Big BRUVver Watches the Bedford Basin

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INTRODUCTION

Benthic ecosystems contribute to global ocean health through biogeochemical functions and provisions of ecosystem services.[3,6] Benthic ecosystems are increasingly threatened by anthropogenic pressures such as climate change[4,8], and therefore, effective marine monitoring strategies are needed to evaluate ecosystem health.

Traditional marine monitoring methods can be extractive, destructive, costly, and labour intensive, limiting scope and repeatability.[1, 2, 5] Baited Remote Underwater Video Systems (BRUVS) represent an innovative monitoring technology, with many advantages compared to traditional survey methods. The majority of BRUVS studies have been conducted in the photic zone within the southern hemisphere, with 61% of studies attributed to Australia alone.[7, 2]Significant knowledge gaps surround the use of BRUVS with integrated lights in poor visibility waters of the North Atlantic.[7]

STEREO-BRUVS CONFIGURATION

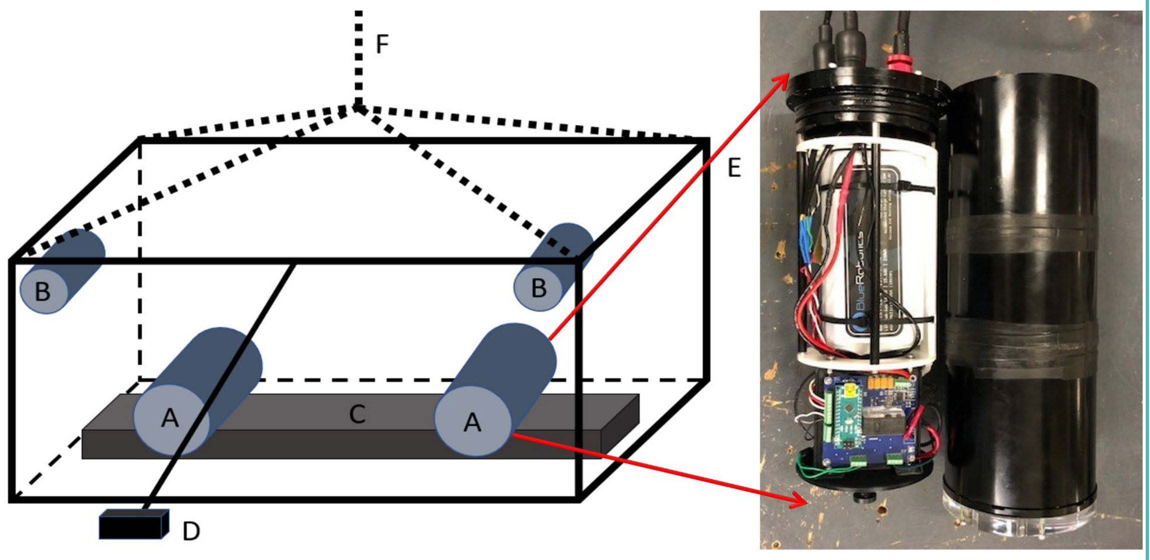

Figure 1. Stereo-BRUVS system configuration consisting two camera systems (A) mounted to a fiber glass frame (C) and two integrated lights (B) contained within a hollowed lobster trap frame (E). The bait arm (D) is attached to the front of the frame, angled slightly towards the seabed. Internally, camera housings contain a Hawkeye Firefly 160° 4K camera and camera board, computer board with integrated an Ardunio nano, and a battery (right).

RESEARCH QUESTIONS

1. Are there differences in species observation related to tidal cycles, and daylight cycles, observed using stereo-BRUVS?
2. Do stereo-BRUVS equipped with red light sample different species abundance, composition and behaviors compared to those equipped with white light?
3. Do differences in recording duration (e.g., 10, 20 30 seconds) impact stereo-BRUVS observations?
4. Do differences in recording interval (e.g., 5, 10, 15, 30 minutes) impact stereo-BRUVS observations?

METHODS

STEREO-BRUVS FIELD SURVEYS

Sampling was conducted within the Halifax Harbour, at the Center for Ocean Ventures & Entrepreneurship (COVE) between January 11th and February 4th, 2022 (Figure 2). Average water depth was ~10-13m at high tide.

