ERMA New Zealand
Evaluation and Review Report

Application for Approval to Import a new organism(s) into containment that is not a geneticaly modified organsims (other than by rapid assessment) under section 40(1) of the Hazardous Substances and New Organsms (HSNO) Act 1996

Application for approval to Import 53 Species of Tropical Butterfly into containment for public display

Application Code: ERMA200600

Prepared for the Environmental Risk Management Authority

1 Executive summary

Otago Museum proposes to import 53 species of tropical butterflies into containment. These are additional species to those that have been previously approved. It will allow a greater diversity for display and education to be offered to the general public.

The imported butterflies proposed in this application are consistent with other similar HSNO Act approvals held by Otago Museum and other Butterfly display facilities. All risks are well known and characterised; these can be managed to an acceptable level with controls.

Although the butterflies are kept within a containment facility there is public entry to allow observation of the butterflies. The exit of the viewing public from the containment facility is an identified pathway of escape. Therefore each butterfly must be assessed, that if it escaped would it survive in New Zealand outside of containment. The two critical factors that will determine survival are the suitability of the New Zealand climate and the availability of suitable host plant species.

A portion of the butterflies in this application had been declined in a previous application on the grounds of limited information on these aspects. This application has introduced more information to a level we believe is sufficient to assess the risks regarding the 53 species of tropical butterflies.

The benefits of allowing the importation of these Tropical butterflies include both the financial benefits to the organisation through increased attraction of customers, and to local economies where the facilities are located through employment opportunities, but also the benefits to the community and society to the increased opportunity to observe, be entertained and educated to the world of entomology. The benefits have been assessed as being **medium** to **low**.

From our assessment we recommend that one species *Catopsilia scylla,* be **declined** on the grounds that after assessing the probability of escape, it was the only butterfly in the application to have the ability, though unlikely, to develop an undesirable self-sustaining population, and therefore the risk of it causing an adverse effect was assessed to be **low** to **negligible**.

We further recommend that the remaining 52 species of butterflies be **approved** to be imported into containment for public display purposes, taking in consideration the containment measures suggested in the application and in this evaluation and review report, the risk of escape, then the ability to develop an undesirable self-sustaining population. The risk that these tropical butterflies (not including *Catopsilia scylla*) of causing an adverse effect was assessed to be **negligible.**

2 Contents

3 Application details

Applicant	Otago Museum
Type of application	Import a new organism into containment that is not a genetically modified organism
Application code	ERMA200600
Purpose of the application	To import 53 species of tropical butterflies into a containment facility for public display.
Formal receipt of application	1 October 2010

4 Background

4.1 Applicant

4.1.1 Otago Museum is the applicant. Otago Museum's mandate, as outlined in the Otago Museum Trust Board Act (1996), is to bring the world to Otago.

4.1.2 New Zealand has only a very small number of native butterfly species. Seeing and interacting with live tropical butterflies and plants in a tropical environment is something a large number of the community would not normally get to be get to experience. Therefore Otago Museum has created a tropical forest exhibition, representing a tropical living environment populated with tropical plants and tropical butterfly species. The tropical forest exhibition was especially built to house and contain tropical butterflies and moths, and has been open since November 2007. In that time this exhibit has become a significant local, national and tourist attraction with over 250,000 visitors in the first two-year period from 2007-2009.

4.2 Description of import

4.2.1 This application is to import 53 species of tropical butterflies (Table 1), not currently allowed to be imported into New Zealand for public display, to complement and extend the list of approved species the Otago Museum presently import into their exhibit area. These additional species will allow a greater diversity for display and education to be offered to visitors.

4.2.2 These species of tropical butterfly have been identified by the applicant as those which will most effectively fulfil the purposes of display diversity and education for visitors, whilst being non-harmful and non-invasive to New Zealand's flora and fauna.

4.2.3 Although the applicant is Otago Museum, if approved the approval could be used by anyone who can meet the containment requirements ie, an approved containment facility.

Table 1 Taxonomic names of butterflies in application, with climatic tolerance, and if suitable host plants are in New Zealand.

Butterfly species to import		Climate Tolerance	Host plant in NZ
1	*Archaeoprepona demophon* (Linnaeus, 1758)	Tropical	Yes
2	*Anteos clorinde* (Godart, 1824)	Tropical	No
3	*Caligo illioneus* (Cramer, 1776)	Tropical	Yes
4	*Callicore pitheas* (Lartreille, 1813)	Tropical	Yes
5	*Catopsilia scylla* (Linnaeus, 1763)	Tropical/ Subtropical/ Temperate	Yes
6	*Cepora aspasia* (Stoll, 1790)	Tropical	No
7	*Charaxes bupalus* (Staudinger, 1889)	Tropical	No
8	*Charaxes harmodius* (Felder, 1866)	Tropical	No
9	*Danaus genutia* (Cramer, 1779)	Tropical	Yes
10	*Danaus melanippus* (Cramer, 1777)	Tropical	Yes
11	*Delias hyparete* (Linnaeus, 1758)	Tropical	Yes

Butterfly species to import		Climate Tolerance	Host plant in NZ
12	*Eryphanis polyxena* (Meerburgh, 1775)	Tropical	Yes
13	*Euthalia adonia* (Cramer, 1782)	Tropical	No
14	*Euploea sylvester* (Fabricius, 1793)	Tropical	No
15	*Godyris zavaleta* (Hewitson, 1855)	Tropical	Yes
16	*Greta nero* (Hewitson, 1854)	Tropical	Yes
17	*Hamadryas laodamia* (Cramer, 1777)	Tropical	No
18	*Historis acheronta* (Fabricius, 1775)	Tropical	No
19	*Lamproptera curius* (Staudinger, 1889)	Tropical/ Subtropical	No
20	*Lexias pardalis* (Moore, 1878)	Tropical	No
21	*Losaria neptunus/Pachliopta neptunus* (Guerin-Meneville, 1840)	Tropical	No
22	*Opsiphanes bogotanus* (Distant, 1875)	Tropical	Yes
23	*Opsiphanes tamarindi* (Felder, 1861)	Tropical	Yes
24	*Pachliopta atropos* (Staudinger, 1888)	Tropical	No
25	*Pareronia valeria* (Cramer, 1776)	Tropical	No
26	*Panacea procilla* (Hewitson, 1853)	Tropical	No
27	*Papilio daedalus/Achilles daedalus* (Felder and Felder, 1861)	Tropical	No
28	*Papilio palinurus* (Fabricius, 1787)	Tropical	No
29	*Parantica aspasia* (Fabricius, 1787)	Tropical	No
30	*Parides childrenae* (Gray, 1832)	Tropical	No
31	*Polyura schreiber* (Godart, 1824)	Tropical	Yes
32	*Troides magellanus* (Felder, 1862)	Tropical	No
33	*Troides plateni* (Staudinger, 1888)	Tropical	No
34	*Samia luzonica* (Watson, 1913)	Tropical	No
Butterflies that were declined in past applications			
35	*Biblis hyperia* (Cramer, 1782)	Tropical/ Subtropical	No
36	*Caligo atreus* (Kollar, 1850)	Tropical	Yes
37	*Consul fabius* (Doubleday, 1849)	Tropical	Yes
38	*Dryadula phaetusa* (Linnaeus, 1758)	Tropical	Yes
39	*Eueides aliphera* (Godart, 1819)	Tropical	Yes
40	*Hamadryas amphinome* (Linnaeus, 1767)	Tropical	Yes
41	*Heliconius hecale* (Fabricius, 1775)	Tropical	Yes
42	*Heliconius hewitsoni* (Staudinger, 1875)	Tropical	Yes
43	*Heliconius ismenius* (Lartreille, 1817)	Tropical	Yes
44	*Heliconius sapho* (Drury, 1782)	Tropical	Yes
45	*Idea leuconoe* (Erichson, 1834)	Tropical	Yes
46	*Ithomia heraldica* (Bates, 1866)	Tropical	No
47	*Mechanitis polymnia* (Bates, 1864)	Tropical	Yes
48	*Memphis eurypyle* (Felder, 1863) Synonym *Anaea eurypyle*	Tropical	No
49	*Morpho granadensis* (Felder, 1862)	Tropical	No
50	*Opsiphanes cassina* (Felder, 1862)	Tropical	Yes
51	*Tithorea tarricina* (Hewitson, 1857)	Tropical	No
52	*Vindula dejone* (Erichson, 1833)	Tropical	Yes
53	*Vindula erota* (Fabricius, 1793)	Tropical	Yes

4.3 History

4.3.1 Since the introduction of the Hazardous Substances and New Organisms Act 1996 (HSNO Act) in 1998, two approvals have been granted for butterflies for display in containment; NOC98008 and NOC03002, which combined approved 130 species of tropical butterflies and moths into containment.

