WILD FOODS

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ABSTRACT: New Zealanders harvest a wide range of species from the wild for food: mammals, birds, insects, plants and fungi that live on the land, and fish, invertebrates and plants from fresh and salt water. This chapter describes the contribution of wild foods as a provisioning service by discussing, from available data, the range and quantities of wild foods harvested (commercially and non-commercially). Commercial harvesting, especially of marine fish, is of significant economic value. Wild foods also provide a cultural service by fulfilling spiritual, recreational, educational and cultural needs. Harvesting relies on access to wild food species, and we provide examples where managing and maintaining access to wild foods is challenging. The effects of legislation, commercial harvesting, conservation activities and land use on wild foods as an ecosystem service are discussed. We conclude by proposing that decision-making regarding wild foods should take an ecosystem service perspective, which means understanding the multiple values wild foods have to people. There are examples where this is happening, but this area is rich in opportunity.

Key words: access, benefits, ecosystem service, fish, gather, harvest, hunt, quantity.

INTRODUCTION

Wild foods are both provisioning and cultural ecosystem services. They contribute to the food supply and are the end product from activities that provide recreational, aesthetic, educational and spiritual benefits (Baker et al. 2011). While harvesting of these foods is often for non-commercial purposes, some wild species stocks (e.g. seafood, deer) are harvested for trading or sale, and harvesting may also be part of commercial tourism ventures (e.g. fishing, hunting). Furthermore, the harvesting and sharing of wild foods has cultural and spiritual significance for some groups in New Zealand, Māori in particular. Traditional foods, their sources, and methods of food gathering (mahinga kai) remain important to Māori and are an integral part of manaakitanga (providing for others) and ahikāroa (maintaining access rights) (Dacker 1990; Turner et al. 2005). This chapter provides an overview of New Zealand wild foods from each of these perspectives, and also identifies where we need to learn more.

The spectrum of wild food species is broad, from the more obvious deer, pigs, shellfish and fish, to less well recognised plants and insects. The foods might be plants or animals that are indigenous to New Zealand, introduced, or transient species that make the New Zealand environment their home for only part of their life cycle. Appendix 1 lists the wide variety of wild foods named in this chapter by their common names, whether English or Māori, and provides their scientific names and some alternative Māori names.

In this chapter, as well as listing the range of wild foods available for harvesting in New Zealand, we quantify the commercial and non-commercial harvesting of these foods where possible. We briefly discuss wild food safety and then present case studies that illustrate some of the challenges in managing and maintaining access to wild foods. We conclude by considering whether viewing wild foods from the perspective of ecosystem services might enable the managers and users to find common ground to ensure this service can be accessed by all into the future. Information gaps that need to be addressed to achieve this are also noted.

MORE THAN FISH, PIGS AND DEER

Food from the land

Feral deer and pigs are the main mammals harvested for food in terms of animal numbers. Recreational hunters harvest these animals, sometimes with the aid of commercial operators who provide access and guide services for 'meat hunts' for non-trophy animals (Figure 1). There are seven deer species distributed throughout New Zealand, of which red deer are the most numerous and widespread. Other commonly-targeted species are

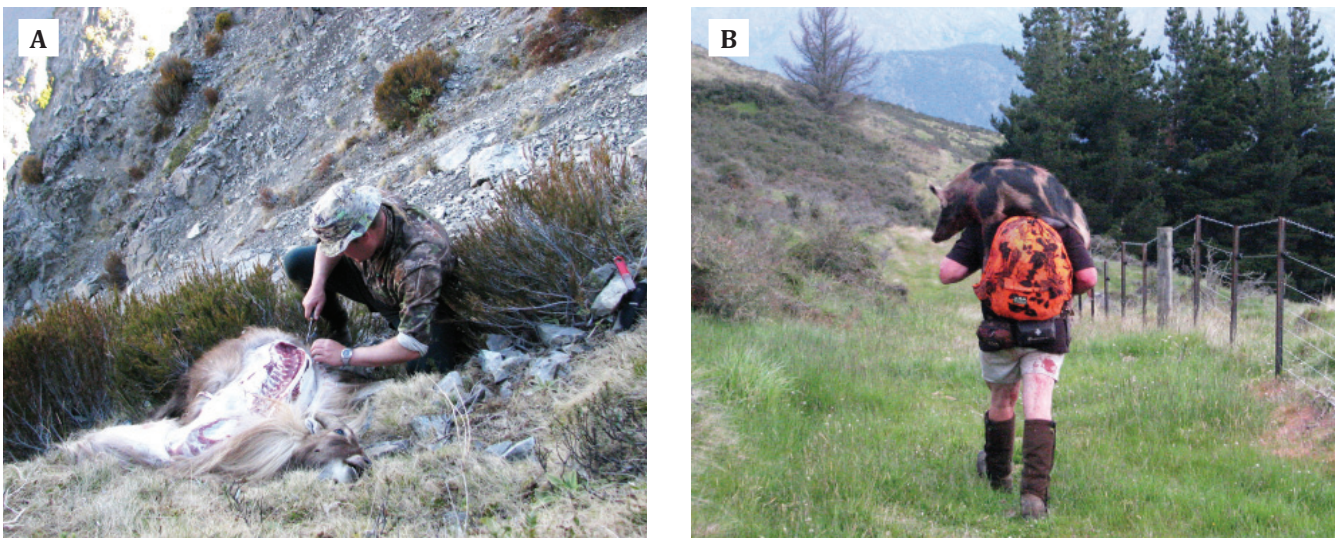

FIGURE 1 Butchering tahr in the Rangitata catchment (A) and carrying out a wild pig from the Canterbury foothills (B). Photographer: G. Kerr.

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feral goats, and, for those hunting in alpine and subalpine areas of the South Island, chamois and Himalayan tahr. Wallabies, rabbits, hares and brushtail possums are often hunted as part of pest control or for sport, but are also consumed as food. A tourism trade has been built around wallabies occupying the Waimate area of the South Island, where consuming a 'wallaby pie' is a notable activity for visitors.

Mallard ducks are the most popular and abundant birds harvested. Other birds harvested in lesser amounts are grey ducks, paradise shelducks, New Zealand shovelers ('spoonies'), black swans, Canada geese, ring-necked pheasants, quail (mostly California quail) and chukar. Feral geese, pukeko and peafowl can also be harvested for food, and buff weka are a targeted food species on the main Chatham Island. The harvesting of chicks of the sooty shearwater, called tītī or muttonbird, is undertaken by Māori who have manawhenua (territorial rights) over the breeding sites on the islands around Stewart Island (Rakiura), and such harvesting is a seasonal and traditional event. Similarly, iwi harvest small numbers of grey-faced petrel chicks (also called tītī, or oi) from islands off the Coromandel Peninsula (Lyver et al. 2008).

Insects and their products are not popular wild foods in New Zealand, but are worthy of mention. Of the insects, the huhu grub is probably the most well known, and is the larval form of New Zealand's largest beetle, the huhu beetle. Honey can also be harvested from hives built by wild populations of honey bees, which often occupy tree hollows, but spread of the bee parasite varroa mite (*Varroa destructor*) now means that populations of wild bees cannot survive unless they are replenished by swarms from nearby commercial hives where this mite is controlled (Donovan 1980; Goodwin and Van Eaton 2001).

There are many edible land plants growing wild in New Zealand, of which puha (sow thistle) is probably the most well known. The most popular eating variety of puha is the smooth-leaved rauriki. Other native and naturalised plants with edible parts include Indian spinach, cabbage tree, nikau palm, kiekie, supplejack, stinging nettle, poroporo, taro, bok choy, mamaku and a variety of ferns (e.g. bracken fern, pikopiko, para) and herbs (e.g. horopito/pepper tree) (Turner et al. 2005; Wehi and Wehi 2010).

The berries from wild-growing introduced (and now naturalised) plant species such as blackberry, gooseberry and raspberry are commonly available. A large number of berries from native trees and shrubs are also edible and were traditionally harvested by Māori as an important part of their diet. Shrubs producing edible berries include karapapa, karamu, poroporo and kawakawa. Berries can also be gathered from trees such as kahikatea, totara, matai, miro, tawa and taraire. The karaka produces orange berries with very poisonous kernels but the toxin (karakin) can be removed by boiling and rinsing the berries in several changes of water. People may also collect fruit from any number of plant species that are usually cultivated, but have grown in areas such as roadsides, e.g. pears, apples, plums and grapes.

The New Zealand environment also provides seeds and nuts for eating. Flax seed can be harvested from New Zealand flax or mountain flax, and is receiving growing attention from industry for inclusion in breads and other products. The variegated thistle produces a large edible seed at the base of the flower head. It is also common to find chestnut trees and walnut trees in New Zealand parks, where many people take advantage of the nut harvest.

There are many edible species of fungi in New Zealand. Probably the most well recognised are field mushrooms, which is a name commonly used for the horse, field and two-ringed mushrooms found in pastures, and the torn-edged mushroom usually found under pine trees. Other edible fungi include the shaggy parasol, ear fungus, porcini, shaggy ink cap and harore.

