

Yukon Artificial Reef Monitoring Project *Data Collection Using Volunteer Research Divers*

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BACKGROUND

The San Diego Oceans Foundation sank the HMCS Yukon in 100 feet of water, 1.85 miles off Mission Beach, California as a haven for sea life, an attraction for scuba divers, a platform for environmental education, and a research site for marine scientists.

Commissioned in 1963 as a Canadian Mackenzie-class destroyer escort, the HMCS Yukon is approximately 366 feet in length, 80 feet tall from keel to tower, and 42 feet wide amid ships. The hull is composed of steel plate while the superstructure and upper decking is aluminum.

Prior to being scuttled, the Yukon was cleared of all debris and hazardous materials. After passing rigorous EPA inspections, access holes were cut throughout the ship and the Yukon was towed out to the site to be scuttled. Unfortunately, the ship took on water while being transferred to the sink site and just hours later, the HMCS Yukon sank prematurely on July 14, 2000. The vessel is resting on her port side pointing due north – ironically right where she was intended to be.

SIGNIFICANCE

Monitoring the Yukon is an essential part of its creation as an artificial reef. Without proper study and evaluation, we have no way to accurately assess the impacts of this new reef. Are new fish populations being created – increasing the number of these species overall, or is the reef only attracting and concentrating fish from other areas? Because artificial reefs may have a strong negative impact, data is needed to make valid judgments to lay controversy to rest.

OBJECTIVES

The main objective of this study is to determine the rate of colonization by fishes, invertebrates, and plants and to determine whether fish remain resident or if they travel between reefs. An advisory team of scientists was created to oversee the project and to provide ongoing consultation regarding data collection and analysis. Observations and samplings are being conducted in two phases: phase one will examine the Yukon and phase two will incorporate the other ships and natural reefs in the area.

By involving members of the local community in direct participation in this research, we enhance public knowledge and understanding of the marine environment, the effects of human activities on marine species, and the need for responsible and sustainable use of the resources we share. We hope to make significant contributions in artificial reef research in the following ways:

- To describe the movement of fish between artificial reefs and natural reefs
- To describe the colonization of the vessel by fishes, invertebrates, and plants
- To undertake the monitoring program with sufficient scientific support for publication of the results in peer reviewed journals

- To use reef research as a method of educating others about the importance and utilization of artificial reefs

CONSIDERATIONS

While developing the research project, there were many considerations to account for, which included: diver experience, diver safety, and the logistics of the dive site. The Yukon is a deep dive with harsh conditions (i.e. it's disorienting, extremely cold, and has heavy surge). Research methods had to be safe and simple to reduce diver task-loading but also needed to be scientifically credible to address our study objectives. Two methods were chosen based on the Yukon limitations: permanent transect surveys and permanent quadrant surveys.

METHODS

Fish surveys are comprised of visual transects 20 m long by 4 m wide and were adapted by methodologies described by AIMS (1997). Four permanent stainless steel cables are placed on the Yukon in the following areas: bow, bridge, starboard hull, and stern. The observer moves along the transect and counts pre-selected fish species and numbers. The species include: black surfperch (*Embiotica jacksoni*), white seaperch (*Hyperprosopon argenteum*), pile surfperch (*Damalichthys vacca*), rubberlip surfperch (*Rhacochilus toxotes*), blacksmith (*Chromis punctipinnis*), garibaldi (*Hypsypops rubicundus*), sheephead (*Pimelometopon pulchrum*), senoritas (*Oxyjulius californica*), rock wrasse (*Halichoeres semicinctus*), kelp bass (*Paralabrax clathratus*), barred sand bass (*Paralabrax nebulifer*), halfmoon (*Medialuna californiensis*), sculpins (*Scorpaena guttata*), rockfish (*Sebastes sp.*), cabezon (*Scorpaenichthys marmoratus*). The observer records the species on a slate then submits data via an online report form.

Besides the importance of reducing site-to-site variation, advantages of permanent transects include: reduced diver task loading (the volunteers do not carry reels or extra equipment) and the opportunity to evaluate variability resulting from differences of the same site for the same diver over time and the differences between diver variability. These sources of error are rarely evaluated. The disadvantages of installing permanent transect lines mostly involve logistical problems such as drilling through warship-steel (limited equipment and resources); transect lines become camouflaged with algae (difficult for new divers to locate); and the tendency for divers hold onto the line during conditions with heavy surge (damages surrounding marine life). The advantages of having permanent transects outweigh the disadvantages as the disadvantages have solutions: C&W Diving, an underwater engineering company was contracted to install the transect lines; algae is scrubbed off the transect lines every month by a local dive club; all transects are marked with small lobster buoys for better identification. The only disadvantage that cannot be solved is the damage divers inflict to surrounding marine life, and we have made huge strides towards the solution of this problem by careful training and selection of competent divers.

Sessile benthos surveys comprise quadrants made out of PVC pipe. Forty (2' x 2') quadrants are placed in groups of ten in four distinct areas of the Yukon to account for vertical / horizontal planes and seaward / leeward currents. The areas include the bow, bridge, starboard hull and the stern. Each quadrant has a number associated with it and can be identified using a combination of its location and individual number (e.g., Bow1, Bow3). These numbers are plainly visible on the top of the quadrant. These quadrants will be photographed over time to allow us to observe changes in the sessile benthos communities.

Initially the quadrants were attached to the ship using splash zone epoxy. This epoxy failed and as a result, all forty grids fell off the ship. Currently C&W Diving is reinstalling the quadrants and is using rods to weld the quadrants onto the ship.

DATA ANALYSIS

An essential aspect of the Artificial Reef Monitoring Project is the connection to the scientific community. All data is reviewed by the Project's Advisors, Dr. Paul Dayton and Dr. Ed Parnell of Scripps Institution of Oceanography. Drs. Dayton and Parnell also provide ongoing consultation and program review. Before data is submitted to Drs. Dayton and Parnell, it is reviewed by SDOF staff for quality control. The staff interviews each volunteer to verify that the data they submitted is accurate.

TRAINING VOLUNTEERS

All volunteers have the opportunity to take the PADI "Yukon Research Diver" Specialty Course where they gain hands-on diving experience. The Course involves a pool session, two open water dives, and reviews all research techniques. To date 154 divers have been trained, 15 have taken the Specialty Course. Roughly 10% have collected data.

CONCLUSIONS

The San Diego Oceans Foundation has successfully bridged the gap between the volunteer and scientific communities. The volunteers collect the data. The Foundation reviews and checks the data. Drs. Dayton and Parnell disseminate and prepare the data for peer reviewed journals. In this fashion, all data is analyzed, published, and accessible by the public.

One possible shortcoming is that we have not been able to apply a value to the data we are asking the volunteers to collect. The volunteers do not understand the worth of the trove of information they are gathering, therefore they seem unenthused about participating. The biggest challenge we are facing is maintaining volunteer interest.