

Social impacts described include the effects on visitor satisfaction of perceived crowding, habitat quality, degree of wildlife encounters, use conflicts and expectations. The authors report that most people engage in recreation to satisfy multiple expectations, that sensitivities of individuals vary greatly, and that recreation activities are self-selected so that satisfaction levels tend to be high.

Ecological research limitations include lack of baseline data, difficulties of separating roles of humans and nature, spatial and temporal discontinuities between cause and effect, and ecosystem complexity. Social impact research has tended to avoid the problem of multiple species, concentrating only on the response of people to other visitors. In terms of management, the authors conclude that "since even low use levels can produce significant impacts ... visitor capacity decisions ultimately depend on value judgements that specify how much impact is acceptable in a given situation". They add that such judgements can be greatly aided by ecological and social relationship knowledge.

**Kuss, F.R.; Graefe, A.R.; Vaske, J.J. 1990. Visitor impact management: a review of research. National Parks and Conservation Association, Washington, D.C.**

This is a textbook that expands on the previous work by the same authors. It has chapters on the impact of recreation on vegetation and soils, on water resources, on wildlife and on the recreation experience itself. It points out the range of needs for better information. It suggests types of management responses to threats posed by visitors, but stops short of going into practical detail. It contains a wealth of references to research studies.

**Knight, R.L.; Gutzwiller, KJ eds. 1995. Wildlife and recreationists: coexistence through management and research. Island Press, Washington D.C.**

This book reviews, via a series of contributed papers, the realm of recreational impacts on wildlife in the USA. It covers much of the ground outlined in the other review documents, and provides management and research perspectives.

### **7.3.2 Other literature**

A wealth of other relevant literature was located during this review. The overseas literature, although voluminous, is well summarised by the key references reviewed in the above section of this report. In this section, I pick out aspects either not well covered by the above or of particular relevance to management. I list them as a series of points.

Literature review of books, reports and theses began with browsing the library shelves and following leads. Journal search took a different form. It began with the most likely abstract journals:

*Animal Behaviour Abstracts*  
*Ecological Abstracts*

Keyword-Index of *Wildlife Research*  
*Leisure, Recreation and Tourism Abstracts*  
*Zoological Record (Aves)*, which has a "Disturbance by man" section

The most useful journals were:

*American Naturalist*  
*Annals of Tourism Research*  
*The Auk*  
*Biological Conservation*  
*Bird Study*  
*Condor*  
*Corella* (Journal of the Australian Bird Study Association)  
*Ducks Unlimited Magazine*  
*Ecological Applications*  
*Emu*  
*Ibis*  
*Forest and Bird*  
*Freshwater Biology*  
*Journal of Applied Ecology*  
*Journal of Environmental Management*  
*Journal of Field Ornithology*  
*Journal of the Royal Society of New Zealand*  
*Journal of Wildlife Management*  
*NZ Journal of Ecology*  
*NZ Journal of Marine and Freshwater Research*  
*NZ Journal of Zoology*  
*Notornis*  
*Wildfowl*  
*Wildlife Monographs*  
*Wildlife Research*  
*Wildlife Review*

The following is a list of key points from this literature. They are arranged under the 19 visitor activity headings from above, and a 20th entitled "Miscellaneous".

## **1. Traditional (Maori) harvest**

NZ Conservation Authority (1994) has produced a discussion document on Maori customary use of plants and animals. Traditional harvest of some sea birds is currently lawful in three island groups, and birding rights are granted on a few others. There are various game birds, waterfowl and pukeko that can be legally hunted under regulation. Their feathers and flesh may be of value and assist, by substitution, with the conservation of more threatened birds. Plant materials most commonly sought include harakeke (NZ flax, *Phormium tenax*) and medicinal plants. The basic principles for customary use should include sustainability, a local focus, sound ecological knowledge, information sharing, and practices of restoration and enhancement.

Responses to the NZ Conservation Authority discussion document have been summarised by Geden & Ryan (1995). Concern came from several quarters

that various birds could be threatened by traditional harvest, including whio. There were calls to fully protect Australasian harrier, black shag and black-backed gull. Species considered appropriate for harvest included paradise shelduck, pukeko, black swan, grey duck, mallard and, interestingly, black-backed gull. The most traditionally used wetland plant was harakeke (NZ flax), which in itself provides wetland bird habitat. Most traditional users grow their own supplies in more accessible sites than wetlands. Concern was expressed about sphagnum harvest and the impact this has on wetlands. Issues of control and management of traditional harvesting were complex. Most submissions recommended iwi or Crown control or a combination of both; there are clearly opportunities for partnerships. The guiding principle called for was sustainability of harvest; research into what this meant in practice was recommended.

Smith (1994) describes how traditional harvest/customary use has led to depletions and extinctions the world over. Many of New Zealand's bird species are not well adapted to cope with habitat change, mammalian presence, and human disturbance. Some traditional bird harvests are not sustainable because of these factors. Some Maori continue to practise such harvests, despite their illegality, whilst others are opposed to them and try to change attitudes through education.

Walls (1994) describes the significance of some Hawke's Bay wetlands for traditional Maori harvests: eels, kakahi (freshwater mussel, *Hyridella menziesi*), birds, harakeke (NZ flax, *Phormium tenax*), ti kouka (cabbage tree, *Cordyline australis*) and rongoa (medicinal) plants.

Strang (1980) reports that avian predators apparently foraged where people had searched for waterfowl nests (egg or clown harvest), thereby compounding the impact of the harvest. By contrast, Datta & Pal (1993) describe the impact of traditional harvesting practices on storks within a wildlife sanctuary in India. Despite the harvesting of birds for plumage and nests for firewood, and much other human disturbance, the storks were increasing in number.

## **2. Hunting**

By definition hunting has a major impact on the creatures being hunted! It usually takes the form of shooting, which is mostly seasonal and noisy. It is typically associated with other activities (walking, boating, vehicles, camping, etc.).

Madsen (1995) found that migratory waterfowl were detrimentally impacted upon by shooting activities, both directly and indirectly. Establishing shooting-free wetland reserves in Denmark has boosted the numbers of these birds significantly. Riddington et al. (1996), describe how wild geese in the UK had the greatest energy expenditure in response to disturbance by gunfire and aircraft.

Green et al. (1996), studying the globally threatened white-headed duck in Turkey, found that illegal hunting was a serious threat to the species. The ducks' behaviour made them more of a sitting target than other birds. The

authors see education of locals and avitourism development as ways of conserving both the ducks and their habitat.

Much has been researched and written about the effects of lead poisoning from the ingestion of shot. Widespread poisoning is a well-established fact world-wide. Matthews (1990) and Pain (1990) provide detailed summaries of the situation. Particularly at risk from direct ingestion are waterfowl, waders, gulls, rails, and coots. These birds normally ingest grit and small stones. At risk from secondary ingestion are scavengers and predators, including raptors. The obvious solution lies in the use of non-toxic shot, yet there seems to be a reluctance to make this move.

### **3. Fishing**

Anglers are mentioned as disrupting birds in most of the New Zealand habitat surveys, impact studies and overviews (Cromarty & Scott 1996, Devlin et al. 1995, Hughey et al. 1986, Montgomery 1991, Moore et al. 1984, O'Donnell & Moore 1983, Robertson et al. 1983, Robertson et al. 1984, Smith et al. 1997, Stephenson 1986, Walls 1994, Ward & Beanland 1996 and Ward & Stewart 1989). Their activities are frequently associated with the use of vehicles and boats. Whitebaiters have been reported in the past as altering water flows, altering habitat and disturbing birds in the vicinity of the kotuku breeding colony, South Westland (Lands and Survey file reports).

Korschgen et al. (1985), in a study of recreational boating disturbance of diving ducks on the Mississippi River, found that most of the disturbances were caused by sport fishermen. The ducks were sent flying, at a cost to their energy budgets, and some left the area altogether. Havera et al. (1992), in a follow-up to this work, suggest public education and restrictions on recreational activities (times of year, times of day, approach distance to birds) to minimise impact.

### **4. Water sports and pursuits**

Montgomery (1991) and Ward & Stewart (1989) describe boating impacts in New Zealand lake situations. Robertson et al. (1984) state that on the Lower Waitaki River braided river system, birds are prone to disturbance by jetboats, especially the more alert species such as shags, spur-winged plover and mallard. Sagar et al. (1995) describe how wave action from boats can disturb black swan nests and feeding sites.

Platteeuw & Henkens (1997a,b) describe how, in a lake study in Holland, conflicts between aquatic recreation and waterbirds were particularly likely during the breeding, moulting and staging periods. Birds avoided heavily used areas, and detailed observations showed reduced bird abundance and distributional shifts. Disturbance to birds resulted in their expenditure of extra energy or loss of foraging time, both of which had to be compensated for. This extra demand decreased the carrying capacity or body condition of the birds in frequently disturbed areas. These in turn were likely to have long-term negative impacts on populations. It was suggested that the core areas for recreation and bird requirements be managed so that they were spatially separated.

Rodgers & Smith (1997) show that in a study in Florida, wetland birds varied in their response to motor boat approach. Mean flushing distance was 26-37m. The authors recommend a buffer of 77-126 m for these birds. Titus and Van Druff (1981), in a major study of human recreational impact on the common loon in wetlands in Minnesota, report that of all activities motor boating was most disruptive, flushing birds and lowering breeding success. However, there was a degree of habituation by the loons to human presence that partially compensated.

Batten (1977), in a study of the effects of sailing on waterbirds on a British reservoir, showed that ducks, grebes and other birds were displaced and disrupted by sailing activities, but were able to persist in shallow areas inaccessible to the boats. Since larger flocks appeared to be more sensitive to disturbance than smaller ones, the suggestion was made that refuge areas could be made more effective with screening. In a Welsh reservoir study, Tuite et al. (1983) found that boating activity significantly limited the carrying capacity of reservoirs for wintering waterfowl.

Vial (1995), in a study of African skimmers in Botswana, found, surprisingly, that nesting skimmers were most sensitive to canoes, because of their slower and nearer approach. They were also disturbed by sudden changes in motor-boat speed and nest flooding from wakes.

The use of boats has been directly implicated in the introduction and spread of aquatic weeds in New Zealand (Howard-Williams & Davies 1988; Johnstone et al. 1985), thereby altering the habitat for wetland birds.

