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ARTICLE

# Comparative Analysis of Three Types of Fishing Gear Marking for Anchored Fish Aggregating Devices in Purse Seine Fishery in Thai Waters

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ABSTRACT

Anchored fish aggregating devices (AFADs) have been widely used for fishing in Thai waters. However, abandoned, lost, and discarded fishing gears (ALDFGs), including lost AFADs, may cause environmental impacts. Fishing gear marking (FGM) is considered as a tool to help identification of ALDFGs. The main objective of this study is to compare the durability represented by the percentage of remaining condition (R-value) of three material types of FGM applied for AFADs, *i.e.*, stainless steel (SS), colored acrylic (CA), and polypropylene (PP). This study was carried out using 50 AFADs deployed in the Gulf of Thailand (GOT) and the Andaman Sea (ANS) between July and October 2020 in cooperation with 10 fishers. The AFADs were deployed in similar habitat (bottom depth and type) between the GOT and the ANS. The three material types of FGM were assumed to be sufficiently durable to last for the lifespan of the AFADs in both the GOT and the ANS (within 2 months and 3.5 months, respectively) though some FGMs in the ANS were detached from cable ties or broken before AFADs were lost. The loss of AFADs and FGMs was mainly caused by adverse weather condition (rough sea). Only data from the ANS was included in comparative analysis due to the insufficient variance data obtained from the GOT. The analysis revealed that SS had the higher durability than CA and PP when the AFADs lasted for less than 3.5 months. As a result of our study, some recommendations were made. For example, the cable ties can be replaced by ropes or threads to improve the installation method. This study serves as a basis to develop FGM and to support responsible fisheries. Beneficiaries of the study include fisheries policy makers, managers, and fishers.

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## 1. Introduction

Purse seine fishery shares a great portion of the world's total catch from marine capture fisheries targeting pelagic fish resources, *e.g.*, tunas, mackerels, sardines, and anchovies [1]. Instead of searching fish schools, fish aggregating device (FAD) has been used by fishers to attract pelagic fish resources in purse seine fishery for several decades [2,3]. FAD can be categorized into two main types; namely, drift FAD (DFAD) and anchored FAD (AFAD). In the main oceans (*i.e.*, Atlantic, Indian, and Pacific Oceans), DFADs are principally deployed in the open seas or oceans, while AFADs are deployed in both inshore and offshore areas [4].

There are many types of AFADs deployed in the three main oceans [5], and the main structures are anchor (weight or sinker), anchor (mooring) line or rope, and float [5-7]. AFADs often have mid-water aggregators attached to the float or the upper mooring line; moreover, the aggregators are frequently made of rope, fishing net, plastic strapping, plastic mesh, or mussel rope [6] as well as fiber-reinforced plastic or coconut/palm fronds [5]. AFADs with only a small float as a position marker but without any tracking device are difficult to detect at sea [8]. Fishers sometimes attach light, steel buoy, and radar reflector on AFADs to locate the position [5-7]; in addition, electronic devices (*e.g.*, satellite buoy) has been recommended to attach on AFADs to enhance fishing operations, but its implementation has low feasibility for small-scale fisheries due to its cost [6].

As benefit of AFADs for fishers, the attraction of pelagic fish resources continued when AFADs remained in the sea without being lost for a sufficient time period [6]. The lifespan of an AFAD varied by areas from few to several months depending on their designs, materials, maintenance, and environmental factors. For example, AFADs usually lasted for two months or less in Indonesia [9], 3-5 months in Thailand [10], 1-33 months in Vanuatu, 4-12 months in Martinique, and up to 65 months in La Reunion [6]. The loss of AFADs was common and fishers regularly replaced AFADs in the fishing ground. Moreover, lost AFAD is one of the several types of abandoned, lost, and discarded fishing gear (ALDFG) which is the major component of sea-based marine litter [11]. The loss of AFADs occurred when the structures are deconstructed from the anchor parts. Floats with/without mooring line and mid-water aggregators are assumed to have a similar function to lost DFADs with a wide range of environmental impacts from beaching [11-13], such as contact with marine habitats (*e.g.*, coral reefs) and entanglement of marine animals (*e.g.*, bony fishes, sharks, and turtles).

