

Outreach Strategy to Reduce Damage to Ocean Data Buoys From Vandalism



**World
Meteorological
Organization**
Weather • Climate • Water



United Nations
Educational, Scientific and
Cultural Organization



Intergovernmental
Oceanographic
Commission



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Preface

On June 7, 2016, the Intergovernmental Oceanographic Commission (IOC) and the World Meteorological Organization (WMO) both requested development of a regionally relevant education and outreach strategy in order to substantially reduce damage to ocean buoys through vandalism or interference. The IOC and WMO, working through the Data Buoy Cooperation Panel (DBCP) and the IOC Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG), prepared a draft strategy for discussion at the May 2017 WMO Executive Council and June 2017 IOC Assembly. The strategy is intended to be jointly implemented by the IOC, WMO, Food and Agriculture Organization of the United Nations (FAO), regional fishery management organizations (RFMOs), Member states, the commercial fisheries sector and other relevant organizations in order to mitigate damage to ocean data buoys.

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1. Executive Summary

Ocean data buoys collect in-situ oceanographic and meteorological data that are critical to a wide user community of government, academic, military, public health, and emergency response stakeholders and the marine transportation, tourism, and fisheries industries. These observations are used in multiple applications including strengthening the quality and accuracy of severe and routine weather forecasting, improved coastal ocean circulation models, environmental and ecosystem monitoring and research, and tsunami warning capability. Monitoring ocean health can only be done through long-term multi-disciplinary observations, many of which are sourced from data buoys that are uniquely suited for this task. Failure to maintain a sustainable network of data buoys puts the health of our oceans and estuaries at risk.

Data buoy vandalism refers to the intentional interference with, damage to, or theft of observing platforms by human action. The purpose of this strategy is to create a framework that will guide the development of outreach and education resources to raise public awareness of the critical value of the services provided by ocean observation networks and warning systems, and of the related disaster risk-reduction benefits. It will help promote education and outreach, especially to recreational, artisanal, and commercial fishers. It will also broaden support of community stakeholders, and enable proactive engagement at regional and local scales through the development of new partnerships to share lessons learned and generate new ideas for addressing vandalism issues.

2. Introduction

Ocean data buoys (Fig. 1) collect in-situ oceanographic and meteorological data that are critical to a wide user community of government, academic, industry, and public stakeholders. Data buoys are located in every ocean, and international cooperation is implemented via the Data Buoy Cooperation Panel (DBCP) under the WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) (Fig. 2). Data buoy observations are used in multiple applications including strengthening the quality and accuracy of severe and routine weather forecasting, improved coastal ocean circulation models, environmental and ecosystem monitoring and research, tsunami warning capability, commercial and recreational marine transportation and fishing. Ocean observations and the improved knowledge they provide, together with socioeconomic data describing the human dimensions in the global environment, can help solve problems, address and mitigate risks, and deliver skillful forecasts of the future behavior of Earth systems. Sustaining the network that supports these observations is of critical importance to the user community and global society.

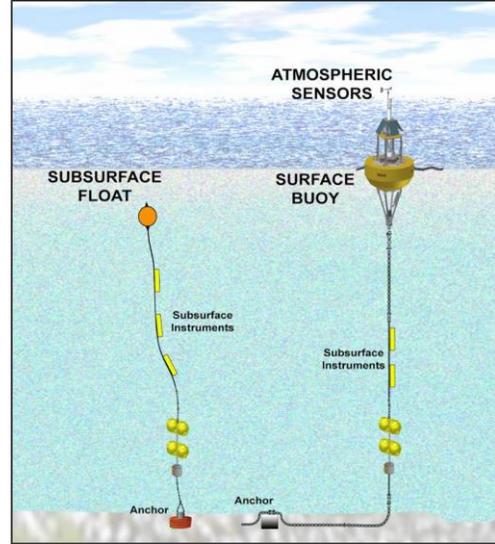


Figure 1. Diagram of an ocean data buoy.
Source: National Oceanic and Atmospheric Administration