Food from the water

The marine and estuarine environments are sources of a huge variety of fish and invertebrates that are harvested commercially and non-commercially. Fish popular with recreational fishers include snapper, tarakihi, kahawai, yellow-eyed mullet, blue cod, red gurnard and flounder. Barracouta have been harvested in large numbers by Māori and are also now an important commercial species (Dacker 1990). Fishing for marine gamefish is a popular sporting activity and these fish are also consumed. Target species include kingfish, tuna, marlin (most commonly striped marlin) and sharks (e.g. mako, blue, school).

In addition to bivalve molluscs, 'shellfish' includes the popular foods paua and rock lobsters ('crayfish'). The most commonly harvested species of bivalve shellfish are mussels (mostly the green-lipped mussel), oysters (Pacific, rock and Bluff), pipi, cockles, scallops and tuatua. The recreational and commercial harvesting of toheroa is currently prohibited to allow the population to recover from overfishing. Other marine invertebrates harvested for food are kina (sea urchin), sea cucumber, plus a variety of crabs, sea snails and limpets.

For at least part of their life cycle, fresh water is the home of salmon (most commonly chinook/king salmon), brown trout, eels, black flounder and pouched lamprey. New Zealand populations of rainbow trout are landlocked and are popular with anglers (McDowall 2006). The annual whitebait season sees the harvesting of juvenile native *Galaxias* species (inanga, kōkopu and kōaro) as they return from the sea to the rivers and lakes to grow. Freshwater crayfish and freshwater mussels are also harvested. Freshwater fishers may also target koi carp, rudd, tench and perch, although not necessarily for eating (McDowall 2006).

Of the aquatic plants, watercress and seaweeds are valued foods, and the latter is also commercially valuable for the production of agar. Watercress is particularly common in the North Island and grows along the margins of slow-moving rivers, streams and other waterways. Most seaweeds are edible, but those particularly sought after are bull kelp, bladder kelp, rehia, karengo and sea lettuce. Wakame is a brown seaweed that was first recorded in New Zealand waters in the late 1980s and is now widespread along New Zealand's east coast (Hay and Luckens 1987). Although considered a pest, the seaweed is often used in Asian dishes, and commercial farming and harvesting are permitted under certain conditions (MAF 2010).

HOW MUCH ARE WE TAKING?

Land animals

Wild red deer are harvested by the commercial venison industry for both domestic and export consumption. For the years 2005–2011 the average annual harvest of wild deer was about 12 000 carcasses, with the fewest (2299) harvested in 2005 and most (21 444) in 2009 (G. Ottmann, Executive Director, Game and Forest Foundation of New Zealand, pers. comm.). People who hunt wild animals or animals from a game estate, and supply these animals to a primary processor where the meat is intended for sale or export, must be certified to undertake this activity (MPI 2012a). As of December 2012 there were 210 certified suppliers

(MPI 2012b).

A national survey of recreational hunters conducted by Lincoln University provides estimates of recreational harvests of big game animals (Kerr 2012). Hunters who completed the survey claimed average kills of 4.5 deer and 3.7 pigs for the year from June 2011 to May 2012. The total big-game-hunter population is unknown, but is estimated to be in the range of 30 000 to 50 000 hunters (Woods and Kerr 2010), indicative of annual harvests of over 100 000 deer and 100 000 pigs. These animals would have potentially yielded in the order of 2500 tonnes of venison and 2500 tonnes of pork.[1] While not all of these animals would have been eaten, it is likely that a large proportion were. The Lincoln University survey results indicate that 'meat' is the single most important motivation for hunting for 28% of big game hunters. Meat was not an important motivation for fewer than 9% of hunters.

Only a few thousand chamois and tahr are killed each year by recreational hunters, most commonly for trophy purposes rather than for meat. Recreational kills of wild goats are likely to be in the order of several hundred thousand animals per year. It is unknown what proportion of those animals is harvested for meat, but a very large number are likely to be shot for pest control purposes and not recovered.

There are no recent estimates for the number of wallabies, rabbits, hares or possums killed. The responses from 8639 licensed firearm owners participating in a postal survey in 1989 were used to estimate total annual kills of approximately 15 000 wallabies, 2.6 million rabbits, 380 000 hares, and 2.6 million possums (Nugent 1992). However, it is not possible to know what proportions were taken for food rather than as part of pest control, sport or fur trading. Currently wild rabbits are also processed into pet food.

Birds

Each year, each of the 12 regional Fish & Game Councils surveys a sample of game bird hunting licence holders in its region. In 2011, data were collected from 10 267 licence holders. This represents 28% of the 36 799 licences sold in the same year, but because the survey is carried out with between six and eight samples of licence holders per region throughout the hunting season, some licence holders may have responded more than once for different periods of time.

From the combined regional data, an estimated 653 000 waterfowl and 25 000 upland game birds were killed in the 2011 season (Figure 2) and hunters spent an estimated 800 000 hours on this activity. In addition, small numbers (<200) of brown quail and chukar were killed, and an estimated 27 000 game birds were shot but not retrieved. The survey does not identify the amount of birds retrieved that are eaten, but it is reasonable to assume that a large proportion is consumed. Mallard ducks are by far the most popular target species followed by paradise ducks, and harvesting of these species does not appear to have changed much in the last decade (Figure 3). Estimates for the mean number of mallard ducks killed per hunter during the 2011 season ranged from 7 mallards per hunter in the West Coast Fish & Game region to 23 mallards per hunter in the Central South Island Fish & Game region.[2]

The harvest of tītī by Rakiura Māori has been estimated as 360 000 (320 000 to 400 000) chicks per year (Newman et al. 2009). This is the first formal estimate of the total tītī harvest and is based on the reported harvests from 21 manu (family harvesting areas) between 1999 and 2005 and estimates of the total tītī populations on each of the islands where the birds are harvested. There are no formal records of the annual Chatham Island buff weka harvest but an estimated 2000–3000 birds are harvested each year for eating (Highet 1977; Beauchamp et al. 1999).

Fish and aquatic invertebrates

The Ministry for Primary Industries (MPI) manages the commercial harvest of wild stocks of marine species in New Zealand through the Quota Management System (QMS). Under this system, each species (or species grouping, e.g. flatfish[3]) is divided into geographically defined quota management areas (QMAs) for management purposes. There are currently 100 species or species groupings subject to the QMS and these species are divided into 636 separate QMAs. The Minister sets harvesting quotas for species under the QMS and these are reviewed yearly (MPI 2012c). The total allowable catch (TAC) is the maximum harvest weight (in tonnes) considered to be sustainable. The TAC is divided into the total allowable commercial catch (TACC), recreational allowance, customary allowance, and an amount allowed for other sources of fishing-related mortality (e.g. undesirable size, by-catch). Commercial fishers must report landings to MPI. Landings for the 2012 fishing year are shown in Tables 1 and 2. These show that hoki was the finfish species harvested in the largest amount (by weight) during the 2012 fishing year, and the non-finfish species harvested in largest amount was arrow squid.

New Zealand fisheries legislation provides for the customary harvesting rights of Māori through the amateur fishing regulations and two sets of customary fishing regulations (Reeves

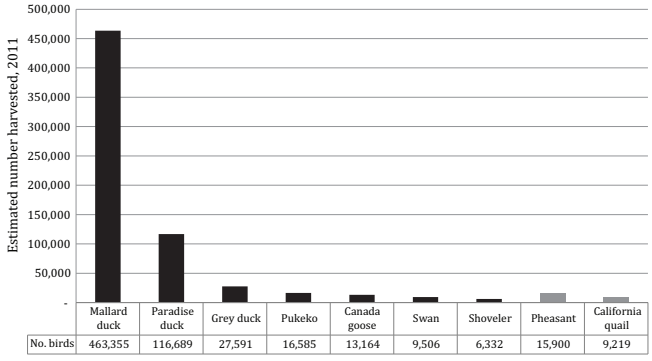

FIGURE 2 Estimated harvest of waterfowl (black) and upland game birds (grey), 2011. Data are the sum of estimates calculated for each of the 12 Fish & Game regions, based on 10 267 survey responses throughout the 2011 game bird hunting season. Data were kindly provided by Fish & Game New Zealand.

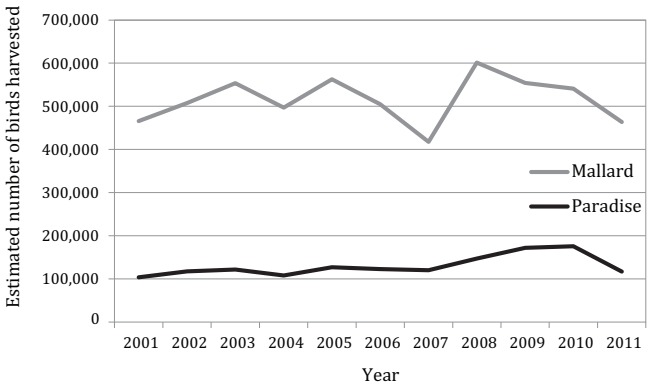

FIGURE 3 Estimated harvest of mallard and paradise ducks, 2001–2011. Data are the sum of estimates calculated for each of the 12 Fish & Game regions. Data were kindly provided by Fish & Game New Zealand.

