MINISTRY OF EDUCATION AND TRAINING

NHA TRANG UNIVERSITY

DO DINH MINH

SOLUTIONS TO RESTRICT TRAWL FISHING ACTIVITIES IN THE COASTAL AREAS OF VAN DON DISTRICT IN QUANG NINH PROVINCE

Major: Fishing

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THESIS ABTRACT

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PREFACE

Van Don district locates in the northeast of QuangNinh province has an area of about 2,171.33 km^2, the mainland is 551.33 km^2; There are 11 communes and 01 town, including 5 island communes. The coastal area of Van Don district has an area of about 1,620 km^2, with more than 600 large and small islands, forming an enclosed sea; the seabed is relatively flat, the substrate is composed mainly of mud and mud sand; fisheries resources are diverse and rich in species composition, many species are of high economic value, evenly distributed in months of the year, so fishing vessels operations can be operated to catch most time of year [9].

The district has 1,501 fishing boats, with 5,100 employees, the fishing activities have many different occupations and many types of fishing gears, including trawlers [9], although the trawlers have been banned since 2005 [1,3,5], but currently, there are still about 721 trawlers (2013) to 708 trawlers (2017) regularly operating in the coastal ares of Van Don district, regardless of state regulations. In terms of the method of use, there are 3 types: Traditional trawl, traditional trawlcombined with electricand non-traditional trawl. Because the functional forces regularly patrolled and controlled, many trawlers' owners turned to the non-traditional trawl to bypass the law; the activities take place most time of year, catching daytime and nighttime, negatively impacting the marine ecosystem, fisheries resources and aquatic environment. The local government has tried to implement to patrol, control, educate, propagate, punish ... but still not prevent the operation of the trawling vessel in the research areas.

Based on the above problems, the author found that the selection of the thesis topic "Solutions to restrict trawl fishing activities in the coastal areas of Van Don district in QuangNinh province" is necessary and urgent.

THE GOAL OF THE THESIS:

Investigate the current status of the trawl fishing, evaluate the invasive level of the trawlers to the fisheries resources and propose solutions to limit the fishing activities to protect the fisheries resources in the coastal areas of Van Don district, Quang Ninh province.

RESEARCH CONTENT:

1. Investigate the current status of the exploitation activities of the trawlers.

2. Evaluate the level of harm to the fisheries resources caused by the trawlers.

3. Analyzing and clarifying the reason why the trawl fishing vessels concentrates on in the coastal areas of Van Don district, Quang Ninh province

4. Proposing solutions to limit the trawl fishing vessels in coastal areas of Van Don district, Quang Ninh province

SCIENTIFIC AND PRACTICAL MEANING OF THE THESIS

Scientific significance: Supplementing scientific data on the current status of the fishing net profession and providing scientific data on the harm level of the net fishery to fisheries resources in coastal areas in Van Don district, Quang province. Ninh.

Practical significance: Provide a scientific basis for local authorities to manage and manage fishing activities, including fishing in coastal areas to protect aquatic resources and the environment Ecological.

THE FINDING OF THE THESIS

1. Comprehensive investigation of the current situation of trawl fishing vessels has the fishing activities in the coastal waters of Van Don district, QuangNinh province.

2. To assess the level impact of trawlers which are harmful to the fisheries resources and the ecological environment in the research water areas.

3. Analyzing and clarifying the reasons why trawlers have the fishing activities in coastal areas, as a scientific basis for making the solutions from trawlers to marine aquaculture and the solution of using artificial reefs to reduce activities of trawlers in research water areas.

4. Suggested 3 solutions to limit the fishing activities of the trawlers and it was a good initial efficiency in the research water areas including: The solution for changing from trawlers to marine aquaculture; the solution for using artificial reefs and combine with planting corals in order to restore coral reefs; formulating and completing local fisheries management mechanisms and legal frameworks.

5. The results of research are able to use as a reference for local managers in organizing activities of the fishing profession, including the trawlers operate in coastal areas in order to protect fisheries resources and the ecological environment.

CHAPTER 1. OVERVIEW OF THE RESEARCH PROBLEM

1.1. Overview of fisheries of Van Don district QuangNinh province

1.1.1. Natural and socio-economic characteristics of Van Don district

- Van Don is an island district in the Northeast of QuangNinh Province; the total natural area is 2,171.33 km^2, of which the mainland is 551.33 km^2, there are 12 administrative units including 01 town and 11 communes. The populationof the district was 46,072 people in 2017; The working age of Van Don district was 21,705 people in 2017, accounting for 47.1% of the district's population.

- The production value of agriculture, forestry and fishery accounted for 36.8%; industry - construction accounted for 32.5%; service sector accounts for 30.7%.

1.1.2. The fisheries economic of Van Don district in 2017

- The total output of fisheries production reaches 21,790 tons, accounting for 18.5% of the total output of the province, of which fishing reaches 12,250 tons, accounting for 56.2%; aquaculture reached 9,540 tons, accounting for 44.8% of total aquaculture production.

- The district has 1,501 fishing boats, in which the number of fishing vessels under 90 CV accounts for 96.8%, there are 48 offshore vessels, accounting for 3.2%. The main fishing occupations include: gill nets, snap nets, trap cages, fishing ... The aquaculture area reached more than 800 ha in 2017, in which the key culturing of marine fish and mullusk.

- There are about 7,300 labors of working in fisheries, in which there are 5,100 fishing workers, accounting for 69.8%, the aquaculture is 1,900 workers, accounting for 26% and fishery logistics services is 300 workers, accounting for 4.2% of the total structure of fishery labor.

1.1.3. The characteristics of sea research areas in Van Don district

- The research area is 1,620 km^2, accounting for 33.6% of the coastal area of Quang Ninh provincie, with 600 large and small islands forming enclose areas which are suitable for fishing and aquaculture activities taking place most time of year;

- The research area is a large potential area for aquaculture development; the diversity of seafood resources thus the catching activities takes place most time of year;

- There are many marine ecosystems such as 7,381 ha of mangroves, coral ecosystems with the cover of 42.7% ÷ 57.1% of the high level of the Tonkin Gulf.

