A STUDY ON COSTS AND EARNINGS OF GILLNET VESSELS IN NHA TRANG, VIETNAM

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ABSTRACT

Vietnam's marine fisheries are in need of knowledge-based management. This necessitates the establishment of reliable indicators, which in turn entails a good data collecting and processing system. To bridge the gap between specific requirements for fisheries policy development and the limited resources available, we have conducted a study on costs and earnings of gillnet vessels in Nha Trang, Vietnam. 50 vessels are covered, in this case accounting for 17.5% of the total vessels of this gear type. Each fishing household, represented by the fisherman and/or his wife, gave a face-to-face interview to research team members in line with a project designed questionnaire form. The interviews were undertaken at home or onboard the vessel. The database noticeably reports on investment and loan, depreciation, repairment, fixed costs, variable costs, and earnings. Data and indicators will be interpreted and fed back into local marine fisheries policy strategies at first hand, and then, hopefully, incorporated into national policies in accordance to knowledge-based adaptive fisheries management.

INTRODUCTION

Khanh Hoa is located along the coastal zone in the Central Southern Vietnam. It is bordered by Phu Yen in the North, Ninh Thuan in the South, Dac Lac and Lam Dong in the West and the South China Sea in the East. On the map, Khanh Hoa extends from 108^0 40'33''to 109^0 27'55'' across Eastern Longitudes, and from 11^0 42'50'' to 12^0 52'15'' across Northern Latitudes. Khanh Hoa (including the mainland, over 200 islands and archipelagos) spreads across a total area of 5,197 square km. The coastline is made up of territorial waters and numerous islands of various sizes. The total length stretches from Cap Varella till the end of Cam Ranh Bay, with the approximate total length of 385km (on the basis of the water line).

Nha Trang is an emerging seaside city that makes Khanh Hoa an increasingly attractive destination for tourism. Of which, the fisheries sector is the driver of growth, responsible for 42% of the city's GDP. Thanks to the geographical advantage, the offshore capture is better positioned to operate because of the short distance to the fishing ground, as compared to many other regions. This favorable feature can also be exhibited in part by the extension system of internal waters. Cai and Lo Rivers, which provides spaces for anchoring vessels after sea trips, as well as offers much-needed logistic services.

The capture sector in Khanh Hoa province, strongly represented by that in Nha Trang, have a long tradition of development. Still, as prevalent in other parts of the country, these activities are conditioned by the local socio-economic and natural characteristics to remain small-scale fisheries. Till the end of 2005, the total number of vessels in Nha Trang was registered at 2,648, with the average capacity of 44.1HP per vessel.

Table 1: The distribution of vessels by location and fishing gear

Gear types / Ward	Gill net	Lift net	Line	Trawl	Purse sein	Purse sein using light	Other gear types	Total
Vinh Phuoc	180	50	51	32	15	0	13	341
Vinh Tho	6	115	45	356	41	1	36	600
Xuong Huan	78	85	111	66	4	2	7	353
Vinh Truong	10	156	16	31	92	1	118	424
Vinh Luong	2	23	10	228	36	0	10	309
Vinh Nguyen	1	99	7	1	23	328	54	513
Other	9	37	23	11	5	1	27	108
Total	**286**	**565**	**263**	**725**	**216**	**333**	**476**	**2,648**

Source: Bureau of Fisheries Resource Conservation in Khanh Hoa

The fisheries in Nha Trang has started rationalization and modernization process since 1997, marked by the offshore capture development. A significant contributor to high economic efficiency of the whole offshore operations is the tuna-mackerel gillnet.

A study on costs and earnings of gill net vessels in Nha Trang, Vietnam is part of the research project undertaken by the Faculty of Economics - University of Fisheries. It is assisted financially by NORAD project and technically by Norwegian experts. Because reliable information remains a precondition for making policies, the research objective is to set up an economic database that can be fed back into local marine fisheries policies and provide a solid foundation for overall fisheries management. A set of indicators to assess the performance of gillnet vessels will be presented. It includes initial investment, costs, revenue, earnings, and return on equity ratio. Some indicators will be clarified as follows:

- *Revenue*, which can be understood in full as gross annual vessel revenue, is the total year's vessel revenue at the landed price. It comprises all gained both in the main and sub seasons. This indicator excludes extra income that the crew can collect individually during the fishing trip.

- *Costs* consist of *fixed costs* (depreciation, payments for major repairs, loan interest, insurance, tax) and *variable costs* (payments for fuel, preservation (ice), provisions (food, soft drink…), labor, minor repairs, and others that are included in each fishing trip).

- *Earnings* is defined as the difference between revenue and costs.

- *Return on equity ratio* (ROE) measures the return on the owner's equity and is calculated by expressing the net earnings as a percentage of the owner's equity.

If a closer look is taken at the distribution of tuna-mackerel gillnet vessels across Nha Trang, it can be concluded that Vinh Phuoc and Xuong Huan are the two wards where fishing activities of this kind are mostly found and properly representative. Therefore, they are selected as the localities in which all the surveys would be carried out by face-to-face interview. The sample size is taken to cover 50 cases, equivalent to 17.5% of the population total.

Brief Description of the Tuna-Mackerel Gillnet Fishery in Nha Trang

Tuna-mackerel gillnet vessels in Nha Trang, 286 in number, have been almost motorized. The total engine power is 24,486.5 HP (85.6 HP in average) and the average length is 14.1m. Regarding volume, the gillnet fishing fleet accounts for 10.8% of the total vessel number in Nha Trang. This proportion is relatively low in comparison with those of other fishing types. Meanwhile, regarding engine power, the share stands at 21%. Once putting these two figures together to examine, it is obvious to see the engine power of tuna-mackerel gillnet vessels have been sizably invested. Traditionally, the gillnet population has been widely distributed in Vinh Phuoc and Xuong Huan wards, along the northern and southern branches of Cai River.