1986a; Hardie Boys 1998, 1999). Where customary harvesting is managed under the two customary fishing regulations, appointed custodians (Tangata Tiaki/Kaitiaki) must keep records of harvesting authorisations and the species and quantities harvested, and must report this information to the Ministry for Primary Industries (King and Lake 2013). For the year ended September 2012, Tangata Tiaki/Kaitiaki reported customary harvesting of 35 species or species groupings. Table 3 presents data for the 14 most popular species in terms of quantity harvested, and indicates that shellfish are commonly gathered under the customary harvesting regulations. These data represent only part of the amount harvested for customary purposes for this time period, as customary harvesting for much of the North Island coastline still operates under the amateur fishing regulations, which do not require customary harvesting to be reported (King and Lake 2013).

The Ministry for Primary Industries undertook a national marine recreational fishing survey during 2011/12. The data from this survey were not available at the time of writing.[4] The last National Marine Recreational Fishing Survey was carried out for the Ministry of Fisheries from December 2000 to November 2001 (Boyd et al. 2004). This survey used data provided by 7374 diarists to produce national harvest estimates for each species of finfish and shellfish, by QMA. Table 4 lists harvest estimates for the 10 types of finfish and 5 types of shellfish harvested in the greatest numbers, plus estimates for kina, rock lobster and paua. There is considerable uncertainty about these data (see Boyd et al. (2004) and King and Lake (2013) for details), but they provide a useful indicator of the types of fish and shellfish recreationally harvested in the highest numbers.

TABLE 1 Total allowable commercial catch (TACC) and commercial harvest for the 2012 fishing year for finfish species subject to New Zealand's Quota Management System, where the landings exceeded 1000 tonnes

Species/species grouping[1]	Fishing year ending	TACC (tonnes)	Reported landings (tonnes)
Hoki	30 September	120 010	130 106
Jack mackerel	30 September	60 547	40 261
Southern blue whiting	31 March	43 408	38 412
Barracouta	30 September	32 672	26 441
Oreo	30 September	18 860	13 094
Ling	30 September	22 226	12 953
Blue mackerel	30 September	11 550	10 817
Red cod	30 September	8278	7627
Silver warehou	30 September	10 380	7130
Hake	30 September	13 211	6568
Snapper	30 September	6357	6544
Orange roughy	30 September	8221	6415
Spiny dogfish	30 September	12 660	5827
Tarakihi	30 September	6439	5347
Common/blue warehou	30 September	4512	3381
Red gurnard	30 September	5181	3350
School shark	30 September	3436	3277
Trevally	30 September	3933	3131
Giant stargazer	30 September	5456	3004
Alfonsino & long-finned beryx	30 September	2996	2896
Flatfish	30 September	5419	2854
Kahawai	30 September	2728	2326
Ghost shark	30 September	3012	2229
Blue cod	30 September	2681	2214
Frostfish	30 September	4019	1665
Redbait	30 September	5050	1599
Rough skate	30 September	1986	1565
Hapuku & bass	30 September	2182	1530
Elephant fish	30 September	1284	1377
White warehou	30 September	6352	1375
Rig	30 September	1919	1305
Bluenose	30 September	2335	1249
Sea perch	30 September	2170	1114
Blue shark	30 September	1860	1007

[1] The landings of 34 of 69 finfish exceeded 1000 tonnes. Data are from Monthly Harvest Returns and were kindly provided by the Ministry for Primary Industries (New Zealand) under the Official Information Act 1982.

TABLE 2 Total allowable commercial catch (TACC) and commercial harvest for the 2012 fishing year for non-finfish species subject to New Zealand's Quota Management System

Species/species grouping[1]	Fishing year ending	TACC (tonnes)	Reported landings (tonnes)
Arrow squid	30 September	127 332	35 207
Spiny red rock lobster	31 March	2 793	2 752
Foveaux Strait dredge oyster[2]	30 September	1 526	1 214
Cockle	30 September	3 214	1 058
Paua (black & yellowfoot)	30 September	1 058	944
Scallop[3]	31 March	6 728	908
Kina	30 September	1 147	862
Scampi	30 September	1 291	705
Green-lipped mussel	30 September	1 720	163
Paddle crab	30 September	765	121
Giant spider crab	31 March	419	99
Triangle shell	31 March	725	83
Pipi	30 September	204	55
Large trough shell	31 March	180	47
Dredge oyster	30 September	594	40
Packhorse rock lobster	31 March	40	32
Bladder kelp	30 September	1510	34
Sea cucumber	31 March	35	20
Southern/deepwater tuatua	31 March	629	17
Deepwater clam	30 September	32	11
Ringed dosinia	31 March	203	5
Tuatua	30 September	43	5
King crab	31 March	90	3
Queen scallop	30 September	380	2
Prawn killer	30 September	36	1
Knobbed whelk	30 September	67	<1
Horse mussel	31 March	29	<1
Frilled venus shell	31 March	16	<1
Red crab	31 March	48	<1

[1] No landings of trough shell or silky dosinia were reported for the 2012 fishing year. Data are from Monthly Harvest Returns and were kindly provided by the Ministry for Primary Industries (New Zealand) under the Official Information Act 1982.
[2] Foveaux Strait dredge oysters are reported as number of individuals. TACC = 14 950 000 individuals; landings = 11 892 602. Conversion to greenweight: 9800 individuals = 1000 kg (MPI 2012f).
[3] Scallops (*Pectin novaezealandiae*) are reported as meatweight. TACC = 841 tonnes; landings = 114 tonnes. Conversion to greenweight: multiply by 8 (MAF 2011).

TABLE 3 Reported quantities of kaimoana gathered under the customary harvesting regulations for the year ended September 2012

Species/species grouping	Harvest according to the reported units[1]			
	Kilograms	Numbers	Other units[2]	Units not provided
Finfish				
Blue cod	1160	1742	0	227
Flatfish	0	4086	0	137
Freshwater eels	2371	3283	0	0
Snapper	2930	272	0	258
Non-finfish				
Cockles	340	12 140	0	0
Crabs	68	23 484	0	7342
Dredge oysters	920	322 498	0	1000
Kina	9044	24 095	15	38 300
Mussels (including green-lipped)	8620	4420	33	35 085
Paua (black & yellowfoot)	72	27 962	0.75	31 237
Pipi	2911	4330	10	4300
Scallop	300	500	0	16 219
Toheroa	0	1758	0	0
Tuatua	130	0	0	2050
Total (all species)	28 866	430 570	58.75	136 155

1 The person completing the form to report the harvest chooses the units to use (e.g. kilograms, numbers, buckets) and sometimes figures without units are reported ('units not provided'). Data shown are only for species or species groupings where the value in kilograms, numbers or 'units not provided' was 1000 or greater (there were an additional 19 species/groupings reported as harvested). Data are only for those areas of New Zealand where customary harvesting is managed according to the Fisheries (Kaimoana Customary Fishing) Regulations 1998 and Fisheries (South Island Customary Fishing) Regulations 1999 (Hardie Boys 1998, 1999). These data were kindly provided by the Ministry for Primary Industries (New Zealand) under the Official Information Act 1982.
2 (buckets, bins, sacks, sugar bags)

Fish & Game New Zealand manages angling for trout, salmon, perch, tench and rudd in all freshwater areas except Lake Taupo and its catchment. The Taupo fishery is managed by the Department of Conservation. Although, there are currently no national estimates of the number of trout and salmon harvested across New Zealand, available statistics show that this activity is very popular. Over the 2007/08 season Fish & Game New Zealand sold 97 994 licences, of which 72% were whole season licences. The estimated total angling effort for the same season was 1.27 ± 0.02 million angler-days (Unwin 2009). A 2010 survey of anglers in the Taupo Fishery estimated a trout harvest of 69 571 fish, of which 46 107 (66%) were kept (and presumably consumed) by anglers (Department of Conservation, unpubl. data).

Access to wild fisheries resources for food is both economically and socially important. The latest fish monetary stock account (year ended September 2009) assessed the total asset value of New Zealand's commercial fish resource under the QMS as $4.0 billion (Statistics New Zealand 2010). For the same year, 256 854 tonnes of commercially harvested and processed QMS species were exported, earning $1.4 billion. Hoki and rock lobster were the highest export earners ($100 million and $189 million, respectively). From a national survey of 4443 adults aged 16 years and over in 2007/08, it was estimated that 19.5% (95% CI: 17.7–21.2) of all New Zealand adults (633 768 people) had participated in fishing at least once over the 12-month period (SPARC 2009). It was also estimated that 16.6% (95% CI: 15.0–18.3) had participated in marine/saltwater fishing and 5.7% (95% CI: 4.6–6.8) in freshwater fishing. For comparison, an estimated 17.6% of adults had participated in running/jogging and 19.6% in cycling.

