THE TAIWAN BUYBACK POLICY OF OFFSHORE FISHING VESSELS

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Abstract: The Taiwanese government has supported the fishing industry since 1951 and encouraged the fishing catch. This policy was replaced in 1991 by a new policy of reducing the number of power crafted fishing boats in order to improve the fishermen's income and reduce government spending. The paper evaluates the benefit-cost of this policy and the trend of fishing boat building and the catch over time. The policy evaluation includes the number of fishing boats and their size, fishing boat oil subsidy, fishing port congestion and manning alternatives. The study finds that the program's net benefit was substantial especially with respect to the oil subsidy saving. The analysis also noted that the net benefits declined annually during the 5-year program.

Key Words: Benefit-cost analysis, buyback policy

1. INTRODUCTION

Starting in 1951, the Taiwanese government supported an increased fishing-catch regime and the fishery industry developed. The government loaned money to fishermen for power craft building and subsidized gasoline. The records indicate that the number of powered fishing crafts increased steadily from 1,371 in 1949 to 13,304 in 2001 with a peak of 15,895 power craft fishing boats in 1989. The increase in the fishing craft fleet was also associated with an increase in the vessel size. The total tonnage of the powered craft fleet in 1949 was 19,731 tons; it increased steadily to a total of 968,473 tons in 1990 before declining to 818,449 tons in 2001. The average fishing craft was 14.39 tons in 1949; it declined to a low of 13.61 tons in 1958 when it increased steadily until 1974 to an average of 36.25 tons per vessel. In 1974 the average tonnage per vessel leveled off for about 10 years before it started to increase again; in 1994 the average was 68.71 tons per vessel. A decline was registered in 1995 (64.76 tons) and was followed by an increase in the following year (68.03 tons) before a new decline

to 61.52 tons in 2001 (figure 1).



To accommodate the new vessel size and seek out new fishing locations, the new fishing craft had a more powerful engine as well. There was an annual modest and steady engine power increase in horsepower (HP) per vessel of 26.21 to 34.31HP from 1949 to 1964. This changed aggressively until 1994, reaching an average of 271.37HP per vessel. There was a small decline in 1995 to 264.50HP before a further increase to 306.85HP in 1991, and a new decline to 298.03 in 2001.

Did the fishermen improve their income by increasing the fishing catch? With the fishing craft fleet growing one could speculate as to whether the fishing catch per vessel would decrease or increase year after year and whether the fishermen's income would change with time. However, when considering the catch per vessel, the catch ranged from a low of 37.56MT (metric tons) in 1960 to a high in excess of 86.89MT in 1998 (figure 2). In 2001, there is a new decline to 75.54MT. However, during the period of the buyback policy the average catch per vessel was 74.96MT.



Figure 2. Quantity of Catch per Vessel (MT)

When considering the catch (MT) per vessel size (ton), there is a clear decline of catch per ton of vessel size (figure 3). The catch per ton of vessel size was at a high of 3.27MT/ton in 1963 and it declined steadily, reaching new lows. The decline passed a landmark when dropping from 1.32(MT/ton) in 1988 to 1.22(MT/ton) in 1989, 1.14(MT/ton) in 1990, and 1.09(MT/ton) in 1991. The low catch to vessel size in the late 80's raised concern for fishermen's income and for the future of the fishermen. The decline continued to new lows in 1991 (1.09MT/ton), 1994 (1.06MT/ton) and 1996 (1.09MT/ton) and was followed by an

increase in the following year (1.35MT/ton) before a new decline to 1.23(MT/tons) in 2001. During the time of the buyback policy the average catch was 1.13MT/ton.



In order to support the fisherman's income, the Taiwanese government restricted fishing craft building. First, new fishing vessels under 300 tons could not be built except for replacement. Between 1968 and 1988, the government broadened the scope of new vessel building restrictions. In 1989, following the low catch per vessel ton (1.50MT/ton), the government restricted overall craft building. Thus, the number of vessels declined.

Globally, in the late 1980's, maritime countries announced their Exclusive Economic Zones (EEZ) of 200 sea miles. Far sea fishing in Taiwan became costly and fish resources in the high seas were declining. The Union Nations and regional fishery associations were planning a reduction of the number of fishing vessels including FOC (Flag of Convenience) fishing vessels.