Each stereo-BRUVS sat on the seabed for a total of 24 hours, set to a recording duration of 30 seconds and 5-minute recording interval. 1 can (106g) of Brunswick Sardines in oil was used as bait.

Figure 2. Map view of study location. (A) Map view of Nova Scotia. (B) Map view of the city of Halifax and Dartmouth. (c) Map view of Halifax Harbour with the sampling location circled in red.

VIDEO PROCESSING

BRUVS footage was reviewed for species observations and identification. Videos were trimmed to reflect different recording durations (e.g., 20-seconds achieved by cutting the last 10-seconds from total 30-second video). Videos excluded from observations to reflect different recording intervals (e.g., 10-minute intervals achieved by excluding every second video).

RESULTS

KEY FINDINGS

- Nocturnal white-light sampling observed the greatest mean number species
  - Nocturnal red-light sampling observed the 2nd greatest
- Nocturnal red-light sampling observed the greatest mean number of individuals
  - Diurnal white-light sampling observed the 2nd greatest
- Recording duration found to have negligible impacts on stereo-BRUVS observation
- Recording interval was found to have a significant impact on the mean number of species observed
- 100% (n=7) of red-light deployments observed >60% all observations within the 1st 6 hours
  - 37.5% (n=8) white-light deployments observed >60% within the 1st 6 hours

