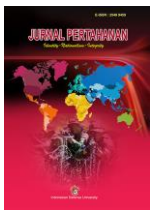
Jurnal Pertahanan

Media Informasi tentang Kajian dan Strategi Pertahanan
yang Mengedepankan *Identity*, *Nationalism* dan *Integrity*
e-ISSN: 2549-9459
http://jurnal.idu.ac.id/index.php/DefenseJournal



UTILIZATION OF OCEANOGRAPHIC DATA IN SUPPORTING THE NATIONAL DEFENSE AND SECURITY ANALYSIS IN TERMS OF HANDLING THE ILLEGAL FISHING IN INDONESIA

Noir P. Purba
Department of Marine Science, Universitas Padjadjaran
FPIK-Unpad, Jatinangor Campus, Sumedang Highway Km. 21 West Java, Indonesia 45363
noir.purba@unpad.ac.id

Marine Kenzi Martasuganda
Alumni of Department of Marine Science, Universitas Padjadjaran
FPIK-Unpad, Jatinangor Campus, Sumedang Highway Km. 21 West Java, Indonesia 45363
marine.kenzi@gmail.com

Dian Adrianto
Navy's Oceanographic Hydro Centre
Pantai Kuta Street V No.1 East Ancol North Jakarta, Indonesia 14430
aqilaadrianto@gmail.com

Article Info

Article history:
Received 12 November 2019
Revised 19 February 2020
Accepted 29 March 2020

Keywords:
Maritime Security,
Ocean Dataset,
RHEA,
Upwelling,
ZEEI
.

DOI:
http://dx.doi.org/10.33172/jp.v6i1.628

Abstract

One of the issues in Indonesia's maritime security is Illegal, Unreported, and Unregulated (IUU) fishing. This research focuses on how to reduce illegal fishing using oceanographic data to support agencies concerned about ocean security. The main data collected from in-situ sampling by NOAA and to support the analysis, data also collected from several reports and published articles. The results showed that many station data already stored in the global database especially in boundary seas of Indonesia. However, the data is not continuously monitored. These data (temperature, salinity, and ocean currents) also correlate with fishing locations, especially in the boundary area. Furthermore, the oceanographic data with high performance of instrument could predict the fishing locations and the changing ocean. In conclusion, ocean databases and real-time data from instruments could support the agencies to protect Indonesia's water.

INTRODUCTION

After independence, Indonesia faces many challenges in marine management and resources. As a fully sovereign country, one indicator is marine governance strength in many aspects (Vinata, 2017). Furthermore, with Indonesia's sea area of around 5.9 million km^2, it is faced with how to secure seas and biota without having to fight with other countries. Nowadays, the problems could arise from the borders with other countries (Marsetio, 2013; Hasan, Jian, Alam, & Chowdhury, 2019). One of the issues related to marine management is how to protect marine resources in the field of fisheries from the threat of illegal fishing (Lestari, Putra, & Larasuci, 2020). As an archipelago country, Indonesia manages 11 Fisheries Management Areas (*Wilayah Pengelolaan Perikanan*, WPP) with a diversity of fish (Siregar et al., 2019).

National Development Planning (NDP) system from 2015 to 2019 is about the management of marine resources (Indonesia law number 25/2004) (Badan Perencanaan Nasional, 2014) which includes illegal fishing. The rise of illegal fishing is the existence of legal problems in both interpretation, implementation and enforcement. Moreover, different understandings of existing rules, inconsistencies in law enforcement, and the theoretical foundation of maritime affairs characterize legal uncertainty (Astor et al., 2015).

Illegal fishing is an activity that catches fish and other resources in an area conducted by foreign vessels without legal permission. United Nations (UN) stated that IUU-fishing as one of the seven major threats to global maritime security. These activities due to the fish movements do not follow the jurisdiction rules. Fish movements are based on environmental conditions.

Comprehensive data related to oceanographic data is needed to be able to monitor the movements of fishing activities. With changing climate conditions, the movements of fish are also increasingly unpredictable (Pörtner & Peck, 2010). Ocean conditions could change due to climate change (Hu & Fedorov, 2019; Swain, Umesh, & Harikrishnan, 2010). Consequently, fish movement patterns are increasingly unpredictable. Indonesia is one of the important migrations of tuna (Satrioaj et al., 2018), mammals and other large pelagic fish, which is very important to gain Indonesia's GDP target. This biota is a renewable resource and very abundant in nature.