The Sustainable Development Goals (SDGs) has been established by the United Nations (UN), and its $14^{th}$ goal (SDG 14) or the "Life below water" is to conserve and sustainably use the oceans, seas, and marine resources for sustainable development, including the preventing and reducing marine pollution, the sustainably managing and protecting marine ecosystems, and enhancing conservation and sustainable use of marine resources [15]. The Code of Conduct for Responsible Fisheries of the Food and Agriculture Organization of the United Nations (FAO) [16] mentioned the fishing gear marking (FGM) as a measure for identifying the ownership of fishing gears, which supports the SDG 14 to address ALDFG. For Thailand fisheries, FGM has been mandated to commercial fishers operating outside Thai waters [17] but has not been applied to the fisheries in the Thailand's EEZ. The FAO has also developed the Voluntary Guidelines on the Marking of Fishing Gear (VGMFG) as a tool for combatting, minimizing, and eliminating ALDFGs and for facilitating the identification and recovery of such gears [18]. The FAO [19] also recommended several types of FGM, for example, coded wire tag, electronic tag, barcode tag, metal or steel tag, band tag, marker tape, and rogue yarn. Aside from identifying the ownership of fishing gear, the benefits of FGM include providing information on the origin of fishing gear entangled on marine animals and indicating the position to reduce gear conflicts and improve safety at sea [20].

For the application of FGM in some fisheries, plastic tags were found effective from the pilot study with small-scale gillnet fishers in Java, Indonesia [21]; plastic bottles and polyurethane foam sheets with coding were used by artisanal gillnet fishers in Kerala, India [22]; stainless steel clamps were applied by Thai trawlers operated in the area of the Southern Indian Ocean Fisheries Agreement [23]. Furthermore, the use of unique identification code was suggested to provide the encrypted information on the FGM that can be read by a machine [22]. In DFAD fishery, tuna purse seiners in the Indian Ocean put identification codes as physical marks on the surface of their satellite buoys for ownership; besides, tuna purse seine fishers suggested that the physical mark should be sufficiently durable to last for the lifespan of a DFAD [24]. However, there is a lack of information on the application of FGM for AFADs.

As AFADs are similar to other static gears, this study focused on the suitable materials for FGM to identify the ownership, which was still needed to develop FGM for AFADs in the purse seine fishery. The main objective of this study was to compare the durability of three material types of FGM applied for AFADs in purse seine fishery in Thai waters. This study is expected to serve as basis for developing the practice of FGM to address ALDFG and support responsible fisheries; moreover, it would benefit fisheries policy makers, managers, and fishers.

## 2. Materials and Methods

### 2.1 Study Area

The exclusive economic zone (EEZ) of Thailand covers 420,280 km$^2$ (304,000 km$^2$ in the Gulf of Thailand (GOT) and 116,280 km$^2$ in the Andaman Sea (ANS)) [25]. This study was carried out in two fishing grounds in Thai waters (*i.e.*, offshore areas of the GOT and the ANS) where AFADs were regularly deployed for purse seine fishery (Figure 1).


**Figure 1.** Study areas where anchored fish aggregating devices were deployed in the Gulf of Thailand and the Andaman Sea

### 2.2 Anchored Fish Aggregating Devices (AFADs)

Fishers deployed AFADs for purse seine fishing operations to capture associated schools of pelagic fishes. The AFADs were anchored in the fishing grounds with the distance of at least 1 nm between AFADs as the regulation of the Department of Fisheries (DOF), Thailand [26]. The structure of AFADs in this study was similar between the GOT and the ANS which were constructed using concrete blocks as the anchor, rope as the mooring line, coconut fronds as the aggregator, and Styrofoam blocks as the float (Figure 2). In this study, 10 voluntary fishers represented the experimental units or cases (five in the GOT and five in the ANS) were recruited, and 50 AFADs (five AFADs or replications for each fisher) were used in our experiment.

