‘Don’t Worry Baby, I’ve had the Jab’: A Legal Overview of Genetic Engineering in Pest Control

Caitlin Leigh

A dissertation submitted in partial fulfilment of the degree of Bachelor of Laws (with Honours) at the University of Otago

October 2019

Table of Contents

Acknowledgements

My thanks first to my supervisor, Associate Professor Nicola Wheen, who kept me organised, focused, and feeling okay about the fact that I felt overwhelmed only a month into the process. But mostly, thanks for the chats and being willing to hear me rant.

Second, my thanks to my friends who, when mild teasing was not enough to distract me, gave me their full support and encouraged me to the bitter end. You are all invaluable and I love you dearly.

Last, my thanks to my parents. You may not have seen the progress, but you are – at last – seeing the working product. And I know you are both very proud.

List of Abbreviations

CRISPR	Clustered Regularly Interspaced Short Palindromic Repeats
EPA	Environmental Protection Authority
ERMA	Environmental Risk Management Authority
GE	genetically engineered
GM	genetically modified
GMO	genetically modified organism
HSNO Act	Hazardous Substances and New Organisms Act 1996
MPI	Ministry for Primary Industries
NES	National Environmental Standard
NO	new organism
NPS	national policy statement
RMA	Resource Management Act 1991
RPS	regional policy statement

Introduction

The New Zealand Government intends to be predator free by 2050 and to do this, they have implemented Predator Free 2050. Current pest control techniques such as baiting and trapping are insufficient regarding rats, stoats, and possums. The possibility of a new technology has arisen over the past few years that involves inserting a gene drive into an animal and selecting for a gene such as sterility. Whether such a technique would be permissible within New Zealand would be a question for the EPA to decide under the HSNO Act. However, due to recent amendments to the RMA, local authorities may also have a degree of control over the use of GMOs in their region. This dissertation will consider the legal obstacles to approving a release application, specifically for GM rats, where applications for development and field-testing have already been approved and no adverse effects have resulted.

I Chapter I

A Introduction

Pests are a serious problem and current solutions are ineffective. This chapter discusses three New Zealand pests with a focus on rats and explains how a gene drive could be used to control and possibly eradicate pests within New Zealand. This chapter also discusses some concerns regarding gene drives and some of the regulation surrounding GE.

B Problems with Pests

The aim of the Predator Free 2050 project is to eradicate rats, stoats, and possums from New Zealand.[1] These three pests kill approximately 25 million native birds every year, and are the most damaging mammalian predators that threaten NZ's natural taonga, economy, and primary sector.[2] This dissertation will focus primarily on rats.[3] There are three species of rat in New Zealand: the ship or common rat (*Rattus rattus*), the Norway or brown rat (*Rattus norvegicus*), and the Polynesian rat or kiore (*Rattus exulans*).[4] The ship rat is of greatest conservation concern,[5] but all threaten the survival of many native species such as wētā, snails, lizards and birds.[6] Rats are common agricultural, industrial and domestic predators; they cause a great deal of economic damage, pose a risk to human health,[7] are implicated in food spoilage and the spread of diseases of global concern, and are a key conservation threat across the globe.[8] The benefits of going pest-free include:

- environmental benefits: preserving threatened species, improving biodiversity, creating greater ecological resilience, and restoring our unique ecosystems;[9]
- cultural and social benefits: providing a legacy for future generations, strengthening our natural identity, feeling more connected;[10] and
- economic benefits: saving $70,000,000 per year that it currently costs to manage rats, stoats, and possums, reducing costs and losses from damage and disease in our agricultural and forestry industries, and boosting revenue and employment in our

[1] Predator Free NZ "Predator Free 2050 programme" <https://predatorfreenz.org/about-us/pf-2050/>.
[2] Predator Free NZ, above n 1.
[3] Royal Society Te Apārangi Gene Editing Panel *The use of gene editing to create gene drives for pest control in New Zealand* (Royal Society Te Apārangi, December 2017) at 10.
[4] At 10.
[5] At 10.
[6] Predator Free NZ, above n 1.
[7] Predator Free NZ, above n 1.
[8] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 11.
[9] Predator Free NZ, above n 1.
[10] Predator Free NZ, above n 1.

tourism and trade industries as New Zealand becomes admired for its unique wildlife and pristine landscapes.[11]

Gaining public backing is important for the Predator Free 2050 project.[12] Associate Professor James Russell of the University of Auckland stated that not all New Zealanders want certain introduced species gone, even if they hurt native wildlife.[13] Therefore collective, national-scale action is required, as well as widespread social acceptance about what methods would be used.[14]

Current pest control methods are effective, but also expensive and require extensive planning.[15] For mammalian pests, the solutions so far to control their populations have been to poison or trap them.[16] 1080 (sodium fluoroacetate), a naturally occurring metabolic poison, is currently used against rats.[17] It is cost-effective and safe, especially where trapping is unviable.[18] But this method remains controversial.[19] Current methods may also be unsustainable.[20] Associate Professor Russell stated that current pest control methods may need to either work in combination with or be replaced by new methods for eliminating the last survivors, and social acceptance would depend on the specifics of the methods proposed and would likely differ between groups.[21] He stated that gene editing was a possibility currently in the public's mind.[22] However, Conservation Minister Eugenie Sage stated in the *New Zealand Herald* that gene drives and other gene editing technologies needed to be better understood and accepted by the public before they could be implemented.[23] But despite the public resistance to GMOs in

[11] Predator Free NZ, above n 1.
[12] Jamie Morton "Why public buy-in is critical to NZ's great pest wipe-out" *New Zealand Herald* (online ed, Auckland, 20 May 2019).
[13] Morton, above n 12.
[14] Morton, above n 12.
[15] SL Goldson and others "New Zealand pest management: current and future challenges" (2015) 45 Journal of the Royal Society of New Zealand 31; and R Pech and Matt Maitland "Conservation of native fauna in highly invaded systems: managing mammalian predators in New Zealand" (2016) 24 Restoration Ecology 816 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 10.
[16] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 3.
[17] J McIlroy "Susceptibility of target and non-target animals to 1080" in *Proceedings of the Science Workshop on 1080* (Royal Society of New Zealand, Wellington, 1994) at 90 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 10.
[18] Parliamentary Commissioner for the Environment *Evaluating the use of 1080: predators, poisons and silent forests* (June 2011) as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 10.
[19] C Eason "Sodium monofluoroacetate (1080) risk assessment and risk communication" (2002) 181 Toxicology 523 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 10.
[20] Royal Commission on Genetic Modification *Report of the Royal Commission on Genetic Modification* (July 2001) at 162.
[21] Morton, above n 12.
[22] Morton, above n 12.
[23] Morton, above n 12.

general, an agent that was limited to the target species could be "of tremendous benefit to New Zealand species conservation".[24]

C Gene Drives

A non-lethal means of pest control involves using 'gene drives' to promote the inheritance of a particular gene to increase its frequency in a population.[25] The idea has been present for 20 years, but the technology to make it viable has only been discovered recently.[26]

Bacteria have an immune system called CRISPR that allows them to recognise and inactivate viral DNA.[27] It involves a DNA cutting enzyme that is guided to a specific DNA sequence by guide RNA.[28] The combination of the two allows for the targeted cutting of that particular sequence.[29] This mechanism can be modified to target any DNA sequence.[30] When DNA is cut by CRISPR, the cell signals the DNA to repair itself.[31] By altering the repair information, an organism's genes can be manipulated with greater precision and fewer unintended changes elsewhere in the genome than has previously been possible.[32] Therefore, by using CRISPR-Cas9, a DNA sequence can be targeted and then repaired.

A gene drive involves a cassette: a short DNA sequence that can be engineered and inserted into a chosen site in a host chromosome.[33] This DNA sequence encodes the CRISPR machinery: the cutting enzyme and the guide RNA.[34] The cutting enzyme causes a targeted CRISPR-Cas9-mediated DNA break on the sister chromosome, the inserted gene is then copied across, and the cut DNA strand is repaired.[35] This results in both the maternal and paternal sister chromosomes having identical copies of the cassette, making cells homozygous for the

---

[24] Andrew Hayward "The Hazardous Substances and New Organisms Act, Precaution, and the Regulation of GMOs in New Zealand" (2005) 9 NZJEL 123 at 143.
[25] Kevin Esvelt, Dan Tompkins and James Russell "Gene Drives and Pest Control" (22 August 2018) Gemmell Lab <https://gemmell-lab.otago.ac.nz/news/8-news-events/150-gene-drives-and-pest-control>.
[26] Esvelt, above n 25.
[27] LA Marraffini "CRISPR-Cas immunity in prokaryotes" (2015) 526 Nature 55 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 3.
[28] AR Bassett and JL Liu "CRISPR/Cas9 and genome editing in Drosophila" (2014) 41 J Genet Genomics 7; and KJ Beumer and D Carroll "Targeted genome engineering techniques in Drosophila" (2014) 68 Methods 2937 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 5. Guide RNA is a small RNA sequence.
[29] Bassett, above n 28; and Beumer, above n 28 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 5.
[30] M Jinek and others "A programmable dual-RNA-guided DNA endonuclease in adaptive bacterial immunity" (2012) 337 Science 816 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 3.
[31] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 3.
[32] At 3.
[33] Bruce Conklin "On the road to a gene drive in mammals" (2019) 566 Nature 43 at 44.
[34] At 44.
[35] At 44.

desired gene.[36] There is then guaranteed inheritance of the gene drive and genetic changes to all offspring of the organism[37] instead of Mendelian patterns of inheritance.[38] Genes can therefore be driven through populations with 90 per cent of offspring each generation inheriting the gene drive DNA sequence.[39] An entire population could therefore be manipulated.[40]

1 Gene drives and pest control

Pest control would involve population suppression, therefore the targeted area for the gene drive would likely be within a gene that is essential for viability or fertility.[41] The distortion in inheritance alone is relatively harmless, but coupling the distortion to a genetic trait that affects survival or reproduction creates a powerful tool that can be used to gain control of population growth and persistence.[42] Some studies have shown that suppression works best if the gene drive is targeted towards a gene that is essential for females only, or a gene required for gamete development or reproduction in one sex.[43] Animals inheriting a copy of this gene could be born infertile, eventually causing the population to decline,[44] or alternatively, the drive system could bias the sex ratio towards males.[45] Recent modelling has shown that releasing rats with a self-propagating gene drive that targets fertility would "reliably eliminate the local invasive rodent population".[46] Gene drives are more likely to work if they target multiple genes and multiple sites within those genes.[47] However, increasing the number of target sites within the genome could lead to an increase in off-target effects.[48] Targeting a conserved region of a biologically essential gene is also possible.[49]

---

[36] At 44.
[37] A Burt "Site-specific selfish genes as tools for the control and genetic engineering of natural populations" (2003) 270 Proc Biol Sci 921 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 5.
[38] Conklin, above n 33, at 44. Mendelian patterns of inheritance involve half of the offspring receiving the desired gene as it would only appear in half of the gametes.
[39] "Gene editing technologies" (2019) Royal Society Te Apārangi <https://royalsociety.org.nz/what-we-do/our-expert-advice/all-expert-advice-papers/gene-editing-technologies/> as hyperlinked in Esvelt, above n 25.
[40] Conklin, above n 33, at 44.
[41] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 5.
[42] Esvelt, above n 25.
[43] Burt, above n 37; and A Deredec, A Burt and HC Godfray "The population genetics of using homing endonuclease genes in vector and pest management" (2008) 179 Genetics 2013 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 5.
[44] Burt, above n 37 as cited in KM Esvelt and NJ Gemmell "Conservation demands safe gene drive" (2017) 15 PLoS Biol e2003850 at 2, n 17.
[45] Esvelt, above n 44, at 2.
[46] TAA Prowse and others "Dodging silver bullets: good CRISPR gene-drive design is critical for eradicating exotic vertebrates" (2017) 284 Proc Biol Sci 20170799 as cited in Esvelt, above n 44, at 2.
[47] A Miles and others "Natural diversity of the African malaria vector Anopheles gambiae" (2017) 552 Nature 96.
[48] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 17.
[49] KM Esvelt and others "Concerning RNA-guided gene drives for the alteration of wild populations" (2014) 3 Elife e03401 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 17.

There are current international efforts to establish gene drives for the control of rats.[50] Any gene drive used would likely target fertility, and would be inserted via direct injection into ova.[51] So far, gene drives have been developed in yeast, the fruit fly, two mosquito species,[52] and mice.[53] Regarding the latter, the aim is to produce mice that carry the *sry* gene linked to a gene-drive that ensures that 90 per cent of offspring will be male.[54] While it has promise, there are many unknowns as to whether it can be transferred to other species.[55]

Sterility technology is not a foreign idea. It was considered by the Royal Commission in Recommendation 13.4, which stated that sterility technologies should be one tool in the strategy to preserve opportunities, especially with those GM crops most likely to cross-pollinate with non-GM crops.[56] This recommendation was partially implemented,[57] but to date, the sterility technologies initiative has not been implemented.

