AN UNMANNED SURFACE VEHICLE FOR LARGE SCALE ACOUSTIC MONITORING

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Abstract: Unmanned systems are finding new applications in ocean data collection or marine fauna monitoring. Their utilization is not always possible, but when this approach is viable, it offers important benefits in terms of campaign duration, costs, repeatability and safety (Verfuss et al, 2019). This contribution presents a novel autonomous surface vehicle and its utilization as a relocatable acoustic receiver for detecting angelsharks and spiny butterfly ray exemplars tagged with acoustic emitters.

It is well known that elasmobranchs' populations are facing a rapid decline at a worldwide scope. Among them, the angelshark (*Squatina squatina*) is considered as critically endangered and has been included in the IUCN Red List of Threatened Species, while the spiny butterfly rays (*Gymnura altavela*) qualifies as endangered (Morey et al, 2019).

Figure 1. The prototype during a sea trial in waters off Gran Canaria

CANBIO and ACUSQUAT II projects address the study of populations of these two species using acoustic tags. The usage of acoustic tags requires not only of an important tagging effort, but also the deployment of a network of moored receivers. The classic methodology is to install a set of moored receivers that remain at fixed positions. Whilst this approach is a well-developed and proved methodology, it is not always feasible as the number of detectors required to provide an adequate level of coverage of the area under study may depend on the range of movement of the species or the existence of geographical constraints that might be exploited (i.e. existence of passages).

This has been the situation faced during the development of ACUSQUAT II and CANBIO projects, aimed at characterizing the filopatria and residence patterns of angelsharks and spiny butterfly rays in two different areas of Canary Islands, (southwest of Gran Canaria and La Graciosa). In the scope of these projects, a network of moored receivers has been complemented with data collected by an autonomous surface vehicle, used as a rellocatable receiver.

This approach has been already tested using an autonomous sailboat (Cabrera-Gámez et al, 2020) with good results, but the utilization of a sailboat is not always possible in periods of low winds and/or strong currents in areas close to shore. To overcome these constraints, a new autonomous surface vehicle, propelled by two brushless thrusters in a differential steering configuration, has been developed from a refurbished windsurf board. Its power system integrates two photovoltaic panels (2 x 130 watts) and a rechargeable LiFePO4 battery (18 VDC, 120Ah). Using a VEMCO VR2C Mini cabled receiver, it is possible to report detections in real-time through the different radio communication links available, either via ISM radio (868 MHz), GSM/3G, or via IRIDIUM SBD.

This article provides a general description of the vehicle and its control architecture. It also presents results achieved during the field trials developed so far. In summary, this vehicle has proved to be a valuable instrument to monitor an extensive area for detections, something unaffordable with moored receivers, which can report georeferenced detections in real-time.

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