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Eradication Programs Eliminating Invasives and their Predators and Scavengers!

Summary

- Eradication programs for mice and Polynesian Rats are planned for the Farallon Islands, Midway and Wake Island.
- Brodifacoum, a potent, persistent and bioaccumulative anticoagulant poison is the toxicant.
- Brodifacoum residues have been detected in almost all fish that were collected following treatment of Palmyra, and trace levels were found in 10 percent of the fish after treatment of Wake.
- Brodifacoum residues in fish caught at Wake increased from trace levels to detectable residues over 3 years.
- Diphacinone is a greater threat of secondary poisoning to mammals than brodifacoum.
- Strandings of whales, some hemorrhaging, occurred within 60 days following anticoagulant bombardment.
- Unusual mass strandings of hemorrhaging dolphins occurred in San Diego and Hawaii years after anticoagulant bombardment.
- There is very little known about the fate of anticoagulant residues in the oceans.

Introduction

Two proposed mice eradication projects using anticoagulant poisons are very alarming. The eradication of mice from Midway authorizes the use of up 214 pounds per acre of poisonous bait per acre.[1] The Farallon Islands project was conditionally approved by the California Coastal Commission on December 16, 2021. The amount discussed at the Coastal Commission hearing was two applications of sixteen pounds per acre. [2]

A third project, to eradicate Polynesian rats from Wake Island, is also being planned. EPA approved the use of up to 136 pounds of bait per acre in December 2021.[3] Eradication of Polynesian rats in 2012 failed, and the Air Force closed the area to fishing for 942 days (consistent with New Zealand restrictions[4]) because trace levels of brodifacoum were found in fish.[5] A second study was conducted 3 years following the treatment. Residues of brodifacoum were detected in fish caught in an "intermittently land locked pond" on Wake Island.[6]

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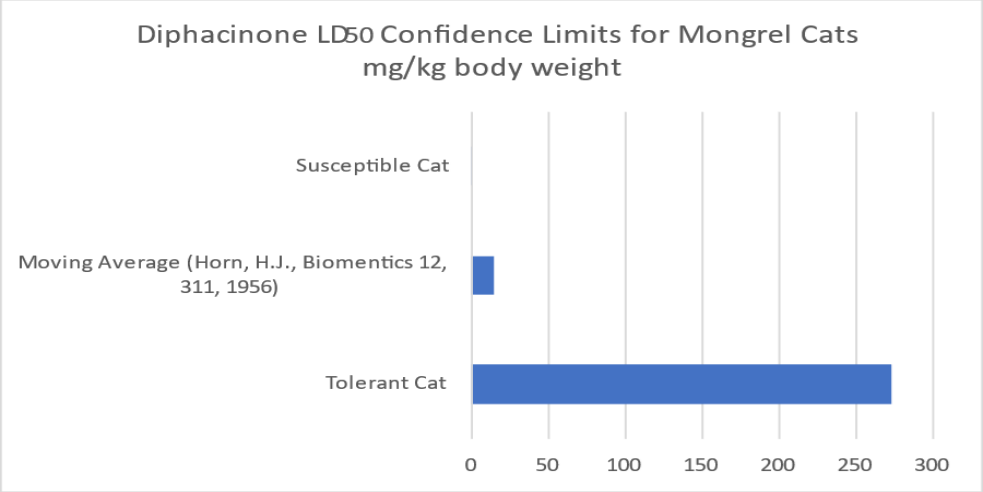
The preferred alternative for these invasive species eradication projects is to bombard these islands with a poison that contains anticoagulants until a target or non-target animal eats a toxic dose and bleeds or experiences some other lethal effect. Application is made to every possible target pest habitat at least two to three times (including intertidal areas). Mice are difficult to control. They develop "bait shyness", so the Farallon Islands will likely be bombarded with a dose similar to the dose proposed for use on Midway. The eradication methodology has been promoted and used by Island Conservation, a "conservation" non-profit with success killing animals on islands throughout the world.

