NIWA
Taihoro Nukurangi

24 November 2016

Ursula Edgington

By email:
fyi-request-4865-142f9c5f@requests.fyi.org.nz

Dear Ursula

Official Information Act 1982 (OIA) – Requests for information

We refer to your email of 28 October 2016 in which you requested the below information under the Official Information Act 1982:

With regard to the original experiment that resulted in this research output:

Suren, A.M.; Lambert, P. 2006. Do toxic baits containing sodium fluroacetate (1080) affect fish and invertebrate communities when they fall into streams? New Zealand Journal of Marine and Freshwater Research 40: 531-546.

please supply a copy of the Principal Investigator's Research Ethics Application plus the accompanying approval from the NIWA Committee, and any relevant correspondence.

We presume you are seeking the relevant 'animal ethics' application, approval and relevant correspondence relating to work resulting in this research output. There were two applications to NIWA's Animal Ethics Committee in relation to work relating to this research output, Application Number 51 and Application Number 60.

We attach to this letter copies of:

- Application Number 51
- Approval letter from NIWA Animal Ethics Committee relating to Application Number 51 (the subject heading of this approval incorrectly refers to Application No 49)
- Application Number 60
- Approval letter from NIWA Animal Ethics Committee relating to Application Number 60
- Further detail that was sought by the Committee in relation to Application Number 60 (this is the same detail that was sought in relation to Application Number 51 and is included at the end of that application but we attach it separately for completeness).

We trust that this response provides you with the information you are seeking.

Yours sincerely

Annabelle Watson
Senior Legal Counsel

National Institute of Water & Atmospheric Research Ltd, 41 Market Place, Auckland Central 1010
Private Bag 99940, Newmarket, Auckland 1149, New Zealand. Phone +64-9-375-2050, Fax +64-7-856-0151

Application Number 51

Application to NIWA Animal Ethics Committee for consideration of research involving animal manipulation

Applicant: Alastair Suren

Date of application (submitted) 4 November 2002
Date of application (accepted) 5 November 2002

Project title: Quantifying effects of Sodium Monofluoroacetate (1080) on stream communities

Proposed start date: 1 March 2003
Proposed finish date: 30 June 2003

Three Rs:
The experiments outlined below specifically involve exposing a variety of fish species to 1080 concentrations that typically occur following aerial 1080 drops, when pollard baits fall into streams. As such we need to expose a known number of fish to potential 1080 plumes leaching from bait. We need sufficient fish (about 10) in each replicate cage to make statistical meaningful comparisons. We also need replicate cages to maintain statistical rigour. Finally we are interested in assessing any longitudinal effect on fish communities, so will place replicate cages immediately below the baits and other cages 200-300 m below. Other upstream cages will act as controls.

There is little option to reduce the number of replicates we need to use. There is no option but to use living fish for this work.

Project overview:

Sodium Monofluoroacetate (1080) is widely used throughout New Zealand for the control of brushtail possums. Its use, however, continues to attract widespread public opposition, despite many studies that have shown the rapid breakdown of this poison in water, and the many studies that have repeatedly failed to detect residual 1080 in water samples collected after widespread 1080 application in forests (Eason et al. 1994; Eason et al. 1992; Fowles and Williams 1997). No studies, however, have looked at the direct effect of 1080 on stream ecosystems, and in particular its effects on aquatic invertebrate and fish communities. Moreover, although aerial drops of 1080 specify buffer zones of 50-100 m of any waterway > 6 meters wide, there are many smaller streams that have no effective buffer zone around them. Under such conditions bait can and does within small streams, especially those that flow under forest canopies and which are not apparent from the air. Such unavoidable discharges have potential ecological consequences, especially given the very productive nature of small streams when compared to larger rivers, and their greatly reduced dilution capacity.

This study will examine the short to medium-term effect of 1080 baits placed into streams on natural invertebrate and fish populations, and will quantify whether there is an adverse impact of 1080 on these organisms, and will quantify the spatial and temporal extent of such impacts. Fish will be placed in small cages at locations above and below where a known quantity of 1080 pollard baits are placed. Fish in these cages will be assessed for any signs of mortality at regular intervals for up to 21 days. The cages will contain natural cobbles for shelter, and will be seeded with invertebrates before the fish are added. Extra invertebrates will be added at regular intervals

throughout the experiment. At the conclusion of the experiment, all fish will be released back at the sites from where they were collected from.