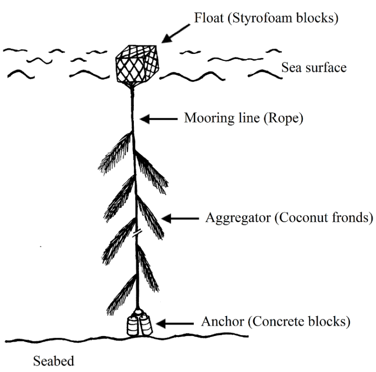


**Figure 2.** Typical anchored fish aggregating devices deployed by fishers in purse seine fishery in the Gulf of Thailand and the Andaman Sea

### 2.3 Fishing Gear Marking (FGM)

We adopted the physical tag with coding which was one of the marking technologies for FGM [20] for the identification of origin and ownership of AFADs. The physical tags used in our experiment were made of three material types, including stainless steel (SS), colored acrylic (CA), and polypropylene (PP) (Figure 3). SS and CA were 30 mm wide and 60 mm long, while PP was 210 mm wide and 297 mm long. The physical tags had holes of 5 mm diameter. Moreover, each physical tag was labeled with 10 alphanumeric code with the first seven characters as simulation of the fishing vessel marking in Thailand [26,27] and the last three characters as the order of FGM. The code was 6 mm high for SS and CA, and 20 mm high for PP. For each AFAD, we prepared one set of FGM consisted of one piece (unit) of each material type, which was attached to the rope using cable ties and installed on the float of an AFAD. For 50 AFADs, we installed 50 sets of FGM in combination of the three material types.

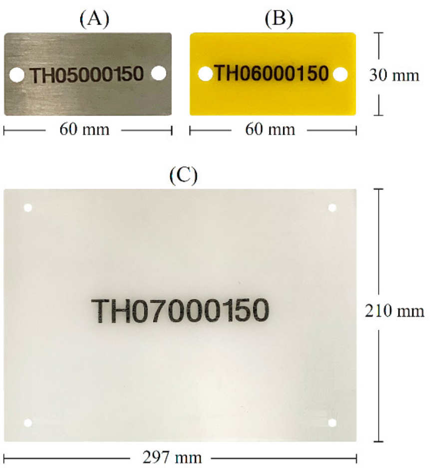


**Figure 3.** Three material types of fishing gear marking (stainless steel (A), colored acrylic (B), and polypropylene (C)) labeled with alphanumeric code

### 2.4 Data Collection

The participation of stakeholders, particularly fishers has been considered as an important mechanism in marine fisheries management [29]. The data were collected in cooperation with the 10 fishers who closely observed the FGMs installed on their AFADs between July and October 2020. We interviewed each fisher and collected information on their fishing vessel and AFADs structures as well as the information on their fishing ground such as bottom depth and type in areas where the AFADs were deployed. Each fisher was also inquired about the remaining condition of each unit of FGM via field surveys and telephone calls. The remaining condition of each unit of FGM for four categories: FGM was broken or lost; all characters were removed, some characters were remained, and all characters were remained. The FGMs were monitored and recorded the remaining condition after installation at five different times at 0.5 month, 1.0 month, 1.5 months, 2.5 months, and 3.5 months (or shorter if all FGMs were broken or lost). For the FGM broken or lost, the information on its cause was also inquired from the fishers.

In addition, the information on the characteristics of particular fishing vessels, including length overall or LOA (m), gross tonnage (GT), and engine power (kW) was acquired from the Marine Department (MD), Thailand [30] and the DOF, Thailand [31].

### 2.5 Data Analysis

For each unit of FGM installed on any AFAD, the value of remaining condition for material type $i$ ($C_i$) was given, *i.e.*, 0 (zero) for FGM broken or lost, 1 (one) for all characters removed, 2 (two) for some characters removed, and 3 (three) for all characters remained. In the other words, $C$-value was between zero and three. The percentage of remaining condition (%) for each material type of FGM installed on AFADs deployed by each fisher each time was calculated using Equation 1;

$$R_i = \left(\sum_{j=1}^{n}\left[\left(C_{ij}/3\right) \times 100\right]\right) \Big/ n_i \qquad (1)$$

Where $R_i$ is the percentage of remaining condition for material type $i$ of FGM used by a fisher; $C_{ij}$ is the value of remaining condition for material type $i$ of FGM installed on the $j^{th}$ AFAD; $n_i$ is the total number of AFADs with material type $i$ of FGM; and $j$ is the $1^{st}$, $2^{nd}$, $3^{rd}$, … , $n^{th}$ AFAD with material type $i$ of FGM. Due to five AFADs applied for each fisher in this study, $n_i$ was equal to five, and $j$-value was between 1 and 5.

