

PROTECTION AND USE OF THE ISLANDS IN HAURAKI GULF MARITIME PARK

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SUMMARY: The *outer islands* (> 10km distant from the mainland) of Hauraki Gulf Maritime Park comprise less than 0.02% of the New Zealand land surface and, taken together, support the only remaining temperate lowland and coastal communities relatively unmodified by European man and his introduced mammals. Their value as wildlife sanctuaries and scientific reserves is unexcelled by any comparable area in a National Park. The *inner islands* of the Park hold an exceptional range of recreational opportunities and in some instances have high scientific value and potential for wildlife as well.

It is recommended that precautions to prevent damage to this limited resource should be increased. New measures are needed to prevent further spread of the two species of European rats and other mammals. Regular control of some introduced plants, particularly boxthorn (*Lycium ferocissimum*), is needed. The number and size of parties visiting some small islands that are densely burrowed by petrels should be restricted. The penalty for oil spillages should be greatly increased and the public educated to remove their picnic rubbish from both the sea and the land of the Park. Patrolling of the outer islands against illegal landings should be increased and the present status of some islands changed to reconcile status with value and function. Additional reserves are needed on some islands as well as along the mainland coastline.

Some research required to ensure wisest use of the islands and their surrounding waters is outlined and specific recommendations made for each island in the Park.

INTRODUCTION

Scientific investigation of the islands of Hauraki Gulf and the Coromandel coast covers a period of more than 100 years. It began with visits and descriptions by T. Kirk, F. W. Hutton, T. F. Cheeseman, A. Reischek and others during the latter part of the nineteenth century, and it continued into this century with the publications of Cockayne (1906), Oliver (1925), Falla (1934), Cranwell and Moore (1935) and Hamilton (1937). In recent years the intensity of scientific work has increased with contributions from members of the Auckland University Field Club and scientists from universities, museums and government departments.

The first step taken towards conserving the flora, fauna and natural communities of these remarkable islands was the purchase, by Act of Parliament, of Little Barrier Island as a bird sanctuary in 1894, with a caretaker taking up residence in 1897. Another important milestone was the elimination of pigs from Aorangi in the Poor Knights group in 1936 by members of what is now the

N.Z. Wildlife Service. The most recent major conservation operation has been the transfer of North Island saddlebacks (*Philesturnus carunculatus rufusater*) by the Wildlife Service from Hen Island, the sole locality where saddlebacks survived, to five other islands.

The increasing growth and affluence of the population, especially since 1950, has brought new pressures on the islands of the Hauraki-Coromandel region; the formation of Hauraki Gulf Maritime Park in 1967 was partly a response of Government to meet these pressures. The conflict between the need to protect and the desire to use has grown more acute. Wise management of any natural resource cannot be effected without adequate factual information and an understanding of the processes influencing that resource. This paper outlines measures for protection and use of the islands that have emerged from the past century of scientific work.

The type of use and degree of protection that can be given an island is related partly to its distance from the nearest human settlements. An

arbitrary distinction between the *outer islands* [lying at distances greater than 10 km (ca. 6 miles) from the mainland or from settlements on other islands] and the *inner islands*, which are closer, is therefore useful. The homes of isolated families living on islands are not considered settlements in this context.

THE EXCEPTIONAL SCIENTIFIC AND WILDLIFE IMPORTANCE OF THE OUTER ISLANDS

The outer islands comprise the Poor Knights group, the Chickens group, Hen. I., Little Barrier I., the Mokohinau group, Cuvier I., the smaller Mercury islands and the Aldermen group (Fig. 1). Taken together they are the largest remaining area in New Zealand of temperate coastal and lowland vegetation with indigenous wildlife that has not undergone major modification by European man or his introduced mammals. Their flora and fauna include many plants and animals that are now very rare or extinct on the mainland. They hold the total world populations of the stitchbird (*Notiomystis cincta*) and North Island saddleback and are the only breeding places in the world for Pycroft's petrel (*Pterodroma pycrofti*) and Buller's shearwater (*Puffinus bulleri*). They include the great majority of islands where the archaic tuatara (*Sphenodon punctatus*) still survives. There are several notable insects such as the giant weta, *Deinacrida fallai*, which occur nowhere else. Plants such as the lily *Xeronema callistemon*, *Hebe boltonii* and *Carmichaelia williamsii* are now largely restricted to these islands.

The terrestrial and marine ecosystems of each of the outer islands are of inestimable value for monitoring environmental changes and for comparison with mainland reserves or with more modified parts of the landscape. Some island groups, the Chickens Is. for example, are like large-scale field experiments because each island in the group differs from the others in some major aspect of its geology, history, soils, vegetation or vertebrate life. Marotiri (Lady Alice) I. of the Chickens group is the obvious choice for a baseline or control because its rocks, soils, vegetation and history are most comparable to those of the mainland and because it provides the greatest range of comparisons with other islands in the group.

