

# Operational Plan for a Pilot Programme for the Management of Feral Pigs on Niue Island

with recommendations for enhanced management of domestic pigs



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Prepared for: Niue Department of Environment

October 2014



**SPREP**  
Secretariat of the Pacific Regional  
Environment Programme

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## 1. ACKNOWLEDGEMENTS

I would like to acknowledge the following people for their assistance with this Operational Plan:

Niue Department of Environment: Sauni Tongatule, Huggard Tongatule, Judy Nemaia

Niue Department of Agriculture, Forestry and Fisheries: Brendon Pasisi, New Aue, Pam Togiakona, Tom Misikea, John Wichman

Niue Police Department: Tony Edwards

SPREP: David Moverley

The farmers, plantation owners and pig hunters who attended the workshop and allowed access to their land to assess crop damage.

Glen Osborne, New Zealand hunter, trainer, motivator.

This plan was made possible by the Global Environment Facility (GEF) under the “*Prevention, eradication and control of invasive alien species in the Pacific Islands*” GEFPAS project, Implemented by the United Nations Environment Programme (UNEP) and Executed by the Secretariat of the Pacific Environment Programme (SPREP). Like most complex projects, the sustainable management of pigs on Niue Island is a team effort and can only succeed through the coordinated and dedicated efforts of many. Fakaau lahi.

## 2. EXECUTIVE SUMMARY

Feral and wandering domestic pigs collectively cause significant environmental damage in Niue, chiefly to coconut crab populations and to seedling coconuts. They also cause significant economic damage to plantations and domestic gardens.

Feral pig eradication on Niue Island would be difficult to achieve and impossible to maintain in the current scenario of domestic pig management. Pig management practices vary from adequate to laissez faire, with constant escape and release from sties. This is due to lack of quality pig sty construction and difficulty for most pig owners in maintaining regular pig watering and feeding. Domestic pigs interact with feral pigs and contribute both to the feral herd and in damage to crops and the environment. Any coordinated programme to improve pig management (housing, feeding, watering, etc) would take several years to be implemented to the stage where impacts on the feral pig herd and crop and environmental damage would be satisfactorily mitigated.

It is therefore recommended that no programme to eradicate feral pigs be undertaken at the present time. Instead, a programme of permanent suppression to very low pig densities should be implemented, in parallel with a programme of assistance to domestic pig owners that will make permanent penning more attractive and sustainable. This needs to be augmented by a comprehensive official pig identification programme which will act as a strong incentive to keep pigs contained.

The Feral Pig Management Pilot Programme Operational Plan covers a six month programme, and includes intensive hunting with dogs, lured enclosures, snaring and a toxin trial. All control approaches, as well as coconut crab population health and harvest levels, will be monitored.

The Plan also contains recommendations for domestic pig management, including incentives, enforcement provisions and community reporting measures.

The Plan utilises local expertise and labour for all operational deliverables. Involvement of the community, including employment of local expertise, is vital to achieving success and maintaining it in perpetuity. The Plan also includes an outline of media and community outreach programmes.

The entire Plan, including operational elements, outreach programmes, monitoring, audit and reporting, is expected to cost \$NZ 82,000.

### 3. GLOSSARY

Acronyms and definitions of terms used in this report.

DAFF	Niue Department of Agriculture, Forestry and Fisheries
DOE	Niue Department of Environment
Domestic pig	Any pig that is owned and domesticated, whether contained in a sty or not i.e. may be stray at times
ESN	Encapsulated sodium nitrite (see below). This is sodium nitrite contained within a starchy polymer to disguise the salty taste
FAQ sheet	Frequently Asked Questions information sheet for government staff to use in dealing with enquiries from the community
Feral pig	Any pig that is not owned and domesticated, is not husbanded in any way, and is unconstrained
GEF	Global Environment Facility, a financial mechanism for the United Nations Convention on Biological Diversity and other conventions.
GPS	Global positioning system device.
KBM	Koru Biosecurity Management
NISSAP	National Invasive Species Strategy and Action Plan 2013-20 (Draft)
Pig bounty	The payment made by Department of Environment to hunters for feral pig tails submitted to the Department, to signify feral pigs killed by the hunters
SN	Sodium nitrite. The common food preservative used in processed meat. In high doses it is toxic to mammals, particularly pigs
SPREP	Secretariat of the Pacific Environment Programme
UNEP	United Nations Environment Programme

## 4, INTRODUCTION

Feral and wandering pigs have been identified as having significant negative impacts on the ecology of Niue Island. Parkes, Yockney and Ikitoelagi<sup>1</sup> reported that, from data collected elsewhere, it is likely that feral pigs *"will alter vegetation structure and regeneration by directly eating plants and fruits and indirectly by rooting the soil. Pigs require protein in their diet, e.g., sows require c. 25% protein in their diet to successfully raise their young (Choquenot et al. 1996). Feral pigs on Niue must obtain some (or most?) of this protein by eating invertebrates (worms, insects and crabs), by preying on ground-nesting birds' eggs or by scavenging dead animals"*.

