Statistics on the Use of Animals in Research, Testing and Teaching in New Zealand in 2018

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Contents

1 Executive summary

This report presents numbers of animals used in research, testing and teaching (RTT) studies in New Zealand that were completed and reported to the Ministry for Primary Industries (MPI) in 2018. Numbers of animals used in long-term projects are not reported annually but either every three years or at the end of the year in which the project is completed, if less than three years.

Any RTT activities involving animals in New Zealand can only be carried out under the requirements of the Animal Welfare Act 1999 (the Act). No animal manipulations can be carried out without the prior approval of an animal ethics committee (AEC), membership of which must include at least three independent members: one a veterinarian nominated by the New Zealand Veterinary Association (NZVA), one a nominee of the Royal New Zealand Society for the Prevention of Cruelty to Animals (SPCA) and one from a local territorial authority. The AEC is tasked with assessing the necessity for any RTT activities, including weighing up the potential benefits against the cost to animal welfare. In addition, the AEC must be confident that researchers have fully addressed the Three Rs – replacement of animals with non-sentient or less sentient alternatives; reduction in animal numbers to the minimum required for statistical significance; and refinement of procedures to ensure the minimum possible impact on animal welfare.

A range of animals are used in RTT, as described in this report. The largest individual species grouping in 2018 was cattle, with more than 100 000 used. In general, the majority of animals used for RTT in New Zealand are agricultural animals. This was the case again in 2018 with nearly 50 percent of the total of 301 335 animals reported to MPI being farm animals. Ninety-six percent of farm animals used for RTT returned to their normal lives following their temporary use as research animals.

Some research, however, does have a greater impact on animals. Efforts to find the most humane methods of pest control, for instance, can carry a relatively high welfare cost. As an example, researchers may need to measure the length of time from ingestion of a poison until an animal is unconscious or dead in order to ascertain the efficiency or otherwise of that method of pest control. Such activities may cause considerable distress, and these are the type of issues that AEC members are required to weigh very carefully against the benefits of improving the survivability of our vulnerable native wildlife populations. Details of RTT activities that are graded as having a high or very high impact on animal welfare are given later in the report.

2 Introduction

The use of animals in RTT is covered by a self-contained set of provisions within New Zealand's animal welfare legislation - Part 6 of the Act. This is because the nature of such use of animals may mean that general obligations under the legislation cannot be met. This recognises that compromised care and some pain and distress to a small number of animals may result in significant benefits to people, other animals or the environment. However, such use carries with it significant responsibilities and strict legislative obligations. Part 6 allows the use of animals for RTT purposes only in accordance with a code of ethical conduct which has been approved by MPI. In 2018, 25 institutions had codes of ethical conduct approved by the Director-General of MPI. These codes set the parameters within which the institutions are allowed to use animals for RTT purposes. Code holders undergo review by an accredited reviewer at least once every five years.

Each project must also be scrutinised and approved by an AEC established under the code of ethical conduct. There were 29 AECs (some institutions, because of their geographic spread, operate more than one committee). In addition, another 121 institutions engaging in RTT involving animals had an arrangement to use another institution's AEC rather than forming their own. The membership of each AEC must include at least one senior staff member of the institution and at least three people with no other association with the institution carrying out the research. These external members must include a nominee from each of the NZVA, the SPCA and a local or regional council. The AEC's role is to decide whether or not to approve projects, to set, vary or revoke conditions of project approvals, to monitor compliance with conditions of project approvals and to monitor animal management practices and facilities to ensure compliance with the terms of the organisation's code of ethical conduct.

When considering applications for project approvals, AECs must have regard to a number of criteria specified in the Act including:
- the scientific or educational objectives of the project;
- the harm to or distress felt by the animals and the extent to which that can be alleviated;
- whether the design of the experiment or demonstration is such that it is reasonable to expect the objectives will be met;
- the factors taken into account in the choice of species; and
- whether the number of animals is the minimum necessary to achieve meaningful results.

In essence, AECs are required to carry out a cost-benefit analysis in deciding whether a RTT protocol should be allowed to proceed: the higher the cost to the animal, the greater the expected benefit must be, whether that benefit be to people, to other animals or to the environment. AECs also ensure that the costs to the animal are minimised through the implementation of the "Three Rs", the internationally accepted principles of humane experimental technique. They are the *reduction* in the numbers of animals to the minimum necessary to achieve a result; the *replacement* of animals with a less sentient or non-sentient alternative wherever possible; and the *refinement* of procedures as well as of animal environments to minimise pain or distress.

Records of the annual numbers of animals used in RTT have been collected since 1987. While previously published within the annual report of the National Animal Ethics Advisory Committee (NAEAC), animal use statistics are now produced as a stand-alone document.

All code holders are required to keep records as specified in the Animal Welfare (Records and Statistics) Regulations 1999 in a readily accessible manner. For record keeping purposes, the term "code holder" includes any person or organisation that has made arrangements to use an existing code and AEC, as well as anyone with an approval to use non-human hominids. (It should be noted that any RTT involving non-human hominids must be in the best interests of the individual non-human hominid or its species and must be approved by the Director-General of MPI rather than an AEC.)

The records must be retained for a period of five years after the year to which they relate, and an annual return of the figures for the previous calendar year must be submitted to MPI by 28 February each year. In addition, the regulations empower the Director-General of MPI or any inspector appointed under the Act to obtain copies of records or details from them at any time. The regulations provide penalties for non-compliance, including for late submission of returns or supplying false or misleading figures.

Records of the number of animals used in long-term projects are not reported annually to MPI but every three years or at the end of the year in which the project is completed (if less than three years).

Hence annual animal usage detailed below reflects the numbers of animals used in studies that were completed during the year and reported to MPI.

The 21 more common species used in RTT in New Zealand are grouped into the following categories:
- Birds (fowls/chickens, "other birds", pigeons);
- Farm animals (cattle, deer, goats, pigs, sheep);
- Miscellaneous (amphibia, cephalopod/crustacea, fish, marine mammals, possums, reptiles);
- Other domestic mammals (cats, dogs, horses);
- Rabbits;
- Rodents (guinea pigs, mice, rats); and

A further category – "other" – covers any other species, including zoo animals and wild animals.