TABLE 4 National recreational harvest estimates for the 10 finfish and 5 shellfish species or species groupings harvested in the highest amount (by numbers), and for kina, rock lobster and paua, December 2000 to November 2001

Species/species grouping	Estimated number of individuals[1]	Estimated weight (tonnes)[2]
Finfish		
Snapper	7 997 000	7697
Kahawai	3 216 000	4226
Blue cod	2 393 000	1665
Tarakihi	1 352 000	797
Flatfish	1 262 000	523
Red gurnard	1 071 000	526
Yellow-eye mullet	884 000	43
Trevally	590 000	594
Grey mullet	422 000	393
Jack mackerel	347 000	132
Shellfish		
Pipi	8 010 000	*96
Tuatua	5 792 000	*151
Scallop	5 179 000	561
Mussel (all types)	4 587 000	*58
Cockle	4 176 000	*33
Other seafood		
Kina	3 145 000	(see note 2)
Rock lobster	1 425 000	1185
Paua	1 190 000	377

1 Data are from Boyd et al. (2004). For each species, harvest estimates were calculated for each Quota Management Area (QMA; fish stock). The data in Table 4 are the sum of these QMA estimates. It is important to note that each QMA estimate was accompanied by a sampling error expressed as percentage coefficient of variation (% c.v.). Some QMA estimates were calculated from harvests reported by a small number of diarists, and in these cases the % c.v. was high (>20%, sometimes >100%). See Boyd et al. (2004) for full details.
2 Data marked with an asterisk are from King and Lake (2013); all other data are from Boyd et al. (2004). An estimated tonnage was not available for kina. Data from Boyd et al. (2004) are the sum of QMA estimates within each species/fishstock, and are based on mean weight data collected for each QMA during boat ramp surveys (see Boyd et al. (2004) for details). Boyd et al. (2004) did not estimate harvest tonnage where mean weight data were unavailable; see table 1 in King and Lake (2013) for weights used to estimate tonnage.

Other foods

Harvest data for other foods are sparse and focused on the types or frequency of specific foods harvested by small populations. Seven Māori elders in the Waikato Region reported harvesting 13 different plants as a source of food (Wehi and Wehi 2010).[5] Participants in two studies of wild kai consumption reported harvesting watercress, puha and seaweed, but the frequency and amounts harvested were not reported (Tipa et al. 2010a, b). In the 1997 National Nutrition Survey, puha was reported to be consumed by 0.4% of the 4636 respondents (of which 2% reported eating puha 1–6 times per week) and 0.7% of respondents reported consuming watercress (Russell et al. 1999).

KNOWING WHEN FOOD IS SAFE TO EAT

While chiefly providing nutrition, wild foods can also (as a result of their habitat, ecology or biology) present a hazard to consumers. Commercial food production and sale in New Zealand are subject to regulatory controls, standards and testing programmes to ensure that consumers are protected from chemical and microbial hazards. This includes the commercial harvesting of wild stocks such as fisheries resources and wild mammals. These regulatory controls (e.g. limits for contaminants) do not apply to harvested wild foods that are not sold or

traded. Recreational or customary harvesters of wild foods who do not intend to sell or trade these foods for pecuniary gain must make their own judgement as to whether the food is safe to eat, although regulatory authorities such as MPI provide advice.

Both the type and source of food are relevant to the safety of non-commercial harvesting. Some hazards are more important for particular types of food. Examples include the concentration of pathogenic viruses from water by filter-feeding shellfish, or the accumulation of chemical hazards (such as polycyclic aromatic hydrocarbons) by predator species further up the food chain such as eels, and naturally occurring toxins (e.g. karaka berry). Examples of location-specific hazards are blooms of toxin-producing algae, sewage or stormwater outfalls, pesticide application, and elevated heavy metal concentrations in geothermal areas. The risk of a food causing illness can be reduced for some (but not all) hazards by appropriate preparation, storage and cooking.

There have been scientific studies of the prevalence or concentration of different hazards in various wild foods (Turner et al. 2005; Donnison et al. 2009; Stewart et al. 2011) but this information is unlikely to be accessed by the general public. Information on how to keep wild food safe is more likely to come from families and communities, clubs and organisations, or from central or local government. MPI has prepared a number of resources to encourage safe handling of wild foods (MPI 2012d). In addition, some agencies have a responsibility to warn the public of the presence of specific hazards in known wild food gathering areas, for example, district health boards and local authorities place warning signs and issue public warnings when there is a risk that shellfish in areas used by non-commercial harvesters are contaminated with marine biotoxins (MPI 2012e).

Information on reported New Zealand foodborne illness incidents and outbreaks is recorded in the national notifiable disease database, EpiSurv (ESR 2012). Between January 2002 and December 2012 there were 1359 reported outbreaks of enteric disease where consumption of contaminated food or drink (excluding water) was a suspected mode of transmission. Of these, wild foods were reported as a possible source of hazard exposure in only eight outbreaks (the source of illness was not confirmed by epidemiological or laboratory investigation in any of these outbreaks). During this period other outbreaks were reported among people sharing a meal at a tangi, hui or marae, but a specific food was not identified as the source of illness. The provision of self-harvested foods at such events is an important part of hospitality, but the EpiSurv reports did not indicate whether wild foods were served on these occasions.

Of the eight outbreaks possibly caused by consumption of wild food, the slaughter, preparation and consumption of wild pigs was one of several possible causes of a campylobacteriosis outbreak. Recreationally harvested shellfish were implicated in the remaining seven outbreaks: three toxic shellfish poisoning outbreaks, two outbreaks of gastroenteritis (pathogen not identified), one combined toxic shellfish poisoning and gastroenteritis outbreak, and one outbreak of shigellosis. The probable cause of the 2005 shigellosis outbreak was shellfish collected from the Opua Marina in the Bay of Islands and subsequent person-to-person transmission. A total of 51 people were identified who may have been associated with this outbreak (Jarman et al. 2006).

There have also been occasional, sporadic cases of foodborne illness reported where the handling or consumption of wild foods were identified as risk factors, and confirmed in some instances (Turner et al. 2005). Examples include a case of campylobacteriosis linked to a gifted supply of wild venison, a case of salmonellosis linked to consumption of wild deer heart, and numerous cases of toxic shellfish poisoning or gastrointestinal infections linked to consumption of contaminated shellfish. It is challenging for investigators to confirm the cause of a foodborne illness case or outbreak. Furthermore, many sick individuals do not visit a GP or otherwise come to the attention of the medical system, so notified cases and reported outbreaks are only a subset of all the cases and outbreaks that occur in New Zealand each year (Lim et al. 2012).

MAINTAINING ACCESS

The harvest of wild foods provides nutrition as well as fulfilling social, cultural or spiritual needs, but is reliant on access to wild food species. Historically, Māori peoples' loss of access to mahinga kai, as land was divided and passed into the ownership of immigrants, directly inhibited their ability to feed themselves and others. The loss of access to mahinga kai reduced the ability of Māori to continue their way of life; for example, Māori had to leave their hapū (subtribe) to find work to earn money to buy food (Dacker 1990). Barriers to accessing wild foods might be national in scope (e.g. permit requirements, size/quantity restrictions, prohibitions), localised (e.g. contaminated or depleted sites, privatised land) or personal (e.g. access to equipment, ability to travel to sites, lack of knowledge). There are many national and local examples where managing and maintaining access to wild foods is challenging. This section briefly provides some examples.

Rights and rules

While it may be considered a basic right to be able to harvest wild food in New Zealand, the harvesting of many wild food species is controlled through some form of legislation. Depending on the food species, there might be licences or permits required, controls over the times and locations for harvesting or the equipment used, or limits on the numbers, sizes or condition of the harvested species. New Zealand legislation also prohibits the harvesting of some food species. This has a particular impact on Māori when such species are culturally significant taonga (treasured) or rangatira (chiefly) food species, and the harvesting of such species is important for maintaining mana (prestige), kaitiaki (environmental guardian responsibilities) and knowledge (mātauranga), and upholding manaakitanga (Lyver et al. 2008; Moller and Lyver 2010). Examples include kererū (New Zealand pigeon; *Hemiphaga novaeseelandiae*) and toheroa (Futter and Moller 2009; Lyver et al. 2009). People of Ngāti Kuia recently harvested a small number of tītī from a traditional harvesting site (Tītī Island, Cook Strait) in order to reassert their right to harvest this taonga species and to preserve their tikanga (customs, rules) for harvesting and preparation (Gaze and Smith 2009).