Anticoagulants are multiple dose poisons and have a delayed toxicity so animals do not associate eating the bait with illness. Some second-generation anticoagulants such as brodifacoum can kill after a single feeding. Almost all the toxicity tests were for $LD_{50,}$ the dose that kills half of the test animals under controlled laboratory conditions. The dose is the single variable tested. Chronic testing is long and expensive. **All doses of anticoagulants caused harm** (usually to females) so manufacturers have not conducted chronic tests and rely on the argument that there is no exposure. Exposure through food sources is certain.

Discussion

Toxicity

One measure of toxicity is the lethal dose for half of the test animals (LD_{50}). The LD_{50} for diphacinone for cats is 14.7 milligrams per kilogram; but cats were killed at lower doses and survived higher doses. The following chart shows the range between susceptible and tolerant cats. This study dated April 15, 1957 reported that the range of toxicity demonstrated the insidious nature of diphacinone.



There is also a wide range between susceptible and tolerant species. One of the most susceptible species to anticoagulants is the vampire bat. Cattle were injected with diphacinone and vampire bats were controlled.[7] Cows are herbivores and have vitamin K (the anticoagulant antidote), which could explain their tolerance.

Exposure

It has been assumed that baits degrade quickly in the sea, which is false. Much of the bait is consumed by fish. Fish sampled prior to, during or after poison drops had consumed bait pellets[9,10]. Studies at Palmyra Atoll showed that fish and other animals that consumed the bait were killed. The authors concluded that "Primary, secondary, tertiary and even further long term exposure of both terrestrial and aquatic organisms that are contaminated with the toxicant should be considered in all eradication operations, and therefore an understanding of the local food web is essential prior to broadcasting toxic bait."

Two studies of fish at Wake Island **funded by the Air Force, not Island Conservation, Blue Planet or other advocates** detected brodifacoum residues. The first, showed traces of brodifacoum in 10% of fish. Three years later brodifacoum was detected in 1 of 8 bluefin trevally, and 4 of 4 blacktail snapper. "How long these residues persist in the environment, affecting the marine food web, and to what extent they persist in fish that are caught by Wake Island residents for sport and consumption, is uncertain."[6] The U.S. Environmental Protection Agency required ecosystems studies before initiation of an eradication program on Midway.[8]

It has been assumed that poisoned rodents retreat to their safe havens (sewers, crevices, hiding spaces in homes and businesses) to die. Some do hide,

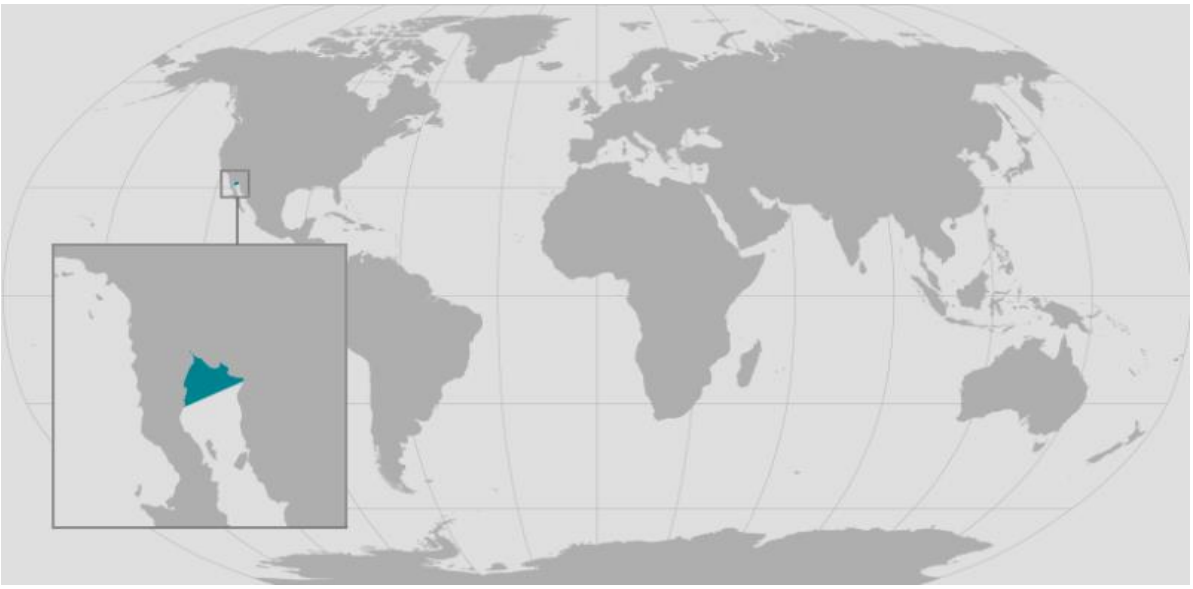
but others wander in open areas seeking out sources of water to quench their thirst, where they may be plucked by a predator. Rodents dying in sewers will be swept downstream to be consumed by scavengers.

