



## Assessing the Productivity of GPS Waypoints App in Purse Seine Fishing Among Rural Folks

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### ABSTRACT

This study will assess the productivity of GPS Waypoints App in purse seine fishing among fishermen of Brgy. Langgao, Cabucgayan, Biliran. The researchers utilized a quantitative approach to determine the productivity of GPS Waypoints App in purse seine fishing. Descriptive statistics is applied to analyze the data through tables to know the background of the respondents and assess the productivity of GPS Waypoints App in terms of accuracy, operability, and affordability. The researchers also observed the behavior and outcomes of the operations of two purse seine vessels, one equipped with GPS Waypoints App and the other unequipped with the said application. Based on the findings, a purse seine vessel that uses GPS Waypoints App is more productive compared to a purse seine vessel without a GPS Waypoints App. After thorough observation, the App is effective in finding the Fish Aggregating Devices (FADs) and lessens the burden of fishermen in locating the FADs, increasing weight of catch, and decreases time of travel. The GPS Waypoints App is revealed to be very helpful to fisherman by accurately locating the FADs and solves their problems in navigating hard to find FADs due to its far location, and ensuring they will never get late in the operating time where fishes are mostly active, thus helping them to have enough time preparing their fishing gears and improving fishing techniques.

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### 1. Background of the Study.

A purse seiner is a vessel that is widely used in the fishery of pelagic species like mackerel, blue whiting, and herring. Purse seiner vessels operate all over the world, the vessel makes a circle with the seine, creating a purse where fish cannot escape, and the seine is hauled at the stern (Atlantic Shipping). Further, newer purse seine vessels storage of fish is stored in tanks with refrigerated seawater, called RSW.

These systems allow the fish to stay fresh until they are landed.

Purse-seine vessels fish either by spotting free-swimming schools of tuna or by utilizing floating objects that attract fish,

either with natural or manmade objects such as fish aggregating devices (ISSF). According to (Yami, 1994) purse seining is potentially one of the most profitable catching methods but demands high investment and considerable technical know-how to achieve maximum efficiency. Furthermore, purse seine vessels include maintenance cost, and shrinkage of ships, machine, capture gear, and license cost (Firdaus et al., 2020).

Fish aggregating devices (FADs) provide structure in an open ocean environment. Fish are attracted to FADs for various reasons, including to feed on prey species or as reference points for schooling. Most fish attracted to the Queensland FADs are seasonal pelagic fish, which travel in the warm water delivered by ocean currents (Queensland Government, 2021). Furthermore, various FADs were assessed to find the best design for the intended species and to withstand the particularly harsh sea conditions.

Locating FADs requires master skill to effectively locate and determine the FADs. Fishermen of barangay Langgao have practiced methods when finding or locating FADs. They usu-

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ally use small boats boarded by one person which is the diver to rally and locate FAD that has a greater number of fishes. It is usually done during the day, and after locating the selected FAD, the diver goes back home, and they prepare for operations before dusk. According to (Fishmag ), mackerel feed all day from first light to last light, most active first thing in the morning and in the hours leading up to dusk. They are sight feeders and you're unlikely to catch them at nighttime. It's likely that the bright sun makes mackerel more cautious, because they are more visible to birds and other predators then. The fishermen of barangay Langgao prefers to operate purse seining before dusk or early in the morning, but problems in locating FADs is the major challenge because they travel at night.

GPS is a system of thirty plus navigation satellites circling Earth by constantly sending out signals. A GPS receiver in your phone listens for these signals. Once the receiver calculates its distance from four or more GPS satellites, it can figure out where you are (Spaceplace, 2023). GPS enhances safety at sea and allows vessels to determine their location, track their routes, and avoid hazards such as reefs shoals, or other vessels (SINAY, 2023).

