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THE ROLE OF THE TNI NAVY'S HYDRO-OCEANOGRAPHIC CENTRE IN MANAGING SUSTAINABLE FISHERIES (A STUDY ON PROVIDING HYDROGRAPHIC DATA FOR MANAGING SUSTAINABLE FISHERY)

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Abstract

Indonesia is a rich country who has many natural resources, especially marine resource. To achieve good and sustainable marine resource management will need marine science as a tool such as hydrography. Nowaday, hydrography is often looked only for creating sea map or nautical chart for navigation. Whereas, if we look deeper about hydrography, it has a key role in fisheries resources management especially for fishermen which is hydrography can be a main support for sustainable fisheries and enhancing economic value. This paper explains about the role of hydrography in supporting economic value for fishermen and sustainable fisheries resource in installation fish aggregating devices (FADs), solving fishermen conflicts, and fisheries port. First, key role in installation FADs, effective and efficient of FADs is depend on the where FADs is installed. There are some criterias that must be considered for installing FADs such as sea depth, distance between FADs, seabed contour, free from shipping lanes, and oceanographic parameters. Those criterias needs data from Hidrography survey. Second, role of hydrography in conflict resolution by creating special map with clear coordinate points to show the boundary of fishing area that often occuring the conflict of fishermen. Third, role of hydrography to determine appropriate place for establishing fishing port. By doing hydrography survey to collect the field data in building jetty, cruise lanes, and break water port.

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INTRODUCTION

Indonesia is an archipelagic country recognized by the international community based on the United Nations Convention on the Law of the Sea (UNCLOS 1982). As an Indonesian archipelago, the sea area is wider than the land area, where almost 2/3 of Indonesia's territory is the ocean. This makes Indonesia very rich in marine resources, this marine wealth needs good and sustainable management in order to continue to provide prosperity to the economy of its people. To manage marine resources, it is necessary to support marine science, one of the disciplines of science is hydrography. According to Djunarsjah and Poerbandono (Djunarsah, 2005) hydrography is a discipline of science in marine studies about physical forms on the surface of the earth that are covered in water and the land that surrounds it. Usually hydrography is also referred to as marine geodesy which deals with measurements or surveys of marine aspects, especially ocean dynamics (currents, winds and tides), depths, and seabed topography.

Currently, the problems faced by sustainable fisheries management in Indonesia are overfishing in several territorial waters of Indonesia which causes fishing hauls to decline and affect the welfare of fishermen. Not limited to that, even causing conflicts between fishermen due to the struggle for limited fish resources. If examined further it is true that fish resources are a recoverable resource, but the question is does the recovery of these fish resources takes a long time? Because if so, it will have an impact on losses in several sectors, especially the fishermen's economy. Therefore, to keep fish resources sustainable and recover quickly, proper and integrated management is needed based on science. In this case the Navy's Hydro Oceanographic Center (Pushidrosal) has one of the functions of the implementation of tasks for the application of the marine environment as a provider of hydro data to support national development in maritime . With all the facilities and capabilities possessed by Pushidrosal in hydrography, it will greatly help national development in the management of sustainable fisheries resources and have an impact in improving the fishermen's economy..

So far hydrography in Indonesia is often seen as limited to marine mapping used in sailor's navigation. Even if hydrography is explored further, it has a key role in the world of fisheries, especially for fishermen, where this hydrographic can be a support for the sustainability of fisheries resources. Some of the uses of hydrography in the field of fisheries that support the management of sustainable fisheries include in the field of installing of FADs, resolution of fishermen's conflict , and fishing ports.

Fishing Aggregation Device (FAD) is a fishing aid for fishermen installed in the middle of the sea to make it easier for fishermen to catch fish. Appropriate and proper installation of FADs will affect the income of fishermen as well as rehabilitate and conserve fisheries resource stocks to maintain sustainability. Rajeswari (Rajeswari. G, 2009) explains that the advantage of installing FADs is that fishermen do not have to spend a lot of time and money searching for fishing grounds. So that this will spend production costs from fishermen and can attain more economic benefits.