In the cases of FGM broken or lost, the percentage of each cause for material type $i$ or $L_i$ (%) was calculated for each fishing ground at the end of our experiment using Equation 2;

$$L_i = \left({M_i}/{n_i}\right) \times 100 \qquad (2)$$

Where $M_i$ is the number of FGM made of material type $i$ lost by the particular cause; and $n_i$ is the number of AFADs with material type $i$ of FGM.

For statistical analyses, only data obtained from fishers in the ANS were utilized because of insufficient variance data obtained from the GOT. There were five experiment units (cases) represented by five fishers (fishing vessels) in the ANS. The material types of FGM and times were defined as the independent variables, and the $R$-value was set as the dependent variable. To avoid the $R$-value of 0% for all cases of each material type observed at the same time, the only four consecutive times between 0.5 month and 2.5 months were included in the analyses. The $R$-value distribution seemed like a binomial rather than a normal, because the characteristics of data distribution were mostly in small percentages (0% to 30%) or large percentage (70% to 100%). To have the data distribution nearly normal, the data of $R$-value (0% to 100%) was transformed prior to analyses using the angular transformation to $\arcsin[(R/100)^{1/2}]$ which gave the transformed $R$-value ($R'$) from zero to 1.5708. The comparative analysis among the three material types and the four consecutive times on the value of $R'$ were performed by the Two-way Repeated Measures Analysis of Variance (Two-way RMANOVA) followed by the Least Significant Difference (LSD) for the post-hoc test. In addition, the Mauchly's ($W$) test was also performed to examine the sphericity assumption. The SPSS Statistics for Windows, version 15.0 (SPSS Inc., Chicago, Ill., USA) was used, and the significant level (α) of 0.05 was applied for all statistical analyses.

## 3. Results and Discussion

### 3.1 Characteristics of Fishing Vessels

The characteristics of 10 fishing vessels in this study are shown in Table 1. The Vessels A-E operated in the GOT and the Vessels F-J operated in the ANS. The 10 fishing vessels had the LOA ranging from 17.4 m to 29.5 m; gross tonnage between 41.12 GT and 234.85 GT; and main engine power of 92-473 kW. These fishing vessels were used to regularly observe AFADs and monitor fish schools in the vicinity of AFADs for purse seine operations. Therefore, the fishers were able to closely observe the remaining condition of each unit of FGM installed on AFADs.

From interview, the bottom depth of deployed AFADs in each fishing ground was 35-60 m in the GOT and 50-80 m in the ANS; moreover, the bottom type was muddy sand for the both fishing grounds. The fishers in each fishing ground also responded that the purse seiners performed AFADs operations about 24 fishing days per month in the GOT, while it was about 22 fishing days per month in the ANS.

Regarding Thai standard for commercial fishing vessels [27], the 10 fishing vessels were categorized in medium size (30.00 GT to 59.99 GT), large size (60.00 GT to 149.99 GT), and extra-large size (150.00 GT and above). The size composition of these fishing vessels reflected the size composition of purse seiners in Thai waters acquired from the licensing system [31] where most (about 70%) of purse seiners was large size, followed by medium size (20%) and extra-large size (6%). From our results, we assumed that the AFADs deployed by fishers in this study were in similar habitat or condition between the two fishing grounds (the GOT and the ANS).

## 3.2. Remaining Condition of Fishing Gear Marking

From the observation of FGMs installed on AFADs in cooperation with fishers, we found that most FGMs were lost together with the float of AFADs, while some FGMs was lost or broken before the loss of AFADs (Figure 4). Figure 5 shows the trend lines of average *R*-value in both the GOT and the ANS along the different times (from 0.0 month to 3.5 months) for the three material types of FGM applied for AFADs. The durability of the three material types of FGM installed on AFADs was less than 3.5 months. In the GOT, the three material types of FGM had the same trend lines of average *R*-value along the different times. After the initial installation of the FGMs on AFADs, the average *R*-value was 100% for the three material types of FGM at 0.5 month and 1.0 month. The average *R*-value decreased to 0% for all material types of FGM at 1.5 months. In the ANS, the three material types of FGM had the similar trend lines of average *R*-value along the different times though the average *R*-value of FGM made of SS appeared to be in higher value than CA and PP between 0.5 month and 2.5 months. After the initial installation of the FGMs on AFADs, the average *R*-value decreased to about 90%, 80%, and 70% for SS, CA, and PP, respectively between 0.5 month and 1.0 months; the average *R*-value continually decreased to about 80%, 60%, and 50% for SS, CA, and PP, respectively at 1.5 months; the average *R*-value was about 20% for SS and CA, while it was about 10% for PP at 2.5 months; and the rest of FGM was already lost at 3.5 months.

