

## Ethics Review Board Statement

### Ethical challenges and societal risks

**Society:** This project will use AI and data fusion of satellite imagery with vessel monitoring systems to identify patterns associated with illegal, unreported and unregulated (IUU) fishing that robs communities and nations of critical nutrition and income and violates worker rights and safety. The project will provide new insights into fishing activities at port and at sea by compensating for weaknesses in different data types, while identifying places in need of further data development, towards making the case for greater port stewardship to reduce IUU fishing and its impact at local and global scales. To build a robust case study, we will focus on Peruvian fisheries because of their global importance and data availability, including tracking of the small-scale fleets.

**Subgroups within society:** Our results should help to inform more effective management for small-scale fisheries. Small-scale fisheries provide critical nutrition and livelihood to millions of people, particularly in developing nations, but considerations and needs of small-scale fisheries have often been overlooked and marginalized. Our analyses will need to consider the potential impacts of our results, both its positive effects and potential unintended consequences, and stakeholder voices and needs in the policy and management processes. Understanding small-scale fisheries is one of the main focuses of our analysis, but we recognize that it is also one of the most challenging aspects of this research. AI algorithms may perform worse in detecting smaller vessels with coarser resolution imagery and certain vessels specific to given regions if the training data do not encompass those images. Furthermore, satellite image analysis may not give a comprehensive overview of fishing activities. For example, squid jigging is commonly conducted at night, which would not be captured by daytime imagery.

**Global:** We envision that our analysis will be applicable to numerous coastal locations. However, if the training data are biased toward certain types of vessels, performance of vessel detection in other regions could be hampered by regional differences in vessel/gear type and size. If the findings are indiscriminately interpreted and communicated without considering regional differences in fisheries practices, it could lead to ineffective management and policy recommendations, potentially harming already marginalized coastal communities.

### Mitigation plans

**General principles:** Our project is specifically designed to minimize data biases in the context of fisheries management through satellite imagery analysis and data fusion. However, the analyses are susceptible to data availability. To mitigate potential societal negative impacts, we will be mindful of (1) the selection of training data in the analysis, (2) the limitations of the data in the interpretation, and (3) societal impacts in the communication of results.

#### **Design decisions:**

1. We will create our own training data that encompass images of fishing vessels that are unique to the region of interest. The results will be verified using commercially available satellite imagery at 50-cm resolution. Similarly, when applying the vessel detection algorithm to other regions, we will re-train it with additional training data specific to the regions.
2. One region in Peru started monitoring 400 small-scale vessels through the GPS-based vessel monitoring system (VMS). These data can be used to validate the inference from satellite image analysis and investigate limitations. In addition, we will use visible infrared imaging radiometer suite (VIIRS) and synthetic aperture radar (SAR) imagery if necessary. By acknowledging that practices in small-scale fisheries are different among regions, we will seek insight from regional experts to interpret the results.
3. Policy recommendations in fisheries management require deep understandings of the complex landscape and clear recognition of the societal and ecological consequences. Communication of the results will be carefully discussed within our interdisciplinary team that encompasses pertinent expertise, including marine ecology and social-ecological systems (Fiorenza Micheli), law and governance (Jim Leape), and socio-ecological dimensions of fisheries (Elizabeth Selig, Colette Wabnitz). Further, we will engage other leading organizations in the field, including longtime COS partners, the Seafood Business for Ocean Stewardship (SeaBOS) and the PEW Charitable Trusts, which provide linkages to both businesses and governments, respectively.