3   Summary of 2018 Animal Use Statistics

A total of 301 335 animals used in RTT were reported in 2018, a reduction of 13 236 over the previous year. The rolling 3-year average was 289 990, up 25 342 on the previous year. 146 institutions reported using animals in 2018.

The most commonly reported species in 2018 was cattle – with 102 520 animals making up 34 percent of the total. Fish (55 926) were the second most common species followed by mice (47 983) and sheep (29 056). Reflecting the importance of research relating to agriculture, production animals (cattle, sheep, deer, goats and pigs) made up 48.6 percent of the total (146 452). Rodents and rabbits together accounting for 24.5 percent (73 900) and fish 18.6 percent.

The main reasons for using production animals were for veterinary research, basic biological research, and teaching, accounting for 108 872 (74.3 percent) of these species. Most fish were used in basic biological research (36 307), with other main uses being teaching and species conservation. Over 94 percent of the rodents were used in medical research, basic biological research, testing the safety and efficacy of animal health products and environmental management. The majority (92.4 percent) of cats, dogs and horses were used in veterinary research, basic biological research and teaching, with 260 horses reported used in the production of biological agents.

Over 76 percent of animals were exposed to manipulations which had no, virtually no, or little impact on their welfare, with another 20.2 percent experiencing "moderate impact". A total of 9866 animals (3.3 percent of the total) experienced manipulations of "high impact" or "very high impact". The species that experienced a "very high" impact were rodents, possums, fish and "other species" – a group that contains such animal as ferrets and stoats.

Animals classified as transgenic/chimera were mostly rodents – 7531 mice and 622 rats. Other transgenic/chimera species were fish, goats, cattle, sheep and amphibia with a total of 8641 (2.9 percent of the total) used in 2018.

Nearly 35 percent of animals were dead or euthanased following their use in manipulations. While over 96 percent of production animals remained alive following use, nearly 98 percent of rabbits and rodents were 'dead or euthanased' following manipulation. This year for the first time, an amendment to the Act required animals that were killed for the purpose of using their tissues for RTT purposes but did not undergo any prior manipulation to be included in the annual statistics. In 2018, 14 308 animals were included in this group, 4.7 per cent of the total.

4 Animal Usage

During 2018, a total of 301 335 animals[1] were reported as manipulated[2] in RTT[3]. This was 13 236 fewer compared to 2017 when 314 571 animals were reported.

Much of the annual variability in the statistics can be attributed to the three-yearly cycle of reporting of long-term projects. Reports of the numbers of animals used in long-term projects are not required annually but rather every three years, when the project is completed or when AEC approval of the project expires, whichever comes first. A truer reflection of overall use is given by the three-year rolling average, up 25 342 in 2018.

To illustrate the influence of the three-yearly reporting cycle, the accompanying graph shows the rolling three-year average compared with the annual totals. For the last three years (2016 to 2018) the average was 289 990.
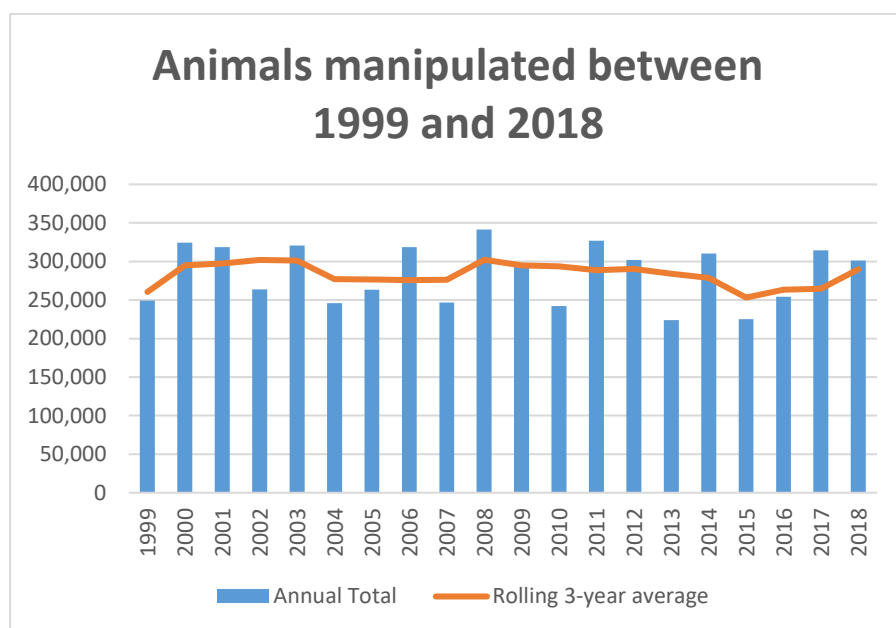
Those species most commonly reported in 2018 were (in order) cattle, fish, mice and sheep, which collectively accounted for 78.1 percent of the total animals manipulated for RTT. Mice, sheep and cattle have all been included in the four most commonly used animals since 1989. The other species making up this group in those 26 years have been fish (in 17 years), rats (in seven years) and birds (in five years). Farm animals were the largest group used for RTT in 2018, making up 48.6 per cent of the total, followed by rodents and rabbits (24.5 per cent) and fish (18.6 per cent).

Cattle made up 70 percent of the farm animals used and 34 percent of total animals used and were mainly used in veterinary research, teaching, basic biological research and environmental management. Fish (55 926) were mainly used for basic biological research and teaching. Mice were mainly used for medical research, testing and basic biological research. Sheep were mainly used for veterinary research, basic biological research, teaching and animal husbandry.

In 2018, 237 animals were reported in the "other species" category. This group was made up of 10 African pouched rats used for veterinary research; 21 alpaca, 2 chinchillas and 2 llamas used for teaching; 44 bats used for species conservation (16) and basic biological research (28); 5 chimpanzees used for veterinary research; 2 elephants and 3 giraffes used for animal husbandry; 32 ferrets, 25 hedgehogs, 66 stoats, and 21 wallabies used for environmental management; and 4 spider monkeys used for basic biological research.