The reality of too many fishing boats chasing less fish caused the fishermen to work harder and yield less. Some fishermen resorted to smuggling goods into Taiwan and/or buying fish from Chinese fishing boats. This raised a new concern of national security.

In 1991, the government introduced an aggressive new plan of purchasing old vessels, to continue for five years. This policy aimed at the supply side of seafood supply to the market; it did not address the demand side. The government budget reflected the effort beyond a reduction in the number of vessels. It was also seeking to improve the fisheries' structure and the environment of coastal and offshore fisheries, increase fisheries' productivity and reduce the large number of accidents.

There are very few papers evaluating the purchasing program. Tseng (1995) used benefit-cost analysis to evaluate the effect of the vessel purchasing program for the year 1991 and estimated data for 1992 (the program was from 1991 to 1995). Taiwan Fisheries Bureau (TFB) (1998) showed the result of the purchasing program. The study used annual data from 1991 to 1995 but not from the rest of the planning period.

This paper evaluates the buyback of fishing boat policy by using benefit-cost analysis. FOC (Flag of Convenience) fishing boats are not included in this paper; national flag fishing boats only are included. In addition, two offshore islands, Kinmen and Matsu, are not included.

In section 2, we describe the cost analysis, the benefit analysis is shown in section 3. Finally, we give the results of benefit-cost analysis and a brief conclusion in section 4.

2. COST ANALYSIS

The program that was set up for the purpose of purchasing fishing vessels between 1991 and 1995 was divided into three cost components: purchasing cost, handling cost and administration cost (table 1). The net present value (NPV) of the total cost was NT\$1,600,145,937.

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Year	Number	Actual	Purchased	Purchasing	Handling	Administration	Total expense	Total expense
	vessels	tonnage	tonnage	cost	Cost	cost		NPV*
1991	874	35,027.76	42,927	513,976,000	33,001,234	3,307,408	550,284,642	514,284,712
1992	614	34,878.31	42,415	497,880,000	27,353,316	4,322,084	529,555,400	462,534,195
1993	527	27,768.60	34,499	408,364,000	37,136,857	4,001,408	449,502,265	366,927,745
1994	211	12,179.56	14,956	177,268,000	29,768,363	5,260,447	212,296,810	161,960,220
1995	96	8,099.94	9,994	112,396,000	16,166,226	3,893,448	132,455,674	94,439,065
Total	2322	117,954.17	144,791	1,709,884,000	143,425,996	20,784,795	1,874,094,791	-
NPV*/TOTAL				1,463,939,445	119,284,895	16,921,596		1,600,145,937

Table 1. The Cost of Purchasing Old Fishing Vessels (NT\$)

* We use 7% discount rate, the post office deposit rate in 1990. Source: Taiwan Fisheries Bureau (1992, 1995, 1998), <u>The report of purchasing old fishing vessels program</u>

The net present value (NPV) of the total cost is:

$$\sum_{i=1}^{5} \frac{C_i}{(1+r)^i}$$
=550,284,642/1.07+529,555,400/1.07²+449,498,265/1.07³+212,296,810/1.07⁴
+132,455,674/1.07⁵
=1,600,142,671

The buyback policy was based on a formula associated with a vessel's physical characteristics and its particulars. The formula basically follows the following:

- 1. Government base payment is NT\$12,000 per craft ton.
- 2. The number of total tonnage is rounded down (for example, 2.6 tons is valued at 2 tons). However, if total tonnage of a vessel is less than 1 ton, then it was valued at 1.
- 3. If total tonnage was measured before July 1982, it is evaluated at an additional 30%.
- 4. The max purchase cost per vessel is NT\$5 million.
- 5. In 1995, trawl boats that abandoned the replacement are purchased at NT\$8,000 per ton. And the max purchase cost per vessel is NT\$3.3 million.

Handling cost is a payment to the private sector that won the bid for handling fishing boat purchases in every county. Wooden boats were destroyed but steel and FRP boats were used at a near coast location to build a fishery reef. Administration cost is a payment for administrating the program.