The loss of lives and property from natural disasters such as the tsunami events in Sumatra (2004), Chile (2007), Samoa (2009), Haiti (2010), Tonga (2010), and Japan (2011) reinforced the need for robust and reliable ocean observing systems. In response to these types of disasters, the world's ocean observing systems have been expanding since 2004. Increasing the coverage of ocean observing systems provides for more robust information on ocean and atmospheric processes. This information provides many benefits including:

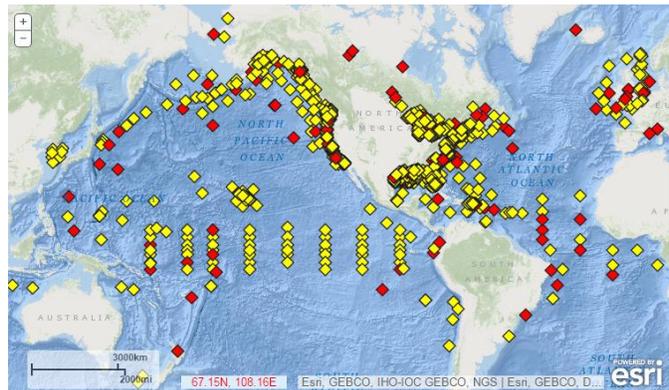


Figure 2. Map representing the extent of the international moored data buoy network
Source: National Oceanic and Atmospheric Administration National Data Buoy Center

- **Climate:** Understanding, assessing, predicting, mitigating, and adapting to climate variability and change.
- **Coastal and Marine Hazards and Disasters:** Reducing loss of life, property, and ecosystem damage from natural and human-induced disasters.

- **Ocean and Coastal Energy and Mineral Resources:** Improving the identification and management of energy and mineral resources.
- **Human Health:** Understanding environmental factors affecting human health and well-being.
- **Ocean and Coastal Resources and Ecosystems:** Understanding and protecting ocean and coastal populations and resources and supporting coastal economies, including fisheries, aquaculture, and other marine ecosystem services.
- **Marine Transportation:** Improving the safety and efficiency of all forms of marine transportation.
- **Water Resources:** Improving water resource management through better understanding and monitoring of the water cycle.
- **Coastal and Marine Weather:** Improving weather information, forecasting, and warnings.
- **Reference Measurements:** Improving reference measurements and the fundamental measurement systems and standards supporting them.

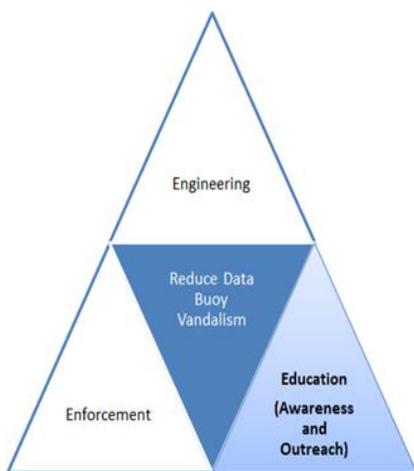


Figure 3. The three-pronged approach to addressing data buoy vandalism includes: engineering, education and outreach, and enforcement and compliance.

Unfortunately, these ocean observing systems are at risk due to intentional or unintentional impacts. It is estimated that over half of these systems have been damaged at least once since deployment (some multiple times), which increases the programs' operating costs and jeopardizes the valuable data the systems provide. In order to address data buoy vandalism, a 3-pronged approach has been used (Fig. 3). This approach includes: (1) regulatory policy and enforcement; (2) engineering and technical modifications to buoy systems to enhance situational awareness and impede third party interference; and (3) the development and distribution of outreach and education materials on the value of ocean data buoys and the impacts of vandalism. For a detailed overview of data buoy vandalism

impacts and responses, see [Ocean Data Buoy Vandalism- Incidence, Impact and Responses](#) (DBCP Technical Document No. 41).