For the FGM broken or lost, the interviewed fishers indicated that the causes include adverse weather condition (*i.e.*, rough sea) and fishing gear conflicts (*i.e.*, bottom trawls) (Table 2). From our interviews, the fishers in the GOT responded that the major cause for the loss of FGM was due to rough sea which resulted in AFADs lost or float removal between 1.0 month and 1.5 months. It should be noted that the towing of a bottom trawl in the AFADs area was a minor threat and caused damage on one AFAD in this study. The fishers in the ANS specified that the only main threat to the loss of FGMs installed on their AFADs was the rough sea which damaged the FGMs

**Table 1.** Characteristics of 10 fishing vessels (Vessels A-J) in this study to observe fishing gear marking installed on anchored fish aggregating devices for purse seine fishery in Thai waters

| Fishing ground | Vessel | Length overall (m) | Gross tonnage (GT) | Size[1] | Engine power (kW) |
|---|---|---|---|---|---|
| Gulf of Thailand | A | 21.5 | 68.64 | L | 235 |
| | B | 21.0 | 59.38 | M | 92 |
| | C | 23.9 | 114.83 | L | 278 |
| | D | 21.1 | 69.95 | L | 278 |
| | E | 17.4 | 41.12 | M | 278 |
| Andaman Sea | F | 23.3 | 89.87 | L | 278 |
| | G | 23.8 | 83.35 | L | 178 |
| | H | 29.5 | 234.85 | X | 473 |
| | I | 24.0 | 136.41 | L | 444 |
| | J | 22.1 | 76.60 | L | 235 |

[1] Size categories of Thai standard for commercial fishing vessels (M: medium size or 30.00 GT to 59.99 GT; L: large size or 60.00 GT to 149.99 GT; X: extra-large size or 150.00 GT and above) [27]

and the AFADs. This was similar to the lost AFADs in the GOT caused by the same reason; consequently, most FGMs was lost together with AFADs, and some FGMs was detached from the cable ties or broken (*i.e.*, two units of CA) during the rough sea.

The results indicated that the life span of AFADs deployed in the GOT was less than in the ANS due to adverse weather condition which was the main cause of the loss of FGMs. Based on the results from the ANS, the average *R*-value of the three material types appeared to be different and needed to be compared to clarify the durability among the three material types.

The lifespan of deployed AFADs in this study was only a few months. This was similar to the other AFADs used in adjacent waters reported by Yusfiandayani *et al.* [9] and Boonjorn *et al.* [10]. The interviewed fishers mentioned that they regularly deployed new AFADs to replace the old ones to maintain their fishing operations. We assumed that the short lifespan of AFADs was mainly a result of deconstruction of the materials between float or mooring line and anchor due to environmental forces. To increase the lifespan of AFADs, the structure should be improved like the AFADs in La Reunion [6], Japan [7,32], and Maldives [33]; besides, maintenance is also needed for deployed AFADs for longer lifespan.