1.2. Overview of foreign researches and domestic researches

1.2.1. Foreign studies: The scholar has researched and analyzed many scientific studies including (1) researched about the impacts of trawl to fisheries resoures (2)

researched and analyzed 5 scientific works in the world on artificial reef to prevent trawl activities; (3) Focusing on researching solutions to change trawlers into aquaculture including countries: Japan for growing Orange fish, Eel and Yellowfin Tuna; Norway and Chile for raising salmon; Indonesia and the Philippines for growing fish; (4) The study focused on researching to improve institutions and policies to improve the legal framework for managing fisheries.

1.2.2. Domestic studies: (1) Study 5 works on the effects of the trawl on fisheries resources; (2) A group of solutions for artificial reef construction with concrete structures was implemented in HaiPhong, Quang Nam, BinhDinh and NinhThuan, based on the results of the current situation survey and artificial reef experiment to establish the system new artificial reef system, creating more space for residence, hiding, growing and developing; (3) Group of works changing their exploitation jobs to aquaculture or converting to other occupations.

1.3 General assessment of foreign researches and domestic researches

- The study focuses on the problemsincluding (1) The impact of trawl on fisheries resources; (2) Organize reefs to create a new space to restore and develop fisheries resources; (3) do changing from fishing to aquaculture.

- Using survey method is mainly; some experimental implementation of artificial reefs; other subject combined with reefs, changing fishing to aquaculture.

1.4. The inheritance points for the thesis topic

1.4.1. The research content: The thesis will focus on the following issues: (1) Changing from trawlers to marine aquaculture; (2) Solutions to prevent and prevent the operating of trawlers in the coastal areas; (3) Studying to improve fishery mechanisms, policies and regulations.

1.4.2. The research method: The PhD student inherits the following research methods: (1) Continuing to use the investigation method (secondary data collection, primary data collection); (2) Experimental method (artificial reefs, changing from trawlers to marine aquaculture).

1.4.3. The problems for continuing research

(1) Assess the current situation of fishing activities of trawlers in the coastal areas of Van Don district in QuangNinh province.

(2) Studying, identifying scientific data and having a convincing assessment of the impact of trawlers on fisheries resources and related ecosystems of the research areas.

(3) Proposing measures to limit the fishing activities of the trawlersin the sea of research areas to protect fisheries resources but ensure the livelihood of fishermen.

CHAPTER 2: METHODOLOGY

2.1. Methods of determining investigation samples:

The number of survey samples for research on the operation of trawlers was determined by Yamane's formula (1967 ÷ 1986); Based on the formula, the surveyed samples were calculated as 88 fishing vessels:

- In which by capacity: there were 8 vessels of less than 20 CV, 39 vessels from 20 to less than 50 CV, 33 vessels from 50 to less than 90 CV, and 8 vessels of more 90 CV.

- According to the fishing type, there were 34 traditional trawl, 26 vessels of trawl combined with electric, 28 vessels of non-traditional trawl.

2.2. Methods of data collection:

- Using the method of secondary data collection and primary data collection;

- Conducted through direct interviews with fishermen using boats, fishing gears and workers on the trawlers with questionnaires in coastal areas.

2.3. Experimental methods:

- Changing from trawlers to marine aquaculture;

- Test on artificial reefs in combination with coral planting.

2.4. Economic efficiency evaluation method:

- The production efficiency of the trawlers, marine aquaculture is evaluated by the indicators of revenue, cost, profit and income of workers;

- The experimental model's efficiency is based on the following items: Cost, revenue, profit/capital investment of the trawlers compared to the experimental model of marine aquacultures.

2.5. The assessment method of impacting on fisheries resourse of trawlers

- The study was conducted from 2013 ÷ 2017, so to assess the harmfulness of agriculture and forestry; the author cited the provisions of the Fisheries Law 2003 and its subordinate documents at this time including Circular 02./2006/TT-BTS and Circular 62/2008/BNN stipulating the mesh size and size of fish to be exploited in order to determine the percentage of juveniles, juveniles and minimum sizes of marine species allowed for exploitation;

- Evaluating the extent of harm and invasion of the residence place of the fisheries resourse in the research areas the basis of:

+ Fishing gear with special structure, prohibited occupations according to the provisions of Decision 2418/QD - UBND; Directive 19/CT-TTg of the Prime Minister.

+ Based on the fishing effort of trawlers operating in the coastal areas of Van Don district.

CHAPTER 3: RESULT AND DISCUSSION

3.1. The vocational structure of trawler in the coastal areas of Van Don district

The results of the vocational structure of trawler in the research areas from 2013 to 2017

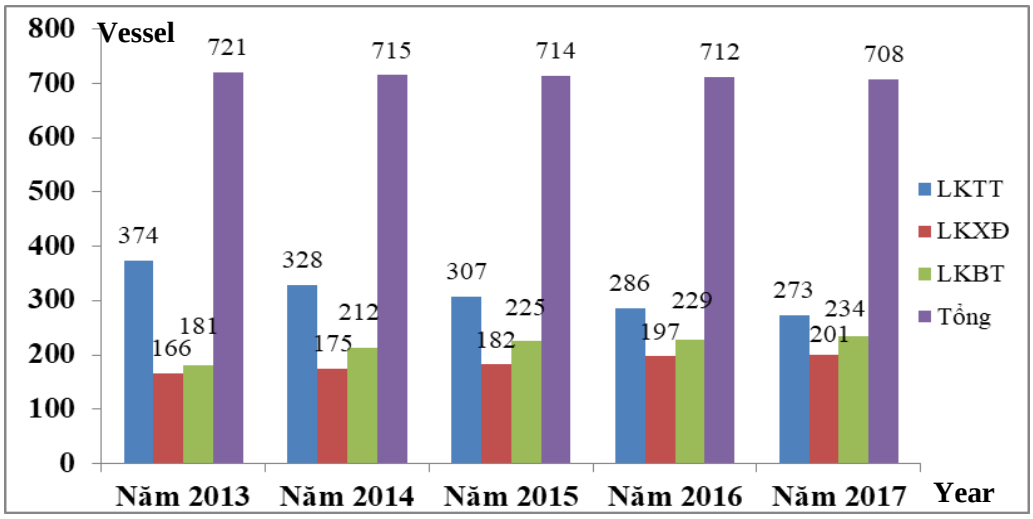

Figure 3.1: The changing of trawl fishing vessels in the research areas

Table 3.1.The trawler activities in the coastal areas of Van Don district in 2017