Massey University's Wildbase Hospital was given approval pursuant to s85 of the Act to undertake research on non-human hominids for a two year period from 7 December 2017. The research involved

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[1] As defined in section 2(1) of the Animal Welfare Act 1999.
[2] As defined in section 3 of the Animal Welfare Act 1999.
[3] As defined in section 5 of the Animal Welfare Act 1999.

taking a series of blood samples from five chimpanzees held in New Zealand zoos that were being anaesthetised for other purposes. The blood samples were to be used to investigate the effects of the anaesthesia on the physiological homeostasis of the animals.

Wherever it appears, the category "cats" includes feral cats. Likewise, wild rats and mice are included in the "rats" and "mice" categories and feral pigs in the "pigs" category.

5 Source of Animals

Code holders are required to report on the source of the animals manipulated according to specified categories. The table below shows the percentage of animals that came from each source in the past two years.

Source of animals	2018	2017
	%	%
Farms	36.9	38.6
Breeding units	23.9	22.2
Captured	18.6	19.0
Commercial sources	8.8	10.9
Public sources	6.4	5.7
Born during project	5.3	3.3
Imported	0.1	0.3

A total of 111 225 animals were sourced from farms in 2018. While over 90 per cent of these were indeed farm animals (100 659), 6800 fish were also classified as coming from farms, as were chickens, dogs, horses, llamas/alpacas and "other birds".

Animals sourced from breeding units numbered 72 072 in 2018. The majority of these were mice, rats and fish.

A total of 55 924 animals were captured in 2018 for RTT purposes. The majority of these were fish and rats, as well as lesser numbers of cephalopod/crustacea, reptiles, "other birds", possums, marine mammals, "other species", amphibia, mice, deer, cats and rabbits.

A total of 26 368 animals came from commercial sources. Most of these were fish and cattle, as well as sheep, goats, chickens, mice, rats, rabbits, deer, "other birds", pigs, horses, guinea pigs, "other species", dogs, pigeons, reptiles and amphibia.

A total of 19 312 animals came from public sources, with the majority being cattle. Others were dogs, rats, cats, "other birds", fowls/chickens, mice, horses, fish, rabbits, guinea pigs, possums, pigeons, amphibia, reptiles, "other species" and goats.

A total of 15 990 animals were born during projects in 2018. The majority of these were sheep.

A total of 444 animals were imported into New Zealand for RTT purposes in 2018. These included 428 mice, 10 rats and six horses.

In 2018, 26 institutions used cattle in RTT and 20 used sheep. Thirteen institutions used only cattle, four used only sheep and seven used only sheep and cattle.

6 Status of Animals

Code holders are required to categorise the status of the animals they use. The following table breaks down the animal status for the past two years.

Status of animals	2018	2017
	%	%
Normal/conventional	86.5	89.9
SPF/germ-free	4.9	3.3
Transgenic/chimera	2.9	1.9
Protected species	2.8	1.5
Unborn/pre-hatched	2.6	3.0
Diseased	0.2	0.3
Other	<0.1	<0.1

As in previous years, the majority of animals manipulated in RTT in New Zealand in 2018 were classified as normal, healthy, conventional animals.

Most (99.8 per cent) SPF/germ-free animals were rodents in 2018. Other species in this category were pigs and fish.

A total of 8641 animals were classified as transgenic/chimera, most of which were mice. This category also included rats, fish, goats, cattle, sheep and amphibia. Six institutions used transgenic/chimera animals in 2018.

Protected species included reptiles, "other birds", marine mammals, amphibia, bats and mice.

7695 animals were included in the unborn/pre-hatched category, made up of fish eggs, fetal mice, chicken eggs, fetal rats and fetal lambs.

A total of 689 animals were classified as "diseased"[4] and included rats, cattle, sheep, deer, cats, mice, dogs and horses.

259 cattle and two sheep and were classified as having a status other than those listed above.

7 Outcome

Appendix 1 shows the five-year summary of the animals used (by species) and the percentages that died or were euthanased before, during, or after manipulations. For the first time in 2018, due to the amendment of the definition of manipulation in the Act, animals that were killed for the purpose of using their tissues for RTT purposes but did not undergo any prior manipulation were included in the annual statistics. In 2018, 14 308 animals were included in this group, 4.7 per cent of the total. Another 90 716 animals died or were euthanased during, or after, manipulations. The remaining 196 311 animals remained alive following manipulation. Of those, 107 798 were returned to owners, 35 590 were released to the wild, 31 715 were retained by the institution and 21 165 were disposed of to others. Forty-three animals were rehomed - 18 rats, 12 chickens, four rabbits, four mice, two reptiles, two guinea pigs and one fish.

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[4] Animals afflicted with naturally occurring disease, the focus of study usually being the cause, effects, cure or prevention of the disease.

Animal use by species reported in 2018
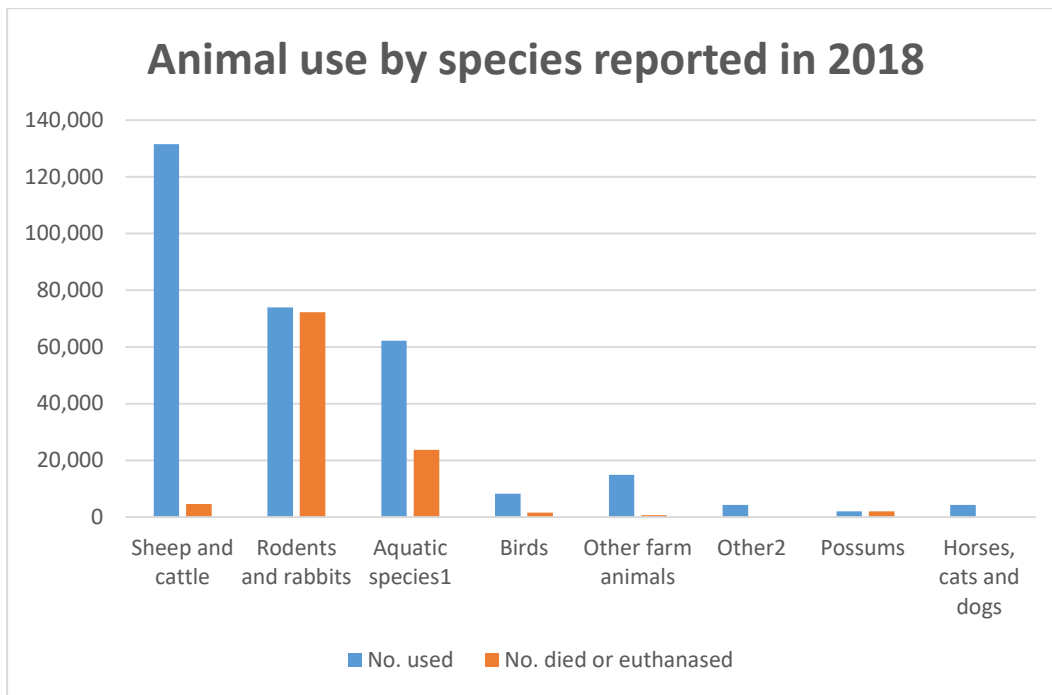
(1)- 'Aquatic species' includes amphibia, fish, marine mammals and cephalopods/crustaceans