Parkes et al also reported that *"We have only anecdotal information on the extent of damage to crops. A few pigs can destroy an entire [taro] patch either by eating the tubers or because they find such cultivated soils attractive to root for invertebrates. Vanilla is a cash crop being grown on Niue for export. Vanilla essence is a recognised lure in baits for pigs and any damage to the vanilla vines or the trees used to support them can have serious economic costs – vanilla plantations are worth \$30,000 – 40,000 per hectare. The Niuean Government is planning to expand commercial agriculture as a means of supporting its economy and people. Damage from pigs may constrain investment in some crops"*.

Craw, Moverley and H Tongatule (2014, unpublished field survey) found extensive damage to coconut seedlings and also crab shell remains in native forest due to pigs, as well as extensive damage to plantations and gardens. Cassava crops in particular are targeted, followed by vanilla, kumara and taro.

The Niuean Government, in its draft National Invasive Species Strategy and Action Plan 2013-2020 (NISSAP), has identified feral pigs as *"damaging forests and plantations and feed on native invertebrates"*. The NISSAP aims to *"increase public awareness of feral pigs' risks and impacts, review the existing pig management strategy, identify achievable management goals, redesign the programme and implement a revised pig management programme"*.

The community recognises the threats posed by feral and unconstrained domestic pigs to ecological and economic values, and supports the NISSAP objectives.

In addition to feral pigs, Niue has a significant issue with unconstrained domestic pigs. There are 200-400 domestic piggeries, mostly crudely built sties, and domestic pigs can often be seen wandering free. Most piggeries lack permanent water and feed supply is unreliable. In this scenario it is convenient for most pig owners to allow domestic pigs to be unconfined for significant periods of time. Pig owners also occasionally release a surfeit of piglets and sick pigs.

The Niue Government previously introduced a pig identification scheme but this was not implemented in full. Without further regulatory intervention, accompanied by incentives and educational programmes, there will be no change to domestic pig management practices on Niue.

No study has been made of the impacts of domestic pigs on crops and ecological values. It is estimated that the damage caused by domestic pigs to plantations is significant but less than that caused by feral pigs.

There is a close interface between feral and domestic pigs. This would allow for feral pig numbers to recover very quickly after any control programme implemented, and effectively rules out island-wide feral pig eradication as an option. For this reason it is vital that any feral pig control programme be augmented by a programme of improved domestic pig management.

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<sup>1</sup> "Sustainable Management of Feral Pigs on Niue", John Parkes, Ivor Yockney and Metric Ikitoelagi; NZ Landcare Research and Niue Department of Agriculture, Forestry and Fisheries, 2005. Landcare Research Project No. 161107. Report No. 373 NIU 11071204

#### 4. CONTEXT OF NIUE ISLAND

The strategic advantages existing on Niue for feral pig control and improved domestic pig management include:

- The ecological driver, i.e. health of coconut crab (unga) populations, is supported by all of the community. Unga are revered as a treasure.
- Damage caused by pigs affects almost all of the community. Unga are harvested by the community, there is an economic driver for change.
- All of the community appears to accept that pig impacts need to be drastically reduced i.e. unga predation by pigs is acknowledged by all. There is overwhelming support for a pig management programme on Niue
- Very little recreational hunting culture exists, which might have otherwise resisted intensive pig control measures.
- No other large animals are present that could be affected by any control programme.
- The size and community attitudes of Niue determine it suitable for a unified national approach. Despite a strong village focus, the locals have stated that they would anticipate a single overall programme over a series of village-based programmes.
- Topography and conditions are generally favourable for control programmes. There are many roads and tracks, and vehicle access is never more than 2 kms away.
- The legislation is broadly appropriate to deal with legal and jurisdictional issues.
- Lower current population means fewer piggeries than previously, making programme success easier to achieve.
- The community is very likely to support a united programme approach, provided that it includes a suite of methods that can be used or at least trialled.
- Programme administration could be achieved within a multi-agency framework – the government agencies are very cooperative.
- Many piggeries could be made secure and attractive for farmers to contain pigs in permanently, by provision of simple measures e. g. permanent water.
- The community accepts that domestic pigs are doubly problematic – causing damage and adding to the feral herd.
- Consultation and communication is relatively easy to undertake on Niue – the community is well connected.
- Overall the community is united in its support for enhanced feral pig control and is reasonably in agreement on the need for better domestic pig management.

The challenges on Niue for feral pig control and improved domestic pig management include:

- Many domestic piggeries (200-400, no census figures known). Many of these have poor security. Most do not have permanent water supply, which means that owners need to visit the sties 2 or 3 times per day to care for the pigs. This often leads to owners letting pigs out when they are going to be absent.
- Convenience of having domestic pigs unconfined, especially where piggeries lack permanent water or feed supply is unreliable. This is the single biggest issue and unlikely to be overcome in the short-medium term.
- Close interface between feral and domestic pigs - will allow for feral pig numbers to recover very quickly after any control programme implemented, and effectively rules out Island-wide feral pig eradication as an option.
- Lack of definition/description of feral vs. wandering domestic pig and consequent lack of information on damage caused by feral pigs vs. damage caused by wandering domestic pigs.
- Lack of one-agency management responsibility, with minor confusion within the community regarding the roles of DOE, DAFF and Police.
- Pig farmers sometimes release surfeit of piglets, sick pigs, etc - this would be expected to diminish if control programmes remove excess pigs, making remaining pigs of greater value.