No	Place	No. of ship (unit)	Group of power (CV)				*No*	Place	No. of ship (unit)	Group of power (CV)			
			< 20	20÷49	50÷89	≥ 90				< 20	20÷49	50÷89	≥ 90
1	VanĐon	148	22	72	54	0	*8*	Ha Long	38	8	14	16	0
2	Tien Yen	8	0	5	3	0	*9*	Uong Bi	34	0	12	13	9
3	Dam Ha	10	0	8	2	0	*10*	Quang Yen	357	28	182	120	27
4	Hai Ha	11	0	3	8	0	*11*	ĐongTrieu	9	0	4	5	0
5	Co To	7	0	0	7	0	*12*	Other province	19	0	0	8	11
6	MongCai	12	0	0	12	0	*13*	Total	708	63	315	271	59
7	Cam Pha	55	5	15	23	12	*14*	*Percentage (%)*	*100*	*8,9*	*44,5*	*38,3*	*8,3*

According to Table 3.1 and Table 3.1, it shows that: (i) The number of trawlers operating in the research areas from 2013 to 2017 decreased but not significantly (1.8%). It is noteworthy that fishermen have changed from traditional trawl (down 27.0%) to non-traditional trawl (up 21.1%) and traditional trawl combination with electic(up 29.3%); (ii) The number of trawlerof Van Don district is only 20.9%, the rest of the trawler is 10 other districts and other provinces; especially the vessels of Quang Yen account for 50.4%.

3.2. The characteristics of trawlers operating in the research areas

3.2.1. The characteristic outside of trawler

Result of the survey according to the maximum length and shell material, year of packing ...

Table 3.2: The length and shell of trawlers operating in the research area in 2017

No.	Type of trawl	Sample	< 8,0m	8,0÷11,9m	12,0÷14,9m	≥ 15m	Material
1	Traditional trawl	34	2	20	11	1	Wood
2	Traditional trawl with electic	26	2	15	8	1	Wood
3	Non-traditional trawl	28	2	24	2	0	Wood
4	Total	88	39	485	173	11	Wood
5	Percentage (%)	*100*	*6,8*	*67,0*	*23,9*	*2,3*	*100*

Table 3.3: The age of shell of the trawlers operating in the research area of Van Don district

No.	Type of trawl	Total of survey	The age of vessel (using year)			
			< 5	5÷ < 10	10÷ < 15	≥ 15
1	Traditional trawl	34	0	7	11	16
2	Traditional trawl with electic	26	0	5	8	13
3	Non-traditional trawl	28	0	2	12	14
4	Total of sample	88	0	14	31	43
5	*Percentagelệ %*	*100*	*0*	*15,9*	*35,2*	*48,9*

According toTable 3.2 and 3.3 show that: (i) 100% of wooden shell, the length of ships is mainly from 8.0 to less than 12 m, accounting for 67.0%; (ii) the shell of ships are mostly old, accounting for 48.9%; In the past 5 years, there have been no newly built trawlers; This shows that the inspection and controlling of the authorities has helped fishermen to strictly abide by the regulations on building new trawlers.

3.2.2. The engine of trawler

The results of survey on the engine of trawlers in the research areas shows that: (i) Trawlersare equipped with 1 to 3 main engine in which 2 engines are the most, accounting for 61.3%; 1 engine (accounting for 26.2%) and 3 engines (accounting for 12.5%). Equipping more main engines will be safer for production process; This is also one of the ways to deal with local government, when the trawl is detected, the captain of trawl will use 2 or 3 engines to speed up for escaping; (ii) The equipped engines are mainly made in China, accounting for 67.0% because of the price, easy to buy, easy to replace; Japan and other countries only accounted for 17.1% and 15.9%.

3.2.3. Marine equipment, communications and exploitation equipment

- Conducted surveys on maritime equipment and communications on 88 trawlers operating in the research areas, it is shown that: (i) the trawlers do not meet the safety and safety standards, etc. (ii) 100% of trawlers are equipped with mobile phones; 84.1% have navigational equipment and 54.5% have a short-range telephone.

- Most of the trawlers use friction-type sheet machines, accounting for 97.7%; Crane devices are I-type and A-type cranes, which are machined and manufactured from iron and wood materials so it is easy to damage, potentially high labor safety risks.

3.2.4. The situation of fishing gears of trawlers operating in the research areas

3.2.4.1. Traditional trawl

The results of investigating the technique indexs of the traditional trawl following table 3.4

Table 3.4: The basic technique indexs of traditional trawl

No.	Group of power	Sample (vessel)	L_{tb} (m)	The length of fishing gear(m)				2a of net (mm)
				$L_{cánh}$	$L_{chắn}$	$L_{thân}$	$L_{đụt}$	
1	Under 20 CV	2	11,3	0,5	1,0	7,8	2,0	14 ÷ 16
2	From 20÷49 CV	15	13,5	0,7	1,5	9,3	2,0	14 ÷ 16
3	From 50÷89 CV	14	15,6	0,9	1,7	11,0	2,0	16 ÷ 18
4	From 90 CV to more	3	19,2	1,2	2,2	13,6	2,2	18

According to Table 3.4, it is shown that: (i) The total length of the traditional trwlis directly proportional to the capacity of the main machine of trawlers; (ii) The mesh size in the lower part of the net is smaller than the specified, showing the full exploitation and destruction of fisheries resources.

3.2.4.2. Trawl combined with electic

It is traditional trawl that is equipped with an electric stimulator; the pulse generator efficiency is calculated by the number of amplifier circuits (ICs). The number of IC, the greater the possibility of destroying fisheries resourses.

Table 3.5: The situation of using IC to create electic of trawlers

No.	Group of power	Sample (vessel)	The number of IC (unit)	The number of IC/vessel
1	Under 20 CV	3	24	8
2	From 20 ÷ 49 CV	12	48	4
3	From 50 ÷ 89 CV	7	96	14
4	From 90 CV to more	4	192	48

According to Table 3.5 shows that: (i) Despite the provisions of the law, prohibiting the use of electric impulses in fishing activities because of the extent of destruction of fisheries resourses but 100% of trawlers have intentionally violated; (ii) Group of ships of over 90 CV equipped with the largest number of ICs (48 ICs/ship); next is the group of ships of 50 ÷ 89 CV (14 IC/ship); The lowest is the 20 ÷ 49 CV ship group (4 ICs/ship).