Chemical properties suggest that some anticoagulants accumulate in fat. Brodifacoum is similar to DDT in it's potential to accumulate in fat.[11] Animals (predators and scavengers) high in the food chain including killer and false killer whales, albatrosses, birds of prey, and vultures are very likely to be exposed to poison by consuming poisoned dead, sluggish, intoxicated prey. Brodifacoum persistence in liver tissue (half-life) is estimated to be 100-300 days. Marine predators and scavengers may migrate hundreds or thousands of miles. Animals intoxicated or killed by anticoagulants may be consumed. More toxicant would be stored in the liver of the predator or scavenger.

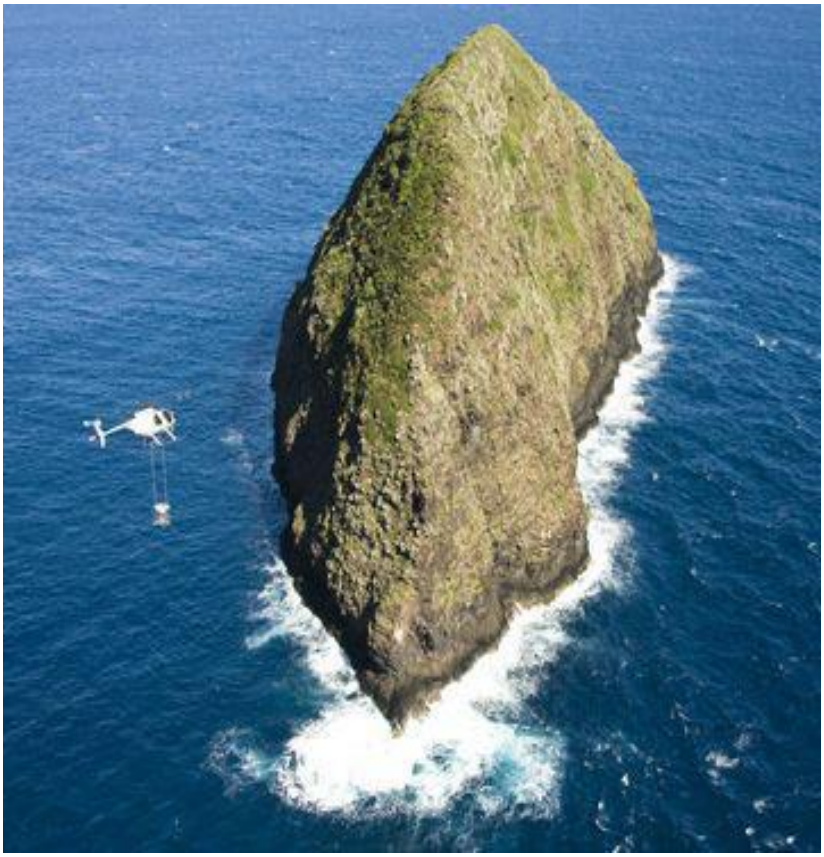
Coincidental Kills Following Anticoagulant Use

The predators and scavengers with the lowest reproduction rate (fecundity) are at great risk of perishing. Consider the fate of the vaquitas, the most endangered species on the planet. The Island Conservation database show that rats were eradicated from three islands (San Jorge Este, San Jorge Medio and San Jorge Oeste) in the Gulf of California (within the critical habitat for the vaquitas) in 2002.[12] Vaquitas declined from around 600 to about 200 individuals between 1997 (the year of the first complete survey) to 2008. Was the only cause of this decline legal fishing?[13] A very unfortunate coincidence that the legal fishing kills of vaquitas and rat poison treatment occurred during the same period. The map shows the critical habitat for the vaquitas.

