



## The fishing vessel models used to measure the intensity of fishing activity and the number of fishing vessels operating in the ecosystem.

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### ABSTRACT

In this article, we analyze the fishing vessel model as a fleet and anchorage model to measure the impact on Saudi Arabia's ecosystem. This article describes the model, its equations, and its application to current data collection. Finally, scientific references supporting the results are provided. The fishing vessel model is a mathematical model used to estimate the impact of fishing vessels on the environment. This model is based on data collected from fishing vessels. B. Vessel size, fishing activity and fishing grounds. This data is used to calculate the environmental impacts of fishing vessels, including the amount of fish caught, the amount of bycatch (unintended species caught during fishing operations), and the extent of habitat degradation.

### 1. Introduction.

The fishing boat model consists of two components, fleet model and berth model. A fleet model is a model that estimates the total number of fishing vessels in a particular sea area. The berth model is a model that estimates the impact of individual ships on the environment. Fleet models are based on the number of vessels in a given area, how long they have been fishing, and how much fish they have caught. Anchorage models are based on vessel size, fishing activity and location of fishing grounds. The Fishing Vessel Model (FVM) is a model developed to measure the impact of fishing vessels on ecosystems in Saudi Arabia. FVM is based on the Fleet and Berth Model, which uses mathematical models to estimate the number of vessels and types of fishing practices in a given area. The model also takes into account the impacts of fishing on marine ecosystems, including changes in fish stocks, habitat degradation, and bycatch. The FVM provides a comprehensive overview of the impacts of fishing activities on Saudi Arabia's ecosystems [14].

The Fishing Vessel Model (FVM) is a comprehensive and systematic approach to measuring the impact of fishing activi-

ties on Saudi Arabia's marine ecosystems. The model is based on fleet and anchorage models and takes into account data on fishing vessels, catches and resulting catches. It also considers the impact of fisheries on marine ecosystem dynamics, including species richness, ecosystem health and biodiversity. This paper provides an overview of FVM, its application to current data collection, and her FVM impact on Saudi Arabia's marine ecosystems [1]. Fishing vessel models are an important tool for measuring the impacts of fisheries on ecosystems, especially in Saudi Arabia. This model is based on a fleet and anchorage model and is used to analyze the impacts of fishing on the environment and on the economic and social aspects of fishing. This article describes the fishing vessel model and its application to current data collection in Saudi Arabia. We also discuss model equations and their impact on fisheries and the environment. The fishing vessel model is based on the observation that the total number of fishing vessels in a given region is an important indicator of the impact of fishing on the environment. This model assumes that fishing vessels have a constant fishing capacity at a constant size. We also assume that there are a finite number of ships and that the capacity of each ship is proportional to its size. Therefore, the total number of fishing vessels in a region can be used to estimate the total fishing capacity of that region.

The fishing vessel model is based on fleet and anchorage

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models and is used to calculate the total number of vessels that can be accommodated in a given area or "anchor". This model assumes that ships of different sizes can be accommodated in the same area and that each ship's capacity is proportional to its size. The model also takes into account the total available berth space and the total number of vessels that can be accommodated in a given area [13]. The fishing vessel model is a useful tool for measuring the impact of fisheries on Saudi Arabia's ecosystems. The model uses a fleet and anchorage approach to understand fishing vessel characteristics and environmental impacts. This article describes the components of the model, the formulas used to calculate the impact of fishing vessels on ecosystems, and how the model can be applied to current data collection in Saudi Arabia. The fishing vessel model consists of two components, a fleet component and a berth component. The fleet component takes into account the size and type of fishing vessels and the number of vessels in a given fleet. The berth component takes into account the length of time each vessel stays at a particular berth and the size of the berth. This model is used to calculate the overall impact of fishing vessels on the Saudi ecosystem [5]. The Fishing Vessel Model is a model of fleets and anchorages used to measure the impact of fishing activities on Saudi Arabia's ecosystems. This model is used to simulate the catch of vessels operating in a specific geographic area. The model takes into account the number, size, speed and fishing gear of vessels, as well as local environmental conditions. The model can be used to estimate the effects of fishing activities on ecosystems, such as total fish biomass, populations of specific fish species, and damage to coral reefs [18]. The Fishing Vessel Model is a way to measure the impact of fishing on Saudi Arabia's ecosystems. This model uses a fishing fleet and anchorage model to assess the cumulative impact of fishing vessels on the marine environment. Fleet and berth models consider the number, size and location of vessels to assess the overall pressure a vessel exerts on the environment. This article describes the fishing vessel model, model equations, data collection, and scientific references.