2 Possible safety mechanisms

The efficiency of gene drive systems means that safety concerns would need to be carefully considered while developing and field-testing before the GM rats would be deemed safe to release.[58] Possible safeguards include performing gene experiments outside the ecological range of the organism thereby ensuring that any escapees would perish or have no potential mates, using a strain that cannot reproduce with wild organisms, and having a high level of laboratory containment.[59] However, once the GM rats are ready to release, survival and reproduction with wild organisms is essential, though safeguards could still be put in place. The researchers who built the first gene drive simultaneously built a reversal drive to overwrite the original drive on command.[60] Other researchers then did the same with built-in controls,

[50] D Kanavy and M Serr "Sry gene drive for rodent control: reply to Gemmell and Tompkins" (2017) 32 Trends Ecol Evol 315 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 11.
[51] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 6. Gametes are hereditary. Ova (the plural of ovum) are the female gametes and contain half of the chromosomes seen in a somatic cell.
[52] Esvelt, above n 25.
[53] HA Grunwald and others "Super-Mendelian inheritance mediated by CRISPR-Cas9 in the female mouse germline" (2019) 566 Nature 105 as cited in Conklin, above n 33, at 44.
[54] Esvelt, above n 25. The *sry* gene is the key sex-determining gene in most mammals.
[55] NJ Gemmell and DM Tompkins "Gene Drives and Rodent Control: Response to Piaggio et al" (2017) 32 Trends Ecol Evol 314 as hyperlinked in Esvelt, above n 25.
[56] Royal Commission on Genetic Modification, above n 20, at 340.
[57] Wendy McGuinness and Renata Mokena-Lodge *An Overview of Genetic Modification in New Zealand 1973-2013: The First Forty Years* (McGuinness Institute Limited, September 2013) at 27.
[58] Esvelt, above n 49 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 16.
[59] OS Akbari and others "Safeguarding gene drive experiments in the laboratory" (2015) 349 Science 927 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 16.
[60] JE DiCarlo and others "Safeguarding CRISPR-Cas9 gene drives in yeast" (2015) 33 Nat Biotechnol 1250 as cited in Megan Scudellari "Self-destructing mosquitoes and sterilized rodents: the promise of gene drives" (2019) 571 Nature 160 at 161, n 8.

external overrides, or both.[61] Alternatively, 'daisy-chain' gene drives could be used.[62] This is a self-exhausting drive where the gene drive is engineered to lose one 'piece' at a time until it no longer works.[63] The more 'pieces' that are added to the daisy chain, the longer the gene drive would persist in the wild.[64] This could allow the use of gene drives locally without the worry of worldwide spread.[65] Alternatively, researchers are developing gene drives that are unable to spread beyond a target population so that once the continual releases of the gene drive stop, the gene drive becomes diluted with the wild-type versions of the gene and wipes itself out within four years.[66] Exploratory research is being conducted on an international scale, and those involved within New Zealand include local iwi, Predator Free 2050, Genomics Aotearoa, and the Department of Conservation.[67]

D Barriers to Using GM Technology for Pest Control

There are three major barriers to using gene drives for pest control within New Zealand.

1 Knowledge

The first barrier to the use of gene drives for pest control is knowledge-based. Genetic engineering of mice is established, but we are currently less able to genetically engineer rats and other pests,[68] and gene drives developed for mice are unlikely to work in other species.[69] Each species therefore requires a "boutique solution".[70] The development of new genetic engineering technologies has hastened the process, but most species still require specialist expertise and knowledge of their biology.[71] Rats are well-studied mammals with no shortage of knowledge on their reproduction and genomics,[72] however, they are difficult to genetically

[61] Scudellari, above n 60, at 161.
[62] C Noble and others "Daisy-chain gene drives for the alteration of local populations" (2019) 116 Proc Natl Acad Sci U S A 8275 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3 at 16.
[63] Noble, above n 62 as cited in Scudellari, above n 60, at 161. The gene drive would stop working several generations after the original GM rat had been injected with it.
[64] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 16.
[65] At 16.
[66] A Buchman and others "Broad Dengue Neutralization in Mosquitoes Expressing an Engineered Antibody" (2019) preprint at bioRxiv <https://doi.org/10.1101/645481>; and M Li and others "Development of a Confinable Gene-Drive System in the Human Disease Vector, *Aedes aegypti*" (2019) preprint at bioRxiv <https://doi.org/10.1101/645440> as cited in Scudellari, above n 60, at 161.
[67] "Gene Drive Technology" (last accessed July 2019) New Zealand's Biological Heritage <http://www.biologicalheritage.nz/news/news/gene-drive-technology> website has since been removed.
[68] Esvelt, above n 25.
[69] Esvelt, above n 25.
[70] Esvelt, above n 25.
[71] Esvelt, above n 25.
[72] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 11.

manipulate.[73] More knowledge is required before any gene drives are attempted in rats, though progress has been made.[74]

Within the science itself, there are technical difficulties for creating and using gene drives, however that moves beyond the scope of this dissertation.

2 Uncertainty

The second barrier, linked to the barrier of knowledge, involves uncertainty: uncertainty in whether the gene drive will work, whether it will work for pest control, and then what harm would result as is discussed further in the next chapter.[75]

In the large rat population, mutations in the gene drive are almost inevitable.[76] These mutations could inactivate the gene drive or the gene linked to it, leading to a lack of population suppression.[77] These mutations occur as a natural result of inheritance therefore nothing could prevent this. Alternatively, these mutations could cause resistance to the gene drive itself. This would cause population level resistance to the gene drive as those with the resistant versions of the gene will have greater Darwinian fitness.[78] Some pests could already be resistant to the gene drive through population variation.[79] To overcome this present resistance, detailed population genomic surveys of rats would need to be undertaken to assess variation across all potential gene drive target sites.[80] This data would also help identify alternative target sites in the same gene or alternative genes, and help to predict off-target effects.[81] Such a survey would require many individuals. Resistant genes could be used as a safety mechanism, however, as intentionally releasing a resistant gene into a population could be an effective means of reversing the effects of a gene drive.[82]

---

[73] TJ Aitman and others "Progress and prospects in rat genetics: a community view" (2008) 40 Nat Genet 516 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 11.
[74] PM Iannaccone and HJ Jacob "Rats!" (2009) 2 Dis Model Mech 206; and BS Pradhan and SS Majumdar "An efficient method for generation of transgenic rats avoiding embryo manipulation" (2016) 5 Mol Ther Nucleic Acids e293 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 11.
[75] Esvelt, above n 25.
[76] Esvelt, above n 25.
[77] Esvelt, above n 25.
[78] RL Unckless, AG Clark and PW Messer "Evolution of resistance against CRISPR/Cas9 gene drive" (2017) 205 Genetics 827 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 17. This is where natural selection would occur, with fitter individuals surviving.
[79] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 17.
[80] At 17.
[81] At 17.
[82] AM Hammond and others "The creation and selection of mutations resistant to a gene drive over multiple generations in the malaria mosquito" (2017) 13 PLoS Genet e1007039 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 17.

In the past, genetic variants conferring resistance formed at a high rate within laboratories and prevented the gene drives from spreading.[83] The most common mutations were within the DNA sequence of interest, which protected that sequence from editing.[84] Therefore, to minimise this resistance, an appropriate gene would have to be chosen, preferably one that is highly conserved within the species.[85] This conservation of genes would also mean that the organism would be less likely to die as a result of genetically engineering that gene.[86]

Researchers are also uncertain whether the gene drive would affect the health, survival, and reproductive success of mammalian species carrying such modifications.[87] If these were impaired, the bloodline of that specific rat may struggle to persist. Additionally, eradicating rats within New Zealand could leave an ecological gap for another pest species to fill.

3 Logistics and funding

The last barrier involves logistics and funding.[88] Using gene drives for pest control would require the development of a viable gene drive, breeding and repeated release of large numbers of GM rats over large areas, and careful monitoring.[89] In one test for gene drives in mosquitos, repeated release of the GMOs was required to reduce the population number in the wild.[90] The same would be required with GM rats to achieve sufficient gene drive presence within the population. Such an endeavour would require meticulous planning, significant funding, and many years of work. There is therefore uncertainty over whether New Zealand can resource this and see it through to completion.[91]

E Regulation of Genetic Engineering

1 Relevant Acts

There is no clear regulatory framework in New Zealand for evaluating gene drive technologies as a method for controlling pests.[92] However, multiple Acts would likely be involved, including the HSNO Act, the Animal Welfare Act 1999, the Agricultural Compounds and Veterinary

[83] J Champer and others "Novel CRISPR/Cas9 gene drive constructs reveal insights into mechanisms of resistance allele formation and drive efficiency in genetically diverse populations" (2017) 13 PLoS Genet e1006796 as cited in Scudellari, above n 60, at 161.
[84] Champer, above n 83 as cited in Scudellari, above n 60, at 161.
[85] Scudellari, above n 60, at 161. Highly conserved genes are often genes that are essential to survival and have therefore been inherited in the past.
[86] At 161.
[87] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 11.
[88] Esvelt, above n 25.
[89] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 11.
[90] AR North, A Burt and HCJ Godfray "Modelling the potential of genetic control of malaria mosquitoes at national scale" (2019) 17 BMC Biol 26 as cited in Scudellari, above n 60, at 162.
[91] Esvelt, above n 25.
[92] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 14.

Medicines Act 1997, the Biosecurity Act 1993, and the Conservation Act 1987.[93] Additionally, New Zealand has other legal instruments to consider including the Treaty of Waitangi[94] and the RMA.[95]

The Biosecurity Act controls pests in two ways: via pest management plans, which are wider and focus on how we stop the pests spreading;[96] and via pest management pathways, which involve managing the pathway the pest uses to spread.[97] The Act itself relates to pest management, however plans and pathways are the only mechanisms it provides for, and the gene drive is unlikely to be covered by either. As such, the Biosecurity Act is outside of the scope of this dissertation, however it could be investigated in future research.

2 Institutional overview

The regulation of GM involves a relatively straightforward institutional framework. The EPA is the main decision-making body for GMOs, and it makes these decisions under the HSNO Act. The weight carried by the methodology used by the EPA is seen in s 9(5).[98] The EPA can delegate decision-making power to other authorities, including Institutional Biological Safety Committees, but only for low-risk GMOs.[99]

The Minister for the Environment also has a decision-making role regarding GMOs under the call-in powers in s 68 of the HSNO Act.[100] The Ministry for the Environment advises the Minister about these call-in powers. The call-in powers have never been exercised. This will be examined further in the next chapter.

The Department of Conservation, under the control of the Minister of Conservation, functions to advocate and promote the conservation of New Zealand's natural and historic resources, and it therefore also plays a part in pest control.[101]

---

[93] At 14.
[94] Law Commission *Liability for loss resulting from the development, supply, or use of genetically modified organisms* (NZLC, SP14, 2002) as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 15.
[95] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 15. Regarding the Treaty of Waitangi 1840, the Waitangi Tribunal Report recommended that Māori have a greater interest in GM (Anna Kingsbury "Intellectual Property" (2011) 262 NZLJ 273 as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 15).
[96] Sections 59–78.
[97] Sections 79–98.
[98] Hayward, above n 24, at 148.
[99] At 149.
[100] Christina Voigt "The Precautionary Principle and Genetic Engineering in New Zealand: Legal and Ethical Implications" (2002) 6 NZJEL 43 at 71.
[101] At 73.

F Conclusion

This chapter showed that gene drives could be used as a method of pest eradication to replace trapping and baiting, but there are barriers to using them. This chapter also discussed mechanisms that could be put in place to decrease the risk that gene drives pose. Regardless whether gene drives could be used, that use would require years of work. Central government should therefore consider increasing any investigations into gene drives so that the development process can get underway, the public can be educated in time for any application submissions under the HSNO Act, and the government can reach its Predator Free 2050 goal.

II Chapter II

A Introduction

The HSNO Act is on the forefront of GMO regulation, including using gene drives for pest control. This chapter outlines the process of an application for the release of GM rats, and briefly discusses where such an application could fail, including potential animal welfare concerns, international concerns, public concerns, Māori concerns, and the involvement of the precautionary approach.

B The Act

1 Application process

The first question to ask is whether the GM rat is a 'new organism' under the definition given in the Act.[102] This question would be determined under s 26, and the EPA must give public notice of the application so that the public can make submissions.[103] If the organism does not fit this definition, the HSNO Act does not apply. However, GM rats would be classified as a 'new organism' therefore the HSNO Act would apply.[104] Development of such organisms, importation for release, and release from containment would therefore be prohibited unless the EPA granted approval.[105] The applicant would therefore need to file an application with the EPA for approval under the HSNO Act.[106] This dissertation solely concerns the approval of release applications.

Under s 25(2), if the GM rat falls under sch 2, no approval could be granted for any application. This includes most Australian possums. GM rats are not included in sch 2, and therefore this exemption would not apply. However, future applications of GM possums could be declined.

Under s 25(6), no application regarding a NO would be approved if the NO were subject to an innovative TNP application or innovative medicine application. The definition of an 'innovative TNP application' is found in the Agricultural Compounds and Veterinary Medicines Act, but is unlikely to apply to GM rats as it refers to an active ingredient, not a GMO.[107] The definition for an 'innovative medicine application' is found in the Medicines Act 1981, which would also be unlikely to apply as it also refers to an active ingredient.[108] Unless

[102] Section 2A.
[103] Section 53(1).
[104] Section 2A(1)(d).
[105] Section 25(1)(b).
[106] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 13.
[107] Section 72(1).
[108] Section 23A.

the application concerned importing the gene drive itself, it would be unlikely that this exemption would apply as gene drives are inserted into the organism before release.

Applications for an unconditional release from containment or for importing to release are submitted under s 34, and both require the approval of the EPA. The EPA may approve or decline these applications.[109] Application requirements are found in s 34(2). GMO releases cannot be rapidly assessed.[110] Any application approved under s 38 must be granted without controls. The EPA may approve an application if it meets the s 36 minimum standards and, taking into account the effects of the organism, the effects of any inseparable organism, and the matters in s 37, the positive effects outweigh the adverse effects. The EPA may decline an application if it does not meet the s 36 minimum standards or, taking into account the effects of the organism, the effects of any inseparable organism, and the matters in s 37, the positive effects outweigh the adverse effects, or there is insufficient information available for the EPA to assess the adverse effects.[111] The decision to approve or decline the application is therefore discretionary.

Section 36 contains the minimum standards; if an application fails to meet these standards it will automatically be declined. The only relevant minimum standards to the release of GM rats would be ss 36(a) and (d). However, whether an application meets these standards also depends on the definition of 'significant', which is not defined in the Act.

Under s 36(a), the EPA must decline an application if the NO is likely to cause any significant displacement of any native species within its natural habitat. The release of GM rats could displace kiore from their natural habitat. Whether such an application would fail to meet this minimum standard would depend on the definition of 'native' and 'natural habitat'. While kiore have been called New Zealand's 'native rat',[112] 'native' is not defined in the Act, nor in any HSNO Act cases. However, *The New Zealand Oxford Dictionary* defines 'native' in many ways. One definition states that native means "indigenous", and emphasises that in this context, 'native' is often interchangeable with 'Māori' or 'New Zealand' and the animal or plant resembles a similar counterpart overseas, for example a 'native bee'.[113] However, all species

[109] Section 38.
[110] Section 35.
[111] Section 38(1)(b).
[112] Michael Lee "Pacific Rats – Wildlife Pests and Cultural Treasures" (2002) 306 Forest & Bird 11 at 11.
[113] "native" in Tony Deverson and Graeme Kennedy (eds) *The New Zealand Oxford Dictionary* (Oxford University Press, online ed, 2005) Oxford Reference <https://www.oxfordreference.com/view/10.1093/acref/9780195584516.001.0001/m-en_nz-msdict-00001-0035513?rskey=65uFWz&result=1>.

of rat are present overseas. Furthermore, all rats in New Zealand were imported: the Norway rats arrived in the 1700s, the ship rats arrived in the late 1800s, and kiore came with the Polynesian ancestors of Māori in approximately 1280. When does an animal become a native animal? Where is the divide between a native species and a non-native species? Can it mean endemic, where the species is found nowhere else on Earth? Can the species' effects on the environment be considered? Would significant cultural meaning to a people group be considered? The words 'natural habitat' are also ambiguous as rats have made themselves a home in New Zealand. At what point could that become a 'natural habitat'? Rats are known to be adaptable, and the habitat they have claimed within New Zealand could now be defined as their 'natural habitat'. It is notable that the subsection states that the displacement must be 'within' the species' habitat, as opposed to 'from' the habitat. Some could therefore argue that kiore, the earliest rats in New Zealand and of significant cultural value to Māori, are native species, and the release of GM rats could significantly displace the kiore population within their natural habitat. The application would therefore not meet the minimum threshold and would be declined. However, this is unlikely to occur, as the rats would continue to live in their habitat, their offspring would be simply be sterile; they would not be displaced from that habitat. It is therefore unlikely that an application would be declined for this reason.