## **5. Off-road vehicle recreation and other traffic**

Robertson et al. (1983, 1984) express concern about the impacts of off-road vehicle use in the Ahuriri and Lower Waitaki braided river systems, and suggest controlling access, especially during bird breeding, and removing road access to key breeding areas.

Rodgers & Smith (1997) show that in a study in Florida, wetland birds varied in their response to all-terrain vehicle approach. Mean flushing distance was 15-32 m. The authors recommend a buffer of 69-101 m for these birds. For ordinary vehicles, the flushing distances were 18-24 m and the recommended buffers were 68-84 m.

Reijnen et al. (1996) found that the densities of breeding birds in grasslands adjacent to busy roads was significantly lower than elsewhere. The birds included several wetland species. The authors consider traffic a serious threat to such breeding bird populations, and that road planning needs to take this into account.

## **6. Aerial sports and pursuits**

Stokes (1996) reports that helicopter ecotour visits to a remote Queensland island probably caused sea eagle breeding failure, and that breeding times should be avoided for such visits. No lasting impacts of helicopters on small non-breeding birds were detected. Riddington et al. (1996), describe how UK

wild geese had the greatest energy expenditure in response to disturbance by aircraft and gunfire. Owens (1977) found the same sort of response in wintering geese to aircraft.

Belanger & Bedard (1989) report that in a bird sanctuary in Quebec, low-flying aircraft caused the greatest disturbance to staging snow geese, disrupting feeding and causing birds to take flight and leave the area. The authors recommend that low-level aircraft flights over such sanctuaries should be strictly regulated.

Overflights of the kotuku breeding colony in South Westland by RNZAF aircraft have been mentioned as a source of concern by various wardens (Department of Lands and Survey reports).

## **7. Conservation management**

The impacts of conservation management are usually beneficial to wetland birds, in that it is focused on habitat restoration, species recovery, enhancing public awareness and enforcing rules and regulations on visitor activities. Kazmierow (1996), Robertson (1993) and others describe instances of the benefits to wetland bird populations of conservation management in New Zealand. Similar examples are woven into the overseas literature as well. Where management involves the use of vehicles, helicopters, power boats, motorised tools, dogs and visitation at sensitive times for birds, the kinds of impacts described for those things apply. So, too, do the effects of researchers, described below.

## **8. Research**

Ellison & Cleary (1978) found that the cormorants they were studying in Canada were disturbed by frequent visits, abandoning nests, being more susceptible to gull predation of nests, and being discouraged from late-nesting. Tremblay & Ellison (1979) found the same sort of impact on breeding night herons. Safina & Burger (1983) found that the impacts of researcher disturbance on breeding terns in New York was dramatic: desertion and breeding failure. Gfitmark and Alilund (1984) observed higher predation rates by gulls on eider nests following field observer disturbance. A similar study on arctic geese in Canada by Armstrong (1996) found no significant effect of researcher disturbance. Davis & Parsons (1991) reported no significant impact of research disturbance during a study of egret chick survival.

The consensus appears to be that there is a spectrum from high observer impact on breeding success to no detectable impact, depending on the species and circumstances. There is certainly a need to take the potential negative impacts of research into account. In a recent examination of black stilt breeding, Sanders (1997) has recommended that study visits to nests be minimised, research disturbances at feeding sites be kept to a minimum, and distant surveillance techniques be used for monitoring.

## **9. Outdoor education**

Although education is mentioned by many authors, I found no literature relat-

ing to particular activities and their impacts. In general, education of the public is seen as vital to the conservation of wetlands and their birds, and a key way of minimising visitor impacts.

#### **10. Picnicking, camping**

Hunt (1972) found that herring gull colonies were affected by picnickers in Maine. Hatching success was lower than in unvisited colonies due to overheating of eggs when parents were flushed from the nest by human disturbance.

Marion (1995) describes how, in a North American back-country recreation area, the impact of campers at river-accessed campsites was minimised by the installation of fixed fireplaces. This confined the impact to small areas, allowing peripheral areas to recover.

#### **11. Walking, tramping and running**

Rodgers & Smith (1997) show that in a study in Florida, wetland birds varied in their response to walking approach. Mean flushing distance was 14-34 m. The authors recommend a buffer of 67-107 m for these birds. Riddington et al. (1996), in a study on wild geese in coastal UK, found that the most frequent disturbance was pedestrians, and that birds fed less and were more vigilant when disturbance was greater, thereby needing to feed at night to balance their energy budget. Henson & Grant (1991) demonstrated a similar effect on swans in Minnesota. Breeding swans were particularly sensitive to pedestrians (including researchers), leading to decreases in breeding success and additional stress on already energy-stressed female birds. Owens (1977) studied the responses of wintering geese to human disturbance and found that they partly habituated to people and noise, but food shortage at that season meant the birds were particularly vulnerable to disturbance. Disturbance by walkers and other visitors at weekends increased the time birds were in flight up to sevenfold.

The Who/Blue Duck Recovery Plan (Department of Conservation 1997a) raises concerns about the impact on the ducks of the Coast-to-Coast endurance race: both during the event and (even more so) during training for it. Norton (1989) considered the impact minimal, but it looks as though subsequent experience has proven otherwise.

#### **12. Sightseeing, photography, painting, seeking solitude**

Photography is mentioned in the same breath as birdwatching, nature study and ecotourism (below). Its impacts are therefore dealt with under those headings. Information on the effects of sightseeing, painting and seeking solitude are not to be found in the literature I examined.

#### **13. Nature study**

Glinsky (1976) points out the types of disturbance caused by birdwatchers and the lack of regulation of this activity. Suggested rules of etiquette include keeping visitor group size small, and avoiding nesting and rare birds.

Scott (1982) recommends the provision of birdwatching hides to minimise disturbance.

#### **14. Ecotourism, nature tourism**

Warren & Taylor (1994) state that ecotourism is being promoted in New Zealand as "clean and green". There is general agreement that ecotourism is characterised by low ecological impact, small scale, local control, and enhancement of conservation resources through education and increased environmental appreciation. The crucial issue for communities is the identification of impacts and informed planning for tourism.

Sage (1995) examines the impact of burgeoning tourism on conservation lands in New Zealand. She concludes that there is cause for genuine concern, yet little impact research or monitoring has been done. She observes that tourism is colonising all the remote places it can, and reiterates the plea made by South Westland explorer Charles Douglas over a century ago to keep at least some places free of tourists, so that there are still places for the imagination to travel (Pascoe 1957). Existing techniques for minimising impact, such as use of boardwalks, guidelines, zonings, environmental care codes, and education are applauded, but the need for better preparation for predicted tourism growth is highlighted.

Veitch (1992) summarises the New Zealand scene of threatened species and the potential impacts of ecotourism. He highlights the destruction of habitat and disruption during courtship or mating periods as serious consequences. He gives examples of sensitive operations that have no known detrimental impacts on birds.

Cessford (1995) describes the conservation benefits of public visits to protected islands (where various wetland birds occur). These are summarised as: heightened public awareness; heightened conservation management (capacity and responsiveness).

Andereck (1995) reviews recent tourism impact research. This has concentrated on the negative impacts of tourism, including effects on water and air resources, plant and animal resources, soil and dune erosion, and aesthetics. However, tourism has some positive influences, such as preservation of natural areas due to tourism and its economic benefits. As Streiffert (1998) points out, the lure of birding dollars is creating a strong incentive to save bird-rich habitats world-wide.

There is a lot of other literature on the environmental impacts and benefits of tourism, drawing on experiences from all around the globe. Much of this is collated in recent books (e.g. Seaton 1994, Fladmark 1994, Coccossis & Nijkamp 1995, Croall 1995, Price et al. 1996) and journals (e.g. Giannecchini 1993, Holmes 1993, Ghazali et al. 1994, Navrud & Mungatana 1994, Goodwin 1995, Manning 1996, Sem et al. 1996). The impacts are recognised, and ways to mitigate these are offered, for example education, user fee levies, restrictions, partnerships and community-based structures. Hunter (1995) argues that the predominant paradigm is too tourism-centric and parochial for sustainable development, and needs to be re-conceptualised to identify what contribu-



tions tourism can make to conservation. Priestly et al. (1996) conclude that a clear distinction needs to be made between the sustainability of a particular tourist and the sustainability of the environment.

The books by Cater & Lowmen (1994) and Hunter & Green (1995) and the paper by Walker (1997) ask the rhetorical question: is ecotourism sustainable? They provide examples of the benefits, as well as the negatives, of ecotourism, and offer management guidelines to minimise impact.

Wang & Miko (1997) present the results of a questionnaire study of 51 national parks in the USA. Negative impacts of tourism on air quality, water quality, vegetation and wildlife were found to be widespread. This stimulated a plea to managers for sensitive planning and for detailed studies of the impacts of tourism in natural areas.

Klein et al. (1995) report on a major study of the impact of ecotours on wetland birds in a wildlife refuge in Florida. Most resident species were less sensitive to disturbance than were migrants; migrant ducks were most sensitive on arrival; shorebirds were displaced; some birds habituated to human presence whilst others remained sensitive; herons and egrets seemed least affected by high levels of visitation. The authors consider that public education and changes in management practices are needed to reduce disturbance, such as zoning for visitation levels, limiting visitor numbers, encouraging visitors to remain in their vehicles in certain areas and closing areas to visitors at migration times. Burger et al. (1995), in a similar study in New Jersey, concluded that bird-watchers and birds could coexist amicably, but only when careful consideration was given to controlling the duration and closeness of the encounters. They recommend the use of boardwalks, fences and closure of areas during sensitive times of the year.

Robertson (1993) illustrates that the erection of basic barriers to discourage visitors from going too close to breeding gannets and albatrosses in New Zealand has led to remarkable population increases. Long-term monitoring has been the key to gaining this knowledge.

In an Australian Study of the effects of human visitation on island-breeding terns, Dunlop (1996) found that the regular presence and relatively predictable behaviour of people led to terns becoming tolerant of much closer human approach. The author states that the implications for management of public access to bird colonies are that, rather than enforce a critical distance guideline approach, the priority is to establish a human presence gradually.

Muir & Chester (1993) describe how management of tourism to a seabird nesting island in Australia has faced a greatly increased demand. This has required a strategic review. Future management must restrict the tourism activities and times to ensure the values of the area are not compromised. Stokes et al. (1996) provide a comprehensive and wider scale update on this situation within the Great Barrier Reef Marine Park region, where developments in vessel technology have put increasing numbers of islands within ready visitor reach. They conclude that human visitation to certain islands is sustainable provided it is well regulated and that adequate monitoring occurs. They propose a detailed code of conduct for visitors in order to mini-

mise impact, and state that Australian national guidelines for such visits are being developed.