(2)- 'Other' includes reptiles and "other species"

8 Organisation Type

Appendix 2 tabulates animal usage by organisation type over the past five years. The pie chart below shows the 2018 information graphically. The top three user groups in 2018 were (in order) commercial organisations, universities and crown research institutes (CRIs).

Animal usage by organisation type

- Commercial — 39.9%
- Universities — 34.4%
- Crown Research Institutes — 13.2%
- Other — 8.1%
- Polytechnics — 2.6%
- Government Departments — 1.1%
- Schools — 0.7%
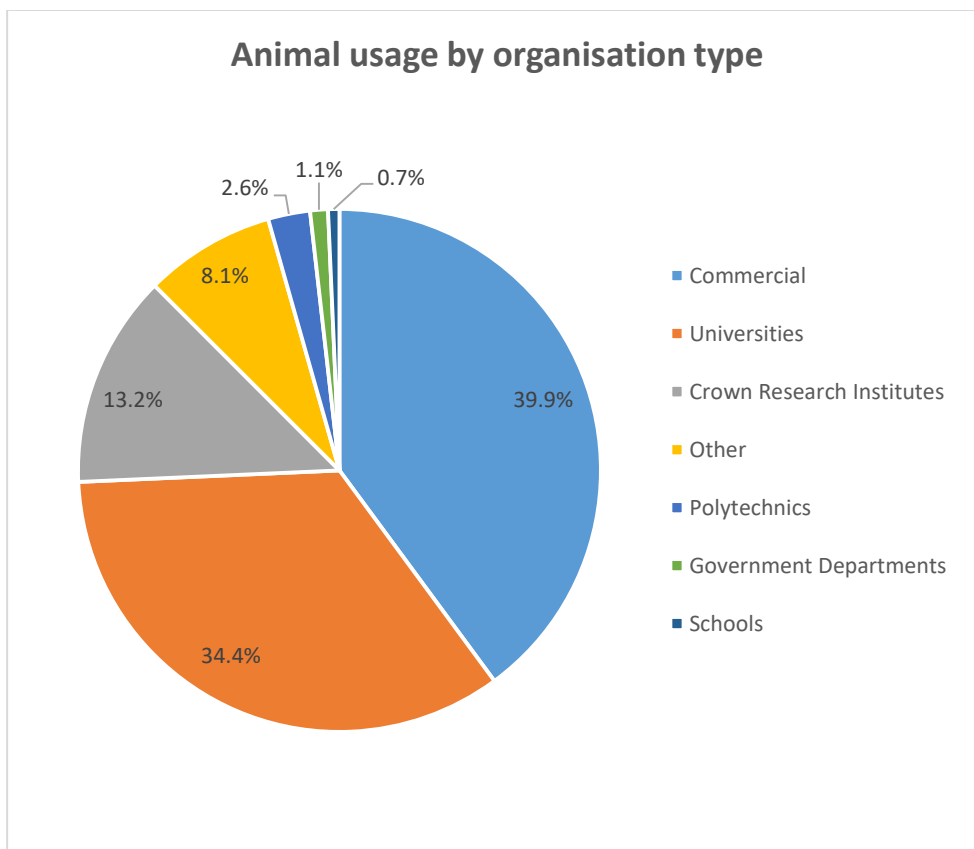
Commercial organisations used 120 220 animals in 2018. Animals reported by commercial organisations were used for veterinary research, testing, basic biological research, teaching, environmental management, production of biological agents, animal husbandry research, "other purposes" and medical research.

Universities reported using 103 786 animals in 2018. Animals reported by universities were used for basic biological research, veterinary research, medical research, teaching, species conservation, animal husbandry research, other purposes, environmental management, producing offspring, development of alternatives, testing and production of biological agents.

CRIs used 39 880 animals in 2018. Animals reported by CRIs were used for environmental management, basic biological research, veterinary research, animal husbandry research, medical research, species conservation, testing, other purposes, production of biological agents and teaching.

Organisations in the 'other' category include non-university medical research institutes, zoos/wildlife parks and individuals. The number of animals reported from this sector was 24 266 in 2018. The majority of these were used for basic biological research. Other animals were used for medical research, teaching, species conservation, veterinary research and animal husbandry.

Polytechnics and institutes of technology reported 7812 animals in 2018. The wide variety of animals manipulated by this sector were nearly all used for teaching, usually for low impact animal husbandry/veterinary nursing or similar training. Other animals were used for basic biological research, environmental management, veterinary research, medical research and animal husbandry research.

Government departments reported the use of 3237 animals in 2018. The majority of these were used in veterinary research, mainly for investigation and surveillance of exotic avian diseases. Others were used in species conservation and basic biological research.

The number of animals in RTT reported by schools was 2134 in 2018. These were mainly cephalopod/crustacea (2047). In addition rats, fish, chickens, cats, mice, other birds, goats, one dog, one horse and one reptile were used for teaching purposes.