The average tonnage and cost per vessel (table 2) increased from year to year (figure 4 and 5). As expected, at the beginning of the program small vessels were purchased, but with time the vessel size increased to reach an average of 84.37 tons. This change is reflected in the total purchasing cost (Figure 5).

Year	Actual	Purchased	Purchasing	Handling	Administration	Total expense
	tonnage	tonnage	cost	cost	cost	
1991	40.08	49.12	588,073.23	37,758.85	3,784.22	629,616.30
1992	56.81	69.08	810,879.48	44,549.37	7,039.22	862,468.08
1993	52.69	65.46	774,884.25	70,468.42	7,592.80	852,945.47
1994	57.72	70.88	840,132.70	141,082.29	24,931.03	1,006,146.02
1995	84.37	104.10	1,170,791.67	168,398.19	40,556.75	1,379,746.60

Table 2.Average Tonnage and Cost Per Vessel (NT\$)



Figure 4. Average Purchased Tonnage Per Vessel



Figure 5. Average Ton Per Vessel Versus Average Actual Ton Per

The average handling cost per vessel increased because the numbers of purchases with a smaller economics of scale were declining. The proportion of wooden boats to steel and FRP boats was declining as well (table 3).

Year	Wooden	Steel	FRP	Total
1991	774	100	0	874
1992	507	106	1	614
1993	387	138	2	527
1994	138	72	1	211
1995	49	43	4	96
Total	1855	459	8	2322
proportion 80%		20	%	100%

Table 3. Construction Of Purchased Boats

The total government administration cost of this program is fixed. The fewer boats purchased, the larger the average cost per vessel.

Given the difference in vessel size each year, how did the policy perform with respect to per ton measures? The average cost per purchased ton (table 4 and figure 5) is consistent and below NT\$12,000, because of the max purchased cost of NT\$5 million per vessel. In 1995, the average cost is the lowest, because the max purchased cost was NT\$5 million per vessel (except trawl boats), and the trawl boats that abandoned the replacement are purchased at NT\$8,000 per ton, with a max purchase cost per vessel of NT\$3.3 million. However, the handling cost increased and so did administration costs by over 400%. Nevertheless, as noted before, they are policy fixed costs.

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Year	Purchasing	Handling	Administration	Total expense
	cost	cost	Cost	
1991	11,973.26	768.78	77.05	12,819.08
1992	11,738.30	644.90	101.90	12,485.10
1993	11,836.98	1,076.46	115.99	13,029.43
1994	11,852.63	1,990.40	351.73	14,194.76
1995	11,246.35	1,617.59	389.58	13,253.52

Table 4. Average Cost Per Purchased Ton (NT\$)

How did the purchase of vessels compare to the fleet in these years? A comparison of fishing crafts purchased indicates that in the early years the average fishing craft size sold was 40 tons (denoted as Actual Tonnage). The vessel size sold was steadily increasing but it was still below the average vessel size (denoted as Ton per vessel) in the entire fleet until 1995, when it changed and exceeded the average fleet vessel size (figure 5).

Following the above announcement, during the 5 years of the plan, a total of 2,322 vessels

were purchased with an actual tonnage of 117,954 tons. The purchasing tonnage of 144,791 tons and a total net present value is over NT\$1.6 billion at 1990 prices (the study's base year).

3. BENEFIT ANALYSIS

For the purposes of the purchasing program, the government stated benefits considered in this paper were to: decrease overfishing, improve the operating efficiency, increase the fishermen's production, reduce oil subsidy, relieve fishing port congestion, and relieve the shortage of fishermen. We divide the benefits into direct and indirect, as follows:

3.1. DIRECT BENEFITS

(1) INCREASE THE FISHERMEN'S PRODUCTION

Fishermen's production might increase by reducing the number of power fishing crafts. The benefits are determined from the total fisheries' production in far sea fisheries, offshore fisheries and coastal fisheries. The total fisheries production data is reported from January 1 to December 31 annually. But the purchasing program is reported from July 1 to June 30 annually. Thus, we averaged total production for every two years to present the fisheries' production in the purchasing year for consistency (table 5). The NPV benefit of fishermen's income by purchasing old vessels is NT\$448,547.