2.1. Data Buoy Vandalism Defined

Data buoy vandalism refers to the intentional interference with, damage to, or theft of observing platforms by human action. Data buoy vandalism has many forms, including:

- Fouling of mooring lines or damage to underwater cables or sensors from fishing lines or nets;
- Using the buoy as a temporary anchor which can overstress mooring lines and damage the buoy superstructure;

- Deliberately dragging the buoy from its moored location;
- Cutting mooring lines or cables; and/or
- Removing physical infrastructure, cables, or sensors, or other hardware.

Fishing activities are the primary cause of damage to data buoys because the buoys act as fish aggregating devices (FADs) which fishing vessels exploit in pursuit of fish. This increases the incidence of direct contact between the buoys and fishing vessels. There are also rare incidences of damage from unintentional impacts such as inadvertent collision with a buoy.

There is direct and indirect proof of vandalism. Physical examination of recovered buoys provides evidence of structural damage, fishing gear entanglement, theft of equipment, mooring and cable cuts, and vessel mooring (as exhibited by remnants of tow or attachment lines) (Fig. 4). In many cases photographic evidence taken from the buoy has confirmed vandalism of the buoy. In other cases, especially when the buoy goes adrift or is lost, there is evidence of abnormal mooring stress, stretching or anchor displacement, or patterns of station data stream failure. Lastly, some stolen buoys have been tracked by their GPS location reports as they are transported across oceans - presumably on the deck of the vandalizing vessel.

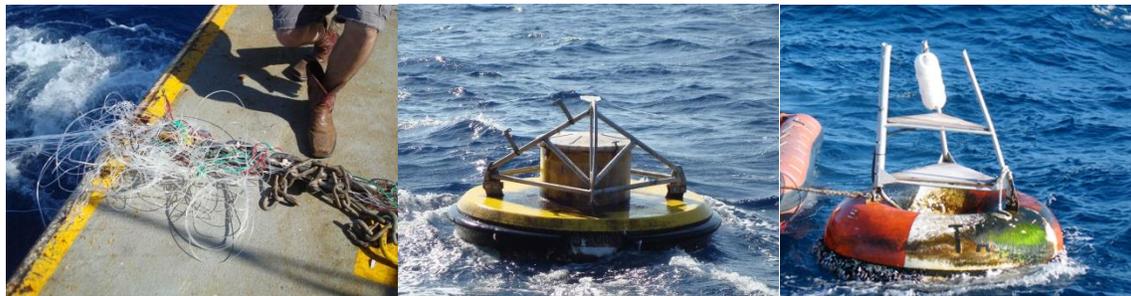


Figure 4. Examples of damage to data buoys: fouling of mooring lines and removing physical infrastructure. *Source: National Oceanic and Atmospheric Administration*

2.2. Global Problem/Regional Impacts

These major tropical moored buoy arrays and expanded tsunameter networks are key components of the Global Ocean Observing System (GOOS) and the internationally networked marine observations coordinated by the JCOMM. These mechanisms provide for international coordination of oceanographic and marine meteorological observing, data management, and services. For the most part, these networks are placed outside Exclusive Economic Zones (EEZs) on the high seas. This means the response to vandalism events requires both national and international efforts.

Buoy vandalism has been a problem since the establishment of ocean observing networks in the late 1980s. The issue has garnered international attention because many platforms such as the tropical Pacific, eastern tropical Indian Ocean, and equatorial Atlantic Ocean are internationally supported and provide data used by the international community.

Incidences of data buoy vandalism are apparent in both ocean and coastal networks. However, only a few highly-impacted networks have consolidated records of vandalism events. These arrays include the tropical moored buoy arrays (TAO/TRITON, PIRATA, and RAMA), the tsunameter networks supporting the tsunami warning systems in the Indian and Pacific Oceans, and the tsunameter networks in the Caribbean and Western Atlantic.