More than 80% of fishermen in Indonesia fall into the category of small-scale fisheries, referring to the results of the Ayunda et al (Ayunda, N., Sapota, M. R., & Pawelec, 2018) study showing that small-scale fisheries in Indonesia have led to over-exploitation of fisheries resulting in overfishing of some fishing areas. This condition causes fishermen to often move out of the appropriate fishing area and cause seizure of the fishing ground which leads to "war" between fellow fishermen. This "war" causes prolonged conflict and threatens the fishermen's economy. During this time the solutions taken in resolving fishermen's conflicts were only for short periods of time such as deliberation and

compromise but did not discuss the technical settlement.

Fisheries port is a special port for fishing activities that integrates land with the sea to be used as a center for fishing activities and equipped with various facilities for fishermen starting from going out to sea to fish to returning home and distributing fish hauls (Lubis E, 2006). The existence of a fishing port is very influential for the fishermen's economy because there is a place for fish auctions which keeps the price of fish stable and not monopolized. In addition, there is also a place for loading and unloading fishing boats and cold storage to maintain the quality of fish so that the selling price is high.

This paper aims to discuss the role of Pushidrosal in providing hydrographic data to support sustainable fisheries management which will have an impact in increasing economic value. Especially in installing FADs, fishermen's conflict resolution, and fishing ports.

RESEARCH METHOD

This study uses qualitative approach by using literature study from several previous studies that are relevant to this study. In order to strengthen and widen the views and analysis, this study also gathers references from several books, journals and other medias.

RESULTS & DISCUSSION

Utilization of Hydrographic Data for Sustainable Fisheries

Hydrography in The Context of FAD Installation

According to the Ministry of Maritime Affairs and Fisheries Regulation No. 26 of 2014, FADs or Fish Aggregating Devices (FADs) are a fishing tool that can collect fish using various forms and types of attractors from solid objects and serves to lure fish to gather so that it is easy to catch. Hikmah et al (Hikmah, N. Kurnia, M. Amir, 2016) added that FADs are included in a simple technology that uses a type of floating object, usually using bamboo installed in the sea with ballast straps underneath and ropes paired with coconut leaves as well as attractors to collect fish in a body of waters so it is easy to capture by suitable fishing gear (Figures 1 and 2). In the short term, FADs have a significant impact on the increase in hauls of fishermen and also make fishing efforts more efficient (Nurdin, 2011).

Based on its depth, FADs are divided into two, namely shallow marine FADs and deep sea FADs. Shallow marine FADs are FADs which are installed at depths less than 100 meters while deep sea FADs are installed at depths of more than 600 meters (Baskoro and Effendy, 2005). Then, referring to the Minister of Maritime Affairs and Fisheries Regulation No. 26 of 2014, based on the placement of FADs, it can be divided into two, namely floated FADs which are placed not settled without an anchor. Then stationary FADs are placed permanently using ballast or anchor. In Indonesia not all fishing gear are suitable for fishing around FADs, some of the fishing gear that usually haul fish around FADs are huhate, trawl rings, tonda fishing rods and gill nets. There are around 333 species of fish from 96 families gathered around FADs, but usually the main target of fish caught around FADs is tuna, big eye and yellow fin (Castro, Santiago, & Santana-Ortega, 2001).

The existence of FADs in Indonesia has existed since the 1940s and began to be used by Mandar fishermen (West Sulawesi). Even so, the development of FADs use in Indonesia is relatively slow because the use of FADs massively and modern only began in 1980 (Subani, W dan Barus, 1988). FADs are not only used by Indonesian fishermen, but are also used in several Asian countries such as the Philippines, Thailand, Malaysia, India, Japan, etc (Rajeswari. G, 2009).

The use of FADs is effective and efficient for fishermen, but only in the short term because the negative effects of using

FADs massively can result in overfishing conditions in an aquatic area. In addition, the use of FADs that are not measurable and regulated in a body of water can change the pattern of migration and growth of fish. Of course this will affect the production and distribution of fish in these waters (Menard F, Fanteneau A, Gartuer D, Nordstorm V, Stequert B, 2000). The role of hydrography in the installation of FADs is very important, where effective and efficient FADs are very determined from the place where FADs are installed. There are several regional criteria that support the installation of FADs, namely as follows (Rajesswari, 2009):