Cessford & Dingwall (1994) describe how New Zealand's Subantarctic Islands managed as nature reserves are increasingly attractive tourism destinations. So far, impacts on wildlife are slight. Information is being gathered to guide management. Sanson (1994) expands on this with a case study, showing that management that sets conservative limits on group size and total annual numbers of visitors, and imposes a code of conduct, ensures high quality of visitor experience whilst minimising impact. He asserts that good long-term monitoring is required as well.

Wright (1998) describes a study of two ecotourism ventures on Otago Peninsula, New Zealand, one based on yellow-eyed penguins and one on Hooker's sea lions. The penguins were somewhat disturbed, but the management guidelines should ensure that there is little impact. The sea lions appeared to be tolerant of people. Monitoring is advocated in both cases.

#### **15. Adventure tourism**

Jetboating, rafting and canoeing get a mention in various publications (see water activities above). The negative impact of white-water activities on whio, and the measures taken to mitigate that are described by Rich (1991), Cessford & Dingwall (1997), and Department of Conservation (1997a).

#### **16. Horse riding and trekking**

I found no specific literature on this subject, but the following impacts undoubtedly occur: disturbance of feeding, roosting, loafing, courting and nesting birds; crushing of eggs and chicks in nests; importation of weed seeds.

#### **17. Fossicking and gathering**

Walls (1997) points out the ecological values of driftwood in New Zealand. They include providing shelter, feeding, nesting or roosting sites to wetland birds. Removal or burning of driftwood can therefore have quite severe consequences for these birds, especially during breeding.

#### **18. Dumping**

I found no specific reference to dumping.

#### **19. Farming, forestry and industrial operations**

Literature on this subject area wasn't pursued. However, I found a few noteworthy references. Madsen (1995), in a Norwegian study, found that the spring fattening of pinkfooted geese was far better in undisturbed areas than in areas disturbed by farmers. The undisturbed birds subsequently bred much more successfully. Many other authors mention the impacts of farmed stock on wetland habitat. Most of it is negative: destruction or disruption of shelter, feeding habitat, nests and nest sites, roosts and loafing areas.

## 20. Miscellaneous

Andersen et al. (1990) showed that raptors moved their home ranges and territories away from areas of military activity in Colorado.

Gosler et al. (1995) assessed whether a gull roost at a reservoir in England could be moved, so that the gulls presented less of a hazard to aircraft, without disturbance to other waterbirds. Using taped distress calls and pyrotechnics, they found that roost formation was prevented without detectable changes in the numbers of the other birds. This may give a clue to selective management of recreational activities.

Kury & Gochfeld (1975) demonstrated that human disturbance varied with wetland bird species in a North American study. They found that shags were far more sensitive to disruption than gulls, and in fact gull predation of shag eggs and chicks increased. Hand (1980) found that the negative impacts of human disturbance on gulls in California were compounded by conspecific predation. The authors of both papers suggest that such results are predictable and can be minimised by the right sort of regulation of visitors.

Balneaves & Hughey (1989), reporting on habitat requirements for braided riverbed birds in Canterbury, focused on the issue of weed encroachment on to open nesting areas. They have thereby raised the spectre of weed importation and spread by visitors.

Vehicles, horses and people all act as seed dispersal agents. Some visitors, such as overseas tourists, like to see colourful flowers and deciduous foliage (e.g. Russell lupins, larches, willows, buddleija and broom) in such areas, oblivious of their ecological impact. Local residents have been known to spread such plants clandestinely.

The disruptive effects of clogs were regularly mentioned in the literature, usually in reference to these animals being there with various kinds of human visitors. The impacts include: predation of adult birds, chicks and eggs; disturbance of feeding, breeding, loafing, roosting and moulting birds. Ground-nesting birds are obviously most vulnerable. Barlow (1995) reports Caspian tern eggs and small chicks being attacked at New Zealand breeding colonies by gulls, the adults having been disturbed by visitors and their dogs. This appears to be a familiar story world-wide.

Robertson et al. (1984) state that on the Lower Waitaki River system, where there is a wide range of recreational activity, the main human impact is disturbance of breeding birds, especially if people are accompanied by dogs. They go on to say "Recreational users engrossed in their own activity may not see birds' nests and eggs and tread on them, or scare the adults away by their presence, thus leaving the eggs exposed. With increased recreation, predators can be more easily led to nesting areas by following scents across land". They suggest controlling human activities via designation of areas for protection, education and surveillance.

Jolly & Brown (1975) provide an excellent synopsis of the physical and biological characteristics of New Zealand lakes. In a splendid section on the

bird fauna by R.A. Falla, there is mention of recreational impacts, especially the disruptive effects of power boating.

There is a body of older natural history literature rich with observations on the intimate lives of New Zealand's birds and their responses to disturbance by people, predators, stock, dogs, fires and habitat change. An example is Guthrie-Smith (1927), whose exquisite descriptions of waterbird behaviour are a heritage to be cherished.

## 8. Management recommendations

As has already been displayed in previous sections of this report, there is a reasonable amount of guidance to be obtained from the literature about how best to manage wetlands and their human visitors so that the birds are least disturbed. Much is in the nature of general principles; some is more specific. Examples of management-focused literature follow, beginning with those based in New Zealand.

The Department of Conservation, in its approach to the designation of New Zealand's Subantarctic Islands as World Heritage sites and the visitor interest that might bring, has devised a set of clear management guidelines (Department of Conservation 1997b). They include: strict measures to prevent accidental importation of pests; a code of conduct designed for minimal impact; annual visitor quotas; departmental representative to be in attendance during every visit; all tourist visits and research activities governed by permits; definition of no-entry areas; landing sites strictly designated; total smoking and fire ban; ongoing visitor monitoring and impact studies. Thus visitors are carefully controlled and their impacts monitored; education is part of the process. This model seems to me to hold much promise for how sensitive wetland areas New Zealand-wide could be managed.

The Department of Conservation, as cited by Sage (1995), has prepared a manual of visitor management techniques for field staff. Techniques suggested for use at "problem" sites include changing visitor expectations, changing their behaviour through education, and reducing the use of sites by limiting numbers or removing facilities.

Kazmierow (1996), in his study of visitor impact on kotuku in South Westland, recommends long-term monitoring be part of future management. He also recommends minimising the number of boat trips, scheduling trips for times when kotuku chicks are least likely to be using the waterway and considering sensitive land-based approaches as an alternative.

Smith et al. (1997), investigating the impacts of recreational users on the birds of the braided river system at Tekapo, recommend heightening user awareness via interpretive material and liaison, especially during sensitive times for the birds.

The New Zealand Conservation Authority (1995), in assessing Maori customary use of native fauna and flora, recommends the creation and fostering of practical working partnerships between traditional users and modern management agencies to conserve the fauna and flora.

Smith (1993), in a questionnaire designed to identify riparian zone management issues, concludes that many professional resource managers lack knowledge of New Zealand's flora and fauna. There is also a perceived lack of basic information on riparian ecology and management techniques. Surprisingly, recreational activities are scarcely addressed.

Ward & Stewart (1989), investigating the impacts of visitors on wetland birds at Lake Alexandrina, suggest that management is required to minimise recreational and farming impacts, e.g. provision of sewage facilities, restrictions on recreational use, and restriction of stock access to lake margins.

Cessford & Dingwall (1997), in their national compilation on the impacts of visitors on natural and historic resources of conservation significance, provide alerts on key impacts requiring management responses. Suggested responses include restrictions on numbers of certain kinds of users (e.g. power boats on lakes), advocacy to improve behaviour and establish care codes, routing people away from sensitive sites, providing protective facilities (such as boardwalks, barriers, jetties), limiting access to certain sites (e.g. boat ramps where the risk of water weed transfer is minimised), enforcement of hunting and fishing conservation regulations, and restriction of disruptive activities (noisy, rapid movement, etc.).

Scott (1982) has edited a comprehensive instruction manual of how to manage wetlands for the benefit of waterfowl. It has a European focus, but its principles are universal. Management measures that result in increases in bird numbers or a halt of decline include:

- regulation of hunting timing and pressure (seasons; times of week; times of (Jay; limit bags);
- improvement of hunting methods and practices (not shooting into flocks, or birds on water, or at too great a range to kill cleanly; limits to numbers of shotgun cartridges to be loaded; prohibition of use of nets and other non-selective techniques);
- speed limits on boats;
- designation of refuges/sanctuaries;
- law enforcement and education;
- control of recreational disturbance.

Recommended wetland management measures to reduce conflict/impact include:

- codes of conduct for various activities;

- education;
- viewing hide construction for birdwatching.

Washburne (1982), in a generalised international look at the concept of wilderness recreational carrying capacity, concludes that the setting of limits on numbers of users (recreationists) when overuse threatens isn't always the answer. He recommends setting standards and monitoring specific conditions instead, as more effective than calculating use capacities. Kuss et al. (1990) back this up in a detailed examination of visitor impact management in North American national parks.

Ream (1980), in compiling an annotated North American bibliography of the impact of back-country recreationists on wildlife, concludes that there are three approaches to reducing wildlife harassment: people management; wildlife management, and habitat modification. She states further that the primary targets of management should be the critical times of year and the key locations of species vulnerable to harassment.

Pomerantz et al. (1988), looking at recreational impacts on wildlife in North America, suggest the use of a classification system for identifying impact so that management responses can be well planned. The classification categories are: direct mortality; indirect mortality; lowered productivity; reduced usage of refuge areas; reduced usage of preferred habitat; aberrant behaviour or stress.

Dunlop (1996), in an Australian study of human disturbance of breeding terns, suggests that human impact can be mitigated by establishing a human presence gradually and (for the birds) predictably. Provision of barriers, walkways, educational signs, supervision and amenities are suggested. Stokes et al. (1996), investigating the management of human visitation to Great Barrier Reef seabird islands, define a comprehensive code of conduct to minimise impact. This includes being quiet and avoiding sudden movement; not approaching too close to breeding birds; avoidance of burrow-nesting areas; removal of all rubbish; no smoking or fires; check of clothing, shoes and gear for plant seeds prior to landing; no removal of plants or animals; minimal use of lights at night; toilet use below high-tide level; particular care during late afternoon-early evening, hottest period of day, wet and/or cold weather and moonlit nights; special care when eggs or young chicks present.