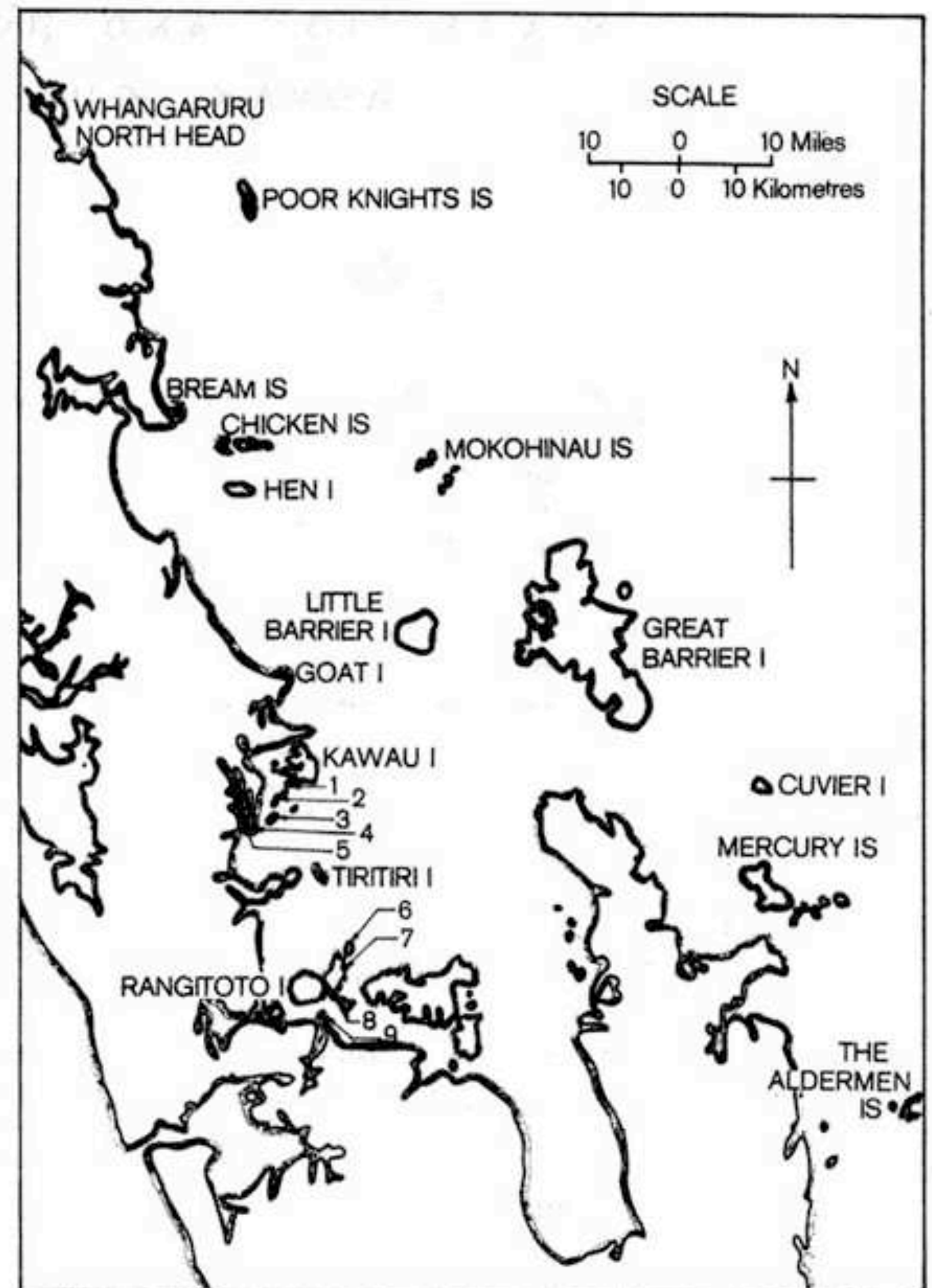


FIGURE 1. Islands of the Hauraki Gulf Maritime Park. Islands indicated by numbers are 1. Beehive I.; 2. Motutara I.; 3. Motuora I.; 4. Saddle I.; 5. Casnell I.; 6. Rakino I.; 7. Motutapu I.; 8. Motuihe I.; 9. Browns I.

The outer islands are highly vulnerable to damage or destruction by the growth of human population and technology. Their combined area is only 4,535 ha (11,201 acres)* or less than 0.02% of the land area of New Zealand. This underlines their critically important position as reserves of coastal and lowland biota and communities; no other part of the country of comparable area contains so much of value.

* Excluding Burgess I. of the Mokohinau group.

