RECOVER Virtual Lab
Transcript - High School/College Level

**Welcome**

Hi! Welcome to the virtual lab for the RECOVER project! I'm Derek and I'll be helping you through some of the same experiments that we use in the lab, to determine the toxic effects of oil spills on fish.

In 2010, one of the worst environmental disasters in history happened in the Gulf of Mexico when the Deepwater Horizon oilrig exploded. The broken pipe beneath the rig leaked for 87 days and more than 3 million barrels oil were released into the Gulf.

The oil slick covered many miles of water forcing the government to close fisheries over health concerns. The oil that washed up on the beaches further damaged the coastal communities and the tourism industry in the region for years to come.

Marine life is extremely susceptible to the toxic effects of crude oil. At the time, we compounds within the oil were harmful to wildlife - and even humans, but the extent and long term impacts were still very much unknown.

Healthy fisheries in the Gulf of Mexico are extremely important for the various ecosystems and economies that stretch far beyond the region. Oil spills are always a real possibility and we need to learn how to better manage and prepare for them in the future.

This is why it is important to understand how oil exposure affects fish. We are going to be running some experiments on two important species in the Gulf of Mexico, the mahi-mahi and the red drum.

**An Intro To Fish**

For this experiment, we will be focusing on two species of fish, the mahi-mahi and red drum.

These species of fish were chosen because they are both ecologically and economically important to the Gulf of Mexico.

Mahi mahi, or dolphin fish, are pelagic fish species, which means they live offshore and have ranges that can span entire oceans. Other kinds of pelagic fish are marlin, tuna and some species of sharks. The oil spill occurred in this pelagic environment so fish that inhabited this area would have been some of the first impacted by this event. Additionally, the oil spill coincided temporally and spatially with the spawning seasons

of many species of pelagic fish. We decided to study the mahi-mahi as a model species for all pelagic fish.

By contrast, red drum, or redfish, are coastal fish. These fish live closer to shore in environments like estuaries, which have a mix of salt and fresh water. The oil would have had to travel further to get to them. Estuaries and wetlands are also one of the most important marine environments as they provide nursery ground for many species. We chose the red drum as a model species for coastal fish.

Because each fish is adapted to live in these different environments, we want to see if there are differences in how pelagic and coastal fish species are impacted by oil exposure.

The fish we will be testing in this experiment are an average of 120 days post hatch.

For this experiment we will be using specialized swim chamber respirometers that can monitor the oxygen consumption and swim performance in fish. This will give us an idea of how oil exposure alters fish physiology. Swim chambers for fish are similar to treadmills for humans.

**First Fish Species**

You have selected the _____. Fish don't like to be handled, they get very stressed out when humans touch them. We need to gently place them in the swim tunnel and have them rest at least three hours before the experiment can begin. During this time, we monitor their metabolic rate to make sure they are acclimated to their surroundings and relaxed before the experiment.

For this experiment you will be comparing the health of three different _____. The first one is healthy and has not been exposed to oil. We call this the control fish as it shows us how a healthy fish behaves.

This second fish has been exposed to a relatively small amount of oil dissolved in the water and this third fish has been exposed to a greater amount of oil dissolved in the water.

During the experiment a computer will monitor how much oxygen is used by each fish swimming at a programmed water velocity. The water velocity will be progressively increased over time until the point that the fish is no longer able to swim at such a speed. The data collected from this type of experiment will provide us with information that can be used to determine the type of impacts oil exposure has on fish.

[3 hours later]

It looks like the fish has calmed down and we are ready to start. You may begin the experiment at any time now by clicking the button below.

**Second Fish Species**

Let's repeat the experiment with the _____ and see how it's different from the _____.

[drop fish]
[fade out 3 hours later]

It looks like the _____ are ready to go! Click the start button to begin the experiment.

**Results and Discussion**

Let's see how your fish performed.

You can see on the Speed chart the point at which the fish became exhausted and could not continue swimming.

Can you see a significant difference in how long or how fast a fish can swim after being exposed to oil? How about when you compare the two species?

Based on the data it looks like fish exposed to higher concentrations of oil are unable to swim at higher speeds, when compared to those fish that either were unexposed or were exposed to lower levels of oil. On the oxygen consumption chart you can also see that the fish exposed to the higher concentrations of oil are unable to attain as high a level of oxygen consumption as those fish which were either unexposed or exposed to lower levels of oil. Therefore, not only are there reductions in swim performance but there are also reductions in metabolic rate resulting from higher levels of oil exposure.

What could this mean for fish in the wild?

By obtaining oxygen consumption data at different swimming speeds, up to the maximum attainable speed, we are able to determine key indicators of metabolic performance in each fish. Specifically, from the collected data we can calculate the basal, or standard, metabolic rate, the maximum metabolic rate, and the difference between the two, which is referred to as the aerobic scope. Adult mahi-mahi have a rather large aerobic scope, compared to other fish like the red drum, which allows them to perform multiple metabolic processes simultaneously and in a very efficient manner.

Their metabolic and physiological performance can be likened to that of a high-performance sports car where energy intensive processes occur rapidly and efficiently.

Life is not easy for both of these fish and they require this high performance capability to survive, migrate, feed, and reproduce in the wild. Therefore, it is likely that any negative impacts to their swimming and metabolic performance would likely reduce their overall fitness.

Thank you for helping us, now let's test what you learned!