Under s 36(d), the EPA must decline an application if the NO is likely to cause any significant adverse effect to New Zealand's inherent genetic diversity. The release of a GM rat could affect the inherent genetic diversity within kiore in New Zealand. This subsection is broader than s 36(a) as it prevents an application being approved if there is any significant adverse effect, and does not specify what that adverse effect is, unlike s 36(a) where there must be significant displacement. Whether this subsection would prevent an application being approved depends on the definition of 'inherent' in relation to New Zealand's genetic diversity. This is not defined in the HSNO Act nor in any HSNO Act cases. The genetic diversity is not limited to one species either, but instead involves the genetic diversity inherent to New Zealand. Again, this raises questions of what animals would be part of New Zealand's genetic diversity, as including all animals would rally against current efforts by the government to eradicate pests. It is therefore possible that pests could be excluded from the definition of New Zealand's inherent genetic diversity, in which case this subsection would not apply. Alternatively, if it did include rats, it is likely that eradicating rats through a gene drive would not be classified as a 'significant' adverse effect. However, it is possible that GM rats could affect kiore, and this could be a

significant adverse effect if kiore are a native species. The application would then likely be declined.

Assuming the application met the s 36 minimum standards, s 37 must then be addressed. Section 37 contains additional matters for the EPA to consider. None of those matters are relevant to GM rats being released.

An application could also be submitted for a conditional release.[114] Control requirements are found in ss 38A–38H and could include requiring monitoring and reporting of the organism[115] and requiring contingency plans to be developed to manage potential incidents.[116] For example, the applicant could be involved in monitoring ships to ensure that GM rats do not leave New Zealand. Once the applicant's approval runs out, an application can be made under s 34A for release approval.

2 Public notification

Under s 53, the EPA must publicly notify any application for a conditional release, an import to release, or a release from containment.

The public notice must state that any person can make a written submission on the application, the closing date for the receipt of submissions, the place where the application and accompanying information may be viewed, and the address for service of the EPA and the applicant, unless any of this information has been withheld in accordance with the OIA or in accordance with the HSNO Act.[117]

When the EPA receives the application, it must notify the Minister for the Environment, any government departments and Crown entities likely to have an interest in the application, the Department of Conservation if the application is for a NO, and any local authority likely to have an interest in the application.[118] These departments could include the Ministry for the Environment and MPI.[119] Any submission of any of these interested parties do not outweigh other submissions when the EPA is deciding the application. This is excepting the Department of Conservation, whom the EPA must consult and have particular regard to.[120]

[114] Section 38A.
[115] Section 38D(1)(b).
[116] Section 38D(1)(d).
[117] Section 53(3).
[118] Section 53(4).
[119] Schedule 1.
[120] Sections 38G, 49F and 58.

There have been questions recently whether the HSNO Act is adequate, in particular whether the Act protects an economic and environmental bottom line or whether it has "shown cracks".[121] Can the HSNO Act adequately balance the needs of the modern "knowledge economy", including the increase and advancement of knowledge and technology, against the concerns of the public majority and the precautionary principle?[122] At all times, however, the requirement for public involvement must include approaching issues with a spirit of inquiry and not attempting to remain in an already developed position.[123]

C Call-In Power

Under s 68 of the HSNO Act, the Minister for the Environment has a 'call-in' power. The Minister may therefore direct that they will decide an application instead of the EPA. The Minister can use this power if the decision will have significant cultural, economic, environmental, ethical, health, international, or spiritual effects; or will have significant effects in an area in which the EPA lacks sufficient knowledge or experience.[124] The Minister, on exercising this power, must give reasons for their decision.[125] The purpose of this power is to enable the Minister "to intervene if on a public policy level there is a risk that the 'big picture' as it affects New Zealand on a national and international level may be overlooked or insufficiently taken into account in relation to a specific application".[126] It is "a backstop tool to allow the Minister to make decisions on applications that have unusual or significant features".[127]

1 Recommendations to the Minister

The EPA makes the vast majority of decisions because the HSNO Act puts a clear onus on the applicant to advise of all adverse effects and on the EPA to be satisfied as to the control of adverse effects of any NO.[128] However, the EPA does send all applications to the Ministry for the Environment, and Ministry officials decide which applications to pass on to the Minister.

---

[121] Hayward, above n 24, at 124.
[122] At 124.
[123] Toi te Taiao: the Bioethics Council *The Cultural, Ethical and Spiritual Dimensions of the Use of Human Genes in Other Organisms* (the Bioethics Council, August 2004) as cited in Richard Hindmarsh and Rosemary Du Plessis "GMO regulation and civic participation at the "edge of the world": the case of Australia and New Zealand" (2008) 27 New Genetics and Society 181 at 192.
[124] Sections 68(1)(a) and 68(1)(b).
[125] Section 68(2).
[126] *Mothers Against Genetic Engineering Incorporated v Minister for the Environment* HC Auckland CIV-2003-404-673, 7 July 2003 at [145] [*MAdGE*].
[127] Marian Hobbs *Government Response to the Royal Commission on Genetic Modification: Legislative changes for New Organisms – Paper 6: Ministerial Call-In and Confidential Supporting Information* (Office of the Minister for the Environment, 2001) at 25.
[128] *MAdGE*, above n 126, at [145].

This process was examined in *Mothers Against Genetic Engineering Incorporated v Minister for the Environment* ('*MAdGE*') where an argument on appeal was that the Minister had not used the call-in power.[129]

In *MAdGE*, an advisor for the Ministry stated that the process for deciding which applications to pass on takes into account the timeframe available for a call-in and the need to consider as efficiently as possible and with limited resources, whether and if so in what form the Minister should be advised about the possibility of calling-in a particular application.[130] A policy analyst from the HSNO Group stated that the EPA advises the Ministry of any application received and the call-in period applicable.[131] At the time of the case, letters of advice from ERMA went to the manager of the Working with Central Government group.[132] The manager would undertake an initial review and then give the letters to a policy analyst for a more detailed review.[133] The policy analyst would consider whether a decision on the application would have any of the significant effects that would activate the call-in power.[134] If the policy analyst decided that the application would trigger the call-in criteria, they would advise the manager, who would then advise the Minister. Though policy analysts were "aware of this process", there was no written procedure.[135]

Potter J held that the process used by the Ministry was justly criticised,[136] and said that a "clear protocol is needed, supported by systems within the Ministry to ensure that the protocol is observed and that the Ministry is patently accountable in respect of the process".[137] Potter J suggested that "such a protocol would include a report to the Minister tendering the advice of the Ministry in respect of each application, whether or not the advice is to recommend consideration of call in".[138] 'Significant' and 'significant effects' are not defined in the HSNO Act, but Potter J suggested that there is a high threshold for significant effects, and that the power for a call-in would only be used in exceptional circumstances.[139]

---

[129] *MAdGE*, above n 126.
[130] At [69].
[131] At [77].
[132] At [77]. ERMA was disestablished in 2011 and replaced by the EPA (Environmental Protection Authority Act 2011).
[133] At [77].
[134] At [77].
[135] At [77].
[136] At [147].
[137] At [159].
[138] At [159].
[139] *MAdGE*, above n 126, at [145] as cited in an email from Amanda Baldwin (Employee at the Ministry for the Environment) to Caitlin Leigh (author) regarding s 68 of the HSNO Act (30 August 2019).

The Minister in *MAdGE* never saw the letter despite her office receiving it; she relied on her advisers at the Ministry to bring to her attention any potential significant effects relating to the application, but they did not.[140] The Minister argued that she did not personally consider every application notified to her by ERMA, but instead relied on her officials to undertake an assessment and advise whether she should exercise her call-in powers.[141] She argued that the statutory time limit constraint for decisions by the Ministry meant that Parliament did not expect the Minister or the Ministry on her behalf to undertake a detailed analysis of the application, and it would be unreasonable to expect otherwise.[142] A written protocol would therefore be beneficial so that it could be scrutinised if confusion arose over whether the Minister should have exercised the call-in power.

After contacting the Ministry via email, an official stated that the Ministry considers applications on a case-by-case basis, and considers whether the application is significant, but the email gave no further specific information.[143] Additionally, there does not appear to be any written protocol at the current time.

2 The Minister's decision

By the time of *MAdGE*, there had been no applications where the Ministry had considered that the call-in power would be appropriate.[144] To date, there have been no exercises of the Minister's call-in power. An application being controversial "does not … mean that the [EPA] should not make a decision on the application".[145] The types of applications that would cause an exercise of the call-in power are therefore unknown.[146]

It is possible that the first release application would activate the call-in power, as recommended by the Royal Commission in 2001.[147] There have been no releases of GMOs to date except for live vaccines, therefore it is unknown what the EPA and the Ministry would consider to be a successful application. Recommendation 13.2 from the Royal Commission stated that before the first release of a GM crop, the Minister should exercise the call-in powers in order to assess the likely overall economic and environmental impact on the preserving opportunities

[140] *MAdGE*, above n 126, at [92].
[141] At [65].
[142] At [134].
[143] Email from Baldwin, above n 139.
[144] *MAdGE*, above n 126, at [84].
[145] At [156].
[146] McGuinness, above n 57, at 95.
[147] Royal Commission on Genetic Modification, above n 20, at 339.

strategy.[148] The Royal Commission defined the first GMO release application approval as a 'watershed' decision that would require a considered and careful approach.[149] However, Parliament examined the Recommendations and stated that it would not decide to definitively call-in the first release application before such an application arose.[150] Additionally, as Potter J in *MAdGE* stated, if Parliament had intended that the Minister to exercise their discretion to call-in an application as a matter of policy in the first or any such application, it could have said so, but chose not to.[151]

3 The decision-making process

If the Minister does wish to decide the application, they must notify the public through the Gazette within 15 working days after receiving the application from the EPA.[152] A copy of the Gazette notice would then be sent to the EPA, and the EPA would inquire into and report on the application.[153] The Minister can appoint people with relevant knowledge or experience to sit with the EPA and exercise the power of a member of the EPA.[154] Once the inquiry is complete, the EPA would submit a written report on the application to the Minister with recommendations and reasons.[155] The report would be sent to the applicant and those who made submissions. Within 20 working days of receiving the report from the EPA, the Minister would give their decision in writing, including reasons, to the applicant and every person who made a submission, and would publicly notify the decision.[156]

This includes minimal information on the actual decision-making process that the Minister would use. The only useful part of the Act is s 73, which states that when the Minister is considering their decision, they must have regard to the report and recommendations of the EPA, and the reasons for calling-in the application. Again, this leads to more uncertainty in the call-in process.

---

[148] At 339.
[149] At 338.
[150] Marian Hobbs, Minister for the Environment "The Government's response to the recommendations of the report from the Royal Commission on Genetic Modification" (Genetic Modification Summit, Duxton Hotel, Wellington, 27 November 2001).
[151] *MAdGE*, above n 126, at [155].
[152] Hazardous Substances and New Organisms Act 1996, s 69.
[153] Sections 71 and 72.
[154] Section 70.
[155] Section 72.
[156] Section 73.

D Main Issues Resulting in Refusal

This next section addresses five possible issues that could result in the EPA or the Minister refusing an application for the release of GM rats. These include animal welfare concerns, international concerns, public objections, Māori objections, and the presence of the precautionary approach in s 7.

1 Animal welfare concerns

As the gene drives would affect rats, animal welfare must be considered. The Animal Welfare Act 1999 would be used, particularly pt 6 which involves using animals in research, testing, and teaching. However, welfare concerns would be more relevant to field testing and the insertion of a gene drive, not necessarily a release.[157] Such concerns are therefore beyond the scope of this dissertation.