3.2.4.3. The situation of non-traditional trawl

Fishing gear has a fixed frame structure, composed of many tooth rods, evenly distributed all the length below the mouth of the frame and arranged with a net and trench net to retain the seafood.

Table 3.6: The technique indexes of non-traditional trawl

No	Technique index	< 20 CV	20÷49 CV	50÷89 CV	Material
1	The length of net (m)	4,2 ÷ 5,2	4,5 ÷ 5,5	5,5 ÷6,5	Iron
2	Scratched tooth length (mm)	80 ÷100	80 ÷100	100 ÷120	Iron
3	Scratch bracket radius (mm)	100 ÷120	110 ÷130	130 ÷160	Iron
4	Mesh bag length(m)	2.0 ÷ 2.5	2.0 ÷ 2.5	2.5 ÷ 3.0	PE380/5x3
5	Distance 2 rake teeth(mm)	25 ÷ 30	30 ÷ 35	35 ÷ 45	-
6	Mesh pocket size (mm)	14 ÷ 16	14 ÷ 16	16 ÷ 18	PE380/5x3

According to table 3.6 shows: The non-traditional trawl is only used on ships with a capacity of less than 90 CV; ships with large capacity are of length, frame size, large rakes and vice versa.

Comment: The above research results clearly show the impacts of trawlers on resources and ecosystems of the research areas compared to other localities that only apply traditional trawl to exploitation. However, there has not been any scientific research in our country that clearly indicates the impact and effectiveness of traditional trawl with electic and non-traditiional trawl compared to traditional trawl, but certainly the impact of these two fishing gears on resources and ecosystems in the research areas as much.

3.2.5. The situation of labor and the educational level of workers of trawlers

Educational level, age of workers on a ship ... are important factors in fishing activities and the ability to apply scientific advances.

Table 3.7: The situation of labor based on type of trawl in the research areas

Type	No. of person/ship	Inter-viewee	Experience working (%)			Educational level			
			< 3 years	3÷10 years	> 10 years	Non-writing	Primary	Secon-dary	High-school
Traditional trawl	2 ÷4	124	*24,8*	*40,0*	*35,2*	3	64	50	7
Trawl with electic	2 ÷5	103	*22,8*	*46,5*	*30,7*	7	51	40	5
Non-traditional trawl	2 ÷3	72	*18,1*	*31,9*	*50,0*	12	39	20	1
Total		299	22,5%	40,3%	37,2%	22	154	110	13

According to Table 3.7, it is shown that: (i) The labor working on the trawlers depends on the capacity of ships; ships with large capacity are arranged to have more labor and vice versa; (ii) Labor with low levels of education, mostly in primary schools, accounted for 51.5%, or even non-writing, accounting for 7.4%. Based on the education, it is very difficult for workers to access advanced production methods,

invest in building offshore ships ... (iii) The majority of workers have seafaring time of` over 3 years, in which from 3 ÷ 10 years, the proportion increased to 40.3%, over 10 years, the proportion was 37.2%.

3.2.6. The situation of production, yield and type of species of trawlers

The survey of production, yield and the proportion of young seafood species of 63 times of catching nets inmain seasonnaland extra seasonal catches on trawlers in 2017, are presented in Table 3.8:

Table 3.8: The yield and the proportion of young fish of trawlers

Type of trawl	Danhmục	Volume of fishing production					
		Total	Fish	shrimp	Squid	Crab	Mollusk
Traditional trawl	Yield (kg)	1.357,9	755,8	419,5	87,3	10,8	84,5
	Young seafood (kg)	483,4	262,8	133,4	61,9	3,9	21,4
	Percentage %	*35,6*	*34,8*	*31,8*	*70,9*	*36,1*	*25,3*
Trawl with electic	Yield (kg)	1.853,1	1.054,2	585,1	121,7	15,4	76,7
	Young seafood (kg)	877,8	499,8	242,4	98,9	10,0	26,7
	Percentage %	*47,4*	*47,4*	*41,4*	*81,3*	*64,9*	*34,8*
Non-traditional trawl	Yield (kg)	908	179	99,4	20,7	2,6	606,3
	Young seafood (kg)	351,3	55,9	44,2	7,7	1,0	242,5
	Percentage %	*38,7*	*31,2*	*44,4*	*37,2*	*38,5*	*40,0*
Trawler	Yield (kg)	4.119	1.989	1.104	229,7	28,8	767,5
	Young seafood (kg)	1.712,5	818,5	420	168,5	14,9	290,6
	Percentage %	*42,0*	*41,0*	*38,0*	*73,0*	*52,0*	*38,0*

According to Table 8, it is shown that: (i) The average yield of the trawl combined with electic is the highest, reaching 88.2% kg per catching net, traditional trawl with 59.0 kg per catching net and non-traditional trawl reaching 47.8 kg/catching net; (ii) The largest proportion of fish accounts for 48.2%, shrimp accounts for 26.8%, mollusks account for 18.6%, squid and crabs have a small volume in the product structure; (iii) The volume of young seafood is very large, an average of 42% exceeding the allowed rate of no more than 15%; All fishing products exceed the allowed level, in which squid has the highest level with 73.0%.