THE EXCEPTIONAL RECREATIONAL OPPORTUNITIES
PRESENTED BY THE INNER ISLANDS

People enjoy visiting islands and the Hauraki Gulf and Coromandel regions contain a greater number of easily accessible islands than any other part of New Zealand. The shores of the inner islands, many of which are now greatly modified from their pre-European condition, offer many opportunities for outdoor recreation such as walking, picnicking, camping, swimming, water skiing, boating, fishing, nature exploration and visiting sites of historic or archaeological interest. They can be enjoyed here in comparatively sheltered water and in a landscape or seascape where the contrasts of sea, shore, vegetation and geological features are often beautiful and varied.

The numbers of people visiting the inner islands, as well as other parts of the coast, is increasing very rapidly, and some of the difficulties resulting from this increase have been discussed by O'Brien (1971). Both in planning the acquisition of new reserves and the management of existing ones, the potential of the inner islands to provide a greater range of outdoor experience should not be underestimated. In the first place, many people are glad to visit an island because it affords a complete escape from the motor car which now dominates the pattern and speed of our movements. Unroaded, but not untracked, shorelines such as can be maintained on the inner islands, are likely to prove an increasingly valuable asset, particularly to city dwellers. Secondly, those islands that still lack predators such as rats, cats and stoats have high potential as wildlife habitat. They can, with appropriate management, be used to establish populations of some of the rare birds that are present on the outer islands but which are not usually accessible to people.

Rangitoto I. holds a unique position among the inner islands. Although its vegetation and wildlife have been modified to some extent by the spread of exotic plants and by possums, wallabies, deer, rats and cats, this vegetation is still the finest example we have in New Zealand of a forest developing on a recent lava flow. Not only does this development show us what probably happened many times following prehistoric volcanic erup-

tions of Auckland and some other parts of the mainland, but it also links us botanically through the Kermadec Islands to volcanic islands scattered throughout the Pacific Ocean as far north as Hawaii. Yet the lava flow vegetation of Rangitoto is comparatively robust and capable of withstanding a certain amount of human use without damage. As it is easily accessible and has an aesthetic attraction of its own, Rangitoto has very high scientific, educational and recreational value.

A CLASSIFICATION OF ISLANDS ACCORDING TO
TYPE OF USE AND DEGREE OF PROTECTION

The Hauraki Gulf Maritime Park Act of 1967 charges the Park Board with the management of the Park "in such a manner as to ensure to the public the maximum proper use and enjoyment of the Park consistent with the preservation of its natural features and the protection and well-being of its flora and fauna." The wording of this part of the Act is essentially identical with that of the National Parks Act of 1952. There is something of a paradox here in that on the *inner islands* as well as the small portions of the mainland coast included within the Maritime Park, there is a larger proportion of semi-natural and agricultural landscape than would be found in a National Park. This allows greater emphasis to be placed on providing recreational opportunities. The *outer islands*, however, are generally in a less modified condition and contain more of scientific and wildlife value per unit area than a National Park. Here, there should be greater emphasis on protection.

Each island has its individuality but a classification, based on use and the degree of protection needed, is necessary for long-term planning. A three-category system is followed here:

- Class A—Islands where scientific and wildlife values should be considered paramount—landing by permit only.
- Class B—Islands where both scientific and recreational values should be considered of comparable importance—unrestricted landing.
- Class C—Islands where recreational values should be considered paramount—unrestricted landing.

SOME GUIDELINES FOR PROTECTION AND USE OF ISLANDS IN HAURAKI GULF MARITIME PARK

Specific recommendations for each island in the Park are given in Table 1 which is otherwise a summary of current status, use and protection. However, objectives for management and future use are suggested for some islands and these will be discussed below.

1. *The Continuing Danger of Rats Reaching Islands*

The wildlife present and the scientific values of an island are very dependent on whether or not rats have established, and if so which of the three species is present. Further evidence has now been published to show that the Polynesian rat or kiore (*Rattus exulans*) can at times significantly reduce the numbers of some plants and animals (Fleet 1972, Atkinson 1972, Crook 1973). Predation by Norway rats (*R. norvegicus*) on ground-nesting birds has long been known and it is now clear that it can be a serious predator of the larger petrels (Imber 1971). Catastrophic declines of an island's forest bird fauna can follow an invasion of the ship rat (*R. rattus*) as occurred on Big South Cape I., near Stewart I., between 1962 and 1964 (Atkinson and Bell, *in press*), but this rat can sometimes co-exist with petrels (Norman 1970). The only rat present on Little Barrier Island is the kiore. Circumstantial evidence indicates that the stitchbird may have survived here only because there is a wide range of nectar-producing plants present and because ship rats have not so far reached the island (Atkinson 1973).