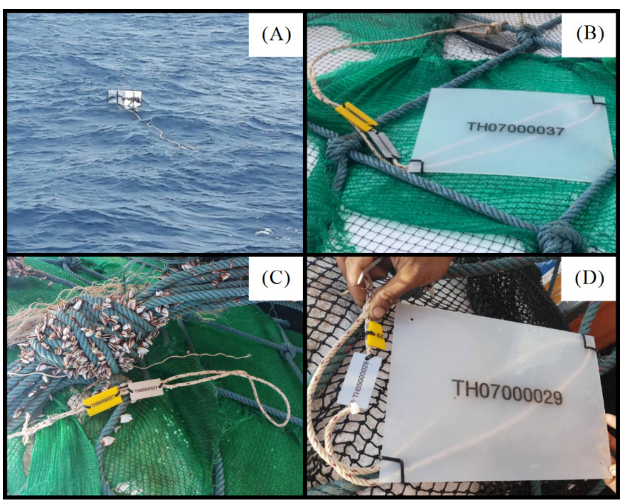


**Figure 4.** Observation of fishing gear marking (FGM) installed on anchored fish aggregating devices during the study in cooperation with fishers: float of an AFAD on the sea (A); three material types of FGM made of stainless steel or SS, colored acrylic or CA, and polypropylene or PP (B); remaining FGMs with lost PP (C); and remaining FGMs with broken CA and replacement of a cable tie on SS (D)

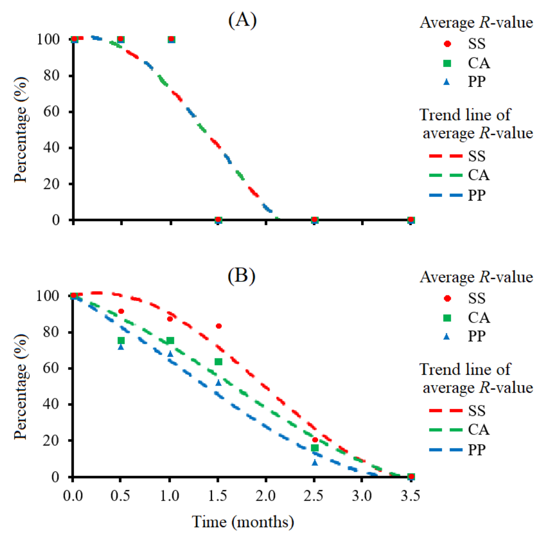


**Figure 5.** Average percentage of remaining condition (*R*, %) for three material types of fishing gear marking installed on anchored fish aggregating devices at different times (from 0.0 month to 3.5 months) in the Gulf of Thailand (A), and the Andaman Sea (B) (SS: stainless steel, CA: colored acrylic, PP: polypropylene)

**Table 2.** Causes of fishing gear marking (FGM) broken or lost (%) in the Gulf of Thailand and the Andaman Sea indicated by fishers who closely observed the FGMs installed on their anchored fish aggregating devices (SS: stainless steel, CA: colored acrylic, PP: polypropylene)

| Cause of FGM broken or lost | Gulf of Thailand ($n$ = 25) | | | Andaman Sea ($n$ = 25) | | |
|---|---|---|---|---|---|---|
| | SS | CA | PP | SS | CA | PP |
| Adverse weather condition | 96 | 96 | 96 | 100 | 100 | 100 |
| Fishing gear conflict | 4 | 4 | 4 | 0 | 0 | 0 |

## 3.3. Comparative Analysis on Percentage of Remaining Condition

Since the three material types were lost at the same time for each set of FGM installed on AFADs in the GOT, the variance data obtained from the GOT were insufficient for the comparative analysis. Consequently, only data obtained from the ANS were included in our comparative analysis for material types and times. The analysis results revealed that the Mauchly's test was not significant for both material types ($\chi^2_{(2)}$ = 1.653, $p$ = 0.438) and times ($\chi^2_{(5)}$ = 5.938, $p$ = 0.339); hence, the Mauchly's test did not show any violation of sphericity. For the Two-way RMANOVA results, Table 3 indicates that there was no interaction between material type and time ($F_{(6,24)}$ = 0.749, $p$ = 0.616); moreover, there were significant differences among the three material types of FGM ($F_{(2,8)}$ = 5.402, $p$ =

0.033) and among the four consecutive times ($F_{(3,12)}$ = 56.505, $p < 0.001$). Figure 6 shows the results of the post-hoc test for the three material types as well as the four consecutive times. For the three material types, SS had the higher $R'$ than CA ($p$ = 0.036) and PP ($p$ = 0.042). Besides, there was no significant difference ($p$ = 0.302) between CA and PP. For the four consecutive times, $R'$ at 0.5 month, 1.0 month, and 1.5 months, there were no significant differences among them ($p > 0.081$); however, $R'$ at the three times were higher than 2.5 months ($p < 0.002$). The results inferred that the percentage of remained FGM made of SS was higher than CA and PP, and the percentages of remained FGMs were not different from 0.5 month to 1.5 months but lowest at 2.5 months.

