Lord Howe
ISLAND BOARD

Lord Howe Island Rodent Eradication Project

NSW Species Impact Statement

February 2017

Appendix J - Marine Hypothetical Scenario

J.1 Marine Hypothetical Effects

J.2 Attraction of Fish to Bait

ATTACHMENT 7 – HYPOPTHETICAL MARINE EFFECTS

A hypothetical evaluation of the effect of extreme brodifacoum contamination of the sea around Lord Howe Island on Marine Mammals; a worst-case scenario.

Around 33 species of marine mammal, about two thirds of which are whale species, have been listed as occurring in the waters of the Lord Howe Island Marine Park.

There is no realistic pathway by which these mammals can be exposed to rodenticide at the Lord Howe Island Group because: a) brodifacoum is poorly soluble in water (WHO 1995) therefore dermal absorption of dissolved rodenticide is not a risk; and b) little, if any, brodifacoum is likely to enter the food chain (Cole and Singleton 1996; Empson and Miskelly 1999; Howald et al. 2005; U.S. Fish and Wildlife Service and Hawai'i Department of Land and Natural Resources 2008; Samaniego-Herrera et al. 2009) so the risk of brodifacoum ingestion is also negligible.

One of the most common whale species in the marine park is the Humpback *Megaptera novaeangliae*. Although this is a baleen whale and therefore feeds on krill, the following hypothetical examples either assume that this species will eat pellets (primary poisoning) or will consume more-substantial marine species than krill, and which contain brodifacoum (secondary poisoning). It also assumes that this species is feeding in the marine park on its return to its feeding grounds in the Antarctic. Based on the Ship Rat LD50 value of 0.27 mg/kg body weight, a 45,000 kg Humpback Whale would have to ingest 12,150 mg of brodifacoum to receive an LD50–equivalent dosage. To obtain this amount, the whale would have to consume 607 kg of Pestoff® 20R, or more than 300,000 bait pellets; yet it is unlikely that the number of pellets that fall into the sea would be at a density greater than 14 pellets/100 metres of coastline (Howald et al. 2005).

The possibility of Humpback Whales being harmed by brodifacoum after consuming marine prey items that have ingested the rodenticide is also very remote, based on the analyses in Section 4.5.1.1d Risks to aquatic life above. The most conservative (worst case) analysis of this scenario will be constructed using data from the 18 tonne brodifacoum spill in New Zealand, resulting from a truck crash on the coast (see Appendix 3). This scenario assumes an adult female Humpback Whale (45,000 kg) will feed exclusively in an area massively contaminated to the extent documented at the spill site in New Zealand, and to feed exclusively on the most contaminated organisms collected during the monitoring of that incident (mussels). One day after the New Zealand truck spilt 18 tonnes of bait pellets directly into nearshore marine waters, mussels contained brodifacoum residues of 0.41 ppm. To ingest 12,150 mg of pure brodifacoum to receive an LD50–equivalent dosage (see above) a Humpback Whale would have to consume 29,634 kg of prey, more than half her body weight, contaminated at the 0.41 ppm level found in mussels collected one day after the New Zealand spill; an impossible scenario.

Several species of dolphin, e.g. the Bottlenose Dolphin *Tursiops truncatus*, have been observed in the marine park. Adult Bottlenose Dolphins can weigh between 150 to 650 kg (Western Australian Marine Parks Authority 2010), and consume approximately 15 kg of fish per day. At nine days post-spill in New Zealand, butterfish had residue concentrations of 0.04 ppm in the liver and 0.02 ppm in the gut, and below the method limit of detection (<0.02 ppm) in the muscle tissue (Primus et al. 2005). Assuming that the LD50 of a Bottlenose Dolphin is 0.27 mg/kg, that it has a body weight of 400 kg and that it ate only fish whose whole bodies were as contaminated as the liver sampled at the spill site, it would have to eat 2,700 kg, or more than six times its total body weight, of brodifacoum-contaminated tissue to receive an LD50 dose; another unlikely scenario.

The required amount of brodifacoum to result in an LD50 by dermal absorption for the Ship Rat is 3.16 mg/kg. Assuming this concentration is also required for dolphins, than an adult would need to be

in contact with 1,264 mg of brodifacoum, i.e., the amount of brodifacoum in 60 kg of bait or 30,000 pellets. As brodifacoum is practically insoluble in water, the risk posed to dolphins by means of dermal absorption of brodifacoum is negligible at most.