1. The depth of the waters, this is related to the living characteristics of tuna fish which is the main target of fishing around FADs. In addition to adjusting the ballast rope installed in FADs so as not to be too short or long which can cause the FADs to shift.
2. FADs must be installed in waters that have flat and sandy base contours. Because if the contours are basically slope or tilted and rocky, the ballast or anchor that is released will potentially be damaged quickly.
3. Waters that are free from strong currents and waves. The waves needed to keep the FADs stable around 0.5-1 meters in height. In addition, so that fishermen can also easily access and maintain these FADs.
4. Temperature, the effective installation of FADs will be adjusted to the living characteristic of tuna fish. In tropical regions like Indonesia, most tuna on average lives in waters between 17-31^0 C.
5. The level of clarity is high enough to make it easier for fishermen to see the position of fish swimming around the FADs so that the use of fishing gear will be maximized.
6. The distance between FADs is at minimal around 10 miles, in accordance with Ministry of Maritime and Fishery Regulation Number.26 of 2014.
7. Does not disturb the shipping lane, especially for Indonesia FADs may not be installed at the Indonesian Archipelago Sea Groove (ALKI).

To obtain hydrographic and oceanographic data used as the criteria for installing FADs described above, data is needed on each fishing area to be fitted with FADs. So far, Indonesian fishermen install FADs only relying on experience and estimation that seem irregular because they do not pay attention to the criteria for the appropriate FADs installation area (Nurdin, 2017).

Utilization of Hydrographic Data as A Middle Ground for Fishermen's Conflict Resolution

Before understanding about the conflicts that exist amongst fishermen, it's good to know the understanding and characteristics of fishing communities first. Sociologically, the character of the fishing community is different from the agrarian community, this is caused by differences in the resources handled. Agrarian communities face controlled resources, such as agricultural and plantation commodities whose results are relatively predictable, their production location does not change. This makes business mobility relatively low and the risk opportunities are not too large (Satria, 2015). Meanwhile, fishing communities faces uncontrolled and open access resources. Resources such as this require fishermen to move in search of maximum fishing hauls, so the risks are far greater, such as the occurrence of conflicts with other fishermen who feel their "territory" is disturbed. (Satria, 2015).

Fishermen conflicts are included in the category of fisheries conflicts. In Indonesia these are several types of fisheries conflicts, the first type of which is conflict that occurs due to unilateral claims of fishermen to fishing areas, thus prohibiting other

fishermen from fish in the area that has been claimed. Both conflicts occur because they are afraid that their hauls will be reduced because they are afraid that their hauls will be reduced because there are other fishermen who use more modern technology. Fourth, is the increase in the number of fishing populations in an area either because of transmigration or the movement of fishing grounds, this can result in the end of fisheries resources in the region (Muawanah, Pomeroy, & Marlessy, 2012)

Following are some case studies of fishery conflicts that occur among fishermen in Indonesia:

1. Traditional fishermen in Bogo Village who are in conflict with Pajeko (modern) fishermen who often come to coastal areas where this area is a traditional fishing area where fishermen in Borgo Village fish (Zalukhu, A. Manoppo, V. Andaki, 2017).
2. Fisherman conflict in Probolinggo in 1998, between Kalibuntu fishermen and Gili Ketapang fishermen in this case the fishermen of Gili Ketapang belong to the modern class fishermen by using Trawl fishing gear and fish in traditional fishing areas that cause the decline of yields of Kalibuntu fishermen. Then the fishermen class conflict that occurred in Pekalongan, because of the presence of fishermen using trawl boats harming traditional fishermen's fishing in Pekalongan.
3. The Lekok fishermen in Pasuruan Regency who use mini trawlers catch fish in the relatively traditional fishing area of Madurese fishermen, leading to the seizure of fishing ground and violence. The main reason for the seizure of the fishing ground was because of the limited fishing ground which made the fishermen claim unilaterally the area of their fishing without being based on a clear scientific and legal basis with regard to latitude and longitude (Triadiyatma, 2016).
4. In Balikpapan conflicts between fishermen who use nets (nets) and boat lift nets, where fishermen boat lift nets fish near FADs so that they are detrimental to the yield of the net fishermen hauls (Kinseng, 2007)
5. The conflict between fishermen in Moro District, Karimun Regency, this conflict occurred between traditional fishermen from Kampung Benteng and semi-modern fishermen from Durai District. This conflict occurred due to the presence of fishermen who were fishing in the area claimed to be the traditional fishing grounds of Kampung Benteng between 0-2 miles from the coastline. In addition, in terms of law enforcement from the authorities (Polairud and TNI AL) did not supervise the boundaries of the fishing area in the waters of the Moro Subdistrict which was stipulated based on Ministry of Maritime and Fishery Regulation Number 2 of 2011 (Ministry of Maritime Affairs and Fisheries Regulation, 2011) which regulated fishing routes (Maulana, 2016).

