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| **Teacher:**  http://fc08.deviantart.net/fs71/i/2009/344/a/c/Biology_by_MaddRaVen.jpg  **“Pride Inside”** | Willy L. Herrera | | | |
| **Date:** | November 18, 2013 | | | |
| **Content:** | **Environmental Science** | | | |
| **Unit:** | Environmental Issues | | | |
| **Topics:** | DNA and Wildlife Forensic | | | |
| **Core Learning Goal(s)**  **or VSC Standard(s)** | | **MSDE Standards:**  ***Skills and Processes:***  **1.2.5** The students will select appropriate instruments and materials to conduct an investigation.  **1.3.1** The student will develop and demonstrate skills in using lab and field equipment to perform investigative techniques.  **1.5.6** The student will read a technical selection and interpret it appropriately.  **1.6.4** The student will manipulate quantities and/or numerical values in algebraic  **Common Core State Standards:**  **RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in specific scientific or technical context relevant to grades 9-10 texts and topics.  **WHST.9-10.2.b** Develop a topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information or examples appropriate to the audience’s knowledge of the topic.  ***Biology Content:***  **3.2.1** The student will demonstrate an understanding that all organisms are composed of cells which can function independently or as part of multicellular organisms.  3.5.1 The student will analyze the relationships between biotic diversity and abiotic factors in environments and the resulting influence on ecosystems  3.4.2 The student will estimate degree of relatedness among organisms or species. | | |
| **Objective:** | | At the end of the lesson students will be able to understand how the principle wildlife forensic can be used in solving environmental issue by modeling gel electrophoresis. | | |
| ***Assessment Focus:***  ***(Key Idea)*** | | **Main Ideas**  **DNA extraction** is the process of removing DNA from the nucleus of a cell. This is the first step researchers must perform in order to examine the genetic makeup of an organism. In this case, DNA is extracted from the cells that make up shark fin tissue. This extracted DNA will be used as the template DNA during the PCR testing for species identification. Note that students do not perform this step in the lab, but you may discuss how this process works so they know where the DNA came from.  **Gel electrophoresis is** a technique that allows separation of molecules based on net charge and size by the use of an electric field through a porous matrix (gel made from agarose). Students will be performing gel electrophoresis in this lab. DNA, a negatively charged molecule, migrates toward the positive pole when placed in an electric field. The rate of movement depends on the length of the DNA fragment; small pieces migrate faster than larger pieces. The positive electrode is colored red and electrophoresis of DNA is always “Running towards Red”. The sizes of the DNA fragments can be determined by comparing them to a DNA standard. The size of a DNA fragment is denoted by the number of base pairs or “bp”.DNA standards can be a DNA “ladder”which has standard DNA fragments of known size and when run on a gel appear as a ladder with many rungs. By comparing the resulting pattern of the DNAfragments on the gel (looking at both the number of bands and the corresponding sizes) the different DNA molecules may be differentiated. You can also run DNA without a ladder and compare to a control sample, as we are doing in this lab. In the WildlifeForensics Lab, the DNA standard is a sample of DNA  from a great white shark.  **The polymerase chain reaction** (commonly referred to as PCR) is a technique that was developed in 1983 by Kary Mullis, an American chemist/molecular biologist. This technique revolutionized the field of genetic research by giving scientists the ability to study specific regions of an organism's genetic code. PCR targets a very specific region of the genome using a short sequence of DNA (primers) and makes millions of copies (amplifies) of that region using an enzyme (polymerase) that facilitates the copying of DNA. PCR is like photocopying a single page of a book millions of times. Millions of copies of a piece of DNA are needed in order to visualize a specific region of DNA using a technique called gel electrophoresis. Therefore, without the use of PCR, there would not be enough DNA copies of the region of interest (i.e. a gene) for scientists to study or to test. PCR is a technique with wide ranging applications in all kinds of scientific research, medical testing, forensics, paternity/pedigree testing, etc. | | |
| **Accommodations and Modifications:** | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **STUDENT INITIAL** | **ACCOMODATIONS/MODIFICATIONS** | | | | | | **Presentation Accommodations** | **Response Accommodations** | **Timing and Scheduling Accommodations** | **Setting Accommodations** | **Supplementary Aids** | | 1. R.W(P2) | **(1-G)**Human Reader for verbatim reading of selected sections of the test. | **(2-J)** Calculation Devices | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students | **(1C) allow use of organizational aid**  **(2A) Altered/modified assignment**  **(1B) Allow use of manipulative** | | 1. A.W (P2) |  | **(2-J)** Calculation Devices (2-L) visual organizer |  | **(4-A)** Reduce distractions to the students | **91H) Monitor independent work** | | 1. J.B (P2) |  | **(2-J)** Calculation Devices | **(3-A)** Extended time  **(3-B)** Multiple or frequent breaks | **(4-A)** Reduce distractions to the students | (5C) Classroom instructional consult  (1D) Check for understanding  (4H) Preferential seating  (3F) Encourage student to ask for assistance when needed | | | |
| **Warm-Up**  **(10 minutes)** | | **Environmental Science:** Students will be asked to develop a paragraph describing what an invasive species is. Students are expected to include the following in their response.   * Definition of invasive species. * The different ways invasive species are transported to the United States. * At least one example of invasive species (its origin and the danger it poses to native species) * Management and control strategies. | Level(s) of Bloom’s taxonomy: | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **Engagement**  **(10 minutes)** | | * Students will be asked to read, annotate and summarize the text “Wildlife Forensic”. * Students will be given time to discuss the issue or problem discussed in the article. |  | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **Exploration**   1. **minutes)** | | * Students will be given the scenario, they will then be directed to state the problem that needs to be solved. * Students will perform the gel electrophoresis simulation activity. | Level(s) of Bloom’s taxonomy: | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **Explanation**  **(10minutes)** | | * Students will be asked to state and explain their conclusion. | Level(s) of Bloom’s taxonomy: | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **Extension**  **(10 minutes)** | | **EXTENDING THE CONCEPT ONE STEP FURTHER:**   * The teacher will lead a class discussion regarding student conclusion and the process they employed to determine whether their fin samples belonged to a great white shark. | Level(s) of Bloom’s taxonomy: | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **Evaluation**  **(10 minutes)** | | **CHECKING FOR UNDERSTANDING:**   * Students will be asked to write a report to the Custom’s officials who confiscated the shark fins. This report should explain the two molecular techniques used to generate these results and the results of the genetic analysis performed by the class: How many samples were from the great white sharks and how many samples were not from great white sharks. | Level(s) of Bloom’s taxonomy: | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **Homework** | | 1. Research about the characteristics, the habitat, the range, and the danger the white sharks are facing. Include a picture of this shark species. | Level(s) of Bloom’s taxonomy: | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **Summary**  **(10minutes)** | | **EXIT TICKET:**  Students will be asked to write a question that they still want to know about the lesson. | Level(s) of Bloom’s taxonomy: | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **References/Credits:** | | <http://www.towson.edu/cse/beop/mdll/Lab_Activities/wildlife_forensics_mdll_teacher_manual.pdf> | | |
| **Reflections:** | | * What went well and why? * What didn’t go well and why? | | |
| ***Areas for Improvement:*** | |  | | |
| ***NOTES:*** | |  | | |