Connectivity between ocean studies and marine security of a country has never been separated especially since World War I (Winokur, 2015). The study of Oceans is an essential aspect from strategic, economic and ocean engineering points of view. In some countries such as America (Lynch, J.F., Newhall, A.E., and Frosch, 2015) for example that WHOI (Woods Hole Oceanographic Institution) develops underwater acoustic systems to support underwater signals. In Indonesia, this role is mainly carried out by the Navy's Oceanographic Hydro Center (Nasution, 2018). At present this role extends to safeguard continual marine and take-off resources (Anggara, Alam, Adrianto, & Pranowo, 2018). Moreover, the strengthening of instruments, data, and monitoring systems are needed to maintain the sovereignty of waters to improve the economy (Rochwulaningsih, Sulistiyono, Masruroh, & Maulany, 2019).

This research aimed to provide an overview of oceanographic data measurement that could support the analysis of national defense and security in the case of illegal fishing. Near-real-time analysis and dissemination of ocean environment variables through operational systems are key factors to conduct cost-effective and efficient activities at sea. Intended for fishery applications, the capability of constructing specific information tailored to each group of fish stocks is a key prerequisite in the active system (Wakamatsu et al., 2017).

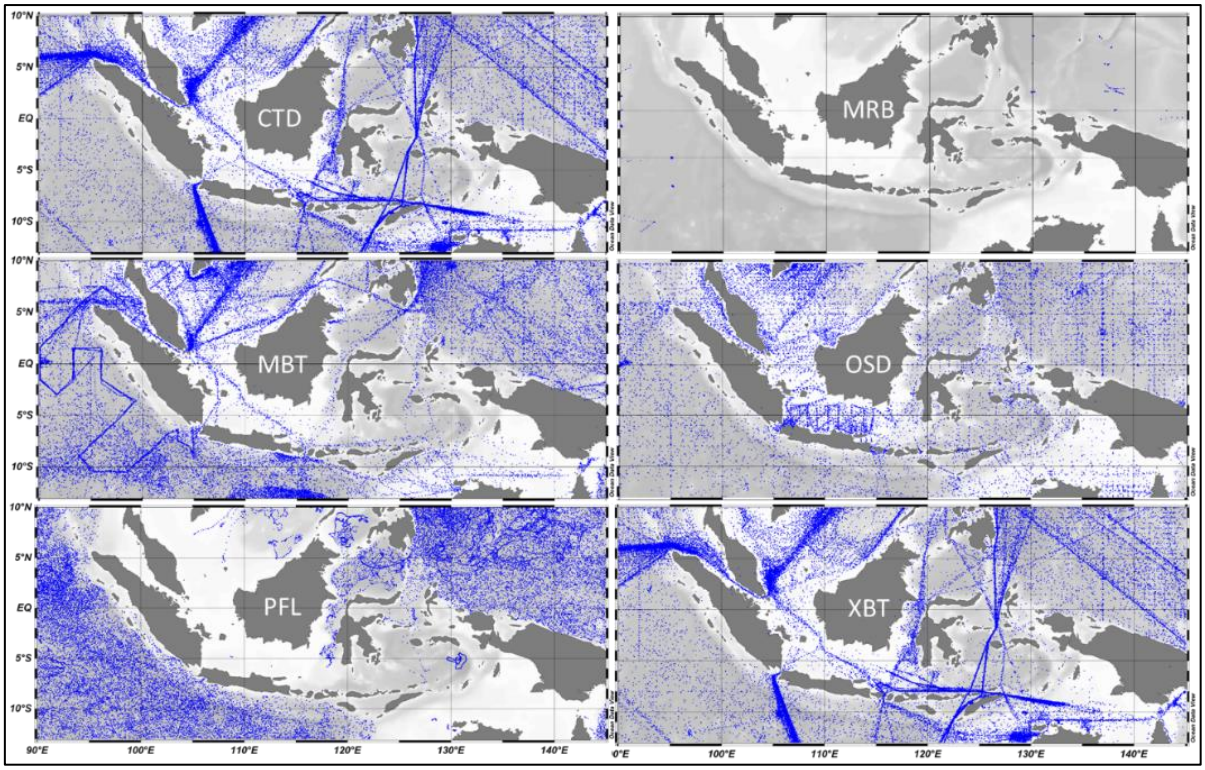


Figure 1. Data locations from the World Ocean Database in Indonesia region until 2018. CTD (Conductivity Temperature and Depth), MRB (Moored Buoy), MBT (Mechanical Bathythermograph), OSD (Ocean Station Data), PFL (Profiling Float), XBT (Expendable Bathythermograph) (Schlitzer, 2018).