Legislation now enables Māori to have some management over resources and to maintain sustainable customary harvesting of fisheries. As mentioned earlier, customary harvesting of fisheries resources (fish, aquatic life or seaweed) is regulated through the Fisheries (Kaimoana Customary Fishing) Regulations 1998, the Fisheries (South Island Customary Fishing) Regulations 1999 or the Fisheries (Amateur Fishing) Regulations 1986 (Reeves 1986a; Hardie Boys 1998, 1999). The two customary fishing regulations enable the Minister responsible to confirm the appointment of custodians (Tangata Tiaki/Kaitiaki) for fisheries resources in a customary food gathering area. These custodians manage customary food gathering within their area by having the power to authorise (or not) individuals to gather more fish,

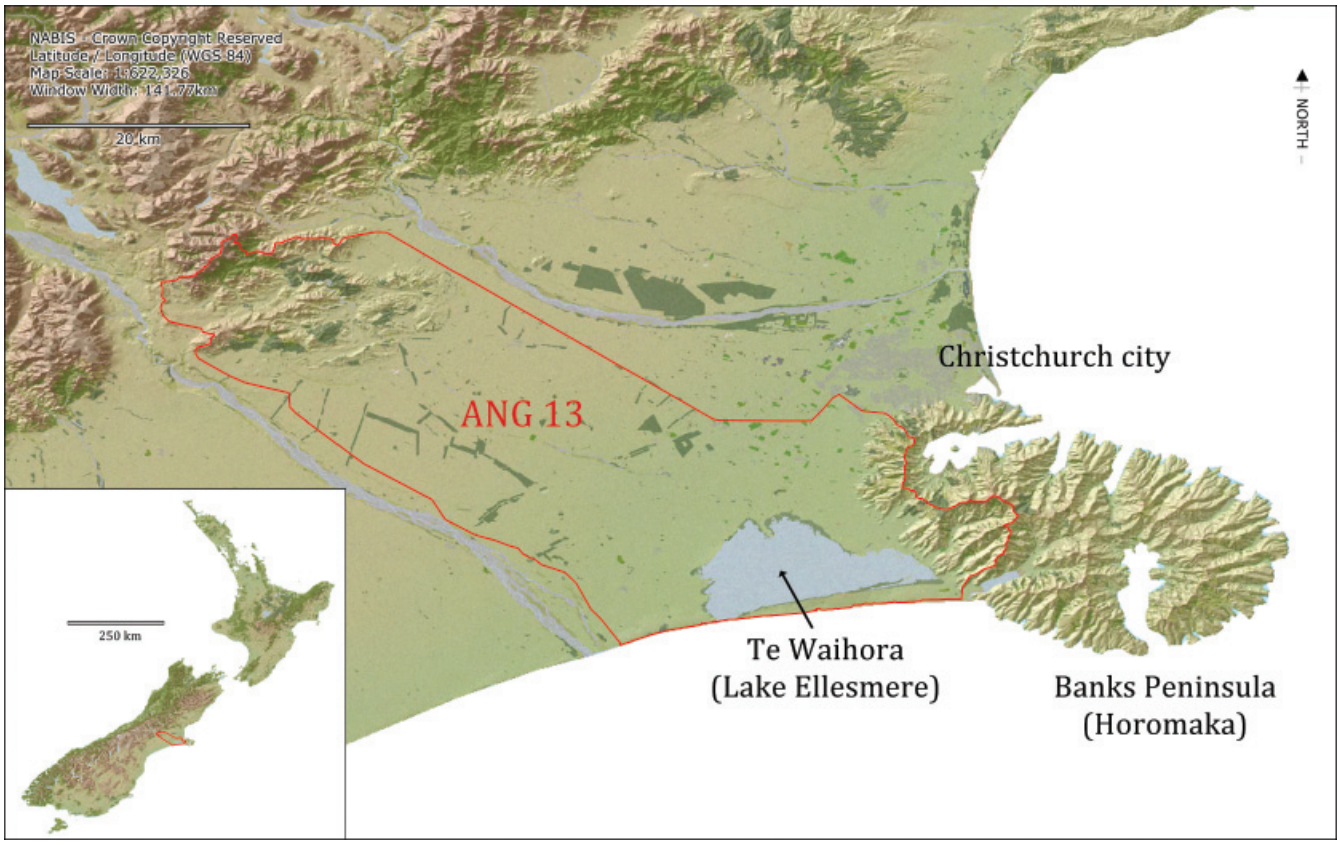

FIGURE 4 Map showing the ANG 13 Quota Management Area (red line) in relation to Te Waihora (Lake Ellesmere) and its catchment, South Island of New Zealand. This map was sourced from NABIS (www.nabis.govt.nz) as provided by the Ministry for Primary Industries. It is intended to be used as a guide only, in conjunction with other data sources and methods, and should only be used for the purpose for which it was developed. Although the information on this map has been prepared with care and in good faith, no guarantee is given that the information is complete, accurate or up-to-date.

aquatic life or seaweed than is permitted by rules set under the amateur fishing regulations, provided the food is gathered for purposes authorised by the Tangata Tiaki/Kaitiaki and is not sold or traded. If there are no custodians appointed for a customary food gathering area, the gathering of fisheries resources for tangi or hui is controlled through regulation 27A of the amateur fishing regulations, which provide for authorising agents appointed by Māori entities to control such harvesting (MOF 2008; King and Lake 2013). The two customary fishing regulations also provide for the establishment of mātaitai reserves (identified fishing grounds), in which Tangata Tiaki/Kaitiaki control all taking of fisheries resources.

For self or for sale

As discussed earlier, some of New Zealand's wild foods are commercially harvested and traded on the domestic and international markets. Conflict can arise when non-commercial harvesters also seek access to these wild foods. The value of a wild food natural resource can be considered in different ways and the economic value cannot easily be compared to cultural or recreational value (Baker et al. 2011). It is challenging for resource managers to balance commercial and non-commercial access to these resources. Wild foods are a renewable resource but excess harvesting can deplete populations of wild food species.

Te Waihora (Lake Ellesmere; Figure 4) is a major mahinga kai to Ngāi Tahu whānui (the wider Ngāi Tahu tribe comprising Ngāti Māmoe and Waitaha). This coastal lagoon, also known as Te Kete Ika o Rākaihautū (The Fish Basket of Rākaihautū), is an important source of eel (tuna) for Ngāi Tahu whānui, and eel gathering (mahinga tuna) is an integral part of the traditional seasonal cycle of food gathering (Dacker 1990; Te Rūnanga o Ngāi Tahu and Department of Conservation 2005). The lake is coastal but landlocked for most of the year. The migration of breeding adults and recruitment of juveniles (glass eels) to the lake depends on the duration and timing of the lake opening to the sea (Jellyman et al. 2003). These openings have occurred naturally when lake levels were high, but openings are now artificially created using bulldozers.

Today, Te Waihora supports a commercial eel fishery and is recognised as a very important customary fishery, and it is necessary to balance the needs of both fisheries while considering sustainability of the overall harvest. Commercial harvesting of eels from Te Waihora began in 1942, and boomed in the 1970s to peak at 847 tonnes in 1976 (Jellyman et al. 2003). In 1978, to control overexploitation, the lake was declared a controlled fishery, and throughout subsequent years the harvest was managed through restricted permits, limits on the total allowable catch and minimum eel size, and the setting aside of areas where commercial harvesting was not permitted (Reeves 1986b; Jellyman 2007). During the 1990s, Māori and industry began to work together to manage the eel stocks in Te Waihora due to concerns that these stocks were declining in numbers and size (O'Connell 1999; Jellyman et al. 2003; Jellyman 2007). Interviews at this time with kaumatua (elders) with knowledge of Te Waihora fishery confirmed that the commercial eel fishery had a detrimental impact on the health of the customary fishery, but also revealed the importance of the commercial fishery as an employment opportunity in the area (O'Connell 1999).

Customary non-commercial fishers desire eels of a greater size, over 750 mm and 1 kg, that is, mature female shortfin eels and mature longfin eels (MPI 2012c). Since commercial fishing began, migrating longfin eels have almost disappeared (these

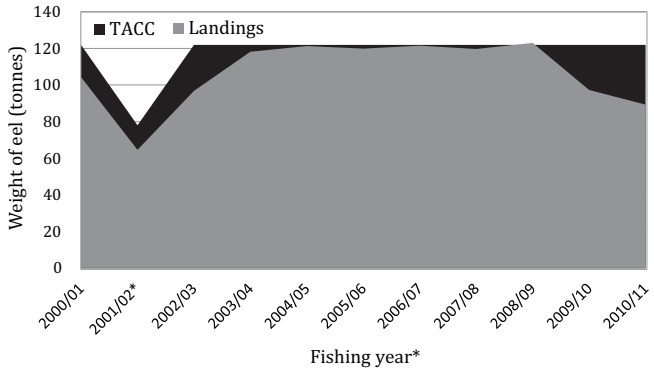

FIGURE 5 Total allowable commercial catch (TACC) and reported landings of eels commercially harvested from the Te Waihora (Lake Ellesmere) Quota Management Area (ANG 13), by fishing year, 2000/01 to 2010/11. Starting from February 2002, the fishing year for ANG13 is 1 February to 31 January. Prior to this the fishing year was 1 October to 30 September. An interim TACC of 78 tonnes was set for the transition period from 1 October 2001 and 31 January 2002. Data source: MPI (2012c).

used to make up a small proportion of the commercial harvest, perhaps one-quarter in the 1940s) and the shortfin population has changed from being dominated by females to males (Jellyman et al. 2003). The overall ecology of the lake has also been affected by habitat modification (particularly wetland drainage) and water quality degradation (Te Rūnanga o Ngāi Tahu and Department of Conservation 2005).

