From pretty pictures to hard data:

Top-down camera orientations enable direct assessment of pot performance

INSIDE OUT

It is very common nowadays for scientists to use underwater cameras to study pots. Cameras are getting cheaper and smaller, and pots act as stable platforms on which to mount these electronic devices. As scientists, we love to observe things, and so it is attractive to add a video component to most research projects. It helps with outreach and public engagement too – a quick YouTube search for "crab pots" reveals dozens of videos created by citizen scientists curious to see what goes on in the pots that they throw into the water.

The questions that we can answer from underwater videos depend greatly on how we orient the camera. Broadly speaking, there are two options: point the camera horizontally or mount it in a top-down orientation. In my experience, most scientists (and curious members of the public) record videos using a horizontal perspective, either looking inward at a section of a pot, or looking outward into the open water at animals swimming around the gear. These videos look great, but it is difficult to turn the observations into quantitative data.

If our interest is in studying the efficiency and selectivity of a pot design (and particularly, if we are interested in improving the gear's design), the top-down view is extremely useful. To understand why, let's break down the steps involved in the capture process. For an organism to be caught in a pot, it basically has to complete four steps. First, it has to approach the vicinity of the pot. Second, it has to find the pot's opening, and make an attempt to enter it. Third, it has to successfully complete the entry. Fourth, once it is in the pot, it cannot exit before the gear is hauled back.

The top-down orientation allows us to objectively count each of those four steps. An approach is defined as occurring when an animal enters the visible area of the pot. An entry attempt occurs when the animal enters the trap opening, and it is recorded as successful if it makes it all the way into the pot. If the animal leaves the pot somehow, we record the exit. Taken together, these data can tell us a lot about how the pot is performing underwater, and enable us to identify bottlenecks in the capture process that are reducing the effectiveness of our gear. For example, if we get low catch rates with a pot, is it because our pot openings are too hard for the animal to get into (expressed as a low proportion of successful entries) or is it that the animals can't find the openings in the first place (expressed as a low number of entry attempts)? My collaborators, students, and I have used the top-down perspective to assess the performance of pots targeting six separate species, and in all six cases the results have been extremely informative (e.g., Figure 1).

Underwater cameras are extremely useful tools, but it is critical for researchers to begin each study by critically considering what questions they will try to answer using their videos, and to select a viewing angle that allows them to do so.

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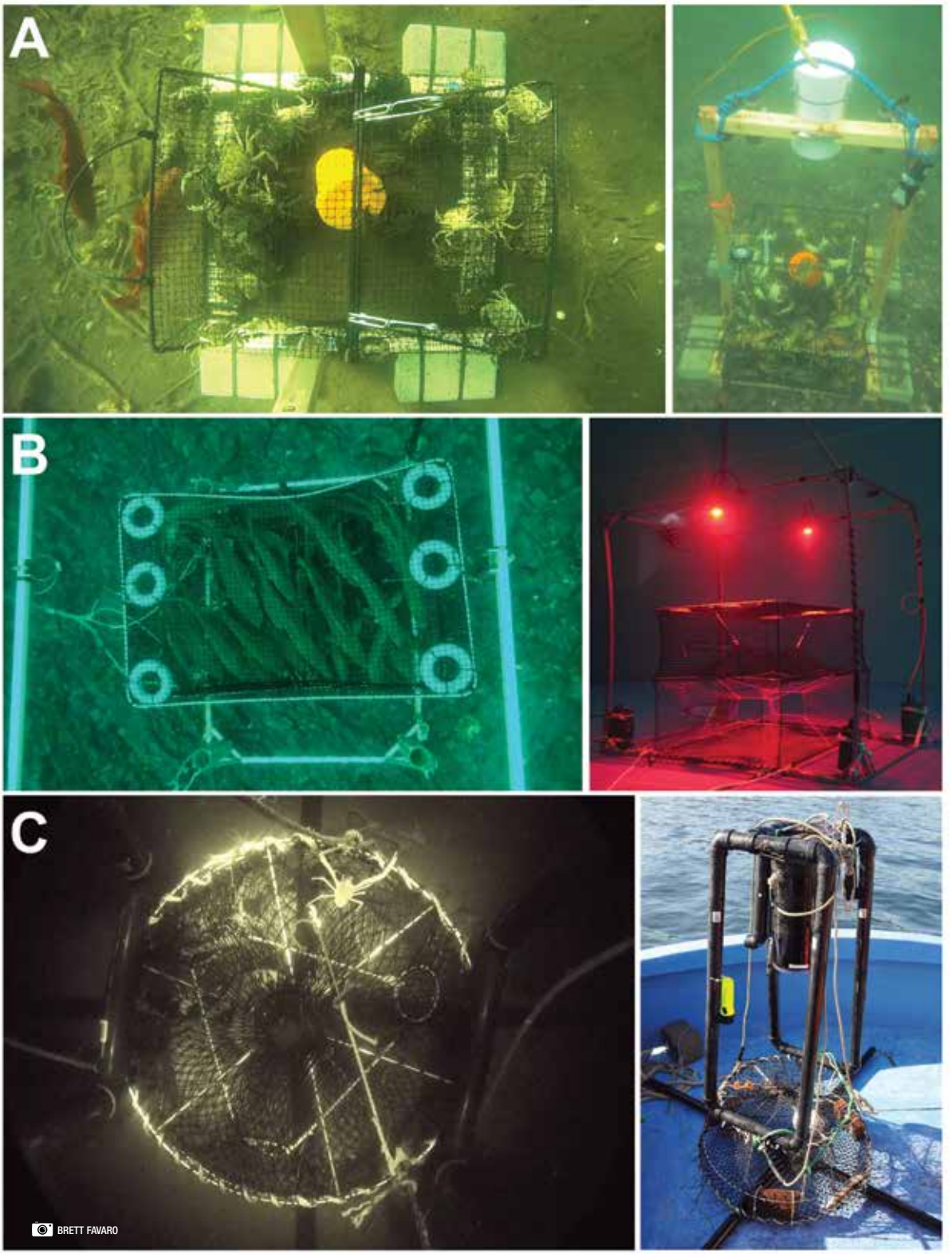

Figure 1: Camera apparatuses designed to record the performance of pots targeting A) European green crab (*Carcinus maenas*), B) Atlantic cod (*Gadus morhua*), and C) spot prawns (*Pandalus platyceros*). Left: screen grabs from video recorded by each camera apparatus. Right: pictures of the camera apparatuses used to record videos.