It is planned to add from 5 – 20 baits into each stream, which equates to 0.05 – 0.21 g of 1080 (assuming the use of 7 g pollard baits, at 0.15 % concentration). Stream flow in the catchments tentatively selected varies from 114 ls^{-1} to 830 ls^{-1}. This equates to a range of daily volumes of 8.6 million litres to slightly over 69.1 million litres. Assuming that the 1080 in the pollard baits dissolves over a 24 h period, the likely concentrations in the streams will be exceedingly small (Table 1).

Table 1. Estimated maximum 1080 concentrations in the stream water (assuming a 24 h rate of dissolution) at flow scenarios of 100 and 800 l s^{-1}, and for 5, 10, 15 and 20 pollard baits added to the streams. Note that the likely number of baits used in the trials will be from 5 – 10 baits (bold figures)

Flow (l s^{-1})	Number of pollard baits	Estimated 1080 concentration (µg l^{-1})
100	**5**	**0.00607**
	10	**0.01215**
	15	0.01823
	20	0.02431
800	**5**	**0.00075**
	10	**0.00152**
	15	0.00227
	20	0.00304

The maximum dose calculated in the above scenario (0.0243 ug l^{-1}) is well below the observed LC_{50} trials for rainbow trout (*Oncorhynchus mykiss*: 54 mg l^{-1}), and the freshwater daphnia (*Daphnia magna*: 350 mg l^{-1}). Indeed, our "worse-case" concentration of 20 baits in a small stream with a discharge of 100 l s^{-1}, and where ALL 1080 leaches from the bait over a 24 h period are less than 2 million times the observed LC_{50} for rainbow trout. Note that the above calculation assumes that the 1080 will all leach from the baits after a 24 h period, but observations of the breakdown of 1080 pollard baits in flow tanks have shown that they can take 3 – 4 days to break down. The concentrations given above are thus conservative, and likely to be much lower.

Manipulations:

This project will involve the capture of a variety of species of wild fish by electric fishing in accordance with NIWA's electric fishing protocol. Captured fish may be held temporarily in holding tanks at either NIWA Christchurch or NIWA Greymouth.

The manipulation will involve placing up to 10-15 fish in cages (approximately 0.9 m x 0.5 m wide x 0.25 m high), lined with natural gravels and cobbles. These cages will have coarse mesh (3 mm) on their ends and top to allow for unimpeded water flow through them. Invertebrates are also expected to drift or crawl into these cages. Other invertebrates will be added to the cages throughout the duration of the experiment.

Three replicate cages will be placed at sites upstream of where a known quantity of 1080 pollard baits will be placed into selected streams, in mesh bags to present being washed away. Three replicate cages will also be placed within 5-10 m downstream of the pollard bait and a further three

placed 2-300 m downstream. All cages will be placed in areas of relatively fast (0.1-0.3 ms^{-1}) and shallow water (up to 30 cm deep).

Fish in each cage will be examined at regular intervals over time after the addition of the bait to the streams (e.g., at days 1, 3, 6, 12 and 24). To examine fish, each cage will carefully be lifted from the streambed and cobbles removed. The cages will be upended into a bucket and all living fish counted. The cobbles will then be replaced into the cages and the fish reintroduced, along with some invertebrates. Any dead fish will be removed and examined for residual 1080 in their tissues.

Staff: Alastair Suren – programme leader, Julian Sykes, Gregg Kelly, Paul Lambert. These staff are experienced at capture and keeping of native fish.

Animals required:

Potential fish species to be selected for the trials include three Galaxid species (*Galaxias brevipinnis, G. vulgaris, G. maculates*), and four species of bully (*Gobiomorphus huttoni, G. cotidianus G. hubbsi* and *G. brevipennis*). We may also choose to use brown trout (*Salmo trutta*) and torrentfish (*Cheimarrichthys fosteri*). Final selection of fish species will depend on where the study will be conducted and what the local fish are.