9 Animal Reuse

In 2018, 38 582 animals used in RTT were reported as having been used previously. Domestic animals (including livestock) accounted for 82.2 per cent of the animals that were reused. With the exception of marine mammals, a proportion of every animal species was reported as having been previously used.

10 Purpose of Manipulation

Organisations are required to provide information on the purpose of manipulations (in broad categories). The table below shows the breakdown and compares the 2018 figures with those reported in 2017. Descriptions of the "purpose of manipulation" categories are outlined in Appendix 3.

Purpose of manipulation	% of animals used	
	2018	2017
Basic biological research	30.3	41.0
Veterinary research	21.0	10.3
Teaching	12.3	14.3
Environmental management	9.4	2.5
Testing	9.3	7.4
Medical research	7.7	8.0
Animal husbandry	4.0	13.4
Species conservation	2.5	2.3
Other purposes	2.0	0.2
Production of biological agents	1.4	0.6
Producing offspring with potential for compromised welfare[5]	0.1	
Development of alternatives	<0.1	0

The main purpose for which animals were manipulated in 2018 was for basic biological research with 91 210 animals in this category. Most of these were fish, cattle, mice, sheep and rats. No deer, possums or guinea pigs were used for this purpose.

A total of 63 253 animals were reported as used for veterinary research in 2018. The majority of these were cattle and sheep. All species were included in this group except pigeons, pigs, amphibia, cephalopod/crustacea, fish and possums.

A total of 37 096 animals were reported as used in teaching in 2018, the majority of which were cattle, sheep and fish. All species except pigeons and marine mammals were used for teaching purposes.

Environmental management research used 28 309 animals in 2018. Cattle and rats made up 82 per cent of animals in this category.

The number of animals manipulated for the purposes of testing was 28 049 in 2018. Most of these were rodents and rabbits and farm animals.

The number of animals reported as being manipulated for medical research was 23 125 in 2018. The majority of these were rabbits and rodents.

Animal husbandry research used 12 014 animals in 2018. The majority of these were farm animals and chickens.

Animal numbers reported for species conservation in 2018 were 7402, mostly made up of fish, "other birds" and marine mammals. Smaller numbers of amphibia, reptiles, rats and "other species" were also used in this category.

Animals reported as used for purposes other than those included above numbered 6085 in 2018. Most of these were fish, cattle and rats.

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[5] This category was introduced in 2018

The number of animals reported as utilised in the production of biological agents was 4211 in 2018. The majority of these were goats and cattle. Mice, horses, rabbits, sheep, guinea pigs and rats were also used for this purpose.

Animal numbers reported for the purpose of producing offspring were 400 made up of 263 mice and 137 rats.

181 mice were used for the development of alternatives in 2018 (see section 12).

11 Grading of Animal Manipulations

Animal manipulations are graded according to a five point scale as specified in the Animal Welfare (Records and Statistics) Regulations. The name and description of the scale was changed in 2008 to better reflect the overall estimate of the impact or invasiveness of each animal use. The five grades are:

- "no impact or virtually no impact" - manipulations that causes no stress or pain or virtually no stress or pain
- "little impact" - manipulations of minor impact and short duration
- "moderate impact" - manipulations of minor impact and long duration or moderate impact and short duration
- "high impact" - manipulations of moderate impact and long duration or high impact and short duration
- "very high impact" - manipulations of high impact and long duration.

A more comprehensive description of the grading system has been published in the MPI publication *Animal Use Statistics* and is available on the website:
https://www.agriculture.govt.nz/dmsdocument/1477-animal-use-statistics-guidance-for-completing-statistical-returns

Appendix 4 summarises the impact grade allocated to animals manipulated for RTT and reported in 2018.

11.1 LONG-TERM TRENDS OF THE IMPACT OF RTT ON THE ANIMALS USED IN NEW ZEALAND

Impact of manipulations on animals used for RTT over the last 19 years
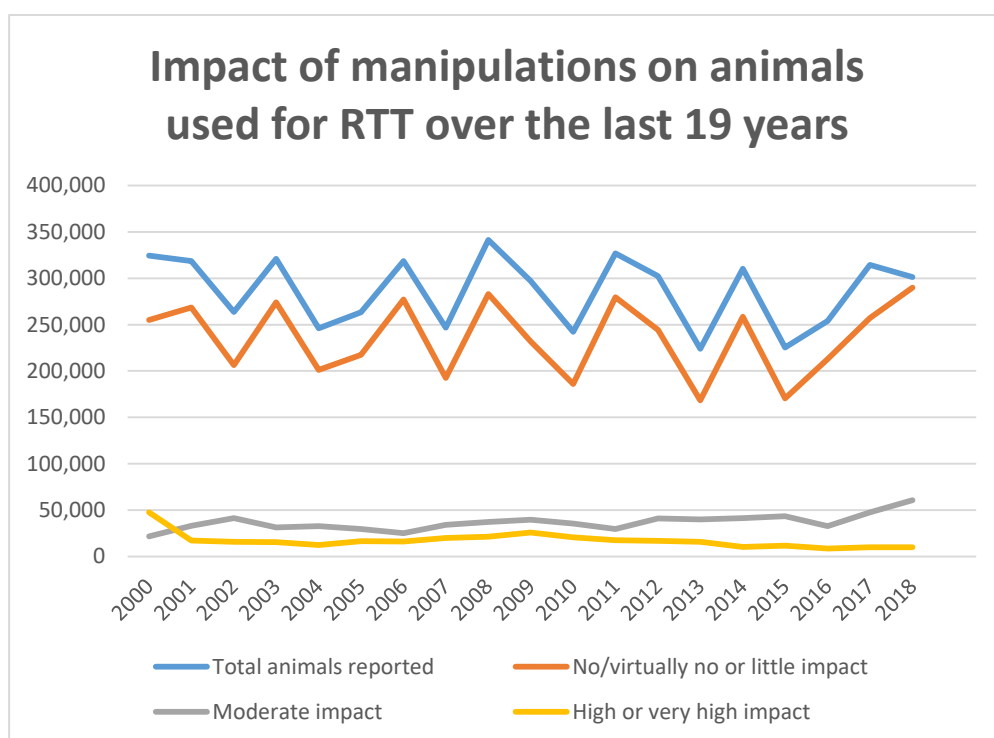
The percentage of animals that experience "no/virtually no" or "little impact" has averaged 80.8 percent since 2000 with a range from 75.2 percent to 87.0 percent. In 2018, 76.5 percent (230 646) of animals were exposed to manipulations in these categories.