The NPV benefit of fishermen's production by purchasing old vessels is:

$$\sum_{i=1}^{5} \frac{I_{i+1} - I_i}{(1+r)^i}$$

 $= (3,631,720-3,822,530)/1.07 + (3,706,442-3,631,720)/1.07^{2} + (4,281,855-3,706,442)/1.07^{3} + (4,472,213-4,281,855)/1.07^{4} + (4,397,426-4,472,213)/1.07^{5} = 448,547$

Table 5. Total Fisheries' Production for Far Sea, Offshore and Coastal Fisheries

Year	Total fisheries'	Number of	Average fisheries'	Average fisheries'	Benefit
	production	Powered	production	production	NPV
		Craft	per vessel	per vessel	
1989	63,383,756,000	15,895	3,987,654	-	-
1990	57,443,213,000	15,706	3,657,406	3,822,530	-
1991	53,178,184,000	14,747	3,606,034	3,631,720	-178,327
1992	54,342,789,000	14,275	3,806,850	3,706,442	65,265
1993	63,256,726,000	13,298	4,756,860	4,281,855	469,708
1994	55,560,616,000	13,268	4,187,565	4,472,213	145,223
1995	63,990,603,000	13,889	4,607,287	4,397,426	-53,322
Total	-	-	-	-	448,547
Benefit					

Source: Fisheries Administration Council of Agriculture Executive Yuan (1999), <u>Fisheries</u> <u>Yearbook Taiwan Area, 1998</u>. pp 95-96.

(2) REDUCE OIL SUBSIDY

In order to improve the fishermen's welfare, historically the government adopted an oil subsidy policy. According to the TFB reports, the subsidy was NT\$6,081 per kiloliter in 1991 and 1992; the subsidy was NT\$6,356 per kiloliter in 1993, NT\$6,300 per kiloliter in 1994, and NT\$6,560 per kiloliter in 1995. According to the TFB reports, the coefficient of consumed oil per hr/HP is 0.23, and each vessel worked about 200 days a year. The government savings by reducing the number of fishing vessels through the buyback policy was NT\$2,395,050,082 (table 6).

Year	HP	Reduce oil subsidy (NPV)
1991	121,704	763,598,649
1992	115,551	677,569,854
1993	101,058	578,858,384
1994	44,585	236,571,968
1995	26,814	138,457,227
Total	409,712	2,395,050,082

Table	6	Oil	Subsidy	Savings	(NT\$)
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Source: Taiwan Fisheries Bureau (1992,1995, 1998),

The report of purchasing old fishing vessels programs.

The calculation is shown below:

<u>Year 1991</u>

0.23 (liter/ H.P. per hour)*121,704 (H.P.)*200(day)*24 (hour/a day) =134,361,216 (liter) 134,361,216/1000*6081 (dollar) = 817,050,554 NPV: 817,049,241/1.07 = 763,598,649 (dollar)

Year 1992

 $\overline{0.23}$ (liter/ H.P. per hour)*115,551 (H.P.)*200 (day)*24 (hour/a day) =127,568,304 (liter) 127,568,304/1000*6081 (dollar) =775,742,857 NPV: 775,737,409/(1.07)² = 677,563,854 (dollar)

Year 1993

0.23 (liter/ H.P. per hour)*101,058 (H.P.)*200 (day)*24 (hour/a day) =111,568,032 (liter) 111,987,552 /1000*6356 (dollar) =709,126,411 NPV: 709,126,411/(1.07)³ = 578,858,384 (dollar)

Year 1994

0.23 (liter/ H.P. per hour)*44,585 (H.P.)*200 (day)*24 (hour/a day) =49,221,840 (liter) 49,221,840/1000*6300 (dollar) =310,097,592 NPV: 310,097,592 /(1.07)⁴ =236,571,968 (dollar)

Year 1995

0.23 (liter/ H.P. per hour)*26,814 (H.P.)*200 (day)*24 (hour/a day) = 29,602,656 (liter) 29,602,656/1000*6560 (dollar) =194,193,423

NPV: 194,350,233.6/(1.07) ⁵=138,457,227 (dollar)

The net present value (NPV) is:

$$\sum_{i=1}^{5} \frac{C_i}{(1+r)^i}$$

=763,598,649+677,563,854+578,858,384+236,571,968+138,457,227
=2,395,050,082

3.2. INDIRECT BENEFITS (1) RELIEVE SHORTAGE OF FISHERMEN

The shortage of seamen was worsening in Taiwan. The government deregulated to allow 1/3 foreign seamen hired per vessel. It may be helpful for deep-sea fishing vessels, but not for near-coast fishing vessels.