Henson & Grant (1991), in an American study of human disturbance of breeding swans, suggest restricting the use of boats and other sources of loud noise, erecting educational signs during the breeding season, and locating viewing sites (having rear access only) well away from nests.

Klein et al. (1995), reporting on the effects of ecotourism on waterfowl distribution in a Florida wildlife refuge, recommend public education, guided tours, designation of low-disturbance zones, and limitation of visitor numbers or even total closure to visitors at critical times. Rodgers & Smith (1995), in another Florida study, recommend set-back distances (nearest approach distances) for various birds, ranging from about 100 m for wading birds to 180 m for terns.

Liddle (1997), in a book on the ecological impact of outdoor recreation and ecotourism, identifies numerous impacts requiring management. Among the most specific recommendations relating to waterbirds is the strict regulation of low-flying aircraft.

All overseas studies I read on lead poisoning in waterbirds recommend the use of non-toxic shot in waterfowl hunting.

There are clearly many lessons for New Zealand wetland visitor management from these studies, and an array of useful techniques. There is a lot of power to enable visitor management by virtue of the Conservation Act 1987, the Wildlife Act 1953, the Reserves Act 1977, the Resource Management Act 1991, the Freshwater Fisheries Regulations 1983, the NZ Wetlands Management Policy 1986, and a whole range of fish and game hunting and management regulations.

Other mechanisms and techniques for management not hitherto mentioned include:

- legislation and regulation review;
- guidelines for tourism and other concessions,
- wetland protection (designation of conservation areas, open space covenants, wildlife refuges, wildlife management areas, international Ramsar sites and Recommended Areas for Protection (RAPS) under the NZ Protected Natural Areas Programme);
- weed and animal pest control (relating to human visitation);
- vigilance by trustworthy people during breeding and moulting times;
- use of traditional Maori controls on harvest;
- screening of visitors or visitor areas for avian disease.

In conclusion, the fundamental management recommendation from the state of knowledge pulled together in this report is: *that agencies managing New Zealand's wetlands should manage visitor activities to minimise impacts on the birds and their environment.*

The suite of visitor impacts is serious enough to warrant that, and current management in most cases is inadequate.

The way to manage impacts is basically obvious: first clearly identify the impacts, then adopt practices to mitigate their effects. The impacts are relatively well known, as this report shows. The management responses should flow from that knowledge, and use successful techniques from overseas as well as innovative techniques tailored to local circumstances. As Liddle & Scorgie (1980) conclude, *management needs to be based on good information and, where areas are designated for fauna and flora preservation, needs to keep those aims clearly in mind.* Management also needs to be sensitive to its own impact!

## 9. Research needs

There are many suggestions for research in the literature. They mostly relate to the identification of visitor impacts and the testing of specific mitigation techniques. Significant knowledge gaps also appear to be in the ecology and behaviour of bird species and habitats most at risk and in the most vulnerable phases for birds. Sociological aspects of human visitation seem to be somewhat neglected too. The most recent literature is of course the best guide to the identification of current research needs.

Cessford & Dingwall (1997) and Cessford (1997) are key references for the New Zealand scene. In summary, the research needs relating to wetlands and waterbirds are:

- establishment of a database of international information on visitor impacts (i.e. this study);
- establishment of baseline data on high priority species;
- identification of key sites for the viability of priority species, and visitor activities and impacts there;
- design of simple guidelines for monitoring visitor impacts;
- investigation into whether early warning indicators can be identified for measuring impacts on breeding success using known case studies such as whio (blue duck) as examples;
- determination of meaningful indicators to detect unknown impacts;
- identification of wetland soil/vegetation associations most susceptible to disturbance, disruption and visitor impacts such as weeds and fire;
- evaluation of disruption from protective and other facilities such as boardwalks and toilets (e.g. leachate, sewage);
- identification of potential site damage (sensitive areas, future likely popular areas);
- distinguishing the respective impacts of different users (e.g. walkers, bikers, drivers, fishers);
- identification of key ecosystems and species in New Zealand aquatic areas;
- investigation of the types of impact of watercraft on aquatic ecosystems;
- review of overseas research on tire introduction and spread of aquatic weeds and animal pests through the use of boats and diving/fishing gear;



- production of a field guide to aquatic pests and their management;
- determination of the ecological significance of alpine tarns, and visitor impacts (or potential impacts) on them.

Ward & Beanland (1996), in reviewing studies on the biophysical impacts of tourism in New Zealand, cite the Rotorua lake study of Montgomery (1991). Montgomery's research suggestions are reinforced and still considered necessary:

- longer-term repeat studies of boating on bird numbers, distribution and diversity;
- assessment of disturbance distances for different bird species;
- assessment of how far birds travel when disturbed;
- investigation of the effect of recreational disturbance on shag breeding success;
- review of the current status, population trends and biology of NZ Dabchick, a bird that may be rarer than North Island kokako;
- investigation into the effect on bird numbers, diversity and breeding success of zoning wetland areas to exclude boats.

Smith et al. (1997), in their Tekapo braided river study, make the recommendation that future research cover a longer period of the bird breeding season, investigate the behaviours of off-road vehicle recreationists, and investigate the attitudes of visitors to birds.

Geden & Ryan (1995), in reviewing Maori customary use of native fauna and flora for the New Zealand Conservation Authority, point out that at present there are few Maori who have studied wildlife biology and ecology to a sufficient level to play a significant role in research. They also indicate the need for research into the impacts and sustainability of traditional harvests.

Kazmierow (1996), in his study of visitor impact on kotuku in South Westland, recommends that future research address the following:

- the issue of long-term effects of behavioural disturbance on colonial birds;
- case-studies of other wetland bird species and visitor impact;
- analysis of the costs and benefits of recreational activities on wildlife when considering specific wildlife-viewing tourist concessions;
- ecology of kotuku, particularly away from the breeding colony;
- development of least-impact techniques for the study of birds.

Among the overseas literature, Keller (1996), in a key review of the effects and management of disturbance of waterbirds by human recreational activities, stresses the need for more studies aimed at the management of sites. She points out the need for more research into:

- the relationships between birds and humans at different sites, and at different times;
- habituation of birds to human presence, and the effects of this on their well-being;
- thresholds of bird tolerance to human disturbance;
- cumulative impacts of suites of human activities;
- methods of wetland management to mitigate the impacts of disturbance.

York (1994), in a North American review of recreational boating disturbances of wildlife, states that as conflicts between boating and resource protection escalate, there will be an increasing need for information on waterfowl flush and flight distances, zoning and buffers, and the disturbance reactions of different species.

Kuss et al. (1990), in a review of research into visitor impact management in North American national Parks, list the following broad research needs:

- investigation of impact interrelationships;
- use-impact relationships over time and in differing circumstances;
- varying tolerance to impacts;
- activity-specific influences;
- site-specific influences.

Several other reviewers state the need for long-term research to assess the enduring impacts of various visitor activities, hence their sustainability. Others point out the need for baseline research and monitoring, in order to have a means for genuinely assessing impacts.

In summary, it is clear that although much is already scientifically known and published about the impacts of visitors on wetlands and their birds in New Zealand and elsewhere, there is plenty of scope for additional research. That new investigation would be best directed at specific local issues and situations, in order to guide future practical conservation management.

## 10. Conclusions

1. A huge amount is known about the impacts of human visitors on wetland birds. Nearly every kind of visitor activity has negative impacts, directly or indirectly. Some of the fastest-growing and most popular pursuits are seriously damaging.
2. New Zealand studies are not numerous, but there are some key studies that symbolise the overall situation well. Concern has been expressed in print since the early 1980s that the impacts of visitors on wetland birds in popular sites are unsustainable and require special management to minimise them.
3. There is also a strong body of collective practical wisdom among researchers and conservation managers. That said, there are also profound blind spots: the ecology of waterfowl and highly threatened waterbirds, and the threats to them, are relatively well known, but the other wetland species and ecosystems are badly neglected.
4. Much work on human impacts on waterbirds and other wildlife has been done overseas, especially in the UK, Europe and North America. Visitor pressure is higher than in New Zealand as a rule, so the lessons are predictive for the potential increases here. Also, there are overseas analogue species and habitats for virtually all of New Zealand's wetland birds and wetlands, making the lessons to be learnt quite direct.
5. In searching the Internet, I found little of direct use at New Zealand web sites. There was more at overseas-based web sites, the most useful and relevant found was that of The Wildfowl and Wetlands Trust (<http://www.greenchannel.com/wwt>), based in the UK,
6. There is a huge amount of information in readily accessible published literature. Key New Zealand references include books on New Zealand birds, the recent directory of wetlands in New Zealand (Cromarty & Scott 1996), various survey reports done under the NZ Wildlife Service, Department of Conservation threatened species recovery plans and a few site-specific studies. There is not a lot in the New Zealand scientific literature, although there are some pertinent papers. The overseas literature scientific, institutional and popular - is voluminous and valuable. There are several comprehensive reviews on the precise topic, numerous scientific case studies and some practical management manuals.
7. Each New Zealand region has its own suite of bird *species*, wetland types, visitor patterns and pressures. Therefore, each Department of Conservation conservancy has to take its own approach to prioritisation, but the management techniques should be discussed nationally and standardised if possible. Otherwise, there will be much inefficiency in approach and possibly also misguidance.

8. Visitor activities involving loud noise, sudden movement and rapid movement are most disruptive. These include the use of power boats, jet skis, off-road vehicles and aircraft. Activities such as running, fishing and bird-watching can also be highly disruptive. Hunting, especially shooting, has a severe direct impact, of course; it also has major indirect impacts through lead poisoning and population demographic changes.
9. People can be peculiarly insensitive to wetland birds and the impacts they are causing, so engrossed are they in their chosen pursuits. Often they simply don't know about the birds or the habitat fragility. Dogs that accompany people can be very disruptive. Weeds, imported unwittingly or deliberately, can radically affect the habitat. Researchers and conservation managers need to be aware of their own impacts, including the subtle one of leaving a scent trail to nests for predators such as mustelids and hedgehogs.
10. Nature-based tourism has the potential to be both damaging and nurturing. It depends how it is handled. There are plenty of overseas case studies and one or two New Zealand ones that can be used to create guidelines to accentuate the positive. The guidelines produced by the Department of Conservation for Subantarctic Islands ecotourism are comprehensive and wise.
11. Birds are most vulnerable during their breeding season, especially when they have eggs and young chicks. Several are also vulnerable during moulting, and at times of stress such as in winter cold and summer drought. The key to good management is the identification of these critical times.
12. There are numerous management techniques available for visitor impact mitigation, and plenty of empowering legislation and regulation in New Zealand. Such techniques include: restriction of visitor numbers; restrictions on types of activities and times of year; supervision and guidance; designation of no-go areas (refuges, sanctuaries); provision of barriers and facilities; education; habitat management (enhancement, buffers, pest control, etc.). All of these have been well tried overseas, so there are good working models available.
13. Although there has been much research carried out on the impacts of visitors on wetlands and their birds, there is a need for more. This needs to be directed at specific local issues and situations, in order to guide future practical conservation management.