Vaquita Critical Habitat



Mokapu Island

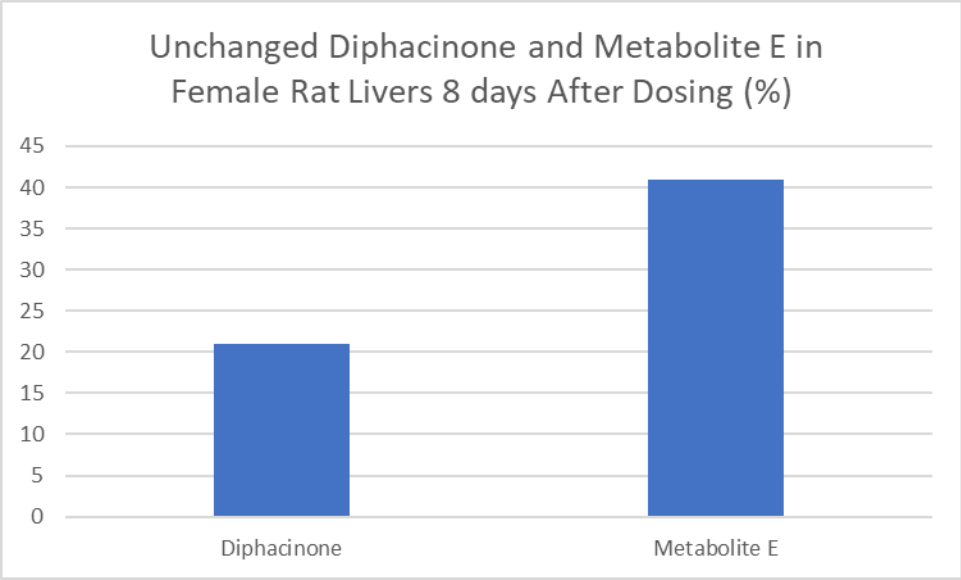


Mokapu Island Coincidental Kill of Juvenile Humpback

Mokapu Island is a small, steep island near the Kalaupapa Peninsula, Molokai. There was evidence of rat presence on Mokapu, and it was treated with diphacinone bait. Thirteen (13) days following completion of the project a humpback whale estimated to be less than 5 weeks old stranded on a Maui beach near Lahaina.

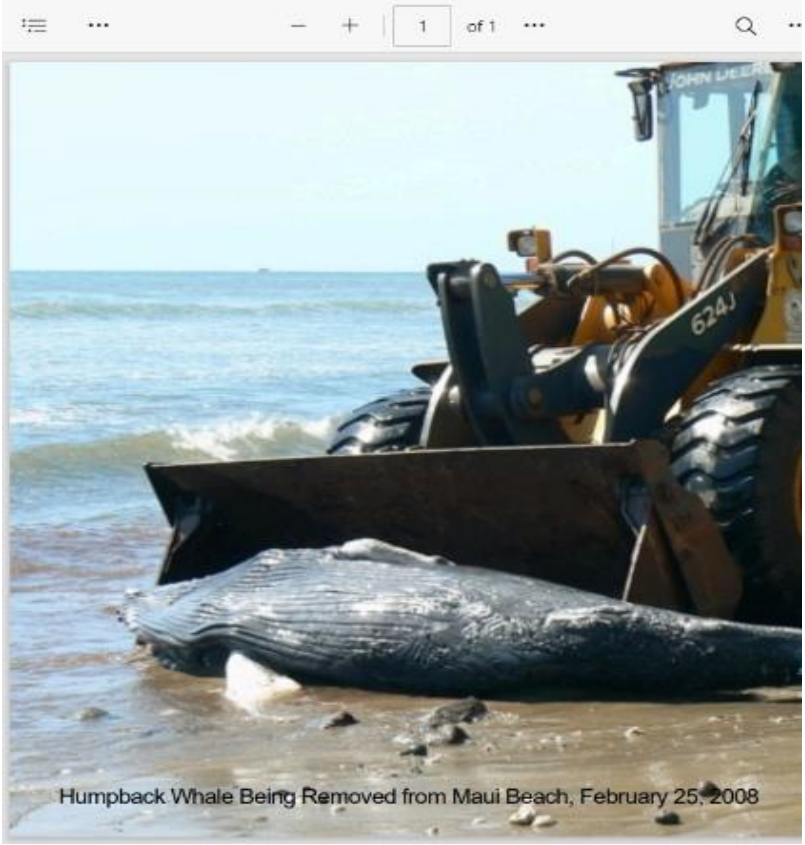
There has been little research on the impact on marine animals even though anticoagulants are very potent secondary poisons. Anticoagulants accumulate in fat and whales milk contains about 40 percent fat.