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DIRECTIONS: Write a report to the Custom’s officials who confiscated the shark fins. This report should include:

* Explain the molecular techniques used to generated the results (PCR and gel electrophoresis)
* The result of genetic analysis
* Class data: How many samples were from great white sharks and how many samples were not from great white sharks?
* Proposal on what punishment should be imposed to the smugglers and other management and protection strategies.

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**What do YOU think? Are the bag of shark fins confiscated by US Custom agents belong to the white sharks?**. (Refer back to the text, the introduction AND your data to help strengthen your argument.) **COMPLETE** the graphic organizer below to draft your argument.

**WARRANT # 1**

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**WARRANT # 1**

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**CLAIM**

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**WARRANT # 2**

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**WARRANT # 3**

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| **Wildlife Forensic**  **Source:** <http://www.towson.edu/cse/beop/mdll/Lab_Activities/wildlife_forensics_mdll_teacher_manual.pdf> | |
| Trade in illegally obtained wildlife is a multi-million dollar business. Although there are laws in place that prohibit the killing and trade of endangered and protected species, the parts of the organism that are being bought or sold are often physically unidentifiable, complicating the efforts of wildlife conservation officers and other agencies responsible for conservation and management of protected species. Thus, the uses of molecular techniques that can unambiguously assign tissue to a particular organism are increasingly being employed to help identify and control the trade of protected plants and animals. | |
| The shark fin trade is a prime example of the challenges facing the agencies assigned to conserve and manage protected species. Shark fins are considered a delicacy in the Asian food market. Shark Fin Soup can sell for as much as $100 a bowl. The huge demand for shark fins and consumer's willingness to pay large sums of money for the fins are fueling the illegal trade and trafficking of sharks. While the trade of some species of shark fin is legal, that of others is forbidden or strictly monitored through permits. However, it is often impossible to visually identify the species from which a shark fin has been taken, especially after it has been dried or otherwise processed. | 1. What is the issue or problem being discussed about the shark fins? |
| Recently, the National Oceanic and Atmospheric Administration (NOAA) enlisted the help of a team of scientists led by Dr. Mahmood Shivji 1, the director of the Guy Harvey Research Institute in Florida, to aid them in  determining the origin of a suspicious shipment of 21 sets of shark fins seized from an East Coast seafood dealer. Although the outside of the confiscated bag read "porbeagle" (a species of shark that may be legally harvested) law enforcement officials suspected the fins belonged to the great white shark (Carcharodoncarcharias) since they found a hidden label on the package that said "blanco" (which is white in Spanish). The great white shark is a protected species and regulations prohibit unauthorized sale or trade. Dr. Shivji and his colleagues developed a molecular technique that allowed them to unambiguously identify any tissue originating from great white sharks. | 1. Who is Dr. Mahmood Shivji? Discuss the job assigned to him and his team. |
| One of the most exciting components of the technique developed by Dr. Shivji and colleagues is the ability to detect the presence of great white shark DNA from extremely small tissue samples, even in the presence of DNA from up to 10 other species of sharks. This technique provides enough certainty in their identification of great white shark tissue to hold up to the burden of proof required in a court of law. Results from the tests performed by Dr. Shivji and his colleagues confirmed that all confiscated tissue was indeed from great white sharks. The genetic results will be presented as evidence in court in the case against the seafood dealer. This example illustrates the importance of cooperation between scientists and law enforcement agencies in the conservation and management of protected species. | 1. What technique did the team of Dr. Shivji used in identifying the great white shark? |
| Wildlife forensics is an emerging field that combines cutting edge biotechnology with traditional law enforcement techniques to halt the trade of endangered and protected species. Further advances in the bioscience field will allow identification of a greater number of protected and endangered species, facilitating the detection and prevention of illegal wildlife trade.  Advancement of the wildlife forensics field is dependent upon scientific research within the bioscience community that will continue to develop new and efficient means of screening and identifying organisms that are illegally hunted, bought and sold. | 1. Define wildlife forensic. |
| **SUMMARY:** | |