During the 1971-72 year there were two instances of boats running ashore on the outer islands of the Park, but fortunately neither resulted in a rat invasion (O'Brien 1972). Where a wharf is present on a rat-free island, the risk of rats reaching that island is greatly increased. We are not sufficiently aware of the value of rat-free islands or the value of those that have kiore alone; nor are we taking enough precautions to prevent rats reaching such islands. There are no regular inspection or control programmes for rats on coastal boats. We have no practical method of eliminating rats from an island once they have established.

2. *Other Introduced Wild Mammals*

The absence of browsing mammals such as goats, pigs, deer, possums and rabbits makes some islands useful control areas for assessing the effects of these mammals elsewhere. The introduction of such mammals invariably results in major, often destructive, changes in the island's vegetation. Cats and stoats can cause great changes in an island fauna through predation—the release of cats on islands by thoughtless people is continuing. The elimination of introduced mammals from islands, if feasible, will often have the long-term effect of increasing the island's scientific and wildlife value. However, the consequences of a proposed control operation should, as far as possible, be predicted and evaluated before the operation is launched.

3. *Introduced Plants*

Some introduced plants can, if left unchecked, change the whole composition and character of an island vegetation. This has happened along the East Cape-Gisborne coast where Bell and Blackburn (1960) found parts of some islands covered by impenetrable thickets of boxthorn (*Lycium ferocissimum*). This spiny shrub, probably transported as seeds by starlings using islands as roosts, has appeared on the smaller Mercury Islands as well as the western Chicken islands. Regular inspection and control is essential. The spread of pines on Rangitoto I. has been checked by voluntary help given to the Park Board, and earlier to the Rangitoto Domain Board.

Another kind of problem arises when organisations or individuals plant trees for aesthetic or shelter reasons. If these trees breed with plants of the same or closely related species already present on the island, then some of the local genetic differences that may have evolved in the island population could be lost. Such differences are of great interest to the biologist and they are sometimes of economic significance.

Thus an island with an "A" or "B" classification should not have any plants introduced to it that have not been raised from seed or cuttings taken from plants which occur naturally on that island. However, such introductions would usually not be necessary. With "C" class islands, care should be

TABLE 1. *Function, Status and Protection of Islands in Hauraki Gulf Maritime Park*

ISLAND	CLASS	FUNCTION	RESERVE STATUS	MAIN PLANT COVER	INTRODUCED MAMMALS	UNUSUAL FEATURES	MANAGEMENT AND USE
INNER ISLANDS (islands less than 10 km from the mainland or from settlement on other islands)							
BEEHIVE I.	C	Recreation	Privately owned	Pines and scrub	?	—	Maintain; day visitors
BREAM IS. (2)	A	Vegetation/wild life reserve	Scenic Reserve	Taupata scrub	None	Fluttering Shearwaters, Diving Petrels in high numbers	Protect and maintain; day visitors to shoreline only, research/interpretation/management
BROWNS I.	C	Recreation	Public Reserve	Grassland	?	—	Farm; day visitors
CASNELL I.	C	Recreation	Recreation Reserve	Grass/trees	?	—	Maintain; day visitors
GOAT I.	B	Vegetation/wild life reserve	Scenic Reserve	Mapou scrub; Pohutukawa forest	Ship rats	—	Protect and maintain; day visitors
KAWAU I. (parts)	C	Recreation incl. historic places, protection of rare species of wallaby	Recreation and Scenic Reserves	Manuka scrub	Wallabies (4 spp.) Possums Rats (? sp.)	Parma Wallaby	Maintain; limited camping; day visitors
MOTUIHE I.	C	Recreation, historic places and finance	Recreation Reserve	Grassland; Pohutukawa forest	Rabbits Rats (? sp.)	—	Farm; day visitors
MOTUORA I.	C	Finance and recreation (shoreline only)	Recreation Reserve	Grassland; forest	?	—	Farm; day visitors to shoreline only
MOTUTAPU I.	C	Finance and recreation (shoreline only)	Recreation Reserve	Grassland; Pohutukawa forest	Rock-wallabies, Possums Rabbits, Rats (? sp.)	Archaeological sites buried beneath Rangitoto ash	Farm; day visitors to shoreline only; limited camping
MOTUTARA I. (part)	C	Recreation	Recreation Reserve	Open ground; some forest	?	—	Maintain; day visitors
RAKINO I. (parts)	C	Recreation	Various small reserves incl. Recreation	Grassland	?	—	Maintain; day visitors
RANGITOTO I.	B	Vegetation/wild life reserve	Recreation Reserve	Low Pohutukawa forest	Fallow deer, Rock wallabies Possums, Rats (? sp.)	Unique vegetation on lavafield of recent origin	Protect and restore; day visitors; research/interpretation/management
SADDLE I.	C	Recreation	Recreation Reserve	Forest	?	—	Maintain; day visitors
TIRITIRI I. (part)	B	Vegetation/wild life reserve; recreation	Recreation Reserve	Grassland, Manuka scrub, Kohekohe forest	Rats (? sp.)	the liane <i>Ipomoea palmata</i>	Protect and restore; day visitors

