



Ocean Exploration Video Challenge

NOAA Ocean Exploration Background

With the mission to explore the ocean for national benefit, NOAA Ocean Exploration is the only U.S. federal organization dedicated to exploring the deep ocean. NOAA Ocean Exploration works with partners to investigate previously unknown areas of our deep ocean, making discoveries of scientific, economic, and cultural value and supporting innovations in exploration tools and capabilities. Through live video streams, online expedition coverage, training opportunities, and other education and outreach programming, NOAA Ocean Exploration allows scientists, resource managers, students, members of the general public, and others to actively experience ocean exploration, allowing broader scientific participation, cultivating the next generation of ocean explorers, and engaging the public in exploration activities.

The data and information collected during expeditions and research supported by NOAA Ocean Exploration are publicly available, giving resource managers, the academic community, and the private sector the information they need to identify, understand, and manage ocean resources for this and future generations of Americans.

Data collections typically include oceanographic and geophysical parameters, video, images, and other information, provided in a range of data formats. During and after missions, the office also develops a range of products to disseminate information about expeditions to broad audiences.

Ocean Exploration Video Challenge

Experts of all ocean science disciplines participate in NOAA Ocean Exploration expeditions from locations across the world, annotating video from the remotely operated vehicle (ROV) in real time or after the dive is over. Many of the organisms seen during these expeditions are being seen alive and in their natural habitat for the first time, and they often may be completely new to science!

Problem: On average, one hour of acquired video takes four to six hours for a human to annotate and double check for accuracy. To reduce the time required for a human to annotate ROV dive video and conduct the associated quality assurance and quality control, NOAA Ocean

Exploration is partnering with the MATE ROV Competition to explore – just as it does with the deep ocean – harnessing the power of cloud computing, machine learning/artificial intelligence, and image recognition/processing.

The Challenge: Student teams are tasked with creating a program that identifies the individual video frames that contain observations of scientific interest that can then be provided to scientists for annotations. The goal is to identify the video segments where annotations are needed, allowing the scientists to skip the video sections that do not contain information that needs annotation, thus saving significant time and effort.

The Challenge is divided into 3 levels.

Level 1:

Find organisms in the NOAA ship *Okeanos Explorer* ROV video clips provided by NOAA Ocean Exploration.

Note organisms observed in the video and identify:

- 1) the time at which they first appear in the video
- 2) the time at which they are no longer in view

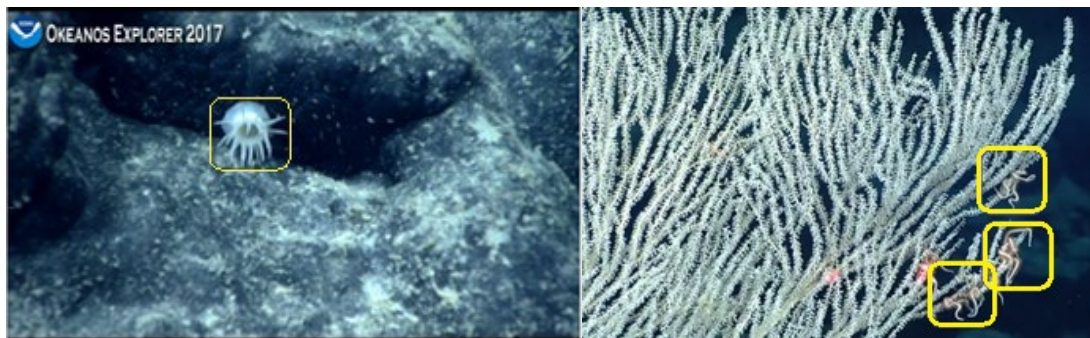
Deliverable: Provide a spreadsheet of the start and end time of the observation.

Level 2:

Localization

In the low-density videos (those with very few organisms), identify the pixels related to the observations and mark them within the frame using a ring or bounding box. In the high-density videos (those with many organisms), teams do not need to mark the coral colonies themselves, but should mark different organisms that may be living on or near the coral colonies.