The percentage of animals that experience "moderate impact" has averaged 13.1 percent over the last 19 years with a range from 6.7 percent to 20.2 percent. In 2018, 20.2 percent (60 823) of animals were classified in this category.

The percentage of animals that experience "high impact" or "very high impact" has averaged 6.0 percent over the last 19 years with a range from 3.1 percent to 14.7 percent. In 2018, a total of 9866 animals (3.3 percent of the total) experienced manipulations in these categories.

11.2 MANIPULATION GRADING OF ANIMALS REPORTED IN 2018

The table below gives details of the gradings for various groupings of animals.

11.2.1 Summary of impact of manipulations in animals used for RTT in 2018

2018 summary	Total reported	Number in each manipulation grade				
		No/virtually no impact	Little impact	Moderate impact	High impact	Very high impact
Rodents and rabbits	73 900	13 086	28 105	24 605	1641	6463
Sheep and cattle	131 576	42 929	71 705	16 718	224	0
Aquatic species[1]	62 243	12 442	35 050	14 387	346	18
Other domestic species	19 119	8804	9505	567	243	0
Birds	8229	2443	1684	4102	0	0
Possums	2030	1073	57	8	850	42
Other[2]	4238	43	3720	436	24	15
Grade totals	**301 335**	**80 820**	**149 826**	**60 823**	**3328**	**6538**
Grade percentages		**26.8%**	**49.7%**	**20.2%**	**1.1%**	**2.2%**

Animals featuring in the "very high" impact group were fish, possums, "other species", guinea pigs, mice and rats. Animals were classified in this and the "high" impact grades for the following reasons:

Cattle
- Calves were subjected to a pressure algometer on their disbudding wound edge at 4 different locations for each wound at 6-8 different time periods throughout the day. Their reaction to pressure led to the higher than expected grading.
- Cows were cannulated for regular collection of rumen fluid used in an *in vitro* fermentation facility.
- Calves were disbudded without pre-emptive analgesia. Post-dehorning, analgesia was provided to most animals.

Sheep
- Two lambs were badly affected with flystrike.
- Control animals (no analgesia) were graded as Category D due to the standard industry practice to hot-iron tail-dock and ring-castrate Merino lambs at four to six weeks of age without provision of analgesia.

Goats
- A study looking at alternative methods of preventing horn development in goats. While animals did receive pain relief, a number had to be disbudded a second time when treatments did not completely prevent horn growth.

Fish
- Salmon were used in an experiment to understand the pathogenesis of disease and mortality in the species.
- Following anaesthesia, eels were implanted with transponder tags as well as being measured. Once recovered from the anaesthetic, they were released.
- In a study involving the capturing of fish using a spear gun, fish that did not die immediately were graded D.
- Fish were tested for increased arousal threshold using bubble curtain stimulation.
- Fish were captured, transported, and subjected to a tank-based dominance hierarchy experiment.
- Fish were subjected to a chase protocol to measure peak metabolic rate (MO2) for the determination of metabolic scope, as well as to manipulation of water temperature to assess the metabolic response of triplefins to their fluctuating rock pool environment.
- Fish were captured by hand net and transported to the laboratory where their resting metabolic rate response could be measured.

Rabbits
- Four rabbits were part of a project to develop a surgically induced model of bladder dysfunction in the species.

Guinea pigs
- Guinea pigs were used in batch release testing for animal vaccines. This is a regulatory requirement to demonstrate potency.
- Guinea pigs were used in veterinary research, and production & evaluation of biological reagents.

Mice
- In an investigation of a bovine blood extract peptides, some mice had adverse reactions to the product.
- Evaluation of shellfish toxin evaluation with animals euthanased at predefined endpoints.
- An investigation of a treatment to improve resilience to influenza.
- A study to understand endophyte metabolites that induce tremors.
- Mice were used in testing of antigens and animal vaccines mandated by regulation.
- Mice were used in veterinary research, production and evaluation of biological reagents.
- Four mice were found unexpectedly dead in their cages.
- Mice were involved in a project to develop and characterise new drugs with reduced side effects compared to opiates such as morphine and codeine. Mice graded as high impact either received reduced analgesia as part of the experiments to characterise the mode of pain relief or were used to determine the duration of effect of the test compounds.

Rats
- Rats were ovariectomised to induce osteoporosis and placed on a diet including strontium to see if such a diet could enable the strontium to be imaged in the bones.

Pest control
- Mice and rats were part of field based trials of a bait containing an anticoagulant toxin.
- Possums and rats were used to test deer-repellent baits for palatability and efficacy.
- 1080 baits containing deer repellent were tested against 60 caged possums.
- Dama wallabies were used in a trial testing pindone baits.
- Rats, possums and stoats were used in the development of improved tools for vertebrate pest control.
- Possums and rats were used in a trial using Feracol as an alternative to 1080.

12 The Three Rs

The 181 mice used for the development of alternatives were used for the production of the active form of a signalling molecule that plays a key role in the reproductive system. Currently available formulations of this protein are extracted from animals that naturally express this molecule. This study is attempting to allow sustained and reliable production of the protein avoiding the use of production animals. This new product is being tested on living animals.