- General abundance of food for pigs in gardens and in wild - likely to make it difficult to entice pigs into enclosures and to bait stations.
- Pig identification scheme trialled but not carried on with – this may have caused some scepticism re official commitment to future programmes.
- The pig tail bounty is popular but not effective. The number of claims is dropping but pig impacts are rising. There is some evidence of domestic pig inclusion. The bounty is essentially a political solution rather than a technical solution.
- Lack of sufficient hunters and dogs to implement an effective hunting programme. The existing hunters are getting older, few young men taking up the activity. Hunting is not considered to be profitable.
- Ammunition, building materials, etc can be difficult to obtain and are expensive.
- Legal limitations on type of firearms available on Niue (shotguns only) means that medium-long distance shooting cannot be undertaken.
- Monitoring of feral pig numbers would be difficult due to interference from uncontained domestic pigs, feral pigs' general browsing habit on Niue (vis-a-vis rooting, which is easier to monitor), and lack of trained salaried personnel.
- Accurate monitoring of coconut crab population (i.e. outcome monitoring of pig control programme) would be difficult. Any improvement in crab numbers (after pig control measures) would not be immediate, would be difficult to measure, and is likely to be compromised by presence of crab harvesting.
- Minor trespass and tapu land issues.
- Lack of open ground and high numbers of wandering domestic pigs means that "line of sight" electronic and surveillance techniques, and electronic "scaring" techniques, would be ineffective and largely inappropriate.
- Rough terrain, hard ground and presence of roads through the Huvalu Conservation Area means that fencing pigs out, by any means (i.e. conventional or electric fences), would be logistically daunting, economically unfeasible to build, and prohibitively expensive and unreliable to maintain. There is no currently known means of effective exclusion of feral animals from areas bisected by public roads.
- Given the technological limitations, surveillance options are limited. The use of trip wires, vibration detectors and infra-red/ heat sensors would be expensive and impractical. Camera surveillance is the most effective and cheapest means of surveillance available for Niue. However this will require availability of at least 3 trained personnel.

Many of the challenges listed above can be successfully met. For instance:

- The identification (ID) system previously trialled by DAFF should be rolled out over the Island. This would work to ensure owners kept pigs contained in sties/piggeries to avoid criticism, fine or claims for damage. The ID system should preferably be a registered earmark rather than eartag, as it would be cheaper to implement and more permanent. Tags can tear out or be removed, but earmarks are permanent. Every family or piggery can be assigned an earmark and a marking tool. However eartagging could be made suitable.
- Agency responsibility should ideally be given to one government department overall - to manage feral pig research and control programmes, and domestic pig identification and containment programmes. This would also better deal with the disjoint between feral and domestic pig impacts.
- The Police should implement (or delegate the implementation of) an enforcement regime for containment of domestic pigs. This would not need to be complied with 100%, however a general compliance would be sufficient to ensure that plantation/garden and ecological damage is greatly reduced, as there will always be feral and escaped pigs that will be controlled by one of several means.
- The lack of permanent watering systems in piggeries could be overcome by DAFF or other agency implementing a programme of building or supplying concrete troughs with covered valves. This would mean that sties would only need to be visited once daily, and the supply of water permanently would lead to better pig health and faster growth rates.

- The proposed feral pig control programme should subsume the budget currently allocated to the pig tail bounty. This \$4000 - \$7000 per annum would fund a significant percentage of annual control costs (20% - 50%, dependent on method), be far better value for investment (in terms of cost per pig), would eliminate any risk of domestic pig inclusion, and would focus the community on the preferred control methodologies.
- A pig redistribution service could be managed by the agency with overall control. This would simply consist of agency staff finding homes for pigs that are reported by owners when they have more pigs or piglets than they can manage. This service is expected to be seldom used but its existence would serve as a good means to build on relationships between agency and pig owners.
- Restriction on firearm type can be overcome by training on dog use, or by enhanced use of ESN.
- A training programme for young men can be provided, covering team and individual hunting techniques, dog training and breeding, etc. This would be a simple matter to provide, using Glen Osborne from New Zealand. Glen is also an excellent role model and motivator. The rugby clubs should be approached for potential hunters, as hunting provides an excellent fitness regimen and hunting should be undertaken very early in the morning or late in the afternoon, making it attractive for those already in employment.
- Ammunition and building supplies for sties can be subsidised by the Niue government, or partly paid for from the current bounty scheme.
- Feral pig monitoring on its own would not need to be done, as it is the impacts of feral and wandering domestic pigs together that is important. This can be measured quite simply by maintaining a phone-in database, where plantation owners can call with simple information e.g. date, general area (e.g. nearest village), crop species affected, and possibly approximate level of damage. This data over time will give a fairly accurate picture of feral and wandering domestic pig numbers, because plantations are very widely and fairly evenly distributed across Niue.
- For outcome monitoring, the health of coconut crab populations would be the simplest and probably best arbiter. This can be measured directly in the forest, but this is likely to be beyond the resources of DOE. If so, a crude and effective, if somewhat delayed, measure could be numbers of crabs detected at the airport when they are flown out by Islanders. Currently a fairly accurate count is made of these crabs.
- The issue of tapu appears to apply to people not dogs, and tapu lands are small, so pigs could still be flushed from tapu blocks without need for human access. Some tapu decisions have been made in order to protect unga so it is likely that hunting would not be jeopardised for tapu reasons. Obviously pig management programme leaders would liaise with local communities to determine and respect access rights.
- It is likely that Government personnel will be made available or hired to undertake camera monitoring, phone-in damage reporting and associated advisory services.