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## 12. References

- Allan, S.; Booth, K. L. 1992. River and lake recreation: issues, research priorities and annotated bibliography. Wellington Environmental Planning and Assessment, Wellington.
- Andereck, K.L. 1995. Environmental consequences of tourism: a review of recent research. *USDA General Technical Report INT-GTR-323: 77-81.*
- Andersen, D.G.; Rongstad, O.J.; Mytton, W.R. 1990. Home-range changes in raptors exposed to increased human activity levels in Southeastern Colorado. *Wildlife Society Bulletin 18: 134-142.*

- Armstrong, T. 1996. Effects of research activities on nest predation in Arctic-nesting geese. *Journal of Wildlife Management* 60(2):265-269.
- Balneaves, J.M.; Hughey, KFD 1989. The need for control of exotic weeds in braided riverbeds for conservation of wildlife. NZ Forest Research Institute report to Department of Conservation.
- Barlow, M. 1995. Habitats and factors affecting breeding success at eleven Caspian Tern (*Sterna caspia*) colonies in New Zealand. *Notornis* 42:138-139.
- Batten, L.A. 1977. Sailing on reservoirs and its effects on water birds. *Biological Conservation* 11: 49-58.
- Belanger, L.; Bedard, J. 1989. Responses of staging greater snow geese to human disturbance. *Journal of Wildlife Management* 53: 713-719.
- Boyle, S.A.; Samson, FB. 1983. Nonconsumptive outdoor recreation: an annotated bibliography of human-wildlife interactions. USDI *Fish and Wildlife Service Scientific Report - Wildlife No. 252*.
- Boyle, S.A.; Samson, F.B. 1985. Effects of nonconsumptive recreation on wildlife: a review. *Wildlife Society Bulletin* 13: 110-116.
- Burger, J; Gochfeld, M.; Niles, L.J. 1995. Ecotourism and birds in coastal New Jersey: contrasting responses of birds, tourists and managers. *Environmental Conservation* 22(1): 56-65.
- Cater, E.; Lowmen, G. 1994. Ecotourism: a sustainable option? John Wiley, London.
- Cessford, G. 1995. Conservation benefits of public visits to protected islands. *Science and Research Series No 95*, Department of Conservation, Wellington.
- Cessford, G. 1997. Impacts of visitors on natural and historic resources of conservation significance, Part 2. *Science & Research Internal Report No. 157*, Department of Conservation, Wellington.
- Cessford, G. R.; Dingwall, P. R. 1994. Tourism on New Zealand's Sub-Antarctic islands. *Annals of Tourism Research* 21(2): 318-332.
- Cessford, G.R. ; Dingwall, P. R. 1997. Impacts of visitors on natural and historic resources of conservation significance, Part 1. *Science & Research Internal Report No. 156* Department of Conservation, Wellington.
- Coccosis, H.; Nijkamp, P. eds. 1995. *Sustainable tourism development*. Avebury, UK.
- Collier, K. 1993. A bibliography of some New Zealand riparian literature. *Science & Research Internal Report No 139*, Department of Conservation, Wellington.
- Croall, J. 1995. *Preserve or destroy: tourism and the environment*. Calouste Gulbenkian Foundation, London.
- Cromarty, P; SCOK, D. A, eds. 1996. *A directory of wetlands in New Zealand*. Department of Conservation, Wellington.
- Dahlgren, R.B.; Korschen, C.E. 1992. Human disturbances of waterfowl: an annotated bibliography. USDI *Fish and Wildlife Service Resource Publication No. 188*.
- Datta, T.; Pal, B.C. 1993. The effect of human interference on the nesting of the Openbill Stork (*Anastomus oscitans*) at the Raiganj Wildlife Sanctuary, India. *Biological Conservation* 64: 149-154.
- Davis, WE.; Parsons, K.C. 1991. Effects of investigator disturbance on the survival of snowy egret nestlings *Journal of Field Ornithology* 62: 432-435.
- Department of Conservation. 1993x. Black stilt recovery plan. *Threatened Species Recovery Plan Series No. 5*. Department of Conservation, Wellington.
- Department of Conservation. 1993b. Subantarctic teal recovery plan. *Threatened Species Recovery Plan Series No. 7*. Department of Conservation, Wellington.
- Department of Conservation. 1993c. New Zealand clatterel recovery plan. *Threatened Species Recovery Plan Series No. 10*. Department of Conservation, Wellington.

- Department of Conservation. 1994. Takahe recovery plan. *Threatened Species Recovery Plan Series No. 12* Department of Conservation, Wellington.
- Department of Conservation. 1996. Brown teal recovery plan. *Threatened Species Recovery Plan Series No. 19*. Department of Conservation, Wellington.
- Department of Conservation. 1997a. Blue duck (whio), *Hymenolaimus malacorhynchos* recovery plan 1997-2007. *Threatened Species Recovery Plan Series No. 22*. Department of Conservation, Wellington.
- Department of Conservation. 1997b. Subantarctic Island Heritage. Nomination of the New Zealand Subantarctic Islands by the Government of New Zealand for inclusion in the World Heritage List. Department of Conservation, Wellington.
- Department of Conservation. 1998. Restoring the dawn chorus: Department of Conservation Strategic Business Plan 1998-2002. Department of Conservation, Wellington.
- Devlin, P.J.; Corbett, R.A.; Peebles, C.J. eds. 1995. *Outdoor recreation in New Zealand*. Vols 1 & 2. Department of Conservation/Lincoln University.
- Ducks Unlimited (NZ) Inc; Sinclair, H. 1984. Sinclair Wetlands - a discussion document Report prepared for QEII National Trust.
- Duffus, D.A.; Dearden, P. 1990. Non-consumptive wildlife-oriented recreation: a conceptual framework. *Biological Conservation* 53: 213-231.
- Dunlop, J.N. 1996. Habituation to human disturbance by breeding bridled terns *Sterna anaethetus*. *Corella* 20(1): 13-16.
- Ellison, L.N.; Cleary, I. 1978. Effects of human disturbance on breeding of double-crested cormorants. *Auk* 95: 510-517.
- Fladmark, J.M. ed. 1994. Cultural tourism: papers presented at the Robert Gordon University Heritage Convention 1994. Donhead Publishing, London.
- Geden, B.L.; Ryan, P.S. 1995. Summary of responses on Maori customary use of native birds, plants and other traditional materials. New Zealand Conservation Authority Wellington.
- Ghazali, A.W; Rahtnan, A.A.A.; Muda, A.H. Impact of tourism on the environment. *Options (Serdang)* 9(2):8-10.
- Giannecchini, J. 1993. Ecotourism: new partners, new relationships. *Conservation Biology* 7: 429-432.
- Glinsky, R. 1976. Birdwatching etiquette: the need for a developing philosophy. *American Birds* 30: 655-657.
- Goodwin, H. 1995. Tourism and the environment, *Biologist* 42(3J): 129-133.
- Gosler, A.G., Kettward, R.E.; Horton, N. 1995. The effect of gull roost deterrence on roost occupancy, daily gull movements and wintering wildfowl. *Bird Study* 42:
- Gotmark, F.; Ahlund, M. 1984. Do field observers attract nest predators and influence nesting success of common eiders? *Journal of Wildlife Management* 48(2J): 381-
- Green, A.); Fox, A.D.; Hilton, G.; Hughes, B.; Yazar, M.; Salathe, T. 1996. Threats to Burdur Lake ecosystem, Turkey, and its waterbirds, particularly the white-headed duck *Oxyura leucocephala*. *Biological Conservation* 76: 241-252.
- Guthrie-Smith, H. 1927. *Birds of the water, wood and waste*. Whitcombe and Tombs.
- Hand, J.L. 1980. Human disturbance in western gull *Larus occidentalis livens* colonies and possible amplification by intraspecific predation. *Biological Conservation* 18:59-63.
- Havera, S.P.; Bocns, L.R.; Georgi, M.M.; Shealy, R.T. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. *Wildlife Society Bulletin* 20: 290-298.
- Heather, B.; Robertson, I.F. 1996. *Field guide: to the birds of New Zealand*. Viking, Auckland.
- Henson, P; Grant, T.A. 1991. The effects of human disturbance on trumpeter swan breeding behaviour. *Wildlife Society Bulletin* 19:248-257.