4.3.2 Although the butterflies are kept within a containment facility there is public entry to allow observation of the butterflies. The exit of the viewing public from the containment facility is an identified pathway of escape. Thus there is a possibility of an escaping butterfly to survive in New Zealand outside of containment. The two critical factors that will determine survival are the suitability of the New Zealand climate and the availability of suitable host plant species.

4.3.3 In the previous decisions, 138 specific butterfly species were not approved due to either a lack of information supplied by the applicants to determine the suitability of the New Zealand environment, or were considered likely to establish in New Zealand on escape from containment.

4.3.4 Nineteen of the butterflies in this application (#35-53, Table 1) were not approved in a previous application due to a lack of information supplied by the applicants to determine the suitability of the New Zealand environment. This application has provided sufficient information to allow a risk assessment to be carried out.

4.3.5 We note that in the past three years, there have been four incidents where tropical butterflies have escaped containment, three of those at Otago Museum. Each incident was reported to MAF and an investigation was conducted to determine the escape route. Although butterflies have escaped, they were all either recaptured or died, there are no reports of any HSNO approved tropical butterflies forming a self-sustaining population.

5 Containment

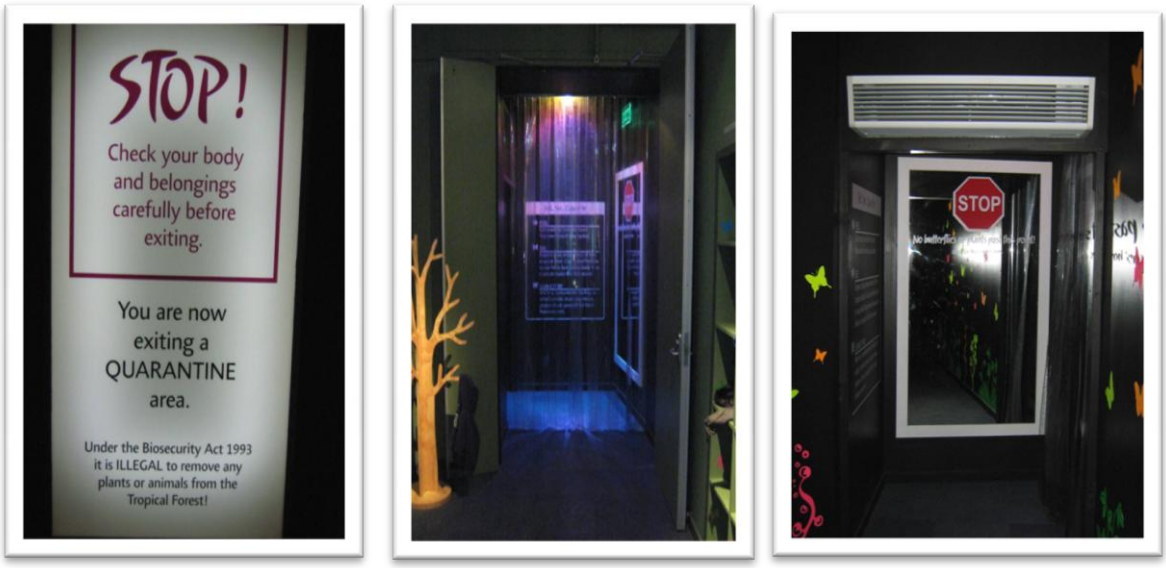
5.1.1 The applicant proposes that the butterflies will be contained within a purpose built structure, which is a MAF approved containment facility.

5.1.2 Since 2007, the ERMA/MAF Standard: *Containment for Zoo Animals* (Section 17) contains requirements pertaining to the housing and exhibiting in containment of butterflies and moths, which had not been developed at the time of the previous decisions. This Standard specifies the requirements to be met to achieve containment of these organisms.

5.1.3 We note that containment facilities for the display of butterflies have an identified pathway of escape that is, the viewing public. To manage this pathway facility staff members are always present to inform the visitors to carefully check for butterfly passengers before they exit the display area.

5.1.4 The photos below show examples of the strategies that are in place to stop the escape of any butterfly from the containment facility. Other strategies include:

- All exit and entrance points are darkened to discourage butterflies flying into these areas,
- mirrors/signs at the exits for outgoing visitors to check they have no 'passengers', and
- mesh on all ventilator openings.



Photos 1, 2 and 3: Exit sign with information for the public on the removal of butterflies from containment and a request to check for any butterfly 'passengers'.

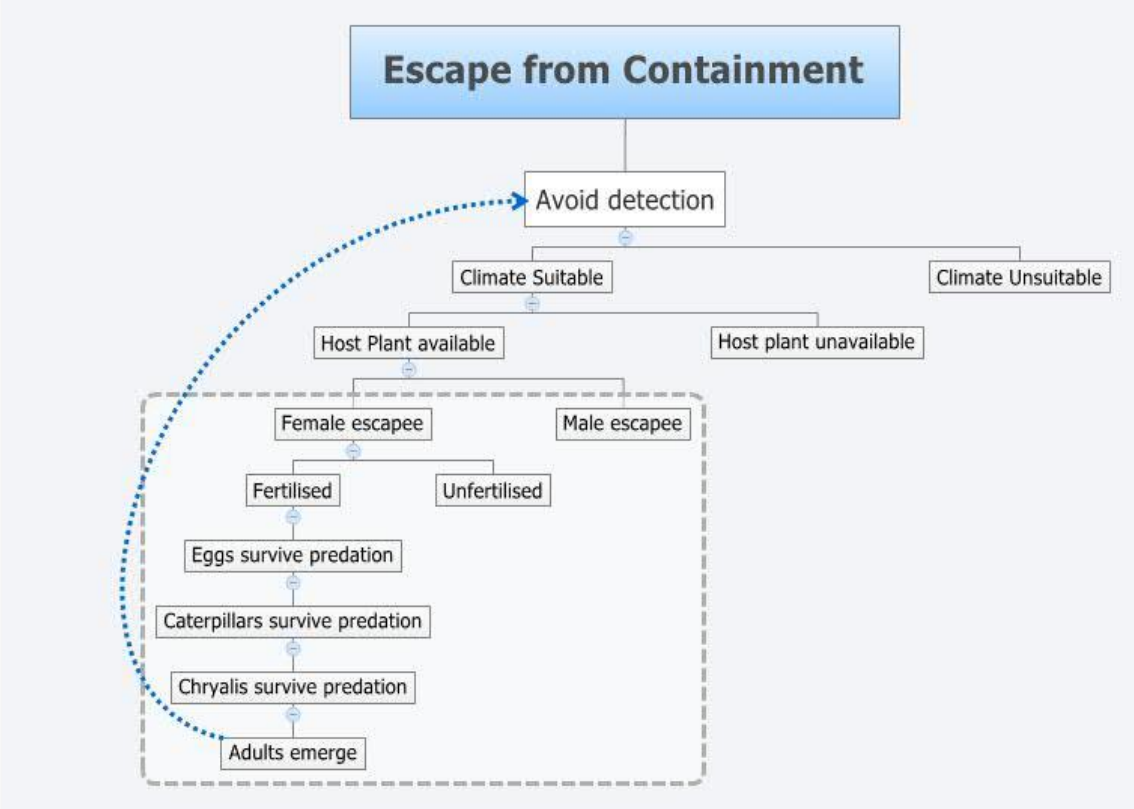
Note the darkened exit rooms and doorway blocked by draping plastic strips, which restrict airflow and actively remove butterfly 'passengers' as people push through them, also overhead UV light allowing butterflies to easily spotted, and an air blower to discourage their presence in the exit area.

Photos 4 and 5: Airflow and water flow exit points are all covered with fine mesh.

6 Ability of the organisms to establish an undesirable self-sustaining population and ease of eradication

6.1.1 As note in 5.1.3 the viewing public is a potential deliberate or unintentional pathway for butterflies to escape. Given that by the nature of the purpose of this application ie, public display, the risk of escape cannot be completely mitigated. Therefore to mitigate the likelihood of establishing an undesirable self-sustaining population each species must be assessed for its ability to survive in the New Zealand climate and the availability of suitable host plants.

6.2 Pathway of escape



6.2.1 The pathway above assumes only one individual of any species escapes at any one time. If the individual is to form a self-sustaining population it must avoid detection, whilst survive the New Zealand climate and it must find a suitable host. If any of the requirements are not met then the individual will die. If only a male or a non-gravid (unfertilised) female escapes there is no chance of a population forming. However, if a gravid female was to escape, and climate and host were suitable then the likelihood of establishment increases. However before the next generation of butterflies can emerge all stages ie, eggs, larvae, and chrysalises must survive predation, parasitism and mechanical or environmental destruction.

6.2.2 Given that what predators and parasites are present in New Zealand is not known then the most effective point to mitigate the risk of forming a self-sustaining population is to identify whether or not the New Zealand climate is tolerable for survival and the availability of suitable hosts.