From a number of case studies on fisherman conflicts above, the average conflict resolution only ends in mediation and deliberation led by local leaders or government representatives, where the resolution of the conflict is only for a short period of time, but not for the long term, meaning conflicts that have been resolved will potentially occur again. Conflict resolution such as mediation and deliberation only leads to compensation if it causes casualties and mutual agreement for the future, an agreement like this is weak in the eyes of the law. Some of the above case studies if analyzed further about the background of the occurrence of conflict other than due to economic factors and the social gap between traditional and modern

fishermen, it is due to the seizure of fishing grounds.

Utilization of Hydrographic Data in The Context of Fisheries Ports

The fishing ports has different requirements and needs from other commercial ports (passenger port, cargo port, crossing port, etc). Fishing port is regulated in the Ministry of Maritime Affairs and Fisheries Regulation Number 8 of 2012 (Ministry of Maritime Affairs and Fisheries Regulation, 2012), in this Ministry Regulation which is referred to as fishing ports is

> "Places consisting of land and surrounding waters with certain limits as a place of government activities and fisheries business system activities that are used as a place to harbor fishing boats, anchoring, and / or loading and unloading of fish equipped with shipping safety facilities and fisheries support activities."

In the Ministry of Maritime Affairs and Fisheries Regulation Number 8 of 2012 (Ministry of Maritime Affairs and Fisheries Regulation, 2012) also explains that in Indonesia there are four types of fishing ports namely class A fishing ports or so-called Ocean Fisheries Ports (PPS), class B fishing ports or so-called Nusantara Fisheries Ports (PPN), class C fishing ports or Coastal ports (PPP), and class D fishing port or called Fish Landing Base (PPI). Each fishery port is distinguished from its technical and operational criteria. At present there are 538 fishing ports operating and spread throughout Indonesia (PIPP, 2018).

Fisheries port is one of the accesses for fishermen to simplify the fishery business both in managing permits and the business of selling the hauls. Some of the functions of fishery ports include fishing grounds and loading and unloading of fishery products, places for maintenance and repair of fishing vessels, and places for marketing and distribution of fish. Fishery ports are also the same as public ports that require facilities to support their operations. According to Lubis (Lubis E, 2006) fishing port facilities consist of basic, functional and additional facilities. The basic facilities include pier, navigation aids, and breakwaters, and shipping lines. Then functional facilities consist of Fish Marketing Sites (TPI), offices, fishing boat maintenance sites, cold storage, communication facilities. Finally, additional facilities such as polyclinics, canteens, fishermen's meeting halls, and guard posts.

Similar to ports in general, to make a fishing port, of course, a hydrographic survey is needed to support the development of fishing ports and determine the right location and suitable for fishing ports based on the type. The following are some of the required data that must be obtained through hydrographic surveys to determine the suitability of the location and manufacture of fishing ports:

1. Construction of Wharves and Anchorage

   The anchoring facilities and the length of the pier of each type of fishing port have different criteria. Based on the Ministry of Maritime Affairs and Fishery Regulation Number 8 of 2012 (Ministry of Maritime Affairs and Fisheries Regulation, 2012) For type A fishing ports must have anchorage for fishing vessels of at least 60 Gross Tonnage (GT), type B of at least 30 GT, type C of at least 10 GT, and type D of at least 5 GT . Then for the specifications of the pier length for type A fishing ports of at least 300 meters, type B is at least 150 meters, type C is at least 100 meters, and type D is at least 100 meters.

   To determine the location of anchorage and the dock according to the requirements of the type of fishing port a hydrographic survey is needed regarding the depth of the waters, tides, and winds in that location. Where each ship hull based on the Gross Tonnage (GT) size has a different buoyancy specification,

so that when the vessel is anchored, the depth of the sea must be higher than the hull that is submerged in water both when low tide and high tide. In addition, the thing that must be considered is wind, because wind creates horizontal forces that must be faced by port construction. Then the wind direction that blows, as it blows towards the ship's body will cause a force to the dock and if the wind blows away the dock will produce the force of the ship's pull against the ship's anchor, this will certainly affect the durability of the dock and ship fastener (Deo, 2007).