It is planned to use 10 fish per cage, giving a total of 30 fish per site or 120 fish per stream. We hope to have four streams for this experiment.

Daily care:

Fish mortalities will be assessed at regular intervals (e.g., days 1, 3, 6, 12 and 24). Between these times each cage will be "seeded" with invertebrates, collected from each stream. Invertebrates will also naturally drift into the cages through the mesh ends. These invertebrates will provide the food for the captive fish. The only stress placed on the fish will be exposure to the 1080 as it leaches from the pollard baits, and handling stress during the days when the cages will be examined.

Stress minimisation:

This will be achieved by provision of good fish handling techniques during the experiment. Fish will only be observed on five occasions, the length of time required for each cage will be <30 minutes. Each cage will have a natural cobble/gravel substrate for fish to shelter in and invertebrates will be added to the cages at regular intervals.

Although we are testing the effects of 1080 exposure to these animals, the final concentrations in the water are likely to be very small and may have no effect on the fish.

Use of anaesthesia:

If required, standard fish anaesthesia will be used to sedate fish for collection of length and weight measurements. These will be done at the beginning and end of the experiment only.

Termination:

At the end of the experiment all fish will be returned to the streams from where they were collected. Any dead fish will be analysed for evidence of 1080 residue in their tissues.

Statutory requirements:

Resource consent is currently being obtained from the West Coast Regional Council. As part of this, discussions have been had with DoC, Timberlands, Fish and Game, and Crown Public Health. DoC has also required us to complete their own AEE according to their guidelines. This has involved extensive discussions between interested parties.

Records
The project leader will be responsible for ensuring that records are kept of the species, number, source and fate of all animals used in this experiment and that this information will be supplied to the NIWA Animal Ethics Committee when required.

Declaration:

We the undersigned have read the application and agree to comply with the details contained in the application and the requirements of the Animal Welfare Act 1999.

All personnel involved must provide a signature, printed name in full and date.

Signature

Name
Date

References cited

Eason, C.T.; Morgan, A.J.; Wright, G.R. (1994). The fate of sodium monoflouroacetate (1080) in stream water, and risks to humans. *Human and Experimental Toxicology 13*: 640.

Eason, C.T.; Wright, G.R.; Fitzgerald, H. (1992). Sodium monofluoroacetate (1080) water-residue analysis after large-scale possum control. *New Zealand Journal of Ecology 16*: 47-49.

Fowles, C.R.; Williams, J.R. (1997). Water quality monitoring in relation to a possum control operation on Mount Taranaki / Egmont. *New Zealand Natural Sciences 23*: 93-99.

Prior to approving this project further information was sought by the Committee. That information is as follows

From:	"Alastair Suren" <a.suren@niwa.co.nz>
Organization:	NIWA
To:	n.boustead@niwa.co.nz
Date sent:	Tue, 14 Jan 2003 12:13:14 +1300
Subject:	Re: responses to AEC questions
Send reply to:	a.suren@niwa.co.nz
Priority:	normal

From:	"Nelson Boustead" <n.boustead@niwa.co.nz>
Organization:	NIWA Christchurch
To:	a.suren@niwa.co.nz
Date sent:	Mon, 16 Dec 2002 16:45:45 +1200
Subject:	**AEC**
Send reply to:	n.boustead@niwa.co.nz
Priority:	normal

Hi Nelson,

replies to your e-mail as follows.

Application 51 Quantifying effects of Sodium Monofluoroacetate (1080) on stream communities
There was considerable discussion on this project and reference to the publication by Rammell and Fleming, (1978): "Compound 1080 – properties and use of Sodium Monofluoroacetate in NZ". It was noted that the dosages tested were considerably below the toxic levels for trout. It was agreed that the project be approved subject to a satisfactory response to four issues, namely:

1) Confirmation that the dosages tested were at the high end of that expected from an aerial drop on a small stream.