6.2.3 In the two previous applications to import butterflies and moths an assessment method was developed by a New Zealand expert in entomology, Mr Dugdale, to evaluate the possibility of a butterfly species establishing a self-sustaining population. This method was used to assess the 53 butterflies in this application (see Appendix 1).

6.2.4 This system takes in account the environment where the butterflies live, climate concepts of 'Tropics', "Subtropics" and "Warm Temperate", and host-plant information, whether that plant is a crop, weed, garden or native plant and including any evidence of host-plant polyphagy (eats many plant species).

6.3 Climatic conditions

6.3.1 New Zealand's climate is considered a temperate, without a dry season, with warm summer climate under the Köppen-Geiger climate classification (the notation for this climate type is Cfb) (Peel, Finalyson and McMahon, 2007). In particular it is noted for its cold wet winters. Cfb climate types are exclusively limited to the southern hemisphere, a notable exception is coastal Vancouver and north-west Washington, and found primarily in south-eastern Australia, Tasmania, and New Zealand. The regions from which the 53 species originate do not have Cfb climates.

6.3.2 Most of the 53 species applied for are found only in the tropics and subtropics. For simplicity 'tropics' or 'tropical' is the geographical belt either side of the equator between 23°N and 23°S ie, covering 46° of latitude. We have defined the term 'subtropics' and 'subtropical' to between the tropics and 30^{o} latitude (Allen, 1995). There is a significant gap between where the subtropics end and New Zealand's most northerly point Cape Reinga (34°26' S).

6.3.3 Tropical localities, range from 21°C in the tropics to 27°C close to the equator. The coolest monthly average temperature at 'sea-level' does not fall below 20°C. There is a marked gap when compared to New Zealand locations (from Dunedin to the Cape Reinga) averages at 11 - 15.6°C. Even subtropical areas have much higher average temperatures (18.3 – 21.3°C).

6.3.4 New Zealand experiences many frosts (0°C) in winter and although mild winters can occur so can exceptionally cold winters. Butterflies from either the tropics or subtropics cannot live in such a cold climate, and could not survive these conditions to establish a self-sustaining population.

6.3.5 There are other parameters besides the mean temperatures that must be taken in account when assessing the possibility that a particular species of butterfly could survive in a particular location. For instance, the time taken for the temperature to rise from a pre-dawn level to greater than 20°C, as butterflies do not fly until warmed sufficiently or the level of humidity and rainfall which effect egg and caterpillar survivability.

6.3.6 The information available indicates that it is likely the butterflies will be unable to survive New Zealand's climatic conditions. However, there is uncertainty as temperature requirements are inferred from knowledge of the broader climate of the region in which the butterflies are found and not on empirical data. Using the descriptive terminology developed by Mr Dugdale the butterflies were categorised

as tropical, subtropical or warm temperate as a means of identifying any uncertainty about temperature tolerances (Appendix 1).

6.3.7 For those indicated as subtropical or warm temperate this uncertainty is very significant as the natural climate range becomes more similar to that of New Zealand. For those species indicated as tropical (indicating a likelihood of being restricted to tropical climates), this uncertainty is significantly diminished.

6.3.8 Of the 53 species of butterfly in the application, 50 are only found in tropical locations, two (*Biblis hyperia* and *Lamproptera curius)* are found in tropical and sub tropical locations, and one has been found in tropical, subtropical and warm temperate locations (*Catopsilia scylla*).

6.3.9 Furthermore measures to reduce the likelihood that a butterfly developing a tolerance to temperatures outside of containment is required in the ERMA/MAF Standard: *Containment for Zoo Animals* (Section 17).

6.4 Suitable host plant

6.4.1 Many butterflies require very specific host plant to complete their life cycle, and will only lay their eggs on a single species and not even other species in the same genus.

6.4.2 All potential hosts were identified and it was determined whether or not the known host or any other closely related species were present in New Zealand. In some instances the recorded host plants are known to be present (such as avocado or Emperor's candlestick), in others the possibility of potential host plant presence in New Zealand has been determined. The potential hosts are based on estimates of the abilities of the organisms to utilise alternative hosts and the identification of plant species sufficiently closely related to a known host to be potential hosts.

6.4.3 Of the 53 species of tropical butterfly in the application, 24 have no host species in New Zealand, 11 had one type of host (crop, weed/ornamental or native plant), 17 had two types of host and one had all three types of host plant. The method of scoring and full results is in Appendix 1.

6.5 Ease of Eradication

6.5.1 New Zealand has successfully eradicated incursions of white spotted tussock moth (*Orgyia thyellina*), painted apple moth (*Teia anartoides*) and Gypsy moth (*Lymantria dispar*) however only because of early detection, lack of specific hosts, at great expense, and causing great angst in the affected communities. Eradication is possible with current technology.

7 Identification and assessment of potentially significant adverse effects (risks and costs)

7.1.1 In accordance with clause 9(c) of the Methodology, we have categorised potential adverse effects by impact on the following areas; environmental, human health, Māori culture, the market economy and society and the community. These adverse effects have been considered in terms of the requirements of clauses 12, 13, and 14 of the Methodology, including the probability of occurrence and the magnitude of

adverse effects, whether or not they are monetary, the distribution of costs and benefits over time, space and groups in the community. Risk characteristics are considered in terms of clause 33 of the Methodology. Risks are assessed in terms of the likelihood of the effect occurring and the magnitude of the effect.

7.2 Potential adverse effects on environment

7.2.1 We consider that for a species to have an effect on the environment, it will need to establish a self-sustaining population.

7.2.2 We further consider that the magnitude of any effect, if a self-sustaining population of any of the butterflies in this application occurs, to be a range from **minimal** to **moderate,** depending on the types (crop, garden or native) and availability of host plants.

7.2.3 Only one butterfly species *Catopsilia scylla*, a result of its natural geographic range extending into hot/warm temperate regions, and having known hosts in gardens in New Zealand appears to have any chance of establish a self-sustaining population.

7.2.4 The hosts of *C. scylla* are: *Cassia fistula* (golden shower tree, Indian laburnum), *Senna alata* (Emperor's candlestick/candlebush), *Senna tora* (sickle senna), and *Tephrosia candida* (white hoary pea, white tephrosia). These are trees or shrubs that are very occasionally grown as ornamentals in New Zealand. Although seeds of these species (except *T. candida*) are permitted for import, they are not widely sold or grown by nurseries in New Zealand.

7.2.5 We assess that the magnitude of potential adverse effects to the environment from *C. scylla* on the establishment of a self-sustaining population is **minimal** to **minor**, because the host plants are uncommon and have low economic value to New Zealand. Though individuals with these plants in their gardens would object to the need to take precautions to protect their plants from this butterfly.

7.2.6 Factoring in the suitability to the New Zealand climate, and then finding its host plants we consider the likelihood that *C. Scylla* will cause an adverse effect to the environment is **unlikely**.

	Magnitude of effect				
Likelihood	**Minimal**	**Minor**	**Moderate**	**Major**	**Massive**
Highly improbable	A	A	A	B	B
Very unlikely	A	A	B	B	C
Unlikely	A	B	B	C	C
Likely	B	B	C	C	D
Highly likely	B	C	C	D	D

7.2.7 *Delias hyparete* has multiple potential host plants (crop, garden and native plants) in New Zealand. But this species is found solely in the tropics. Therefore we consider that it would be **highly improbable** for *D. hyparete* to establish in New Zealand in the event that it escaped from the containment facility.

7.2.8 In our assessment for the remaining 51 species of butterflies in this application the likelihood that species will establish in New Zealand as **highly improbable** in the event that they escaped from the containment facility.

	Magnitude of effect				
Likelihood	**Minimal**	**Minor**	**Moderate**	**Major**	**Massive**
Highly improbable	A	A	A	B	B
Very unlikely	A	A	B	B	C
Unlikely	A	B	B	C	C
Likely	B	B	C	C	D
Highly likely	B	C	C	D	D

7.3 Potential adverse effects on native or valued plant species

7.3.1 We have identified potential hosts in the previous section and given the requirement for a tropical to subtropical climate in most cases we therefore have not identified any adverse effects on native or valued plants.

7.3.2 We note that *Opsiphanes tamarindi* and *Opsiphanes cassina* are designated as regulated pests on the MAF Biosecurity New Zealand web site.[1] The reason for these two species are listed is that they have been associated with coconuts and could potential turn up at the border on coconut imports. We are unaware of any risk assessment conducted by MAF to validate the inclusion on this list. We further note that the Authority has previously approved for importation into containment insects that have this classification, and it is therefore not seen as a barrier to importation into containment.[2]

7.4 Human health and safety effects

7.4.1 We note that this application contains no further information on potential adverse effects of butterflies or moths on human health and safety to that presented in application NOC98008 or NOC03002. In evaluating that earlier application, ERMA New Zealand noted that Mr John Early of the Auckland Museum commented that some tropical butterflies and moths have caterpillars with urticating hairs which can cause irritation and infection if they get under the skin. The E&R Report on application NOC98008 concluded that this risk is low. We consider that, given exposure to this hazard is voluntary and is limited to those persons in direct contact with caterpillars, this risk is negligible and no further assessment is warranted.