A clear picture emerged that feral pig eradication is impossible in the current scenario of widespread domestic pig ownership and laissez faire management. Even if domestic pig management practices were to improve radically, eradication would be impossible to achieve, due to the difficulties currently faced by pig owners. It is therefore imperative that no programme to eradicate feral pigs be undertaken at the present time. Instead, a programme of permanent suppression of feral and wandering pigs, to a very low density i.e. near zero net impact, should be implemented. This needs to occur in conjunction with a programme of assistance to domestic pig owners that will make permanent penning more attractive and sustainable, underpinned by a regulatory framework. This needs to be augmented by a comprehensive official pig identification programme which will act as a strong incentive to keep pigs contained.

## **5. COMPONENTS OF THE PILOT PROGRAMME**

The pilot programme covers a six month period from March-April 2015 to November 2015, with follow up in successive years for whichever options are retained. The programme contains the following key elements:

1. Intensive hunting with dogs. This will build on existing hunting practice by training 4-6 young men and use of better trained dogs.
2. Lured enclosures. This utilises large pens with a trapdoor and automated bait feeders to lure pigs.
3. Snaring. This includes provision of improved steel impregnated cord for existing snare users.
4. Toxin trial. This involves use of encapsulated sodium nitrite in strictly controlled circumstances.

All the above methodologies have advantages and limitations. The situation on Niue is unique in many respects and it is impossible to state with any degree of certainty that any one method will be effective or cost-effective unless they are trialled and compared. This is why a six month programme has been designed. At programme end the four approaches will be compared and recommendations made as to further actions.

Monitoring provisions for all control approaches are included. Outcome monitoring (coconut crab take) is included with an option for field monitoring of coconut crab.

The Plan also includes an outline of media and community outreach programmes.

The Plan utilises local expertise and labour for all operational deliverables after training has been provided. Involvement of the community, including employment of local expertise, is vital to achieving success and maintaining it in perpetuity.

The costs of each component is provided in the relevant section.

All the pig control measures have the potential to impact upon domestic pigs if the pigs are not contained in sties or behind secure fencing. Owners of domestic pigs will be informed before commencement of all programme measures, by public notice and via community radio. In addition, several incentives and measures have been identified that would assist in preventing programme impacts on domestic pigs, escape of domestic pigs, consequent increase in feral pig numbers and further damage to plantations and the environment. These incentives and measures are listed in the section on management of domestic pigs.

Following the pilot programme a full report will be provided by KBM, with recommendations as to further actions.

## **6. CONTROL METHODS**

### **Intensive hunting with dogs**

This will require six local hunters to be trained by experienced hunter-trainer-motivator Glen Osborne from New Zealand. Glen is extremely experienced as a contract hunter and in using the preferred hunting and recording methods (which he helped design), a hunting trainer, and a motivator. He uses his All Black and TV hunting-sporting host experiences to communicate with and motivate trainees. Glen will bring dogs in from New Zealand for the training, and will leave some of the dogs behind permanently for the hunters to use. This initial exercise will take two weeks and is planned for March/April 2015. Training includes use of dogs, guns and knives, safety measures, teamwork, GPS tracking and recording, and motivation. Glen will then supervise the first round of hunting.

Once trained, the hunters will work in pairs (at least initially), and will be allocated designated parts of Niue to work in. Hunting should be undertaken for 3-5 hours at a time, which may be before or after the normal hours of work. GPS units will be carried to collect data to provide the date, identification of the hunter, hunter effort, areas worked, location of kills, and sex/ age/ condition/ litter size (if appropriate) of pigs culled. A simple programme will be entered into each GPS unit to enable rapid recording. Hunters

will upload data at regular weekly intervals to a computer held and managed by DE, which will collate all data and manage the day-to-day activities of the hunters.

Hunting sessions will occur on approximately three days per week for an average of four hours per day. The programme will run on a rotational basis for three weeks at a time followed by a two week break. This rotation will run for four cycles. The programme is therefore expected to take 20-22 weeks and should not exceed 26 weeks. The frequency of hunting can be slightly modified to suit weather, hunter availability and dog condition, however breaks need to occur to allow for disturbed feral pigs to emerge from hiding and recommence feeding. Despite hunting frequency and timing, the overall labour budget (\$17,280) should not be exceeded.

Daily hunting areas will be advertised by public notice and via community radio. Signs will be erected at road/track entrances for areas being hunted, immediately before hunting commences and will be taken down immediately after hunting ceases.

All pig carcasses will be recovered and will be the property of DOE, which will distribute them as it sees fit. It is recommended that the carcasses be given to families and not be sold. DOE will determine if pig entrails can be left or buried in the field, or recovered for disposal in a sanctioned manner.

The hunters will supply their own vehicles and firearms. DOE will supply all ammunition. It is recommended that single ball shot be purchased. 410 gauge guns are preferred over 12 gauge as they are smaller, lighter and with shorter range. They are easier to use and safer than 12 gauge shotguns.