The number of 1080 pellets added to each stream will be based on results of survey work of aerial drops, where I am counting the number of pellets than have landed in streams. I want to assess the effects of a "worst case" scenario, and so will most likely double the number of pellets found in a clump in streams. Results to date show that up to 4-5 pellets can land close together, so I will be adding no more than 8 - 10 pellets for the experiments. One of 2 more drops will be surveyed as they come up, so the final figure may change slightly, but this is not expected to represent a great increase.

2) Confirmation that the size of the brown trout to be tested would be small, young fish.

If trout are used for the experiments, these will most likely be young, small fish, as larger fish will be impractical to use in the cages. Final choice of fish will be up to negotiation with AHB.

3) An explanation as to why sub lethal effects, such as histological changes were not being examined in this study.

This work was to establish whether any ecological effects of 1080 baits landing in streams are detectable, and was never intended to be a more detailed study to examine sub-lethal effects. If we detect an ecological effect to either invertebrates or fish, then there will be ample opportunity to approach organisations such as AHB for further funding.

Moreover, 1080 is a labile compound, and is quickly metabolised by animals when they ingest sublthal doses. 1080 is converted within the mitochondria to fluorocitrate, which inhibits and blocks the Krebs citric acid cycle in cells. As a consequence of this inhibition, citrate accumulates in tissues, and may leak into blood plasma. Gooneratne et al (1994) found that citrate accumulation in rabbit tissues and plasma declined rapidly after 0.5 - 2 h after sub-lethal dosing, but that after 12 h, no more citrate was detected. This suggests that all the 1080 was metabolised within half a day. Given the quick breakdown of sub-lethal doses, it is unlikely that any histological changes would be observed.

4) Advice on whether or not 1080 has a cumulative effect and if so how this would be taken into account.

1080 decays relatively quickly in water (e.g., Eason et al 1994; Parfitt et al 1994) and is also metabolised rapidly by animals that recieve sub-lethal doses (Gooneratne et al 1994). As such, there is little chance of cumulative effects to either fish or invertebrates.

I also reiterate that the expected concentrations of 1080 in the water as a result of the experiment will be very low, and over 2 million times LOWER that the published LC50 figures for rainbow trout. Given this, it is tempting to question the reasons for the study. However, one must consider that the aerial application of 1080 is highly controversial, and so any research that sheds light on the fate and effect of 1080 in freshwaters may help alleviate public concern. The information gleaned will also be fed into the ERMA reclassification process for 1080.

I trust that these answers are satisfactory.

Cheers Alastair

File: Ethics
31 Jan 2003

Alistair Suren
NIWA
P O Box 8602
Christchurch

Dear Alistair

ANIMAL ETHICS: Application No 49

I refer to your proposed research entitled:

"Quantifying effects of Sodium Monofluoroacetate (1080) on stream communities"

The NIWA Animal Ethics Committee has given approval for you to conduct the animal manipulations described in this proposal.

Please ensure the records are kept of species, numbers, source and fate of all animals used.

These records are required to be supplied to the NIWA Animal Ethics Committee on completion of the project or three years from the date of this approval to meet our reporting requirements to the National Animal Ethics Advisory Committee. Records are also to be available at any time to anyone authorised by the DG of MAF or to any inspector appointed under the Animal Welfare Act 1999.

Yours sincerely

Nelson Boustead
Secretary
NIWA Animal Ethics Committee

Application Number 60

Application to NIWA Animal Ethics Committee for consideration of research involving animal manipulation

Applicant: Alastair Suren

Date of application submitted 25 June 2003
Date of application accepted 25 June 2003

Project title: Assessing lethal effects of Sodium Monofluoroacetate (1080) bait on freshwater crayfish (*Paranephrops planifrons*)

Proposed start date: 7 July 2003
Proposed finish date: 1 October 2003

Three Rs:
The experiments outlined below specifically involve exposing freshwater crayfish (*Parenephrops planifrons*) to 1080 bait in a stream simulator, to see whether these animals will ingest pellets, and whether they die from this. Animals will also be humanely killed by freezing after increasing lengths of time after being exposed to the 1080 bait to determine whether there has been any uptake of 1080 into body muscle or vicera. Nothing is known of the vulnerability of freshwater crayfish to 1080 bait, so we need to expose a number of individuals to bait under semi-natural conditions to see whether they will indeed consume pellets. We need sufficient replicate crayfish (5) to make statistical meaningful comparisons. We also need to assess whether crayfish build up a body burden of 1080 after a certain period, and so will be investigating this after 1, 2, 4 and 8 days after exposure to the bait.