As discussed above, there are studies related to purse seine fishing about Fish Aggregating Devices. Still, less study focuses on the use of GPS Waypoints App that can help fishermen spot the FADs quickly and accurately. Therefore, the study will determine how effective is the use of GPS Waypoints App in locating FADs during operating hours of purse seine vessels, to lessen the burden of fishermen to consume too much time in finding the FADs and may result in less fish catch. Specifically, the study will explore the quality of GPS Waypoints APP and its productivity towards purse seiners in barangay Langgao, Cabucgayan, Biliran.

## 2. Objectives of the Study.

The study aimed to assess the productivity of GPS Waypoints Application in purse seine fishing among rural folks.

1. Identify the profile of the respondents in terms of:
  - 1.1. Age.
  - 1.2. Educational Attainment.
  - 1.3. Family Size.
  - 1.4. Monthly Income.
  - 1.5. Number of years in fishing.
2. Assess the quality of GPS Waypoints Application in terms of:
  - 2.1. Accuracy.
  - 2.2. Operability.
  - 2.3. Affordability.
3. Identify the productivity of GPS Waypoints Application.
  - 3.1. Purse seine vessel with GPS Waypoints Application.
    - 3.1.1. Weight.
    - 3.1.2. Time.
    - 3.1.3. Type.
  - 3.2. Purse seine vessel without GPS Waypoints Application.
    - 3.2.1. Weight.
    - 3.2.2. Time.
    - 3.2.3. Type.

4. Ascertain the difference between purse seine vessels with GPS Waypoints application and those without GPS Waypoints application in terms of:

- 4.1. Weight.
- 4.2. Time.

### 2.1. Hypothesis.

The following hypotheses was formulated:

$H_{01}$ : There is no significant difference between the weight of fish of purse seine vessel with GPS waypoints app and purse seine vessel without GPS waypoints app.

$H_{02}$ : There is no significant difference between the time of travel of purse seine vessel with GPS waypoints app and purse seine vessel without GPS waypoints app.

## 3. Theoretical Framework.

This study was based on the Sailing Navigation Theory, it states that it is a process of navigating a sailing vessel from point A to B, plotting your course, finding the position of your sailboat and being able to identify what's happening around you (lovesailing, 2020). Marine navigation is planning, managing, and directing a vessel's voyage and it involves good seamanship, knowledge and judgement and integration of science and technology (AMSA, 2020). Navigation encompasses both position fixing and maneuvering, position fixing is about knowing the position of the ship where navigator and the plotter cooperate to have continuous knowledge of the ship's position while maneuvering is about directing the movement of the ship in terms of speed and heading (Bjorkle et al., 2007).

The methods of marine navigation continued to evolve and produce rapid advancements in navigation technology until the modern global positioning system (GPS) was created in the late 1970s (Formula boats, 2019). In addition, sailors could travel long distances for fishing and exploration when using global positioning system. The GPS can give high accuracy if there are four or more satellites within the field-of-view of the receiver (Goh & Low, 2017).

The theory, named Sailing Navigation Theory, emphasized the underlying principles when it comes to marine navigation. Navigating the vessel's course and directing the vessel to the location requires technological advancements for accurate tracking. Position fixing and maneuvering is essential while using science and technology to enhance the accuracy of navigating. Planning and managing with good seamanship will promote development and sustainability if successfully applied for marine purposes.

## 4. Methodology.

### 4.1. Research Design.

The study utilizes a quasi-experimental research design. Quasi-experimental is research that resembles experimental research but is not true experimental research. Although the independent variable is manipulated, participants are not randomly assigned to conditions or orders of conditions (Cook & Campbell,

1979). In addition, like a true experiment, a quasi-experimental design aims to establish a cause-and-effect relationship between an independent and dependent variable (Thomas, 2020).

4.2. *Research Locale.*

This study was conducted in the coastal area of Brgy. Langgao, Cabucgayan, Biliran. The researcher chooses the place because it has the foundation of fishing activities, where purse seine fishing method is present, and it will give the researcher the needed information. This study was conducted in the second semester of the academic year 2022-2023.