3.2.7. The survey results of economic indexes of trawlers in the research areas

Survey results of production data of 88 trawlers of 3 types of fishing according to the capacity of fishing activities in the coastal areas of Van Don district are presented in Table 3.9:

Table 3.9: Economic efficiency of trawlers in the research areas in 2017

(Unit: 1.000 VND/vessel)

No.	Content	Type of trawl	< 20 CV	20÷49CV	50÷89 CV	≥ 90 CV
1	Capital	Traditional	*68.400*	*137.825*	*203.200*	*647.700*
		With electic	*106.100*	*155.000*	*215.833*	*652.000*
		Non-traditional	*119.333*	*173.188*	*235.600*	*702.400*
	Mean		97.900	155.338	218.211	667.367
2	Revenue	Traditional	*413.800*	*681.250*	*1030.000*	*1322.400*
		With electic	*486.667*	*686.250*	*1.023.333*	*1266.667*
		Non-traditional	*540.833*	*860.000*	*1081.000*	*1517.200*
	Mean		480.433	742.500	1.044.778	1.368.756
3	Cost	Traditional	*260.000*	*480.000*	*808.200*	*877.000*
		With electic	*398.333*	*526.875*	*765.833*	*854.733*
		Non-traditional	*422.000*	*686.125*	*839.000*	*959.100*
	Mean		360.111	564.333	804.344	896.944
4	Profit	Traditional	*153.800*	*201.250*	*221.800*	*445.400*
		With electic	*88.333*	*159.375*	*257.500*	*411.933*
		Non-traditional	*118.833*	*173.875*	*242.000*	*558.100*
	Mean		120.320	178.167	240.433	471.811
5	Income	Traditional	*35.000*	*38.750*	*50.000*	*62.000*
		With electic	*42.167*	*48.250*	*60.000*	*70.000*
		Non-traditional	*38.333*	*45.000*	*55.000*	*66.000*
	Mean		38,5	44,0	55,0	66,0

According to Table 3.9, it shows: (i) The average investment capital of non-traditional trawl is the highest and traditional trawl has the lowest investment capital; (ii) revenue, cost and profit indicators of trawler are positineproportional to the engine capacity; indicators of investment capital, revenue, cost, profits of the vessel with large capacity are high level and vice versa; (iii) The average income of workers of trawl combined with electic is higher than that of traditional trawl and non-traditional trawl.

3.2.8. The situation of law violations of trawlers in the research areas

- Law violations of trawlers are mainly technical and administrative violations as shown in table 3.10:

Table 3.10: The situation of law violations of trawlers from 2013 to 2017

Type of trawl	Unit	2013	2014	2015	2016	2017
Traditional trawl	*Case*	115	119	143	155	178
Trawl with electic	*Case*	216	232	241	263	286
Non-traditional trawl	*Case*	55	67	102	198	325
Total	*Case*	386	418	486	616	789

According to Table 3.10, it shows that: (i) The violations of trawlers increase every year, after 5 years the number of case increases 2.0 times; in 2013, there were

386 cases of violations, by 2017, there were 789 cases, which shows that the level of occupational violations is quite common and complicated; (ii) The type of trawl with electic has more violations than traditional trawl and non-traditional trawl; However, in 2017, the type of non-traditional trawl had a higher number of violations than traditional trawl and trawl with electic.

3.2.9. The situation of density of trawler activites in the research areas in 2017

- The survey results show that: (i) There are 7 zones where trawler activities are concentrated, zone with high density such as Thang Loi - Ngoc Vung commune with a density of 1.13 km^2/ship, BaiTu Long Bay density 1,58 km^2/ship, Van Don bay is 1.89 km^2/boat and coastal areas is 1.69 km^2/ship; (ii) traditional trawl and trawl with electic distributed in 7 main zones, but non-traditional trawl often concentrated in areas such as ThangLoi - Ngoc Vung, Bai Tu Long Bay.

- Survey results on operating time, there are 61.4% of trawler operating during the daytime and 38.6% operating at nighttime; however, the non-traditional trawl is mainly daytime, of which 30 are on trawlers having 25 during the daytime (accounting for 83.3%); but trawl with electic is mainly at nighttime, of the 26 vessels surveyed, 65.4% of vessels operate at nighttime.

3.3. Assessment of the harmful level of trawler on fisheries resourses in the coastal areas of Van Don district

3.3.1. Catching the juvieline, young species, ungrown adult species

- The net of catching trawlers catches any object within the scope of the swept-net mouth; analysis results 4.119.1 kg of 19 species of seafood, 18 species are on the list of species with smaller size than the specified;

- The proportion of young and young seafood accounts for a large volume, of which squid has the highest percentage accounting for 84.6%, fish accounting for 73.4%, and others from 17.6% to 63.6%.

3.3.2. Harm on habitat, breeding and growth of aquatic species

Investigation of discarded waste composition of catching nets appears to be seagrass, seaweed for traditional trawl and trawl with electic and mollusk shells, it is found more in non-traditional trawl.

Table 3.11: The waste composition of catching nets

Type of trawl	Seagrass (%)	Seaweed (%)	Coral (%)	Mollusk, Mollusk shell (%)	Mud (%)	Sand (%)	Stone (%)
Traditional trawl	29,5	25,4	19,2	9,6	16,3	0	0
Trawl with electic	35,6	26,2	15,7	12,3	10,2	0	0
Non-traditional trawl	7,8	10,3	18,6	54,8	0	8,5	0

According to Table 3.11 shows that: traditional trawl and trawl with electic encountered many seagrass species accounting for 29.5 ÷ 35.6%, seaweeds accounted for 25.4% ÷ 26.2%, corals accounted for 15.7 ÷ 19.2% in the structure of discarded waste. The non-traditional trawl appears with many mollusks, the mollusk shells accounts for 54.8% but the occurrence of seagrass, seaweed is lower in the types of traditional trawl and trawl with electic.

3.3.3. Harm on life environment of aquatic species in the research areas

The trawler operates with a great effort, continuously daytime and nighttime and takes place most time of year; The total area of fishing gears swept in a daytime and nighttime, accounting for 50.7% of the area of fishing zonesof trawlers in the research areas.

3.4. Assess the reasons of trawler focusing on in the research areas

3.4.1. The research areas have advantage conditions for growing trawler

- The research area has a large area, is airtight; diversified and abundant aquatic resources in species composition, high economic and nutritional value, evenly distributed throughout the months of the year; has a large consumer market... so attractive for trawlers to operate ashore;

- Van Don district is developing marine fish farming, the demand and food source for marine fish farming are mainly trash fish, which has been the driving force for the development of agriculture and forestry.

3.4.2. The lower educational level of fishermen

- Most fishermen have low education, limited legal knowledge, vocational training in the form of "hereditary" or "just hand-held"... very difficult to access advanced production methods, apply science and technology... to expand production;

- Establishing morning routines or vice versa, the ship owners are afraid of offshore and long-term operations, so they only focus on near-shore activities, thus violating the exploitation and use of small meshes or electrical impulses to recover AFF.

