AgriCos e-Newsletter
ISSN: 2582-7049
Open Access Multidisciplinary Monthly Online Magazine
Volume: 06 Issue: 04 April 2025 Article No: 11

Wave Glider: A Fisherman's Guide to Better Fishing

Semina Yasmin[4], Ravikumar T.[1], Mariappan S.[1], Durai V.[2], Emiema S.[3], Trashbh Baghel[4] and Tamilselvan R.

[1]Assistant Professor, Department of Fishing Technology and Fisheries Engineering, Fisheries College and Research Institute, Thoothukudi

[2]Assistant Professor, Department of Fishing Technology and Fisheries Engineering, Fisheries College and Research Institute, Thalainayeru, Nagapattinam

[3]Ph.D Scholar, Department of Fishing Technology and Fisheries Engineering, Fisheries College and Research Institute, Thoothukudi

[4]PG Scholar, Department of Fishing Technology and Fisheries Engineering, Fisheries College and Research Institute, Thoothukudi

SUMMARY

Wave gliders are advanced, unmanned marine platforms powered by wave and solar energy, transforming fisheries by providing real-time, cost-effective data on ocean conditions, fish stocks, and marine ecosystems. The technology was developed by Liquid Robotics Inc., a subsidiary of Boeing. This autonomous system consists of a surface float, submerged glider, and connecting tether, enabling fuel-free navigation and data collection. They improve fisheries management by enhancing observational quality and accessing remote areas, while reducing costs and increasing safety. Regardless of problems like bio-fouling and remote repairs, innovations like telemetry systems have made wave gliders a vibrant device for fisheries and support fishermen and scientists to work smarter and more efficiently by offering nonstop real time ocean monitoring, fish stock assessments, and augmenting marine conservation efforts.

INTRODUCTION

Innovation and new technologies are growing at the fastest rate in every field ever-before and Ocean is no exception. While the ocean is in ever-dynamic motion, it also serves as a massive reservoir of data and information. Ocean stakeholders like fishers, researchers, and scientists collect and assess these data to monitor the activities and health status of the marine world. Usually, fish stock assessments are conducted via huge-to-medium-size manned vessels equipped with a fuel-expensive engine and costly machinery that limit the number of survey days, precision, or quality of multiple sampling. To counteract such gaps, a startup company named Liquid Robotics Inc. developed an autonomous wave glider that aids in scientific, military, and commercial applications in around 2005. These Wave gliders revolutionize marine technology, helping fishermen thrive on the open seas. Basically, they are unmanned mobile platforms primarily invented as a new ocean-observing paradigm. Normally it contains, (i) Surface float (ii) Glider and (iii) Connecting tether.

Surface Float: A floating surface powered by current and solar energy. It contains two side lifts, a centre lift, a resilient tracker, a cover plate, a mast plate, and a Command-and-Control Unit (CCU) redone.

Glider: Submerged portion of the wave glider. It includes six pairs of wings and a rudder specially designed to convert current energy into forward thrust.

Connecting tether: A submerged glider attached to the surface floats via a flexible tether known as an Umbilical rope. It is approximately 4-8 meters (13-26 ft) long, a crucial aspect of the vehicle's design.

Fisheries researchers used wave gliders as ocean observers to do a real-time acoustic survey of various marine species like the humpback whales in the Humpback Whale National Sanctuary, Hawaii Island. Hydrophones were used to capture their acoustic signals. However, the technology was ineffective in static ocean and boisterous cloudy environments. Just after Liquid Robotics collaborated with VEMCO, it incorporated acoustic monitoring receivers and models, enhancing its ability to track marine species and their acoustic signature effectively.

Working principle:

The basic principle behind the construction of a wave glider is the continuous conversion of ocean current energy into forward thrust (independent of wave direction) via the wings of the submerged glider, and storing solar energy by solar panels on the surface float respectively. The energy at the ocean's surface is maximum and decreases with increased depth. Wave gliders use this energy difference for forward propulsion. As waves lift the surface platform, the submerged fins of the glider rotate clockwise passively, pushing the float forward. This process reverses when the wave descends. Thus, the propulsion mechanism makes it energy-efficient. At the same time, it also makes it difficult for the wave glider to navigate along a pre-planned trajectory. To tackle the problem, a robust path-following approach based on the LOS algorithm and restricted circles was deployed among various studied methods. However, the result was unsatisfactory under extreme conditions as its operational execution depends on the sea state. The state of the sea measured in foot waves (wave height) is directly proportional to the glider speed as mentioned below:

S. No	Sea State (foot waves)	Gliders Speed
1	0 (O m)	0.25-0.5 knots (0.47- 0.94km/h)
2	1 to 3 (0.3 – 0.9 m)	1.5 Knots(2.8km/h)
3	>3 (1 m)	>1.5 Knots(2.8km/h)