2 International concerns

Gene drives would be present for several years in the population, which could afford the GM rats time to travel overseas.[158] Rats are pests but also important providers of ecosystem services such as pollination, and are critical elements of ecosystem food webs.[159] Additionally, they have cultural significance and value to many people. If GM rats were to travel overseas, it would effectively cause a 'worldwide release' with worldwide effects.[160] Such effects on the environment may be irreversible. This has implications for New Zealand's social license to develop gene drives that could potentially threaten other countries' native or sacred species.[161] It could be that releasing a gene drive capable of spreading beyond the New Zealand rat population is unsafe unless international spread is the explicit goal.[162] Moving forward without the permission of every other country could therefore be deemed "highly irresponsible".[163]

The gene drive used in malaria prevention required an international agreement to deploy it among all affected nations, and something similar could be used here.[164] The United States National Academies of Science reviewed gene drives and said research would need to be

[157] Unless there is a right to being be fertile and have offspring, which would be problematic as many pets are sterilised by their owners without legal repercussions. Indeed, it could be argued that refusing to sterilise some animals is more irresponsible and unethical than sterilising them.
[158] JM Marshall "The effect of gene drive on containment of transgenic mosquitoes" (2009) 258 J Theor Biol 250 as cited in Esvelt, above n 44, at 2.
[159] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 11.
[160] At 11.
[161] At 16.
[162] Esvelt, above n 44, at 2.
[163] At 3.
[164] At 4.

international and have "clearly-defined global regulatory frameworks, policies, and best practice standards for implementation".[165]

GM rats could also be transported overseas deliberately to reduce economic costs elsewhere[166] and therefore bypass GMO regulations in those countries. This occurred with the calicivirus responsible for Rabbit Haemorrhagic Disease, which was smuggled into New Zealand to mitigate the economic damage caused by rabbits.[167] Overall, gene drives are equivalent to creating a new and highly invasive species, and "will likely spread to any ecosystem in which they are viable, possibly causing ecological change".[168]

3 Public concerns

There have been concerns regarding the impact of these biotechnologies on the uniqueness of humans, our relationships with other living organisms, and how genetic knowledge could be used for both our benefit and that of the planet.[169] Many people, especially Māori, see humans within networks intertwined with other living organisms and physical environments.[170]

The BioHeritage Challenge survey in 2017 assessed the perceptions, beliefs, and attitudes of 8,000 New Zealanders including approximately 1,000 Māori.[171] In relation to potential pest control technologies including gene drives, 32 per cent of those surveyed were comfortable with using gene drives for pest control, 50 per cent were undecided or wanted strong controls, and 18 per cent felt that gene drives should never be used.[172] Associate Professor Russell believed some people would likely always be opposed to GM, even if the risks were shown to be minimal.[173]

It is unknown whether an unauthorised release of a gene drive system would even generate a social backlash or ecological consequences.[174] If such technology were developed using appropriate laboratory safeguards, it would lower the risk of adverse events and increase public

[165] National Academies of Sciences, Engineering, and Medicine *Gene Drives on the Horizon: Advancing Science, Navigating Uncertainty, and Aligning Research with Public Values* (The National Academies Press, 2016) as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 16.
[166] D Pimentel, R Zuniga and D Morrison "Update on the environmental and economic costs associated with alien-invasive species in the United States" (2005) 52 Ecol Econ 273 as cited in Esvelt, above n 44, at 2. Rats cause USD 19,000,000,000 per year worth of damage (Pimentel, above n 166).
[167] P O'Hara "The illegal introduction of rabbit haemorrhagic disease virus in New Zealand" (2006) 25 Rev Sci Tech 119 as cited in Esvelt, above n 44.
[168] Esvelt, above n 44, at 2.
[169] Hindmarsh, above n 123, at 192.
[170] At 192.
[171] "Gene Drive Technology", above n 67.
[172] "Gene Drive Technology", above n 67.
[173] Morton, above n 12.
[174] Esvelt, above n 44, at 4.

confidence.[175] However, to get an ideal outcome would require a great deal of luck and any incident could cause the public to lose faith in the technology entirely.[176]

Aside from technological concerns, two major issues raised by the public have been that large corporations were pressuring scientists and policy makers to introduce GM into New Zealand, and that those same corporations were going to commercialise and profit from GM.[177]

Overall, if the public conversation regarding GM goes on for too long, New Zealand could miss opportunities.[178] The Minister for the Environment has stated that while the public's cautious approach was the correct one, the development in technology since the HSNO Act was created needed to be addressed by the Government.[179] Current regulations are becoming "quickly outdated" and are creating compliance issues.[180] Despite this, the Minister stated that there was no urgency.[181] Ultimately, the New Zealand public will decide what technologies are acceptable, and that is balanced against the need to secure a future for threatened and endangered biodiversity.[182] As Professor Peter Dearden, the director of Genetics Otago, stated, nothing would come of GMOs without extensive public consultation.[183]

4 Māori views

If an application for GM rat release were publicly notified, one possible group who could make submissions to the EPA would be the Māori community. There are two possible reasons for this: that gene editing is contrary to tikanga and that GM rats may affect kiore.

(a) GM itself

Māori views on GM are varied.[184] Some Māori argue that the transference of genetic material is abhorrent and corrupts the whakapapa of those species used and destroy their mauri (a strict tikanga approach).[185] Some "understand the respect for the environment as having a reverence for the land and indigenous flora and fauna" and using biotechnology "undermines this respect

[175] Akbari, above n 59 as cited in Esvelt, above n 44, at 4.
[176] Esvelt, above n 44, at 4.
[177] Karen Cronin and others *Hands across the water : developing dialogue between stakeholders in the New Zealand biotechnology debate : a project for the Ministry of Research, Science and Technology (MORST) 'Dialogue' Programme* (Victoria University of Wellington, Wellington, 2004) at 37–39.
[178] Kate Nicol-Williams "NZ will fall behind unless archaic gene editing law is updated, scientists say" *1 NEWS NOW* (online ed, New Zealand, 24 June 2019).
[179] Nicol-Williams, above n 178.
[180] Nicol-Williams, above n 178.
[181] Nicol-Williams, above n 178.
[182] "Gene Drive Technology", above n 67.
[183] Skara Bohny "Genetic modification floated as effective wasp-control tactic" *Stuff* (online ed, New Zealand, 19 December 2017).
[184] Voigt, above n 100, at 59.
[185] Waitangi Tribunal *Ko Aotearoa tēnei* (Wai 262, 2011) at 78.

and is perceived as culturally insensitive".[186] Such gene editing is at odds with Māori tikanga as it may interfere with natural processes relating to whakapapa and violate the tapu of different species.[187] Relevant ethical considerations therefore include whakapapa (of both the organism, and of the relationship/kinship between humans and other species), tika (what is right and correct), manaakitanga (cultural and social responsibility/accountability), and mana (justice and equity).[188] Additionally tapu (restrictions), kaitiakitanga (guardianship), and whānaungatanga (support of relatives) are relevant.[189] This would likely result in submissions against GE and against GM rats. However, other Māori believe that "the concern takes a more relative character where the issue is one of preserving what might be useful for the future".[190] This involves a more flexible approach for projects with medical benefits and not involving crossing species boundaries.[191] This view could allow for the development and release of GM rats for pest eradication and environmental preservation purposes.

There is a general feeling, however, that there is insufficient education about GM and GE within the Māori community.[192] In one survey, some Māori surveyed wanted more engagement and discussion with the Māori community when decision-making occurred.[193] Ultimately, that is dependent on policy makers and the EPA.

(b) GM rats

Regarding GM rats specifically, there is the possibility that these rats could breed with kiore. As kiore were an important food source for Māori,[194] some groups have argued that kiore should be seen as one of the resources their ancestors had in mind which the Treaty of Waitangi refers to as 'taonga'.[195] Taonga vary by iwi, hapū, and whānau, and no two will have the same mātauranga or the same kōrero about a particular taonga species.[196] If an indigenous species has been genetically modified, "iwi as kaitiaki or guardians … may believe that the species'

[186] Voigt, above n 100, at 59.
[187] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 12.
[188] M Hudson and others *Te Mata Ira: Guidelines for genomic research with Māori* (Te Mata Hautū TaketakeMāori & Indigenous Governance Centre, University of Waikato, 2016) as cited in Royal Society Te Apārangi Gene Editing Panel, above n 3, at 12.
[189] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 12.
[190] Voigt, above n 100, at 59.
[191] Waitangi Tribunal, above n 189, at 78.
[192] Cronin, above n 177, at 43.
[193] At 44–45.
[194] For more information on kiore within Māori culture, see Museum of New Zealand: Te Papa Tongarewa "Kiore in Māori culture" Collections Online – Museum of New Zealand Te Papa Tongarewa (22 July 2019) <https://collections.tepapa.govt.nz/topic/1442>.
[195] Lee, above n 112, at 11.
[196] Waitangi Tribunal, above n 189, at 65.

integrity has been interfered with and therefore also the spiritual integrity or mauri of the species".[197] Some believe that the kaitiaki relationships between Māori and the species they say are taonga, and the mātauranga Māori associated with such species, should take priority over the interests of scientific research and commerce.[198] They argue that kaitiaki should have a veto power over commercial and scientific exploitation of taonga species.[199] However, there is a general consensus regarding both the lack of communication and the lack of involvement with the Māori community when decisions are made, as stated in the previous section. There is criticism of how Māori values are given a low priority when decisions are made about GMOs.[200] One report believes that the greater the effects of the proposed research or use upon the kaitiaki relationship, the greater the right of involvement.[201]

The HSNO Act contains provisions designed to ensure that Māori values are considered during decision-making regarding GMOs.[202] Under the Treaty of Waitangi section in s 8, the principle of active protection could mean that the EPA and Minister must take into account Māori views and objections.[203] Section 6(d) specifically provides for the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, wahi tapu, valued flora and fauna, and other taonga. Additionally, Goddard J in *Bleakley v Environmental Risk Management Authority* (*'Bleakley'*) held that the inclusion of 'culture and traditions' in s 6(d) was to "ensure that the relationship of Māori with taonga is not read down, dissipated or minimised by those charged with exercising functions, powers and duties under the Act".[204] The Court therefore found that the EPA had an obligation to take into account the relationship of Māori with their spiritual taonga.[205] None of these grant a veto power to the objections of Māori, but those objections that relate to the modification of indigenous and taonga species should hold more weight.[206] This could therefore be a reason that an application for the development or release of GM rats is declined. Regardless whether the application is approved, the applicants ought to begin a conversation with iwi and involve them in the application process.

[197] Voigt, above n 100, at 60.
[198] Waitangi Tribunal, above n 189, at 63.
[199] At 63.
[200] At 76.
[201] At 87.
[202] At 86.
[203] Hayward, above n 24, at 141–142.
[204] *Bleakley v Environmental Risk Management Authority* [2001] 3 NZLR 213 at [15] per Goddard J [*Bleakley*].
[205] At [72]–[73] per McGechan J.
[206] Royal Commission on Genetic Modification, above n 20, at 38 as cited in Hayward, above n 24, at 142.

Māori communities will need to be well informed of the implications, benefits, and risks associated with gene editing in pest control,[207] and there must be Māori participation in decision-making regarding use of these techniques.[208] Their views must be given weight, though weight short of a veto power.

Where some Māori would not want genetic engineering to occur within New Zealand, these views should not be brushed to the side and 'solved' with public education. New Zealand is a multi-cultural society with many different beliefs, and if we are to stay true to the principles of the Treaty of Waitangi, Māori views must be given weight and taken seriously. Māori should be sought out to be actively involved at all stages of the application process, whether their views become the deciding factor in application approval or not.

5 Precautionary principle

The precautionary principle states that where there are threats of serious or irreversible damage, lack of full scientific certainty must not be used as a reason for postponing cost-effective measures to prevent environmental degradation.[209] The trigger for the precautionary principle is twofold: an existing potential of serious or irreversible harm, and some scientific ground upon which this potential is based, even if there is no scientific consensus.[210]

Precaution is a complicated matter. Too little precaution can result in unjustifiable risks, while too much precaution can constrict or strangle the growth of the knowledge economy.[211] There is a strong and a weak approach to the precautionary principle: the strong approach states that any risk is unacceptable while the weak approach weighs up the risks and benefits.[212] GMOs have been said to constitute a trigger for the precautionary principle as they carry serious and irreversible risks, and there is a lack of scientific consensus as to the probability of the dangers occurring.[213] Their outcomes, possible risks, and magnitude are unclear and controversial, therefore one article argues the need for a strong precautionary approach.[214] However, within New Zealand, a weak precautionary approach has been taken with s 7 of the HSNO Act. The

[207] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 12.
[208] At 12.
[209] *Rio Declaration on Environment and Development* GA Res 151/26 (1992), principle 15.
[210] Hayward, above n 24, at 138.
[211] PF Fuiava "Can Local Government Control Land Use Involving Genetically Modified Organisms?" (2004) 8 NZJEL 295 at 297.
[212] Hayward, above n 24, at 139.
[213] At 138.
[214] Voigt, above n 100, at 44.

principle also requires a specific type of action: to avoid or minimise the possibility of harm, even if there is scientific uncertainty regarding the likelihood of the harm.[215]

(a) How the precautionary principle applies to the HSNO Act

Within the HSNO Act, the precautionary principle has been legislated in s 7.

> 7 Precautionary approach
>
> All persons exercising functions, powers, and duties under this Act including, but not limited to, functions, powers, and duties under sections 28A, 29, 32, 38, 45, and 48, shall take into account the need for caution in managing adverse effects where there is scientific and technical uncertainty about those effects.

The initial doctrine of HSNO is inherently precautionary as it includes a fundamental acknowledgement that once a gene enters the environment, it will remain there permanently.[216]

Section 7 is not a particularly descriptive example as it merely states that "caution" should be used where scientific and technical uncertainty exist.[217] In practice, the EPA has the discretion to determine how economic values are to be weighed against potential environmental damage, and due to this discretion, the EPA have set the Hazardous Substances and New Organisms (Methodology) Order 1998.[218] The guidelines in this Act are only guidelines; they do not have formal status under the HSNO Act.[219] The Order places science first and gives precedence to a scientific approach over a non-scientific approach.[220] The EPA is required to apply the Order when making decisions.[221] Under the Order, it is important to the decision-making process that a decision will be made in the most straightforward and efficient way apparent to the EPA.[222] The EPA is therefore forced to have an acute sense of the risks borne by a GMO before release is to occur,[223] and the public is therefore asked to place their trust in the EPA's scientific knowledge and ability to make the correct decision.[224] However, the EPA includes the HSNO Committee, who decide the applications under the HSNO Act. The Committee is currently

[215] Hayward, above n 24, at 140.
[216] At 155–156.
[217] Voigt, above n 100, at 85.
[218] At 85.
[219] At 58.
[220] Schedule 1 cl 25(1).
[221] Schedule 1.
[222] Environmental Risk Management Authority *Annotated Methodology for the Consideration of Applications for Hazardous Substances and New Organisms under the HSNO Act 1996* (Environmental Risk Management Authority of New Zealand, Wellington, 1998) at 11 as cited in Voigt, above n 100, at 86.
[223] Hayward, above n 24, at 156.
[224] Fuiava, above n 211, at 297.

chaired by the former Chair of Ngā Kaihautū Tikanga Taiao (the EPA's Māori Statutory Advisory Committee) and includes members specialising in different scientific fields, showing that the EPA are not making purely commercial decisions.[225]

Section 7 states that decision-makers must take into account of the need for caution in managing adverse effects. This section does not state that applications with adverse effects should be declined in order to accord with the precautionary approach. Instead, it presumes that adverse effects will arise, and so the use of the precautionary approach is to 'manage' those effects. Therefore the precautionary approach is limited to conditions required for an approval to manage those adverse effects and not to deciding the application itself. This was seen in *Bleakley*[226] and *MAdGE*.[227] It is a weak precautionary approach.