2. Determination of Shipping lane
   The ability of fishing ports to accommodate the entry of fishing vessels into ports is differentiated according to the type of fishing port. Based on the Ministry of Maritime Affairs and Fishery Regulation Number. 8 of 2012 For type A fishing ports must be able to accommodate at least 100 fishing vessels or a total of at least 6000 GT, type B of at least 75 fishing vessels or a total of 2250 GT, type C of at least 30 vessels fisheries or a total of at least 300 GT, and type D of at least 15 fishing vessels or a total of at least 75 GT

   In the determination of shipping lanes it takes a measurement of the current that functions for navigation safety and ship control (maneuvering) towards the port and is anchored to the pier to carry out loading and unloading of fishery products. In addition, data on the depth of water that is based on the frequency of fishing vessels that will enter the fishing port is also needed, especially for fishing vessels that have a large GT must portwhen the tide is high while for small vessels may port at any time. (Deo, 2007)

3. Fishery Port Breakwater Infrastructure (*breakwater*)
   The breakwater serves to "neutralize" the waves that hits the port area to make it easier for ships to port and anchor to the dock. Besides that it also functions to control and slow down the rate of abrasion. To determine the location and construction of breakwater structures, data on wind, tides and water waves are needed. Tidal data is needed to determine the water level elevation during high tide and low tide to determine the breakwater construction. Then the data about the wind, because the wind will affect the ocean waves, where sea waves create a force that must be borne by breakwaters to hold the construction of port buildings

The role of Pushidrosal in fishery management

One of the institutions or authorities in charge of dealing with hydrography in Indonesia is the Navy's Oceanographic Hydro Center (Pushidrosal) which is the main command of the Navy training based on Presidential Regulation 62 of 2016 article 134 A has the task of organizing hydro oceanographic guidance which includes surveys, research, marine mapping, publication, application of the marine environment, and safety of shipping navigation both for the benefit of the TNI and for the public interest, and preparing data and information on defense areas in the sea in order to support the main tasks of the Indonesian Navy. One of the functions of carrying out the tasks of Pushidrosal is the application of the marine environment where Pushidrosal provides hydro data to support national development in maritime sector. In this paper, the national development in maritime sector is carried out is the sustainability of fishery resources, in accordance with one of the pillars of the vision of the Ministry of Maritime Affairs and Fisheries to make the sea the future of the nation. Sustainability of fishery resources is the management and utilization of resources by prioritizing environmentally friendly principles that ensure the sustainability of fishery resources, which will lead to an increase in