Examples:



Deliverable: Links to all four processed videos showing a ring or bounding box around all organisms.

Level 3:

Identify the organisms in one of the following broad morphological categories:

- Annelids
- Arthropods
- Cnidarians
- Echinoderms
- Mollusca
- Porifera
- Other Invertebrates
- Vertebrates: Fishes
- Unidentified Biology

Deliverable: The organisms may be identified by adding a column for identification to the spreadsheet and/or by adding identification criteria to the computer screen. A percentage of reliability for the identification may also be included as a column within the spreadsheet or added to the screen.

Example images of each of these categories of organisms can be obtained from the [NOAA Ocean Exploration Benthic Animal Guide](#).

- Additional resources, including additional images of undersea animals, can be found here:
[Google Folder:](#)
https://drive.google.com/drive/folders/15F1ItSO6F6GpyjvTD6s6ZuezUOyM_hQH?usp=sharing

Ocean Exploration Challenge Video Clips

Student teams will use four videos taken from the 2017 NOAA Ocean Exploration expedition to the Musicians Seamounts (EX1708) north of the Hawaiian Islands. Two of these videos are considered “low-density;” very few organisms appear in them. Two of the videos are considered “high-density;” numerous organisms appear in them and the ROV’s video camera often zooms in for a close-up look.

Low-density videos:

- https://www.ncei.noaa.gov/data/oceans/oer/video/EX1708/Video/EX1708_DIVE15_20170921/Compressed/EX1708_VID_20170922T003500Z_ROVHD_Low.mp4
- https://www.ncei.noaa.gov/data/oceans/oer/video/EX1708/Video/EX1708_DIVE09_20170915/Compressed/EX1708_VID_20170916T001000Z_ROVHD_Low.mp4

High-density videos:

- https://www.ncei.noaa.gov/data/oceans/oer/video/EX1708/Video/EX1708_DIVE07_20170913/Compressed/EX1708_VID_20170914T012500Z_ROVHD_Low.mp4

- https://www.ncei.noaa.gov/data/oceans/oer/video/EX1708/Video/EX1708_DIVE19_20170925/Compressed/EX1708_VID_20170925T224500Z_ROVHD_Low.mp4

See the NOAA Ocean Exploration [Deep-Sea Symphony: Exploring Musician Seamounts Expedition](#) (EX1708) for more information and additional videos.

Registration Link:

Student teams intending to participate in the 2022 Ocean Exploration Computer Coding Challenge should [register here](#). There is no fee to register, and the challenge is open to everyone.

Submission Requirements:

Student teams undertaking the **Ocean Exploration Video Challenge** will have ~7 weeks to create their program and deliver that program, an explanation of the program including user documentation, the resulting spreadsheet, and a video showing Level 2 working in real time. The program, explanation, spreadsheet, and video must be submitted no later than 11:59 PM, Hawaii time, June 5, 2022. These will be reviewed and evaluated by NOAA Ocean Exploration scientists and MATE ROV Competition officials.

Expectations for submissions:

- The following naming convention should be used for submissions: School or organization name_company name_ document type 2022, where document type is either the program, explanation, or spreadsheet.
- The spreadsheet must be submitted as an XLS file.
- The program should be submitted in the file format it is written in. The program should be open source and preferably be Python based.
- The explanation of the program should include a user guide and explanation of the user interface.
- The videos should be uploaded to YouTube or Vimeo and links provided to those videos.
- The program, spreadsheet, and video link should be submitted to the [2022 Ocean Exploration Video Challenge](#) form.
- Resulting programs must be free, open source, preferably Python based, complete with a user interface, and use documentation (standard operating protocol or SOP), and a license/royalty free copy for use by NOAA.

Announcement of Winners – and an incredible opportunity!

Winning student teams will be announced during the 2022 MATE ROV Competition World Championship Awards Ceremony. In addition to awards and prizes, student team members will be eligible for the opportunity to continue their work under the guidance of NOAA Ocean Exploration staff! More details on that opportunity to come.