Appendix 1

ANIMAL USAGE REPORT: FIVE-YEAR SUMMARY OF THE NUMBER OF ANIMALS USED AND THE PERCENTAGE THAT DIED OR WERE EUTHANASED (BY SPECIES)

	2018		2017		2016		2015		2014	
	No. used	% died or euthanased	No. used	% died or euthanased	No. used	% died or euthanased	No. used	% died or euthanased	No. used	% died or euthanased
Amphibia	258	9	66	38	593	3	1368	13	771	51
Birds	8229	24	33 355	55	9716	17	15 627	13	31 588	42
Cats	701	10	1099	<1	926	<1	519	3	728	<1
Cattle	102 520	1	44 007	<1	104 338	<1	59 330	1	75 496	<1
Cephalopods/ crustaceans	4349	28	4028	20	4815	28	2200	27	4756	28
Deer	1968	11	1537	11	7688	2	8497	<1	25 058	<1
Dogs	2624	<1	888	2	1304	7	812	3	1006	3
Fish	55 926	40	101 167	82	19 632	56	40 764	49	40 555	30
Goats	11 429	2	3297	3	4400	5	2052	9	3176	6
Guinea pigs	2 404	94	1952	94	1900	96	1967	95	1864	95
Horses/ donkeys	918	2	756	<1	924	1	283	0	237	2
Marine mammals	1710	6	698	0	2974	0	403	0	843	0
Mice	47 983	99	52 196	99	34 013	98	48 341	99	58 379	97
Pigs	1479	15	455	91	533	89	738	54	724	42
Possums	2030	96	983	89	1169	75	2977	84	3983	94
Rabbits	1291	90	1208	85	1225	90	1494	90	1445	91
Rats	22 222	95	7592	84	8770	87	9387	87	11 807	92
Reptiles	4001	<1	1096	<1	1235	8	4473	<1	325	<1
Sheep	29 056	12	57 436	6	47 548	4	23 474	11	44 745	8
Other species	237	44	360	18	604	7	2801	5	394	5
Total	**301 335**		**314 571**		**254 063**		**225 310**		**310 287**	
Yearly %		35%		54%		25%		39%		34%

Appendix 2

ANIMAL USAGE REPORT: FIVE-YEAR SUMMARY OF ANIMAL USAGE
(BY ORGANISATION TYPE)

Group	Year	Rodents, rabbits	Sheep, cattle, goats	Other domestic animals	Birds	Fish	All other species	Total
Commercial organisations	2014	20 436	82 185	218	24	2984	12	105 859
	2015	22 195	60 708	714	7474	4811	319	96 221
	2016	15 726	98 908	960	12	-	48	115 654
	2017	22 777	54 923	172	1	10	10	77 893
	2018	**17 530**	**101 535**	**1048**	**60**	**10**	**37**	**120 220**
Universities	2014	31 346	16 822	19 681	23 258	22 877	6461	120 445
	2015	22 737	9682	2003	5801	22 554	6393	69 170
	2016	20 403	10 981	1554	2505	9862	5106	50 411
	2017	22 203	16 098	2283	30 321	81 692	1818	154 515
	2018	**32 098**	**25 315**	**4218**	**4248**	**31 252**	**6655**	**103 786**
Crown Research Institutes	2014	1866	22 975	7108	6103	11 174	1431	50 657
	2015	1818	13 828	7422	-	8537	2980	34 585
	2016	4681	43 039	7788	4791	2284	1265	63 848
	2017	2442	18 023	1444	191	9327	2909	34 336
	2018	**14 194**	**12 650**	**1824**	**1559**	**7495**	**2158**	**39 880**
Others	2014	16 705	-	-	4	50	216	16 975
	2015	14 231	73	37	65	1398	563	16 367
	2016	4367	947	78	79	1628	584	7683
	2017	15 124	35	110	102	1834	497	17 702
	2018	**9755**	**2212**	**86**	**93**	**11 309**	**811**	**24 266**
Polytechnics	2014	206	1312	641	77	3418	146	5800
	2015	208	491	652	75	3455	75	4956
	2016	207	2342	910	57	5602	34	9152
	2017	299	509	707	78	8294	38	9925
	2018	**288**	**1289**	**505**	**111**	**5537**	**82**	**7812**
Government Departments	2014	2920	-	47	2081	2	3053	8103
	2015	-	-	17	2212	5	613	2847
	2016	501	-	7	2243	245	977	3973
	2017	-	-	-	2620	-	629	3249
	2018	**-**	**-**	**-**	**2145**	**298**	**794**	**3237**
Schools	2014	16	123	58	41	50	2160	2448
	2015	-	74	4	-	4	1082	1164
	2016	23	69	78	29	11	3132	3342
	2017	3	15 152	19	42	10	1725	16 951
	2018	**35**	**4**	**9**	**13**	**25**	**2048**	**2134**
Total	2014	73 495	123 417	27 753	31 588	40 555	13 479	310 287
	2015	61 189	84 856	10 849	15 627	40 764	12 025	225 310
	2016	45 908	156 676	11 375	9716	19 632	11 146	254 453
	2017	62 948	104 740	4735	33 355	101 167	7626	314 571
	2018	**73 900**	**143 005**	**7690**	**8229**	**55 926**	**12 585**	**301 335**

Appendix 3

ANIMAL USAGE REPORT: 'PURPOSE OF MANIPULATION' CATEGORIES

Category	Description
Teaching	Animals used for teaching or instruction, at any level.
Species conservation	Work directed towards species conservation. The species to be conserved may or may not be directly involved, e.g. nutrition studies using more common species can benefit an endangered species.
Environmental management	Environmental management, including the control of animal pests and research into methods of reducing production of greenhouse gases.
Animal husbandry	Animal husbandry, including reproduction, nutrition, growth and production.
Basic biological research	Basic biological research.
Medical research	Research aimed at improving the health and welfare of humans, but not research on human subjects.
Veterinary research	Research aimed at improving the health and welfare of production and companion animals.
Testing	Animals used for public health testing or to ensure the safety, efficacy or quality of products to meet regulatory requirements for human or animal products, either in New Zealand or internationally.
Production of biological agents	Animals used for raising antibodies or for the supply of blood products.
Development of alternatives	Work aimed at developing methods to replace or reduce the use of live animals in research, testing and teaching.
Offspring with compromised welfare	Breeding animals, using a breeding technique that produces offspring that maybe/are likely to be more susceptible or at greater risk of pain or distress during their life.
Other	Manipulations for purposes other than those listed above.