On 1 October 2000, Te Waihora eel fishery was introduced into the QMS and assigned the QMA name ANG 13 (Figure 4) (MPI 2012c). Since introduction into the QMS, commercial landings in Te Waihora have been close to the TACC limits each year, until recently (Figure 5). Te Rūnanga o Ngāi Tahu holds 20% of the TACC quota, which it leases to fishers (Te Rūnanga o Ngāi Tahu and Department of Conservation 2005). Commercial eel fishers can voluntarily assist with sustainable harvesting by using larger escapement tubes in fyke nets so that larger juvenile eels can escape (effectively increasing the minimum size limit from 220 g to 280 g), and returning all longfin eels caught in Te Waihora to the water. Customary fishers and Tangata Tiaki have assisted the fishery by leaving more than 25 tonnes of the customary allowance in the lake each year, thereby supporting the resident eel numbers and supporting eels to reach customary size ranges (N. Scott and J. Arnold, Te Rūnanga o Ngāi Tahu, pers. comm.).

Under the QMS, the customary and recreational allowances for ANG 13 have been set at 31 and 3 tonnes, respectively (MPI 2012c). The quantity of eels harvested by recreational harvesters is not known, but a recreational harvester is permitted to harvest up to six eels per day (Reeves 1986a). Appointed Tangata Tiaki/Kaitiaki now manage customary harvesting of eel from Te Waihora as provided by the Fisheries (South Island Customary Fishing) Regulations 1999 (Hardie Boys 1999). Effectively managing the harvest of Te Waihora eels under the QMS, to ensure both customary and commercial fishers have satisfactory access to this resource, will continue to be challenging.

Consumption or conservation?

The Department of Conservation was established in 1987 to, among other things:

- manage land and other natural and historic resources for conservation purposes;
- preserve so far as is practicable all indigenous freshwater fisheries, and protect recreational freshwater fisheries and freshwater fish habitats; and
- foster the use of natural and historic resources for recreation, and to allow their use for tourism, to the extent that these uses are not inconsistent with the conservation of any natural or historic resource (New Zealand Government 1987; DOC 2012a).

The Department faces challenges when there is apparent conflict between its conservation responsibilities and its mandate to ensure that New Zealanders have access to natural resources. Conflict also arises when the Department makes decisions about the access or use of the Conservation estate that impact on the ability of harvesters to freely access their preferred foods (legally). For example, people wishing to harvest food plants from Conservation lands must apply for a permit to do so (DOC 2012b). The recreational harvests of whitebait and wild deer illustrate the difficulties managers face balancing conservation activities with access to wild food.

The whitebait fisheries are a mixture of traditional, artisanal, recreational and commercial fisheries (McDowall 2006). People are currently free to harvest whitebait from most areas of New Zealand provided they abide by the whitebait fishing regulations, which stipulate when and how whitebait must be harvested and list the areas on the West Coast of the South Island where whitebait fishing is prohibited (Eichelbaum 1994a, b). The Department of Conservation is responsible for managing New Zealand's whitebait fisheries and for ensuring that whitebait harvesters understand and adhere to these regulations. While whitebait harvesters are encouraged to take only what they need, there are no harvest limits, and therein lies the conflict. The Department of Conservation is also responsible for protecting New Zealand's native freshwater fish, which includes the five *Galaxias* species that make up the majority of the whitebait harvest (inanga, kōaro, giant kōkopu, shortjaw kōkopu and banded kōkopu). Of these species, four have the threat classification of 'declining' (the banded kōkopu is classified as 'not threatened') (Townsend et al. 2008; Allibone et al. 2010). In essence, the Department must manage the exploitation of some species that it regards as under conservation threat (McDowall 2006). Any future decisions the Department might take to protect these fish species are likely to impact the whitebait harvest.

The Department of Conservation, on behalf of the Minister of Conservation, has overall responsibility for managing wild deer, whether on private land or the Conservation estate (New Zealand Government 1977). The Department works alongside regional councils, the Animal Health Board, landowners, and private and commercial hunters to control or eradicate these animals on a regional basis. Notably, deer are not considered 'pests' under the Wildlife Act 1953; they are only identified as pests when a statutory body classifies them as such and puts in place a management plan to control them (Figgins and Holland 2012). A 2008 Ministerial Panel review of the management of deer, chamois, tahr and wild pigs found that deer and pigs were the species most valued for food and recreation, and that hunting was a means of providing sustenance for Māori and Pākehā (non-Māori) (Anonymous 2008). However, the Panel found an entrenched conflict between those who saw the animals primarily as a resource and those who regarded them as harmful. Such polarising views prevented the development of a national deer control plan in the 1990s (Cole 1998; Parkes and Murphy 2003).

The Panel recognised that private (commercial and recreational) hunting was the principal management tool for introduced wild animals, but found that hunters were dissatisfied that

introduced wild animals were not being managed to provide more satisfying opportunities for them. On the other hand, the Panel recognised that the Department of Conservation has to prioritise native biodiversity over introduced species and cannot give recreational or any other hunting primacy over its conservation objectives. As a result of this consultation process, a Bill is before Parliament to establish a Game Animal Council whose primary purpose will be to improve the management of deer, tahr, chamois, and wild pig, including the improvement of opportunities to hunt those animals (Wilkinson 2011). The Department of Conservation is also beginning to prepare a national deer control plan that will consider the views of hunting and conservation stakeholders (DOC 2012c).

The impact of land use

Land use affects the location, abundance and quality of wild foods. In some cases, land-use changes might encourage some species of wild foods (e.g. puha growing on cultivated land), but there are many examples in New Zealand where ecosystem modification (e.g. deforestation, land drainage) and environmental contamination have reduced wild food quality or availability. In a 2010 survey on the public perceptions of the New Zealand environment (610 respondents), participants were asked to identify up to three causes of damage to native plants and animals living on the land and in freshwater (Hughey et al. 2010). Those most commonly selected by the participants were pests and weeds (52% of participants), farming (38%) and urban development (26%). Participants also most commonly identified commercial fishing (70%), sewage and stormwater (39%), and recreational fishing and hazardous chemicals (20% each) as the most prominent causes of damage to marine fisheries.

The land tenure review process provides an example where Government decision-making on land use has affected access to wild food, in this case big game animals. Some areas of Crown land in the high country of the South Island are leased to farmers for pastoral use. These lands are not openly accessible to the public like Conservation lands, but can provide good opportunities for hunters of big game animals if the leaseholder permits access. Through the tenure review process, the Crown or a private individual gains freehold ownership of previously leased areas (LINZ 2012).

These land use and tenure changes can have a significant impact on access to, and successful harvest from, recreational hunting areas. The passing of land to Crown freehold ownership opens significant tracts of land to the public, which appears to enhance recreational hunting opportunities. However, when land is released through tenure review there is a rush to harvest game animals. This diminishes the quality of hunting for those who previously had access to pastoral lease lands where animal densities are often higher than on surrounding public land. Recruitment of game to new and existing public land diminishes because 'refuge areas' are lost, both because of hunting on former lease lands and also due to land use intensification on newly privatised lands (T. McCarthy, National President, New Zealand Deerstalkers Association, pers. comm.).

DISCUSSION

The harvesting and consumption of wild foods is increasingly featured in various media. The Hokitika Wildfoods Festival has been an annual event since 1990 and attendees are now capped at 15 000 (Westland District Council 2012). Television broadcasters present wild food programmes, and some fishing programmes also include a cooking segment. Restaurants can participate in wild food competitions and there have been cookbooks published that cater specifically for wild game (Lyver 2007; Meates 2011). Individuals are also starting small businesses selling wild food products. Arguably, these activities popularise wild foods and increase the need for careful management of these resources.

In the preceding material we have described wild food species, harvesting data, and have briefly discussed some of the issues and conflicts surrounding wild food access, which usually arise because people view the resource in different ways. The perspective a person has about a wild food is usually based on how they value this food, which can be influenced by many things including responsibilities (e.g. Kaitiaki, public servant, provider for a family), tradition (family, cultural), education (formal and informal) and the media.

It has been recognised on an international scale that current decision-making processes often ignore or underestimate the value of ecosystem services. Decision-making can be particularly challenging because of the multiple values ecosystem services have to different people (Millennium Ecosystem Assessment 2003). Viewing wild foods as an ecosystem service means taking into account all of the values these foods have for people.

Valuing wild foods in terms of their provisioning service usually means applying market values to the foods (i.e. a consumptive value; Baker et al. 2011). This might be achievable for currently traded goods such as whitebait or watercress, but is challenging for other wild foods, for example taraire berries or pupu. Even for currently traded foods there can be difficulties in applying market values. For example, most venison available on the domestic market is from farmed animals, but differences in taste, less exposure to chemicals, and innate 'wildness' may invoke a value premium for the wild product. In addition, wild foods not financially marketable now may become valuable traded goods in the future. Valuing the provisioning service that a wild food offers also requires knowledge about the population accessing this resource as a food, particularly knowing the amount harvested and consumed. For some people, non-commercially-harvested wild foods are an important part of their food supply and these people (or their providers) direct considerable time and effort towards harvesting and preparing wild foods. A 2005 review of non-commercial wild food in New Zealand found there were insufficient data on the amounts of wild foods consumed (or harvested) and the frequency of wild food consumption (Turner et al. 2005). This chapter summarises valuable data that have emerged since that review, but gaps remain.