GPS units will be supplied, Garmin 62 or similar model.

Hunters will at all times attempt to not interact with domestic pigs, and dogs will be trained to ignore pigs in sties. However it must be recognised that uncontained domestic pigs may attract the attention of the hunting dogs.

The programme will be monitored by KBM and Glen Osborne after every round and any necessary amendments made.

At the end of the hunting programme (6 months), the programme will be audited by KBM regarding expenditure. The programme will be assessed for efficacy (number of pigs recovered), efficiency (cost per kill), trends over time, spatial and other factors (e.g. community acceptance, hunter skills, value of dogs, other limitations).

The estimated cost of this pilot component is \$NZ 42,000.

## **Lured enclosure trials**

It is anticipated that the hunting programme will experience a range of issues that are likely to limit its effectiveness. The lured enclosure method obviates most of these issues but may present several limitations of its own, such as lack of mobility and the need for highly trained personnel. Control by lured enclosure requires use of one or two trained, mature and highly trusted personnel with a lot of patience. However if pigs can be lured into the enclosure, then the method can be very cost-effective.

This methodology provides the advantage of the ability to identify individual pigs and family groups. In this way any domestic pigs (if identifiable e.g. by eartag) can be spared and returned to their owners, or killed and forfeited/fines imposed, or another management regime applied. Also, pig carcasses can be recovered for human consumption.

Two similar or identical removable enclosures will be built at least 8 km apart. These will consist of approximately 10m x 8m oval structures, using 1550 mm tall, 15 wire, high tensile steel wire deer fencing, supported and held by steel "Y" posts 1600mm apart, tied with wire ties. The entrance will consist of a single vertical dropping trapdoor which can be remotely triggered. There will be a camera placed to observe all animals around the enclosure, which is radio-linked to a monitor screen. The enclosures will have a hanging automatic bait feeder which distributes lured pig pellets at timed intervals, typically mid-evening. The enclosures may also have water troughs during dry periods.

The bait feeder and camera are installed initially, with bait available to the pigs before construction of the enclosure. This attracts pigs in larger numbers and trap shyness is avoided. The enclosure is then built in stages with the netting attached incrementally and the trapdoor left open at all times. The operator will observe activity every night that bait is laid, and will not trigger the trapdoor until every pig in the cohort group is inside. It is critical to ensure that there are no surviving pigs which would immediately become very trap shy. The operator will arrange for the trapped pigs to be dispatched the next morning, to prevent pigs burrowing out or damaging themselves or the apparatus.

One of the enclosures will then be moved to another location while the other is left in the same location, with netting removed. This will establish if there is any resistance to pigs approaching areas where other pigs have been killed.

The only significant potential limitation is the ability to lure pigs to the enclosure. This will be addressed by the graduated construction of the enclosure, constant monitoring by camera, changing of lures if required, trickling of pellets and lure into the enclosure, provision of water, and minimising human scent.

Full training will be given in construction and management of the enclosures, and monitoring of feral pig behaviour.

Monitoring will include effort (time required), numbers of pigs captured, trends over time, number of escapes or non-captures, preferred lures, and any other timing or methodology variations. A field data form and spreadsheet will be provided for this purpose.

This method, if successful, can be replicated at any time during the year, and in any place, provided that telemetry can be installed, and trained and dedicated personnel are available to manage the apparatus. If highly successful then the methodology might require only 4-5 replicates island-wide.

The estimated cost of this pilot component is \$NZ 19,000.

## **Snares**

Snares have been used by a number of plantation owners over a number of years, with very limited success. Pigs have become snare-shy, particularly after escaping a snare, which is a frequent occurrence. Escape has been due to a number of reasons including poor setting and poor materials. However the method is extremely cheap and easy to implement, and if successful would provide a useful supplementary control method. Several snare users have stated that the major limitation has been availability of good quality snare cord. It is proposed to supply 4-5 users with several types of steel threaded cord that will not break. Users will be requested to report data to provide indicators of success such as number of sets, number and frequency of catches and escapes, any issues with dispatching snared pigs, any collateral damage and overall effort required. A field data form will be supplied to the users for this purpose.

The cost of this programme will be limited to the cost of the cord provided.

DE will maintain a database of users and reports as above.

The estimated cost of this pilot component is \$NZ 300.

## **Toxin trial**

Encapsulated sodium nitrite (ESN) has recently been approved for use in New Zealand for feral pig control. Sodium nitrite (SN) is the well known food preservative primarily used in sausages, salami, pork, bacon, ham, corned beef and other preserved meats. It is a salt that is very quickly metabolised into the lesser salt sodium nitrate, which is urinated out within a very short time period. SN therefore is not residual either in flesh, viscera, the soil or the wider environment. In small doses, it is metabolised and urinated out by all mammals without effect. Animals that receive a sub-lethal dose make a full recovery and can be killed and eaten within a short time, so the toxin presents no problems for humans or the

environment. Carcasses in the bush can be eaten by dogs with negligible risk of secondary poisoning. The risks of using SN are extremely low. Because it is used as a food preservative, the legal restrictions on its use are few. Pigs are particularly sensitive to SN so it is very useful as a toxicant for pigs.