There is little option to reduce the number of replicates we need to use, and there is no option but to use living crayfish for this work.

Project overview :

Large-scale control of mammalian pests (especially the brushtail possum) in New Zealand requires use of baits containing sodium monofluoroacetate (compound 1080), which are aerially applied over rough, forested terrain that is impenetrable for ground application. Many consent conditions for aerial applications of 1080 bait specify buffer zones of 50-100 m away from waterways greater than 6 meters wide, but smaller streams have no such buffer zones. Bait is highly likely to land in small streams, especially given their prevalence in the steep, highly dissected mountainous country where aerial application of 1080 occurs. The standard aerial application rate of 6g 1080 cereal baits on the West Coast is approximately 3 kg ha^{-1}, or 500 baits per ha (Dale Rowling, *pers. Com.* Pest Supervisor, WCRC). This is approximately 1 bait every 20 m^2. Thus 10 cereal baits could be expected to fall directly into a 100 m section of stream that is 2 m wide.

The ecological effects of this accidental contamination are presently unknown. 1080 breaks down quickly in water in laboratory tests (Ogilvie et al. 1996), suggesting that any impacts should be short-lived. Moreover, Eason et al (1999) suggested that dilution of 1080 in streams would reduce its presence to toxicologically insignificant concentrations. However, despite these assertions, no

studies have looked at the direct effect of 1080 on stream ecosystems, and in particular its effects on aquatic invertebrate and fish communities.

Observations on the fate of 1080 baits that fall into flowing water have shown that they slowly swell, and begin to fragment after 3-4 days, depending on the size of the bait. After 4-5 days, little of the original bait remains as a result of fragmentation, and it is likely that these fragments would be washed away or become trapped within the spaces between cobbles. The ecological effects of 1080 baits that fall into water would most likely occur during the time that the baits were intact for, and when 1080 could leach from them. Once the baits had fragmented, the subsequent ecological effect would be minimal, as a result of a combination of fragmentation, leaching, and natural breakdown of the compound.

Consequently, there may be a 4-5 day "window" of time that pellets in a stream may adversely affect fish and invertebrate communities, although the method of effect would differ between these animal groups. Native fish are usually visual feeders, consuming living aquatic or terrestrial invertebrates that have fallen into the river (Main et al, 1988; McDowall 1990). Other fish (e.g., kokopu) rely less on vision to find their prey, but instead use their lateral line to sense where prey is. These native fish are predators, and so the risk of consumption of whole or fragmented pollard baits by native fish would be extremely low. Eels are more opportunistic in their diets, and consume a mixture of living and dead food items that they encounter. Whether eels would be inclined to consume baits they encounter is unknown: this is presently under study by Landcare research. Notwithstanding this, fish would most likely be affected by direct toxicity of 1080 leaching from the pellets, and not by direct consumption.

In contrast to fish, freshwater crayfish (koura) are likely to consume whole 1080 pellets that fall into streams. New Zealand has 2 species of freshwater crayfish, *Paranephrops planifrons* and *P. zealandicus*. *P. planifrons* is found in the North Island and in the north and west of the south island, and *P. zealandicus* is found in the east of the South island and in Stewart Island. These animals are common throughout New Zealand and are an important traditional food source to maori (Hiroa 1921; Whitmore and Huryn 1999). They are found in both pasture and forested streams (Parkyn et al 2002), and are regarded as omnivores, consuming a wide variety of plant material and aquatic insects (Parkyn et al 2001). In particular, crayfish living in native forest streams appear to consume large quantities of detrital material, with their stomachs being dominated (> 60%) by leaf detritus.

