173 Monitoring remote aquatic protected area use with remote methods during a pandemic: Innovation as necessity

Ross Andrew[1], **Robert Burns[1]**, **Angela Hentz[1]**, **Danielle Schwarzmann[2]**, [1]West Virginia University, USA. [2]NOAA Office of National Marine Sanctuaries, USA

Monitoring outdoor recreation and use in remote aquatic areas presents challenges beyond traditional sampling and methodologies. A diversity of entry points and mechanisms, coupled with diffuse pathways to enter such areas makes assessment of use especially sensitive to bias and limitations of methods. Also, the unique attributes of protected areas make use assessment and monitoring an inherently customizable problem. To address these challenges, an iterative process that incorporates local expert knowledge to prioritize methods that balance accuracy and efficiency is preferred. One such process, called NMS-COUNT (Burns et al. 2020) has been developed to address use monitoring at National Marine Sanctuaries within the United States. This process seeks to apply a standardized assessment of potential methods through extensive literature review (Andrew et al. 2021) and expert panel feedback to arrive at a customized formula of methods suitable for context-specific protected areas. This method was applied to two pilot study sites using data from 2019-2020 in Gray's Reef National Marine Sanctuary and Florida Keys National Marine Sanctuary in the southeastern U.S. During the development phase of the process, mixed methods were prioritized, including the use of in-person surveys and counting. As the design phase progressed and was ready for implementation, the COVID-19 pandemic emerged as an even greater challenge to human use sampling and monitoring.

Restrictions imposed by the COVID-19 pandemic interrupted field work, travel, and other in-person methods proposed in the pilot studies. Due to these issues and influence of such lockdowns, innovative ways of collecting useful data without direct contact interactions were necessary. Survey methods were adjusted from intercept based targets to fully online versions. The use of such web surveys creates challenges for survey methodologists therefore, it is important to keep in mind the most desirable online surveying practices and the four traditional sources of survey errors – sampling, coverage, measurement and nonresponse (Dillman, & Bowker 2001). Some of the benefits that an online interview can provide to the interviewers during COVID-19 include 1) being comfortable, non-intrusive and safe; 2) engaging and convenient; 3) online communication ease and easy set-up. On the other hand, some of the limitations include lack of non-verbal communication, poor set-up, and privacy and access issues (Dodds & Hess, 2020). These factors were considered as the remote survey methods were applied to pilot study sites using contacts obtained through recreational providers and state agencies. Thousands of contacts were obtained, and subsets were created to distribute multiple surveys.

Over 3,200 survey responses were collected over a period of contact and data collection in spring and summer 2020. Contacts were addressed following Dillman & Bowker (2001) recommendations of personalization and follow-up procedures to maximize engagement and response rate. Mean effective response rate across survey instruments and locations was 69.1%, and survey responses covered a range of topics related to visitation frequency, group size, duration of use, seasonality of use, motivations, demographics, and basic economics of use. Survey results were used within an analysis framework that was mutli-faceted. First, survey results were used in self-contained analyses that provide estimates of visitor use patterns and group dynamics. Second, survey data were used to supplement other remote methods that help inform visitor use in a more simplified count-based process. This integration provided results that transcend what is possible with survey methods or remote sensing data alone.

The integration of survey data with remote methods such as satellite imagery, automated vessel identification, and crowd sourced data from social media allowed estimation of visitor counts using activity type, groups sizes stratified by activity and vessel type/size, and economic value of activities at

given locations and time periods. For example, automated vessel identification information for location and time period was used along with vessel size to determine the approximate amount of people per vessel using survey derived estimates that respondents listed based upon vessel size and activity for typical group size. Furthermore, based upon group size and mean expenditures for a single trip in a given activity collected in the survey data, estimates of economic value of activities in a particular time and location are demonstrated. Survey questions asking visitors about the frequency of social media usage were coupled with posting magnitude for locations of interest to create stronger estimates than crowd sourced social data would alone. Finally, methods such as satellite imagery and automated vessel identification were compared against each other to assess gaps between them in specific time and space intervals.

Using a portfolio approach to remote methods, driven by necessity in the pandemic, allowed deeper understanding of methods that may be integrated to produce stronger results than one or two could alone. With respect to monitoring visitation in an increasingly technology-drive world, this approach offers impressive efficiency once methods are established and validated. Sourcing data is a major driver of such analytical approaches, and may replace costs typically associated with more intensive field operations for data collection. However, in the research environment shaped by the limits of the pandemic, these findings illustrate what is possible with limited contact, field time, and sampling budgets for monitoring visitation in the modern world.

References
Andrew RG et al. 2021. **https://doi.org/10.3390/w13030305.** Burns RC et al. 2020. **https://doi.org/10.1080/14724049.2020.1746794.** Dillman DA & Bowker DK 2001. The web questionnaire challenge to survey methodologists. Online social sciences. Dodds S & Hess AC 2020. **https://doi.org/10.1108/JOSM-05-2020-0153**