ISLAND	CLASS	FUNCTION	RESERVE STATUS	MAIN PLANT COVER	INTRODUCED MAMMALS	UNUSUAL FEATURES	MANAGEMENT AND USE
OUTER ISLANDS (islands greater than 10 km from the mainland or settlements on other islands)							
ALDERMEN IS. Hongiora I.	A(r)	Vegetation/wild life reserve	Flora and Fauna Reserve and Wildlife Sanctuary	Karo/Taupata scrub, Karo forest	None	<i>Carmichaelia williamsii</i> Tuatara, large Storm Petrel colony	Protect and maintain; research/interpretation/management (<i>restricted</i>)
Middle Chain I.	A	Vegetation/wild life reserve	Flora and Fauna Reserve and Wildlife Sanctuary	Pohutukawa forest, Flax scrub	Kiore	<i>Carmichaelia williamsii</i>	Protect and maintain; research/interpretation/management
Ruamahua I.	A	Vegetation/wild life reserve; experimental area	Flora and Fauna Reserve and Wildlife Sanctuary	Pohutukawa/Karo forest, Karo/Taupata scrub	None	Tuatara, Petrels	interpretation/management Protect and maintain; research/
Ruamahuanui I.	A	Vegetation/wild life reserve	Flora and Fauna Reserve and Wildlife Sanctuary	Mahoe forest, Mixed scrub, grassland	None	Tuatara, Petrels	Protect and maintain; research/interpretation/management
CHICKEN IS. Coppermine I.	A	Vegetation/wild life reserve	Flora and Fauna Reserve	Pohutukawa forest Flax scrub, Kanuka forest	Kiore	Large flesh-footed shearwater colony Tuatara	Protect and restore; research/interpretation/management
Marotiri (Lady Alice I.)	A	Vegetation/wild life reserve introd. of threatened species; experimental area	Flora and Fauna Reserve	Kanuka forest, Pohutukawa forest	Kiore	Saddlebacks, Tuatara, Petrels	Protect and maintain; ranger-guided parties; research/interpretation/management.
Mautaha (West Chicken I.)	A	Vegetation/wild life reserve	Flora and Fauna Reserve	Kanuka scrub and forest; Mapou forest	Kiore	Petrels	Protect and maintain; research/interpretation/management
North-west Chicken Is.	A(r)	Vegetation/wild life reserve	Flora and Fauna Reserve	Karo/Taupata scrub	None	Dense Petrel colony	Protect and maintain; research/interpretation/management (<i>restricted</i>)
Pupuha I.	A(r)	Vegetation/wild life reserve	Flora and Fauna Reserve	Karo/Taupata scrub	None	Dense Petrel colony	Protect and maintain; research/interpretation/management (<i>restricted</i>)
Whatupuke I.	A	Vegetation/wild life reserve; introd. of threatened species	Flora and Fauna Reserve	Kanuka forest; Pohutukawa forest	Kiore	Saddlebacks, Tuatara, Petrels	Protect and restore; research/interpretation/management
CUVIER I. (part)	A	Vegetation/wild life reserve; introd. of threatened species; experimental area	Flora and Fauna Reserve	Pohutukawa forest, grassland	Kiore	Saddlebacks, Tuatara, Petrels	Protect and restore; research/interpretation/management