Source: www.nodc.noaa.gov processed by Authors, 2019

Measurement of marine data can be done by direct observation (Purba et al., 2019) or from satellites. Satellites can measure spatially widely (Chen et al., 2019) and direct observation can measure changes vertically (Purba, N.P., Pranowo, 2015). Both of these measurements are mutually supportive especially when related to upwelling and the presence of fish (Purba & Khan, 2019).

METHODS

This study uses a qualitative approach by using primary and literature studies from several that are relevant to this study. The oceanographic database also updated from a new database, the World Ocean Database (WOD) 2018 (www.noaa.nodc.gov) (Boyer et al., 2018). WOD is one of the largest databases that consist of oceanographic data all around the globe. It is worldwide use, free, and easy to access. The vessel activities captured from Global Fishing Watch (GFW) (https://globalfishingwatch.org) to compare the locations of fishing and oceanographic data. In order to strengthen and widen the views and analysis, this study also gathers references from several books, journals, and other media.

To analyze the data, we combined the dataset with fishing prediction locations from the National Institute of Aeronautics and Space (LAPAN), and illegal fishing locations from several repo rts and published articles. LAPAN used oceanographic data to predict fishing locations. This data will give us a comprehensive view of the needed data to analyze for future programs.

RESULT AND DISCUSSION

Oceanographic system

Oceanographic studies are very important to support activities to maintain maritime security carried out by government