The Australian Fur Seal *Arctocephalus pusillus* and New Zealand Fur Seal *A. forsteri* are occasional visitors to the marine park (MPA 2010). Males weigh between 120 kg to 360 kg, and females between 35 kg and 113 kg (Australian Museum 2010, Western Australian Marine Parks Authority 2010). They feed on fish, squid and octopus therefore it is highly unlikely that direct ingestion of Pestoff® 20R pellets would occur during the proposed baiting. Even in the unlikely event that a fur seal ate bait pellets, a 100 kg fur seal would have to ingest 27 mg of pure brodifacoum to receive an LD50–equivalent dosage (based on the Ship Rat LD50 value of 0.27 mg/kg body weight). To obtain this amount, the seal would have to ingest more than 1.3 kg of Pestoff® 20R bait pellets (i.e. more than 650 pellets). Even if a fur seal was attracted to bait pellets as a food item, it is extremely unlikely that it could find this many as only low numbers of pellets have been recorded to land in the sea (Howald et al. 2005; Samaniego-Herrera et al. 2009) and those that do quickly disintegrate (Empson and Miskelly 1999).

The possibility of fur seals being exposed to rodenticides by consuming marine prey items that have ingested rodenticides is also very remote, based on the analyses in Section 4.5.1.1b above. The most conservative (worst case) analysis of this unlikely scenario will be constructed using data from the 18 tonnes of brodifacoum spilt in New Zealand (Appendix 3). This scenario assumes an adult fur seal of weight 100 kg feeds exclusively in an area massively contaminated by brodifacoum, and only on the most contaminated organisms collected during the monitoring of that incident (i.e., mussels containing brodifacoum residues of 0.41 ppm). Based on the Ship Rat LD50 value of 0.27 mg/kg body weight, a 100-kg fur seal would have to ingest 27 mg of pure brodifacoum to receive an LD50–equivalent dosage. To obtain this amount, the seal would have to eat 65 kg of mussels contaminated at the 0.41 ppm level found in mussels collected one day after the New Zealand spill, i.e., more than half the seal's bodyweight in heavily contaminated prey.

At nine days post-spill in New Zealand, butterfish had residue concentrations of 0.04 ppm in the liver and 0.02 ppm in the gut, and below the method limit of detection (<0.02 ppm) in the muscle tissue. However, conservatively assuming that a fur seal ate only fish whose entire bodies were as contaminated as the liver sampled at the spill site, it would have to eat 675 kg of contaminated tissue (almost seven times its total bodyweight) to receive an LD50 dose. Therefore, even using unrealistic assumptions based on a worst case, no effects to fur seals would be expected to occur from indirect ingestion of rodenticide in contaminated prey.

Dermal absorption of dissolved rodenticide is also not a risk for fur seals due to the virtual insolubility of brodifacoum in water and the low amount of bait that may fall into the sea.

ATTRACTION OF FISH TO BAIT

Attraction of nearshore marine fishes to placebo Ramik Green rat bait pellets (2-3 gram size) at Lehua Island, Hawai'i, September 18-19, 2004

:- data from the *Final Supplemental Environmental Assessment Lehua Island Ecosystem Restoration Project: October 2008* (U.S. Fish and Wildlife Service and Hawai'i Department of Land and Natural Resources (2008), Honolulu, Hawaii) reporting that none of the fish observed consumed bait pellets.

Common Name	**Scientific Name**	**Total # of Fish**	**Inspected Bait***	**Touched Bait***	**Consumed Bait***	**Number of bait interactions per species**
Orangespine Unicornfish	*Naso literatus*	13	10	8	0	18
Convict Tang	*Acanthurus triostegus*	8	0	0	0	0
Whitebar Surgeonfish	*Acanthurus leucopareius*	85	19	0	0	19
Orangeband Surgeonfish	*Acanthurus olivaceous*	7	3	5	0	8
Achilles Tang	*Acanthurus achilles*	2	0	0	0	0
Ringtail Surgeonfish	*Acanthurus blochii*	1	0	0	0	0
Eyestripe Surgeonfish	*Acanthurus dussumieri*	1	0	0	0	0
Lagoon Triggerfish	*Rhinecanthus aculeatus*	1	1	0	0	1
Black Durgon	*Melichthys niger*	6	21	13	0	34
Pinktail Durgon	*Melichthys vidua*	5	13	9	0	22
Moorish Idol	*Zanclus cornutus*	1	0	0	0	0
Ornate Butterflyfish	*Chaetodon ornatissimus*	1	0	0	0	0
Longnose Butterflyfish	*Forcipiger longirostris*	1	0	0	0	0
Cornetfish	*Fistularia commersonnii*	1	0	0	0	0
Gray Reef Shark (juv.)	*Carcharhinus amblyrynchos*	1	1	0	0	1
Blackspot Sergeant	*Abudefduf sordidus*	1	3	0	0	3
Manybar Goatfish	*Parupeneus multifasciatus*	2	0	0	0	0
Blue Goatfish	*Parupeneus cyclostomus*	3	0	0	0	0
Yellowstripe Goatfish	*Mulloidichthys flavolineatus*	1	0	0	0	0
Hawaiian Hogfish	*Bodianus bilunulatus*	1	1	1	0	2
Parrotfish spp.	Family *Scaridae*	2	0	0	0	0

*** some individuals interacted multiple times**