A fishing gear of this type is composed of separate pieces of small nets that are combined together to form a big one. Each piece may contain up to 1,000 meshes in length and 180-200 meshes in depth. When casted, meshes will take the square shape with 5 cm for each side, corresponding to the measurements of 60m (in length) and 9-10m (in depth) for the whole piece. Each vessel is typically equipped with 200-300 pieces for a big net to be created that can spread across the distance of 12-18 km.

Tuna-mackerel gillnet operations primarily take place along the territorial waters in Nha Trang and all its way to southward areas. The capture is done in the areas of 70 nautical miles onwards from the coastline. Fishing grounds are featured by migratory species, distributing along the movement direction of fish shoals, which can be divided into 3 main regions:

- *Truong Sa* ($112^0$30-$114^0$30'E; $6^0$30'-$8^0$30'N) where Tuna[1] is the target species and 70% of total production is contributed by Striped tuna[1];

- *Ba Ria-Vung Tau-Con Dao island* (104^0-108^0E; 6^0-8^0N) where Mackerel[2] is the target species and the level of striped tuna[1] production is low; and

- *The overseas fishing ground* that refers to the international sea waters bordered Malaysia and Indonesia (109^0-110^0E; 6^0-7^0N) where Striped tuna[1] is the target species, occupying over 90% of the total catch.

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[1]Bullet tuna (*Auxis rochei*), Frigate mackerel (*Auxis thazard*), Eastern little tuna (*Euthynnus affinis*), Longtail tuna (*Thunnus tonggol*), Striped tuna (*Sarda orientalis*), Skipjack tuna (*Katsuwonus pelamis*), Yellowfin tuna (*Thunnus albacares*) Bigeye tuna (*Thunnus obesus*).

[2]Indo-Pacific Spanish mackerel (*Scomberomorus guttatus*), Wahoo (*Acanthocybium solandri*), Narrow barred Spainish mackerel (*Scomberomorus commerson*).

The tuna-mackerel gillnet fleet can be split into two major categories, that is, tuna gillnet (in waters of greater than 60 m deep) and mackerel gillnet (in waters of less than 60 m deep).

Tuna gillnet group: The target species of this kind are Tuna, and by-catch accounts for approximately 20-25% of the total production, chiefly made up of Broadbill swordfish (*Xiphias gladius*), Black marlin *(Makaira indica*), Mahi mahi (*Coryphaena hippurus*), etc... The fishing season falls on the period between February and July when fish are mostly found off the distant waters from Nha Trang to Ba Ria-Vung Tau. This coincides with the main fishing season for the gillnet fishery in Nha Trang due to fine weather conditions. It is also particularly favorable for vessels of low engine powers since fishing operations can be conducted in the vicinity of Nha Trang. On the other hand, during the wintertime from October to January of the following year, tuna is concentrated in the extreme South of the country, bordering with Malaysia and Indonesia. At that time, vessels of high capacity are able to shift its fishing location, navigating along the migratory path of fish shoals. Meanwhile, those with limited capacity can not afford to go further, consequently, fishing in the area between Nha Trang and Vung Tau. Some other vessels of medium size and capacity have difficulties in taking southward trips. So, they operate in Tonkin Gulf fishing ground. These activities have been mostly undertaken in the common ground between Vietnam and China.

Mackerel gillnet group: The number of this gear type is small. It is mainly employed by fishers in Vinh Phuoc ward. This comes as mackerel gillnet fishery is rather selective and higher quality in gear. Another important source of success is the cumulative experience and knowledge of the captain, especially related to his capability in the prediction of fishing ground circumstances. And recently, the main season remains in the marked tendency of mackerel stock depletion. Mackerel is the target species whose contribution to the overall production is estimated at 30-40% in volume and 65-75% in value terms. The rests come first with tuna (accounting for 50% of the total production), then, followed by Broadbill swordfish (*Xiphias gladius*) , Black marlin (*Makaira indica*), butterfish (*Parastromateus niger*), scads (*Decapterus russelli*), etc. The principal fishing season with good weather patterns falls on February to June while the secondary period comes within August and January of the ensuing year when the capture is exposed to bad weather conditions. Fishing grounds for mackerel gillnet vessels are mostly concentrated off the coast from Binh Thuan to Con Son.

A gillnet vessel typically operates at night, equivalent to the time necessary for one haul of fish. In average, casting nets takes 2 hours. The next 2-4 hours is required for waiting fish to enter the nets and this duration varies from time to time dependent on the time of moon appearance. Then, the hauling in and preserving fish continue to consume other 4-6 hours. Each fishing trip lasts 10-25 days with the frequency of 1-2 trips per month according to seasons and vessel's lengths, usually made from 17^{th} to 12^{th} of the following lunar month. In the main fishing period, small vessels can be away on 2 trips per month with a 2-5 day break in between for preparations. Thus, total days-at-sea of each vessel will range from 230 to 250 during the year.

The production fluctuates by season. While the average production in total is recorded at 7-9 metric tons per fishing trip for the whole tuna gillnet fleet, this figure is relatively low for Mackerel, about 4-6 metric tons per one. The products then will be put into cubic boxes and arranged in layers covered separately with ice. Next, these boxes are piled up in the insulating hold which is also covered with ice to preserve products in the best condition possible. Fish is often sold to a fixed group of middle-men who handle the deals right at port. In the first days of the fishing trip, 45-50% of fish is likely to be sold directly at sea, and the rest goes on to be kept in cold storage for direct sales at ports in Phan Rang, Nha Trang, Phan Thiet, Vung Tau, Da Nang etc.

Almost all of the vessels stop fishing for 1-2 months over the year, primarily in August and September for a couple of reasons. Fishers take advantage of this period to make necessary preparations in vessels, gears and other equipment for the coming fishing season. Besides, bad weather conditions negatively influence the migrating path of fish, hence, physically challenge fishing activities.