For the material types of FGM, the FAO [19] recommended several types of FGM to identity the ownership of AFADs, and we also adopted the steel tag as SS in this study; in addition, we applied plastic tag (*i.e.* CA) and plastic plate (*i.e.*, PP) to our study. Our results suggested that SS had the highest durability among the three material types of FGM. Due to the short lifespan of deployed AFADs in our study, almost all FGMs were lost together with the float of AFADs. We recommend that the improvement of AFADs lifespan is needed for enhancing the particular fishery, and the development of FGMs (*e.g.*, materials and installation) is also necessary for longer use along with the AFADs lifespan. To improve the installation method by using cable ties to install FGMs on the rope in our study, the ropes or threads should be considered instead of the cable ties. Furthermore, the production and effective cost of FGMs should be taken into consideration for adoptability for the implementation [23]. Also, the FGM system should be established, including registry and database, related measures, and retrieval program for lost AFADs. This is supported by the VGMFG of the FAO [18] to address ALDFGs and facilitate the identification and recovery of AFADs.

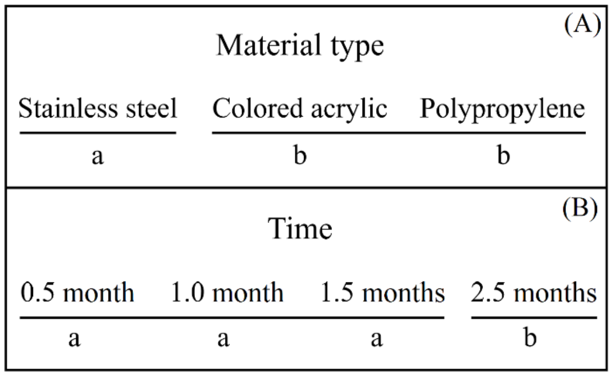


**Figure 6.** Post-hoc test on average percentage of remaining condition among three material types (A) and four consecutive times (B). Material types and times with same letter (a or b) under the same horizontal line were not significantly different.

## 4. Conclusions

Among the three material types, all FGMs used in the GOT were durable to last for the lifespan of deployed AFADs, while some FGMs used in the ANS were detached from the cable ties or broken before AFADs were lost. The loss of AFADs and FGMs was mainly caused by adverse weather condition. Therefore, the three material types of FGM were assumed to be sufficiently durable to last for the lifespan of the AFADs both in the GOT and the ANS within 2.0 months and 3.5 months, respectively. For the ANS, the comparative analysis suggested that SS had the higher durability than CA and PP when the AFADs lasted for less than 3.5 months. Besides, ropes or threads should be further considered instead of the cable ties. The FGM system is also required to support the implementation of FGMs. This study would benefit fisheries policy makers, managers, or fishers as a basis to develop FGM to address ALDFG and support responsible fisheries.

## Author Contributions

Watcharapong Chumchuen: Conceptualization, Methodology, Investigation, Validation, Formal analysis, Writing-original draft and Writing-review & Editing. Jirawut Kumpirod: Investigation, Validation, Writing-

**Table 3.** Summary of Two-way Repeated Measures Analysis of Variance from data of fishing gear marking installed on anchored fish aggregating devices in the Andaman Sea

| Source | Sum of Square | df | Mean Square | $F$-ratio | $p$-value | Partial $\eta^2$ |
|---|---|---|---|---|---|---|
| Material type | 0.993 | 2 | 0.496 | 5.402 | $0.033^{*}$ | 0.575 |
| Time | 7.572 | 3 | 2.524 | 56.505 | $< 0.001^{***}$ | 0.934 |
| Material type x Time | 0.097 | 6 | 0.016 | 0.749 | $0.616^{ns}$ | 0.158 |

$^{ns}$ $p > 0.05$ $^{*}$ $p < 0.05$ $^{***}$ $p < 0.001$

original draft. Sahaphat Duerasor: Investigation, Validation, Writing-original draft. Chanont Nualsri: Resources, Investigation. Thassanee Suppapruek: Resources, Investigation. Kraison Krueajun: Resources and Investigation. All authors have read and agreed to the published version of the manuscript.

## Conflict of Interest

Authors declare that there is no conflict of interest.

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