7.5 Māori and their culture and values effects

7.5.1 The project team considered the potential Māori cultural effects of this application in accordance with sections 6(d) and 8 of the HSNO Act 1996, and the assessment framework contained in the ERMA New Zealand User Guide "Working with Māori under the HSNO Act 1996".

7.5.2 In accordance with ERMA New Zealand policy and guidelines, the applicant was not required to consult with Māori regarding this application as it does not directly involve New Zealand native or valued species. In addition, the project team consider that the containment and quarantine requirements of the application minimise the potential for adverse effect to New Zealand native or valued species.

[1] http://www.biosecurity.govt.nz/pests-diseases/registers-lists/unwanted-organisms/

[2] Approval of application NOC98008.

7.5.3 However, having considered the information provided by the applicant, and in previous sections of this report, the project team considers that the escape from containment of some of the species of tropical butterfly poses potential adverse effect to native or valued species and therefore the kaitiakitanga of Māori, including the protection and enhancement of the mauri of taonga (native and valued) flora and fauna species and ecosystems.

7.5.4 Overall, the potential for adverse effect to the relationship of Māori with their culture and traditions with their ancestral lands, water, sites, waahi tapu, valued flora and fauna and other taonga is considered to be not significant due to the nature of the import request, the containment requirements, and additional controls suggested in this report.

7.6 Social and community effects

7.6.1 We agree with the applicant that there are no significant potential adverse social and community effects of approving the importation of these butterflies.

7.7 The market economy effects

7.7.1 We note that the potential adverse effects on valued plant species assessed above may have an impact on the market economy as a result of butterflies becoming economically significant pests of commercial crops. We note that no information has been provided on the potential adverse effects on commercially important crop plant species and that consequently the magnitude and likelihood of these is uncertain. However, we consider that the establishment of a self-sustaining population is required before any of the species of butterfly could become a pest of sufficient significance to affect the market economy. This risk is negligible and no further assessment is warranted.

7.8 Identification of costs

7.8.1 We consider that any costs associated with the application would only be as a result of the adverse effects identified and assessed above. No further costs have been identified, other than the costs borne by the applicant. Therefore, no further assessment of costs has been conducted in this report.

8 Identification and assessment of potentially significant beneficial effects

8.1.1 In accordance with clause 9(c) of the Methodology, between the applicant and ERMA staff, we have identified the potential beneficial effects. These beneficial effects have been considered in terms of the requirements of clauses 13, and 14 of the Methodology.

8.1.2 The applicant has listed a number of benefits that may flow from the importation into containment of tropical butterflies and moths for public display. These include:

- Financial benefits to the Museum that house butterflies and moths through increased attraction of customers, and to local economies where the facilities are located through employment opportunities.
- Increased entertainment, education and satisfaction of visitors.
- Educational benefits through schools and visitors having an opportunity to learn and get in contact with something that is normally out of reach.
- Ethical benefits. The applicant mentions the trade in tropical butterfly and moth pupae as being beneficial to the economies of countries from which the organisms are sourced (many of which are low- income countries).

8.1.3 We note that there are no specific benefits to Māori arising from this application.

8.1.4 We further note that the public display in zoos is a recognised purpose for the importation of new organisms into containment.[3] This purpose indicates that Parliament has recognised the public benefit of displaying exotic animals in zoos which we describe as a benefit to public education. In assessing these potential benefits we note that, to some extent these benefits are currently being obtained through the use of the approvals NOC98008 and NOC03002 to import into containment 130 other species of tropical butterfly or moths. The applicant has noted that this number of species is restrictive because not all of the approved species are readily obtainable and some do not perform well in the containment situation. Part of the applicant's rationale for this application is to increase the quality of the exhibition by utilising a wider range of species. For the purposes of evaluating the benefits of this application, no information is available that relates the potential benefits to any individual (or groups of) species in the application. Rather the benefits are described as applying to the application as a whole.

8.1.5 Indications are that the potential benefits are **likely** to be realised, include both monetary and non-monetary benefits and are distributed over a wide sector of the community which includes schools and other visitors, taking in consideration from the previous two approvals. The potential for such facilities to be established throughout New Zealand increases the number of communities that may potentially gain these benefits. We assess the magnitude of this benefit to range between **moderate** to **minor**.

	Magnitude of effect				
Likelihood	**Minimal**	**Minor**	**Moderate**	**Major**	**Massive**
Highly improbable	A	A	A	B	B
Very unlikely	A	A	B	B	C
Unlikely	A	B	B	C	C
Likely	B	B	C	C	D
Highly likely	B	C	C	D	D

[3] Section 39(1)(e) of the HSNO Act 1996.

9 Analysis of potential effects (risks, costs and benefits).

9.1.1 Potential effects of this proposed importation have been identified by considering the causes of effect, the pathways for exposure to the butterflies (eg, escape), and the effect of the butterflies to the environment, as well as the likelihood and size of effect. We categorised adverse and beneficial effects identified by the applicant, other government departments and ourselves in relation to: the environment, human health and safety, relationship of Māori to the environment, the market economy, and society and community. These are discussed in Appendix 1.

9.1.2 Before assessing the risks, costs and benefits, we analysed the ability to contain the organisms, this included identifying and analysing the potential pathways of escape. While the containment Standards[4] are robust on the whole, we have recommended additional controls to give additional details on notification of use (Control 2) and on notification of a breach (Control 5).

9.1.3 The identification and assessment of risks to New Zealand on the event that any of these 53 species of butterfly escape from containment using the Dugdale scoring system is contained in Appendix 1.

9.1.4 The benefits of allowing the importation of these tropical butterflies include both the financial benefits to the organisation through increased attraction of customers, and to local economies where the facilities are located through employment opportunities, but also the benefits to the community and society to the increased opportunity to observe, be entertained and educated to the world of entomology. The benefits would be **medium** to **low**.

9.1.5 We recommend that one species *Catopsilia scylla* be declined on the evidence that it has been found in places with a hot/warm temperate climate. After consideration of the containment measures suggested in the application and in this E&R report, the risk of escape, and the ability to develop a self-sustaining population our assessment potential adverse effects regarding *Catopsilia scylla* is **low** to **negligible**. As the risk range is non- negligible, indicating it may, though with a low probability, form an undesirable self-sustaining population, and cause an adverse effect, we recommend declining its importation.

9.1.6 This application has delivered information to a level we believe is sufficient to recommend after consideration of the containment measures suggested in the application and in this E&R report, the risk of escape, then the ability to develop a self-sustaining population the potential adverse effects regarding the specific tropical butterflies proposed in application ERMA200600 besides *Catopsilia scylla* are **negligible**.

9.1.7 The suggested containment and other controls address potential effects. We did not identify any new or unusual significant risks or costs of this application.

[4] Containment standards specify the structural and operating requirements for containment facilities. They have been approved by both MAF and ERMA NZ. The organisms from this application come under MAF/ERMA New Zealand Standard: *Containment Facilities for Zoo Animals*;

9.1.8 We therefore recommend approving 52 species in this application with the proposed controls, and declining one species.

10 Proposed containment controls

10.1.1 The following controls are recommended to manage potential adverse effects.

Containment controls:	
1	The approval user (organisms using this approvals) must ensure compliance with the following controls
2	Each approvals user must, the first time it uses this approvals at each containment facility, notify ERMA New Zealand and the MAF Inspector in writing.
3	This approval is limited to the importation into containment of the tropical butterfly species listed in Table 1 (except for *Catopsilia Scylla*) for public display.
4	Subject to the other controls of this approval, tropical butterflies must be held within a containment facility in accordance with the most recent version of the MAF/ERMA New Zealand Standard *Containment Facilities for Zoo Animals.*
5	Within 24 hours of the discovery of any breach of containment the approvals user must notify the MAF inspector of the breach and details of any action taken to restore containment.