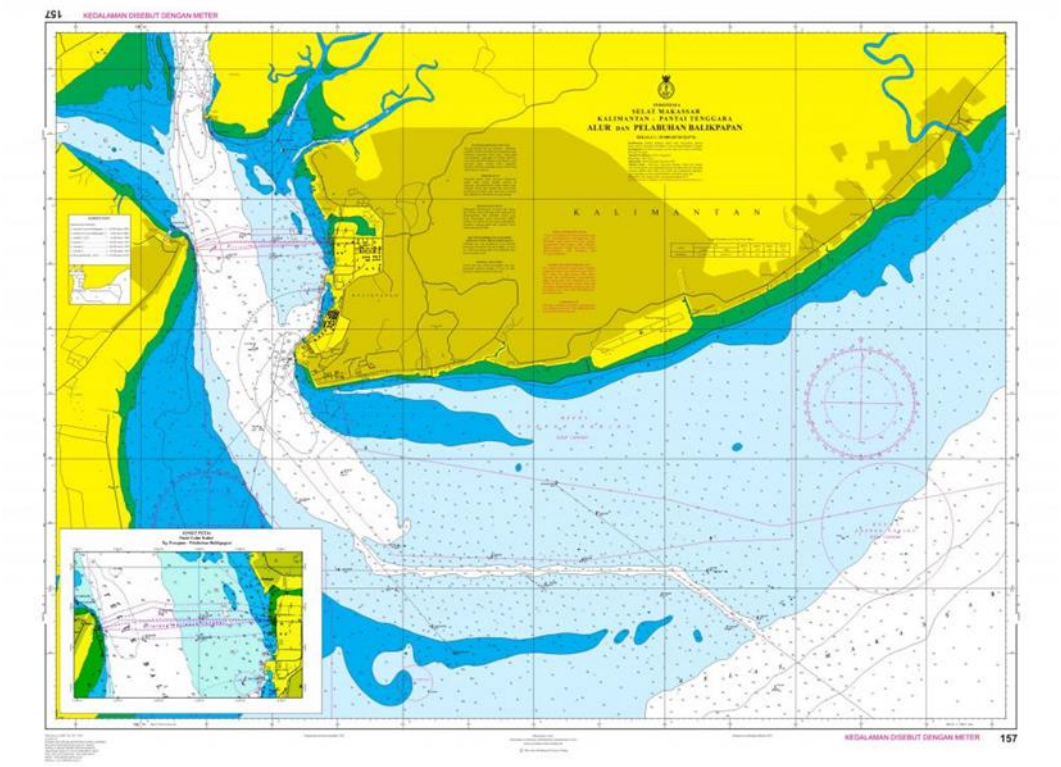

Figure 1. Sea Mapping (*source*: Pushidrosal.id, 2018)

the economic value of marine users, especially fishermen.

In accordance with the spirit of development of the Indonesian Maritime, Pushidrosal has an important role to be involved in, especially in the field of fisheries. Because so far Pushidrosal has only been seen as an organization within the Indonesian Navy which functions to chart sea maps (Figure 1). Though more than that, Pushidrosal has the ability to be able to participate in general maritime development not only in terms of defense and security. Quoted from the official website of Pushidrosal that "*In order to fulfill the demands of the task and along with the government's policy to make the maritime sector one of the national development priorities, the contribution of the hydro – oceanographic sector carried out by the Navy's Dishidro is demanded to be furthered improved*." Therefore, this institution previously had the name of the Hydro-Oceanographic Service of the Indonesian Navy (Dishidros) which changed to Navy's Hydro and Oceanographic Centre (Pushidrosal) based on Presidential Regulation Number 62 of 2016 (President Regulation, 2016). This name change is not merely a formality, but it shows the sincerity of Pushidrosal to improve its ability in the field of hydrography and its usefulness for national development in the maritime field.

Pushidrosal ability in hydro-oceanography is without a doubt. It is even supported by highly sophisticated research vessels, namely KRI Rigel 933 and KRI Spica 934, even some parties claim that this research vessel is the most sophisticated research vessel not only in Indonesia but also in the world, including the Menristek Dikti which states that KRI Rigel 933 is one of the most sophisticated research vessels in the world (sindonews.com, 2018).

As mentioned, one of the functions of implementation of the tasks of Pushidrosal is the application of marine environment where Pushidrosal provides hydro data to support national development in maritime sector, in this case the development of the fisheries sector. Thus, it is very possible for

Pushidrosal to collaborate with the Ministry of Maritime Affairs and Fisheries to assist and support hydrographic data related to realizing sustainable fisheries as a manifestation of the implementation of synergy in realizing the marine economy. Especially in the installation of FADs, construction of fishing ports, and preventing fishery conflicts.

Certainly, the collaboration between Pushidrosal and MOMAF will be very supportive in improving the economy of fishermen if the installation of FADs is carried out in the right water area with accurate hydro-oceanographic data, so that in the future FADs will no longer be a threat. So far, many problems have arisen because of the massive illegal FADs installed by not complying with existing regulations, namely Ministry of Maritime Affair and Fishery Regulation Number 26 of 2014 (Ministry of Maritime Affairs and Fisheries Regulation, 2014). This happened because of the weak data collection of FADs licensing and supervision and distribution of installation of FADs in Indonesian waters (Satrioajie, W, 2017). If it continues to be allowed, FADs that were able to improve the fishermen's economy will turn out to be a source of overfishing in Indonesian waters.

According to Charles (Charles, 1992) there are four types of conflicts that occur in the field of fisheries, namely fishery jurisdiction, management mechanisms, internal allocation, and external allocation. But basically almost every fisherman conflicts that occur in Indonesia are included in fishery jurisdiction because the determination of the boundaries of fishing grounds with traditional and modern tools is the responsibility of the government. The failure of the government in managing and implementing policies in this case the determination of the boundaries of fishing grounds is a factor in the occurrence of fisherman conflicts. So it is appropriate to prevent fishermen conflicts from occurring. Cooperation between the government and local stakeholders must be made (Bennett et al., 2001).