The mode of action of SN is to replace oxyhaemoglobin with methaemoglobin, leading to anoxia (lack of oxygen to the brain), drowsiness, sleep, unconsciousness and death. It is therefore extremely humane. The only limitations of SN are the high dose rate needed and extremely salty taste. These issues have been overcome by encapsulation in a starchy polymer, which breaks down in the gut. (Refer to references at the end of this document)

The conditions of use of ESN in New Zealand are few. They include:

- Approval must be given by the relevant government authority (in Niue this is likely to be DOE)
- The toxin is subject to normal conditions of transport, storage and handling as other Vertebrate Toxic Agents. All label requirements must be met.
- Use in approved pig-specific bait stations only. These allow pigs to open the bait station lid but other animals are not able to do this.
- Signage must be placed in the area - recommended on all tracks within 100 metres of the bait stations.
- Public notification of programme and general area of operation.
- All data on kills and any collateral damage must be recorded and provided to the relevant authority (in this case DOE).
- Antidote (methylene blue) must be held by veterinarians and other relevant authorities.

All New Zealand conditions of use will be imposed in Niue, with the following added restrictions:

- All persons on Niue handling ESN to have appropriate training.
- Cameras placed at all bait station sites, to record all activities, including any collateral issues.
- Daily monitoring of the cameras when toxin has been laid.
- An area of 100m radius around the bait stations will be searched the day following application of toxin, to determine the level of control. Pig carcasses will be recovered if DOE determines that this is required. These pigs will not be consumed but will be buried or otherwise disposed of safely.
- All lure will be vegetable-based and not attractive to dogs.
- Public notification warning people not to kill and eat any pigs in the area for at least two days after the baits have been eaten or removed. The re-entry date will also be notified. This date will be at two or more days after removal of any uneaten bait.

The potential for safe use in Niue is very high, as there are no other livestock, other than dogs, that can come into contact with bait. Risks to dogs will be obviated via the methodology.

It is proposed that two trial sites be set up, each with two bait stations three metres apart. This allows pig family group members to feed simultaneously. A camera will be mounted to view all activity at each site. This will not require live radio-monitoring and the camera and bait stations need only be monitored once daily by a technician visiting the site and downloading the pictures.

Lured prefeed is placed in the bait stations and trickled in lines leading to the stations daily until all of the prefeed bait is being taken daily from the stations alone, and with no prefeed placed outside the bait stations. The toxic bait is then placed in the stations. Water troughs may also be placed to lure pigs in dry periods. It is not critical that all pigs in a family group succumb or that all pigs are exposed to the baits. Because dosed pigs fall comatose without pain, any pig receiving a sub-lethal dose is unlikely to become bait shy and will return to the stations for further bait within a short time.

After the toxic bait application, the cameras will be monitored for 2 days to determine control level. If pigs return then the prefeed regime will recommence. If no pigs return, the trial site will be moved to at least one kilometre away from the original site.

The only limitation to this methodology is the ability to lure pigs to the bait stations. This may require some experimentation as to preferred lures, likely rotation of lure types and to use of water troughs.

Only one person is needed to manage the toxin trial, however it is recommended that two people be trained to cover contingencies. Full training will be provided by KBM.

DOE and KBM will monitor the trial at minimum on a weekly basis. The trial will continue for 3-4 months to determine best lure types, best placement, animal behaviour and any other relevant factors. Monitoring data will include dates, numbers and range (distance from stations) of prefeeds, lure preferences, numbers of baits laid, uptake rates, kills recorded, any evidence of sub-lethal dosing or bait shyness, and overall effort. A field data form and spreadsheet will be provided for recording. All data will be loaded onto a DOE computer for its use.

An application for consent to use ESN in Niue will be prepared by KDM and submitted to DOE.

The estimated cost of this pilot component is \$NZ 12,500.

### **Pig bounty**

The pig bounty has served some purpose in dealing with complaints in a political sense, that is the government is offering something by way of a solution, however it has not been effective in lowering pig impacts. It is recommended that the bounty be discontinued at the commencement of the hunting programme and that the budget be subsumed into the hunting budget. This will be acceptable to the hunters as they will still be paid to hunt, and it is likely to be more acceptable to the community as better pig control will eventuate.

If the hunting programme is not found to be effective for any reason, then the bounty budget should be applied to whichever programme is adopted.

## 7. MANAGEMENT OF DOMESTIC PIGS

The feral pig population will always be likely to increase as a result of escapes and interaction of domestic and feral pigs. In addition, domestic pigs cause crop and environmental damage. It is therefore vital that the feral pig control programme be supported by measures to ensure that domestic pigs are contained at all times. These measures need to include enforcement of existing legal requirements, incentives, and community-based monitoring. Although costs of some of these measures are estimated below, they do not have a budget currently allocated them.

### Legal requirements and enforcement

The police and DAFF need to reaffirm the requirement to keep domestic pigs contained, and should include penalties for non-compliance (e.g. cost recovery if action taken, killing of pigs found loose).

This should be underpinned by a mandatory pig identification regime. This was previously implemented but not followed up on. If pigs can be identified then complaints can be accurately addressed with pig owners and restitution for damage obtained if necessary, or legal action taken by the police or DAFF including recovery of the costs of the associated actions.

