BUSINESS RESEARCH AND INNOVATION INITIATIVE

# Counting fish using advanced technologies

## Fact sheet

### *Challenge summary*

The Australian Institute of Marine Science (AIMS) is seeking an innovative and flexible fish survey (video) data processing solution. This would harness advanced technologies, such as the power of machine learning and artificial intelligence techniques to enable marine researchers to efficiently analyse video-based fish surveys conducted throughout the Australian region.

### *Potential themes*

Advanced technology, image recognition, machine learning, artificial intelligence, automated data analytics and marine life surveys.

### *Overview of challenge*

Baited Remote Underwater Video Stations (BRUVS) are a common tool used around the world for surveying and monitoring fish communities, from inshore to the edge of the continental shelf. The BRUVS method involves deploying small 'action camera' type video cameras, along with a bait-bag on the seabed, to record the fish community. Analysis of these videos is currently done manually; a marine scientist has to manually identify the fish species, count the fish and take measurements.

The resulting data provides a standardised sample of the fish community and helps AIMS to understand attributes, such as the proportion of carnivorous and herbivorous fishes and the proportion of juvenile-to-adult fish, which are important measures of fish community health. The current BRUVS data analysis method requires manual analysis of the video footage, which is time consuming and requires marine science expertise. While the collection of the data is scalable, the manual analysis method is not.

Out-of-the-box thinking to develop a solution to this challenge is recommended. The challenger may propose modifications to hardware and data collection methods to provide a data stream more conducive for machine-driven analysis. A solution that increases the effectiveness of the video analysis will have immediate and significant benefits to the marine community.

### *Solution requirements*

This challenge could provide an order of magnitude increase in the information that is available to scientists, government decision-makers and Traditional Owners to help them understand how fish communities are changing around Australia. Machine learning will play a part, but an innovative approach is needed to integrate this technology into a solution that meets Australia's needs.

Importantly, any solution that increases the efficiency of the video analysis work flow will have immediate and significant benefits to the marine community. For example, simply identifying parts of the video where fish are present allows an operator to skip past irrelevant parts of the video; this ability alone could reduce analysis time significantly. As such, even a partial solution of this challenge that would provide real and tangible benefits to the marine management community.

The solution should be able to determine:

1. Fish biodiversity. The solution should be able to reliably identify the fish taxa (for some types down to species) for a set of target species / taxa in the video.
2. Species relative abundance. The solution should determine the maximum number of each taxa seen in the video. That is, it should find the frame in the video with the maximum number of fish for each target taxa and record the number. The frame should be recorded to enable the user to verify the species abundance count.
3. Fish biomass. The solution should be able to measure fish length, which is used to estimate fish biomass. Presently, this is achieved manually using stereo photogrammetry. Other approaches that provide accurate absolute measurements via a calibration or other mechanism may be considered.

The solution should be easy to use by a non-technical user, and adaptive to improved imaging systems and techniques as they become apparent (such as increasing image resolution and image enhancement techniques).

Innovative solutions could include:

- redesigned hardware to capture better or more information
- a novel end-to-end workflow solution, or
- a partial solution that looks to increase the effectiveness of part of the processing workflow.

This challenge could also deliver frameworks for solving similar biological target identification challenges, such as the identification of marine invertebrates (pest species, commercially important species, etc.) from towed or remotely operated vehicle videos of the seabed. There is the potential to radically increase the capability and efficiency of many environmental monitoring activities worldwide.

AIMS, through its partners, is an active member of an international community that is looking to solve environmental monitoring challenges. As such, there is the potential for commercialisation at an international scale. An adaptable solution would present further sales opportunities in domestic and global markets.

## *Benefits of the solution*

A solution to this challenge will provide a way to scale data analysis, and hence the uptake and use of the method, which in turn will expand the potential to deliver critical information about fish communities nationally and beyond.

The solution will also provide social benefits, including empowering Indigenous and local communities to do their own monitoring backed by world-class analysis systems. The increased data from areas for which AIMS typically have scant information provides an environmental benefit by providing an avenue to better manage and monitor coastal fish communities.

By streamlining data analysis, there is also an opportunity to broaden the BRUVS user base into the citizen science market. By introducing levels of automation into the data analysis process, citizen scientists could produce data that complements existing scientist-collected datasets.

There is a clear market opportunity for a company to develop a flexible solution for the application of machine learning to image-based ecological surveys, with BRUVS being just one case. There is a need for a pathway for environmental management agencies to gain access to new operational-ready capabilities in a way that does not distract from their core business.

### How to apply

For information on how to apply, visit business.gov.au/BRII





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