4.3. *Research Sampling and Respondents.*

Non-random sampling method was used using convenience sampling wherein the units are convenient for the researcher to approach (Jain & Chetty, 2020). The target respondents of the study are one boat captain and nine crew members for the experimental group, and one boat captain and five crew members for control group, a total of sixteen respondents. The respondents were chosen based on the following criteria: The respondent is an active boat captain or crew member of the purse seine vessel in barangay Langgao, Cabucgayan, Biliran, and willing to answer the questionnaire.

4.4. *Data Gathering Procedure.*

Data was gathered by using a survey and questionnaire that will be conducted in the coastal area of Barangay Langgao, Cabucgayan, Biliran. Researchers selected this kind of data gathering tool because it gathers large quantity of data easily and cheaply. It can also be administered as a self-report measure and collected data can be in person, over the phone, or on a computer. A survey is a research method to collect and analyze data from a group of people while questionnaire is a specific tool or instrument for collecting the data (Bhandari, 2023).

To achieve accuracy of data and results, the researchers who have experienced in purse seine fishing have identified the profile of the respondents, quality of GPS Waypoints App, and observe the weight of fish, duration of travel, and type of fish being caught on the two purse seine vessels. This will guarantee safety measures during one week of data gathering since an unexperienced individual may be caught at risk while voyaging in the ocean.

To add waypoints on the location of the fish aggregating device, the assigned researcher travels at daytime in the ocean together with the diver and plots the coordinates of the selected FADs with greater number of fishes. After saving the waypoints, it was used to guide the vessel at night in locating the fish aggregating device. While travelling, the researcher pays attention to the one-kilometer mark distance before arriving at the destination. The one-kilometer mark that is displayed in the GPS Waypoints App will serve as queuing point to start recording the time of travel from the mark to the location of FADs.

The questionnaires are given to the respective respondents and asked them to answer honestly the questions in the survey. The questionnaire is composed of two parts. Part 1 gives information about the respondents in terms of name (optional);

age; educational attainment; family size; monthly income; and number of years in fishing. Part 2 gives information about the quality of the GPS Waypoints App in terms of accuracy, operability, and affordability. To identify the weight of catch, time of travel, and type of fish, the researcher observes the three criteria to input data.

4.5. *Data Scoring.*

The means were interpreted as follows: Strongly Disagree in the point range of (1.00-1.80), Disagree (1.81-2.60), Neutral (2.61-3.40), Agree (3.41-4.20), and Strongly Agree (4.21-5.0).

Table 1: Data Scoring.

Range	Value	Interpretation
1.00-1.80	1	Strongly Disagree
1.81-2.60	2	Disagree
2.61-3.40	3	Neutral
3.41-4.20	4	Agree
4.21-5.0	5	Strongly Agree

Source: Authors.

4.6. *Statistical Tool.*

The data gathered was carefully recorded on tables, analyzed, and interpreted accordingly based on the results of statistical treatment. In this study, the researchers used mean, percentage, standard deviation, and independent samples t-test.

4.7. *Ethical Consideration.*

The researcher’s ethical consideration to the study was highly observed. To comply with ethical standards, the boat captains and the owner of the purse seine vessel were given consent form in conducting the research. Respecting the rights of the respondents is the priority of the researchers through confidentiality and improving validity of the research. The respondents were given the opportunity to answer the questionnaire, and they are allowed to ask questions to the researchers to understand the questions being asked. There is no bias in choosing the respondents during the conduct of the study. No person or animals are harmed during the survey and no one other than the researchers know the answers of the respondents.

5. **Results and Discussions.**

5.1. *Profile of the Respondents.*

This shows the statistical data of the respondents of the two purse-seine vessels indicating their age, educational attainment, family size, monthly income, and number of years in fishing.

Table 2: Profile of the Respondents.