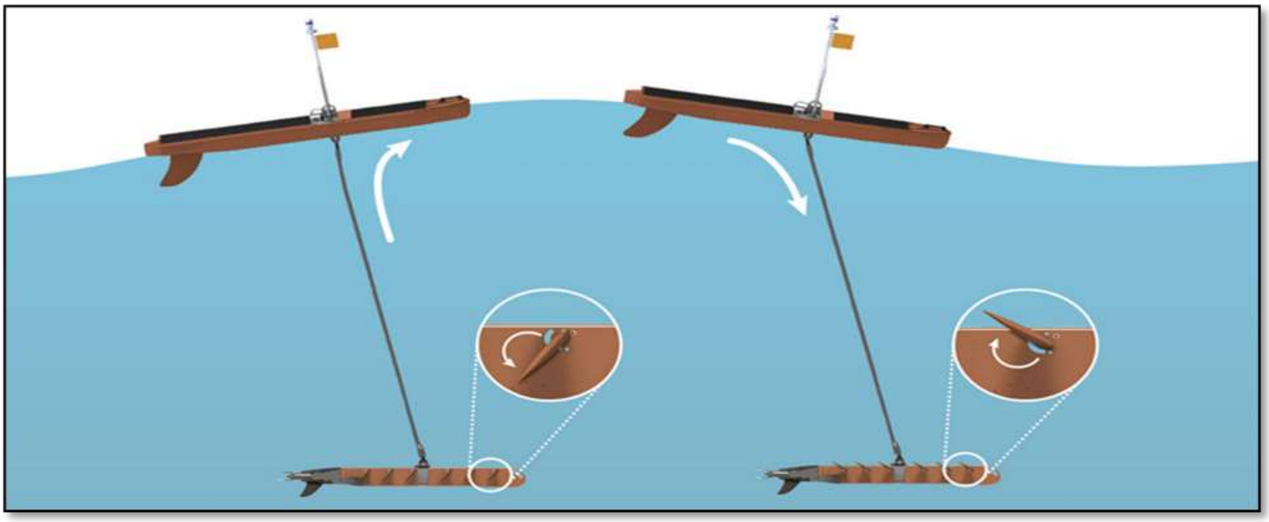

Figure 1. Wave Glider's Working Principle (Source: Liquid Robotics Official Website)

With the working principle established, the following features outline the wave glider's capabilities.

Features: (source: Liquid Robotics official website)

S. No	Features	Specifications
1	Water Speed	Up to 2.0 kt
2	Endurance	Up to 1 year (depends on operating conditions and location)
3	Minimum Water Depth	> 15 m
4	Station Keeping	30 m radius
5	Payload Mounting Options	On Mast, In-Float, Hull, Sub, Winch, Towing
6	Average Continuous Power	5W – 25W
7	Max Solar Collection	225W (nominal)
8	Battery Capacity	0.9kWh – 6.8kWh rechargeable
9	Communications	Satellite, Cell, Wi-Fi, Line of Sight Radio

Harnessing the above features, the wave glider has proved to be a promising tool in the fishery sector.

Application in Fisheries

- Used for prolonged fish stock monitoring.
- Used to monitor marine mammals.
- It reduces the data uncertainty and increase understanding of managers
- It can constantly communicate via satellite (Iridium), cell phones, radio links for piloting, and real-time data transmission.
- It can be used conveniently for tracking, tagging, and detecting marine species.
- It acts as a tool to detect rare, endangered species.
- Access inaccessible areas beyond traditional shipping routes.
- It can be used for fishing ground inspection at a much lower running cost.
- It can provide early weather warnings to improve the safety of the sea.

Challenges and its measures:

- Bio-fouling and entanglement are the main drawbacks however it can be counteracted by engineering a lower freeboard.
- In remote areas, the glider has experienced challenges in surface mooring.
- Repair and replacement activities become expensive due to the long voyage of support vessels in remote areas. Countermeasure, Liquid Robotics has incorporated a telemetry (tsunami boy) system into the wave glider.

CONCLUSION:

Wave gliders are more than just a piece of technology developed to empower fisheries work-force working even in the deeper ocean. Wave gliders collect the information even from the remotest places and deliver the output very accurately, efficiently and safely. This recent technology is an asset particularly to the fisheries sector as it monitors continuously and offers real-time data for helping in control the fishery resources for future generations.

REFERENCES

Carlon, R. (2015, October). Tracking tagged fish using a wave glider. In OCEANS 2015-MTS/IEEE Washington (pp. 1-5). IEEE.

Frolov, S., Bellingham, J., Anderson, W., & Hine, G. (2011, September). Wave Glider—A platform for persistent monitoring of algal blooms. In OCEANS'11 MTS/IEEE KONA (pp. 1-5). IEEE.

Greene, C. H., Meyer-Gutbrod, E. L., McGarry, L. P., Hufnagle Jr, L. C., Chu, D., McClatchie, S., ... & Pelkie, C. (2014). A wave glider approach to fisheries acoustics: transforming how we monitor the nation's commercial fisheries in the 21st century. *Oceanography*, *27*(4), 168-174.

Liao, Y., Wang, L., Li, Y., Li, Y., & Jiang, Q. (2016). The intelligent control system and experiments for an unmanned wave glider. PloS one, 11(12), e0168792.

Manley, J. E., & Hine, G. (2016, September). Unmanned Surface Vessels (USVs) as tow platforms: Wave Glider experience and results. In OCEANS 2016 MTS/IEEE Monterey (pp. 1-5). IEEE.

Manley, J. E., Carlon, R., & Hine, G. (2017, September). Ten years of wave glider operations: A persistent effort. In *OCEANS 2017-Anchorage* (pp. 1-5). IEEE.

Manley, J., & Willcox, S. (2010). The wave glider: A new concept for deploying ocean instrumentation. *IEEE instrumentation & measurement magazine*, *13*(6), 8-13.

Swart, S., Zietsman, J. J., Coetzee, J. C., Goslett, D. G., Hoek, A., Needham, D., & Monteiro, P. M. (2016). Ocean robotics in support of fisheries research and management. *African Journal of Marine Science*, *38*(4), 525-538.

Wang, P., Wang, D., Zhang, X., Guo, X., Li, X., & Tian, X. (2019). Path following control of the wave glider in waves and currents. *Ocean Engineering*, *193*, 106578.

Wang, Y., & Yang, S. (2022). Glider. In Encyclopedia of Ocean Engineering (pp. 643-655). Singapore: Springer Nature Singapore.