In this case the hydrographic approach is needed by the Indonesian Navy in this case Pushidrosal which can play a role in resolving conflicts between fishermen, particularly conflicts over claim of good fishing grounds but different regions and fishing gear that differ between modern and traditional fishing gear. This approach is the charting of special sea maps with clear coordinate points to show the boundaries of fishing areas in areas that often occur in conflict. So far the Ministry Maritime Affairs and Fisheries Regulation Number 2 of 2011 (Ministry of Maritime Affairs and Fisheries Regulation, 2011) which regulates fishing routes for traditional, semi-modern, and modern fishing gear only regulates the issue of the authority of fishing areas such as traditional fishing boats with a distance of 0-4 miles, semi-modern 4 -12 miles, and modern over 12 miles. However, there is no clarity of the coordinates so that fishermen who catch fish in conflict areas of fisheries can freely claim and acquire sea plots according to the estimated distance.

In making these special sea maps, the Indonesian Navy represented by Pushidrosal must work with local stakeholders both local government, community leaders and representatives of fishermen in conflict. Such cooperation will reduce the source of conflict and increase community compliance with regulations, this is also a manifestation of co-management where the government and the community can share authority and obligations (Pomeroy et al., 2007).

CONCLUSION AND RECOMMENDATION

The conclusion of this paper is, first Pushidrosal can collaborate with the Ministry of Maritime Affairs and Fisheries by providing hydro data needed to support sustainable fisheries management, this is a function of the task implementation of Pushidrosal in implementing the marine environment where Pushidrosal provides

hydro data to support national development in the maritime sector. Second, the key role of hydrographi is in the installation FADs, where effective and efficient FADs are determined from the place where FADs are installed. Some criteria for installing FADs are taking into account the water depth, FAD distance, sea floor contour, free of shipping lanes, and oceanographic parameters (brightness, temperature, current and wave) where hydrographic surveys are needed to obtain these data. Third, the role of hydrography in resolving fishery conflicts is by charting special sea maps with clear coordinates to show the boundaries of fishing ground in areas that conflicts often occurs, because so far, the resolution of fishermen's conflicts has only led to mediation and it is probable that conflicts will occur again. Fourth, the role of hydrography in determining a location for the development of appropriate and proper fishing ports through hydrographic surveys, this survey is needed to determine the making of docks and anchoring of fishing vessels, shipping lines, and fishing port breakwater structures.

REFERENCES

Ayunda, N., Sapota, M. R., & Pawelec, A. (2018). The Impact of Small-Scale Fisheries Activities Toward Fisheries Sustainability in Indonesia. In *Interdisciplinary Approaches for Sustainable Development Goals* (I. S. Tymo, pp. 147–167). Springer International Publishing.

Bennett, E., Neiland, A., Anang, E., Bannerman, P., Atiq Rahman, A., Huq, S., … Clerveaux, W. (2001). Towards a better understanding of conflict management in tropical fisheries: Evidence from Ghana, Bangladesh and the Carribean. *Marine Policy*. https://doi.org/10.1016/S0308-597X(01)00022-7

Castro, J. J., Santiago, J. A., & Santana-Ortega, A. T. (2001). A general theory on fish aggregation to floating objects: An alternative to the meeting point hypothesis. *Reviews in Fish Biology and Fisheries*. https://doi.org/10.1023/A:1020302414472

Charles, A. (1992). Fisheries Conflict : A Unified Framework. *Marine Policy*, 379–344.

Deo, P. (2007). Peranan Survei Hidrografi Untuk Perencanaan Lokasi Pembangunan Pelabuhan (The Role of the Hydrographic Survey for Port Development Site Planning). *Spectra Journal*, *5*(10).

Djunarsah, E. dan P. (2005). *Survei Hidrografi (Hydrography Survey)*. Bandung: Refika Aditama.

Hikmah, N. Kurnia, M. Amir, F. (2016). Pemanfaatan Teknologi Alat Bantu Rumpon untuk Penangkapan Ikan Di Perairan Kabupaten Jeneponto (Utilization of FADs Aid Technology for Fishing in Waters of Jeneponto Regency). *IPTEKS PSP*, *3*(6), 455 – 468.

Kinseng, R. (2007). *Kelas dan Konflik Kelas Pada Kaum Nelayan di Indonesia (Class and Class Conflict for Fishermen in Indonesia)*. University of Indonesia.