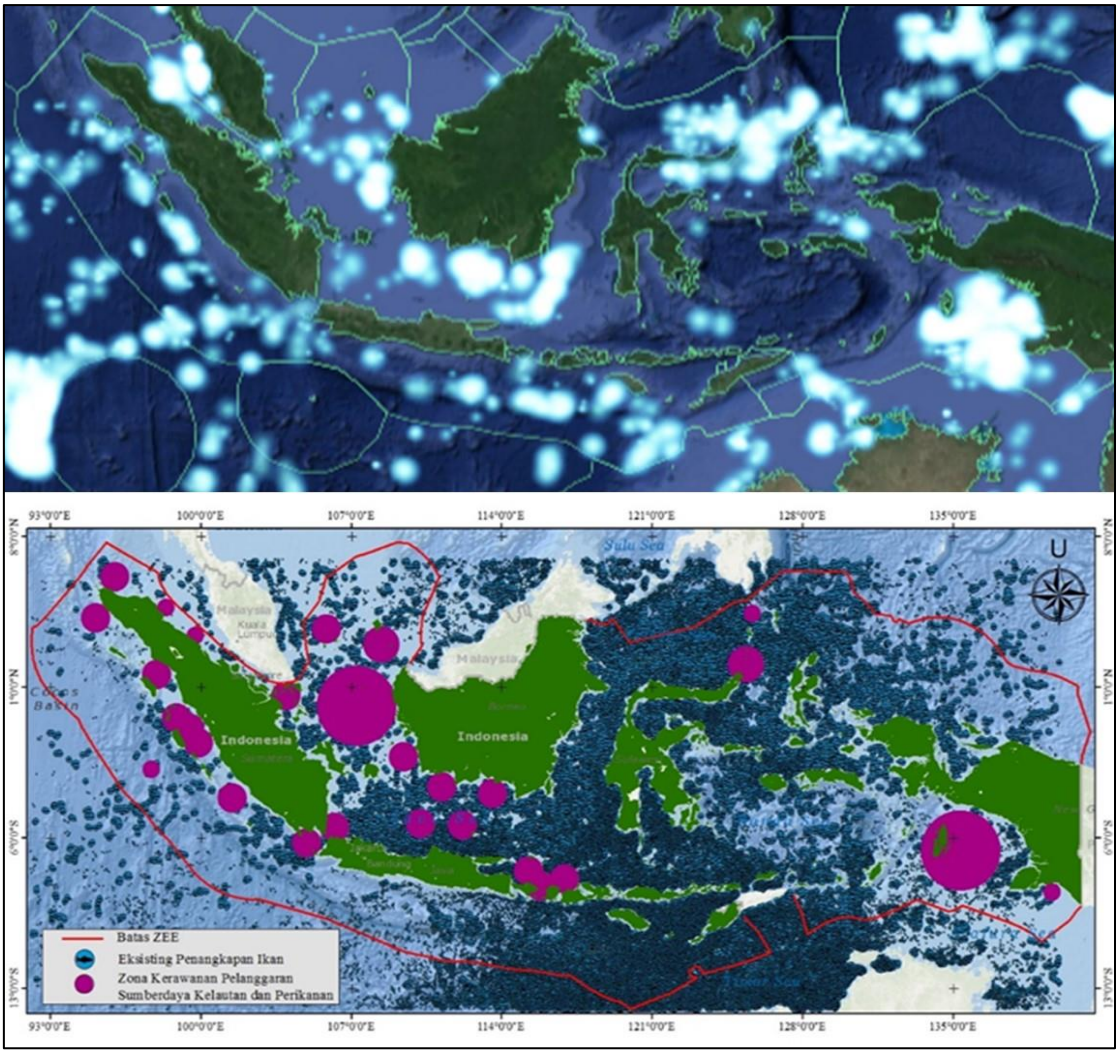


Figure 2. (top) Vessel activities in 2019 from GFW, (bottom) The overlay between fishing locations, illegal fishing locations, and Economic Exclusive Zone. The intense illegal fishing locations in the Natuna Seas.
Source: (top) GFW snapshot processed by Authors, 2020 and (bottom) LAPAN processed by Authors, 2019

agencies. At present, from the direct measurement database stored by NODC, there are many measurement stations in Indonesia (Figure 1). These data cover all Indonesian waters nevertheless have not been carried out continuously. This is because the basis of this activity is the need for research/projects. To get complete data on fishing ground location and water conditions, more frequent measurements are needed. These data have to monitor spatial and vertical to know the condition of the water column. Fishes move not only from the horizontal section however spread to the water column by vertically moving.

Based on oceanography measurements throughout Indonesian waters, these data already include fishing locations. This database covered includes Indonesian deep waters and oceans (Indian and the Pacific Ocean). In Indonesia, these kinds of oceanographic data are also collected by various agencies and stored specific repositories. This is a challenge in developing oceanographic databases in Indonesia because access to these data needed more effort. Furthermore, In 2018, Indonesia has launched One Map Policy, which has a significant impact on managing big data. Although the data is currently still developed, the researcher, various

institutions, and other agencies could use it freely and easily to download.

Oceanographic databases could predict fishing locations in any waters including waters with a boundary to other countries. With accurate predictions, water sovereignty can be achieved with the cooperation of various agencies. Based on Satria (2014), illegal fishing mostly occurs in the area around the Natuna Sea, the Indian Ocean adjacent to Sumatra, the Aru Sea and surrounding areas, and waters bordering the Philippines. In the field of oceanography, these areas also as locations of an upwelling (Purba & Khan, 2019). At present, Indonesia is participating in the Vessel Monitoring System (VMS). VMS is a tracking system currently installed on vessels weighing more than 30 GT. This instrument provides information about the position of the ship, type of ship, length of time of fishing. In addition, there is also an Automatic Identification System (AIS) which is basically a system used by ships to share information between two or more ships. These data are very accurate and can be used to view activities at sea during the day and night (Figure 2).