ISLAND	CLASS	FUNCTION	RESERVE STATUS	MAIN PLANT COVER	INTRODUCED MAMMALS	UNUSUAL FEATURES	MANAGEMENT AND USE
OUTER ISLANDS (islands greater than 10 km from the mainland or settlements on other islands)							
Great Barrier I. (part)	C	Recreation	Recreation Reserve	?	European rats, Goats	—	Maintain; day visitors Camping?
HEN I.	A	Vegetation/wild life reserve; introd. of threatened species; experimental area	Flora and Fauna Reserve	Kanuka forest; Pohutukawa forest; Taraire-Tawa forest	Kiore	Saddlebacks, Pycroft's Petrel, Tuatara <i>Xeronema</i>	Protect and restore; research/interpretation/management
LITTLE BARRIER I.	A	Vegetation/wild life reserve	Fauna Reserve	Pohutukawa forest, Kanuka forest, Kauri forest, Rata/Tawa forest Tawa/Tawhero forest	Kiore, cats	Stitchbirds, montane vegetation, Black Petrels and Cook's Petrel	Protect and restore, ranger-guided parties; research/interpretation/management
MERCURY IS. (excluding Gt. Mercury I.)							
Double I.	A	Vegetation/wild life reserve	Flora and Fauna Reserve	Pohutukawa forest, Mahoe forest	Kiore	Petrels	Protect and maintain; research/interpretation/management
Green I.	A(r)	Vegetation/wild life reserve	Scenic Reserve	Karo/Taupata scrub, Wharangi-mahoe forest	None	Diving Petrels Tuatara	Protect and maintain; research/interpretation/management (<i>restricted</i>)
Kawhitihu I.	A	Vegetation/wild life reserve	Flora and Fauna Reserve	Mahoe forest	Rabbits, Kiore	Petrels	Protect and maintain or restore; research/interpretation/management
Korapuki I.	A	Vegetation/wild life reserve; experimental area	Scenic Reserve	Pohutukawa forest, Mahoe forest	Rabbits, Kiore	Petrels, incl. Pycroft's Petrel	Protect and restore; ranger-guided parties; research/interpretation/management
Middle I.	A(r)	Vegetation/wild life reserve	Scenic Reserve	Karo/Taupata scrub, Milk Tree forest, Wharangi-mahoe forest	None	Milk Tree forest, Tuatara, Diving Petrel colony	Protect and maintain; research/interpretation/management (<i>restricted</i>)
Red Mercury I.	A	Vegetation/wild life reserve; introd. of threatened species; experimental area	Scenic Reserve	Mapou scrub, Pohutukawa forest	Kiore	Saddlebacks, Tuatara, Pycroft's Petrel	Protect and restore; research/interpretation/management
MOKOHINAU IS. Fanal I.	A	Vegetation/wild life reserve	Flora and Fauna Reserve and Wildlife Sanctuary	Pohutukawa forest, flax scrub	Kiore	Saddlebacks, Petrels	Protect and maintain or restore; research/interpretation/management

ISLAND	CLASS	FUNCTION	RESERVE STATUS	MAIN PLANT COVER	INTRODUCED MAMMALS	UNUSUAL FEATURES	MANAGEMENT AND USE
Flax I.	A	Vegetation/wild life reserve	Flora and Fauna Reserve and Wildlife Sanctuary		?	Petrels	Protect and maintain; research/interpretation/management
Trig. I.	A	Vegetation/wild life reserve	Flora and Fauna Reserve and Wildlife Sanctuary		?	Petrels	Protect and maintain; research/interpretation/management
Groper Rk.	A	Vegetation/wild life reserve	Flora and Fauna Reserve and Wildlife Sanctuary		?	?	Protect and maintain; research/interpretation/management
Navire Rk.	A	Vegetation/wild life reserve	Flora and Fauna Reserve and Wildlife Sanctuary	Mostly rock	None	Gannets	Protect and maintain; research/interpretation/management
POOR KNIGHTS IS. Aorangaia I.	A	Vegetation/wild life reserve	Scenic Reserve	Karo and Pohutukawa scrub	None	Several endemic plant and animal forms, Buller's shearwater colony, Tuatara.	Protect and maintain; research/interpretation/management
Aorangi I.	A	Vegetation/wild life reserve; experimental area	Scenic Reserve	Pohutukawa forest, Kanuka forest, Kohekohe-Karaka forest	None		
Archway I.	A	Vegetation/wild life reserve	Scenic Reserve	Grassland	None		
Tawhiti Rahi I.	A(r)	Vegetation/wild life reserve	Scenic Reserve	Pohutukawa forest, Kanuka forest, Kohekohe-Karaka forest	None		

taken to ensure that restorative plantings of native or exotic plants will not be a potential threat to the vegetation of neighbouring islands and that the plants used are aesthetically and ecologically compatible with the overall character of the island in question. In discussing this problem, Godley (1972) has stressed the need to document such plantings with respect to time of planting and origin of the plants used.

4. *Vulnerability of Some Islands to Damage by Trampling*

Because the soils of some islands are densely burrowed by petrels, the island's communities are easily damaged by trampling. To give adequate protection to eggs and young of petrels and to tuataras living in the burrows, it is essential that visiting scientific or management parties should be limited in number and small in size. Islands in this category are indicated by an "r" (= *restricted access*) placed after the "A" in the class column of Table 1. When it is not important to visit an island during the breeding seasons of petrels, landings should be made at other times of the year.

5. *Pollution Control*

Outstanding among several pollution dangers is the hazard of major oil spillages arising from increased shipping, particularly the increased flow of tankers to the oil refinery at Marsden Point, and from the growth of petroleum prospecting. Oil spillages have been shown to cause extensive damage to coastal marine life including shellfish as well as the more obvious effects on seabirds and beaches (Murphy 1971). Liquid dispersants are at present the most effective method of fighting an oil spillage but the dispersants themselves are toxic to marine life in varying degree. It seems necessary to extend the facilities and methods available in New Zealand for controlling an oil spillage quickly. Mr P. N. McKellar (pers. comm.), Superintendent of the Northland Harbour Board, considers that the penalties for oil spillage should be greatly increased above the present maximum of \$2,000.