The number of crew on board ranges from 8 to 12. In general, fishers have little conception of rest days, even on the holiday occasions of great significance like Tet - the Lunar New Year in Vietnam. In the face of complexities of offshore fisheries, captains are supposed to be those who are qualified in terms of both license and experience.

The Analysis of Investment in Tuna-Mackerel Gillnet Vessels

Initial investment in vessels and fishing gears can be considered as the main factor determining the production efficiency in fisheries. These decisions have long-term impacts in operating costs, such as costs for depreciation and payments for loan interest, which presumably have a close relationship with the ultimate objective of earnings.

Table 2: Investment

Unit: US$ (US$ 1 = VND 15,900)

Number of vessels: 50

Criteria	Average	(%)	Max	Min	Standard deviation
Hull	16,515.7	26.27%	28,301.9	4,402.5	6,478.7
Engine	7,620.1	12.12%	15,723.3	817.6	3,891.1
Mechanical equipment	1,405.0	2.24%	4,911.9	698.1	648.1
Electronic equipment	1,353.9	2.15%	5,427.7	355.3	701.6
Fishing gear	35,158.3	55.93%	63,333.3	13,289.3	10,839.6
Storage equipment	458.1	0.73%	1,132.1	62.9	191.2
Other equipment	347.4	0.55%	974.8	144.7	148.5
Total investment	**62,858.5**	**100.00%**	**95,320.8**	**22,150.9**	**19,337.7**

The average amount of investment capital needs to be put in the purchasing of a vessel with wholly equipment is calculated at US$ 62,858.5. This figure just reflects the total value of vessels already in operation and is made on the basis of market value in 2005 so that the investment in a brand-new one calls for a greater amount. Fishers individually can hardly afford, as a result, they establish a mechanism of joint investment in a new fishing vessel. It is objective to say tuna-mackerel gillnet requires the highest original investment, noticeably that in fishing gear, relative to other fisheries. To be more persuasive, take the category of the highest engine power of tuna long line vessels (> 140HP) in Nha Trang for example. The average sum invested in a tuna-mackerel gillnet vessel is twice as much as that of the tuna long liner.

Of the total investment, that in hull is registered at US$ 16,515.7 in average, responsible for 26.27%; while in engine is US$ 7,620 and 12.12% respectively. Fishers tend to realize a greater investment value in hull than in engine, normally at double rate. Vessel engines are commonly the second-hand ones imported from industrialized countries, except for those among offshore fishing vessels whose purchase are financed in the form of loans by state banks. In these cases, vessel's owners have come under pressure from banks to invest in brand-new engines. In general, the quantity of investment in hull and engine of tuna-mackerel gillnet vessels is relatively large as compared to other types because the great majority of gillnet vessels has sizable hull length and engine capacity. In addition, since 2000, the gillnet fishery has recently been intensified in line with the government encouragement to enhance offshore capture because economic efficiency has been registered in reality on account of the discovery of new fishing grounds in distant waters. Then, since 2000 onwards, the investment flow in vessels has shown an upward trend. However, at that time, the hull price increased dramatically as a consequence of the government's policies involved in forest conservation.

Fishing gear consumed an average amount of US$ 35,158.3, equivalent to 55.93%. It took the biggest share in the investment composition, and also the biggest rate of all gear types. It led to obstacles that tuna-mackerel gillnet fishers have to take into account when asking for loans granted from the offshore fishery program to invest in vessels and gears. Just a fixed amount of money was available for purchasing vessels whereas gears were not inclusive due to the uncertainty and risk in fishing activities. Obviously, this contributed to the failure, or collapse in more realistic terms, of an ambitious program for the offshore gillnet fishery set up by the government.

Contrary to hull and engine, other items such as mechanical equipment, electronic devices, storage facilities and others cover a modest proportion of the total investment. It is in inverse ratio to the importance that they play in fishing activities. For instance, mechanical equipment can indicate the level of mechanization and specialization; electronic devices demonstrate the degree of science-technological application in effective communication and information exchange; and storage facilities secure post-harvest quality. These pieces of equipment are associated with safety and product quality. But to most of fishers' thinking, these do not increase productivity, so, not attract serious concerns and adequate investment from fishers.

Concerning electronic equipments, most vessels are equipped with sonar and short-distance communication equipment. Long-distance communication equipment is more widely utilized on vessels of large engine sizes. Mechanical equipment is chiefly composed of winches which seem to be experience-intensive rather than technology-intensive products, so, fall short of effective fishing requirements. The case can apply well to storage facilities. Fishers often make use of the insulating hold available on board whose value has been already incorporated into the hull investment. As mentioned above, ice are prevalently used to keep fish fresh so that boxes

are employed to avoid high pressures from ice above that can reduce fish quality. Conversely, the magnitude of investment in equipment is sizeable in other ASEAN countries. Advanced electronic and storage devices have been sought for more efficient operations such as radar, fish-finding, sonar, and sea water-powered freezer or ice-maker. This means that fishers in Nha Trang, as in the common case throughout Vietnam, have been behind those operating in regional and global fisheries if measured against the technology-intensive investment. Negative consequences follow from the state of poor technological application. One result is that vessels are almost left susceptible to preventable accidents once hydro meteorological information is either slow to be furnished or almost inaccessible to a large part of fishing population. A considerable number of accidents occurring for the same or at least similar reasons have been reported annually. Thousands of fishers in the central part of Vietnam have still remembered the loss and damage caused by the Chanchu Storm erupting last May. Over 200 lives were claimed. Another one lies in the inefficiency where fishers continue to gain less with more efforts due to out-of-date post-harvest systems.