11 Comments from Ministry of Agriculture and Forestry (MAF) and Department of Conservation

11.1 MAF Biosecurity New Zealand

Section 5, Pg 40	▪ MAF commends the museum on instituting measures to encourage visitors to the facility to leave bags and coats outside the facility and provide free lockers for this purpose. MAF recommends that a control requiring bags to be kept outside the facility be made mandatory in order to limit the likelihood of butterflies being intentionally removed.
ERMAs response	▪ **We agree with the principle of this suggestion, but feel it is more appropriate to suggest this to be included in the containment manuals of these facilities as best practise to reduce the risk of a breach of containment**
Section 7, Pg 45	▪ The applicant notes that *"there has been no recorded escapes leading to adverse effects on the environment, public health and safety, Māori and their culture or the market economy"*. This statement is a little misleading because it implies that there have been no escapes. This is not the case. MAF has investigated several instances of butterflies escaping from the facility and noted some of the inadequacies of the facility in dealing with these. Non-compliances were issued and corrective actions required to prevent further escapes. MAF is satisfied that the operation of the facility has improved to effectively manage the likelihood of escapes.
ERMAs response	▪ **Noted, and we have made reference to this in the E&R report**
	▪ MAF notes, however, that because the facility is accessible by the public, the risk a breach of containment through intentional removal of butterflies from the facility will remain high.
ERMAs response	▪ **Noted**

11.2 Department of Conservation

The Department of Conservation has no significant concerns with this application. We agree that the risk of escape is low, and we trust that the Authority will apply sufficient controls to minimise that risk as much as possible. In addition, it is our opinion that, based on current scientific knowledge, the expected impact on the native environment, in the event of escape, is low (given the tropical butterflies are very unlikely to establish in the New Zealand climate).

12 Sources and references

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13 Appendix One: Butterfly risk scoring using Dugdale system

John S. Dugdale developed a scoring system ranging from 0 (low) to 9 (high) to help classify the range of risk associated with a particular species of butterfly. Mr Dugdale was asked to give expert comment on the previous application NOC03002.

Using descriptive terminology the butterfly species are categorised into tropical, subtropical or warm temperate fields as a means of identifying the degree of uncertainty about temperature tolerances that exists for each species. For those indicated as subtropical or warm temperate this uncertainty is very significant. For those species indicated as tropical (indicating a likelihood of being restricted to tropical climates), this uncertainty is far less.

Furthermore potential host plants are identified to their presence in New Zealand allowing for the possibility that butterflies (more correctly the next generation of caterpillars) may have a food source. In some instances the recorded host plants are known to be present either as a crop plant, a garden or weed plant or a native. In others the indications of potential host plant presence in New Zealand is based on estimates of the abilities of the organisms to utilise alternative hosts and the identification of plant species sufficiently closely related to a known host to be potential hosts.

Risk assessment scoring:

Of the 53 species of tropical butterfly in the application, 50 are only found in tropical locations, 2 are found in tropical and sub tropical locations, and 1 has been found in tropical, subtropical and warm temperate locations.

Of the 53 species of tropical butterfly in the application, 24 have no host species in NZ, 11 have one type of host (crop, weed/ornamental or native plant), 17 have two types of host and one species had all three types of host plant.

Distribution scores

(–2)	Tropical
+1	Tropical and Subtropical or Subtropical
+3	If distribution includes warm temperate

Host plant scores:

0:	No host genera or other relatives in groups indigenous in NZ
1:	Host taxa present only as a garden (ornamental) or woodlot plant or weed
2:	Host plant present only as a crop
3:	Host plant present only has NZ indigenous or endemic relatives
4:	Two host-plant categories present:
5:	All three host-plant categories present:
+**1**	If polyphagous

Examples of scoring system

Archaeoprepona demophon : distribution is T (-2) and has no host relatives in NZ (=0), so its score is **0.**
Catopsilia Scylla: distribution is T/ST/Wte (= +3), is polyphagous (+1) and has 1 host category (+1), thus scoring **5**.
Polyura schreiber : distribution is tropical (–2), is polyphagous (+1) and 2 host plant categories (*Rosa*) is a crop and garden plant in NZ (+4), and scores **3**.
Biblis hyperia: distribution is TST (=1) but has no host in NZ (=0), so its score is **1**.
Delias hyparete: distribution is tropical (–2), is polyphagous (+1) and all three host categories (+5), and scores **4**.
Danaus melanippus: distribution is tropical (–2), is polyphagous (+1), has 1 host category (+1) so its score is **0**.

Results Table 1 (T: tropical, ST: subtropical; Wte: Warm temperate)

Name	Butterfly # in application	Climate Range	Crop hosts	Garden/ weed host	Native host	Multi host	Risk level score
Archaeoprepona demophon (Linnaeus, 1758)	1	T	✓				0
Anteos clorinde (Godart, 1824)	2	T					0
Biblis hyperia (Cramer, 1782)	35	T/ST					1
Caligo atreus (Kollar, 1850)	36	T	✓	✓			2
Caligo illeonus (Cramer, 1776)	3	T	✓	✓		✓	3
Callicore pitheas (Lartreille, 1813)	4	T	✓		✓	✓	3
Catopsilia scylla (Linnaeus, 1763)	5	T/ST/ Wte		✓			5
Cepora aspasia (Stoll, 1790)	6	T					0
Charaxes bupalus (Staudinger, 1889)	7	T					0
Charaxes harmodius (Felder, 1866)	8	T					0
Consul fabius (Doubleday, 1849)	37	T	✓	✓		✓	3
Danaus genutia (Cramer, 1779)	9	T	✓			✓	3
Danaus melanippus (Cramer, 1777)	10	T		✓		✓	0
Delias hyparete (Linnaeus, 1758)	11	T	✓	✓	✓	✓	4
Dryadula phaetusa (Linnaeus, 1758)	38	T	✓		✓	✓	3
Eryphanis polyxena (Meerburgh, 1775)	12	T	✓	✓			2
Eueides aliphera (Godart, 1819)	39	T	✓		✓	✓	3
Euthalia adonia (Cramer,	13	T					0

1782)							
Euploea sylvester (Fabricius, 1793)	14	T		✓			0
Godyris zavaleta (Hewitson, 1855)	15	T		✓			0
Greta nero (Hewitson, 1854)	16	T		✓			0
Hamadryas amphinome (Linnaeus, 1767)	40	T		✓	✓	✓	3
Hamadryas laodamia (Cramer, 1777)	17	T					0
Heliconius hecale (Fabricius, 1775	41	T	✓		✓		2
Heliconius hewitsoni (Staudinger, 1875)	42	T	✓		✓		2
Heliconius ismenius (Lartreille, 1817)	43	T	✓		✓		2
Heliconius sapho (Drury, 1782)	44	T	✓		✓		2
Historis acheronta (Fabricius, 1775)	18	T					0
Idea leuconoe (Erichson, 1834)	45	T			✓	✓	0
Ithomia heraldica (Bates, 1866)	46	T					0
Lamproptera curius (Staudinger, 1889)	19	T/ST					1
Lexias pardalis (Moore, 1878)	20	T					0
Losaria neptunus/Pachliopta neptunus (Guerin-Meneville, 1840)	21	T					0
Mechanitis polymnia (Bates, 1864)	47	T		✓		✓	1
Memphis eurypyle (Felder, 1863) Synonyms Anaea eurypyle	48	T					0
Morpho granadensis (Felder, 1862)	49	T					0
Opsiphanes bogotanus (Distant, 1875)	22	T		✓		✓	1
Opsiphanes cassina (Felder, 1862)	50	T	✓	✓			2
Opsiphanes tamarindi (Felder, 1861)	23	T	✓	✓			2
Pachliopta atropos (Staudinger, 1888)	24	T					0
Pareronia valeria (Cramer, 1776)	25	T					0
Panacea procilla (Hewitson, 1853)	26	T					0
Papilio daedalus/Achilles daedalus (Felder and Felder, 1861)	27	T					0

Papilio palinurus (Fabricius, 1787)	28	T				✓	0
Parantica aspasia (Fabricius, 1787)	29	T					0
Parides childrenae (Gray, 1832)	30	T					0
Polyura schreiber (Godart, 1824)	31	T	✓	✓		✓	3
Tithorea tarricina (Hewitson, 1857)	51	T					0
Troides magellanus (Felder, 1862)	32	T				✓	0
Troides plateni (Staudinger, 1888)	33	T					0
Samia luzonica (Watson, 1913)	34	T		✓		✓	1
Vindula deione (Erichson, 1833)	52	T	✓		✓	✓	3
Vindula erota (Fabricius, 1793)	53	T	✓		✓	✓	3

Butterflies species highlighted as of concern:

Butterfly #05 *Catopsilia scylla - scoring a 5/9*

Butterfly #11 *Delias hyparete- scoring a 4/9*

14 Appendix Two: Qualitative descriptors for risk/benefit assessment

This section describes how the Agency staff and the Authority address the qualitative assessment of risks, costs and benefits. Risks and benefits are assessed by estimating the magnitude and nature of the possible effects and the likelihood of their occurrence. For each effect, the combination of these two components determines the level of the risk associated with that effect, which is a two dimensional concept. Because of lack of data, risks are often presented as singular results. In reality, they are better represented by 'families' of data which link probability with different levels of outcome (magnitude).