Another growing problem is that of picnic rubbish taken to islands. We should not expect a Park Board to provide a rubbish-disposal service on an island used by hundreds of visitors each week.

Rather we must educate people to leave an island with their rubbish. Nor can the dumping at sea of non-biodegradable rubbish, such as bottles, be tolerated. The ocean floor and the life it supports are as important as parts of the Park and our environment as the land surface, even if less often seen.

6. *Vegetation/Wildlife Reserves*

This is the basic function of most of the islands that are not being used primarily for recreation. Although the concept of flora and fauna reserves gives deserved emphasis to the protection of particular species of plants and animals, it does not stress the equal and, in some instances, greater importance of protecting examples of natural communities.

7. *Introduction of Threatened Species*

Many islands have been reserved due to the plants and animals (often birds) they support at present. In the future some islands in the Hauraki Gulf may prove to be the only satisfactory places where other species, threatened with extinction on the mainland, can be protected. Those islands with this potential are indicated in Table 1, although the possible consequences of a particular liberation should be thoroughly studied before a decision is made.

8. *Experimental Areas*

Although reserved islands are not considered "productive" in the usual sense of the word, much useful information can be "harvested" from them, especially with the aid of long-term measurements and experiments. Such experiments have to be limited to those having no permanent damaging effect on vegetation, wildlife or other features including archaeological sites. An example might be an enclosure which, by excluding kiore, could yield information concerning the effects of this rat on regeneration of plants. Islands best suited for experimental work are indicated in Table 1 as *experimental areas*.

9. *Vegetation/Wildlife Restoration*

Most of the islands in the Park were considerably modified during Maori settlement although, unlike the mainland, many have been virtually undisturbed for a century or longer. As more is

learnt of their history and improvements made in management techniques, it is becoming possible to restore some islands to a condition more like that which the Maori found. The work done by the Wildlife Service on Cuvier Island is a good example. Those islands where research has shown that restorative work is likely to result in real gains to the diversity and interest of the island's communities are indicated in the management column of Table 1 with the word *restore*. For example, islands where there is a need to remove introduced mammals have "restore" in the management column. With islands where the only management needed at present is that of allowing present trends to continue, the word *maintain* is used.

10. *Importance of Diversity*

Most people need a variety of outdoor experience and they vary greatly in the type of experience that gives them most satisfaction. As discussed earlier the inner islands can provide an exceptional range of outdoor recreational opportunities, but their diversity must be carefully protected so that the needs of as many different people as possible can be met. For example, if all high quality bathing beaches are developed to cope with thousands of day-visitors, we are not providing anything very different from that already available on the adjacent mainland. Some high-quality beaches should purposely be left undeveloped and less accessible. Equally, an island like Tiritiri, where forest is being allowed to re-establish in what was farmland, would be of less interest to many visitors if allowed to become completely covered by forest. If some open grassy areas and other non-forest vegetations are retained, the island would be more suitable for picnicking, archaeological and historic sites would be more easily examined and displayed, and habitats for a greater variety of birds would be available. Planting programmes should be varied to suit each island; the concealment with trees of all buildings would make Park shorelines an improvement on those elsewhere.

A flexible attitude to introduced browsing mammals on the inner islands is desirable. On Rangitoto I. the brush-tailed rock-wallaby (*Petrogale penicillata*) is rightly regarded as a damaging influence to the flora and vegetation and we should

make every effort to control the population. Records of plant growth in enclosures are needed on Rangitoto to decide what level of control is necessary. On the adjacent Motutapu I., however, a small population of these rock-wallabies, a species now rare in Australia, could be managed on part of the coastline where damage to the farmland can be minimised. This would help safeguard the species, be of commercial value, and give visitors an aesthetic pleasure seldom to be found in New Zealand. On Kawau I. we have an international responsibility to protect the population of parma wallabies (*Macropus parma*), a species which has been close to extinction in Australia, and it may become necessary to give official protection to the rock-wallabies there as well.

11. *Marine Reserves*

It is beyond the scope of this paper to discuss the need for marine reserves in detail. However, the intertidal and seabottom communities of the Hauraki and Coromandel regions are of great scientific and recreational interest and are of basic ecological importance in maintaining fish and shellfish productivity. Representative examples of these communities need to be completely protected from commercial and amateur exploitation so that we can safeguard a source of useful information as well as protect parts of our underwater scenery. It seems logical to associate at least some of these marine reserves with existing island reserves. A first step has been taken in this direction with the Park Board's suggestion to Government that the waters surrounding the Poor Knights Is. should be made a marine reserve (O'Brien 1972).