The large amount of leaf litter found in the stomachs of crayfish emphasises the fact that these animals will consume dead and decaying organic matter. They are also very likely to be attracted to pollard baits that land in streams: indeed many commercial growers use artificial diets of protein-based pellets as feed for crayfish. Crayfish may thus be exposed to potentially lethal doses of 1080 if they consume a pollard bait that has landed in a stream.

There is only limited information known about the lethal effects of 1080 on aquatic invertebrates. For example, the US EPA have performed toxicity tests on the small freshwater invertebrate *Daphnia magna* (Fagerstone et al 1994), but no studies have quantified the toxicity of 1080 to New Zealand freshwater invertebrates, or established whether crayfish may consume pollard baits and die from this.

This study will provide valuable experimental-based data to assess whether crayfish indeed consume 1080 baits that fall into streams, and if so whether there are any lethal effects.

Manipulations:

This proposal will involve collecting 60 large crayfish from a number of streams on the west coast, where they will be transported back to the laboratory in Christchurch. Here a stream simulator has been set up to provide two discrete habitats: a riffle and a pool. These will be partitioned into small experimental units by use of fine mesh: 25 in each habitat type. Small PVC tubes will be placed in each experimental area to provide the animals with hiding habitat. Quantities of detritus and freshwater invertebrates (e.g., mayflies, caddisflies, snails) will be added to the stream simulator at densities comparable to those in natural conditions, and crayfish left for up to 10 days to acclimate to these conditions. After this time, individual 1080 pollard baits will be added to each experimental section, and crayfish behaviour observed every evening and morning. Mortality will be assessed at days 1, 2, 4 and 8 after the addition of the bait. Five replicate individuals will be collected after each time for tissue analysis of 1080 contamination. Five additional replicate crayfish in each habitat type will be kept in the simulator and fed on non-toxic pollard bait. A final 10 crayfish will be kept in a large aquaria to serve as a control.

Crayfish will be exposed to only 1 pollard bait. The stream simulator will be set up to have the greatest volume of water flowing through it as possible, with the entire volume (*c.* 8000 *l*) being replaced every 40 – 60 minutes. Concentrations of 1080 that leach into the water are expected to be minimal (< 0.3 $\mu g\ l^{-1}$). This is well below the observed LC_{50} trials for rainbow trout (*Oncorhynchus mykiss*: 54 $mg\ l^{-1}$), and the freshwater daphnia (*Daphnia magna*: 350 $mg\ l^{-1}$). Any lethal effects will thus come from the crayfish consuming the 1080 baits directly.

Staff: Alastair Suren – programme leader, Marty Bonnett, Julian Sykes, Gregg Kelly. Staff are experienced fisheries scientists and technicians, each with over 10 y experience dealing with fish capture and husbandry techniques.

Animals required: We will use *Parenephrops planifrons* as this species is found in areas where 1080 operations commonly occur, especially on the west coast. We will need to use 60 animals: 10 in a control fish tank, 5 each being fed non-toxic pollard baits, and 5 each being fed 1080 pollard baits, and analysed for residual 1080 at days 1, 2, 4, and 8. These manipulations will be conducted in 2 habitat types: a riffle and a pool, as the mode of bait breakdown will differ between these habitats.

Addendum re sample numbers requested by the AEC

We have 2 habitats: pool and riffle. We are looking at 4 times after exposure; days 1,2, 4 and 8. Each time has 5 replicate crayfish. This means we have 2 habitats x 4 times x 5 replicates = 40 animals.

I am also feeding an additional 5 crayfish in each habitat non-toxic bait, giving us a total of 50 animals (i.e,. 40 + 10). These will be kept untill day 8. An additional 10 animals will be housed in fish tanks (one set up as a riffle, and one as a pool) to act as a double control (i.e., exposure to neither 1080 pollard or the minute quantities of 1080 that leaches from the baits.) These could be fed non-toxic bait if necessary. This means that there will be a total of 60 animals necessary for the experiment.

I was planning to sacrifice only the control animals in the stream simulator that are fed on non-toxic pellets, but which are exposed to very small concentrations of 1080 that leach from the pellets. These are expected to show at best only a very small amount of 1080 body burden. I was not planning to sacrifice the crays that were placed in the fish tanks, as these would have no 1080 in their tissues. These are kept to assess mortality due to experimental handling. The cost of the tissue analysis ($488 per animal) is too expensive to prove that animals not exposed to 1080 do not have 1080 in their system (i.e. we are saving the client $4880).