If we look at the territorial waters of Indonesia, fishing locations are in all waters. The territorial waters including borders such as the Natuna Seas, the Savu Sea, and North Sulawesi are waters that are vulnerable to illegal fishing based on fishing zone predictions. This indicates that these waters must be protected by involving many institutions in the context of safeguarding the sea. In Indonesia, the main institutions dealing with maritime resources and security issues include the Coordinating Ministry of Maritime Affairs and the Ministry of Marine and Fisheries (KKP). These institutions supported by Coordinating the Ministry of Politics, Law, and Security (Kemenhumkam), the Indonesian Maritime Security Agency (Bakamla), Indonesian Navy (TNI AL), the Indonesian National Police (Polri), Dir. Gen. Sea Transportation (Hubla), Dir. Gen. Custom and Excise (Customs and Excise), Dir. Gen. of Immigration (Ditjenim), and the Indonesian Sea and Rescue Agency (Basarnas) (Chapsos, I. and Malcolm, 2017).

Sub-Integration between ocean dataset and database system

To facilitate the use of oceanographic databases in the context of maritime security, adequate infrastructure is needed to collect and process data. Data collected from various sources such as scientific shipping, agency research projects, and various other sources. The use of oceanographic data for illegal fishing is very important. With the oceanographic database, instruments that support marine mapping, and human resources, maritime sovereignty over fish resources is expected to be maintained. Map of fishing prediction and in-situ tracking can already be used as a base to find out waters that are vulnerable to illegal fishing, especially in boundary areas.

This data is in the form of raw data and is stored in various databases such as universities and government institutions. Data to be used for analysis must pass a screening process carried out by experts. These experts perfect the data and make predictions so that it is suitable for use by the navy (Figure 3).

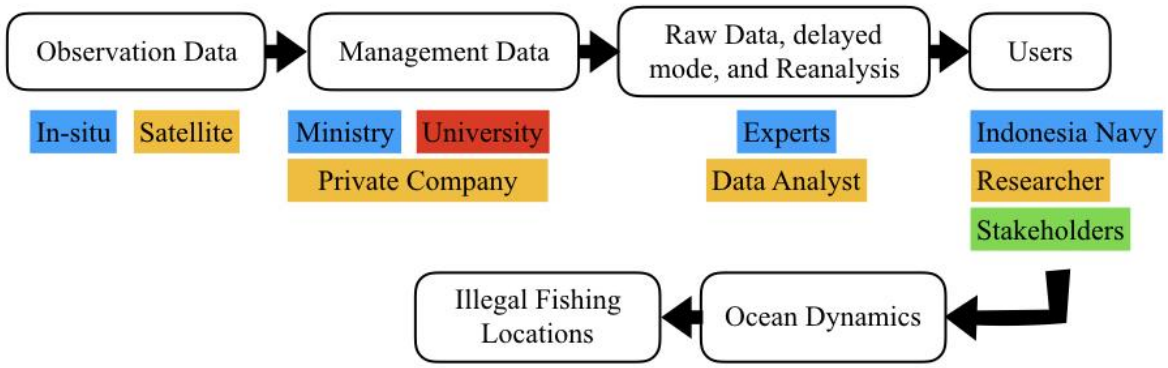


Figure 3. Concept of oceanographic data management for illegal fishing applications.
Source: Authors, 2019

Many global institutions have used this concept to support the operations of shipping, seabed mapping, and maritime security. In this case, Indonesia has to develop instruments that can be adjusted to the desired needs. Besides, the role of satellites can also be maximized to see water conditions on a broad scale. Satellites can also be maximized in their use to support VMS to reduce illegal fishing. At present, there are several efficient measurement instruments such as meter floats (http://www.argo.ucsd.edu/), RHEA (Purba et al., 2019), TRITON (http://www.jamstec.go.jp). This instrument can provide oceanographic and atmospheric data both in real-time and in delayed mode. On the other hand, some oceanographic databases that already exist in Indonesia are INDESO (Infrastructure Development for Space Oceanography) which is a collaboration between Indonesia and France (http://www.indeso.web.id) and currently under development of PODC (Padjadjaran Oceanographic Data Center) (http://podc.fpik.unpad.ac.id/). INDESO has been implemented by the CTF since 2012 (Serge et al., 2018).