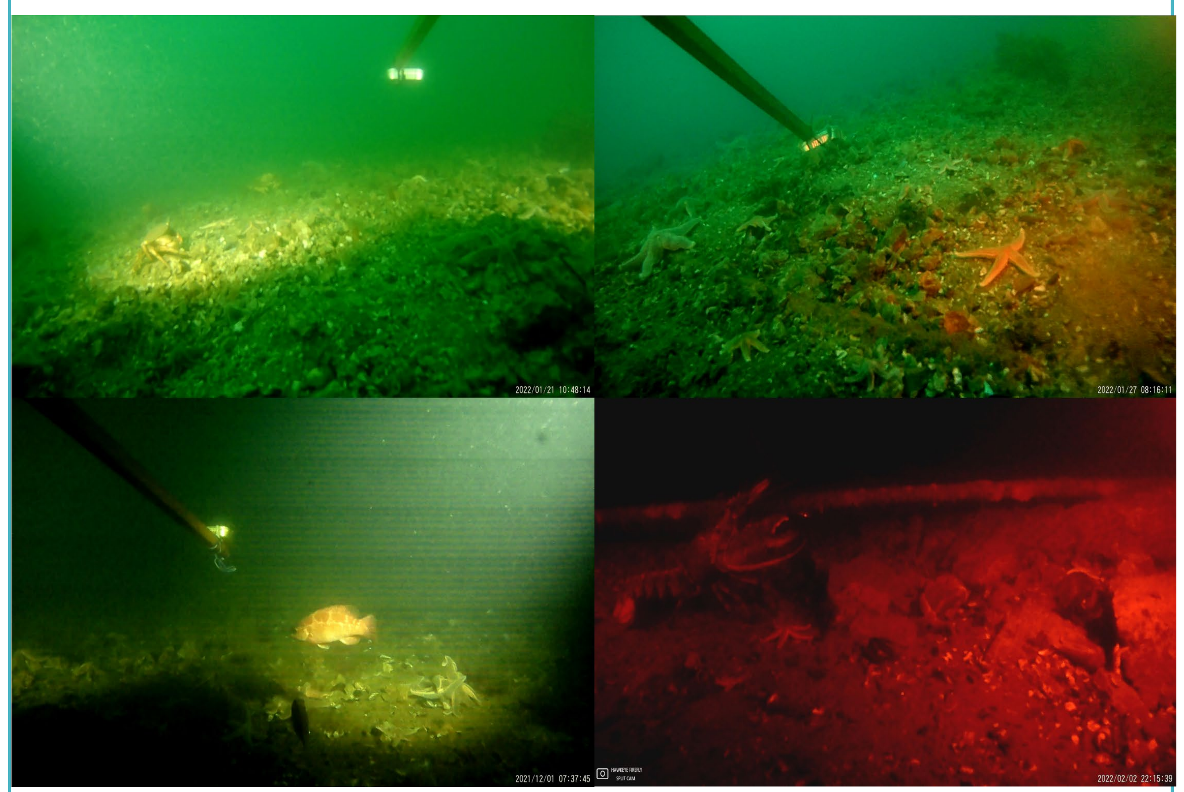

Figure 3. Stereo-BRUVS imagery collected during sampling. (Top left) Diurnal stereo-BRUVS sampling in low-light conditions using white light, with two rock crab. (Top right) Diurnal stereo-BRUVS sampling in low –light conditions using red light with starfish visible on the seabed. (Bottom left) Nocturnal stereo-BRUVS observations of Cunner fish using white light. (Bottom right) Nocturnal stereo-BRUVS sampling using red-light with an Atlantic lobster visible.

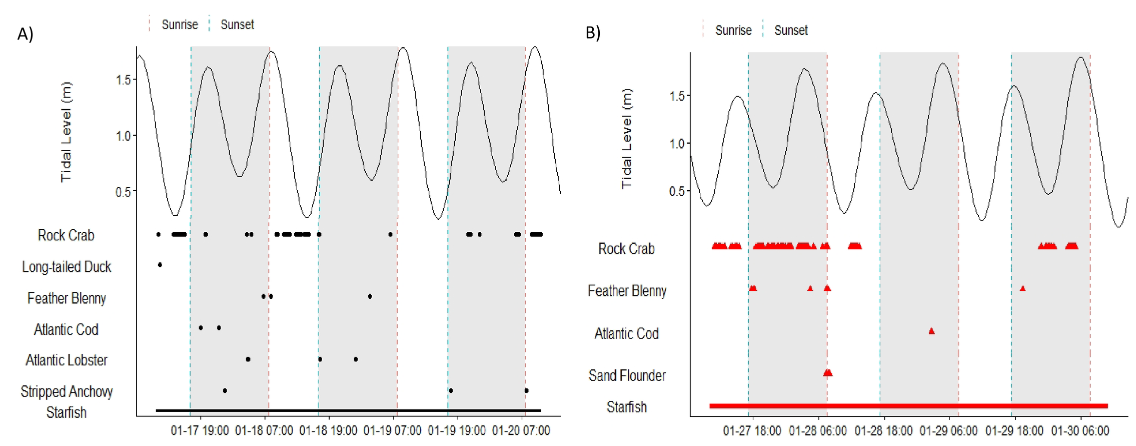

Figure 4. Example of stereo-BRUVS observations against tidal and daily light cycles. (A) Sampling using white light occurred from 01/17/2022 to 01/20/2022 and reflects two separate deployments. (B) Sampling using red light occurred from 01/27/2022 to 01/29/2022 and represents two sperate deployments.

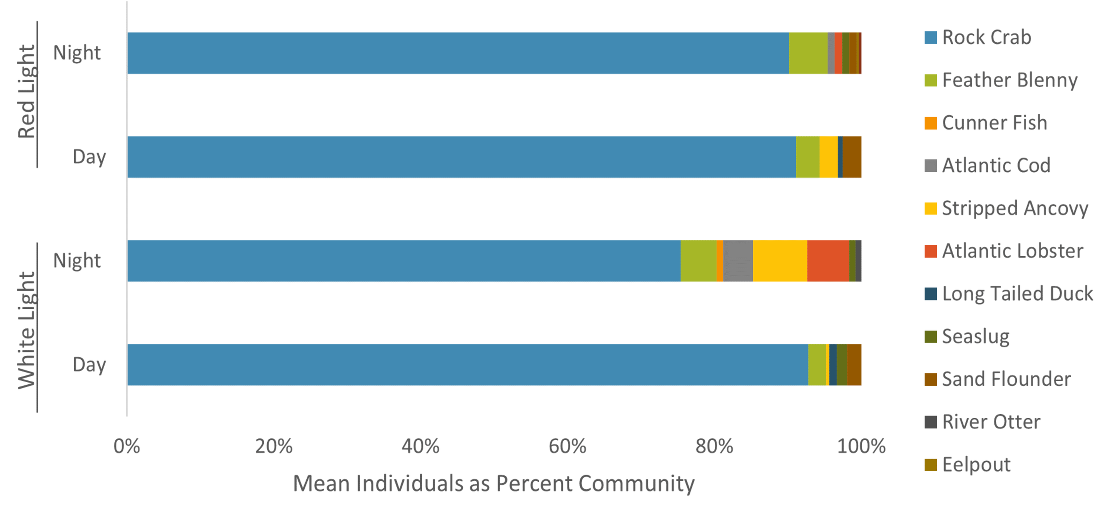

Figure 5. The mean number of individuals as percent contribution to the total observed community assemblage by stereo-BRUVS between light treatments and time of day.