Table 3: Investment structure according to vessel groups

Unit: US$ (US$ 1 = VND 15,900)

Criteria	< 15,5m		15,5m - 17m		> 17m	
Number of vessels	15		18		17	
	Average volume	Percentage	Average volume	Percentage	Average volume	Percentage
Hull	13,920.3	29.91%	15,129.3	24.30%	20,273.8	26.03%
Engine	5,178.2	11.13%	6,509.4	10.45%	10,950.8	14.06%
Mechanical equipment	1,149.7	2.47%	1,293.5	2.08%	1,748.2	2.24%
Electronic equipment	990.6	2.13%	1,401.5	2.25%	1,624.0	2.08%
Fishing gears	24,662.1	53.00%	37,095.0	59.58%	42,368.8	54.39%
Storage equipment	361.4	0.78%	468.2	0.75%	532.7	0.68%
Others	271.7	0.58%	366.2	0.59%	394.4	0.51%
Total	**46,534.1**	**100.00%**	**62,263.1**	**100.00%**	**77,892.8**	**100.00%**

The way fishers raise capital is often relation-based, obviously exhibiting the characteristic of a small-scale fishery. “Joint investment” can be made on the basis of kinship, or “sole owner” can ask for loans from their neighbors. Loans from banks are small, averaging US$14,952.2 for vessel with equipment, making up 23.7% of the total investment. This means there is no easy access to loans from financial institutions. Thus, the offshore fishery program initiated by the government has not delivered expected results. Because fishing operations are highly exposed to risks, banks almost always insist on secured loans to minimize risks on their part. Therefore, potential operators lose the incentive to engage in new fishing ventures as they found themselves in great obstacles when coming to banks for money.

Table 4: Capital structure

Unit: US$ (US$ 1 = VND 15,900)

Criteria	Equity	Loan	Equity/Investment (%)
Average	47,906.3	14,952.2	76.21%
< 15,5m	42,479.6	4,054.5	91.29%
15,5m - 17m	55,624.4	6,638.7	89.34%
> 17m	44,522.5	33,370.3	57.16%

The mean value of investment in vessels of less than 15m is equal to US$ 46,534.1. The owner’s equity amounts to US$ 42,479, accounting for 91.29%. In this case, fishers tend to be largely self-financed, as opposed to the group of greater than 17m where the capital structure has basically changed. Among the average investment rate of USD 77,892.8, owner’s equity stands at USD 44,522.5, equivalent to 57.16% and the rest 42.84% comes from loans. Though limited, the offshore fishery program has made it easier for fishers to get money from banks for purchasing vessels of higher lengths and stronger engine capacities. This facilitates offshore fishing, and therefore, removing part of pressure on coastal resources caused by overexploitation.

Analysis of Depreciation

The depreciation in one year totals US$ 7,117.6. These costs are determined by the initial investment value and estimated usage duration of vessels. Consistent with the investment level of the gillnet fleet, depreciation remains in high rate.

Table 5: Depreciation structure

Unit: US$ (US$ 1 = VND 15,900)

Criteria	Average		< 15.5m		15.5m - 17m		> 17m	
Number of vessels	50		15		18		17	
	Volume	Percentage	Volume	Percentage	Volume	Percentage	Volume	Percentage
Hull	1,046.8	14.60%	856.0	16.79%	1,004.4	14.08%	1,260.1	13.94%
Engine	507.4	7.08%	353.2	6.93%	456.5	6.40%	697.4	7.71%
Mechanical equipment	242.0	3.37%	173.3	3.40%	237.2	3.33%	307.8	3.40%
Electronic equipment	151.7	2.11%	100.6	1.97%	162.2	2.27%	185.5	2.05%
Fishing gears	5,036.0	70.22%	3,439.7	67.46%	5,092.3	71.38%	6,384.8	70.63%
Storage equipment	113.0	1.58%	112.9	2.21%	103.7	1.45%	123.0	1.36%
Others	74.7	1.04%	63.4	1.24%	78.2	1.10%	80.9	0.89%
Total	**7,171.6**	**100.00%**	**5,099.2**	**100.00%**	**7,134.6**	**100.00%**	**9,039.5**	**100.00%**

Of all depreciation costs, those for fishing gears total US$ 5,036.0, equal to 70.22%. This stems from the fact that gillnets are very much prone to damage and are more likely to lose much of its effect in attracting fish after 6 years of usage. It is because nets are easily clung by planktons to become quite visible, thus, noticeable to fish. This naturally drives fish away from nets, causing the total production down to the low level. In consequence, fishing gears are frequently replaced within the range 6-8 years even when the usage period of time can be extended. It explains the fairly short life of gillnet, and further, the requirement of rapid depreciation compared to other items.

In contrast, hull and engine can be put in operation for a long time, about 15-25 years. Consistent with the high level of initial investment is the costs for periodical major repairs on the annual basis, and also, for either equipment replacement or upgradation. Another explanation of its long usage duration is that the vast majority of tuna-mackerel vessels are newly-built, less exposed to physically destructive forces created by fishing operations. In the cost structure, payments for hull and engine depreciation are generally less remarkable than its initial investment level.

Mechanical-, electronic-, storage equipment and others display the compatibility between the rates of investment and depreciation. With the share of 8.1% in total, the depreciation costs of these items come to be minor.