CONCLUSION, RECOMMENDATION, AND LIMITATION

The use of oceanographic data for the purpose of illegal fishing is very important. With the oceanographic database, instruments that support marine mapping, and human resources, maritime sovereignty over fish resources is expected to be maintained. Map of fishing prediction and in-situ tracking can already be used as a base to find out waters that are vulnerable to illegal fishing, especially in boundary areas. Moreover, to support the completeness of oceanographic data, instruments that are cheap, precise and reliable are needed.

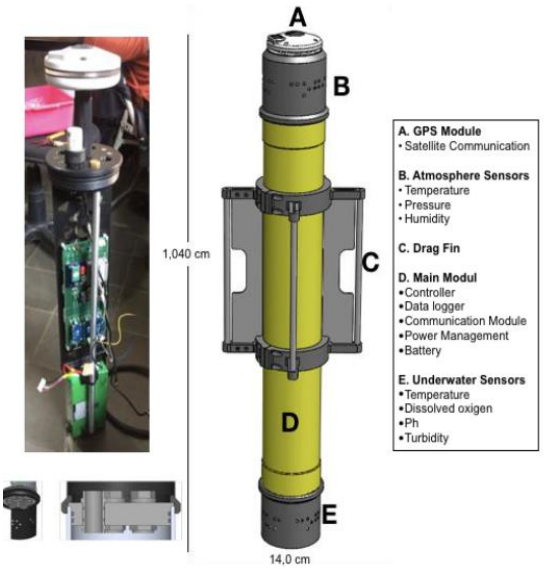


Figure 4. RHEA design. New instrument measure oceanographic parameters with real-time transfer data
Source: Purba et al., 2019.

Moreover, to support the completeness of oceanographic data, instruments that are cheap, precise and reliable are needed. One of the new instruments to cover data with cheap, efficient, and reliable is the Drifter

Oceanography Coverage Area (RHEA) (Figure 4).

RHEA is a floating tracker to store and send data from the ocean to land receiver. It is equipped with GPS and other sensors with real-time data or near-real-time to acquire geographical positions and data. The drifter could send data for three months. Nevertheless, it highly depends on the life period of data transmission (Purba et al., 2019). It is also could use in the freshwater area for measuring water quality and send the data via a phone or stored in a memory card.

REFERENCES

Anggara, P. D., Alam, T. M., Adrianto, D., & Pranowo, W. S. (2018). The wave characteristics in Natuna Sea and its adjacent for naval operation base purposes. In *IOP Conference Series: Earth and Environmental Science*. https://doi.org/10.1088/1755-1315/176/1/012003

Astor, Y., Sulasdi, W.N., Wisayantono, D., Hendriatiningsih, S. (2015). Integration Construction of Marine Utilization Elements Towards Indonesia Good Ocean Governance in Marine Cadastre Perspective. *Indonesian Journal of Geospatial*, 1–15.

Badan Perencanaan Nasional. (2014). *Konsep mainstreaming ocean policy kedalam rencana pembangunan nasional. Kedeputian Bidang Sumber Daya Alam dan Lingkungan Hidup Badan Perencanaan Pembangunan Nasional*.

Boyer, T.P., O. K. Baranova, C. Coleman, H. E. Garcia, A. Grodsky, R. A. Locarnini, A. V. Mishonov, T.D. O'Brien, C.R. Paver, J.R. Reagan, D. Seidov, I. V. Smolyar, K. Weathers, and M. M. Z. (2018). World Ocean Database 2018.

Chapsos, I. and Malcolm, J. A. (2017). Maritime security in Indonesia: Towards a comprehensive agenda? In *Marine Policy* (pp. 178–184).

Chen, G., Tang, J., Zhao, C., Wu, S., Yu, F., Ma, C., … Wu, L. (2019). Concept design of the "Guanlan" science mission: China's novel contribution to space oceanography. *Frontiers in Marine Science*. https://doi.org/10.3389/fmars.2019.00194

Hasan, M. M., Jian, H., Alam, M. W., & Chowdhury, K. M. A. (2019). Protracted maritime boundary disputes and maritime laws. *Journal of International Maritime Safety, Environmental Affairs, and Shipping*. https://doi.org/10.1080/25725084.2018.1564184

Hu, S., & Fedorov, A. V. (2019). Indian Ocean warming can strengthen the Atlantic meridional overturning circulation. *Nature Climate Change*. https://doi.org/10.1038/s41558-019-0566-x

Lestari, D. I., Putra, A. R., & Larasuci, A. Y. (2020). The main consequences of continued illegal, unreported, and unregulated (IUU) fishing within Indonesian waters for maritime security actors and coastal communities. *Research, Society and Development*. https://doi.org/10.33448/rsd-v9i1.1566

Lynch, J.F., Newhall, A.E., and Frosch, R. A. (2015). Underwater acoustics research at the Woods Hole Oceanographic Institution. *Acoustical Society of America*, *23*, 1–12.