DAFF should decide on the identification method to be adopted. The options are:

- Ear-tagging. This is the previously used method and the one preferred by government officials. Tags are easy to spot and relatively easy to apply. Their drawbacks include a higher cost than ear-marking, a tendency to fall or tear out, and illicit removal. The tags can never be considered as a permanently reliable identification method.
- Ear-marking. This involves cutting notches in piglets' ears with a particular tool. The earmark is there for the life of the pig. The only drawbacks are occasional difficulty in reading from a distance, and lack of community knowledge of who owns which earmark. This last issue is shared to some degree with eartags.

It is recommended that an ear-marking regime be implemented. Marks can be applied to three or four different parts of either ear, so a combination of three notches provides over 400 potential personalised earmarks. A register should be maintained by DAFF, with existing and new owners being offered new combinations from a prescribed list.

DAFF could implement a piggery inspection regime, to commence at the same time as the feral pig control programme. In this way, the legal requirements and the feral pig control programme can be explained at the same time, with attendant risks also explained and any incentives (see below) also introduced. It needs to be acknowledged that the pig control programmes will impact on wandering domestic pigs, so enforcement measures can be delayed and implemented only if the feral pig control programmes fail to control the uncontained domestic pigs.

### Incentives

DAFF could supply every pig owner with an ear notching tool. These cost approximately \$NZ 48 but savings could be made for bulk purchase. The cost to Niue of this is likely to be \$NZ 8,000 or less. If eartagging is used, a register will still need to be kept of tag numbers and codes. Ongoing costs of tagging will be substantially higher than \$NZ 8,000. DAFF may consider supplying or subsidising the cost of tags and tagging pliers.

A key issue for most pig owners is the need to visit sties two or three times daily to provide water. Most sties do not have automatic watering systems. This lack of permanent watering systems could be overcome by DAFF or other agency implementing a programme of building or supplying concrete troughs with covered valves. This would mean that sties would only need to be visited once daily or less for feeding purposes, and the supply of permanent water would lead to better pig health and faster growth rates. Because the troughs would be filled automatically, through normal trough valves, and are therefore

always full, the troughs could be very small (20 litre capacity or less) and relatively cheap. Troughs of this nature in New Zealand cost \$90 or less and a bulk buy might save 50% of this cost. Plastic cannot be used as pigs would eventually chew them up. Alternatively the troughs could be easily made in Niue from a mould sent from New Zealand. A Niue -wide programme to supply free troughs would cost approximately \$NZ 20,000 plus \$NZ 4,000 freight however the cost would be considerably less if the troughs were made locally.

A pig redistribution service should be managed by the agency with overall control. This would simply consist of agency staff finding homes for pigs that are reported by owners when they have more pigs or piglets than they can manage. This service is expected to be seldom used but its existence would serve as a good means to build on relationships between agency and pig owners.

### **Community based monitoring and reporting**

The phone-in complaints register is anticipated to act in a very direct way to obtain better compliance by pig owners. Most people own or are dependent on their gardens and plantations and these are not always the same people as the pig owners. Also damage to one plantation may not be due to the owners' pigs as the plantations are usually far removed from the sties which are close to home. So pig and plantation owner is expected to report on the pig owner. This peer driven complaints system is far more likely to result in improved behaviour than complaints from Government officials.

It is recommended that DOE, DAFF and the Police monitor community concerns and implement programme elements in a staged manner so as to raise pig management standards in a sustainable and calm fashion, and avoid community discord.

## 8. OUTCOME MONITORING

The primary objective of the programme is protection of biodiversity values in Huvalu Conservation Area. A priority concern is the health of the native coconut crab (unga) population. Evaluation of the different control approaches as described above, although accurate in terms of output monitoring, is not a worthwhile measure of overall programme success. This is because feral pig populations typically recover extremely quickly after control programmes. Pig control programmes elsewhere typically achieve quick population knockdown followed by rapid recovery, usually because lower pig densities result in better pig health (through less competition for the available food resource), which leads to larger litter size and earlier onset of breeding. It is therefore imperative to measure the outcomes of the programme, along with the actual kill statistics. Unga population is the best ecological arbiter existing on Niue.

It is proposed to monitor unga populations in several ways:

1. Survey by Niue Biosecurity staff of unga detected at airport departure point. Given that unga are harvested regularly, any variation in harvest would be a reasonably accurate (if somewhat delayed) measure of population health. Biosecurity staff to report monthly detection rates to DOE.
2. Direct field survey of unga population by DOE and DAFF staff. This is currently undertaken and should be continued annually, at the same time every year.

Another outcome monitoring measure is trends in pig impacts on plantations and gardens. A key community driver for pig control is plantation damage, a very important economic factor on Niue. Plantations and gardens are spread very widely on the island, as are pig impacts. Because ecological and economic impacts are caused by feral and wandering domestic pigs, any variation in pig impacts on gardens and plantations would be a useful outcome measure.

A database of complaints (of pig damage to plantations and gardens) will be set up by KBM and managed by DOE or DAFF. This will record date, name of complainant, general area (i.e. nearest village), and crop species damaged. No degree of damage will need to be recorded as this is entirely subjective and unreliable. The community will be informed of this service and encouraged to respond. The incentive to respond will be the increased likelihood of pig control programme in the area.

