Exterminate Performance Assessment Rubric

This is designed to be used with the Exterminate Global Transform materials. It enables assessment of one science idea: independence, and 3 inquiry (RRI) skills: communicate ideas, interrogate sources and estimate risk.

Criterion 1: Topic: Interdependence Knowledge type: Idea, Mastery dimensions: Know, Apply

	General	Specific
Outstanding	All or nearly all features, or shows more insight, originality, critical thought than expected	
Good	The majority of these features are included to a good degree, though not all, resulting in effective performance to a good quality.	
	Know: Describe what the cause is	• Removal of mosquitoes from the food web by the use of GM mosquitoes. These are male mosquitoes which are released into the wild and breed with the normal, disease carrying, female mosquitoes. The offspring will die.
	Know: Describe what the change to the population is	• The populations of both male and female mosquitoes along with their offspring (mosquito larva) will decrease.
	Apply: Describe consequences, using the food chain/web	• Both male and female mosquitoes are **prey** for bats. If the **population** of mosquitoes decreased then bats would have less food. Bats are prey for eagles, so a reduction in the bat population would also affect the eagle population. • A decrease in the population of adult mosquitoes will affect the number of mosquito larvae. Mosquito larvae feed on algae. A decrease in mosquito larvae could lead to an increase in algae in the water. This could affect other aquatic life in a positive way - there will be more algae for other organisms to eat.

		• Frogs are also **predators** of adult mosquitoes as well as their larvae. A decrease in frog population will affect their predators the catfish and crocodile. • Male mosquitoes feed on plant nectar and help **pollinate** some species of plant such as orchids. A decrease in the male mosquito population will therefore lead to a decrease in the orchid population as these plants would not be able to **reproduce** as effectively.
Developing	Some but not the majority of the features are included, with many gaps, resulting in inconsistent use of the knowledge or skill performance to a good quality.	

Criterion 2: Communicate ideas Knowledge type: Process Mastery dimensions: Know

	General	Specific
Outstanding	All skills shown consistently, though not necessarily perfectly. And shows insight or critical thought.	
Good	The majority of skills though not all, shown to a good degree, resulting in effective performance.	
	Write in a style to fit purpose and audience.	
	Use clear language and well formed sentences.	
	Illustrate ideas with real-life examples	
	Clear connections between paragraphs/ideas	
	Use scientific vocabulary accurately	
	Logical order of paragraphs/points	
	No mistakes in spelling, punctuation or grammar.	
Developing	Some but not the majority of skills shown, resulting in inconsistent performance.	

Criterion 3: Interrogate sources

Knowledge type: Process Mastery dimensions: Know

	General	Specific
Outstanding	All skills shown consistently, though not necessarily perfectly. And shows insight or critical thought.	
Good	The majority of skills though not all, shown to a good degree, resulting in effective performance.	
	the research was published in a peer reviewed journal	• The article 'Field performance of engineered male mosquitoes' was published in 'Nature' Biotechnology
	the researcher or funder might benefit from reporting the finding	• Some scientists who wrote the article work for Oxitec, the company who make the GM mosquitoes • They want to present evidence that the technology works to sell it • The press release was also written by Oxitec
	the author might have a vested interest	• The press release and video were written by Oxitec, so could be biased to present the information in a positive light • The data in the press release may be manipulated to make the results look better than they are
	the experimenter collected enough data	• The scientists released mosquitoes for 4 weeks and tested 1316 • This was in a 10 hectare area. They did not test a very large area, and did not release enough GM mosquitoes to suppress the wild population. • They need to carry out another experiment to find out more information
	they gave a scientific explanation of the findings	• Yes, they collected mosquito larva containing the right gene. • The gene must have come from GM mosquitoes so the method works.
	the findings were backed up by other research	• The method of using sterile insects to control populations is backed up by other research (referenced in the journal article) • But there is no other research using the same method.
Developing	Some but not the majority of skills shown, resulting in inconsistent performance.	

Criterion 4: Estimate risk Knowledge type: Process Mastery dimensions: Know

	General	Specific
Outstanding	All skills shown consistently, though not necessarily perfectly. And shows insight or critical thought.	
Good	The majority of skills though not all, shown to a good degree, resulting in effective performance.	
	Identify main significant benefits and risks and uncertainties accurately	• The main benefit of exterminating mosquitoes is to stop the spread of diseases that are carried by mosquitoes including zika, dengue fever and malaria. These kill millions of people every year. • The only other method is to use pesticides, which have negative environmental impacts such as killing beneficial insects like pollinators. • This technology has never been used on a large scale so there are possible unknown risks including: • The release of female GM mosquitoes that can bite humans. Some people think they could inject the modified DNA into people and cause health problems. • The modified DNA (lethal gene) could pass into other organisms, causing them to die. • The removal of mosquitoes from an ecosystem could affect other organisms that are predators or prey of mosquitoes.
	Weigh up the benefits and risks and uncertainties	• The benefit of stopping diseases carried by mosquitoes is a very large one that could save many lives. • There is no scientific evidence that the modified DNA could pass from any GM organism into other organisms so this risk is very low. GM technology has been used for many years and this risk has not been seen.

		• However, the release of large numbers of GM organisms into the environment that cannot be recaptured is new, so there may be risks of this that have not been considered. Previous trials using GM mosquitoes have been on a relatively small scale. • Scientists cannot agree on the risk to mosquito prey and predator populations. This is an uncertainty.
	Explain why you made this decision.	
	Use an ethical perspective (utilitarianism, rights, care-based thinking) to evaluate the options	• You can use the ethical principle rights and duties to consider this dilemma. • We have a duty to prevent people getting life-threatening diseases such as dengue fever. Some would argue then, that we should use whatever method is best. • Others might argue that we also have a duty to maintain populations of all organisms on the Earth, including mosquitoes - what gives humans the right to cause a species to become extinct? • People also have a right to choose what happens in the place where they live. They can choose not to be exposed to GM mosquitoes if they wish and it should only go ahead if all people in the area agree that it si a good idea.
Developing	Some but not the majority of skills shown, resulting in inconsistent performance.	