Provisioning services are but one product of the harvest of wild food. The harvest of some food species may also contribute to regulating services. For example, harvest of wild deer confers conservation benefits by regulating deer populations and thus reducing the impacts of these introduced species on the natural environment. The Department of Conservation spent $1.2 million on deer control for the year ended 30 June 2012 (DOC 2012d). The cost of wild deer control on public lands would far exceed this figure if it were not for the efforts of recreational hunters (seeking meat or trophies) and commercial meat hunters. The recreational harvesting of wild game brings about conservation benefits such as maintained or improved habitat for native species, but valuing these benefits is difficult.

Of greater challenge to decision-makers is determining how the spiritual, recreational, educational and cultural values of wild foods can be incorporated into decision-making, that is, valuing the cultural service that wild foods offer humans. The harvesting

of tītī by Rakiura Māori provides an example. The market price of tītī reflects the commodity value to the purchaser and in January 2013 A-grade birds were selling for around $13 per bird. If the estimated annual harvest of 360 000 birds (Newman et al. 2009) was entirely A-grade birds, the commodity value of this harvest would be $4.7 million per annum. However, the management and harvesting of tītī are not just about the value of the birds as a commodity; they encompass wider values, including family, tradition, personal and tribal identity, kaitiaki responsibilities, ahikāroa, and maintaining mana, mātauranga and tikanga. These values are difficult to incorporate meaningfully into decision-making processes. Moreover, wild foods can also have indirect value by being part of ecosystems that as a whole serve to support human well-being, and for some people (Māori in particular) wild foods also have non-use value in that they are viewed as a resource to be bequeathed to future generations (Baker et al. 2011).

Cultural impact assessments, iwi management plans (Te Raranga Mahi)[6] and the Ministry for the Environment's Cultural Health Index for Streams and Waterways are examples of tools that enable Māori cultural values, including mahinga kai, to be incorporated into decision-making (MfE 2013). These tools are designed for their own purposes and as such are focused on recording and communicating Māori values. There are opportunities for decision-makers to trial an ecosystem services approach that captures the breadth of values we have described here, as held by Māori and non-Māori. Although some of these elements are difficult to measure and to evaluate equally, recognising this multiplicity of values will enable decision-makers to make better-informed decisions.

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ENDNOTES

1 Assuming full carcass recovery and the deer harvest is 62% red deer and 38% small deer. The amount of meat recoverable from each type of animal is assumed to be: red deer 30 kg, small deer 12 kg, pig 25 kg (C. Bromley, Bromley's Home Butchery Ltd., pers. comm.). Hunters frequently retrieve only the best cuts, such as back steaks and hindquarters, particularly if the animal is killed far from vehicle access. In some cases no meat is recovered. Note that an earlier study (Nugent 1992) uses 'whole weights' for a mix of adult and subadult animals: red deer 55 kg, fallow deer 27 kg, pig 40 kg.
2 All data courtesy of Fish & Game New Zealand.
3 The species grouping 'flatfish' includes yellow-belly flounder, sand flounder, black flounder, greenback flounder, lemon sole, New Zealand sole, brill, and turbot (MPI 2012c).
4 The results of this survey will be available in June 2013 (MOF 2011).
5 Cabbage tree, taro, pikopiko, puha, bok choi (kōrou/pōhata/poneki), watercress, karaka, mamaku, bracken fern, flax, kiekie, poroporo and potato (*Solanum tuberosum*).
6 Iwi management plans (iwi authority planning documents) must be taken into account by regional and territorial authorities when preparing policies and plans (New Zealand Government 1991; MfE 2000).

APPENDIX 1 Common, scientific and some Māori names for wild food species

Common name(s)	Scientific name	Māori name(s)[1]
Land animals		
Brushtail possum	*Trichosurus vulpecula*	Paihamu, pohima
Chamois	*Rupicapra rupicapra*	
Goat	*Capra hircus*	Pirikoti
Hare	*Lepus europaeus*	Hea
Himalayan tahr	*Hemitragus jemlahicus*	
Rabbit	*Oryctolagus cuniculus*	Rāpeti
Red deer	*Cervus elaphus*	Tia
Pig	*Sus scrofa*	Puaka, kapene kuki, poaka
Wallaby	*Macropus* spp.	Warapī
Birds		
Black swan	*Cygnus stratus*	Wani
Brown quail	*Coturnix ypsilophorus*	Kuera, koera
Buff weka	*Gallirallus australis hectori*	
California quail	*Lophortyx californica*	Kuera, koera
Canada goose	*Brant canadensis*	Kuihi
Chukar	*Alectoris chukar*	
Feral goose	*Anser anser*	
Grey duck	*Anas superciliosa*	Parera
Grey-faced petrel	*Pterodroma macroptera gouldi*	Tītī, oi
Mallard duck	*Anas platyrhynchos*	Rakiraki
Muttonbird, sooty shearwater	*Puffinus griseus*	Tītī, hakoko
New Zealand shoveler	*Anas rhynchotis variegata*	Kuruwhengi
Paradise shelduck	*Tadorna variegata*	Putangitangi
Peafowl, peacock	*Pavo cristatus*	Pīkao, pīkake
Pukeko, Pacific swamphen	*Porphyrio porphyria*	Pūkeko
Ring-necked pheasant	*Phasianus colchicus*	Peihana
Insects and insect products		
Honey from wild honey bees	*Apis mellifera*	Honi, mīere
Huhu	*Prionoplus reticularis*	Huhu
Land plants		
Bracken fern	*Pteridium esculentum*	Rārahu, manehu, rahurahu, rarauhe, rarauhe-mahuika, tākaka
Blackberry	*Rubus fruticosus*	
Bok choi, chinese cabbage	*Brassica rapa*	Kōrou, pōhata, poneki, horuhoru, kotami, nanī
Cabbage tree	*Cordyline* spp.	Tī, tī eiei
Chestnut	*Castanea* spp.	
Gooseberry	*Ribes uva-crispa*	
Horseshoe fern, para, king fern	*Marattia salicina*	Para, mouku
Indian spinach	*Basella alba*	
Kahikatea	*Dacrycarpus dacrydioides*	Kahikatea, kahika, kaikatea, katea, kōaka, koroī
Karaka	*Corynocarpus laevigatus*	Karaka, kōpī
Karamu	*Coprosma lucida, C. robusta*	Karamū, kākaramū, kākarangū, kāramuramu, karangū
Karapapa	*Alseuosmia macrophylla*	Karapapa, horopito, korotaiko, pere, toropapa
Kawakawa, pepper tree	*Macropiper excelsum*	Kawakawa, kawa
Kiekie	*Freycinetia banksii*	Kiekie
Mamaku, black tree fern	*Cyathea medullaris*	Mamaku, katātā, kōrau, pītau
Matai	*Prumnopitys taxifolia*	Mataī, kāī, kākāī, māī
Miro	*Prumnopitys ferruginea*	Miro, toromiro
Mountain flax	*Phormium cookianum*	Whaririki, kōrari-tuauru
New Zealand flax	*Phormium tenax*	Harakeke, harareke, kōrari
Nikau palm	*Rhopalostylis sapida*	Nīkau
Pikopiko, common shield fern	*Polystichum neozelandicum*	Pikopiko, pīpiko, tutoke
Pikopiko, hen and chickens fern	*Asplenium bulbiferum*	Pikopiko, mouku, maku, manamana, mauku, moku, mouki
Poroporo, bullibulli	*Solanum laciniatum, S. aviculare*	Poroporo, pōpopo, poroporotanguru, raupeti
Puha, sow thistle	*Sonchus* spp.	Pūhā, pororua, pūwhā, rauriki
Raspberry	*Rubus idaeus*	
Stinging nettle	*Urtica* spp.	Pūngitangita, pūnitangita
Supplejack	*Ripogonum scandens*	Kareao, akapirita, kakareao, kakarewao, karewao, kekereao, pirita, taiore
Taraire	*Beilschmiedia tarairi*	Taraire
Taro	*Colocasia esculenta*	
Tawa	*Beilschmiedia tawa*	Tawa, tawa rautangi
Totara	*Podocarpus totara*	Tōtara, amoka
Variegated/milk thistle	*Silybum marianum*	
Walnut	*Juglans* spp.	
Fungi		
Ear fungus	*Auricularia polytricha*	Hakeka, kakeke
Field mushroom	*Agaricus* spp.	
Harore	*Pholiota adiposa*	Harore
Porcini, cep, sticky bun	*Boletus elegans*	
Shaggy ink cap	*Coprinus comatus*	
Shaggy parasol	*Macrolepiota rhacodes*	
Marine finfish		
Alfonsino & long-finned beryx	*Beryx splendens, B. decadactylus*	
Barracoutta	*Thyrsites atun*	Nihomāka, makā, mangā
Blue cod	*Parapercis colias*	Rawaru, pakirikiri, patutuki, kopukopu, pātukuki, pākirikiri, rāwaru
Blue mackerel	*Scomber australasicus*	Tawatawa, tewetewe
Blue shark	*Prionace glauca*	Mangō-pounamu, matawhā, ngerongero, pounamu, poutini, taha-pounamu
Bluenose	*Hyperoglyphe antarctica*	Matiri
Brill	*Colistium guntheri*	Patikinui
Common/blue warehou	*Seriolella brama*	Tarakihi, warehou
Elephant fish	*Callorhinchus milii*	Makerepe, repe, reperepe
Flounder	*Rhombosolea* spp.	Patikitotara, pātiki, pātikimohoao
Frostfish	*Lepidopus caudatus*	Hiku, pāra, para-taha-rangi, taharangi, tīkati
Ghost shark	*Hydrolagus novaezealandiae*	
Giant stargazer	*Kathetostoma* spp.	
Hake	*Merluccius australis*	Kehe, tīkati
Hapuku & bass	*Polyprion oxygeneios, P. americanus*	Moeone, ngutoro, toti, hāpuku, hakuraa, kapua, kauaeroa, and others
Hoki	*Macruronus novaezelandiae*	Hoki
Jack mackerel	*Trachurus declivis, T. murphyi, T. novaezelandiae*	Hāture, hauture
Kahawai	*Arripis trutta, A. xylabion*	Kōpūhuri, kooukauka, kahawai, hāpukupuku, kōhere, kōwaitau, kōwerewere, papa, koria, kūngongingongi, pūawai, tāhuri, tāroto, tapurupuru