## **9. OUTREACH PROGRAMME**

All of the four components of the pilot programme will require a high degree of community knowledge and support. This will be achieved by liaison with villages, provision of a pamphlet, several field days, and regular messages over community radio. KBM will create the script for these items, which can also be placed on websites if deemed advantageous. The pamphlet will be placed on local notice boards, mailed out if necessary and be made available at key Government offices.

An FAQ sheet will also be produced by KBM, for key Niue Government staff.

The conservation hunting programme with training by Glen Osborne will provide a unique and very high potential for publicity for Niue. It is proposed that the training and some of the hunting will be filmed for Maori TV (NZ), at no cost to the programme. The resultant television show will highlight the programme, the participants and Niue itself. This will bring considerable potential benefits in tourism and raise the status of the pig management programme overall.

## **10.REPORTING ON THE PILOT PROGRAMME**

In addition to the monitoring of the programme elements, an overall assessment will be made at the end of the programme and Report provided to DOE, DAFF and SPREP. The Report will contain recommendations for further actions.

An Issues, Risks and Complaints Register should be kept by DOE, recording all complaints received from the community or anyone else regarding all parts of the programme. It should also record all issues and risks raised by anyone inside or outside of the programme management.

The estimated cost of this pilot component is \$NZ 3,600.

In addition, the provision of ongoing sustainable funding from external sources will be investigated.

## 11. TIMELINE

All equipment to be used in the programmes will be purchased and placed in the pre-arranged shipping container, in Auckland in January 2015

	March-April 2015	May-June 2015	July 2015	August 2015	September 2015	October 2015	November 2015
Hunting	Training. 1st hunting round	Hunting 2nd round		Hunting 3rd round		Hunting 4th round	KDM assess, report
Lured enclosures	Build, train, implement	Continue trial	KDM assess, report				
Snares	Distribute, train for reporting	Implement, report	KDM assess, report				
Toxin trial	Build, train, implement	Continue trial	KDM assess, report				
Domestic pig mgmt	1 March -DAFF advertise pig fencing requirement. 1 April - DAFF commence pig ID / piggery inspection programmes, complete ID 30 April	31 May - DAFF complete piggery inspections	Maintain programme	Maintain programme	Maintain programme	Maintain programme	Maintain programme. KBM assess, report
Outcome monitoring * Note: DOE to determine timing of unga field survey	1 March - DOE/DAFF commence phone in complaints db Biosecurity commence airport unga reporting	Maintain db, unga reporting	Maintain db, unga reporting	Maintain db, unga reporting	Maintain db, unga reporting	Maintain db, unga reporting	Maintain db, unga reporting. KBM assess, report
Outreach programme	1 February: KDM supply scripts, FAQ. 1 March: radio, pamphlet releases. Early April: field day	Maintain programme: radio fortnightly, etc	Maintain programme: radio fortnightly, etc. KBM assess, report				
Programme reporting	KBM assess	KBM assess	KBM assess	KBM assess, interim report	KBM assess	KBM assess	KBM assess, report

## 12. REFERENCES

Impacts of pigs

"Sustainable Management of Feral Pigs on Niue", John Parkes, Ivor Yockney and Metric Ikitoelagi; NZ Landcare Research and Niue Department of Agriculture, Forestry and Fisheries, 2005. Landcare Research Project No. 161107. Report No. 373 NIU 11071204

"Managing Vertebrate Pests: Feral Pigs"; David Choquenot, John McIlroy and Terry Korn; Australian Bureau of Resource Science 1996. ISBN 0 644 35847 5. <http://www.feral.org.au/wp-content/uploads/2010/03/Managing-vertebrate-pests-feral-pigs.pdf>

Use of encapsulated Sodium Nitrite:

Connovation Ltd. Background information on toxicity

<http://www.google.com/patents/WO2010151150A2?cl=en>

NZ Environmental Protection Authority notification of ESN approval for use

[http://www.epa.govt.nz/news/epa-media-releases/Pages/New\\_pest\\_control\\_bait\\_approved.aspx](http://www.epa.govt.nz/news/epa-media-releases/Pages/New_pest_control_bait_approved.aspx)

Connovation Ltd. Advice on use of ESN

<http://www.connovation.co.nz/products/c/90/Feral%20Pigs>

## 13. ATTACHMENTS

1. NZ Environmental Protection Authority - Decision on Encapsulated Sodium Nitrite  
[http://www.epa.govt.nz/search-databases/HSNO%20Application%20Register%20Documents/ERMA200570\\_ERMA200570\\_Decision\\_final\\_web.pdf](http://www.epa.govt.nz/search-databases/HSNO%20Application%20Register%20Documents/ERMA200570_ERMA200570_Decision_final_web.pdf)
2. NZ Environmental Protection Authority - Application for permission to use bait containing sodium nitrite for feral pig control  
[http://www.epa.govt.nz/Publications/Application\\_Form\\_Permission\\_Sodium\\_Nitrite\\_EPA0346.pdf](http://www.epa.govt.nz/Publications/Application_Form_Permission_Sodium_Nitrite_EPA0346.pdf)