Lubis E. (2006). *Buku I Pengantar Pelabuhan Perikanan*. Bogor: Departemen Pemanfaatan Sumberdaya Perikanan, Fakultas Perikanan dan Ilmu Kelautan.

Maulana, R. (2016). *Konflik Kelas Nelayan Tradisional Kampung benteng Kecamatan Moro dan Nelayan Semi Modern*. University of Maritim Raja Ali Haji.

Menard F, Fanteneau A, Gartuer D, Nordstorm V, Stequert B, M. E. (2000). Exploitation of small tunas by purse-seine fishery with fish

aggregating device from accoustic surveys in french polynesia. *Aquat Living Resour*, (13), 183–192.

Ministry of Maritime Affairs and Fisheries Regulation. concerning Fishing Lane And Placement Of Fishing Equipment And Fishing Supporting Gear In The Fisheries Management Areas Of The Republic Of Indonesia, Pub. L. No. 2 (2011). Indonesia.

Ministry of Maritime Affairs and Fisheries Regulation. Concerning Fishing Ports, Pub. L. No. 8 (2012). Indonesia.

Ministry of Maritime Affairs and Fisheries Regulation. concerning FAD, Pub. L. No. 26 (2014). Indonesia.

Muawanah, U., Pomeroy, R. S., & Marlessy, C. (2012). Revisiting fish wars: Conflict and collaboration over fisheries in Indonesia. *Coastal Management*. https://doi.org/10.1080/08920753.2012.677633

Nurdin, E. (2011). *Teknologi dan Manajemen Perikanan Tuna Berbasis Rumpon Yang Berkelanjutan di Prigi Jawa Timur (Sustainable Tuna Fishery Technology and Management Based on FAD in East Prigi)*. Bogor Agricultural Institute.

Nurdin, E. (2017). *Rumpon Sebagai Alat Pengelola Perikanan Tuna Berkelanjutan (FADs as a Tool for Sustainable Tuna Fisheries Management)*. Bogor Agricultural Institute.

Pomeroy, R., Parks, J., Pollnac, R., Campson, T., Genio, E., Marlessy, C., … Thu Hue, N. (2007). Fish wars: Conflict and collaboration in fisheries management in Southeast Asia. *Marine Policy*. https://doi.org/10.1016/j.marpol.2007.03.012

President Regulation. Concerning Organizational Structure of the Indonesian National Army, Pub. L. No. 62 (2016). Indoneisa.

Pushidrosal.id. (2018). Layaknya Makhluk Hidup Peta Laut Itu Hidup (Just like Living Creatures The Sea Map Is Alive). Retrieved November 16, 2018, from Pushidrosal.id

Rajeswari. G. (2009). Fish Aggregating Devices. In *Handbook of Fishing Technology* (p. 338).

Satria, A. (2015). *Introduction to Coastal Society Sociology*. Jakarta: Faculty of Human Ecology and Indonesian Torch Foundation.

Satrioajie, W, N. (2017). "Dilema Penggunaan Rumpon : Kepentingan Ekonomi Versus Konservasi Tuna" (The Dilemma of Using FADs: Economic Interest Versus Tuna Conservation). Retrieved from http://theconversation.com/dilema-penggunaan-rumpon-kepentingan-ekonomi-versus-konservasi-tuna-82719

sindonews.com. (2018). Menristek Bangga RI Punya Kapal Riset (Ministry of Research, Technology, and Education Is Proud That The Republic Indonesia Owns A Research Vessel). Retrieved November 16, 2018, from sindonews.com

Subani, W dan Barus, H. (1988). Alat Penangkapan Ikan dan Udang Laut di Indonesia (Sea Shrimp and Fishing Equipment in Indonesia). *Marine Fisheries Research*, (50), 248.

Triadiyatma, A. (2016). *Model Penyelesaian Konflik Nelayan Berbasis Kearifan Lokal Sebagai Modal Sosial Di Kecamatan Lekok Kabupaten Pasuruan (Local Wisdom Based Fisherman Conflict Resolution Model As Social Capital In Lekok District, Pasuruan Regency)*. University of Airlangga.

Zalukhu, A. Manoppo, V. Andaki, J. (2017). Fishermen Conflict Analysis

In Utilizing Fishery Resources in Borgo Village, Tombariri District, Minahasa Region. *Acculturation Journal*, *5*(9), 717–725.