There is one quick test for anticoagulants. Measuring the time blood takes to clot is an indicator of anticoagulant activity. Chemical confirmation requires large sample sizes, specialized equipment, and methods to identify anticoagulants of concern. Methods for most metabolites have not been developed. The graph below shows twice the amount of a metabolite compared to unchanged diphacinone in rat livers after 8 days.[14]



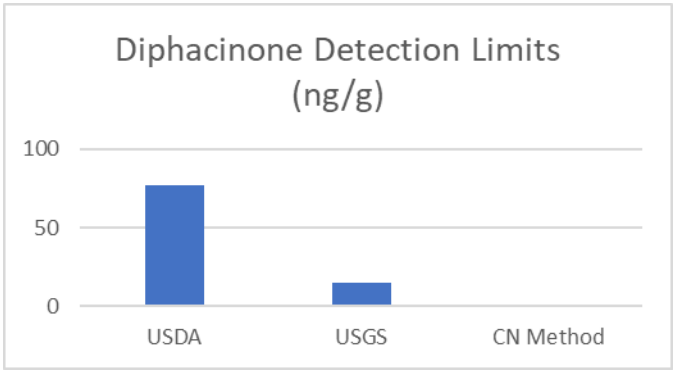
The stranding of the juvenile humpback[15] less than 100 miles from the site of anticoagulant use provided a unique opportunity to collect samples. Samples were collected and analyzed by government labs.[16] The letter providing results of

analyses also advised NOAA that no exposure was possible. The Fish and Wildlife Services did not report or perhaps even know about the observation of feeding in March, 1989.[17]



Humpback Whale Being Removed from Maui Beach, February 25, 2008

Other samples were collected too, including seawater, soils, and limpets. Methods used by USDA and NOAA to test the liver of the humpback whale that stranded following the treatment of Mokapu for diphacinone had high limits of detection for diphacinone (77 ppb for USDA-National Wildlife Research Center and 15 ppb for NOAA-Columbia Environmental Research Center). No diphacinone was detected. In comparison to a published method that can detect 0.3 nanograms[18], the USDA-NWRC method was 256 times less precise. The failure to detect toxicant is not surprising because fish were filleted before testing. Anticoagulants are not likely to be detected in seawater or soils unless a pellet was collected.



All reports of analyses for diphacinone in biological systems had the following or similar caveat: "**All samples with diphacinone** concentrations less the LOD [limit of detection] did not have peaks that matched the retention times or spectra of diphacinone standards."[19]

Could it be metabolite E?

Coincidental Bleeding Following Lehua Treatments

Bleeding, a symptom of anticoagulant poisoning, has been observed in marine mammals after poison projects. Two projects were to kill Polynesian rats on Lehua Island. The pilot whale below was part of a group that stranded on October 13, 2017, at Kalapaki Beach, Kauai, about six weeks following a series of rat poison drops to Lehua Island near Niihau.[20]

Following a poison drop in January 2009 there was a coincidental fish kill and Humpback Whale stranding on Niihau.