The TAO/TRITON array is a major component of the El Niño/Southern Oscillation (ENSO) Observing System located in the eastern tropical Pacific Ocean. The array provides data for coastal weather information, forecasting the ENSO, and the assessment and advance warning of tsunamis. It also has the longest experience with and records of vandalism, which are significant in both operational cost and the loss of scientific data. As an example, estimates of vandalism costs can be about US\$1 million annually for equipment restoration-not including costs of lost data and other indirect costs. For the period of January 2013-May 2016, there were 66 confirmed vandalism events involving TAO buoys. In some cases, newly deployed TAO buoys have been lost within days – or even hours – following their deployment.

The tsunameter networks in the Indian Ocean also have a consistent multi-national record of vandalism events. India's National Institute of Ocean Technology (NIOT) has reported serious losses through vandalism to their moored buoys in the Arabian Sea and Bay of Bengal. From 2006-2010 there were 31 vandalism events, which has resulted in some sites being abandoned as locations for buoy deployment because of the high frequency of damage resulting from vandalism. Using conservative assumptions, the total direct cost of Indian Ocean Tsunami Warning System vandalism between 2006 and 2010 is estimated to be around US\$3.4 million (US\$110,000 per event).

Vandalism erodes a system's cost-benefit proposition. The substantial costs of upgrading equipment to deter vandalism and restoring vandalized stations add to the costs of establishing and sustaining networks. At the same time, unless networks are fully resilient to equipment outages, the consequential data losses and the degradation of derived services reduce the societal benefits provided to communities from data buoys.

3. Purpose of the Strategy

The purpose of this strategy is to create a framework that will guide the development of outreach and education resources to raise public awareness of the critical value of the services provided by ocean observation networks and warning systems, and of the related disaster risk-reduction benefits. It will help promote education and outreach, especially to recreational, artisanal, and commercial fishers. It will also broaden support of community stakeholders, and enable proactive engagement at regional and local scales through the development of new partnerships to share lessons learned and generate new ideas for addressing vandalism issues.

3.1. Key Regionally- Relevant Stakeholder Groups

Multiple stakeholders have an interest in reducing intentional and incidental impacts to ocean data buoys. These stakeholders include national and local governments, intergovernmental organizations (e.g., IOC, WMO), communities, emergency managers, ocean industry sectors (e.g., fishing and navigation), and scientists. In order to effectively address data buoy vandalism, more stakeholders, willing to serve as buoy advocates, are needed from the commercial fishing and shipping sectors, nongovernmental organizations, local communities, educators, media, and emergency managers. This strategy is the first step in identifying and engaging those stakeholders to develop education and outreach materials to increase sector and public awareness of buoy vandalism along with the social benefits enabled by sustained networks of ocean observations.

3.2. Timeline for Strategy

The DBCP will use this strategy to guide its efforts to address vandalism for the next five years (2018-2023)¹. The DBCP Task Team on Buoy Vandalism will provide an annual report during the DBCP annual session to include updates and/or recommendations identified at the IOC Assembly and WMO Executive Council meetings. Additionally, outreach and education recommendations will be submitted to the IOC Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG), the Food and Agriculture Organization of the United Nations (FAO), regional fishery management organizations (RFMOs), Member states, the commercial fisheries sector and other relevant stakeholder organizations as identified.

4. Current Education and Outreach Efforts

Numerous local, national and international efforts have been made to educate and inform people, in particular the fishing community, about the negative consequences of data buoy losses for research; weather, climate and ocean forecasting; and tsunami warnings. These observing losses have direct impact on loss of human life and property.

Examples of existing efforts include:

- The TAO and TRITON Project Offices have issued leaflets in several languages to fishing organisations and fishing boats, and have produced educational materials for local dissemination or promulgation via the internet.
- The DBCP has produced a [leaflet](#) on the value of ocean data buoys, translated in multiple languages, for circulation to fishermen and mariners. The leaflet provides advice with respect to interference with data buoys. Its content has been promulgated in full or in part by a number of national agencies, by port authorities, and by the International Hydrographic Organisation.
- The DBCP also developed [technical documents](#) to describe and document data buoy vandalism issues and presented findings at various ocean observation technical and intergovernmental meetings.