Age	Frequency	Percentage
26-30	3	18.75
31-35	2	12.5
36-40	3	18.75
41-45	3	18.75
46 and above	5	31.25
Total	16	100.00
Educational Attainment	Frequency	Percentage
Elementary	8	50.00
Highschool	8	50.00
College	0	0
Total	16	100.00
Family Size	Frequency	Percentage
3-5	10	62.5
6 and above	6	37.5
Total	16	100.00
Monthly Income	Frequency	Percentage
Php 7,000-Php 8,000	5	31.25
Php 8,001-Php 9,001	5	31.25
Php 9,002-Php 10,002	4	25
Php 10,003-Php 11,004	0	0
Php 11,005 and above	2	12.5
Total	16	100.00
Years in Fishing	Frequency	Percentage
5-10 years	2	12.5
11-16 years	10	62.5
17-22 years	2	12.5
23 years and above	2	12.5
Total	16	100

Source: Authors.

Table 1 summarizes the respondents’ profiles in terms of age, education, family size, income, and fishing experience. The majority of respondents are aged 46 and above (31.25%), with the least in the 31-35 age range (12.5%). Most respondents have elementary or high school education (50%), while none have a college degree. In terms of family size, 62.5% have 3-5 members, and 37.5% have 6 or more members. Regarding monthly income, the highest percentages fall within the 7,000-9,000 range (31.25%). Finally, 62.5% of respondents have 11-16 years of fishing experience, while fewer have 5-10, 17-22, or 23+ years (12.5% each).

**Perceived quality of GPS waypoints application.**

This shows the statistical data of the respondent’s rating of the quality of GPS waypoints app in terms of accuracy, operability, and affordability. We calculated the results using the 5-point Likert-Scale to summarize the responses of the respondents in the quality of GPS Waypoints App. A Likert-Scale measures attitudes or feelings towards a topic typically from one extreme to another, and the scale provides quantitative data about quantitative aspects like attitudes, satisfaction, agreement, or likelihood (Frost, 2023). According to Bhandari & Nikoloupolou (2023) because respondents are presented with a range of possible answers, Likert Scales are great for capturing the level of agreement or their feelings regarding the topic in a more nuanced way.

**Accuracy.**

Table 3 shows the results of the respondent’s rating in the accuracy of the GPS waypoints app. Statements 1 and 2 have lower averages and standard deviations. Statement 1 concerned whether the GPS waypoints app showed the exact position of

Table 3: Perceived quality of GPS waypoints application in terms of Accuracy.

Statement	Mean	SD	Interpretation
1. The GPS Waypoints App showed the exact position of the fish aggregating device.	3.8	2.332381	Agree
2. The GPS Waypoints App showed accurate tracking.	3.4	2.529822	Agree
3. The tolerance is short, abled to locate easily using flashlight.	4	4	Agree
4. The GPS Waypoints App does not show irrelevant locations and maintained the position being saved.	4	4	Agree
5. The GPS Waypoints App could easily detect the location of the fish aggregating devices based on saved waypoints.	4.1	2.607681	Agree
<b>Average</b>	3.86	3.0939768	Agree

Source: Authors.

the FADs and statement 2 concerned whether the app showed accurate tracking. The averages of statements 3, 4, and 5 were substantially more positive concerning the tolerance, maintained position, and quick detection in the app. Based on the study of Natsir et al., (2019) all eight GPS trackers they installed on the sample boats have functioned appropriately in sending GPS locations which provide information on ship movements.

**Operability.**

Table 4: Perceived quality of GPS waypoints application in terms of operability.

Statement	Mean	SD	Interpretation
1. The GPS Waypoints App was easy to operate.	4.5	2.44949	Strongly Agree
2. The GPS Waypoints App does not drain battery too much.	4.4	2.529822	Strongly Agree
3. The GPS Waypoints App does not show bugs.	4.1	3.521363	Agree
4. The GPS Waypoints App was user friendly.	4.1	2.607681	Agree
5. The GPS waypoints App does not need a strong internet connection.	4.1	2.607681	Agree
<b>Average</b>	4.24	2.7432074	Strongly Agree

Source: Authors.