The magnitude of effect is described in terms of the element that might be affected. The qualitative descriptors for magnitude of effect are surrogate measures that should be used to gauge the end effect or the 'what if' element. Tables 1 and 2 contain generic descriptors for magnitude of adverse and beneficial effect. These descriptors are examples only, and their generic nature means that it may be difficult to use them in some particular circumstances. They are included here to illustrate how qualitative tables may be used to represent levels of adverse and beneficial effect.

Table 1 Magnitude of adverse effect (risks and costs)

Descriptor	Examples of descriptions - ADVERSE
Minimal	Mild reversible short term adverse health effects to individuals in highly localised area Highly localised and contained environmental impact, affecting a few (less than ten) individuals members of communities of flora or fauna, no discernible ecosystem impact Local/regional short-term adverse economic effects on small organisations (businesses, individuals), temporary job losses No social disruption
Minor	Mild reversible short term adverse health effects to identified and isolated groups Localised and contained reversible environmental impact, some local plant or animal communities temporarily damaged, no discernible ecosystem impact or species damage Regional adverse economic effects on small organisations (businesses, individuals) lasting less than six months, temporary job losses Potential social disruption (community placed on alert)
Moderate	Minor irreversible health effects to individuals and/or reversible medium term adverse health effects to larger (but surrounding) community (requiring hospitalisation) Measurable long term damage to local plant and animal communities, but no obvious spread beyond defined boundaries, medium term individual ecosystem damage, no species damage Medium term (one to five years) regional adverse economic effects with some national implications, medium term job losses Some social disruption (e.g. people delayed)
Major	Significant irreversible adverse health effects affecting individuals and requiring hospitalisation and/or reversible adverse health effects reaching beyond the immediate community Long term/irreversible damage to localised ecosystem but no species loss Measurable adverse effect on GDP, some long term (more than five years) job losses Social disruption to surrounding community, including some evacuations
Massive	Significant irreversible adverse health effects reaching beyond the immediate community and/or deaths Extensive irreversible ecosystem damage, including species loss Significant on-going adverse effect on GDP, long term job losses on a national basis Major social disruption with entire surrounding area evacuated and impacts on wider community

Table 2 Magnitude of beneficial effect (benefits)

Descriptor	Examples of descriptions -BENEFICIAL
Minimal	Mild short term positive health effects to individuals in highly localised area Highly localised and contained environmental impact, affecting a few (less than ten) individuals members of communities of flora or fauna, no discernible ecosystem impact Local/regional short-term beneficial economic effects on small organisations (businesses, individuals), temporary job creation No social effect
Minor	Mild short term beneficial health effects to identified and isolated groups Localised and contained beneficial environmental impact, no discernible ecosystem impact Regional beneficial economic effects on small organisations (businesses, individuals) lasting less than six months, temporary job creation Minor localised community benefit
Moderate	Minor health benefits to individuals and/or medium term health impacts on larger (but surrounding) community and health status groups Measurable benefit to localised plant and animal communities expected to pertain to medium term. Medium term (one to five years) regional beneficial economic effects with some national implications, medium term job creation Local community and some individuals beyond immediate community receive social benefit.
Major	Significant beneficial health effects to localised community and specific groups in wider community Long term benefit to localised ecosystem(s) Measurable beneficial effect on GDP, some long term (more than five years) job creation Substantial social benefit to surrounding community, and individuals in wider community.
Massive	Significant long term beneficial health effects to the wider community Long term, wide spread benefits to species and/or ecosystems Significant on-going effect beneficial on GDP, long term job creation on a national basis Major social benefit affecting wider community

The likelihood applies to the composite likelihood of the end effect, and not either to the initiating event, or any one of the intermediary events. It includes:

- the concept of an initiating event (triggering the hazard), and
- the exposure pathway that links the source (hazard) and the area of impact (public health, environment, economy, or community).

Thus, the likelihood is not the likelihood of an organism escaping, or the frequency of accidents for trucks containing hazardous substances, but the likelihood of the specified adverse effect[5] resulting from that initiating event. It will be a combination of the likelihood of the initiating event and several intermediary likelihoods[6]. The best way to determine the likelihood is to specify and analyse the complete pathway from source to impact.

Likelihood may be expressed as a frequency or a probability. While frequency is often expressed as a number of events within a given time period, it may also be expressed as the

[5] The specified effect refers to scenarios established in order to establish the representative risk, and may be as specific as x people suffering adverse health effects, or y% of a bird population being adversely affected. The risks included in the analysis may be those related to a single scenario, or may be defined as a combination of several scenarios.

[6] Qualitative event tree analysis may be a useful way of ensuring that all aspects are included.

number of events per head of (exposed) population. As a probability, the likelihood is dimensionless and refers to the number of events of interest divided by the total number of events (range 0-1).

Table 3 Likelihood

Descriptor	Description
Highly improbable	Almost certainly not occurring but cannot be totally ruled out
Very unlikely	Considered only to occur in very unusual circumstances
Unlikely (occasional)	Could occur, but is not expected to occur under normal operating conditions.
Likely	A good chance that it may occur under normal operating conditions.
Highly likely	Almost certain, or expected to occur if all conditions met

Using the magnitude and likelihood tables a matrix representing a level of risk/benefit can be constructed.

In the example shown in Table 4, four levels of risk/benefit are allocated: A (negligible), B (low), C (medium), and D (high). These terms have been used to avoid confusion with the descriptions used for likelihood and magnitude, and to emphasise that the matrix is a tool to help decide which risks/benefits require further analysis to determine their significance in the decision making process.

For negative effects, the levels are used to show how risks can be reduced by the application of additional controls. Where the table is used for positive effects it may also be possible for controls to be applied to ensure that a particular level of benefit is achieved, but this is not a common approach. The purpose of developing the tables for both risk and benefit is so that the risks and benefits can be compared.

Table 4 Level of risk

	Magnitude of effect				
Likelihood	**Minimal**	**Minor**	**Moderate**	**Major**	**Massive**
Highly improbable	A	A	A	B	B
Very unlikely	A	A	B	B	C
Unlikely	A	B	B	C	C
Likely	B	B	C	C	D
Highly likely	B	C	C	D	D

15 Appendix Three: Decision path for applications to import into containment any new organism (non GMO)

Context
This decision path describes the decision-making process for applications to **import into containment any new organism that is not a GMO**. These applications are made under section 40 of the HSNO Act, and determined under section 45 of the Act. Applications to import a new organism into containment require consideration of section 44 (section 37 and ability to escape: section 37 refers to the ability of the organism to form an undesirable self-sustaining population and ease of eradication).

Introduction
The purpose of the decision path is to provide the Authority with guidance so that **all relevant matters** in the HSNO Act and the Methodology have been addressed. It does not attempt to direct the weighting that the Authority may decide to make on individual aspects of an application.

In this document 'section' refers to sections of the HSNO Act, and 'clause' refers to clauses of the ERMA New Zealand Methodology.

The decision path has two parts –

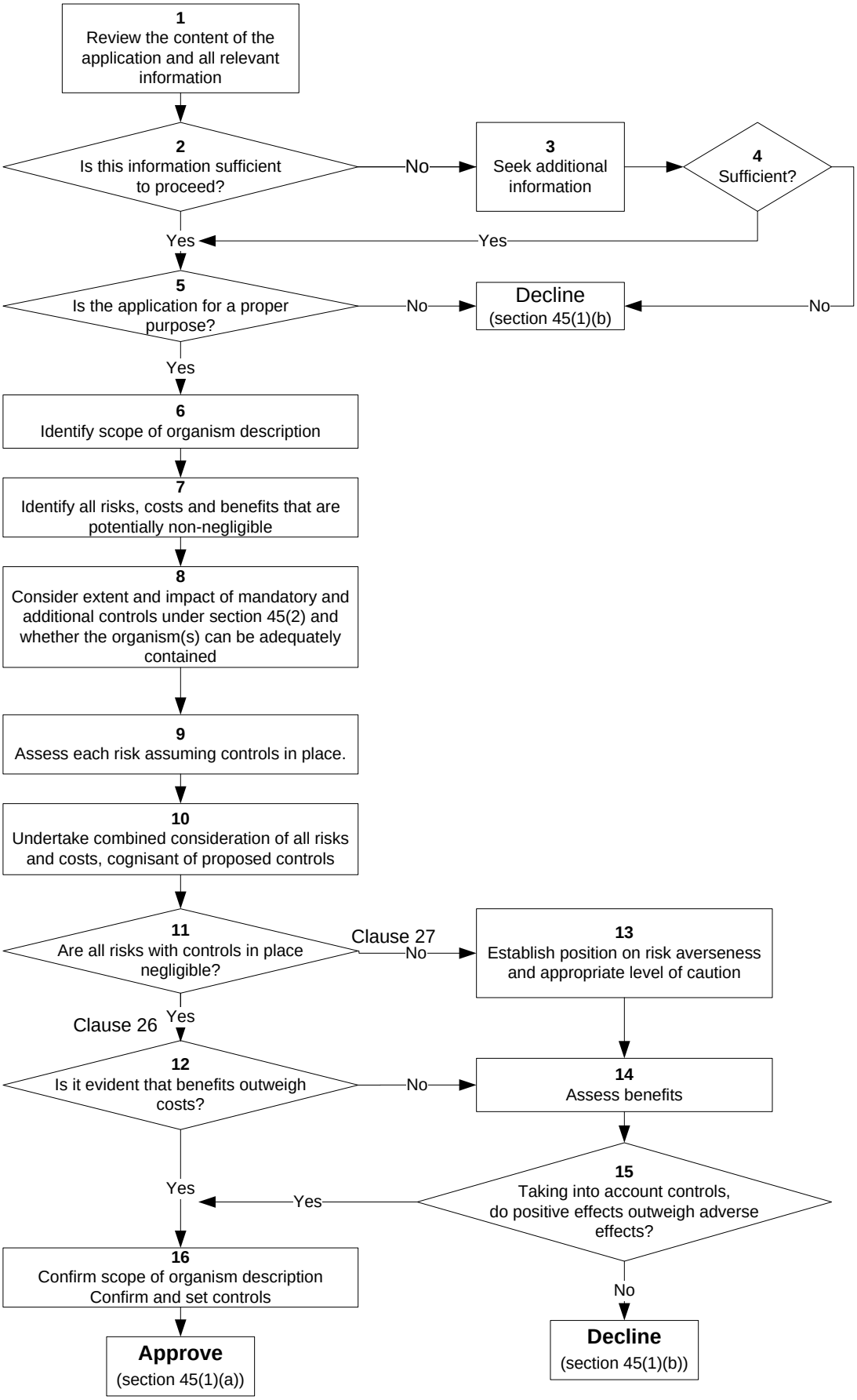
- **Flowchart** (a logic diagram showing the process prescribed in the Methodology and the HSNO Act to be followed in making a decision), and
- **Explanatory notes** (discussion of each step of the process).