¹ Upon adoption by the IOC and WMO.

- The German-led GITEWS project was proactive in coastal community education in Indonesia during the deployment of its tsunameter network, including distributing shirts with GITEWS tsunami buoy images to promote their recognition.
- The Jakarta Tsunami Information Centre in Indonesia has produced community education materials including a poster on tsunami buoys.
- India has mounted public information campaigns for coastal communities, using public television broadcasts in local languages across a number of coastal states.
- Some ocean platforms carry signage in multiple languages. This is in addition to prominent graphical signage, such as the tsunami warning (wave) symbol.
- RFMOs including the Indian Ocean Tuna Commission, Inter-American Tropical Tuna Commission, and Western and Central Pacific Fisheries Commission have adopted [resolutions](#) (conservation and management measures) to protect moored ocean observing systems, which promote regional and local awareness of the issue.

These efforts are ongoing, but have met only limited success. While these efforts help to draw awareness to the impacts of data buoy vandalism, they are not adequate to stem the continued, documented vulnerability and loss of essential, multi-purpose ocean observing systems. Rather, these efforts provide the foundation that this strategy will build upon to increase education and outreach efforts.

5. Strategy Goals and Objectives

5.1. Goal I: Develop Regionally and Nationally Relevant Education Materials

Outcome: A tool kit of regionally-relevant print and web-based resources for targeted stakeholder groups to improve the effectiveness of strategies for reducing the impacts of data buoy vandalism.

Objective: Inventory education and outreach resources to know what types of materials already exist.

There are a variety of materials and resources on data buoy vandalism that already exist (Section 4). Therefore, to inform the other activities in this strategy, the DBCP will lead an effort to reach out to TOWS, FAO, and RFMOs to identify regional, national, and/or local education and outreach materials that already exist. Based on this inventory, the DBCP will lead a gap analysis to determine the specific areas (e.g., format [print, web-based], topic, language) where materials are needed. This will also inform the identification of one or more areas (e.g., geography, language, topic) to conduct a needs analysis with key stakeholders.

Objective: Develop guidelines for regional and national organizations to use to develop education materials for protection of ocean data buoys.

In order to help regions, nations, or localities to develop education and outreach materials and, as appropriate, provide consistent messages, the

DBCP will coordinate with relevant groups to create a set of guidelines that can be used to develop these educational and outreach materials.

Objective: Develop education and outreach materials for stakeholder use.

Based on the inventory of resources, national, regional, or international groups could develop new materials or modify existing materials to meet specific regional or national needs for outreach. This could also include exploring the development of a web-based toolkit on data buoy vandalism that can serve as a central repository of these resources for stakeholders and the public. Promoting existing data buoy resources such as the [JCOMMOPS website](#) could help stakeholders see the distribution and types of services that ocean data buoys around the world provide. Developing materials could also include coordinating on the translation of web pages and select materials.

5.2. Goal II: Enhance national, regional, and global coordination and cooperation to protect data buoys

Outcome: Increase visibility of the problem of data buoy vandalism by working with and through national, regional, and global partners.

Objective: Promote and develop new resource and outreach materials for raising awareness of the importance of data buoys and the consequences of vandalism and interference.

Encourage national and local governments and their partners to help develop nationally and regionally relevant educational materials and implement outreach programs. Explore opportunities for promoting, developing and utilizing new resources and outreach materials to raise awareness of data buoy vandalism. Increasing visibility could facilitate new and innovative funding mechanisms to help support improving the understanding of the strategic role of data buoys for coastal communities. This effort could include developing web-based platforms and/or using social media for engaging with stakeholders more directly and regularly. Increasing the role of the media could help to improve public understanding of the role of data buoys by helping to communicate technical information in an easy to understand way. This could also include increasing information sharing (as appropriate) between and among data buoy operators, fishery managers, navigation managers, and other relevant stakeholders.

Objective: Explore opportunities for increasing the ability for rapid response to data buoy incidences.