- Higgins, P; Davies, S. eds. 1996. *Handbook of Australian, New Zealand and Antarctic birds*. Vol. 3. Oxford University Press, Melbourne, Australia.
- Holmes, J. 1993. Loving nature to death. *NZ Science Monthly* April 1993: 6-8.
- Howard-Williams, C.; Davies, J. 1988. The invasion of Lake Taupo by the submerged water weed *Lagarosiphon* major and its impact on the native flora. *New Zealand Journal of Ecology* 11: 13- 19.
- Hughey, K.F.D.; Smith, L.A.; Preston, D.C. 1986. Birds of the Lower Clutha River: their distribution and habitat use. *NZ Wildlife Service Occasional Publication No. 11*. New Zealand Wildlife Service, Wellington.
- Hunt, G.L. 1972. Influence of food distribution and human disturbance on the reproductive success of herring gulls. *Ecology* 53: 1051-1061.
- Hunter, C.J. 1995. On the need to re-conceptualise sustainable development. *Journal of Sustainable Tourism* 3(3): 155-165.
- Hunter, C.; Green, H. 1995. *Tourism and the environment: a sustainable relationship?* Routledge, UK.
- Johnstone, I.M.; Coffey, B.T.; Howard-Williams, C. 1985. The role of recreational boat traffic in interlake dispersal of macrophytes: a New Zealand case study. *Journal of Environmental Management* 20. 263-279.
- Jolly, V.H., Brown, J.M.A eds. 1975. *New Zealand Lakes*. Auckland University Press.
- Kazmierow, B.J. 1996. Ecological and human dimensions of tourism-related wildlife disturbance at the Wailangirotto White Heron (Kotuku) colony, Westland, New Zealand. Unpublished Master of Parks, Recreation and Tourism Management thesis, Lincoln University.
- Keller, V. 1989. Variations in the response of great crested grebes (*Podiceps cristatus*) to human disturbance - a sign of adaptation? *Biological Conservation* 49: 31-45.
- Keller, V 1996. Effects and management of disturbance of waterbirds by human recreational activities: a review. *Game and Wildlife* 13: 1039-1047.
- Klein, M.L.; Humphrey, S.R.; Percival, H.F 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. *Conservation biology* 9(6): 1454-1465.
- Knight, R.L.; Gutzwiller, K.J eds. 1995. *Wildlife and recreationists: coexistence through management and research*. Island Press, Washington DC, USA.
- Korschgen, C.E.; George, L.S.; Green, W.L. 1985. Disturbance of diving ducks by boaters on a migrational staging area. *Wildlife Society Bulletin* 13: 290-296.
- Kury, C.R.; Gochfeld, M. 1975. Human interference and gull predation in cormorant colonies. *Biological Conservation* 8:23-34.
- Kuss, E.R.; Graefe, A.R.; Vaske, J.J. 1990. *Visitor Impact Management*. National Parks and Conservation Association, Washington, D.C., USA.
- Liddle, M.J. 1997. *Recreation ecology: the ecological impact of outdoor recreation and ecotourism*. Chapman & Hall, London.
- Liddle, M.J.; Scorgie, H.R.A 1980. The effects of recreation on freshwater plants and animals: a review. *Biological Conservation* 17.: 183-206.
- Lord, A.; Waas, J.R.; Innes, J. 1997. Effects of human activity on the New Zealand dotterel *Charadrius aquilonius* chicks. *Biological Conservation* 82(1): 15-20.
- Madsen, J. 1995 Impacts of disturbance on migratory waterfowl. *Ibis* 137 (Supplement 1): 67-74.
- Manning, E.W. 1996. Carrying capacity and environmental indicators. what tourism managers need to know. *WTO (World Tourism Organisation) News* 2:9-12.
- Marchant, S.; Higgins, P. eds. 1990,1993. *Handbook of Australian, New Zealand and Antarctic birds*. Vols. 1&2. Oxford University Press, Melbourne, Australia.
- Marion, J.L. 1995. Capabilities and management utility of recreation impact monitoring programs. *Environmental Management* 19(5): 763-771.



- Matthews, G.V T ed. 1990. Managing waterfowl populations. *International Waterfowl Research Bureau Special Publication No. 12*.
- Molloy, J; Davis, A. 1994. *Setting priorities for the conservation of New Zealand's threatened plants and animals*. Department of Conservation, Wellington.
- Molloy, L. F ed. 1983. *Wilderness recreation in New Zealand*. Proceedings of the FMC 50th jubilee Conference on Wilderness. Federated Mountain Clubs of NZ (Inc).
- Molloy, L.F. et al. eds. 1980. Land alone endures: land use and the role of research. NZ *DSIR Discussion Paper No. 3*.
- Montgomery, P.J. 1991. The effects of water-based recreational disturbance on waterbirds at Lake Rotoiti, Rotorua. *Technical Report Series No. 14*, Department of Conservation, Wellington.
- Moore, P.J.; Ogle, C.C.; Moynihan, K.T. 1984. Habitat requirements of wetland birds in the Lake Wairarapa wetlands. *NZ Wildlife Service Occasional Publication No. 5* New Zealand Wildlife Service, Wellington.
- Muir, E; Chester, G. 1993. Managing tourism to a seabird nesting island. *Tourism Management* 14(2):99-105.
- Navrud, S.; Mutungatana, E. D. 1994. Environmental valuation in developing countries: the recreational value of wildlife viewing. *Ecological Economics (Amsterdam)* 11(2): 135-151.
- Norton, D.A. 1989. Environmental impact report on Mingha/Deception section of Coast-to-Coast endurance event. Report prepared for Robin Judkins, Christchurch.
- New Zealand Conservation Authority. 1994. Discussion paper: Maori customary use of native birds, plants and other traditional materials. New Zealand Conservation Authority, Wellington.
- O'Donnell, C.J.E; Moore, S.M. 1983. The wildlife and conservation of braided river systems in Canterbury. *Fauna Survey Unit Report No. 33*, New Zealand Wildlife Service, Wellington.
- Owen, K.L. 1996. Case for greater protection for the Australasian harrier. *Technical Report Series No. 25*, Department of Conservation, Wellington.
- Owens, N.W. 1977. Responses of wintering brent geese to human disturbance. *Wildfowl* 28: 5-14.
- Pain, D.J. 1990. Lead poisoning in birds: an international perspective. *In: Acta XX Congressus Internationalis Ornithologici Vol IV*, 2343-2352.
- Pascoe, J. ed. 1957. *Mr Explorer Douglas*. A.H. and A.W. Reed, Wellington.
- Pierce, R.J. 1996. Ecology and management of the black stilt *Himantopus novaehelandiae*. *Bird Conservation International* 6: 81 -88.
- Platteeuw, M.; Henkens, RJ H.G. 1997a. Waterbirds and aquatic recreation at Lake Ijsselmeer, The Netherlands: the potential for conflict. *Wildfowl* 48. 210-224.
- Platteeuw, M.; Henkens, RJ H.G. 1997b. Possible impacts of disturbance to waterbirds: individuals, carrying capacity and populations. *Wildfowl* 48: 225-236.
- Pomerantz, G.A., Decker, D.J.; Goff, G. R.; Purdy, K.G. 1988. Assessing impact of recreation on wildlife: a classification system. *Wildlife Society Bulletin* 16. 58-62.
- Price, M.E; Smith, VL eds. 1996. *People and tourism in fragile environments*. John Wiley,
- Priestly, G.K.; Edwards, J.A.; Coccois, H. eds. 1996. *Sustainable tourism? European experiences*. CAB International, UK.
- Ream, C.H. 1980. Impact of backcountry recreationists on wildlife: an annotated bibliography. *USDA Forest Service General Technical Report INT-84*.
- Rebergen, A.; Keedwell, R.; Moller, H.; Maloney, R. 1998. Breeding success and predation at nests of banded dotterel (*C. baradrius bicinctus*) on braided riverbeds in the Central South Island, New Zealand. *New Zealand journal of Ecology* 22(1):

- Reijnen, R.; Foppen, R.; Meeuwsen, H. 1996. The effects of traffic on the density of breeding birds in Dutch agricultural grasslands. *Biological Conservation* 75: 255-260.
- Rich J W. 1991. Management strategies for the riparian zones of the Manganuiateao River. Unpublished M.Appl.Sci. thesis, Lincoln University.
- Riddington, R.; Hassall, M.; Lane, S.J.; Turner, P.A. 1996. The impact of disturbance on the behaviour and energy budgets of brent geese *Branta b. bernicla*. *Bird Study*
- Robertson, C.J.R. 1993. Effects of nature tourism on marine wildlife. Proceedings, Marine Conservation & Wildlife Protection Conference 1992:53-60, NZ Conservation Authority, Wellington.
- Robertson, C.J.R.; Law, E.; de Hamel, R.J.B.; Courtney, S.P. 1984. Habitat requirements of wetland birds in the Lower Waitaki River catchment, New Zealand. *NZ Wildlife Service Occasional Publication No. 6*, New Zealand Wildlife Service, Wellington.
- Robertson, C.J.R.; O'Donnell, C.J.F.; Overmars, F.B. 1983. Habitat requirements of wetland birds in the Ahuriri River catchment, New Zealand. *NZ Wildlife Service Occasional Publication No. 3*, New Zealand Wildlife Service, Wellington.
- Rodgers, J.A.; Smith, H.T. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. *Wildlife Society Bulletin* 25 (1):
- Safina, C.; Burger, J. 1983. Effects of human disturbance on reproductive success in the black skimmer. *Condor* 85: 164-171.
- Sagar, P.M.; Schwarz, A.M.; Howard-Williams, C. 1995. Review of the ecological role of Black Swan (*Cygnus atratus*). *NIWA Science and Technology Series* 25.
- Sage, E. 1995. Beyond the picture postcard: what tourism means for conservation. *Forest and Bird* No 275: 20-30.
- Sanders, M.D. 1997. Food supplies at black stilt nest sites. *Science for Conservation* 58 Department of Conservation, Wellington.
- Sanson, L. 1994. An ecotourism case study in Sub-Antarctic islands. *Annals of Tourism Research* 21(2): 344-354.
- Scott, D.A. ed. 1982. *Managing wetlands and their birds: a manual of wetland and waterfowl management*. International Waterfowl Research Bureau, Slimbridge, England.
- Seaton, A.V. ed. 1994. *Tourism: the state of the art*. John Wiley, UK.
- Sem, J.; Clements, C.J.; Blootquist, P. 1996. Tourism and recreational management: strategies for public lands. *Parks and Recreation*, 31(9). 92-104.
- Smith, C.M. 1993. Perceived riverine problems in New Zealand, impediments to environmentally sound riparian zone management, and the information needs of managers. *Water Quality Centre Publication* 24, NIWA, Hamilton.
- Smith, D.; Hughey, K.; Booth, K. 1997. Impacts of recreational users on the wildlife of braided rivers - a preliminary study on the Tekapo River. Department of Resource Management, Lincoln University.
- Smith, K. 1994. To harvest or not to harvest? *Forest and Bird* 274: 28-34.
- Stephenson, G. 1986. Wetlands: discovering New Zealand's shy places. Government Printing Office Publishing, Wellington.
- Stokes, T. 1996. Helicopter effects upon white-bellied sea eagles and upon smaller birds at an isolated protected location (Eshelby Island, Great Barrier Reef, Australia). *Corella* 20(1): 25-28.
- Stokes, T.; Hulsman, K.; Ogilvie, P.; O'Neill, P. 1996. Management of human visitation to seabird islands of the Great Barrier Reef Marine Park region. *Corella* 20(1): 1-13.
- Strang, C.A. 1980. Incidence of avian predators near people searching for waterfowl nests. *Journal of Wildlife Management* 44: 220-222.
- Streiffert, K.G. 1998. Birding and ecotourism. *Living Bird* 17(1): 28.