Analysis of Major Repairs

Table 6: Major repairs

Unit: US$ (US$ 1 = VND 15,900)

Criteria	Average		< 15,5m		15,5m - 17m		> 17m	
Number of vessels	50		15		18		17	
Year: 2004	Volume	Percentage	Volume	Percentage	Volume	Percentage	Volume	Percentage
Hull	901.9	32.25%	543.0	26.71%	922.4	32.57%	1,196.8	34.86%
Engine	495.0	17.70%	438.2	21.56%	475.2	16.78%	566.0	16.49%
Mechanical equipment	106.0	3.79%	78.8	3.88%	101.3	3.58%	135.0	3.93%
Fishing gears	1,174.4	41.99%	876.9	43.15%	1,204.1	42.51%	1,405.5	40.94%
Storage equipment	11.3	0.40%	16.8	0.83%	10.5	0.37%	7.4	0.22%
Others	107.9	3.86%	78.8	3.88%	118.8	4.19%	122.1	3.56%
Total	**2,796.5**	**100.00%**	**2,032.5**	**100.00%**	**2,832.3**	**100.00%**	**3,432.9**	**100.00%**
Year: 2005	Volume	Percentage	Volume	Percentage	Volume	Percentage	Volume	Percentage
Hull	1,064.2	31.96%	654.1	28.04%	1,097.1	32.34%	1,391.0	33.58%
Engine	562.3	16.89%	486.4	20.85%	566.0	16.69%	625.2	15.09%
Mechanical equipment	130.3	3.91%	90.6	3.88%	122.3	3.60%	173.9	4.20%
Fishing gears	1,441.7	43.30%	991.2	42.50%	1,474.1	43.45%	1,804.8	43.56%
Storage equipment	19.5	0.59%	44.0	1.89%	10.5	0.31%	7.4	0.18%
Others	111.7	3.35%	66.2	2.84%	122.3	3.60%	140.6	3.39%
Total	**3,329.6**	**100.00%**	**2,332.5**	**100.00%**	**3,392.4**	**100.00%**	**4,143.0**	**100.00%**

Major repair costs averaged US$ 2,796.5 over the year of 2004 and amounted to US$ 3,329.6 in 2005, equivalent to the increase of 19.1%. Major repairs mentioned in this study just covered those preparing for the next trips, exclusive of the price for purchasing new equipment. Besides, costs involved in fixing gears would include

money paid for family labors to mend nets. Meanwhile, expenses for repairing electronic devices were incorporated into minor repairs that were referred to as variable costs.

The total payments for fixing fishing gears in 2004 made up of 41.99% of major repair costs, and slightly went up to 43.3% in 2005. As can be obtained from direct interviews, this difference is accounted for by the rising labor costs associated with mending nets, approximately 20-25%. For gillnet fishery, of all items in the major repair breakdowns, these costs are normally dominant, compatible with the high original investment level, rapid degradation as well as excessive exposure to breakdown over the time in a number of ways. The most prevalent loss comes from net damage that can occur when big fish try to escape out of nets or when other vessels pass by the fishing area where nets are spreaded. Thus, it is why among components of fixing gear, mending nets is the most important activity that generates costs. The labor cost remained at US$ 2-2.5/labor /day in 2004 and increased to US$ 2.5-3/labor /day in 2005, with the number of 1-2 people required for finishing one piece of net. The total payment for net fibers is relatively low, responsible for 20% of total costs connected to repairing fishing gears.

Also considerable among all components of major repair costs is the payment for fixing hull and engine. It took the share of 49.95% in 2004 and 48.85% in 2005. With respect to hull, some costs generating activities can include landing vessel in shipyard, cleaning up the hull surface, applying protective paint, and other repair work. Hull needs to be under repairs for once or twice over the year. The payment in 2005 was generally higher than that in 2004, up about USD 163.2, again as a result of the rise of 10-15% in payment for service labors. With respect to engine, costs are determined by payments for replacing piston rings and fixing some component parts that do not work well. A major repair often needs to be done in one or two years. Other engine repair work will be put into variable costs counted per each trip.

Mechanical devices, storage equipment and some others did not take much of the budget in major repairs, just got a share of 8.05% in 2004 and 7.85% in 2005. Storage equipment was mostly free of repair costs, averaging US$ 10-20 for the whole year. There may be two main sources of explanation. One can be that storage hold, which is available on board, often has long usage period. Hence, the interval between repairs is wide. More importantly, payment for each time is low because only the insulating material is required to be replaced. Another reason is that plastic box is the other mean of keeping fish away from spoilage which counts for little value. Thus, if the quality goes down, fishers will decide to throw it away rather have it fixed for reuse.

Generally, structures of major repair costs among fishing fleets do not change markedly over the period. But in 2004, percentage of fixing fishing gear in the total cost structure decreased slightly by vessel classes (15.5m or less, 15.5-17m, 17m or over). Still, the trend was reversed in 2005. This can be understood in the situation where in 2004, given the discovery of new fishing grounds in international waters bordering with Malaysia and Indonesia, long vessels were in need of being equipped with new fishing gear, which was then realized in practice. So, bills for major repairs of gears received by big vessels were low relative to those of small ones. But this is not the case in the following year when major repair costs began to arise, compounded by increasing labor costs. As a result, in 2005, payments for gear's major repairs required by large fishing vessels became higher. The explanation concerning new purchases can be applied in the case of engine where the percentage of repair costs seemed to be in inverse ratio to vessel length. But for this time, it held true in both 2004 and 2005. Meanwhile, the case is contrary for hull as costs would take up a share proportional to vessel length. It can be deduced that the greater the length is, the more difficult the repair work tends to be because existing technical conditions of shipyards commonly fall short of requirements, resulting in a higher payment for services.

