

## 8. Appendix 1: New Zealand Freshwater Fish Risk Assessment Model (FRAM)

### Part A - Establishment risk in New Zealand

		RESPONSE		
		NO	YES	UNSURE
<b>1</b>	<b>History of spread and climate match</b>			
1.1	Has the species a history of establishment outside its natural range?	0	1	1
1.2	Is it native to, or established in regions with similar climates to New Zealand?	0	1	1
1.3	Does it tolerate a wide climate range?	0	1	1
1.4	Is there a good climate match or overlap with waterways that are common in New Zealand?	0	Score 1 to 3 for a H/M/L match	3
<b>2</b>	<b>Reproduction possible in NZ</b>			
2.1	Can imported stocks produce viable gametes (e.g., sterile or triploid fish do not)?	Score -4 for overall assessment. Note that establishment risk is zero	1	1
2.2	Does the species have specific reproductive requirements to complete its life cycle (e.g., spawning habitat types or conditions) that are rare/absent in NZ?	1	if requirements rare score -1; if absent score -4	1
2.3	Is its reproductive habitat present within New Zealand?	0	1	1
2.4	Is its reproductive habitat widespread in New Zealand?	Score -3 if highly localised, -2 if rare, -1 if scarce	1	1
2.5	Does the species have a long (>10 years) life-span?	Score -1 if < 2 yr, otherwise 0	1	1
2.6	Does mating involve few (i.e., 1:1 mating) as against many fish?	0	1	1
<b>3</b>	<b>Vectors and propagule pressure</b>			
3.1	Is it likely to be readily introduced to natural waters. Probability will be higher for species used in some way (e.g., bait, aquaculture, biocontrol, angling, by-catch, ornamental)?	0	Score 1 to 3 depending on probability (H/M/L) of spread	0
3.2	Can large numbers of adult fish readily escape confinement or be easily transported to natural waterways because of either pelagic larvae or small size of adults?	0	1	1

## Part B – Impact risk in New Zealand

		RESPONSE		
		NO	YES	UNSURE
<b>4</b>	<b>Reported impacts in other countries</b>			
4.1	Are there reported impacts on other fish species?	0	score 1 to 3 depending on severity (L/M/H) of impacts	2
4.2	Are there reported impacts on aquatic fauna other than fish?	0	score 1 to 3 depending on severity (L/M/H) of impacts	2
4.3	Are there reported impacts on aquatic plants?	0	score 1 to 3 depending on severity (L/M/H) of impacts	2
4.4	Are there reported impacts on water quality or fish habitats?	0	score -1 if positive effect, or 1 to 3 depending on severity (L/M/H) of negative impacts	2
<b>5</b>	<b>Feeding &amp; Competition</b>			
5.1	Does the species eat aquatic plants (excluding planktonic algae and plant detritus)?	0	small part of diet = 1; voracious herbivore = 3	1
5.2	Does it eat or kill other fish?	0	small part of diet = 1; voracious piscivore = 3	1
5.3	Are adults planktivores (feeding on Daphnia)?	0	small part of diet = 1; major part = 3	2
5.4	Is it likely to compete with any native fish species for food or space?	0	score 1, 2, 3 for L/M/H overlap	2
5.5	Does its feeding or other behaviour reduce habitat quality for native species (e.g., change substrate, suppress macrophytes)?	0	score 1, 2, 3 for L/M/H overlap	2
5.6	Are its main natural predators present in New Zealand?	no major predators score =2; some major predators score =1	0	2

5.7	Does it have a reputation for aggressive, agonistic behaviour to other fish?	0	1	1
5.8	Is its feeding strategy widely adaptable (opportunistic omnivores are typically more adaptable)?	0	1	1
<b>6</b>	<b>Reproductive rate</b>			
6.1	Does it have a plastic reproductive strategy (e.g., low age-at-maturity, flexible spawning habitat, adaptable larval feeding strategy)?	0	1	1
6.2	Does it have the potential to hybridise with native species (or uses males of native species to activate eggs)?	0	1	0
6.3	Is the species able to change sex?	0	1	0
6.4	Is fecundity high (e.g., >10,000 eggs/kg, multiple spawnings per year)?	0	1	1
6.5	Does it mature at an age of 1+ or less?	0	If it matures at age 2 to 3 score 1, if older score 2	1
6.6	Does it produce live young (e.g., poeciliids) or exhibit parental care of eggs and/or young (e.g., mouth brooding, egg guarding)?	0	1	1
<b>7</b>	<b>Dispersal mechanisms</b>			
7.1	Are any life stages hardy and prone to unintentional release from boat bilge water, nets, trailers etc?	0	1 for low risk, 2 for high risk	1
7.2	Are life stages likely to be dispersed intentionally by people (e.g., potential game fish, biocontrol, baitfish)?	0	1 for low risk, 2 for high risk	-
7.3	Are eggs able to disperse widely (e.g., buoyant eggs or eggs attached to weeds, boats)?	0	1	1
7.4	Are larvae/juveniles able to disperse widely (e.g., pelagic larvae, juvenile migrations)?	0	1	1
7.5	Are juveniles or adults known to move large distances (e.g., spawning/feeding migrations, diadromous species, prone to displacement by floods)?	0	1	1
7.6	Are juveniles or adults able to climb or jump migration barriers (e.g., culverts and weirs)?	0	1	1
7.7	Are eggs likely to be dispersed by other animals (e.g., birds)?	0	1	1
7.8	Does the fish have a wide salinity tolerance (e.g., can it survive estuarine or marine conditions to reach other catchments)?	Score 0 for little tolerance. 1 for moderate tolerance, 2 for good tolerance	2	1

<b>8</b>	<b>Physical and chemical tolerances</b>			
8.1	Are any life stages able to survive extended periods (days) out of water?	0	survives in mud &/or wet ground score=1; survives in shaded &/or humid conditions score=2	0
8.2	Is the species tolerant of a wide range of water quality conditions (low oxygen, high temperature, low pH)?	0	1	1
8.3	Can the species occupy a wide range of habitat types (e.g., slow and fast water; deep and shallow water, weed/silt/rock substrates)?	0	1	0
8.4	Does it tolerate or benefit from environmental disturbance?	0	1	1
<b>9</b>	<b>Invasive relatives and special quarantine requirements</b>			
9.1	Does its taxonomic family or genus include any pest species, races, varieties, transgenics, or sub-species? (NB. if very difficult for quarantine staff to distinguish from target species then include all variants in evaluation)	0	1 (Flag the need for special quarantine conditions to allow taxonomic confirmation)	1
9.2	Does it have a reputation for hosting and/or transmission of parasites and pathogens that may affect other fish or humans?	0	1 (Flag the need for special quarantine conditions for disinfection)	1
<b>10</b>	<b>Undesirable traits</b>			
10.1	Is the species poisonous or does it pose other risks to human health (e.g., poison spines, toxic substances)?	0	1 (Flag the need for a more careful appraisal of potential harm to humans)	1
10.2	Is it likely to reduce people's use of waters (e.g., recreation, fishing, water abstraction)?	0	1 (Flag the need for a more careful appraisal of potential impacts)	1
10.3	Is it a host and/or vector for undesirable pests and pathogens affecting humans or other fish (and not already present)?	0	1 (Flag the need for special quarantine conditions for disinfection)	1