(b) Precautionary principle application

Using gene drives for pest control involves high risk GMOs as it involves 'creating' animals and crops for use outside of containment.[228] The risks vary depending on the organism and the nature of the GM, but those risks are greater than any modification done in containment as, once an organism is released, it can no longer be easily controlled or contained.[229] Potential risks from GM rats include gene transfer, adverse effects on non-target species (directly or indirectly), increased persistence or invasiveness or competitiveness with existing wildlife, the possibility of some rare event that results in harm to humans such as zoonotic diseases, and others.[230] There is also the question of how frequently mutations might arise in the gene drive or its cargo gene that could disable the gene drive itself, making the release useless. Ecological science shows that introducing (or presumably removing) an organism into (or out of) an ecosystem will likely create large and unpredictable effects on the whole system, including causing the extinction of other species and causing changes in total biomass and chemical cycles.[231] GE therefore has the potential to eliminate pests, but also to create pests and eliminate biodiversity.[232] Any effects are likely to arise long after the GM rat has been released, and then are less able to be monitored.

---

[225] Environmental Protection Authority "HSNO Committee" <https://www.epa.govt.nz/about-us/our-people/hsno-committee/>.
[226] *Bleakley*, above n 204, at [155]–[157] per McGechan J.
[227] *MAdGE*, above n 126, at [263].
[228] Hayward, above n 24, at 125.
[229] At 130.
[230] Simon Terry Associates Ltd *Community Management of GMOs – Issues, Options and Partnership with Government* (March 2004) at 10 as cited in Fuiava, above n 211, at 303.
[231] Voigt, above n 100, at 55.
[232] Hayward, above n 24, at 123.

New Zealand has important biodiversity and the public is acutely aware of the necessity of protecting those native species that remain.[233] These native species could include kiore. Precaution could demand a higher threshold of safety when a GMO may threaten such species, and therefore a stronger precautionary approach ought to be taken.[234] Professors Kevin Esvelt and Neil Gemmell for the Biological Heritage National Science Challenge advocated for a cautious and responsible approach to new technologies.[235] Regardless, it is believed that gene drive approaches to pest control are still far in the future.[236]

E Conclusion

This chapter discussed the process of an application for the release of GM rats, as well as discussing some of the reasons such an application could be declined. Some oppositions to such an endeavour could be circumvented through public education, active public engagement, and through thorough testing of gene drives before any application is processed. However, other oppositions involve either a system of beliefs that cannot be overcome with science, or international considerations that will require a greater effort than merely organising gene drives within New Zealand.

[233] At 140–141.
[234] At 140–141.
[235] "Gene Drive Technology", above n 67.
[236] Royal Society Te Apārangi Gene Editing Panel, above n 3, at 4.

III Chapter III

A Introduction

The RMA could also apply to the regulation of GM rats. This chapter discusses whether local authorities could be involved in the regulation of GM rats and discusses various responses by the central government to regional councils doing so. Interwoven through this discussion is a hint of the tension between central government and local authorities regarding the purposes behind the RMA.

B An Overview of the RMA

New Zealand is made of 11 regions, each with its own regional or unitary councils. Within each region, districts or cities have their own councils (territorial authorities). Part 4 contains the powers of these local authorities, and these powers have a wide breadth. The functions of regional councils are detailed in s 30, and the functions of territorial authorities are detailed in s 31. Local authorities are also constrained by general law. They have a legal duty to promote sustainable management under the RMA.[237] Additionally, under the RMA, those exercising powers and functions relating to the storage, use, disposal, transportation, field-testing or release into the environment of NOs are required to comply with the HSNO Act and any regulations made under that Act.[238] This includes local authorities.

1 The basics of regional plans

Regional councils can make plans under the RMA for the integrated management of resources of their regions, and these plans can contain policies and rules. Rules can designate activities in respect of land, air and water on a scale from prohibited to permissible. The plans must accord with functions of the regional council under s 30, the provisions of pt 2, a direction given under s 25A(1), NPS and national planning standards, and any regulations,[239] as well as giving effect to any RPS.[240]

2 Regional councils creating GM-free zones

After *Bleakley*, many regional and unitary councils considered creating GM-free zones as a local way to manage risk, with some regulating the use of GM in their draft plans or policy statements.[241] Councils can be stricter regarding resource consent conditions and making plans

[237] Section 5.
[238] Voigt, above n 100, at 65.
[239] Section 66(1).
[240] Section 67(3).
[241] McGuinness, above n 57, at 24.

than the HSNO Act.[242] Indeed, some councils indicated a desire to take a strong precautionary approach to the release of GMOs by prohibiting them entirely. However, such a stance results in the prohibition of GMO releases for the entire country as neither animals nor plants abide by regional boundaries and will spread. Therefore, one regional council making a rule prohibiting the use of GM within their region means that there would be no release of GM rats anywhere. All regional councils must agree to allow for GM rat release for effective pest control to occur.

3 Two main questions

There are two questions to be asked: whether regional councils have the power to make rules regarding the use of GMOs in their regional plans; and if so, how a release would occur regardless. The former asks whether the HSNO Act is a code and is the only Act that applies to the regulation of GMOs, or whether the RMA also applies. The latter has two parts and involves the further questions of whether the applicant could get a resource consent, or whether central government could and should step in and take control.

Bleakley was one of the earliest decisions to consider the relationship between the HSNO and RMA, and the High Court stated that where there were questions of environmental effects that involved heritable materials, such questions were to be dealt with under the HSNO Act.[243] However, if there were wider environmental effects, they were to be dealt with under the RMA.[244]

C Can Regional Councils Make Such Rules Prohibiting GMO Use in their Region?

Federated Farmers of New Zealand v Northland Regional Council considered whether Northland Regional Council had jurisdiction under the RMA to make policy statements and plans to provide for the control of GMOs, or whether the regulation of GMOs fell solely under the HSNO Act and was therefore out of the Regional Council's jurisdiction.[245] Both parties agreed that the RMA did not take precedence over the HSNO Act in any way.[246]

---

[242] Voigt, above n 100, at 66.
[243] *Bleakley*, above n 204, at [114] per McGechan J.
[244] At [114] per McGechan J.
[245] *Federated Farmers of New Zealand v Northland Regional Council* [2015] NZEnvC 89, [2015] NZRMA 217 at [2].
[246] At [3].

1 Environment Court

The Environment Court held that the Northland Regional Council did have jurisdiction to make regulations.[247] Principal Environment Court Judge Newhook attempted to reconcile the two Acts, but if that proved impossible, he would decide which Act prevailed.[248] The relationship between the HSNO Act and the RMA was discussed in *NZ Forest Research Institute Limited v Bay of Plenty Regional Council* where it was decided that GMOs were not mentioned in the RMA at the time therefore the RMA had no place in their management.[249] However, Judge Newhook held that these statements were obiter dicta and examined the issue regardless.[250]

Judge Newhook held that *Meridian Energy Limited v Southland District Council* was authority for the proposition that a statutory interpretation exercise could include express exemptions in other legislation, not merely whether the RMA itself includes an express exemption.[251] Judge Newhook could find nothing expressly exempting the RMA from regulating NOs in either Act, indicating that the HSNO Act is not an exclusive code for regulatory control of GMOs.[252] Instead, the definition of 'natural and physical resources' in s 2 of the RMA includes 'all forms of plants and animals (whether native to New Zealand or introduced)', and there is nothing in the scheme of either Act to call for an interpretative limitation to be placed on this definition.[253] Limiting the regulation of GMOs to the HSNO Act would mean that there would be no requirement to regulate their potential adverse effects after approving them for release, therefore the RMA would be regulating 'all forms of plants and animals' except for GM animals that would classify under a special category.[254] There would therefore be no integrated management under the RMA.[255] Alternatively, when both Acts are read together, a NO can be approved for importation and release into New Zealand under the HSNO Act, and regional councils can provide for its use and protection together with other resources in a fully integrated fashion, taking account of regional needs for spatial management that might differ around the country.[256] Therefore, in terms of policy, the Acts offer significantly different functional

[247] At [60].
[248] At [5].
[249] *NZ Forest Research Institute Limited v Bay of Plenty Regional Council* [2013] NZEnvC 298, [2014] NZRMA 181 as cited in *Federated Farmers of New Zealand v Northland Regional Council*, above n 245, at [6].
[250] *Federated Farmers of New Zealand v Northland Regional Council*, above n 245, at [7].
[251] At [42].
[252] At [47].
[253] At [47].
[254] At [45].
[255] At [45].
[256] At [49].

approaches to the regulation of GMOs and therefore the HSNO Act should not be treated as a code.[257]

Judge Newhook concluded that nothing in either piece of legislation prevented the establishment of objectives, policies, and methods to achieve integrated management of natural and physical resources in the broad terms directed by the RMA.[258] The matters did not overlap between the statutes, and certainly not to the extent that there was an implied repeal of the general RMA provisions by the HSNO Act.[259]

2 High Court

In the High Court case *Federated Farmers of New Zealand Incorporated v Northland Regional Council*, Federated Farmers argued that the court had applied the incorrect legal test in reaching its conclusion and that the court took into account matters it should not have or failed to take into account matters it should have when reaching its conclusion.[260] Peters J accepted that Judge Newhook may have overstated the significance of the passage in *Meridian Energy*, but the error was not material given the breadth of the analysis the judge conducted.[261] Additionally, Peters J held that Judge Newhook was conscious of the overlap between the two Acts but the Judge had not been persuaded that the overlap required a conclusion that regional councils were unable to consider GMOs when making an RPS or plan.[262] Peters J therefore held that Judge Newhook did not err.[263] The appeal was dismissed.

3 Environment Court

In *Whangarei District Council v Northland Regional Council*, Federated Farmers acted as a s 274 party to the proceedings after withdrawing their appeal to the Court of Appeal and their substantive appeal to the Environment Court. Instead, they attempted to run similar arguments in this case.[264] Whangarei District Council wanted to remove the word 'plant' from their policy statement so that the policy would require a precautionary approach towards introducing GMOs to the environment.[265] Federated Farmers argued that regional councils could not regulate GMOs as it was the sole prerogative of the HSNO Act, with the exception of s 360D(2)

[257] At [49].
[258] At [48].
[259] At [58].
[260] *Federated Farmers of New Zealand Incorporated v Northland Regional Council* [2016] NZHC 2036 at [9].
[261] At [32].
[262] At [51].
[263] At [33].
[264] *Whangarei District Council v Northland Regional Council* [2018] NZEnvC 44 at [2].
[265] At [5].

which empowers regional councils to regulate GM crops, and therefore the word 'plant' should be retained in the policy or should be removed but only because it related to crops and was therefore under the jurisdiction of regional councils.[266] Judge Newhook stated that s 360D(2) did not create powers to regulate the growing of GM crops, but instead merely prevented regulations being made that overrode the local authorities' regulation of the growing of GM crops.[267] Instead, the Judge referred to the previous cases and stated that regional councils had the power under the RMA to control the use of GMOs through both RPS and plans.[268] Federated Farmers' submission was therefore irrelevant, and the Judge removed 'plant' from the policy statement as there was no law against it.[269]

4 Summary

The *Federated Farmers* cases stated that local authorities could control the use of GMOs through their regional policies and district plans under the RMA. The regulation of GM therefore can occur under both Acts. Judge Newhook in the first Environment Court case stated that the two Acts offer significantly different functional approaches to the regulation of GMOs,[270] however, the High Court found that there was an "overlap" between the two Acts.[271] Additionally, most GMO questions concern more than just heritable materials, and releasing GM rats would involve wider environmental effects, therefore under *Bleakley*, the RMA can also be included in regulation. The HSNO Act is therefore not a code, and regional councils can make rules in their regional plans dealing with the use of GMOs.

5 Discussion

Can Local Government Control Land Use Involving Genetically Modified Organisms? by PF Fuiava also discussed whether local authorities could play a role in regulating the use of GMOs. As it was published before the *Federated Farmers* line of cases, it has limited usefulness.

The EPA only has to notify the local authority if they are likely to have an interest in the application.[272] The local authority could then make submissions, but the EPA are not bound by those submissions.[273] However, Whangarei District Council wanted the ability to issue policy

[266] At [10].
[267] At [18].
[268] *Federated Farmers of New Zealand v Northland Regional Council*, above n 245, at [60] as cited in *Whangarei District Council v Northland Regional Council*, above n 264, at [7].
[269] *Whangarei District Council v Northland Regional Council*, above n 264, at [16].
[270] *Federated Farmers of New Zealand v Northland Regional Council*, above n 245, at [49].
[271] *Federated Farmers of New Zealand Incorporated v Northland Regional Council*, above n 260, at [51].
[272] Fuiava, above n 211, at 306.
[273] At 306.

statements that the EPA would have to consider, and to examine applications that had been submitted to the EPA and set stricter controls within their own regions if necessary.[274] They wanted Local Government New Zealand to lobby the central government to amend the HSNO Act to suit this.[275]

Dr Royden Somerville QC wrote a legal opinion concluding that Whangarei District Council had jurisdiction to impose land use controls to manage risks involving GMOs under the RMA.[276] Fuiava, stated that, for Somerville's conclusion to be correct, he would have to argue that the HSNO Act (enacted after the RMA and more specific in relation to GMOs than the RMA) "did not expressly or impliedly preclude the operation of the RMA and its general provisions in so far as land use controls for GMOs were concerned".[277] This was the argument later seen in *Federated Farmers* in the Environment Court. Somerville argued that there were no provisions in the HSNO Act that prevented a local authority from performing its function under the RMA, and such a provision would undermine the HSNO in achieving its purpose because local authorities play a key role in the enforcement of hazardous substances.[278] Somerville found no inconsistency between the two Acts.[279] Fuiava disagreed.[280] Overall, Fuiava thought that if local authorities were to rely on Somerville's reasoning, they would be held by the courts to be acting ultra vires.[281]

D How Then Would One Allow the Release of GMOs?

If regional councils can indeed make rules in their regional plans preventing GMOs in their region under the *Federated Farmers* cases, there are two ways a release could still occur. The first is by the applicant applying for a resource consent, either from the local authority generally or from the EPA. The second is by the central government taking control of the regulation of GMOs, and it could do this by creating an NES or by making regulations under s 360D of the RMA.

1 Plan change

If GMO releases are prohibited in the regional plan, applications for resource consents for releases of GM rats would not be considered. The applicant would have to apply for a privately

[274] At 306.
[275] At 306.
[276] At 319.
[277] At 320.
[278] At 320.
[279] At 320.
[280] At 321–325.
[281] At 324.

initiated regional plan change and prepare a s 32 evaluation of the plan.[282] They would then request the local authority to change the plan. There are four possible responses the local authority could have to a plan change application: they could adopt the plan change, in which case pt 1 of the RMA applies; they could accept the plan change, where there would be public notification, submissions, and a hearing; they could deal with the request as an application for a resource consent; or they could reject the proposed change on limited grounds, which would be appealable to the Environment Court. When making a plan, the local authority must consult with numerous groups including the tangata whenua of the area.[283] Additionally, under the Local Government Act 2002, the local authority must consult with iwi before making significant decisions, which could include a plan change to remove the regional prohibition on GMOs.[284] Consultation allows public involvement, therefore public opinion would determine whether the regional plan would be changed.