Of necessity the words in the boxes in the flowchart are brief, and key words are used to summarise the activity required. The explanatory notes provide a comprehensive description of each of the numbered items in the flowchart, and describe the processes that should be followed to achieve the described outcome.

For proper interpretation of the decision path it is important to work through the flowchart in conjunction with the explanatory notes.

15.1 Flow Chart: Decision path for applications to import into containment any NO (non GMO) (application made under section 40 of the Act and determined under section 45 of the Act)

For proper interpretation of the decision path it is important to work through the flowchart in conjunction with the explanatory notes



15.2 Explanatory Notes

An application may be for a single new organism or for a variety or range of new organisms where the boundaries of the extent of modifications envisaged are well defined (see ERMA New Zealand Protocol: *Interpretations and Explanations of Key Concepts* interpretation 'Identification of New Organisms'). In both of these cases organisms having similar risk profiles should be grouped into categories. Each category should be considered separately via the path below.

Item 1: **Review the content of the application and all relevant information**
Review the application, the E&R Report (or draft decision and Agency advice), and information received from experts and that provided in submissions (where relevant) in terms of section 40(2) of the Act and clauses 8, 15, 16 and 20 of the Methodology.

Item 2: **Is this information sufficient to proceed?**
Review the information and determine whether or not there is sufficient information available to make a decision.

The Methodology (clause 8) states that the information used by the Authority in evaluating applications shall be that which is appropriate and relevant to the application. While the Authority will consider all relevant information, its principal interest is in information which is significant to the proper consideration of the application; ie information which is "necessary and sufficient" for decision-making.

Item 3: **(if no) Seek additional information**
If there is not sufficient information then additional information may need to be sought from the applicant, the Agency or other parties/experts under section 58 of the Act (clause 23 of the Methodology).

Item 4: **Sufficient?**
When additional information has been sought, has this been provided, and is there now sufficient information available to make a decision?

If the Authority is not satisfied that it has sufficient information for consideration, then the application must be declined under section 45(1)(b).

Under section 40(4) of the Act the applicant may choose to withdraw the application at any time.

Item 5: **(If 'yes' from item 2 or from item 4) Is the application for a proper purpose?**
Section 39(1) of the Act specifies the purposes for which the Authority may approve the importation of a new organism. If the application is not for one of the purposes listed under section 39(1) then it must be declined.

Item 6: **Identify scope of organism description**
Clearly identify the scope of the organism description. Particular attention should be paid to whether the application is for a single new organism or a variety of new organisms as referenced in the Introduction to these notes. Exclusions may be used to sets bounds on the scope of the organism description where a range or

variety of new organisms is being considered.

Item 7: Identify all risks, costs and benefits that are potentially non-negligible[7]

Costs and benefits are defined in the Methodology as the value of particular effects (clause 2). However, in most cases these 'values' are not certain and have a likelihood attached to them. Thus costs and risks are generally linked and may be addressed together. If not, they will be addressed separately. Examples of costs that might not be obviously linked to risks are direct financial costs that cannot be considered as 'sunk' costs (see footnote 1). Where such costs arise and they have a market economic effect they will be assessed in the same way as risks, but their likelihood of occurrence will be more certain (see also item 12).

Identification is a two step process that scopes the range of possible effects (risks, costs and benefits).

Step 1: Identify all risks and costs (adverse effects) and benefits (beneficial effects) associated with the approval of the organism(s), and based on the range of areas of impact described in clauses 9 and 10 of the Methodology and sections 5 and 6 of the Act[8].

Relevant costs and benefits are those that relate to New Zealand and those that would arise as a consequence of approving the application (clause 14).

Consider short term and long term effects.

Identify situations where risks and costs occur in one area of impact or affect one sector and benefits accrue to another area or sector; that is, situations where risks and costs do not have corresponding benefits.

Step 2: Document those risks, costs and benefits that can be readily concluded to be negligible[9], having regard to the characteristics of the organism and the circumstances of the application, and eliminate them from further consideration.

Note that where there are costs that are not associated with risks some of them may be eliminated at this scoping stage on the basis that the financial cost represented is very small and there is no overall effect on the market economy.

Item 8: Consider extent and impact of mandatory and additional controls under sections 45(2) and whether the organism(s) can be adequately contained

Section 45(2) requires the application of controls for all applicable matters

[7] Relevant effects are **marginal effects**, or the changes that will occur as a result of the organism(s) being available. Financial costs associated with preparing and submitting an application are not marginal effects and are not effects of the organism(s) and are therefore not taken into account in weighing up adverse and positive effects. These latter types of costs are sometimes called 'sunk' costs since they are incurred whether or not the application is successful.

[8] Effects on the natural environment, effects on human health and safety, effects on Māori culture and traditions, effects on society and community, effects on the market economy.

[9] Negligible effects are defined in the Annotated Methodology as "Risks which are of such little significance in terms of their likelihood and effect that they do not require active management and/or after the application of risk management can be justified by very small levels of benefits".

specified in the 3rd Schedule (Part II). The Authority may consider other controls to give effect to the purpose of the Act. The impact of these controls also needs to be considered.

Section 45(1)(a)(iii) requires the Authority to be satisfied that the organism can be "adequately contained". The concept of adequate containment includes the satisfactory biological and/or physical containment of the organism and also the ability of the applicant to apply and maintain all the controls satisfactorily.

Item 9: Assess each risk assuming controls in place

The assessment of potentially non-negligible risks and costs should be carried out in accordance with clauses 12, 13, 15, 22, 24, 25, and 29 to 32 of the Methodology. Most of these risks and costs will relate to matters in sections 5 and 6 of the Act. In undertaking this assessment the Authority must take into account the principles of the Treaty of Waitangi (section 8, and clause 9(c)(iv)).

The assessment is carried out with the controls in place. It should consider the following three matters that have particular relevance for this type of application.

(1) The ability of the organism to escape from containment (section 44)

Although strictly speaking, this requirement applies only to field test applications and not to development applications (see section 45(1)(a)(ii)), it is prudent and good practice to consider it anyway. This element must be considered in an integrated way in the assessment process because the ability to escape depends on the containment controls set.

(2) Self-sustaining population (section 37).

Section 37 of the Act requires the consideration to have regard to the ability of the organism to establish an **undesirable** self sustaining population and the ease of eradication if it were to establish such a population. **Undesirable** means (in effect) able to create significant risks.

(3) Additional matters

Other matters to be considered in the assessment are:

- the extent to which the risk will be mitigated by the setting of containment and other controls, including the mandatory controls in the Act; and
- the extent to which the risk will be mitigated by the ability to eradicate the organism if it becomes established.

Assess each potentially non-negligible risk and cost estimating the **magnitude** of the effect if it should occur and the **likelihood** of it occurring considering also the level of risk if containment or other controls fail, as well as the probability of such a failure. In estimating the **magnitude** of the adverse effect take into account the extent to which the risk might be mitigated by how or whether it might be possible to eradicate the organism if a significant adverse effect eventuated (section 37). When estimating the **likelihood** of the effect occurring, consider the full pathway, that is, all the possible steps that must occur before the final identified effect is realised. Estimating the likelihood requires combining (multiplying) all of the individual likelihoods for each link in the chain of events.