Analysis of Fixed Costs

Table 7: Fixed costs

Unit: US$ (US$ 1 = VND 15,900)

Criteria	Average		< 15.5m		15.5m - 17m		> 17m	
Number of vessels	50		15		18		17	
Year: 2004	Volume	Percentage	Volume	Percentage	Volume	Percentage	Volume	Percentage
Major repairs	2,796.5	23.33%	2,032.5	23.71%	2,832.3	24.88%	3,432.9	21.95%
Interest	1,333.0	11.12%	972.8	11.35%	809.0	7.11%	2,205.7	14.10%
Tax	329.7	2.75%	311.4	3.63%	303.5	2.67%	373.6	2.39%
Insurance	356.3	2.97%	158.1	1.84%	304.3	2.67%	586.1	3.75%
Depreciation	7,171.6	59.83%	5,099.2	59.47%	7,134.6	62.67%	9,039.5	57.81%
Total fixed cost	**11,987.2**	**100.00%**	**8,574.0**	**100.00%**	**11,383.7**	**100.00%**	**15,637.7**	**100.00%**

Year: 2005	Volume	Percentage	Volume	Percentage	Volume	Percentage	Volume	Percentage
Major repairs	3,329.6	27.73%	2,332.5	28.81%	3,392.4	29.12%	4,143.0	26.15%
Interest	820.2	6.83%	194.2	2.40%	508.2	4.36%	1,703.0	10.75%
Tax	331.6	2.76%	311.4	3.85%	308.8	2.65%	373.6	2.36%
Insurance	356.3	2.97%	158.1	1.95%	304.3	2.61%	586.1	3.70%
Depreciation	7,171.6	59.72%	5,099.2	62.99%	7,134.6	61.25%	9,039.5	57.05%
Total fixed cost	**12,009.4**	**100.00%**	**8,095.4**	**100.00%**	**11,648.3**	**100.00%**	**15,845.2**	**100.00%**

The budget for fixed costs increased in a narrow year-to-year range, from US$ 11,987.2 in 2004 to US$ 12,009.4 in 2005. Of which, that for major repairs witnessed the most significant increase. Still, a positive sign has been detected during the surveyed period related to the sharp decrease of loan interests. This followed from the reduction in loan size as an implication of greater operating efficiency among vessels. Depreciation in 2005 stayed at the same level of that in 2004. This is also true for the insurance item owing to the stability of charges and number of fishers engaged in this activity.

Of the total fixed costs, depreciation is the highest, responsible for about 60%. The second biggest is major repairs, with 23.33% in 2004 and 27.73% in 2005. Loan interests had a relatively low level, mainly offered by the national offshore fishery program at a rate of 0.45-0.6% per month, and by poverty reduction schemes of 0.6-0.8% per month. So, loan charges did not inflict much suffering on fishers with the rate of 0.74% per month in 2004 and down to 0.62% in 2005 (other loan deals via personal transactions are included, often at higher rates, from 1.5% to 5% per month). To clarify this point, let's make a simple comparison. The average interest rate paid by fishers is evidently 0.3-0.4% fewer than the level that banks generally charge for its loans. The most striking illustration is from the loan price offered by the offshore fishery program that is even lower than the deposit interest rate (0.6-0.7%).

Vessel insurance fees accounted for 2.97% of the total fixed costs. However, this comes from banks' pressure to minimize risks on their loans rather than from self-awareness among fishers. In fact, the majority of fishers buy vessel insurance just in case they want to obtain bank loans. Only a handful of fishers do this on the voluntary basis. Even life insurance has found itself in the similar situation. This can be confirmed through face-to-face interviews given by fishers as to their decision whether or not to purchase insurance. Fishers are often lack of risk prevention awareness, regardless of high uncertainty and risks in fishing activities, and of the poor working conditions, especially demonstrated by the badly-equipped marine safety devices. Their fishing operations are extremely vulnerable to natural disasters. Misfortune, if occurs to any fisher, will inevitably spread to the rest of his family or larger as he often provides the main earning source for his whole family. Besides, he has no way to claim compensation for loss or damage. This situation can be best described as the vicious cycle of poverty, risk and sufferings that completely expose fishers (the Chanchu Storm in May 2006 is a typical example).

Fishing is generally imposed less tax than other forms of businesses. The business tax enjoys a half-cut rate, income tax is equal to 3-7% of profits, and resource tax is equivalent to 0.5-1% of the total revenue. Fishers do not have to pay value-added tax. Favorable loan and tax rates exhibit a great deal of efforts made by Vietnam government in supporting fishing operations. In addition, from the beginning of 2006, those who start their own fishing ventures will be officially exempted from all kinds of taxes within 5 years. Open access is also available to new entrants. Still, this process is not favorable to resource conservation and sustainability development efforts.

Fixed costs for vessels of 15.5m or less were registered at US$ 8,574.0 in 2004 but down to US$ 8,095.4 in 2005, equivalent to the difference of 5.6%. This is because these fishers could operate at a high profit in 2005 and pay off part of their loans, thus, reducing interest charges.

Analysis of Variable Costs

Table 8: Variable costs

Unit: US$ (US$ 1 = VND 15,900)

Criteria	Average		< 15.5m		15.5m – 17m		> 17m	
Number of vessels	50		15		18		17	
Year: 2004	Volume	Percentage	Volume	Percentage	Volume	Percentage	Volume	Percentage
Fuel	10,562.8	39.87%	9,767.8	40.03%	10,072.6	40.44%	11,783.2	39.27%
Preservation	3,089.3	11.66%	2,867.1	11.75%	2,853.6	11.46%	3,535.0	11.78%
Provisions for crews	2,367.3	8.94%	2,182.4	8.94%	2,330.5	9.36%	2,569.4	8.56%
Fees & others	286.2	1.08%	155.1	0.64%	241.1	0.97%	449.5	1.50%
Minor repairs	1,849.7	6.98%	1,859.5	7.62%	1,719.1	6.90%	1,979.3	6.60%
Wage	8,334.6	31.46%	7,571.1	31.03%	7,688.0	30.87%	9,692.9	32.30%
Total	**26,489.8**	**100.00%**	**24,403.0**	**100.00%**	**24,904.9**	**100.00%**	**30,009.2**	**100.00%**
Year: 2005	Volume	Percentage	Volume	Percentage	Volume	Percentage	Volume	Percentage
Fuel	15,426.5	44.04%	14,763.7	44.32%	14,377.7	43.48%	17,121.8	44.33%
Preservation	3,441.6	9.83%	3,396.6	10.20%	3,162.1	9.56%	3,777.3	9.78%
Provisions for crews	3,281.8	9.37%	3,046.1	9.14%	3,286.2	9.94%	3,485.0	9.02%
Fees & others	423.9	1.21%	270.4	0.81%	424.5	1.28%	558.6	1.45%
Minor repairs	2,722.6	7.77%	2,706.5	8.13%	2,445.8	7.40%	3,030.0	7.85%
Wage	9,732.2	27.78%	9,126.2	27.40%	9,371.8	28.34%	10,648.5	27.57%
Total	**35,028.6**	**100.00%**	**33,309.6**	**100.00%**	**33,068.1**	**100.00%**	**38,621.3**	**100.00%**