Daily care:
The stream simulator will be stocked with quantities of detritus (leaf litter) and invertebrates, to mimic natural conditions. Extra quantities will be added at regular intervals. Each animal will be provided with PVC tubes for them to hide in. Observations will be made in the evening and morning to detect any mortality arising from consuming 1080 bait.

Stress minimisation:
This will be achieved by provision of good crayfish handling techniques during the experiment. Animals will only be observed on five occasions, the length of time required for each experimental unit will be <5 minutes. The simulator will be set up to have a natural cobble/gravel substrate, as well as quantities of detritus in each experimental unit. Small PVC pipes will also be provided for animals to shelter in. Freshwater invertebrates will be added to the cages at regular intervals as a supplementary food source.

Use of anaesthesia:
If required, standard fish anaesthesia (e.g., phenoxyethanol) will be used to sedate crayfish after collection to determine their length and weight. This would be done at the beginning and end of the experiment only.

Termination:
At the end of the experiment all remaining crayfish (10 control animals) will be returned to the streams from where they were collected. Any dead crayfish will be analysed for evidence of 1080 residue in their tissues, as will all animals collected at days 1, 2, 4, and 8.

Statutory requirements:
Resource consent is not needed for this experiment as no discharge of contaminants to the environment will occur. The stream simulator will be plumbed into the sewer system, so all water that passes over the 1080 baits will flow directly into this. This is covered under NIWA's tradewaste permits that we hold. All crayfish will be collected on non-DoC land, so no collecting permits are required from them. Animal Health Board have also been liaising with DoC over this study.
There are also no special permits required for the use of 1080 by NIWA, as the laboratory use of small quantities of this pesticide are exempt from the HSNO Act.

Records
The project leader will be responsible for ensuring that records are kept of the species, number, source and fate of all animals used in this experiment and that this information will be supplied to the NIWA Animal Ethics Committee when required.

Declaration:
We the undersigned have read the application and agree to comply with the details contained in the application and the requirements of the Animal Welfare Act 1999.

All personnel involved must provide a signature, printed name in full and date.

Signature

Name **Alistair Suren**
Date **30/6/03**

References cited

Eason, C.T.; Wickstrom, M.; Turck, P.; Wright, G.R.G. (1999). A review of recent regulatory and environmental toxicology studies on 1080: results and implications. *New Zealand Journal of Ecology 23*: 129-137.

Fagerstone, K.A.; Savarie, P. J.; Elias, D.J.; Schafer, E.W. Jr. (1994) Recent regulatory requirements for pesticide registration and the status of the Compound 1080 studies conducted to met EPA requirements. *In*: Seawright, A. A.; Eason, C. T. (eds). Proceedings of the science workshop on 1080. pp 33-38. The Royal Society of New Zealand, *Miscellaneous Series 28*

Hiroa, T.R. (1921) Maori food supplies of Lake Rotorua, with methods of obtaining them. And useages and customs pertaining thereto. *Transactions and Proceedings of the new Zealand Institute 53:* 433-451

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McDowall, R.M. (1990). New Zealand Freshwater Fish - a natural histroy and guide. Heinemann Reed, Auckland. 553 p.

Ogilvie, S.C.; Hetzel, F.; Eason, C.T. (1996). Effect of temperature on the biodegradation of sodium monofluoroacetate (1080) in water and in *Elodea canadensis*. *Bulletin of environmental contamination and toxicology. 56*: 942-947.