Where there are non-negligible financial costs that are not associated with risks then the probability of occurrence (likelihood) may be close to 1. Relevant information provided in submissions should be taken into account.

The distribution of risks and costs should be considered, including geographical distribution and distribution over groups in the community, as well as distribution over time. This information should be retained with the assessed level of risk/cost.

Approach to risk and approach to uncertainty

Consider the Authority's **approach to risk** (clause 33 of the Methodology) or how risk averse the Authority should be in giving weight to the residual risk, where residual risk is the risk remaining after the imposition of controls.

The risk characteristics set out in clause 33 are:

(a) Exposure to the risk is involuntary:

(b) The risk will persist over time:

(c) The risk is subject to uncontrollable spread and is likely to extend its effects beyond the immediate location of incidence:

(d) The potential adverse effects are irreversible:

(e) The risk is not known or understood by the general public and there is little experience or understanding of possible measures for managing the potential adverse effects.

Consider each non-negligible risk in terms of the factors listed and decide whether to be risk averse by giving additional weight to that risk. This may be done as part of estimating the magnitude of the effect or where this is not relevant, it may be done separately.

Where the Authority chooses to be risk averse, and there is uncertainty as well, the approach to risk may be consolidated with the approach to uncertainty by adopting a conservative approach such as the worst feasible case scenario.

See the ERMA New Zealand report 'Approach to Risk' for further guidance[10]

The assessment includes consideration of how cautious the Authority will be in the face of **uncertainty** (section 7 and clauses 29-32). Where there is uncertainty, it may be necessary to estimate scenarios for lower and upper bounds for the adverse effect as a means of identifying the range of uncertainty (clause 32). It is also important to bear in mind the materiality of the uncertainty and how significant the uncertainty is for the decision (clause 29(a)).

For each component (magnitude and likelihood) consider the degree of uncertainty associated with the estimation of each component. In some cases it may be clear that the uncertainty could be reduced by gathering further information (undertaking more scientific tests, or extending the literature search). Before requesting or seeking further information it is important to consider how important the uncertainty is in terms of the decision (clause 29(a) – materiality),

[10] http://www.ermanz.govt.nz/resources/publications/pdfs/ER-OP-03-02.pdf

and to essentially consider the cost-effectiveness of gathering further information.

Another approach to addressing uncertainty is to look at a range of scenarios and consider a best feasible-worst feasible scenario range. However, where there is a large degree of uncertainty, this may not be particularly meaningful for calculating the level of risk. In other cases, calculating the level of risk for each end of the range may result in a fairly similar level of risk. Where this does not occur, rather than presenting a wide range in the level of risk it may be better to concentrate on analysing why the uncertainty occurs and whether or not there is any obvious way of resolving it.

Additional controls

Controls additional to those mandated in section 45(2) of the Act (see item 8) may need to be considered in order to mitigate risks to whatever level is considered to be appropriate, and to provide adequate containment.

Item 10: Undertake combined consideration of all risks and costs, cognisant of proposed controls

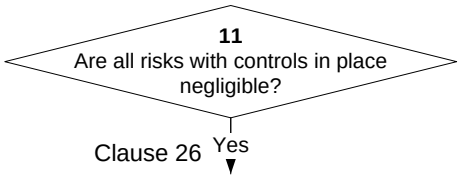
Once the risks and costs have been assessed individually, if appropriate consider all risks and costs together as a 'basket' of risks/costs. This may involve combining groups of risks and costs as indicated in clause 34(a) of the Methodology where this is feasible and appropriate, or using other techniques as indicated in clause 34(b). The purpose of this step is to consider the interactions between different effects and determine whether these may change the level of individual risks.

Item 11: Are all risks with controls in place negligible?

At this point the decision path branches. Looking at individual risks in the context of the 'basket' of risks, consider whether all of the residual risks are negligible. Consider also the cumulative effect of the assessed risks.

Where all risks are negligible, and the cumulative effect of the risks is considered to be negligible then take the **clause 26** option and move to item 12. If one or more of the risks is considered to be non-negligible, or the cumulative sum of the risks is non-negligible, then take the **clause 27** option and move to item 13.

Item 12:



(from item 11 - if 'yes') Is it evident that benefits outweigh costs?

Risks have already been determined to be negligible (item 11), therefore the decision must be made under clause 26 of the Methodology. In the unusual circumstance where there are non-negligible costs that are not associated with risks they have been assessed in item 9.

Costs are made up of two components: internal costs or those that accrue to the

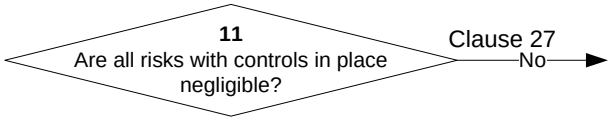
applicant, and external costs or those that accrue to the wider community.

Consider whether there are any non-negligible external costs that are not associated with risks.

If there are no external non-negligible costs then external benefits outweigh external costs. The fact that the application has been submitted is deemed to demonstrate existence of internal or private net benefit, and therefore total benefits outweigh total costs[11]. As indicated above, where risks are deemed to be negligible, and the only identifiable costs resulting from approving an application are shown to accrue to the applicant, then a cost-benefit analysis will not be required. The act of an application being lodged will be deemed by the Authority to indicate that the applicant believes the benefits to be greater than the costs.

However, if this is not the case and there are external non-negligible costs then all benefits need to be assessed (via item 14).

Item 13:



(from item 11 - if 'no') Establish position on risk averseness and appropriate level of caution

Although 'risk averseness' (approach to risk, clause 33) is considered as a part of the assessment of individual risks, it is good practice to consolidate the view on this if several risks are non-negligible. This consolidation also applies to the consideration of the approach to uncertainty (section 7).

Item 14: Assess benefits

Assess benefits or positive effects in terms of clause 13 of the Methodology.

Since benefits are not certain, they are assessed in the same way as risks. Thus the assessment involves estimating the magnitude of the effect if it should occur and the likelihood of it occurring. This assessment also includes consideration of the Authority's approach to uncertainty or how cautious the Authority will be in the face of uncertainty (section 7). Where there is uncertainty, it may be necessary to estimate scenarios for lower and upper bounds for the positive effect.

An understanding of the distributional implications of a proposal is an important part of any consideration of costs and benefits, and the distribution of benefits should be considered in the same way as for the distribution of risks and costs.

[11]Technical Guide 'Risks, Costs and Benefits' page 6 - Note that, where risks are negligible and the costs accrue only to the applicant, no explicit cost benefit analysis is required. In effect, the Authority takes the act of making an application as evidence that the benefits outweigh the costs. See also Protocol Series 1 'General requirements for the Identification and Assessment of Risks, Costs, and Benefits'.

The Authority will in particular look to identify those situations where the beneficiaries of an application are different from those who bear the costs[12]. This is important not only for reasons related to fairness but also in forming a view of just how robust any claim of an overall net benefit might be. It is much more difficult to sustain a claim of an overall net benefit if those who enjoy the benefits are different to those who will bear the costs. Thus where benefits accrue to one area or sector and risks and costs are borne by another area or sector then the Authority may choose to be more risk averse and to place a higher weight on the risks and costs.

As for risks and costs, the assessment is carried out with the default controls in place.

Item 15: Taking into account controls, do positive effects outweigh adverse effects?

In weighing up positive and adverse effects, consider clause 34 of the Methodology. Where possible combine groups of risks, costs and benefits or use other techniques such as dominant risks and ranking of risks. The weighing up process takes into account controls proposed in items 8 and 9.

Where this item is taken in sequence from items 13 and 14 (i.e. risks are not negligible) it constitutes a decision made under clause 27 of the Methodology.

Where this item is taken in sequence from items 12 and 14 (i.e. risks are negligible, and there are external non-negligible costs) it constitutes a decision made under clause 26 of the Methodology.

Item 16: Confirm scope of organism description
Confirm and set controls

At this step the scope of the organism description for generic applications should be reviewed. If changes are made to the organism description, items 7-15 above should be repeated for the revised organism description. Then the weighing up process in this item for the revised organism description should also be repeated.

The scope of the organism description has been identified in item 6. This step in the decision-making process confirms the scope of the organism description in such a way that the risk boundaries are defined. Controls have been considered at the earlier stages of the process (items 8, 9 and 15). The final step in the decision-making process brings together all the proposed controls, and reviews them for overlaps, gaps and inconsistencies.

Once these have been resolved the controls are confirmed.

[12] This principle derives from Protocol Series 1, and is restated in the Technical Guide 'Risks, Costs and Benefits'.