Kingfish	*Seriola lalandi lalandi*	Haku, kahu, maku-maku, warehenga
Ling	*Genypterus blacodes*	Hoka, hokarari, rari
Mako shark	*Isurus oxyrinchus*	Mako, mangō-makomako
Orange roughy	*Hoplostethus atlanticus*	
Oreo	*Oreosomatidae* (Family)	
Patagonian toothfish	*Dissostichus eleginoides*	
Redbait	*Emmelichthys nitidus*	
Red cod	*Pseudophycis bachus*	Hoka
Red gurnard	*Chelidonichthys kumu*	Kumukumu, kumi-kumi, pūwhaiau
Rig	*Mustelus lenticulatis*	Kapetā, makō, mangā, mangō, pioke
Rough skate	*Zearaja nasuta*	Pakaurua, waewae, whai, uku
School shark	*Galeorhinus galeus*	Tope, tupere, makohuarau
Sea perch	*Helicolenus* spp.	
Silver warehou	*Seriolella punctata*	
Snapper	*Pagrus auratus*	Tāmure, karatī, kouarea, kourea, paratete, paratohe, patai, pepe tamure
Sole	*Pelotretis flavilatus, Peltorhamphus novaezelandiae*	Kutuhore, pātiki, rore, pakeke
Southern blue whiting	*Micromesistius australis*	
Spiny dogfish	*Squalus acanthias*	Huarau, kāraerae, makohuarau, mangō-hapū, mangō-pekepeke, mangō-tara
Striped marlin	*Tetrapturus audax*	Taketonga
Tarakihi	*Nemadactylus macropterus*	Tarakihi, tātarakihi
Trevally	*Pseudocaranx georgianus*	Arāra, komutumutu, kopapa, raumarie, raumarie ārāra, raumarire, ruamarie, ruamarie ārāra
Tuna	*Thunnus* spp.	
Turbot	*Colistium nudipinnis*	Pātikinui, patiki
White warehou	*Seriolella caerulea*	
Yellow-eyed mullet	*Aldrichetta forsteri*	Aua, kātua, makawhiti, awa, kātaha, kataka, marahea, maraua, marakā, matakawhiti, mokowhiti, pōnaho
Marine invertebrates		
Arrow squid	*Nototodarus sloanii, N. gouldi*	Wheketere
Bladder kelp	*Macrocystis pyrifera*	
Cockle	*Austrovenus stutchburyi*	Tuaki, tuangi, pipi, hinangi, huangi, hūai, hūangiangi, hungangi, hūwai, tanetane, tungangi, hingani, anutai, huawai
Deepwater clam	*Panopea zelandica*	Hohehohe
Dredge/Bluff/flat oyster	*Ostrea chilensis*	Tio, tio paruparu, tiopara, tiorepe
Frilled Venus shell	*Bassina yatei*	Pūkauri
Giant spider crab	*Jacquinotia edwardsii*	
Green-lipped mussel	*Perna canaliculus*	Kukutai, kūtai, pōrohe, kuku, pipi
Horse mussel	*Atrina zelandica*	Hoemoana, hururoa, kukupati, kūkuku, kūkukuroa, kūpā, pati, patikuku, toretore, waharoa
Kina, sea urchin	*Evechinus chloroticus*	Kina, kina ariki, kina kōrako, pūarau
King crab	*Lithodes murrayi, Neolithodes brodiei*	
Knobbed whelk	*Austrofusus glans*	Kākara
Large trough shell	*Mactra murchisoni*	Whakaiotama
Pacific oyster	*Crassostrea gigas*	Tio
Packhorse rock lobster	*Jasus verreauxi*	Pawharu
Paddle crab	*Ovalipes catharus*	Papaka
Paua/abalone (black and yellowfoot)	*Haliotis iris, H. australis*	Paūa, kararuri, hihiwa, karahiwa, karariwha, korohiwa, tuke-o-rangi, inaka, mahewa, mariri, wharangi, hauwai, kāhiwahiwa, koeo, koroiwha, maraiwha
Pipi	*Paphies australis*	Pipi, angarite, kakahi, kōkota, ngaingai, taiawa
Prawn killer	*Ibacus alticrenatus*	
Queen scallop	*Zygochlamys delicatula*	Tipa
Red crab	*Chaceon bicolor*	
Ringed Dosinia	*Dosinia anus*	Tuangi haruru
Rock lobster (‘crayfish’)	*Jasus edwardsii, Sagmariasus verreauxi*	Koura, pawharu, kōura, kōura papatea, mata-para, matapuku
Rock oyster	*Saccostrea glomerata*	Tio, repe
Scallop	*Pecten novaezelandiae*	Kuakua, pure, tipai, tupa, tipa
Scampi	*Metanephrops challengeri*	
Sea cucumber	*Stichopus mollis*	
Silky dosinia	*Dosinia subrosea*	Hākari, hahari, harihari
Southern/deepwater tuatua	*Paphies donacina*	Tuatua
Spiny red rock lobster	*Jasus edwardsii*	Kōura papatea, mata-para, kōura, matapuku, weta
Toheroa	*Paphies ventricosa*	Toheroa, moeone, roroa, taiwhatiwhati, tupehokura
Triangle shell	*Spisula aequilatera*	Kaikaikaroro
Trough shell	*Mactra discors*	Kuhakuha, whāngai-karoro
Tuatua	*Paphies subtriangulata, Paphies donacina*	Tuatua, kahitua, kaitua, pipi-tairaki, tairaki, taiwhatiwhati
Freshwater finfish		
Black flounder	*Rhombosolea retiaria*	Mohoao, pātiki mohoao
Brown trout	*Salmo trutta*	Taraute-pākākā, tarautete
Chinook/king salmon	*Oncorhynchus tshawytscha*	Hamana
Eel	*Anguilla* spp.	Tuna, kaiwharuwharu, hau
Rainbow trout	*Oncorhynchus mykiss*	Taraute, tarautete
Pouched lamprey	*Geotria australis*	Piharau, kanakana
Whitebait	*Galaxias* spp.[2]	Inanga
Freshwater invertebrates		
Freshwater crayfish	*Paranephrops spp.*	Koura, kewai
Freshwater mussels	*Hyridella menziesii*	Torewai, kakahi, kaio
Koi carp	*Cyprinus carpio*	
Perch	*Perca fluviatilis*	
Rudd	*Scardinius erythrophthalmus*	
Tench	*Tinca tinca*	
Aquatic plants		
Bladder kelp	*Macrocystis pyrifera*	
Bull kelp	*Durvillaea antarctica*	Rimurapa
Karengo	*Porphyra* spp.	Karengo, parengo
Rehia	*Gigartina* spp.	Rehia
Sea lettuce	*Ulva lactuca*	
Wakame, Asian kelp	*Undaria pinnatifida*	
Watercress	*Nasturtium officinale*	Kōwhitiwhiti, hanea, poniu

References: Dacker (1990), Allan Herbarium (2000), Turner et al. (2005), Wehi and Wehi (2010), MPI (2012g).

1 There may be more names than those listed here. Also, some names are species-level names for different species of this genus, and some names are for different life stages of a species.

2 Juvenile inanga (*Galaxias maculatus*), kōaro (*G. brevipinnis*), giant kōkopu (*G. argenteus*), shortjaw kōkopu (*G. postvectis*) and banded kōkopu (*G. fasciatus*).