3.4.3. The management of authorities are not suitable

- The province has a large number of ships, but has no detailed planning for aquatic resource exploitation; the management of marine areas, boats and jobs is still limited;

- There has been no research and study on the effectiveness of conversion of trawler as a basis for fishermen to consider and select job change suitable to their financial conditions.

3.4.4. Economic benefit of trawler

- The initial investment is not large, but the high profit is 0.63 to 1.23 times higher than the investment capital, which is the motivation for ship owners to develop inshore trawler.

- Investment interest of up to 63 to 123%/year is extremely large interest in business (meanwhile the bank's interest rate is only 7 to 8%/year).

- The input factors for production are constantly increasing, but the product price increases are insignificant, so fishermen bring ships to exploit nearshore to reduce fuel costs.

3.4.5. The behavior of fishermen conflict the authorities

- Fishermen have changed the form of traditional trawl to the type of non-traditional trawl; deliberately not marking fishing vessels identification; wrong license content.

- Use the phone to grasp the time information, movement direction of the functional forces through traders in wharves or rafts owners on the sea.

- Taking advantage of complex terrain, vast seas to evade; When women, old people and young children are used as a screen when they are dealt with, they will not accept violations.

3.5. The solution to limit trawl activities in the coastal area of Van Don district

3.5.1. The solution of changing from trawler to aquaculture

3.5.1.1. Change from trawler to fish cage aquaculture

(1) The pilot model for changing from trawler to fish cage aquaculture

- According to the survey results, the study has chosen trawler owner to participate in the model is Mr. Nguyen Van Dao, born in 1973, educational level 7/12; inThiDua village, ThangLoi commune, Van Don district; is the owner of QN-66348-TS vessel; The capacity is 15 CV, with 3 employees working on trawler in the coastal areas of Van Don District during the past 11 years.

- Investing in 8 cage cells, the size is 4m x 4m x 4m, the volume is 64 m^3/cage and 01 management space with an area of 20m^2. Growing grouper fish with 4 cage cells, the number of seeds is 6,400, the density of 25 fish/m^3 cage, the size of fish dropped from 10 ÷ 12 cm/fish... Cobia farming is 4 cage cells, the number of seedis 2,048 fish, with a density of 8 fish/m^3 in a cage, with fish sizes of 16 ÷ 18 cm.

- Feed used is 50% trash fish and 50% pelleted industrial feed; twice daily in the early morning and late evening. The care process is carried out closely to check, monitor and measure environmental factors such as salinity, pH, temperature ...

- Harvested after 11 months of stocking. Survival rate of grouper was 55.6%, cobia reached 65.5%; Grouper weight reached 1.1 kg/fish, Cobia reached 3.3 kg/fish. The total production reached 8,340 kg, of which: Hybrid grouper 3,914 kg; Cobia 4,426 kg. Revenue reached 1,181,599 million VND, in which grouper fish reached 767.65 million VND and Cobia reached 413,949 million VND. The cost is 669,023 million VND, in which the fixed cost is 56,485 million VND accounting for 8.4% and

the variable cost is 612,538 million VND accounting for 91.6%. Profit of the tested model reached 512,576 million VND.

(2) Assess the efficiency of trawler with the model of fish cage aquaculture

Economic efficiency of cage fish farming compared to trawler in coastal areas

Table 3.12: Campare the economic efficiency between trawler and marine aquaculture

No.	Content	Unit	Fish cage aquaculture	Trawl
1	Investment capital	1.000 VND	164.850	101.020
2	Revenue	1.000 VND	1.181.599	508.656
3	Cost	1.000 VND	669.023	399.306
4	Profit	1.000 VND	512.576	109.351
5	Profit/investment capital	%	4,06	3,95
6	Revenue/investment capital	%	7,17	5,04
7	Profit/investment capital	%	3,11	1.08
8	Salary of worker	VND/hour	37.500	20.450
9	Working time	hour/day	4	10
10	Time of job	-	daytime	Nighttime
11	Risk level	-	Low	High
12	Number of worker	person	1÷2	3

According to table 3.12, it is shown that: (i) Cage fish farming has an investment of 1.63 times but profit is 4.69 times higher than that of net fishing; (ii) The return on invested capital of cage fish culture is 2.88 times higher than that of net fishing; (iii) Wages for 1 working hour of cage fish culture are 1.83 times higher than trawler.

3.5.1.2. Change from trawler to Pacific oyster aquaculture

(1) The pilot model for growing Pacific oyster

- Model of raising TBD in Ban Sen commune, Van Don district. The model owner is Mr. Long Van Quang, CaiRong town, Van Don district; the main job is raising fish in cages with 5 employees, having boats operating trawl net; 15 hectares of sea surface; education is 12/12;

- Organize training for model owner and 24 owners of trawlerchange to aquaculture in Ban Sen commune to help fishermen have more knowledge about farming techniques and management of Pacific oyster aquaculture.

- Pilot model: Area of 15,000m2 including: 100 main rope, length of 100 m/line, distance between 2 wires is 1.5 m; 25m2 management house; reuse 01 wooden trawler; 22 CV capacity to manage and support cages. The number of almost stocked seeds:

1.92 million seedlings (40,000 strings), each of which has 10 stands, each of which has 4 ÷ 5 of the seeds;

- Harvest after 11 months of rearing with the following results: Turnover reaches VND 1,605,652.7 million. The cost is 1,188.4 million VND, of which initial investment is 711.75 million VND, accounting for 59.9%, production cost is 476.6 million VND, accounting for 40.1%. Profit reached 417,252.7 thousand dong.

Thus, after nearly 1 year of implementing the model, there have been positive results; profits will be higher in subsequent years because there is no capital investment required.

(2) Limite trawl activities in aquaculture zones

- Survey before implementing the model, this area often has 5 occupations such as trawling, fishing, dragging, cage traps, shoveling; the number of ships operating is 18, of which 50% operate during the day and 50% operate at night;

- After one year of implementing the model, this area is reduced to 2 occupations: gill net, hand fishing; the number of active ships decreased to 9, of which there were 7 ships during the day, 2 at night and no boats with operation of trawlers;

- Survey on 6 vessels of 3 gill net, fishing lines, trap cages shows that aquatic resources have increased significantly compared to before the implementation of the model; in which gill nets increased by 5 species, fishing hands increased by 2 species and cage cages increased to 6 species;

Comment: The farming area acts as a scrub system so it can attract concentrated AFF, stay and grow, on the other hand, the farming area also forms a large and complex reef system, which limits exploitation. Therefore, AFF is protected and developed.