12. *Interpretation*

Without first class interpretation there can be little hope of protecting the unique natural assets of Hauraki Gulf Maritime Park in the long term. The Board's appointment of an information officer in 1970 has been followed by a steady flow of informative publications about the Park. The outer islands, because of the vulnerability to irreversible damage, are accessible to relatively few people, mostly research workers and those responsible for island management. It is important that opportunities be given to responsible interpretation workers who with camera, tape-recorder and pen,

can communicate some of the beauty and value of these places to all. In most cases, such workers would need guidance from Park Rangers or Wildlife Officers.

There is, however, no complete substitute for experiencing an island. Some of the "A" class islands are suitable for ranger-guided parties and although such parties would sometimes be difficult to organise due to weather, with care and patience a large number of genuinely interested people could experience a relatively unspoilt island without risk of irreversible damage. In this connection, there is scope for rangers to record their own observations of natural phenomena and thus further increase their effectiveness as Park Interpreters.

DISCUSSION

RESEARCH NEEDS

The islands of the Park and their associated marine communities are a limited natural resource. This is particularly so in respect of their combined area, shoreline length, beach length and some of the organisms they contain. It is possible to list certain areas where more knowledge is needed to ensure adequate protection and wisest use of this resource. What follows, however, is in no way a summary of the wide range of research that could be done in the Park.

1. *Ecological Surveys*

Intelligent management of any piece of land, terrestrial or marine, is not possible without exact knowledge of its composition—its geology, soils, plants, animals, and the communities they form. Surveys of the following are required:

- (a) Surveys of lesser-known islands, both those within the Park and those that might be included.
- (b) Surveys of Park coastline and potential Park coastline on the mainland.
- (c) Surveys of introduced animals on the inner islands to determine which species, particularly rats, are present.
- (d) Surveys of fresh-water communities.
- (e) Surveys of the distribution of seabottom communities including breeding grounds.
- (f) Studies of the distribution and seasonal movements of pelagic organisms.

2. *Monitoring Studies*

Such studies are needed to identify the sources and measure the amounts of heavy metals, agricultural pesticides such as DDT, and industrial pollutants such as oil and polychlorinated biphenyls (PCBs) which are entering marine and terrestrial ecosystems in the Hauraki and Coromandel region. Organisms such as algae or petrels can sometimes be used as sensitive early-warning indicators of deterioration in less obvious but important components of our environment.

3. *Rare and Endangered Species*

Detailed life history studies of some rare plants and animals restricted to islands are needed to ensure their continued survival, e.g. stitchbirds and black petrels on Little Barrier I.

4. *Introduced Animals and Plants*

Research towards finding more effective methods of eliminating certain introduced animals and exotic plants from some islands is needed. Equally there is a need to understand more fully the interaction between certain introduced mammals and native plants and animals on some islands, e.g. the interaction between rabbits, vegetation and petrels on the smaller Mercury islands and the effects of kiore on the regeneration of native plants and on the reproductive success of petrels and forest birds.

INCREASED PROTECTION AND ADDITIONS TO ISLAND AND COASTAL MAINLAND RESERVES

1. *Disparity Between Status and Function of Some Reserves*

An examination of the reserve status and the function of the islands listed in Table 1, particularly for the outer ones, reveals a disparity between the two. Thus the Poor Knights Islands and Middle and Green islands of the Mercury group are all of far greater vegetation/wildlife value than is implied by their scenic reserve status. Little Barrier I. is classified as a fauna reserve, yet it contains the finest relatively undisturbed altitudinal sequence of lowland forest (up to 725 m) remaining in the North Island.

2. Increased Protection for Island Reserves

If we wish to protect the scientific and wildlife values of the outer islands, we have no alternative but to regulate people's access to them. The inner islands are a recreational asset but, looked at ecologically, they show every stage of modification from islands that have been little disturbed since the Maori period to those that are rather uninteresting, rat-inhabited, forestless pieces of land, depleted of their original flora and fauna and not different basically from parts of the nearby mainland. This depletion has in most cases resulted largely from the effects of European man and his introduced animals. To prevent these changes slowly repeating themselves on one after another of the outer islands, we need increased vigilance on the part of all responsible people who use the Gulf. The flow of small boats to the outer waters is growing annually and with it the protection that distance has given these islands is decreasing. During peak holiday periods helicopters should be used to patrol the outer islands. The establishment of resident rangers on some of the outer islands may be a solution, but this has to be balanced against the increased risk of introducing European rats or bird diseases with domestic poultry. However, unless we are prepared to spend more money on protection we cannot expect to retain these unique islands in their present condition.

3. Additional Reserves

There are still many small islands or parts of large islands, such as Great Barrier I., that have high scientific, wildlife or recreational value. Every effort should be made to reserve these areas, as well as unroaded mainland coastline, as extensions to Hauraki Gulf Maritime Park.

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