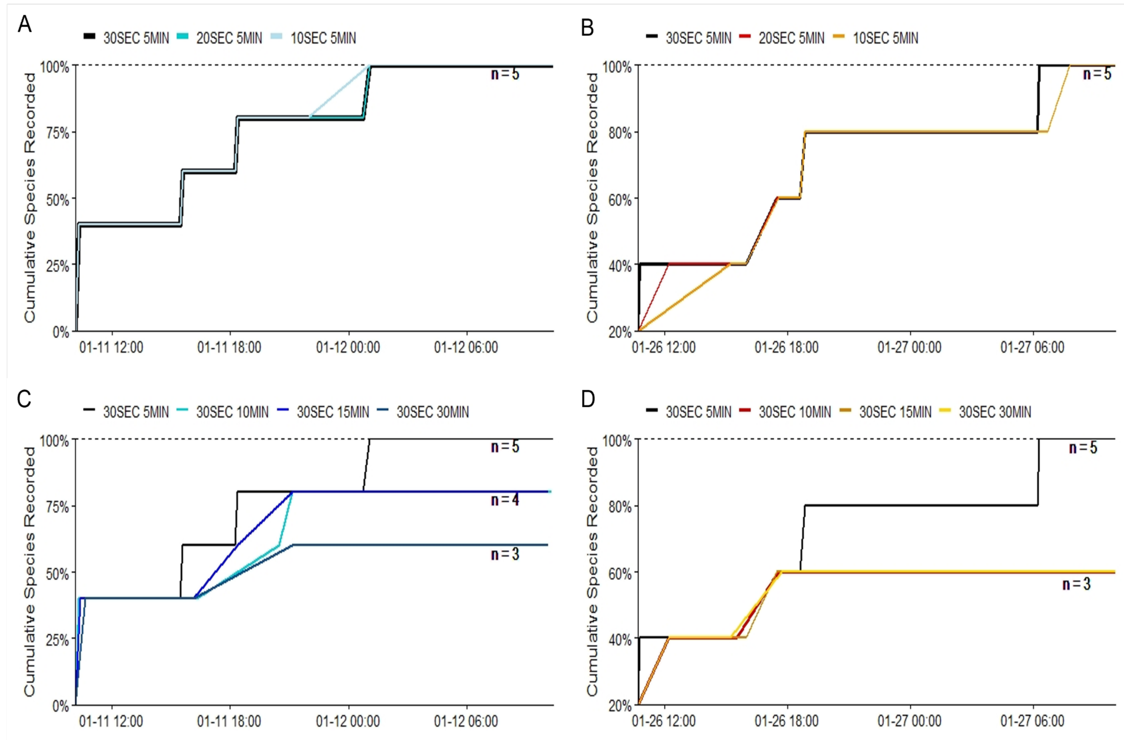

Figure 6. Example species accumulation curves between recording durations (A) and recording intervals (D) during white-light sampling on January 11th- 12th, 2022. (C) Cumulative species recorded between recording durations and (D) recording interval during red-light sampling on January 26th-27th , 2022. Similar species accumulation curves observed during alternate deployment days.