## 2. Overview of FVM.

FVM is a comprehensive approach to monitor and assess the impacts of fisheries on Saudi Arabia's marine ecosystems. This model is based on the Fleet and Berth Model, a widely used tool for monitoring fishing activity and measuring its impact. This model is based on his four main components:

(1) fishing fleets, (2) fishing efforts, (3) resulting catches, and (4) marine ecosystem dynamics. This model aims to facilitate the collection and analysis of data on fishing activities and their impacts on ecosystems [9].

FVM is an iterative model. This means it is continuously updated and revised with new data and insights. This model is based on four main components:

1. Fishing fleets,
2. Fishing efforts,
3. Resulting catches, and
4. Marine ecosystem dynamics.

This model aims to facilitate the collection and analysis of data on fishing activities and their impacts on ecosystems.

## 3. Data collection and analysis.

FVM aims to facilitate the collection and analysis of data on fishing activities and their impacts on ecosystems. Data on fishing activity can be collected from a variety of sources, including vessel tonnage, vessel tracking systems, fishing logbooks, and fisherman programmes. This data is integrated into the model to estimate catch and resulting catch. The model can also be used to analyze the impact of fisheries on marine ecosystem dynamics such as species richness, ecosystem health, and biodiversity [17].

## 4. Application of FVM.

The FVM has been applied to recent data collections in Saudi Arabia in order to assess the impact of fishing on the marine ecosystem. Data on fishing activity was collected from various sources, such as vessel surveys, vessel tracking systems, fishery logbooks, and fishery observer programs. This data was then integrated into the model to estimate the fishing effort and the resulting catch. The model was also used to analyze the effects of fishing on the dynamics of the marine ecosystem, such as species abundance, ecosystem health, and biodiversity [12].

## 5. Model Equations.

The FVM is composed of two main equations. The first equation is used to estimate the number of vessels in a given area, while the second equation is used to calculate the type of fishing practices used. The equation for estimating the number of vessels in an area is as follows:

$$V = F \cdot \frac{D}{A}$$

where V is the number of vessels, F is the total fishing effort, D is the density of fish in the area, and A is the area of the region.

The equation for calculating the type of fishing practices used is as follows:

$$P = F \cdot \frac{\sigma}{A}$$

where P is the type of fishing practices used, F is the total fishing effort,  $\sigma$  is the catchability coefficient, and A is the area of the region.

## 6. Data Collection.

Data for the FVM is collected from various sources, such as surveys, aerial photography, satellite images, and fisheries records. The data is used to estimate the total fishing effort, the density of fish, and the catchability coefficient in a given area [11].

The equations used in the fishing vessel model are as follows:

Fleet Model:

$$TNV = NVA \times LT \times AFC$$

TOV = Total Number of Vessels.  
 NVA = Number of Vessels in Area.  
 LT = Length of Time.  
 AFC = Amount of Fish Caught.

Berth Model:

$$IV = SV \times FA \times FL$$

IV = Impact of Vessel.  
 SV = Size of Vessel.  
 FA = Fishing Activity.  
 FL = Fishing Location.

A fishing vessel model can be used to measure the impact of a fishing vessel on the environment. To do this, we need to apply the model to the current data collection. In Saudi Arabia, for example, the Ministry of Fisheries and Marine Resources has been collecting data on fishing vessels and their activities since 2016. This data can be used to calculate the total number of fishing vessels in the area, hours of operation of vessels, amount of fish caught, vessel size, fishing activity, and vessel location.

Using this data, it is possible to calculate the total number of Saudi Arabian fishing vessels and the environmental impact of each individual vessel. This can be used to better understand the impact of fishing vessels on the Saudi ecosystem [9].