Variable costs averaged US$ 26,489.8 in 2004 and 35,028.6 in 2005, up by 32% between the two periods. The most central components are fuel and labor costs.

Fuel accounted for 39.87% and 44.04% of the total variable costs in 2004 and 2005 respectively. Fuel was used principally for vessel's moving during the time-at-sea and between fishing grounds, as well as back-and-forth movement between the shore and fishing areas. As compared to other variable costs, fuel experienced the highest increase in 2005, up 1.46 times relative to 2004 owing to the diesel price soaring to 1.42 times in 2005.

Average labor costs were US$ 8,334.6 in 2004 and US$ 9,732.2 in 2005, reflecting an increase of 16.77% over 2004. Each vessel was run collectively by eight to twelve crews with the average wage of US$ 793.7 in 2004 and US$ 923.4 in 2005, up 16.34%. As can be indicated from both time periods, these rates were higher than the average personal income on the national scale (US$ 554.6 per capita in 2004 and US$ 590 in 2005) and in Khanh Hoa's (US$ 653 per capita in 2004 and US$ 768 in 2005). If compared with the similar indicator of other gear types in Nha Trang, tuna-mackerel gillnet operators rank first. Besides, since fishers commonly possess equity in the form of gear, their real income is normally greater than wage. But high salary does not deliver better living conditions to fishers. The fate of a large part of fishing population has still been unstable. The first reason is the male-dominated characteristic of the fishing labor force where women have little leeway to join in directly for livelihood. Instead, they carry out household chores and take care of their children. Another factor is the widespread phenomenon of large family size that almost takes away the merit of high salary earned by fishers, leaving most of fishing households in the category of poverty, with the average income of US$ 200-250 per capita.

In 2005, provision (e.g. food) costs escalated by 38.63% relative to the previous year as a result of the change in both parameters, price and volume. The former is consistent with high price index in 2005, while reducing landing times with a view to saving their fuel costs the latter keeps larger food store per fishing trip.

The gap in total variable costs between the group less than 15.5m and 15.5-17m is narrow. Thus, attention should be paid on the group of over 17m where almost all components of variable costs arise in a greater size, namely:

- Costs for fuel and storage stayed high since these vessels operated primarily in fishing grounds bordering Malaysia's and Indonesia's waters. It took them a considerable duration for traveling to fishing areas (about 3 days) and also a long time for capture activities. Therefore, a substantial volume of fuel and ice were required for each trip.

- Labor costs were often at high level. Wages were calculated on the basis of 50% of the results obtained from the total revenue less total costs. Meanwhile, the two other groups used the way of 35% of the results from revenue

less variable costs. Another source of explanation derives from the large crew size, often between 11-12 labors per vessel.

Analysis of Earnings

In order to have a better insight into earnings, we should start with the two major parameters (total costs and revenue) that directly influence the value of earnings. More specifically, variable costs and fixed costs need to be carefully examined.

Table 9: Cost composition

Unit: US$ (US$ 1 = VND 15,900)

Criteria	Average		< 15.5m		15.5m - 17m		> 17m	
Number of vessels	50		15		18		17	
Year: 2004	Volume	Percentage	Volume	Percentage	Volume	Percentage	Volume	Percentage
Variable costs	26,489.8	68.85%	24,403.0	74.00%	24,904.9	68.63%	30,009.2	65.74%
Fixed costs	11,987.2	31.15%	8,574.0	26.00%	11,383.7	31.37%	15,637.7	34.26%
Total costs	38,477.0	100.00%	32,977.0	100.00%	36,288.6	100.00%	45,647.0	100.00%
Year: 2005	Volume	Percentage	Volume	Percentage	Volume	Percentage	Volume	Percentage
Variable costs	35,028.6	74.47%	33,309.6	80.45%	33,068.1	73.95%	38,621.3	70.91%
Fixed costs	12,009.4	25.53%	8,095.4	19.55%	11,648.3	26.05%	15,845.2	29.09%
Total costs	47,038.0	100.00%	41,405.0	100.00%	44,716.4	100.00%	54,466.5	100.00%

Variable costs are calculated by putting operating costs per trip and crew wage together. Fixed costs are referred to payments, mainly made by vessel owners, for major repairs of e.g. hull, engine, and fishing gears; depreciation; tax; insurance; loan interests and others. In 2004, total costs averaged US$ 38,477, with 68.85% of which was made up of variable costs. The corresponding figures in 2005 were US$ 47,038 for total, with 74.47% for variable costs and the remaining 25.53% for fixed costs.

Average revenue reached US$ 42,196.2 in 2004 and US$ 53,542.8 in 2005, up to 26.89%. Product price hike, along the lines of the price index's growth rate, was one of the significant determinants of this positive change. Some detailed information linked to fish price has been revealed by fishers during the interviews. For instance, Striped tuna (*Sarda orientalis*) reaches peak rate of 0.55-0.6 USD/kg in 2005, compared to 0.45-0.5 USD/kg in 2004. Another important factor is the favorable winter weather in 2005, leading to a production upsurge in the months that are supposed to be "harshest for capture".