RESULTS

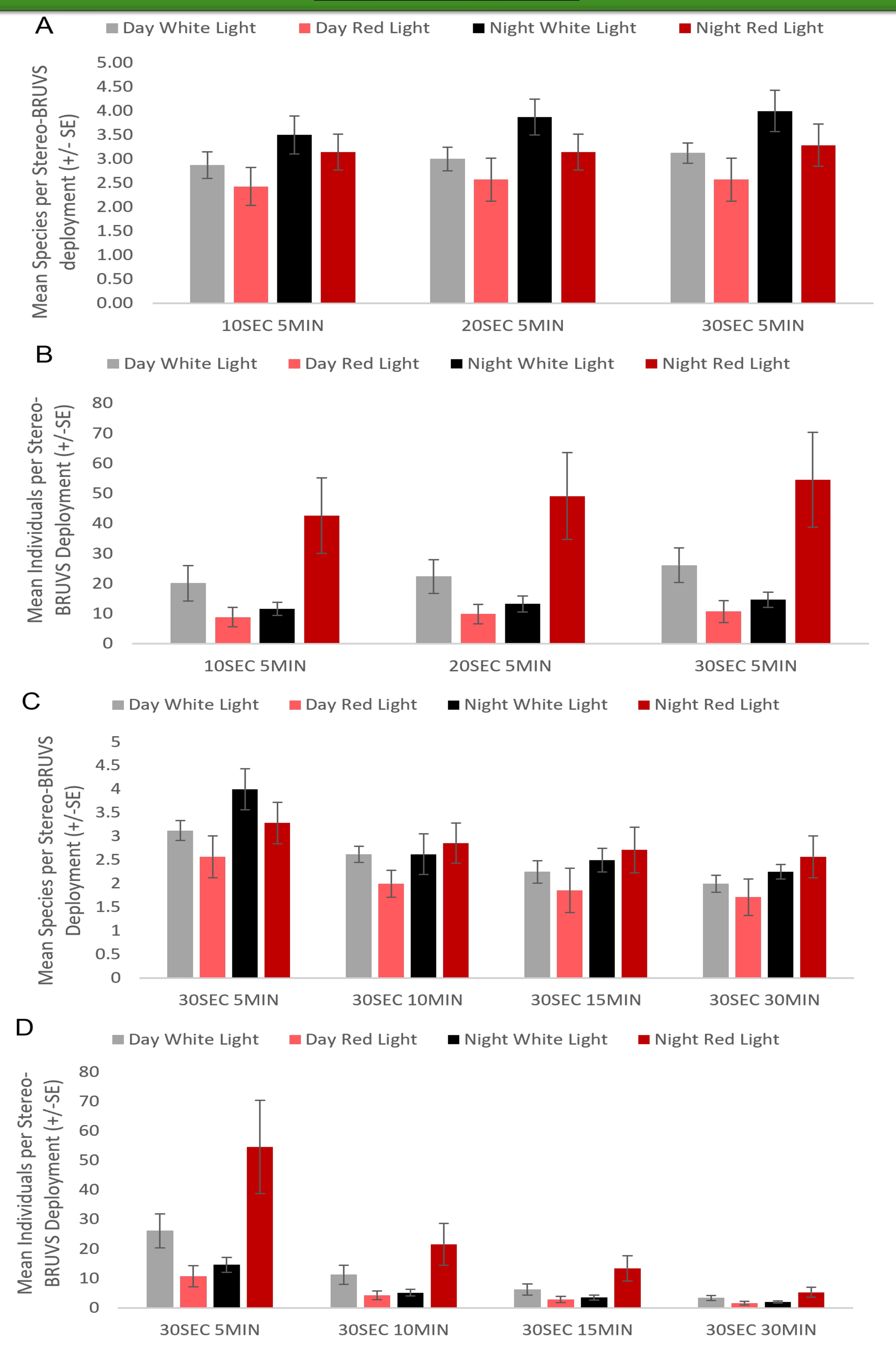

Figure 7. (A) Mean species per stereo-BRUVS deployment observed between light treatments and time of day for each tested recording duration. (B) Mean number of individuals observed per stereo-BRUVS deployments for each tested recording duration between light treatments and time of day. (C) Mean species observed per stereo-BRUVS deployment s between light treatment and time of day for each recording interval tested. (D) Mean number of individual observed per stereo-BRUVS deployment between light treatments and time of day for each recording interval.

CONCLUSIONS

Given the increase in individuals observed, red light may be more effective during nocturnal sampling, however, white light may be more effective during diurnal stereo-BRUVS sampling. Recording duration was found to have negligible impacts on stereo-BRUVS observations, suggesting 10-seconds may be sufficient for observations, thus conserving battery power and providing options for longer deployment durations. However, increased recording duration may aid in species identification and behaviour observations, but with the trade-off of increased processing time and video storage requirements. Increased recording interval generally observed decreased number of species and individuals, suggesting smaller intervals may be more effective.

SCAN ME

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