.; Roper, N.; Schnauer, R. 1995: Kapiti Island: a subtidal survey - paua and crayfish numbers. Unpublished report, Bay of Plenty Polytechnic Marine Studies report, Bay of Plenty Polytechnic, Tauranga.
- Miller, K.J.; Mundy, G. 1999: Population structure, damage frequency and growth rates of red coral in Doubtful Sound. Contract Report for Department of Conservation, Invercargill. NIWA, Wellington, New Zealand.
- New Plymouth Underwater Club. 1989: Marine Biology of the Sugar Loaf Islands Marine Park. Unpublished report held at Wanganui conservancy (File COA 0211 Vol.1).
- Pugsley, C.; Turnbull, J. 1994: Marine reserves monitoring workshop, 24-25 February 1994. *S&R Internal Report No. 146*, Department of Conservation, Wellington, New Zealand.
- Schiel, D.R. 1984: Poor Knights Island Marine Reserve: a biological survey of subtidal reefs. *University of Auckland Leigh Laboratory Bulletin no. 15*. University of Auckland, Auckland, New Zealand.
- Schiel, D.R.; Kingsford, M.J.; Choat, J.H. 1986: Depth distribution and abundance of benthic organisms and fishes at the Kermadec Islands. *New Zealand Journal of Marine and Freshwater Research 29*: 521-535.
- Shears, N.T.; Babcock, R.C. 1997: 1996-97 re-survey of Cape Rodney to Okakari Point Marine Reserve. In: Ecological studies from marine reserves in north-eastern New Zealand. Unpublished report. University of Auckland, Auckland, New Zealand.
- Turnbull, J. 1993: Draft Piopiotahi Marine Reserve biological monitoring: report of October 1993 trip. Unpublished internal report, Southland Conservancy, Department of Conservation, Invercargill, New Zealand.
- Walls, K. in press.: Research in New Zealand marine reserves—a research focus. In: Proceedings of the First International Workshop on Marine Reserves, Spain. Edited by Ministeries de Agricultura, Pesca y Alimeritación, 2000, Spain.