- Titus J R.; Van Druff, L.W. 1981. Response of the common loon to recreational pressure in the Boundary Waters Canoe Area, Northeastern Minnesota. *Wildlife Monographs No 79*: 5-59.
- Tremblay, J.; Ellison, L. N. 1979. Effects of human disturbance on breeding of black-crowned night herons. *Auk 96*: 364-369.
- Tuite, C.H.; Owen, M.; Paynter, D. 1983. Interaction between wildfowl and recreation at Llangorse lake and Talybont Reservoir, South Wales. *Wildfowl 34*: 48-63.
- Vaske, J J; Graefe, A.R.; Kuss, ER. 1983. Recreation impacts: a synthesis of ecological and social research. *Transactions of the 48th North American Wildlife and Natural Resources Conference 1983*.
- Veitch, D. 1992. Ecotourism and threatened species. Proceedings of the Conference Ecotourism Business in the Pacific: 134-140.
- Vial, C. 1995. The effect of boat disturbance on the distribution and breeding success of African skimmers (*Rhynchops flavirostris*) in the Okavango Delta, Botswana. *University of Otago Wildlife Management Report No. 76*.
- Walker, S. L. 1997. Perceived impacts of ecotourism development. *Annals of Tourism Research 24(3)*: 7 i3.
- Walls, G.Y. 1994. The New Zealand hydrilla problem: a review of the issues and management options. *Conservation Advisory Science Notes No. 71*, Department of Conservation, Wellington.
- Walls, G.Y. 1997. Where water meets land: the ecological values of driftwood. *Conservation Advisory Science Notes No. 165*, Department of Conservation, Wellington.
- Wang, C.-Y.; Miko, P.S. 1997. Environmental impacts of tourism on U.S. national parks. *Journal of Travel Research*, Spring 1997: 31-36.
- Ward J C. and Beanland, R.A. 1996. Biophysical impacts of tourism. *Information Paper No. 56*. Lincoln University.
- Ward, J.C.; Stewart, I.D. 1989. An approach to lake management: ecology, values and conflicts at Lake Alexandrina. Unpublished report, Centre for Resource Management, Lincoln College, Canterbury.
- Warren, J.A.; Taylor, C.: N. 1994. Whales, penguins, kauri and glowworms: the potential of ecotourism for sustainable resource development in New Zealand. NZ Institute for Social Research and Development Ltd, Wellington.
- Washburne, R.F. 1982. Wilderness recreational carrying capacity: are numbers necessary? *Journal of Forestry* November 1982: 726-728.
- Weeden, R. 1976. Nonconsumptive users: a myth. *Alaska Conservation Review 27(9)*: 3-15,
- Wright, M. 1998. Ecotourism on Otago Peninsula: preliminary studies of yellow-eyed penguin (*Megadyptes antipodes*) and Hooker's sea lion (*Phocarctos hookeri*). *Science for Conservation 68*. Department of Conservation, Wellington.
- York, D 1994. Recreational-boating disturbances of natural communities and wildlife: an annotated bibliography. USDI *National Biological Survey Biological Report 22*.

## APPENDIX 1 : CASE STUDIES IN NEW ZEALAND

The following is a brief description of four case studies in New Zealand of special wetland areas where visitor activities are an issue for waterbird conservation.

### **Tongariro Delta ecotourism**

This case is the one that triggered this whole review. The Tongariro Delta is a large diverse wetland system where the Tongariro River enters southern Lake Taupo. It has a labyrinth of waterways navigable by small boat and a complex mosaic of wetland vegetation. The wetland supports about 30 species of waterbirds, including Australasian bittern, banded rail, marsh crake, spotless crake, North Island fernbird, NZ dabchick, brown teal and NZ scaup. Many waterfowl, gulls, terns, shags, stilts and oystercatchers rely on the delta for breeding, feeding, moulting, loafing and refuge.

The delta is also a prime site for human visitors. They include fishers, boaters, hunters, walkers, picnickers, nature watchers, researchers, conservation managers, outdoor educators and their pupils, and ecotourists. Recognising that, though still in its infancy, ecotourism in the delta was set to increase, the Department of Conservation in Turangi, principal custodians of the wetlands, signalled the need for research on the likely impacts on avifauna.

Having briefly looked at the delta, its wetland birds and a local ecotour operation, I can assert that ecotourism has the potential to be quite damaging, but if sensitively managed should cause minimal disturbance to the avifauna. The operation, if done well as a partnership with the Department, could have real conservation benefits, too. The following are some suggested guidelines.

1. Strict operational guidelines be negotiated and laid down for the ecotourism concession at the outset.
2. Training in wetland ecology, bird biology and behaviour and human impacts be given by the Department of Conservation to the ecotour operators.
3. Regular inspections of the operation be made by qualified Department of Conservation staff.
4. Boat approaches be slow and quiet, and avoid bird retreat and takeoff avenues.
5. Land approaches be on defined routes and boardwalks, with designated viewing places.
6. Breeding times and moulting times for birds be strongly respected, and if necessary avoided for tours.
7. Times of clay and periods of stress and hardship for birds be avoided, such as during morning and late afternoon feeding, evening roosting, mating, winter cold and summer drought.

8. Near-approach thresholds for triggering flight or diving be experimentally determined for sensitive birds, and ecotour guidelines be imposed accordingly. The ecotour minimum approach distances should be 50-100% greater than the experimental thresholds.
9. Ecotour operators ensure their clients are calm and restrained during bird encounters and when in areas where sensitive birds might be.
10. Educational material along these lines be compiled, displayed and disseminated, including being offered to other types of visitors to the delta.
11. The Department of Conservation and the ecotour operators deliberately strive to set up the operation as a model for other such visitor experiences elsewhere.

### **Project River Recovery, Canterbury**

Project River Recovery is sited in the upper Waitaki River catchment. It is a DOC programme that is funded by ECNZ under a compensatory funding agreement to mitigate the negative impacts of hydro power development.

The upper Waitaki River catchment is large and diverse, comprising several large braided river systems, large glacial lakes, smaller lakes, kettleholes, swamps and a series of artificial waterways associated with the hydro-power development. It is home to numerous wetland birds, notably black stilt, wrybill, crested grebe, black-fronted tern and large populations of ducks, shelducks, geese, swans and gulls, all of which breed there. Robertson et al. (1984), Pierce (1996), Smith et al. (1997), Sanders (1997) and Rebergen et al. (1998) provide insights into the wetlands, birds and visitor issues of the system.

The rivers and lakes attract large numbers of visitors for fishing, hunting, tramping, sightseeing, water sports, off-road vehicle pursuits, picnicking and tourism. Many of these activities impact seriously on the birds, especially during breeding. There are weed and animal pest problems. In the 1980s, the NZ Wildlife Service recognised the conflicts of use and the impacts on the birds, and worked hard to gain recognition for the indigenous biodiversity of the area. This was backed up and extended by the Department of Conservation, with support from various conservation and user groups. The result was Project River Recovery, which began in 1990. The project was designed to conserve and enhance the natural habitats of the catchment.

Project River Recovery has achieved considerable protection and enhancement of the wetlands of the area, through weed control, predator control, planting, fencing and mechanical means. However, there are still many instances of negative impacts on the wetland birds by visitors intent on their chosen activities.

Visitor impacts on the braided rivers of the Upper Waitaki basin are localised, with most visitor use occurring on the Ohau/Tekapo delta. Project River Recovery supported preliminary research on visitor impacts (Smith et al. 1997) and used the results as the basis for an extensive public awareness campaign over the 1998/99 bird-breeding season. The campaign included the employ-

ment of a summer staff person to survey and transfer information to visitors, mail out of Braided River Care Codes to all local fishing licence outlets, newspaper releases, an article in a national fishing magazine, radio advertisements, marking of access tracks, and signage. Most visitors were ignorant of their impacts but supportive of suggested codes of behaviour. The benefits of such an approach are hard to quantify but Project River Recovery intends to continue monitoring visitor behaviour and trial methods of linking visitor impacts to bird breeding success over the 1999/2000 breeding season.

### **Sinclair Wetlands, Otago**

Sinclair Wetlands is a 315 ha lowland waterfowl park, south of Dunedin near the mouth of the Taieri River. It owes its existence to Horrie Sinclair, who bought the wetland area to protect it, then gifted it to Ducks Unlimited New Zealand Inc. (Ducks Unlimited & Sinclair 1984). It is protected in perpetuity under a QEII National Trust Open Space Covenant. It is run as a public facility and education centre.

The wetland comprises numerous shallow peaty lagoons, a maze of waterways and two islands, well vegetated in sedges, raupo, harakeke and various shrubs. Ducks, shelducks, geese and swans dominate the avifauna, but also resident are Australasian bittern, marsh crake and NZ scaup. There is a permanently-staffed visitor centre and a series of walkways and observation points. Guided tours are arranged for tour parties, clubs and school visits.

This is a model wetland conservation site, to my mind. The area is legally secure, visitors are welcomed but well controlled, and threats are kept under good control. There is a full education programme, including lectures, guidance, brochures, signs and an excellent video.

### **Waitangiroto kotuku colony, South Westland**

This has already been referred to in the Key References section of the report (Kazmierow 1996). It is one of several sites for bird-watching pilgrims in New Zealand, but the only one I am aware of that focuses on a single species of waterbird. The only breeding colony of the kotuku, revered in this country, is protected within a nature reserve. It is the subject of an ecotourism concession specifically to view the birds.

Kazmierow (1996) studied the impact of the ecotourism operation on the kotuku at the colony. He found that there was sufficient disruption (primarily boating traffic) to warrant concern, and recommended ways of minimising the impact (fewer boat trips, better timed to avoid key periods of bird feeding; alternative land approaches to the colony).

This is a test case for New Zealand. It indicates that ecotourism must be sensitive to the natural system it relies on, and responsive to suggestions for better management. Otherwise it will simply not be sustainable, and will do more harm than good. In this instance the ecotour operators appear to be strongly concerned for the well-being of the kotuku and willing to adapt their operation to lessen its impact.

## APPENDIX 2: DEPARTMENT OF CONSERVATION CONSERVANCY SUMMARIES

The following are brief summaries of the country's wetlands and waterbird issues, by Department of Conservation conservancy. It is based on Cromarty & Scott (1996), and supplemented by information from interviews and other literature sources.