Reducing the number of fishing vessels can also relieve the manning shortage problem by employing, in the existing fleet, the fishermen who sold their vessels instead of employing Chinese fishermen. According to Tseng (1995), the cost of hiring Chinese seamen is NT\$48,000 a year. Thus, the NPV of the savings on labor cost from purchasing old vessels is NT\$195,803,243 (table 7).

		6
Year	Persons	Saving labor cost (NPV)
1991	1,586	71,147,664
1992	1,182	49,555, 420
1993	1,213	47,528,128
1994	495	18,126,390
1995	276	9,445,641
Total	4,752	195,803,243

Table 7.Saving on Labor Cost (NT\$)

Source: Taiwan Fisheries Bureau (1992, 1995, 1998), The report of purchasing old fishing vessels programs.

The calculation is shown below:

Year 1991

Above 100 tonnages: 94(boat)*5(person)=470(person)

Above 20 tonnages, under 100 tonnages: 168(boat)*3(person)=504(person) Below 20 tonnages: 612(boat)*1 (person) = 612(person) Total person =470+504+612=1,586(person)

Year 1992

Above 100 tonnages: 103(boat)*5(person)=515 (person) Above 20 tonnages, under 100 tonnages: 78(boat)*3(person)=234(person) Below 20 tonnages: 433(boat)*1 (person) = 433(person) Total person =515+234+433=1,182(person)

Year 1993

Above 100 tonnages: 70(boat)*5(person)=350(person) Above 20 tonnages, under 100 tonnages: 203(boat)*3(person)=609(person) Below 20 tonnages: 254(boat)*1 (person) = 254(person)Total person =350+609+254=1,213(person)

<u>Year 1994</u>

Above 100 tonnages: 31(boat)*5(person)=155(person) Above 20 tonnages, under 100 tonnages: 80(boat)*3(person)=240(person) Below 20 tonnages: 100(boat)*1(person)=100(person) Total person =155+240+100=495(person)

<u>Year 1995</u> Above 100 tonnages: 30(boat)*5(people)=150(people) Above 20 tonnages, under 100 tonnages: 30(boat)*3(people)=90(people) Below 20 tonnages: 36(boat)*1(people)=36(people) Total person =150+90+36=276(person)

The NPV benefit about is:

 $\sum_{i=1}^{5} \frac{Ni * 48,000}{(1+r)^{i}}$ =1,586*48,000/1.07+ 1,182 *48,000/1.07²+ 1,213 *48,000/1.07³+495*48,000/1.07⁴+ 276*48,000/1.07⁵ = 195,803,243

(2) RELIEVE FISHING PORT CONGESTION

Due to operating difficulties, an increasing number of fishing vessels are idle. Their permanent "parking" in the port, almost all year round, has aggravated congestion in fishing port.

The buyback policy can relieve some congestion in the fishing port and save the public the expense of building or expanding existing fishing ports. Using the Taiwan Fisheries Bureau standard anchorage area of fishing boats, the NPV of relieving fishing port congestion by purchasing old vessels is NT\$1,419,011,446 (table 8). Furthermore, according to Tseng (1995), the cost of building a new fishing port is NT\$7,235 per m².

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Year	Saved port area	Total building cost	Total building cost				
	(m^2)		NPV				
1991	72,991.50	528,093,503	493,545,330				
1992	62,189.00	449,937,415	392,992,764				
1993	55,334.75	400,346,916	326,802,338				
1994	23,834.45	172,442,246	131,555,364				
1995	14,367.80	103,951,033	74,115,650				
Total	228,717.50	1,654,771,113	1,419,011,446				

Table 8.Saved Building Cost Of Fishing Port (NT\$)

Source: Taiwan Fisheries Bureau (1992, 1995, 1998), The report of purchasing old fishing vessels program.