Establish relationships between DBCP and key stakeholders to facilitate information exchange and increase awareness and allow for rapid response to data buoy incidences. This could include hosting a series of webinars on data buoy vandalism or participating in capacity building efforts in target areas to

share and promote the resources available. This could also include conducting a pilot study on an alert network for reporting data buoy incidences (observed intentional or unintentional) to allow for rapid response.

5.3. Goal III: Identify key stakeholder groups and enhance education and outreach efforts to those stakeholders

Outcome: Increase awareness of data buoy vandalism issues among key stakeholders through strategic and effective partnerships.

Objective: Identify stakeholder groups that have an interest in data buoy vandalism issues.

There are multiple stakeholders that have already engaged in activities to address data buoy vandalism. However, there are opportunities for re-engaging with those partners and/or identifying new partners with a particular focus on regions with the highest incidences of vandalism. This will inform the development of education and outreach materials that are most relevant to the communities in that region. There could also be opportunities to engage in other existing efforts or campaigns to integrate data buoy vandalism issues. These partnerships could encourage increasing awareness, but also encourage funding support and new policy mechanisms to support regional and local efforts.

Objective: Promote cooperation between and among data buoy operators, fishery managers, navigation managers, and other relevant stakeholders

Promote educational and outreach cooperation regionally and internationally which could include developing specific initiatives with governmental or intergovernmental partners (i.e., RFMOs, ICGs, TOWS, International Hydrographic Organization (IHO), International Maritime Organization (IMO) and the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA)) to help educate stakeholders on the benefits of data buoys and the impact of data buoy vandalism on coastal communities. This could also include increasing the outreach efforts related to existing governmental or intergovernmental initiatives.

Objective: Explore opportunities for engaging with new partners to address data buoy vandalism

Data buoy operators and fishery managers are actively working to raise awareness of data buoy vandalism. There could also be opportunities for working with non-governmental partners and/or local community leaders to incorporate new perspectives and to increase engagement with new stakeholders and the public.

5.4. Implement education and awareness strategies to build compliance and support enforcement

Outcome: Increase compliance with data buoy resolutions through effective education and awareness activities.

Objective: Explore compliance issues with existing data buoy resolutions

Since the IOC, WMO, RFMOs, and individual countries have adopted both voluntary and binding measures and recommendations on intergovernmental collaboration, these organizations could consider information sharing to address data buoy vandalism. There could be a discussion and information sharing on the successes and challenges with those various efforts. This could also identify specific gaps or facilitate leveraging ideas or resources among interested stakeholders. Consistent reporting on data buoy incidences would enable collection of more consistent data across regions and nations. There could be opportunities for establishing new incentive and/or recognition programs for local fishermen or other stakeholders, particularly those who report the incidences or that contributes to increasing awareness of the importance of data buoys in their communities.

Objective: Explore opportunities for increasing and/or improving data collection on vandalism incidents.

There are a variety of ocean activities that that may contribute to data buoy vandalism. More information and consistent information about vandalism incidents could increase awareness and improve understanding of the relationship between data buoy vandalism and other ocean activities. More information could also allow for improved cost estimates to understand the economic impact of vandalism.

6. Next Steps

This education and outreach strategy will guide the continued engagement with regional, national, and local stakeholders to strengthen their efforts to reduce data buoy vandalism. It will facilitate creation of new educational materials, expanded national and international collaboration, innovative stakeholder partnerships and information sharing to support compliance. It will also help to identify needs and gaps in order to increase the effectiveness of these efforts. This strategy enhances the international approach to reduce damage to observing systems through engineering and technological modifications to buoys, regulatory policy and enforcement. The DBCP will continue to lead this effort with the goal of engaging additional and new stakeholders that can also champion efforts to reduce data buoy vandalism. This strategy will be reviewed by JCOMM, subsequently proposed for adoption by the IOC and WMO in 2018 and would be implemented 2018-2023. Annual reporting will track progress toward implementation during that period.