Parkyn, S.M.; Collier, K.J.; Hicks, B.J. (2001) New Zealand stream crayfish: functional omnivores but trophic predators? *Freshwater biology 46:* 641-652

Parkyn, S.M.; Collier, K.J.; Hicks, B.J. (2002) Growth and population dymanics of crayfish Paranephrops planifrons in streams within native forest and pastoral land uses. *New Zealand Journal of Marine and Freshwater Ecology 36:* 847-861

Whitmore, N.; Huryn, A.D. (1999) Life history and production of *Paranephrops zealandicus* in a forest stream, with comments about the sustainable harvest of a freshwater crayfish. *Freshwater biology 42*: 467-478

File: Ethics
30 June 2003

Alistair Suren
NIWA,
PO Box 8602,
CHRISTCHURCH

Dear Alistair

ANIMAL ETHICS: Application No 60

I refer to your proposed research entitled:

"Assessing lethal effects of Sodium Monofluoroacetate (1080) bait on freshwater crayfish (*Paranephrops planifrons*)"

The NIWA Animal Ethics Committee has given approval for you to conduct the animal manipulations described in this proposal.

Please ensure the records are kept of species, numbers, source and fate of all animals used.

These records are required to be supplied to the NIWA Animal Ethics Committee on completion of the project or three years from the date of this approval to meet our reporting requirements to the National Animal Ethics Advisory Committee. Records are also to be available at any time to anyone authorised by the DG of MAF or to any inspector appointed under the Animal Welfare Act 1999.

Yours sincerely

Nelson Boustead
Secretary
NIWA Animal Ethics Committee

1 Questions and answers from Alistair Suren concerning AEC application no 60.

From: "Alastair Suren" <a.suren@niwa.co.nz>
To: n.boustead@niwa.co.nz
Date sent: Tue, 14 Jan 2003 12:13:14 +1300
Subject: Re: responses to AEC questions

Hi Nelson,

replies to your e-mail as follows.

1) Confirmation that the dosages tested were at the high end of that expected from an aerial drop on a small stream.
The number of 1080 pellets added to each stream will be based on results of survey work of aerial drops, where I am counting the number of pellets than have landed in streams. I want to assess the effects of a "worst case" scenario, and so will most likely double the number of pellets found in a clump in streams. Results to date show that up to 4-5 pellets can land close together, so I will be adding no more than 8 - 10 pellets for the experiments. One of 2 more drops will be surveyed as they come up, so the final figure may change slightly, but this is not expected to represent a great increase.

2) Confirmation that the size of the brown trout to be tested would be small, young fish.
If trout are used for the experiments, these will most likely be young, small fish, as larger fish will be impractical to use in the cages. Final choice of fish will be up to negotiation with AHB.

3) An explanation as to why sub lethal effects, such as histological changes were not being examined in this study.
This work was to establish whether any ecological effects of 1080 baits landing in streams are detectable, and was never intended to be a more detailed study to examine sub-lethal effects. If we detect an ecological effect to either invertebrates or fish, then there will be ample opportunity to approach organisations such as AHB for further funding.

Moreover, 1080 is a labile compound, and is quickly metabolised by animals when they ingest sublthal doses. 1080 is converted within the mitochondria to fluorocitrate, which inhibits and blocks the Krebs citric acid cycle in cells. As a consequence of this inhibition, citrate accumulates in tissues, and may leak into blood plasma. Gooneratne et al (1994) found that citrate accumulation in rabbit tissues and plasma declined rapidly after 0.5 - 2 h after sub-lethal dosing, but that after 12 h, no more citrate was detected. This suggests that all the 1080 was metabolised within half a day. Given the quick breakdown of sub-lethal doses, it is unlikely that any histological changes would be observed.

4) Advice on whether or not 1080 has a cumulative effect and if so how this would be taken into account.
1080 decays relatively quickly in water (e.g., Eason et al 1994; Parfitt et al 1994) and is also metabolised rapidly by animals that recieve sub-lethal doses (Gooneratne et al 1994). As such, there is little chance of cumulative effects to either fish or invertebrates.

I also reiterate that the expected concentrations of 1080 in the water as a result of the experiment will be very low, and over 2 million times LOWER that the published LC50 figures for rainbow trout. Given this, it is tempting to question the reasons for the study. However, one must consider that the aerial application of 1080 is highly controversial, and so any research that sheds light on the fate and effect of 1080 in freshwaters may help alleviate public concern. The information gleaned will also be fed into the ERMA reclassification process for 1080.

I trust that these answers are satisfactory.

Cheers Alastair

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