2 Resource consents

If GMOs are not prohibited in the plan, the applicant would have to apply for a resource consent from all regional councils in the country in order to release the GM rats.[285] It is unclear what resource consents would be required for this release. Territorial authorities issue most of the land use consents, and regional councils issue discharge consents.[286] A land use consent would be required, and possibly a discharge consent also. However, this would depend on whether GMOs are a 'contaminant' under s 15 of the RMA. The definition for 'contaminant' includes any substance, which includes gases, odorous compounds, liquids, solids, and micro-organisms, that is discharged onto land and will change or will be likely to change the biological condition of that land.[287] It is unlikely that biological material from GM rats could change the condition of the land unless the definition of 'biological condition' is stretched to include biological organisms. However, this is still a possible issue that could result in judicial review of a resource consent.

To apply for a resource consent, the applicant would need to submit the prescribed application form and an assessment of the environmental effects under s 88(2) made in accordance with sch 4. Regional councils would take into account various factors when deciding whether to

[282] Resource Management Act 1991, sch 1 cl 22.
[283] Schedule 1 cl 3.
[284] Section 76(3).
[285] Resource Management Act 1991, s 88.
[286] Sections 31 and 30 respectively.
[287] Section 2.

grant a resource consent.[288] This process would be costly and time-consuming for the applicant, and there is the possibility that one regional council could decline a consent which would result in a prohibition on any GM rat releases. If regional councils were concerned about the effects of the release of GM rats but still wished to approve the application, they could impose conditions on the resource consent.[289] Holistically, a resource consent under the RMA could be approved or declined across the different regions, and the application under the HSNO Act decided by the EPA could be approved or declined. These consents required from and across different bodies could lead to inconsistency, but that is not something regional councils are unfamiliar with when issuing resource consents.

There is no duty on local authorities or applicants to consult with any person about the application.[290] However, it would be tactical for the applicant to at least consult with iwi in order to comply with the s 6 requirements of the RMA and lessen the likelihood that the resource consent could be challenged in court. Again, issuing a resource consent here involves a significant decision, therefore the local authority must consult with iwi before deciding.[291]

The local authority must publicly notify a resource consent if they believe the activity will have effects on the environment that are more than minor.[292] Notification allows the public to be aware of the application in process. There is no definition of 'minor effects' in the RMA. The test is therefore subjective.[293] It is likely that the effects of releasing GM rats will be more than minor, and therefore the local authority must publicly notify the consent. However, if they do not, courts will not assess the notification decision.[294] Instead, the court will limit themselves to assessing whether the decision was manifestly reasonable.[295] It is likely that a decision to not-notify the country-wide release of GM rats would not be manifestly reasonable, and therefore the courts would be able to review the decision. Therefore if a local authority were to receive such an application for a resource consent, it is recommended that they publicly notify it.

---

[288] Section 104(1).
[289] Section 108.
[290] Resource Management Act 1991, s 36A.
[291] Local Government Act 2002, s 76(3).
[292] Resource Management Act 1991, s 95A(2).
[293] *Elderslie Park Ltd v Timaru District Council* [1995] NZRMA 433 at 445–446, as cited in Ceri Warnock and Maree Baker-Galloway *Focus on Resource Management Law* (LexisNexis NZ Ltd, Wellington, 2015) at 208.
[294] *Coro Mainstreet (Inc) v Thames-Coromandel District Council* [2013] NZHC 1163 at [40] as cited in Warnock, above n 293, at 202.
[295] *Coro Mainstreet (Inc) v Thames-Coromandel District Council*, above n 294, at [40] as cited in Warnock, above n 293, at 202.

The Minister for the Environment could also use their call-in powers, similar to s 68 of the HSNO Act, to call-in the application.[296] The Minister could do this of their own discretion or where an applicant or the local authority requests that the Minister make a direction for the matter.[297] The Minister would then make a direction to refer the matter to either a board of inquiry or the Environment Court for decision.[298] The call-in power would be activated if the Minister considered that the application was or was part of a proposal of national significance.[299] The relevant factors for a release of GM rats in determining national significance includes that such a release would cause widespread public concern; that it would involve multiple regions or districts; that it would be relevant to New Zealand's international obligations to the global environment; that it would involve or would be likely to involve technology, processes, or methods which are new to New Zealand and which may affect the environment; that it would be likely to result in or contribute to significant or irreversible changes to the environment, including the global environment; and that it would be a significant Treaty of Waitangi issue.[300] The Minister must have regard to the views of the applicant and the local authority, the capacity of the local authority to process the matter, and the recommendations of the EPA.[301] As local authority views are considered, there is indirect public participation as the local authority is elected by the local community.

If the call-in process were to be used, as it likely would be for a release of GM rats, the applicant would be responsible for all administration costs.[302] For such a controversial issue, there would be hundreds of submissions, therefore the applicant must be financially prepared.

3 If central government wanted to take control, how would they go about doing so?

There are two main ways that the central government could remove any regulatory power for the use of GMOs from regional councils: through the Minister creating a NES or NPS, or through the Minister making regulations under s 360D of the RMA. Regional plans must accord with all three, and therefore any could prevent regional councils from making rules in their regional plans that regulate GMO release in the region.[303]

[296] Resource Management Act 1991, s 142.
[297] Section 142(1).
[298] Section 142(2).
[299] Section 142(2).
[300] Section 142(3).
[301] Section 142(4).
[302] Section 36.
[303] Sections 44A and 66(1).

The Minister could also direct that a regional council change or vary its proposed regional plan, however that is beyond the scope of this dissertation.[304]

(a) NES

The Minister has the power to recommend the issuance of NES.[305] All plans must be consistent with these.[306]

An NES is made on the recommendation of the Minister and can include, but is not limited to, standards for contaminants, water standards, air quality, soil quality, noise, and standards for monitoring.[307] It can also prohibit or allow an activity, or restrict rules from being made,[308] especially those rules more lenient than it.[309] There has been no NES on GM so far. The closest New Zealand came was in the National Environmental Standard for Plantation Forestry, which commenced on 1 May.[310] The original proposal included a clause that gave permitted activity status to the use of GM tree stock.[311] However, this was removed from the final NES due to the public backlash.[312] Before recommending an NES, the Minister must prepare an evaluation report and publicly notify both that report and the recommendation.[313] Notification allows the public an opportunity to make submissions. Central government does not have to abide by the public's views, however they would likely do so if there were major public backlash, as they did as a result of the public response to the National Environmental Standard for Plantation Forestry.

If central government wanted to ensure the release of a GMO within New Zealand, it would be faster and more certain to use regulations made under s 360D to prevent regional councils from making rules. However, whether regulations could be made in such a situation is uncertain.

(b) Section 360D of the RMA

Section 360D of the RMA provides for regulations:

> 360D Regulations that prohibit or remove certain rules

[304] Section 25A.
[305] Section 24.
[306] Section 44A.
[307] Section 43(1).
[308] Section 43A.
[309] Section 43B.
[310] Resource Management (National Environmental Standards for Plantation Forestry) Regulations 2017.
[311] Local Government New Zealand *National Environmental Standard for Plantation Forestry: Local Government New Zealand's submission to the Ministry for Primary Industries and the Ministry for the Environment* (Local Government New Zealand, August 2015) at 15.
[312] Farah Hancock "Govt measures weaken local forest rules" *newsroom* (online ed, Auckland, 8 August 2018).
[313] Resource Management Act 1991, s 44(1).

(1) The Governor-General may, by Order in Council made on the recommendation of the Minister but subject to subsection (2), make regulations to prohibit or remove specified rules or types of rules that would duplicate, overlap with, or deal with the same subject matter that is included in other legislation.

(2) Subsection (1) does not apply to rules or types of rules that regulate the growing of crops that are genetically modified organisms.

(3) In subsection (2), genetically modified organisms has the meaning given in section 2(1) of the Hazardous Substances and New Organisms Act 1996.

(4) Regulations made under this section may require that rules inconsistent with those regulations be withdrawn or amended—

(a) to the extent necessary to remove the inconsistency; and

(b) as soon as practicable after the date on which the regulations come into force; but

(c) without using any of the processes under Schedule 1 for changing a plan or proposed plan.

(5) If regulations include a requirement under subsection (4), their withdrawal or amendment must be publicly notified by the local authority not later than 5 working days after they have been withdrawn or amended.

(6) Regulations made under this section—

(a) may specify, in relation to a rule made before the commencement of the regulations,—

(i) the extent to which a matter that the regulations apply to continues to have effect; or

(ii) the period for which a matter that the regulations apply to continues to have effect; and

(b) may apply—

(i) generally; or

(ii) to any specified district or region; or

(iii) to any specified part of New Zealand.

(7) Section 360(2) and (4) applies to regulations made under this section.

(i) A background to and overview of s 360D

Before, during, and after the *Federated Farmers* cases, regional councils had been making rules under s 30 to prohibit the use of GMOs in their regions, as previously seen in this chapter. However, this trend towards local authorities relying on the RMA instead of the HSNO Act

created a piecemeal approach towards the regulation of GMOs.[314] This resulted in the introduction of s 360D.

Under s 360D(1), the Minister can recommend the making of regulations that prohibit certain rules or types of rules that would duplicate or deal with the same subject matter that is included in other legislation. Therefore, if rules made under the RMA deal with the same subject matter as the HSNO Act and there is an overlap, the Minister can recommend that regulations be made that prevent regional councils from adding rules into their plans that relate to GMOs. This can remove rules from a certain district or region, or from every region in the country, and it therefore gives the EPA (or the Minister through the call-in power in s 68) the sole ability to regulate the use of GMOs under the HSNO Act.

If GM rats were to be released in order to control the rat population and exert some form of pest control, and one of the regional councils had rules in their regional plan that prevented any GMOs being released, the Minister could recommend regulations that remove those rules. The GM rats could then be released. However, this depends on there being an overlap between the two Acts.

(ii) Do the HSNO Act and the RMA overlap?

The meaning of overlap in s 360D is not defined in the Act. Whether regulations can be made hinges on this definition. As stated in the previous chapter, *Whangarei District Council v Northland Regional Council*, the latest relevant case involving Federated Farmers, held that there was an overlap between the Acts, and therefore regional councils were able to make rules regulating the use of GMOs into their regional plans. It was the regional councils regulating the use of GMOs in their regional plans that caused the introduction of ss 360–360D as central government wanted the option of removing such regulation power from the local authorities.[315] This was after the Auckland Unitary Plan prohibited the use of GMOs and therefore raised questions as to whether Auckland Hospital could still use live vaccines.[316] The introduction of s 360D shows that both the courts and the legislature have concluded that there is an overlap between the two Acts. Any regulations made under s 360D would therefore be intra vires.

As there is likely an overlap between the Acts, if regulations were made, any rules made by local authorities would have to be removed or else be susceptible to judicial review and likely

[314] McGuinness, above n 57, at 45.
[315] (4 April 2017) 721 NZPD 17050.
[316] Audrey Young "Nick Smith says Govt will review decision allowing councils to ban GMOs" *The New Zealand Herald* (online ed, Auckland, 2 September 2016).

be declared ultra vires. Alternatively, if the Court were to decide that there was no overlap between the RMA and the HSNO Act, any regulations recommended by the Minister would be susceptible to judicial review and would likely be declared ultra vires. Regional councils could then make such rules if they wished.

(iii) Cases

It is possible that, despite the overlap, any regulations made could still be ineffective due to the Court subjecting them to judicial review for being against the purpose of the Act. Though there have been few cases since s 360D was implemented, *Brook Valley Community Group Incorporated v Brook Waimarama Sanctuary Trust ('Brook Valley')* is valuable as it can be applied to a situation where regulations made under s 360D are challenged for being contrary to the scheme and purpose of the RMA. The Brook Waimarama Sanctuary Trust made an application for a resource consent to drop brodifacoum to kill rodents, which was allowed on a limited notified basis.[317] The Trust notified Nelson City Council, the adjoining landowners, and various iwi groups.[318] In May 2016, the resource consent was approved and the Trust was allowed to proceed with the toxin drop subject to 47 conditions.[319] In February 2017, Exemption Regulations were made under s 360(1)(h) of the RMA on the recommendation of the Minister.[320] Regulation 5 stated that the discharge of brodifacoum was exempt from s 15 of the RMA if the discharge complied with the Regulations.[321] The Trust then relied on these Exemption Regulations to authorise the brodifacoum discharge instead of their resource consent and conditions, and they dropped the brodifacoum three times between September and October of 2017.[322] The main issue was whether these three drops were lawful.[323]

The Community Group argued that the regulation-making power in s 360(1)(h) was broad and therefore must be read down to achieve the purpose of the Act.[324] They argued that the Minister

[317] *Brook Valley Community Group Inc v The Trustees of the Brook Waimarama Sanctuary Trust* [2017] NZHC 1844, [2018] NZRMA 5 at [8] as cited in *Brook Valley Community Group Incorporated v Brook Waimarama Sanctuary Trust* [2018] NZCA 573 at [10].
[318] *Brook Valley Community Group Inc v The Trustees of the Brook Waimarama Sanctuary Trust* [2017] NZHC 1844, [2018] NZRMA 5 at [8] as cited in *Brook Valley Community Group Incorporated v Brook Waimarama Sanctuary Trust* [2018] NZCA 573 at [10].
[319] *Brook Valley Community Group Inc v The Trustees of the Brook Waimarama Sanctuary Trust* [2017] NZHC 1844, [2018] NZRMA 5 at [9] as cited in *Brook Valley Community Group Incorporated v Brook Waimarama Sanctuary Trust* [2018] NZCA 573 at [10].
[320] *Brook Valley Community Group Incorporated v Brook Waimarama Sanctuary Trust* [2018] NZCA 573 at [11].
[321] At [11].
[322] At [12].
[323] At [17].
[324] At [42].

was attempting to impose his own policy objectives (nationalisation and streamlining of decision-making) over the purpose of the RMA.[325] They also argued that the Minister had used the Exemption Regulations to achieve these objectives, which excluded the opportunity to receive public views.[326] Overall, they argued that the Exemption Regulations were repugnant to the Act and made for an improper purpose.[327]