Appendix 4

ANIMAL USAGE REPORT: SUMMARY OF THE IMPACT GRADE ALLOCATED BY SPECIES IN 2018

Species	No impact	Little impact	Moderate impact	High impact	Very High impact	Total
Amphibia	3	255	-	-	-	258
Birds	2443	1684	4102	-	-	8229
Cats	269	374	58	-	-	701
Cattle	42 203	48 319	11 791	207	-	102 520
Cephalopods/ Crustacea	968	214	3108	59	-	4349
Deer	111	1675	182	-	-	1968
Dogs	1165	1413	46	-	-	2624
Fish	11 265	34 557	9799	287	18	55 926
Goats	6843	4208	135	243	-	11 429
Guinea pigs	51	812	23	910	608	2404
Horses	382	421	115	-	-	918
Marine mammals	206	24	1480	-	-	1710
Mice	2551	19 615	19 880	329	5608	47 983
Pigs	34	1414	31	-	-	1479
Possums	1073	57	8	850	42	2030
Rabbits	55	1194	33	9	-	1291
Rats	10 429	6484	4669	393	247	22 222
Reptiles	20	3601	380	-	-	4001
Sheep	726	23 386	4927	17	-	29 056
Other species	23	119	56	24	15	237
TOTAL	80 820	149 826	60 823	3328	6538	301 335
Percentage	26.8%	49.7%	20.2%	1.1%	2.2%	

Appendix 5

LIST OF CODE HOLDERS REQUIRED TO SUBMIT A STATISTICS RETURN FOR 2018

Aakland Chemicals (1997) Ltd
Abacus Biotech Ltd
Advanced Genetics 2015 Ltd
Ag Challenge Ltd
Agilis Vets Ltd
AgResearch Ltd
AgriHealth NZ Ltd
AgVet NZ Ltd
Alleva Animal Health Ltd
Alltech (NZ) Ltd
Aloe Vera NZ Ltd
Animal Breeding Services (2007) Ltd
Ara Institute of Canterbury
Argenta Manufacturing Ltd
Aroa Biosurgery Ltd
Arotec Diagnostics Ltd
AsureQuality Ltd
Auckland University of Technology
Auckland Zoological Park
Bayer New Zealand Ltd
B+LNZ Genetics
BioCell Corporation Ltd
Boehringer Ingelheim Animal Heath New Zealand Ltd
Boffa Miskell Ltd
BW & MB McLeod Partnership
Caledonian Holdings Ltd
Carne Technologies Ltd
Cawthron Institute
Cognosco, Anexa Animal Health
Cropmark Seeds Ltd
CRV Limited
CuroNZ Ltd
Dairy Goat Co-operative (NZ) Ltd
DairyNZ Ltd
Dairy Production Systems Ltd
Damar Industries Ltd
DCS Animal Health Studies Ltd
Department of Conservation
Dermvetonline
Disease Research Ltd
Eastern Institute of Technology
Elanco Animal Health
EquiBreed NZ Ltd
Eurofins AgroScience Services NZ Ltd
Eurofins Animal Health NZ
FIL (New Zealand) Ltd
Flint, Pania
Franklin Vets
Goldenberg, Silvan
Grace, Neville
Halter Ltd
Haywood, Ursula
Hillcrest High School
Innovative Medical Solutions Ltd
InterAg
Intuit Regulatory & Marketing Ltd

Invetus NZ Ltd
Jurox Pty Ltd
Karori Sanctuary Trust
Keane, Susan
Landcare Research New Zealand Ltd - Manaaki Whenua
Lawrence, Dr David W
Levin and Horowhenua Veterinary Centre
LIC Deer Ltd
Life Technologies New Zealand Ltd
Lincoln University
Livestock Improvement Corporation Ltd
Living Cell Technologies New Zealand Ltd
Malaghan Institute of Medical Research
ManukaMed Limited Partnership
Massey University
Matamata Veterinary Services Ltd
Matthews, Lindsay
McLeod, Graeme & Janelle
Medical Plus New Zealand
MetriKlenz Ltd
MPI Diagnostic and Surveillance Services
National Institute of Water and Atmospheric Research Ltd
National Trade Academy
Nelson Marlborough Institute of Technology
New Zealand Agriseeds Ltd
New Zealand Association of Science Educators
New Zealand Institute for Plant and Food Research Ltd
New Zealand Leather and Shoe Research Association
New Zealand National Fieldays Society Inc
North Canterbury Veterinary Clinics
NZ AutoTraps Ltd
NZ Companion Animal Council
NZeno Ltd
Oamaru Veterinary Centre
On-Farm Research Ltd
Oritain Global Ltd
Otago Polytechnic
Otakaro Pathways Ltd
Ottmann, Garry
Parnell Technologies Pty Ltd
PGG Wrightson Seeds Ltd
Pharmfirst Ltd
PharmVet Solutions
PJM Scientific Pty Ltd
Practical CPD Ltd
Quantec Ltd
SBScibus Ltd
Schering-Plough Animal Health Limited
SciLactis Ltd
Seacrest Farms Ltd
Sirona Animal Health Ltd
Skretting
South Pacific Sera Limited
Southern Institute of Technology
Spring Sheep Dairy LP
Starboard Bio Ltd
StemVet New Zealand Ltd
Synlait Milk Ltd
Synthase Biotech Ltd
Taihape Veterinary Services
Te Whare Wananga o Awanuiarangi
Techion Group Ltd
The New Zealand King Salmon Co Ltd

The New Zealand Merino Company Ltd
Toi Ohomai Institute of Technology
Totally Vets Ltd
Towers Consulting
Trinity Bioactives Ltd
Unitec Institute of Technology
Universal College of Learning
University of Auckland
University of Canterbury
University of Otago
University of Waikato
Vence NZ Ltd
Vet Nurse Plus
Vet Resource Ltd
Veterinary Enterprises Group
VetLearn
Vetlife Ltd
Vetora
VetSouth Ltd
Victoria University of Wellington
Waikato Institute of Technology
Waikato Regional Council
Wellington Institute of Technology
Wellington Zoo Trust
West Coast Vets Ltd
Wildland Consultants Ltd
Zoetis New Zealand Ltd