Seen from revenue point of view, the group of 15.5-17m got poorest results. The distance between the best performed group (over 17m) and the worst (15.5-17m) was US$ 8,126.8 in 2004, and US$ 6,952.2 in 2005. Because the length of 15.5-17m vessels is a restrictive factor that limits their activities within fishing grounds of the coast along Khanh Hoa and Ba Ria-Vung Tau, where a large number of vessels are operating.

Table 10: Revenue, Costs and Earnings

Unit: US$ (US$ 1 = VND 15,900)

Criteria	Average	Max	Min	Standard deviation	< 15,5m	15,5m - 17m	> 17m
Year: 2004							
Revenue	42,196.2	90,566.0	18,301.9	13,063.2	41,681.3	38,469.6	46,596.4
Variable costs	26,489.8	56,301.9	13,171.1	7,253.3	24,403.0	24,904.9	30,009.2
Capital contribution	15,706.4	35,534.6	4,729.6	7,320.7	17,278.3	13,564.7	16,587.2
Fixed costs	11,987.2	23,928.8	4,174.2	4,335.3	8,574.0	11,383.7	15,637.7
Earnings	3,719.2	24,559.2	-12,610.1	7,739.5	8,704.3	2,181.0	949.5
Year: 2005							
Revenue	53,542.8	120,754.7	19,591.2	17,628.8	54,786.2	49,633.1	56,585.3
Variable costs	35,028.6	69,886.8	16,484.3	9,767.0	33,309.6	33,068.1	38,621.3
Capital contribution	18,514.2	50,867.9	-201.3	10,298.9	21,476.6	16,565.0	17,964.0
Fixed costs	12,009.4	23,164.7	4,281.2	4,311.2	8,095.4	11,648.3	15,845.2
Earnings	6,504.8	39,440.5	-20,031.5	11,242.3	13,381.2	4,916.7	2,118.8

Earnings varied greatly across the years. In addition, the value of standard deviation was high, approximately twice as big as the mean value. While some vessels can record good earnings, others have been far from achieving operational efficiency; suffering a very big costs; as result massive losses. Let's take a case in 2005 for example.

Among 50 surveyed samples, one vessel was closely approaching the point of collapse since revenue can not cover variable costs.

A preliminary conclusion is that the longer the length and the larger the investment in a vessel is, the fewer earnings it may get. This stems from a small difference in revenue but a big difference in costs between the 2 groups. Vessels of less than 15.5m produced an average earnings value of 9.2 times as high as those of greater than 17m in 2004, and 6.3 times in 2005. Following the offshore fishery program supported by the government, most of vessels of over 17m have had greater access to bank loans. This scheme is designed to make loans more available to fishers. However, in reality, many fishers who have little or even no experience in fishing also get loans to purchase big vessels, resulting in a big waste in investment. This is aggravated by high rates in depreciation, repairs, and interests. Besides, variable costs, specifically high fuel consumption due to technical requirements, soar to a great degree. Moreover, as a result of fisher's lack of operational experience in offshore fishery, economic efficiency has been low, putting fishers in an extremely difficult situation to repay their loans.

Table 11: Return on equity ratio (ROE)

Criteria	Return on equity ratio (ROE)	
	2004	2005
Average	10.94%	17.99%
< 15,5m	24.11%	33.81%
15,5m-17m	4.82%	9.61%
> 17m	5.80%	12.91%

The return on equity ratio (ROE) for tuna-mackerel gillnet fishery reaches 10.94% in 2004 and 17.99% in 2005, relatively high as compared to average deposit rates offered by banks (7%-9% per year). Most vessels enjoyed a good ROE indicator in 2005 due to economic efficiency brought about from the tuna-mackerel stock abundances off the international waters in the south of Vietnam. In this regards, the best performers are vessels of less than 15.5m thanks to high accumulative earnings but low investment. The category of 15.5-17m experienced the poorest ROE despite yielding better earnings than those of the group of over 17m because the mid-class operates primarily on the owner's equity (US$ 55,624.4). Meanwhile, in spite of high investment, but less owner's equity, hence, ROE performed by the fleet of over 17m seems to be better.

Conclusion

With obvious evidence derived from the study, we can conclude that tuna-mackerel gillnet fishery in Nha Trang, representing for one type of offshore operations, has achieved remarkable economic efficiency. Also, it functions as a provider of livelihood for a large part of both local fishermen and outsiders. Although technological application can be outperformed by fishing fleets from regional countries, it still remains to be an effective player in the fisheries on the national scale in a number of ways and reasons. One possible reason is the substantial investment directed to well-equipped vessels with considerable length. Another is in stock supply. In reality, there are large fishing grounds already existed that can provide tuna-mackerel gillnet vessels with rooms for large scale operations. Now, it is supplemented by new ones, all presumably abundant in fish stock, that have been found off the south of Vietnam and in the Tonkin Gulf. Moreover, the market price of Tuna and Mackerel has constantly been and is witnessing an upward trend in pace with increasing demand for inputs by export processing enterprises in Nha Trang.

Vietnam's fisheries is now on the path of development. For sustainability, statistical data are always in need. Because of the close relationship between reliable information and good decision making, data collecting and processing is of great necessity to devise the master plan of fisheries management and development at various levels. The study is designed to create a set of economic indicators of tuna-mackerel gillnet in Nha Trang on the basis of 50 samples surveyed directly among vessel skippers in Vinh Phuoc and Xuong Huan wards. Anyway, these results represent just an initial step for further investigation. It also facilitates research work in other gear types existing in Nha Trang and hence, can be also developed to work on the national scale. Scope is also provided for further studies, hopefully on how experience of captain, technical characteristics of vessels and gears impact on its economic indicators.

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