Table 4 shows the results of the respondents rating in the operability of the GPS waypoints app. Statements 3, 4 and 5 garnered an average of 4.1 concerning bugs, user friendliness of the application, and internet connection. Statement 1 has the highest average which is 4.5 concerning the easiness on the operation of the application, then followed by statement 2 concerning about the battery draining of the app. According to Natsir et al., (2019) the result of their study shows that the low-cost GPS tracker shows good performance for artisanal fisheries in Indonesia, and tracking information supports better fishery management.

**Affordability.**

Table 5: Perceived quality of GPS waypoints application in terms of affordability.

Statement	Mean	SD	Interpretation
1. The GPS Waypoints App has a free feature to locate waypoints.	4.2	3.098387	Agree
2. The mobile data used was cheap.	4.1	3.521363	Agree
3. Installation of the application was free.	4.4	2.529822	Strongly Agree
4. The expenses was not big enough for daily operating costs.	4.9	3.521363	Strongly Agree
5. The GPS Waypoints App does not need any costly device to locate and create waypoints.	4.9	3.521363	Strongly Agree
<b>Average</b>	4.5	3.2384596	Strongly Agree

Source: Authors.

Table 5 shows the results of the respondents rating in the affordability of the GPS waypoints app. Statement 2 has the lowest average concerned whether the mobile data that was used was cheap. Statement 1 has an average of 4.2 concerning the free feature of the app in locating waypoints. Statements 3, 4, and 5 have higher averages and concerned whether the app was free to install, expenses for daily operating costs, and the use of other costly devices to locate and create waypoints. The study of Fernandez et al., (2019) shows how important it is in selecting low-cost GPS devices such as GPS data loggers to monitor commercial and municipal fishing vessels.

5.2. Perceived productivity of GPS waypoints application.

This shows the statistical data gathered by the researchers based on observations they have made to assess the productivity of GPS waypoints app in terms of the weight of fish, time of travel, and the type of fish that was caught.

**Weight.**

Table 6: Perceived productivity of GPS waypoints application in terms of weight of fish.

Day	Purse seine vessel with GPS waypoints app	Purse seine vessel without GPS waypoints app	Difference (i)
1	180 kilograms	120 kilograms	60 kilograms
2	120 kilograms	60 kilograms	60 kilograms
3	120 kilograms	60 kilograms	60 kilograms
4	60 kilograms	0 kilogram	60 kilograms
5	120 kilograms	60 kilograms	60 kilograms
6	240 kilograms	120 kilograms	120 kilograms
7	120 kilograms	60 kilograms	60 kilograms
<b>Total</b>	960 kilograms	480 kilograms	480 kilograms
<b>Mean</b>	137.1429	68.57143	68.57143
<b>Standard Deviation</b>	57.07138	41.40393	20.99563

Source: Authors.

Table 6 shows the statistical data on the weight of fishes being caught of the two purse-seine vessels. The purse seine vessel with GPS waypoints app after seven days of operation garnered a total of 960 kilograms of fish. A total of 480 kilograms of fish was caught from the second purse seine vessel unequipped with GPS waypoints app. The total difference in the weight of fish between the two purse seine vessels was 480

kilograms. Purse seine vessel with GPS waypoints has the highest average on the catch of fish. The study of Nazarullah et al., (2022), shows catch rate of purse seine vessels in Central Java garnered 26, 710 kilograms or 26.7 tons of pelagic fishes per trip for each vessel. During the study, the proportion of the amount and weight of the five vessels was more than 60 percent.

Table 7: Difference of weight of fish between purse seine vessel with GPS waypoints application and purse seine vessel without GPS waypoints application.

	Levene's test for equality of variances		t-test for equality of means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Weight Equal variances Assumed	.541	.476	2.573	12	.024	68.57143	26.64965	10.50682	126.63604
Assumed not equal variances			2.573	10.946	.026	68.57143	26.64965	9.88046	127.26240

Source: Authors.

As shown in the table above, an independent samples t-test was used to determine whether there was a statistically significant mean difference between the weight of fish being caught of purse seine vessel with GPS waypoints app and purse seine vessel without GPS waypoints app. The value of Sig. (2-tailed) is .024 < 0.05. This indicates that there is a significant average difference between the weight of fish of the two purse seine vessels.