Pilot Whale Stranding at Kalapaki on October 13, 2017

Following Poisoning Lehua in Early January 2009, Juvenile Humpback Whale Stranded on Niihau on January 17, 2009

Uncommon Stranding Events

The U.S. Navy issued a Southern California Stranding Response Plan for Hawaii-Southern California Training and Testing (HSTT) Study Area in November 2013

Page 11 of the Stranding Response Plan defines Uncommon Stranding Event (USE) as a stranding event that takes place during a military training exercise and involves any one of the following:

- Two or more individuals of any cetacean species (i.e., could be two different species, but not including mother/calf pairs, unless of species of concern listed in next bullet) found live on shore or dead-on shore or dead floating in the water within a two-day period and within 10 miles of one another.
- A single individual or mother/calf pair of any of the following marine mammals of concern: Guadalupe fur seals, beaked whales of any species, Kogia sp., short-finned pilot whales, humpback whales, sperm whales, blue whales, fin whales, or sei whales
- A group of 2 or more cetaceans of any species exhibiting indicators of distress.[22]

Hemorrhaging is not a usual symptom in mass strandings. Necropsies of three Fraser Dolphins stranding in Hawaii in December 2021 showed hemorrhage.

The necropsy summary for the Fraser Dolphins provided information concerning an uncommon stranding of three common bottlenose dolphins that occurred on October 21, 2015 in San Diego, California. All showed hemorrhage. Did anticoagulants contribute to this uncommon stranding? There is no definitive cause for any of the coincidences above.

Conclusion

There is evidence including spatial, temporal, visual hemorrhagic symptoms, and tests for brodifacoum in fish at Wake Island and Palmyra that coincide with anticoagulant use. Definitive cause of death could not be determined. Are these really coincidences? This question deserves an answer before more projects drop more anticoagulant poisons on islands are authorized!

Many fish died after the eradication attempt on Lehua in January 2009 and were swept to the Niihau shoreline. The veterinarian working with the Hawaii

Department of Agriculture, Aquaculture Program's advice was to secure the services of a veterinarian with a Fish Practice Specialty from the American Board Veterinarian Practitioners to necropsy the fish. Washington State University had such a veterinarian. The veterinarian was contacted and was sent photos of some of the fish collected. The veterinarian declined to conduct a necropsy because of the advanced state of decomposition of the fish. Licensed veterinarians must be available and equipped with the resources to determine cause of death.

The U.S. Fish and Wildlife Services, their cooperators and contractors are using public funds, to advance alarming and very destructive eradication projects. studies and information that demonstrates alarming risks to predators and scavengers with low fecundity.

There is a record of two pesticide enforcement actions, one in Alaska and one in Hawaii for Island Conservation and its State and Federal cooperators for failure to comply with conditions that would result in reducing secondary poisoning (collecting and burying carcasses). There is also the record of National Wildlife Research Center study verifying that there are residues of brodifacoum in fish 3 years following its use on Wake Island. Are Island Conservation, Blue Planet, the National Wildlife Research Center and others paid with invasive species eradication funds capable of an unbiased study? The funding available for monitoring these projects is not enough to study the complexity of the food web.

"Silent Spring" focused on pest control/eradication practices in the United States at that time that were having unintended, long-term consequences on wildlife and people. These programs, founded on governments' "good intentions" to use science to control our environment, were flawed in that they failed to recognize that intervention in natural, evolutionary processes may bring dire consequences that cannot be reversed for decades.

"The credibility of the witness is of first importance. The professional biologist on the scene is certainly best qualified to discover and interpret wildlife loss.…Yet it is the control men in state and federal governments - and of course the chemical manufacturers - who steadfastly deny facts reported by the biologist and declare they see little harm to wildlife. Like the priest and the Levite in the biblical story, they choose to pass by on the other side and see nothing. Even if we charitably explain their denials as due to the shortsightedness of the specialist and the man

with an interest this does not mean that we must accept them as qualified witnesses.

The best way to form our own judgment is to look at some of the major control programs and learn, from observers familiar with the ways of wildlife, and unbiased in favor of chemicals just what has happened in the wake of a rain of poison falling from the skies and into the world of wildlife."

"Through ignorance, greed and negligence, government has allowed poisonous and biologically potent chemicals" to fall "indiscriminately into the hands of persons largely or wholly ignorant of their potentials for harm". When the public protested, it was "fed little tranquilizing pills of half-truth" by a government that refused to take responsibility or acknowledge evidence of damage."[21]

Rachel Carson would not have peace if she remained silent, nor will I. Support treatment and care, not killing.

Robert Boesch
Visiting Colleague
Honolulu, Hawaii
Retired Pesticide Regulator
EPA Region 9 and the Hawaii Department of Agriculture

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