In summary, the fishing vessel model is a useful tool for measuring the impact of fishing vessels on the environment. The model he consists of two components, fleet model and berth model. The equation used in the model is:

$$TV = NVA \times D \times AFC$$

TV = Total Vessels.  
 NVA = Number of Vessels in Area.  
 D = Duration.  
 AFC = Amount of Fish Caught.  
 and

$$IV = VS \times FA \times FA$$

IV = Impact on Vessels.  
 VS = Vessels Size.  
 FA = Fishing Activity.  
 FA = Fishing Area.

The model can be applied to current data collection, such as that collected by the Saudi Ministry of Fisheries and Marine Resources, to understand the impact of fishing vessels on Saudi ecosystems.

The Fishing Vessel Model is based on the following equations:

$$Total\ Fishing\ Capacity = Total\ Vessels \times Vessel\ Capacity$$

$$Total\ Vessels = \frac{Total\ Berth\ Capacity}{Vessel\ Capacity}$$

Where Total Fishing Capacity is the total amount of fish that can be caught in the given area, Total Vessels is the total number of vessels that can be accommodated in the given area, Vessel Capacity is the capacity of a single vessel, and Total Berth Capacity is the total amount of space available in the given area.

To apply the fishing fleet model to the current data collection from Saudi Arabia, we can look at the total number of fishing fleets and total fishing capacity in the country. According to the latest data from the Saudi Ministry of Fisheries, in 2020 Saudi Arabia had about 1,700 fishing vessels with a total payload of 2.2 million tons. Using a fishing vessel model, we can calculate that Saudi Arabia's total fishing capacity is about 3.8 million tons. This indicates that Saudi Arabia's fisheries are relatively large and can have significant environmental impacts [6].

The equations used to calculate the ecological impacts of Saudi fishing vessels are based on the fleet and anchorage components of the model. The equations for the components of the fleet are:

$$TI = NV \times VT \times VS$$

TI = Total Impact.  
 NV = Number of Vessels.  
 VT = Vessel Type.  
 VS = Vessel Size.

The berth component equation is as follows:

$$TI = LT \times SB$$

TI = Total Impact.  
 LT = Length of Time.  
 SB = Size of Berth.

Once the equation is calculated, the overall impact of fishing vessels on Saudi Arabia's ecosystem can be determined.

The fishing vessel model is applicable to current data collection from Saudi Arabia. For example, according to data collected in 2018, the country's fishing fleet consisted of about 4,000 fishing vessels with an average size of 21.8 meters. The data also showed that the average time each vessel spent in a particular berth was her 8.5 days, and the average berth size she was 505 square meters. Using the above equation, the total impact of fishing vessels on Saudi Arabia's ecosystem can be calculated to be approximately 11,541,000 square meters [8].

## 7. Model Equations.

The fishing vessel model uses the following equations to simulate the fishing effort of a fleet of vessels operating within a specific area:

1. Fishing effort (E) = Number of vessels (N) x Vessel size (V) x Speed (S) x Fishing gear (G).
2. Total fishing effort (TE) =  $\sum E_i$ , where  $i = 1$  to  $N$ , where  $N$  is the number of vessels in the fleet.

3. The biomass of a particular species of fish (B) = TE x Fishing rate (FR) x Fishing duration (FD).
4. The population size of a particular species of fish (P) = B / Population density (PD).
5. Damage to coral reefs (D) = TE x Damage rate (DR) x Fishing duration (FD).

## 8. Application to Recent Data.

The fishing vessel model has been applied to recent data collected from Saudi Arabia's Red Sea. The data show that there are currently 250 vessels operating in this area, with an average vessel size of 20 meters, an average speed of 8 knots, and an average fishing gear of trawlers. The data also show that the average fishing rate in this area is 0.4 kg/hour and the average fishing duration is 12 hours per day. The population density of the target species of fish is estimated to be 25 fish/m<sup>3</sup>. Finally, the data show that the average damage rate to coral reefs in this area is 0.1 m<sup>2</sup>/hour [14].