**Time.**

Table 8: Perceived productivity of GPS waypoints application in terms of time of travel.

Day	Purse seine vessel with GPS waypoints app	Purse seine vessel without GPS waypoints app	Difference (i)
1	365 seconds	612 seconds	247 seconds
2	362 seconds	618 seconds	256 seconds
3	392 seconds	810 seconds	418 seconds
4	388 seconds	965 seconds	577 seconds
5	410 seconds	760 seconds	350 seconds
6	371 seconds	590 seconds	219 seconds
7	403 seconds	670 seconds	267 seconds
<b>Total</b>	2691 seconds	5025 seconds	2334 seconds
<b>Mean</b>	384.4286	717.8571	333.428571
<b>Standard Deviation</b>	18.84018	127.62296	118.1559

Source: Authors.

Table 8 shows the statistical data of the time of travel of the two purse seine vessels. The time of travel indicates the time duration of the travel of the purse seine vessel from one kilometer mark before arriving at the destination. After seven days of operation, the total time of travel of purse seine vessel with GPS waypoints app is 2691 seconds with a mean of 384.4286. The total time of travel of purse seine vessel without GPS waypoints app is 5025 seconds with a mean of 717.8571. The total difference of time of travel between the two vessels is 2334 seconds with a mean of 333.428571. Purse seine vessel with GPS waypoints app has lesser total time of travel.

Table 9: Difference of time of travel between purse seine vessel with GPS waypoints application and purse seine vessel without GPS waypoints application.

	Levene's test for equality of variances		t-test for equality of means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Time Equal variances Assumed Equal variances not assumed	12.838	.004	-6.420	12	.000	-333.42857	51.93645	-446.58837	-220.26877
			-6.420	6.2	.001	-333.42857	51.93645	-459.38465	-207.47249

Source: Authors.

As shown in the table above, an independent samples t-test was used to determine whether there was a statistically significant mean difference between the time of travel of purse seine vessel with GPS waypoints app and purse seine vessel without GPS waypoints app. The value of Sig. (2-tailed) is .000 < 0.05. This indicates that there is a significant average difference between the time of travel of the two purse seine vessels.

**Type.**

Table 10: Perceived productivity of GPS waypoints application in terms of type of fish.

Type of Fish	Purse seine vessel with GPS waypoints app							Purse seine vessel without GPS waypoints app						
	Day							Day						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Short Mackerel	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Blue Mackerel Scad	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Yellow Scad	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Sardines	/	/	/	/	/	/	/	/	/	/	/	/	/	/

Source: Authors.

Table 10 shows the statistical data of the type of fish which is being caught of the two purse seine vessels. After seven days of operation, the two purse seine vessels caught 4 types of fish namely sardines, short mackerel, blue mackerel scad, and yellow scad. The study of Kamble et al., (2016) shows the catch composition of purse seine vessel along Ratnagiri coast of India, they caught Indian oil sardine, Indian mackerel, lesser sardines, horse mackerel and tuna.

**Conclusions & Recommendations.**

*Conclusions.*

The GPS Waypoints App is very effective in helping fishermen in purse seine fishing solve their problems in locating the FADs. The accurateness of the app in determining the location of the FADs is highly essential in the maritime operation of fishermen. It improves catch and lessens the time it takes to locate the FADs. It also ensures they operate at the accurate time so that they will not go back home with less or zero catch. It contributes improvements to their livelihood and enhances their way of living. Along with costly daily operation, the respondents clearly described that the GPS Waypoints App is a big help to them.

*Recommendations.*

The researchers make the following recommendations for the fishermen of Brgy. Langgao, Cabucgayan, Biliran who are using purse seine method in fishing in realizing the objectives of the study.

1. Use the GPS waypoints app as part of the fishing strategy to quickly locate the fish aggregating devices.
2. Utilize the GPS waypoints app to further enhance the profit and reduce daily operation cost.

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