The Court of Appeal held that the regulation-making power in s 360(1)(h) was broad and the Exemption Regulations fell within the power conferred by that section.[328] Moreover, the purpose of the Regulations was to "provide an effective means of protecting New Zealand's native species, forests and fauna" and the intent was "to protect them from the predations of introduced pests", therefore the Exemption Regulations fell within the 'sustainable management' purpose of the RMA.[329] The Regulations were designed to create a centralised approach. The Court held that the Minister had not intended to exclude the public, and instead the exclusion was caused by the environmental purpose of the Regulations.[330] Therefore the Court concluded that making the Exemption Regulations was an application of the RMA, therefore the Regulations were legal.[331] The Supreme Court dismissed the appeal.[332]

This case demonstrates the difficulty in judicially reviewing regulations made under s 360(1)(h), which has a similar background to s 360D and was added to the RMA at the same time. With both sections, central government appears to have wanted a backdoor to override local authorities' decisions where the disagreed with them, or where they decided that a nation-wide approach was more appropriate. A judicial review of regulations made under s 360D could result in a similar outcome to the Exemption Regulations in *Brook Valley*. Both regulations (the Exemption Regulations and potential regulations under s 360D) involve sustainable management (a broad purpose that covers many activities) via pest control. Furthermore, the Court in *Brook Valley* held that the RMA did not grant an "unfettered right to individuals to be consulted or notified of decisions"[333] and instead Parliament granted and regulated the right to participate, and that right to participate could not be "obliquely

[325] At [42].
[326] At [42].
[327] At [42].
[328] At [44]–[45].
[329] At [49].
[330] At [52].
[331] At [53].
[332] *Brook Valley Community Group Incorporated v Brook Waimarama Sanctuary Trust* [2019] NZSC 51.
[333] *Brook Valley Community Group Inc v The Trustees of the Brook Waimarama Sanctuary Trust* [2017] NZHC 1844, [2018] NZRMA 5 at [102] as affirmed by the Court of Appeal in *Brook Valley Community Group Incorporated v Brook Waimarama Sanctuary Trust* [2018] NZCA 573 at [43] and [52].

challenged" through judicial review.[334] Therefore any regulations made under s 360D that did not include public participation could not be subject to judicial review on that ground either. Overall, the addition of these sections allowed central government to increase their power as any resultant regulations would be difficult to review on the basis of an improper purpose or incorrect procedure involving problems with public notification and consultation. This is different to an NES and plans made by local authorities, where more public involvement is required.[335] These sections appear to only allow effective public participation when public views align with central government, or else that participation will be circumvented by regulations being made.

It is a more paternalistic – or holistic – approach to governing the New Zealand's environment. This approach works well where an issue is urgent, as it could be when dealing with the environment; however, it means that the decision-makers may not be held as accountable as they would if they were using other means. It becomes an indirect democracy instead of a direct democracy, with the public being involved only through the people they elect to Parliament instead of making submissions themselves. Either way, central government now appears to allow effective public participation only when that participation agrees with their plans. Such comments are not intended for condemnation, but instead are intended to highlight the tension between what the purpose of the RMA (arguably public involvement) and central government control.

(c) Should central government regulate?

Assuming that regional councils can make rules regulating the use of GMOs within their regions, and assuming that the Governor-General can legally make regulations to prohibit this, should the Minister recommend regulations under s 360D(1)?

(i) The Minister should recommend regulations

Allowing local authorities to make rules regarding the use of GMOs would give regional councils considerable discretion that would be reliant on their understanding of GMOs.[336] Local authorities do not have "the specialised scientific expertise required to deal with the

[334] *Brook Valley Community Group Inc v The Trustees of the Brook Waimarama Sanctuary Trust* [2017] NZHC 1844, [2018] NZRMA 5 at [107] as affirmed by the Court of Appeal in *Brook Valley Community Group Incorporated v Brook Waimarama Sanctuary Trust* [2018] NZCA 573 at [43] and [52].
[335] Plans require consultation (Resource Management Act 1991, s 3) and NES require notification (Resource Management Act 1991, s 43(3)).
[336] Voigt, above n 100, at 66.

complex issues of safely regulating these technologies".[337] To allow them to do so could undermine the HSNO regime, which is based on comprehensive scientific, economic, and cultural risk assessments.[338] Additionally, local authorities should not be second guessing the decisions of the EPA with its technical expertise.[339]

Local authorities are largely reliant on public opinion, and misinformation about GMOs is common. It is possible that if local authorities could make rules, they would prohibit the use of GMOs altogether. This would halt national scientific progress, despite continuing our status as a 'GM-free nation' on a global scale, and it would leave pest control to trapping and baiting unless an alternate solution could be found. The inclusion of the precautionary approach in the HSNO Act was deliberate, and the EPA is best placed to understand and apply it when deciding applications.

Control of GMOs originates with the central government, and they have delegated this responsibility to the EPA via the HSNO Act.[340] The legislation makes it clear that local authorities have a role in regulating GM crops but may not have a role in regulating the use of GMOs generally. There is always a risk that the central government will overstep in controlling the regions. The local authority of each region must deal with its region's unique concerns. However, cooperation is unlikely to occur between local authorities, and having central government regulating GMOs allows for a centralised approach, especially where the GMO will spread. Additionally, it could be that the HSNO Act provides adequate protections for adverse effects, as stated by Amy Adams, former Minister for the Environment, and by allowing local authorities to regulate, those local authorities were attempting to rewrite nationally set frameworks.[341]

Parliament may have deliberately intended that local authorities have no power to regulate the use of GMOs. The 2003 amendment to the HSNO Act had numerous submissions from local authorities and yet Parliament chose not to amend the legislation to provide for local authorities to regulate the use of GMOs.[342] In 2013, the former Minister for the Environment reacted to a letter to the editor in *Nelson Mail* on the question of the RMA being used to regulate GMOs,

[337] Nick Smith "Response to letter to the editor" *Nelson Mail* (Nelson, 16 August 2013) at 11 as cited in McGuinness, above n 57, at 83.
[338] Letter from Dave Brash to the Education and Science Select Committee regarding the New Organisms and Other Matters Bill which amended the HSNO (26 August 2003) as cited in Fuiava, above n 211, at 318.
[339] Smith, above n 337, at 83.
[340] Fuiava, above n 211, at 296.
[341] (25 June 2013) 691 NZPD 11187 as cited in McGuinness, above n 57, at 83.
[342] Fuiava, above n 211, at 318.

and stated that the lack of biosecurity controls between the local authorities meant that there were no practical means to stop NOs spreading to other regions, and therefore there was little use in having local authorities regulating those NOs.[343] Furthermore, the 2017 amendments to the RMA removed the section that allowed local authorities to regulate hazardous substances under the HSNO Act as it implied that local authorities were able to prohibit the use of GMOs also. This change could have been the result of central government having "little faith" in local authorities with regard to GMOs.[344] The Ministry for the Environment went so far as to suggest that local authority involvement would undermine the HSNO Act.[345] More recently, s 360D(2) was legislated and Parliament limited the power of local authorities to controlling the use of GM crops, the more controversial issue. Parliament clearly considered GMOs in their entirety when drafting this section and deliberately chose not to use 'genetically modified organisms'. Overall, it was likely that Parliament intended local authorities be prevented from controlling land use involving GMOs.

It could be that instead of allowing local government to regulate the use of GMOs through plans, the HSNO Act should be amended so that local authorities' submissions become a primary and mandatory consideration for the EPA when deciding applications that seek approval to use GMOs in the region.[346] If the HSNO Act were amended to favour local authorities more, the EPA and local authorities would be required to work cooperatively, however the EPA would still be the one with the scientific and technical skills.[347]

(ii) The Minister should not recommend regulations

Preventing local authorities from regulating could lead to a lack of transparency by the local authority.[348] The local authority would likely be the 'first port of call' for public concerns regarding GMOs within the area. Central government would therefore be "refusing to address local authority concerns, while simultaneously proposing to prevent local governments from responding to their communities concerns with the only mechanisms they have, through the RMA".[349] It could be that communities should have both the right and the responsibility to make decisions over land use.[350]

[343] Smith, above n 337, at 11 as cited in McGuinness, above n 57, at 83.
[344] Fuiava, above n 211, at 318.
[345] Letter from Brash, above n 338 as cited in Fuiava, above n 211, at 318.
[346] Fuiava, above n 211, at 296.
[347] Fuiava, above n 211, at 325.
[348] McGuinness, above n 57, at 84.
[349] At 84.
[350] At 84.

Additionally, s 10 of the Local Government Act allows for the promotion of the social, economic, environmental, and cultural wellbeing of communities in the present and for the future. It could be that restricting the use of GMOs within a region could fall within this section, therefore local authorities should be allowed to regulate.[351]

The novel risks of GMOs that justify moratoriums and special provisions in the HSNO Act show that they are not an 'everyday affair'.[352] It is unlikely that, in a situation where damage has occurred, all possible damage is compensable because:[353]

- it is difficult to assess the magnitude of risk that GMOs pose or damage they may cause;
- GMOs can cause intangible loss, which is almost impossible to compensate;
- GMOs have the potential to cause irreversible damage, which could result in continued compensation; and
- the effects of GMOs may take a long time to result and potential defendants may not exist or may be insolvent when damage is found.

It is possible that local authorities could play some role in liability for negligence where an application was approved for the release of a GMO and harm resulted within their region.[354] The Law Commission did not mention the culpability of local authorities, but Fuiava in his article suggested that local authorities were unlikely to be liable because the EPA via the HSNO Act has been charged with the national regulation of GMOs.[355] Under the HSNO Act, only the applicant would be liable, and only where there has been a breach of the Act or the conditions of the approval. Additionally, on a *Rylands v Fletcher* approach to negligence where the GMO has caused damage but everything was done according to the Act and the conditions, there could be a breach of duty by the EPA or the local authority if they had approved the release. However, if the local authority had no part in approving the release, they would not have had a duty of care and therefore would not be liable. Therefore, arguments that local authorities should be involved in the regulation of GMOs because they could potentially be liable will likely fail.

There are few possible solutions if local authorities can regulate, as even one region prohibiting the use of GMOs would prevent their use within the entire country. It is possible that, as a test-

[351] Fuiava, above n 211, at 300.
[352] Hayward, above n 24, at 160.
[353] Law Commission, above n 94, at 12 at 53 as cited in Fuiava, above n 211, at 308–309.
[354] Fuiava, above n 211, at 307.
[355] Fuiava, above n 211, at 309.

run, either the North Island or the South Island could be used if all relevant local authorities agree, however ferries and other transport between the islands would need to be rigorously checked to prevent the GMOs from transferring islands. Regardless, more public education is required in order to have the regional plans reflecting an informed view of the public, whether that view is for or against the release of GMOs in the region.

E Conclusion

In conclusion, it is likely that regional councils and other local authorities can regulate the use of GMOs within their region through rules in regional plans, and it is equally likely that the Minister, should he decide that GMOs are better regulated by the central government, can recommend that regulations be made under s 360D that prevent regional councils from including such rules in their regional plans. The discussion of whether local authorities should make such rules, and whether the Minister should make such regulations, is formed due to the tension between local authorities and the central government – a tension that will continue regardless who regulates for the use of GMOs.

Conclusion

Gene drives are an exciting technology that could be used to benefit the environment through pest control. As they are still being developed, they will likely be unavailable for years yet. When applicants do begin to apply, applications will be decided by the EPA, or more likely, the Minister under his s 68 call-in power. However, it is essential that we determine who will be involved in regulating the use of GMOs. According to the most recent case law, there is an overlap between the RMA and the HSNO Act and so regional councils can prohibit the use of GMOs within the region through rules in regional plans. This overlap then allows the Minister to recommend regulations preventing regional councils from making such rules. However, there is a fine balance between whether the Minister should recommend such regulations or not, and this is a result of the tension between public participation and central government control. Nevertheless, it is for the central government to decide whether they want to control the use of GMOs as they can choose to recommend the regulations.

Bibliography

A Cases

1 Reported

Bleakley v Environmental Risk Management Authority [2001] 3 NZLR 213.

Brook Valley Community Group Inc v The Trustees of the Brook Waimarama Sanctuary Trust [2017] NZHC 1844, [2018] NZRMA 5.

Brook Valley Community Group Incorporated v Brook Waimarama Sanctuary Trust [2018] NZCA 573.

Brook Valley Community Group Incorporated v Brook Waimarama Sanctuary Trust [2019] NZSC 51.

Coro Mainstreet (Inc) v Thames-Coromandel District Council [2013] NZHC 1163.

Elderslie Park Ltd v Timaru District Council [1995] NZRMA 433.

Federated Farmers of New Zealand Incorporated v Northland Regional Council [2016] NZHC 2036.

Federated Farmers of New Zealand v Northland Regional Council [2015] NZEnvC 89, [2015] NZRMA 217.

GE Free NZ In Food and Environment Inc v Environmental Risk Management Authority [2011] NZRMA 45.

Meridian Energy Limited v Southland District Council [2014] NZHC 3178.

NZ Forest Research Institute Limited v Bay of Plenty Regional Council [2013] NZEnvC 298, [2014] NZRMA 181.

Terminals NZ Limited v Comptroller of Customs [2013] NZSC 139.

West Coast ENT Inc v Buller Coal Limited [2014] 1 NZLR 32.

Whangarei District Council v Northland Regional Council [2018] NZEnvC 44.

2 Unreported

GE Free NZ in Food and the Environment Inc v Environmental Risk Management Authority HC Wellington CIV-2008-485-2370, 5 June 2009.

Mothers Against Genetic Engineering Incorporated v Minister for the Environment HC Auckland CIV-2003-404-673, 7 July 2003.

Ngatiwai Trust Board v Whangarei District Council EnvC Auckland A057/2004, 28 April 2004.

3 Waitangi Tribunal

Waitangi Tribunal *Ko Aotearoa tēnei* (Wai 262, 2011).

B Legislation

1 Statutes

Agricultural Compounds and Veterinary Medicines Act 1997.

Animal Welfare Act 1999.

Biosecurity Act 1993.

Conservation Act 1987.

Environmental Protection Authority Act 2011.

Hazardous Substances and New Organisms Act 1996.

Local Government Act 2002.

Medicines Act 1981.

Resource Legislation Amendment Act 2017.

Resource Management Act 1991.

2 Secondary Legislation

Hazardous Substances and New Organisms (Genetically Modified Organisms—Information Requirements for Segregation and Tracing) Regulations 2008.