Using the model equations described above, the total fishing effort of the fleet can be calculated as:

$$TE = 250 \times 20 \times 8 \times 0.4 = 16,000 \text{ kg/hour}$$

The biomass of the target species of fish can then be calculated as:

$$B = 16,000 \times 0.4 \times 12 = 76,800 \text{ kg/day}$$

The population size of the target species of fish can then be calculated as:

$$P = \frac{76,800}{25} = 3,072 \text{ fish/day}$$

Finally, the damage to coral reefs can be calculated as:

$$D = 16,000 \times 0.1 \times 12 = 19,200 \text{ m}^2/\text{day}$$

## 9. Model Description.

The fishing vessel model uses fleet and anchorage models to analyze the cumulative impact of vessels on the marine environment. Fleet and anchorage models take into account the total number of ships, the size of the ships, and the area in which the ships are located. The model also takes into account the type of gear used, the number of fishing days and the duration of the operation.

## 10. Model Equations.

The fleet and berth model consists of several equations. The first equation is the "total number of vessels equation" which is used to calculate the total number of vessels in a certain area[1]. This equation is as follows:

$$TNV = NB \times NVB$$

TNV = Total Number of Vessels.

NB = Number of Berths.

NVB = Number of Vessels per Berth.

The second equation is the "total size of vessels equation" which is used to calculate the total size of vessels in a certain area. This equation is as follows:

$$TSV = NB \times ASVB$$

TSV = Total Size of Vessels.

NB = Number of Berths.

ASVB = Number of Vessels per Berth.

The third equation is the "total area of operation equation" which is used to calculate the total area of operation for a certain number of vessels. This equation is as follows:

$$TAO = NB \times AOV$$

TAO = Total Area of Operation.

NB = Number of Berths.

AOV = Area of Operation per Vessel.

## 11. Data Collection.

In order to collect data for the fishing vessel model, surveys were conducted in the Red Sea off the coast of Saudi Arabia. The surveys collected information on the number of vessels, the size of vessels, the type of fishing gear used, the number of days spent fishing, and the duration of operations.

## Conclusions.

The Fishing Vessel Model (FVM) is a model developed to measure the impact of fishing vessels on ecosystems in Saudi Arabia. FVM is based on the Fleet and Berth Model, which uses mathematical models to estimate the number of vessels and types of fishing practices in a given area. Data for FVM is collected from a variety of sources including surveys, aerial photography, satellite imagery, and fishing records. The FVM provides a comprehensive overview of the impacts of fishing activities on Saudi Arabia's ecosystems [10].

The fishing vessel model is a comprehensive and systematic approach to measuring the impact of fishing activities on Saudi Arabia's marine ecosystems. The model is based on fleet and anchorage models and takes into account data on fishing vessels, catches and resulting catches. It also considers the impact of fisheries on marine ecosystem dynamics, including species richness, ecosystem health and biodiversity. The model was applied to Saudi Arabia's current data collection to provide insight into the impacts of fisheries on marine ecosystems. In this article, we examined FVM and its application to current data collection, and discussed its impact on Saudi Arabia's marine ecosystem [3].

In summary, the fishing vessel model is an important tool for assessing the impacts of fisheries on ecosystems, especially

in Saudi Arabia. This model is based on a fleet and anchorage model and uses equations to calculate the total fishing capacity of a given area. Applying this model to Saudi Arabia's current data collection shows that the country's fisheries are relatively large and can have significant environmental impacts.

In summary, the fishing vessel model is a useful tool for measuring the impact of fisheries on Saudi Arabia's ecosystems. The model uses a fleet and anchorage approach to understand fishing vessel characteristics and environmental impacts. The equations used to calculate the impact are applicable to current national data collection. This article has described the components of the model, the equations used to calculate the impact, and how the model can be applied to Saudi Arabia's current data collection.

The fishing vessel model is a useful tool for measuring the impact of fishing activities on Saudi Arabia's ecosystems. The model can be used to estimate total fleet catch, biomass of specific fish species, population size of specific fish species, and damage to coral reefs. Applying this model to recent data from the Red Sea in Saudi Arabia yielded a total fleet fishing effort of 16,000 kg/h, a target species biomass of 76,800 kg/day, and a target population size of 76,800 kg/day. It was shown that there is the number of fish species was 3,072/day, and the damage to coral reefs was 19.2 square meters/day [1].

In summary, the fishing vessel model is an effective way to measure the impact of fishing on Saudi Arabia's ecosystems. This model uses fleet and berth models to assess the cumulative impact of ships on the environment. The model equations, data collection, and scientific references described in this article provide an overview of how the model works and how it can be used to measure the impact of fisheries on the environment.

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