### **Northland Conservancy**

This conservancy contains many wetlands, mostly relatively small in scale. They include distinctive dune lake systems. The Aupouri Peninsula wetlands support a big range of indigenous waterbirds, including threatened species. Visitor activities there include gamebird hunting, water-skiing, canoeing, picnicking. The Muriwhenua wetlands have some protected area designation and support various waterbirds. There is some illegal hunting of waterbirds. Other activities include traditional harvesting, fishing, camping and picnicking. The Pouto Peninsula wetlands contain several threatened waterbird species and some legally protected areas. Activities include fishing, bird-watching, duck hunting and 4WD tourist operations.

Overall, there appear to be few serious conflicts between visitor activities and wetland conservation at present. What issues exist are overshadowed by those concerning estuarine conservation.

### **Auckland Conservancy**

This conservancy also contains many wetlands, mostly relatively small in scale, with few current conflicts. The Whangapoua wetlands are protected for conservation, have various threatened waterbird species and little human disturbance. Kaitoke Swamp on Great Barrier Island is highly significant for waterbirds, containing brown teal, Australasian bittern, banded rail, crakes and North Island fernbird. It is only partly protected for conservation, and visitor activities (walking, picnicking, bird-watching, etc.) cause some disturbance to the birds.

### **Waikato Conservancy**

Waikato Conservancy contains a wide variety of wetland systems, including the lower Waikato River, peatlands, lakes and swamps. Current conflicts between visitor use and conservation revolve around shooting and disturbance of protected waterbirds by duck hunters, and disturbance by recreational boating and off-road vehicles. Visitor management at wetlands is perceived as an important issue by the Department of Conservation in some areas but not in others.

On the Lower Waikato River, there is some Crown protection and a range of enforced regulations for fishing and hunting. Off-road vehicles and boats disturb breeding waterbirds. The Whangamarino wetland is mostly a well-managed conservation area. There is a range of potentially disruptive visitor activities, but these are managed for minimal impact. The Waikato lowland lakes

and mineralised swamp lands, the Kopuatai Peat Dome, and the Waipa Peat Lakes have been significantly depleted and disrupted by human activities. What remain are largely protected and visitor activities are controlled. The Taharoa Lakes have no formal protection, various threatened and common waterbirds and a wide range of visitor activities. Management is a partnership between tangata whenua and various agencies (including the Department of Conservation).

### **Bay of Plenty Conservancy**

There are two big wetland complexes: the Kaituna Catchment lakes and wetlands that include Lake Rotorua, and the Upper Tarawera Catchment lakes. Both abound with waterfowl and other waterbirds, including threatened species. They attract numerous visitors for a wealth of activities including hunting, fishing, boating, aerial activities and various forms of tourism. The visitors and their activities are managed to varying degrees through protective area designation, permits, licences, bag limits, and concessions. Management is by tangata whenua and various agencies (including the Department of Conservation). There are several education programmes. Regular counts of waterbirds are done.

### **Tongariro/Taupo Conservancy**

This conservancy encompasses Lake Taupo, a mecca for tourists, trout anglers and boaters, and the big rivers that flow into and drain the lake. The issues relating to visitor activities and wetland conservation at the Tongariro Delta have been covered in Appendix 1. They also apply to varying degrees to other parts of the big wetland complex. Management is by the Department of Conservation, the Fish and Game Council and the Taupo District Council, in collaboration with tangata whenua. There are several interpretative facilities and education programmes.

### **East Coast/Hawke's Bay Conservancy**

There is the big upland Lake Waikaremoana and its magical satellite Lake Waikareiti, drawcards for many visitors and managed within Te Urewera National Park. There are many significant lowland lakes, lagoons, swamps and ponds, some partly protected but all managed primarily for hunting and fishing. Tangata whenua perspectives relating to them are rarely officially recognised or accommodated, and threatened waterbirds are passively managed through periodic monitoring. The conservancy has the frightening waterweed *Hydrilla verticillata*, currently confined to four lakes in Hawke's Bay (Walls 1994). Unless controlled to low levels, this weed will inevitably escape to threaten wetlands nationwide.

There are also large river systems flowing from the axial ranges to the sea. Some have substantial braided riverbeds. At their heads they are a stronghold for whio, which are under study in the Ruahine Range. The biggest rivers are becoming very popular for gung-ho outdoor pursuits, with little monitoring of impacts or guidance from conservation agencies.



## **Wanganui Conservancy**

This conservancy has some upland mires, swamps and tarns, not known to have waterbirds. It also has a couple of lagoons (Hawkens and Pukepuke) that have a wide range of waterbirds (including threatened species) and are highly popular for hunting and fishing. They are protected areas carefully managed to balance these pursuits and conservation. The Department of Conservation has recently recommended the use of non-motorised boats for commercial eeling, and has invoked wildlife refuge regulations to prevent recreational boating in one site. It also recognises that the continued use of lead shot is a problem, as is the transfer of water weeds on boats. There are interpretative facilities and education programmes.

Lake Koputara, a small dune lake, is protected under a QEII National Trust Open Space Covenant.

## **Wellington Conservancy**

The great ever-changing mass of Lake Wairarapa lies in this conservancy. It has been much studied (e.g. Moore et al. 1984) and is managed for conservation, commercial fishing and recreation. Where conflicts between these occur, they are usually sorted out collaboratively.

There are various coastal lagoons and lowland wetlands, including Taupo Swamp, managed for conservation and controlled visitation by QEII National Trust and the Department of Conservation. Kapiti and Mana Islands have small wetlands, protected by the reserve status of the islands. The Chatham Islands have a range of distinctive wetlands not well managed for conservation.

## **Nelson/Marlborough Conservancy**

Arguably the most diverse of the conservancies, Nelson/Marlborough has wetlands from the coast to the tops and from wet Northwest Nelson to dry Marlborough. They include two big lakes (Rotoiti and Rotoroa), protected within a national park, and smaller lakes, tarns, swamps, lagoons, estuary heads and river systems. Most contain a wealth of waterbirds; many contain threatened species. So far there appear to be few conflicts between visitors and conservation. This may partly reflect the degree of control and vigilance over the key areas by the Department of Conservation.

## **West Coast Conservancy**

As a huge strip of the wet western coast of the South Island, this conservancy would be expected to contain many wetlands. It does: a sparkling array of lakes, swamps, lagoons and rivers along its entire length, including some of the least-modified wetlands in the country. They abound with birdlife, including many threatened species. They also attract visitors for various pursuits such as fishing, hunting, boating and tourism, but not yet in high densities. Many of the wetlands have protective status. Hunting and fishing are governed by regulations. Ecotourism activities have concession guidelines. An example is the kotuku breeding colony ecotour operation in Waitangiroto

Nature Reserve (see Appendix 1). On the most popular lakes where there are several types of visitor activities, such as Lake Ianthe, there may be the potential for conflict. Probably the most important consideration for wetland conservation is the continuation or revival of wetland drainage, such as at Kongahu Swamp and the Barrytown flats.

### **Canterbury Conservancy**

This conservancy can claim to be the braided river epicentre of the country. It also has a great range of sizeable lakes carved out by former glaciers, associated mosaics of kettleholes, bogs, swamps and smaller lakes, numerous alpine tarns and some coastal lagoons, including Lakes Forsyth and Ellesmere. These are all highly significant for waterbirds. The braided rivers are the breeding grounds of species, such as the black stilt, that spend other times around the New Zealand coast.

The lakes, riverbeds and big lagoons are the playgrounds of many people pursuing many activities. The impacts of visitors in these areas are being investigated, documented, monitored, and managed for mitigation.

### **Otago Conservancy**

There are several lowland wetland systems. One such includes Lakes Waipori and Waihola and Sinclair Wetlands (described in Appendix 1). They have a very diverse avifauna, several species of which are rare. Visitors come for fishing, boating, gamebird hunting and picnicking. Sinclair Wetlands is a major tourist attraction for the area and has a comprehensive educational facility.

The Kawarau Catchment wetland complex, with its great lakes and wild rivers, is very significant for waterbirds. It also has a massive amount of adventure tourism, eventing, passive visitor pursuits, fishing, water sports and scenic flights. Jetboats cause disturbance to wildlife and increase water turbidity. Cromarty & Scott (1996) state that "Helicopter landings at one of the huts threaten the very sensitive environment, and may lead to distress amongst the bird communities in the immediate vicinity." There are educational activities, but as in Canterbury, visitor activities are neither adequately monitored nor controlled well enough to prevent significant impacts on the waterbirds and their habitats.

The Greenstone, Caples, Dart and Rees Rivers contain a special range of wetlands: braided flood channels, small lakes, cushion bogs, sphagnum bogs, swamps, toe-slope flushes and moraine wetlands. They too are significant for waterbirds. They attract many visitors seeking wilderness, game or sport. Their impacts on waterbirds are not well assessed or deliberately mitigated. Lake Hayes is another key waterbird site, also very popular with visitors.

### **Southland Conservancy**

Fiordland is the wettest part of New Zealand. It has many lakes and tarns, from the coast to the tops. It also has a range of other types of wetlands such

as bogs, swamps, flushes and rivers. Most of the wetlands and their birds are relatively secure beneath the national park blanket, but some sites are subject to increasing visitation. Takahe are intensively managed for protection.

In other mainland parts of the conservancy are wetlands such as the Awarua Plains wetland complex. Most of that is Crown land with reserve status, managed primarily for conservation. There is also limited use for education, fishing, hunting, walking, birdwatching, water sports and tourism.

Stewart Island has a large wetland system in its centre, home to many waterbirds and subject to low-impact tramping, hunting and ecotourism. It has the protective management of the Department of Conservation. Stewart Island, Whenua Hou (Codfish Island), The Snares and the Subantarctic Islands (the Auckland Islands and Campbell Island) are peculiar in containing populations of wetland birds not living in typical wetland situations. These include the southern subspecies of NZ dotterel, the Auckland Island subspecies of banded rail, three subspecies of fernbird, Subantarctic teal (two subspecies) and Auckland Island rail. None of these are yet subject to intense enough visitation to be disrupted, although the breeding of the NZ dotterel on Mt Anglem may be unacceptably disturbed. The Snares and Subantarctic Islands are regularly visited by researchers and ecotourists, but the conditions, guidelines and codes of behaviour laid down for their visits are strictly controlled by the Department of Conservation to minimise impact.