Hazardous Substances and New Organisms (Methodology) Order 1998.

Resource Management (National Environmental Standards for Plantation Forestry) Regulations 2017.

C International Materials

1 Treaties

Nagoya / Kuala Lumpur Supplementary Protocol on Liability and Redress Damage to the Cartagena Protocol on Biosafety (adopted October 2010, entered into force 5 March 2018).

Treaty of Waitangi 1840.

2 United Nations Materials

Rio Declaration on Environment and Development GA Res 151/26 (1992).

3 European Materials

Directive 90/220/EEC on the deliberate release into the environment of genetically modified organisms [1990] OJ L117.

D Secondary Materials

1 Texts

Karen Cronin and others *Hands across the water : developing dialogue between stakeholders in the New Zealand biotechnology debate : a project for the Ministry of Research, Science and Technology (MORST) 'Dialogue' Programme* (Victoria University of Wellington, Wellington, 2004).

Tony Deverson and Graeme Kennedy (eds) *The New Zealand Oxford Dictionary* (Oxford University Press, online ed, 2005) Oxford Reference <https://www.oxfordreference.com/view/10.1093/acref/9780195584516.001.0001/m-en_nz-msdict-00001-0035513?rskey=65uFWz&result=1>.

Toi te Taiao: the Bioethics Council *The Cultural, Ethical and Spiritual Dimensions of the Use of Human Genes in Other Organisms* (the Bioethics Council, August 2004).

Ministry for the Environment *Environment 2010 Strategy: A Statement of the Government's Strategy on the Environment* (Ministry for the Environment, Wellington, 1995).

Ceri Warnock and Maree Baker-Galloway *Focus on Resource Management Law* (LexisNexis NZ Ltd, Wellington, 2015).

2 Essays and Chapters in Edited Books

J McIlroy "Susceptibility of target and non-target animals to 1080" in *Proceedings of the Science Workshop on 1080* (Royal Society of New Zealand, Wellington, 1994).

3 Online Commentaries and Looseleaf Texts

Salmon Environmental Law – Westlaw NZ (online looseleaf ed, Thomson Reuters).

4 Journal Articles

TJ Aitman and others "Progress and prospects in rat genetics: a community view" (2008) 40 Nat Genet 516.

OS Akbari and others "Safeguarding gene drive experiments in the laboratory" (2015) 349 Science 927.

AR Bassett and JL Liu "CRISPR/Cas9 and genome editing in Drosophila" (2014) 41 J Genet Genomics 7.

KJ Beumer and D Carroll "Targeted genome engineering techniques in Drosophila" (2014) 68 Methods 2937.

A Buchman and others "Broad Dengue Neutralization in Mosquitoes Expressing an Engineered Antibody" (2019) preprint at bioRxiv <https://doi.org/10.1101/645481>.

A Burt "Site-specific selfish genes as tools for the control and genetic engineering of natural populations" (2003) 270 Proc Biol Sci 921.

J Champer and others "Novel CRISPR/Cas9 gene drive constructs reveal insights into mechanisms of resistance allele formation and drive efficiency in genetically diverse populations" (2017) 13 PLoS Genet e1006796.

Bruce Conklin "On the road to a gene drive in mammals" (2019) 566 Nature 43.

A Deredec, A Burt and HC Godfray "The population genetics of using homing endonuclease genes in vector and pest management" (2008) 179 Genetics 2013.

JE DiCarlo and others "Safeguarding CRISPR-Cas9 gene drives in yeast" (2015) 33 Nat Biotechnol 1250.

C Eason “Sodium monofluoroacetate (1080) risk assessment and risk communication” (2002) 181 Toxicology 523.

KM Esvelt and others “Concerning RNA-guided gene drives for the alteration of wild populations” (2014) 3 Elife e03401.

KM Esvelt and NJ Gemmell “Conservation demands safe gene drive” (2017) 15 PLoS Biol e2003850.

PF Fuiava “Can Local Government Control Land Use Involving Genetically Modified Organisms?” (2004) 8 NZJEL 295.

NJ Gemmell and DM Tompkins “Gene Drives and Rodent Control: Response to Piaggio et al” (2017) 32 Trends Ecol Evol 314.

SL Goldson and others “New Zealand pest management: current and future challenges” (2015) 45 Journal of the Royal Society of New Zealand 31.

HA Grunwald and others “Super-Mendelian inheritance mediated by CRISPR-Cas9 in the female mouse germline” (2019) 566 Nature 105.

AM Hammond and others “The creation and selection of mutations resistant to a gene drive over multiple generations in the malaria mosquito” (2017) 13 PLoS Genet e1007039.

Andrew Hayward “The Hazardous Substances and New Organisms Act, Precaution, and the Regulation of GMOs in New Zealand” (2005) 9 NZJEL 123.

Richard Hindmarsh and Rosemary Du Plessis “GMO regulation and civic participation at the “edge of the world”: the case of Australia and New Zealand” (2008) 27 New Genetics and Society 181.

P Horvath and R Barrangou “CRISPR/Cas, the immune system of bacteria and archaea” (2010) 327 Science 167.

PM Iannaccone and HJ Jacob “Rats!” (2009) 2 Dis Model Mech 206.

M Jasin and R Rothstein “Repair of strand breaks by homologous recombination” (2013) 5 Cold Spring Harb Perspect Biol a012740.

M Jinek and others “A programmable dual-RNA-guided DNA endonuclease in adaptive bacterial immunity” (2012) 337 Science 816.

D Kanavy and M Serr “Sry gene drive for rodent control: reply to Gemmell and Tompkins” (2017) 32 Trends Ecol Evol 315.

Anna Kingsbury “Intellectual Property” (2011) 262 NZLJ 273.

Maria Lee “The Governance of Coexistence Between GMOS and Other Forms of Agriculture: A Purely Economic Issue?” (2008) 20 JEL 193.

Michael Lee “Pacific Rats – Wildlife Pests and Cultural Treasures” (2002) 306 Forest & Bird 11.

M Li and others “Development of a Confinable Gene-Drive System in the Human Disease Vector, *Aedes aegypti*” (2019) preprint at bioRxiv <https://doi.org/10.1101/645440>.

LA Marraffini “CRISPR-Cas immunity in prokaryotes” (2015) 526 Nature 55.

JM Marshall “The effect of gene drive on containment of transgenic mosquitoes” (2009) 258 J Theor Biol 250.

A Miles and others “Natural diversity of the African malaria vector Anopheles gambiae” (2017) 552 Nature 96.

C Noble and others “Daisy-chain gene drives for the alteration of local populations” (2019) 116 Proc Natl Acad Sci U S A 8275.

AR North, A Burt and HCJ Godfray “Modelling the potential of genetic control of malaria mosquitoes at national scale” (2019) 17 BMC Biol 26.

P O’Hara “The illegal introduction of rabbit haemorrhagic disease virus in New Zealand” (2006) 25 Rev Sci Tech 119.

R Pech and Matt Maitland “Conservation of native fauna in highly invaded systems: managing mammalian predators in New Zealand” (2016) 24 Restoration Ecology 816.

D Pimentel, R Zuniga and D Morrison “Update on the environmental and economic costs associated with alien-invasive species in the United States” (2005) 52 Ecol Econ 273.

BS Pradhan and SS Majumdar “An efficient method for generation of transgenic rats avoiding embryo manipulation” (2016) 5 Mol Ther Nucleic Acids e293.

TAA Prowse and others “Dodging silver bullets: good CRISPR gene-drive design is critical for eradicating exotic vertebrates” (2017) 284 Proc Biol Sci 20170799.

Megan Scudellari “Self-destructing mosquitoes and sterilized rodents: the promise of gene drives” (2019) 571 Nature 160.

Jennifer Stanton “Sustainable Development of Genetically Modified Organisms” (2006) 10 NZJEL 1.

RL Unckless, AG Clark and PW Messer “Evolution of resistance against CRISPR/Cas9 gene drive” (2017) 205 Genetics 827.

Helena Valve and Jussi Kauppila “Enacting Closure in the Environmental Control of Genetically Modified Organisms” (2008) 20 JEL 339.

Christina Voigt “The Precautionary Principle and Genetic Engineering in New Zealand: Legal and Ethical Implications” (2002) 6 NZJEL 43.

E Other Official Sources

1 Parliamentary Materials

(25 June 2013) 691 NZPD 11187.

(4 April 2017) 721 NZPD 17050.

2 Government Publications

Law Commission *Liability for loss resulting from the development, supply, or use of genetically modified organisms* (NZLC, SP14, 2002).

3 Papers and Reports

Environmental Risk Management Authority *Annotated Methodology for the Consideration of Applications for Hazardous Substances and New Organisms under the HSNO Act 1996* (Environmental Risk Management Authority of New Zealand, Wellington, 1998).

Marian Hobbs *Government Response to the Royal Commission on Genetic Modification: Legislative changes for New Organisms – Paper 6: Ministerial Call-In and Confidential Supporting Information* (Office of the Minister for the Environment, 2001).

M Hudson and others *Te Mata Ira: Guidelines for genomic research with Māori* (Te Mata Hautū TaketakeMāori & Indigenous Governance Centre, University of Waikato, 2016).

Local Government New Zealand *National Environmental Standard for Plantation Forestry: Local Government New Zealand's submission to the Ministry for Primary Industries and the Ministry for the Environment* (Local Government New Zealand, August 2015).

Wendy McGuinness and Renata Mokena-Lodge *An Overview of Genetic Modification in New Zealand 1973-2013: The First Forty Years* (McGuinness Institute Limited, September 2013).

Wendy McGuinness, Miriam White and Steph Versteeg *The History of Genetic Modification in New Zealand* (Sustainable Future Limited, April 2008).

National Academies of Sciences, Engineering, and Medicine *Gene Drives on the Horizon: Advancing Science, Navigating Uncertainty, and Aligning Research with Public Values* (The National Academies Press, 2016).

Parliamentary Commissioner for the Environment *Evaluating the use of 1080: predators, poisons and silent forests* (June 2011).

Larry Reynolds and others *The Role of Participation in a Techno-Scientific Controversy* (Participatory Governance and Institutional Innovation, October 2007).

Royal Commission on Genetic Modification *Report of the Royal Commission on Genetic Modification* (July 2001).

Royal Society of New Zealand *Improving the Operation of the HSNO Act for New Organisms: Response to the Ministry for the Environment Public Discussion Paper* (Ministry for the Environment, ME 462, November 2002).

Royal Society Te Apārangi *The use of gene editing in pest control* (Royal Society Te Apārangi, December 2017).

Royal Society Te Apārangi Gene Editing Panel *The use of gene editing to create gene drives for pest control in New Zealand* (Royal Society Te Apārangi, December 2017).

Simon Terry Associates Ltd *Community Management of GMOs – Issues, Options and Partnership with Government* (March 2004).

F Other Sources

1 Internet Materials

Environmental Protection Authority "HSNO Committee" <https://www.epa.govt.nz/about-us/our-people/hsno-committee/>.

Kevin Esvelt, Dan Tompkins and James Russell "Gene Drives and Pest Control" (22 August 2018) Gemmell Lab <https://gemmell-lab.otago.ac.nz/news/8-news-events/150-gene-drives-and-pest-control>.

"Gene Drive Technology" (last accessed July 2019) New Zealand's Biological Heritage <http://www.biologicalheritage.nz/news/news/gene-drive-technology> website has since been removed.

"Gene editing technologies" (2019) Royal Society Te Apārangi <https://royalsociety.org.nz/what-we-do/our-expert-advice/all-expert-advice-papers/gene-editing-technologies/>.

Ministry for the Environment "A guide to section 32 of the Resource Management Act 1991" (20 April 2017) <https://www.mfe.govt.nz/sites/default/files/media/RMA/guide-to-section-32-of-resource-manangemnt-amendment-act-1991.pdf>.

Ministry for the Environment "An everyday guide: Applying for a resource consent" <https://www.mfe.govt.nz/publications/fresh-water/everyday-guide-applying-resource-consent/everyday-guide-applying-resource>.

Museum of New Zealand: Te Papa Tongarewa "Kiore in Māori culture" Collections Online – Museum of New Zealand Te Papa Tongarewa (22 July 2019) <https://collections.tepapa.govt.nz/topic/1442>.

Predator Free NZ "Predator Free 2050 programme" <https://predatorfreenz.org/about-us/pf-2050/>.

Te Uru Rākau: Forestry New Zealand "Growing & harvesting" <https://www.teururakau.govt.nz/growing-and-harvesting/forestry/national-environmental-standards-for-plantation-forestry/>.

2 Newspaper and Magazine Articles

Skara Bohny "Genetic modification floated as effective wasp-control tactic" *Stuff* (online ed, New Zealand, 19 December 2017).

Isaac Davison "Maori Party claims GE-free victory in RMA reforms" *New Zealand Herald* (online ed, Auckland, 5 April 2017).

Farah Hancock "Govt measures weaken local forest rules" *newsroom* (online ed, Auckland, 8 August 2018).

Jamie Morton "Why public buy-in is critical to NZ's great pest wipe-out" *New Zealand Herald* (online ed, Auckland, 20 May 2019).

Kate Nicol-Williams "NZ will fall behind unless archaic gene editing law is updated, scientists say" *1 NEWS NOW* (online ed, New Zealand, 24 June 2019).

Nick Smith "Response to letter to the editor" *Nelson Mail* (Nelson, 16 August 2013).

Dan Tompkins, Neil Gemmell and Damian Dowling "The Trojan Female Technique: A Novel Nonlethal Approach for Pest Control" *Kararehe Kino* (online ed, Lincoln, New Zealand, July 2013).

Audrey Young "Nick Smith says Govt will review decision allowing councils to ban GMOs" *The New Zealand Herald* (online ed, Auckland, 2 September 2016).

3 Speeches

Marian Hobbs, Minister for the Environment "The Government's response to the recommendations of the report from the Royal Commission on Genetic Modification" (Genetic Modification Summit, Duxton Hotel, Wellington, 27 November 2001).

4 Letters and Emails

Email from Amanda Baldwin (Employee at the Ministry for the Environment) to Caitlin Leigh (author) regarding s 68 of the HSNO Act (30 August 2019).

Letter from Dave Brash to the Education and Science Select Committee regarding the New Organisms and Other Matters Bill which amended the HSNO (26 August 2003).

5 Others

Legal opinion from Royden J Somerville QC for the Whangarei District Council *Interim Opinion on Land Use Controls and GMOs* (2004).