Marsetio. (2013). Strategi TNI Angkatan Laut Dalam Pengamanan Batas Maritim NKRI: Kajian Historis-Strategis. *Citra Lekha*, *17*(1).

Nasution, A. M. (2018). The Role Of The TNI Navy's Hydro-Oceanographic Centre in Managing Sustainable Fisheries (A Study on Providing Hydrographic Data for Managing Sustainable Fishery). *Jurnal Pertahanan*, *4*(3). https://doi.org/https://doi.org/10.331

72/jp.v4i3.428

Pörtner, H. O., & Peck, M. A. (2010). Climate change effects on fishes and fisheries: Towards a cause-and-effect understanding. *Journal of Fish Biology*. https://doi.org/10.1111/j.1095-8649.2010.02783.x

Purba, N.P., Faizal, I., Mulyani, P.G., Prayogo, N., Prasetyo, T., Khan, A. M. A. (2019). Performance of lagriangan drifter oceanography coverage area (RHEA): second phase. *International Journal of Oceans and Oceanography*, *13*(2), 353–361.

Purba, N.P., Pranowo, W. S. (2015). *Dinamika Oseanografi, Deskripsi Karakteristik Massa Air dan Sirkulasi Laut*. UNPAD Press.

Purba, N. P., & Khan, A. M. A. (2019). Upwelling session in Indonesia waters. *World News of Natural Sciences*.

Rochwulaningsih, Y., Sulistiyono, S. T., Masruroh, N. N., & Maulany, N. N. (2019). Marine policy basis of Indonesia as a maritime state: The importance of integrated economy. *Marine Policy*. https://doi.org/10.1016/j.marpol.2019.103602

Satria, A. (2014). Policy Paper: Road Map Investasi Kelautan Di Indonesia. Jakarta.

Satrioajie, W. N., Suyadi, Syahailatua, A., & Wouthuyzen, S. (2018). The importance of the Banda Sea for tuna conservation area: A review of studies on the biology and the ecology of tuna. In *IOP Conference Series: Earth and Environmental Science*. https://doi.org/10.1088/1755-1315/184/1/012004

Schlitzer, R. (2018). Ocean Data View.

Serge, A., Berny, S., Philippe, G., & Riza, F. A. (2018). INDESO project: Results from application of remote sensing and numerical models for the monitoring and management of Indonesia coasts and seas. *Marine Pollution Bulletin*. https://doi.org/10.1016/j.marpolbul.2018.01.056

Siregar, N.M.A., Swastanto, Y., Said, B. D. (2019). Fishery resources management in the Republic of Indonesia's fishery management region 711 for the sustainable fishery resources control. *Jurnal Pertahanan*, *5*(1), 19–33.

Swain, J., Umesh, P. A., & Harikrishnan, M. (2010). Role of oceanography in naval defence. *Indian Journal of Marine Sciences*.

Vinata, R. T. (2017). Power of Sharing Sumber Daya Kelautan Republik Indonesia. *Jurnal Ilmiah Hukum Legality*. https://doi.org/https://doi.org/10.22219/jihl.v24i2.4272

Wakamatsu, T., Igarashi, H., Tanaka, Y., Nishikawa, S., Ishizaki, S., Ishikawa, Y. (2017). Development of operational oceanography system for fishery management and its application in the Central North Pacific Ocean. In *Proceedings of the Eigth EuroGOOS International Conference, Operational Oceanography* (pp. 473–480).

Winokur, R. S. (2015). Naval oceanography contributions to underwater acoustics—The Cold War era. *The Journal of the Acoustical Society of America*. https://doi.org/10.1121/1.4920426