3.5.1.3. The result of solution to change job

(1) Make the solution to change from trawler to marine aquaculture

- The research area has 708 trawl fishing boats, but the number of ships in Van Don district is only 148 units, the rest is from other districts or provinces. Within the scope of the thesis, only a solution to change the number of trawlers managed by Van Don, the number of trawlers of other localities is used by other solutions.

- According to the planning of the aquaculture surface area of Van Don district is 4,200 ha; up to now, 800 hectares have been used, leaving 3,400 hectares of unused sea surface. With the regulation, one owner of trawler changed to marine aquaculture will be provided with 1 ha of water surface, 148 vessels of Van Don district manage to have enough water surface fund for conversion.

- Organized 06 meetings with 117 participating trawler owners accounting for 79.05%; the rest (31 ship owners) we have to coordinate with village leaders, fisheries

associations, fishery control stations to meet directly with each ship owner to propagate, mobilize...

- Organize 3 tours for 118/148 owners of trawler on effective marine farming models in Cat Ba - HaiPhong, Cua Lo - Nghe An, NinhHoa - KhanhHoa so that owners can confidently carry out change job.

- Continue to help fishermen increase knowledge of aquaculture by opening 06 technical training courses at localities for 97/148 ship owners to participate (65.5%);

- After the advocacy and technical guidance on marine farming, 96 ship owners accounted for 64.8% of the registered changes from trawler to marine farming according to the roadmap from 2017 to 2020, in which 56 households raised fish in cages and40 mollusk farming households.

(2) The result of changing job

- In 2017 to the end of 2018, there were 56 tugboat owners implementing the transformation, of which, in 2017, it was 22 ship owners and in 2018 it was 34 ship owners; The cultured species are marine fish, molluscs and marine farming services.

- The survey results of profit of owners changed to aquaculture in 1 year of the period 2017 ÷ 2018, are listed in Table 3.13:

Table 3.13: The profit of changing job model from 2017 to 2018

Type of aquaculture	Household	< 200 (VND)	200 ≤ 300 (VND)	Từ 300 ÷ 500 (VND)	> 500 (VND)
Marine fish aquaculture	21	0	2	9	10
Mollusk aquaculture	17	0	3	6	8
Fishery services	18	12	6	0	0
Total	56	12	11	15	18

According to Table 3.13 shows that: (i) 100% of trawlers changed to marine farming they had the efficiency of marine aquaculture, in which marine fish and mollusk farming are more profitable than the type of fishery services; (ii) Marine fish culture has a profit of over VND 300.0 million/year, accounting for 90.4% while that of mollusk culture has a profit of VND 300 million/year, accounting for 82.4%; no owner of marine farming has profit of less than VND 200.0 million/year.

In the two years of implementing the solution to changetrawlers to aquaculture, the initial results have been achieved: The number of owners oftrawlers changed to marine farming that has increased, from 22 households in 2017 to 34 households in 2018, which is a good sign. Continuing to monitor that 56 owners changed to marine farming in 2017 and 2018 showed good results, fishermen excited because of stable income and higher than trawler.

(3) Assess the efficiency of the solutions

- Socio-economic efficiency: Solutions to change jobs are suitable to the habits, customs and qualifications of fishermen, helping ship owners to meet the conditions for lightening, returning or vice versa. The investment is either large or small depends on the financial capacity of the fishermen; Does not require high technology; Using less labor in accordance with the financial resources of the fishermen. Creating a new job, replacing trawler, increasing income for fishermen because raising oyster by hanging ropes that is a new form of farming, growing Pacific oyster does not have to pay for food, so production costs are much lower than marine fish culture.

- Effective protection of aquatic resources and the marine environment: Marine fish farming, Pacific oyster farming uses large water surface, and culture areas form obstacles and hassles that prevent trawler activities; raft aquacultureand cage aquaculture have created a system of artificial rubs and artifitialreefs to attract fisheries resourse, constrating for hatching and development. Pacific oyster is a friendly, naturally occurring filter feeder, each oyster is a filter machine, removing algae, plankton, and cleaning the environment. Development of marine culture to replace trawlers contributes to the protection of resources and the environment.

3.5.2. The solution of dropping artifitial reefs

3.5.2.1. Survey the zone of dropping artifitial reefs combined with planting corals

- Surveying 3 areas including: Dau Cao with an area of 6.72 km^2, Da Bac with an area of 4.17 km^2, Cai Cong with an area of 7.6 km^2, all 3 locations have coral distribution but have decline due to activities of trawler activities;

- Selecting Cai Cong area to release reefs because of the area, hydrology, activities and energy resources showing signs of decline; the reef drop area is divided into 3 areas: the core area of 0.36 km^2, the buffer zone of 1.08 km^2, the transition zone of 7.6 km^2;

- Before releasing the reef, conducting the survey for 08 days, twice times per day and arranged in two schedules, showing: There are 7 fishing professions such as trawler, gill net, fishing line, snap net, trap cage, mixed phase shoveling and diving; the number of ships operating was 52 times/day/night (23 times during the daytime and 29 times at nighttime); number of trawlers with the highest frequency is 23 (10times during the daytime and 13 at nighttime); Most of the fishing objects are smaller than the specified size.

3.5.2.2. Dropping artifitial reef combined with planting coral

- Organize training for 30 people to popularize artificial reef areas in combination with growing corals and coral rehabilitation; harmful effects of trawler destroy the seabed, coral ecosystems;

- Artificial reef release combined with coral restoration planting with an area of 3,600 m2, dropping 300 reefs (150 cylindrical reefs and 150 semi-circular reefs) with 1,800 coral branches; periodically every 3-4 months to monitor the activities of trawlers, increase coral reefs and attract and concentrate fishery resources in the area of reefs;

- Implementation time 12 months. Review and evaluate the effectiveness of the model in limiting the activities of trawler and the ability to restore corals in artificial reef areas.

3.5.2.3. Assess the efficiency of the solution to drop artifitial reefs

After 1 year of conducting artificial reef release in combination with planting and restoring coral reefs, organizing the survey in 08 days, twice a day/shift, arranged in 2 waves, showing:

- The number of vessel has decreased from 52 to 36; no trawlers operating in the core area, 10 operations in the buffer zone and transitions around the reef area;

- Survey of 11 trawlers' owners operating outside the core zone shows that if the trawler owners operate in the core area, they will be: Torn the net, cut off the towing cable, lose the net;

- Survey results of 40 different fishing vessels showed that the number of species increased by 75%, product size increased by 85% and production increased by 87.5%; new appearance of some species such as seahorse;

- The average growth of corals is 2.2cm/year, the survival rate of corals decreases over time, after 1 year the rate of 65.3%;

3.5.2.4. Discussion of applying the model of dropping artifitial reefs

- Significant reduction in the number of trawlers and the frequency of fishing in reef areas, especially trawlers;

- Restoring corals, many seafood species are restored, including valuable and high economic species such as some species of shrimp, squid, seahorse ...

- Some of the cylindrical reefs are collapsed due to the impact of storms and the activities of ,trawlers so it is necessary to link the reef assemblies to be more effective.

The area is small, so it is limited to operate in the artificial reef; If investing to develop the scale of artificial reefs has a large area, it is necessary to invest larger funds.

3.5.3. The solution of improving management

3.5.3.1. The community monitors trawler activities in the coastal areas

- Set up a hotline to protect aquatic resources including 2 numbers 0945,541,313 and 02033,831,313 to receive, process information and implement inspection and handle violations; 24 hours/24 hours operating time.

- Through verified messages and handling 128 cases; fine of 640 million VND; including 44 trawlers 'owners, contributing to raising people's awareness in the struggle, eliminating and denouncing owners of trawlers' violations in the coastal areas of Van Don district.

3.5.3.2. Improving controlling the activities of trawler in the coastal areas

- Promulgated Directive 18-CT/TU of Provincial Party Committee and Plan 42/KH-UBND dated September 28, 2017 of QuangNinh Provincial People's Committee on strengthening management of fishing, protection and development of aquatic resources in QuangNinh province.

- Initial results: Increasing propaganda, signing commitments not to produce and trade banned fishing gears; do not use banned occupations and fishing gears. Strengthen patrol, inspection and handling of 358 banned fishing gears, destruction of 8 violating fishing net boats.

3.5.3.3. Perfecting institutions and mechanisms

- Provincial People's Committee issued Decision 209/2017/QD-UBND stipulating allocation and lease of sea surface water without collecting money for aquaculture; In 2017 and 2018, there were 38 owners of trawler of Van Don district assigned sea surface to change to aquaculture.

- Provincial People's Council issued Resolution 121/2018/NQ-HDND; The Provincial People's Committee issued Decision 4673/QD-UBND on interest rate support for vocational investment conversion loans; As a result, in 2017 and in 2018, 56 owners were supported to convert to aquaculture;

- QuangNinh Provincial People's Committee issued Decision No. 32/2018/QD-UBND providing for handling of material evidences and means of violations according to which, by the end of 2018, to carry out cranes to detain 25 violating trawlers; confiscated and destroyed 8 vehicles.

CONCLUSION AND SUGGESTION

I. Conclusion

1. In the coastal area of Van Don district, QuangNinh province, there is a large number of trawlers operating (708 units), of which 148 ships are managed by Van Don district and 560 towing ships of the districts and other province. Using 3 methods of fishing: Traditional trawl, Traditional trawl with electic and Non-traditional trawl; Activities both day and night are major harmful agents for AFF.

2. The dissertation analyzed, carefully evaluated and clarified 5 main reasons that the agriculture and forestry activities exploited in the VBSPBV Van Don district as a scientific basis to build solutions to change jobs for trawl boats of Van Don district. and artificial reef solutions to prevent local trawlers in QuangNinh and other provinces operating in VBNC.

3. The dissertation has successfully conducted two models of changing trawling to cage culture and TBD farming as a scientific basis to build a process of converting AFF to aquaculture. After 2 years of implementation, 56/148 owners of Van Don district ships of Van Don district were converted to aquaculture with high efficiency.

4. Successfully testing the artificial reef-dropping model combined with growing coral reefs in Minh Chau commune, Van Don district with an area of 3,600m2, implementing 300 artificial reefs in combination with restoring 1.800 corals for branches. scientific basis for solutions to prevent NLK boats operating in the VBVB; especially the trawl ship group of other localities in QuangNinh province and other provinces.

5. The thesis has developed and completed a number of management regulations, mechanisms and policies, created a strong enough legal corridor, created the most favorable conditions to support fishermen and fishermen to switch to aquaculture. no charge; interest rate support of 6% / year; establish hotline for protecting aquatic resources; promulgate sanctions and penalties sufficient to deter owners of trawlers who commit violations such as confiscation and destruction of infringing vessels.

II. Suggestion

- Continue to research, improve and implement measures to limit the capacity of fishing activities in the coastal areas of QuangNinh province.

- Studying mechanism to mobilize socialization resources for artificial reefs in combination with growing corals and marine conservation zones, in BaiTu Long and Ha Long bays to expand the space, residence and reproduction areas. and development of aquatic species;

- Research to build a fishery force in QuangNinh province to increase its regular presence at sea in the provincial waters.

LIST OF PUBLISHED RESEARCH

1. Do Dinh Minh, Phan Trong Huyen, Hoang Van Tinh "Research on the current situation of fishing trawl fishing activities in coastal areas of Van Don district, Quang Ninh province"; Journal of Fisheries Science and Technology, No. 2/2020.

2. Phan Trong Huyen, Do Dinh Minh, Hoang Van Tinh "The results of research on building solutions to change the trawler of Van Don district, Quang Ninh province in coastal areas into marine aquaculture"; Journal of Fisheries Science and Technology, No. 2/2020.

3. Do Dinh Minh, Hoang Van Tinh "Assessment of the harm to fisheries resources of the trawlers operating in the coastal areas of Van Don district, Quang Ninh province"; Journal of Agriculture and Rural Development, No. 386/2020.