The NPV benefit of relieving fishing port congestion by purchasing old vessels is:

$$\sum_{i=1}^{3} \frac{C_i}{(1+r)^i}$$

=528,093,503/1.07+449,937,415/1.07²+400,346,916/1.07³+172,442,246/1.07⁴
+103,951,033/1.07⁵
=1,419,011,446

4. CONCLUSION AND RECOMMENDATIONS 4.1 THE RESULTS OF BENEFIT-COST ANALYSIS

The Taiwanese government stated that their policy of buying back power vessels had multiple objectives and achieved most of them but not necessarily in the order that was set up. The NPV of the net benefit of the policy was NT\$2,410,617,381(table 9), confirming the policy objectives. Furthermore, the benefit-cost ratio was 2.50, which implies that an input of one dollar can create benefits of NT\$2.50.

		After discounted						
		1991	1992	1993	1994	1995	Total	
Direct	Fishermen's income	-178,327	65,265	469,708	145,223	-53,322	448,547	
Benefit	Oil subsidy	763,598,649	677,563,854	578,858,384	236,571,968	138,457,227	2,395,050,082	
Indirect	Relieve shortage of fishermen	71,147,664	49,555,420	47,528,128	18,126,390	9,445,641	195,803,243	
Benefit	Relieve fishing port congestion	493,545,330	392,992,764	326,802,338	131,555,364	74,115,650	1,419,011,446	
Total benefit		1,328,113,316	1,120,177,303	953,658,558	386,398,945	221,965,196	4,010,313,318	
Cost		514,284,712	462,534,195	366,927,745	161,960,220	94,439,065	1,600,145,937	
	Net benefit	813,828,604	657,643,108	586,730,813	224,438,725	127,526,131	2,410,167,381	

Table 9. The Benefit-Cost Analysis of the Buyback Old Fishing Vessels Policy from 1991 to 1995 (NT\$)

The results of benefit-cost analysis from 1991 to 1995 (table 9) indicate that:

The direct benefit of the buyback policy could improve fishermen's income and reduce oil suvsidy.

- (1)The NPV of fishermen's income was only NT\$448,547. The policy of buying back the old fishing vessels did not improve fishermen's economic well-being significantly.
- (2)The savings from oil subsidy policy provided a substantial NPV savings of NT\$2,395,050,082, the most sizeable amount in the buyback policy.

The indirect benefit of the buyback policy could relieve the shortage of fishermen, relieve fishing port congestion and save the expenditure of building or expanding fishing port.

- (1)The NPV of relieving the shortage of fishermen was NT\$195,803,243. The buyback policy would provide social benefits and redistribute social resource between the past owners of fishing crafts and present owners.
- (2)The NPV of fishing port congestion was NT\$1,419,011,446. This analysis assumed that the

purchased fishing vessels worked all year round. If the purchased vessels stayed at port most of the year, the effect of the purchasing policy might not be so impressive but the purchase would provide new space in the port instead of building more ports. In order to increase benefits, the objective should be to buy working vessels. But it could also be argued that the first year of buyback was of laid-off vessels; this cleared the way for an actual reduction in the next years of working vessels.

4.2 RECOMMENDATIONS

The policy did not address a few issues and left others unclear.

- (1)The policy did not demonstrate a decrease in fishing. The catch was increasing annually but it could be declining per capita.
- (2)The data did not provide an opportunity to determine improvement in operations efficiency.
- (3)Fisherman production as measured by catch per vessel increased (figure 2), but the catch per vessel size declined (figure 3).
- (4)The buyback policy was aimed at reducing the number of vessels in order to increase the catch per vessel, but in reality, during the period of this policy, the number of vessels declined by 1817. The vessel size and its power also changed but less dramatically. This implies that the vessels actually being sold were small and the average vessel size were actually increased.

An additional glance at the buyback policy also reveals that the annual net benefit was declining (Figure 6), primarily because of the oil subsidy annually declining benefits, and the shortage of fishermen and fishing port congestion in proportion to the number of old fishing boats purchased also added to the decline. Thus, the fewer the number of old fishing boats purchased, the less the net benefit.



Figure 6. TheBenefit (in million) from 1991 to 1995

Since 1999, the government has introduced a new 5-year program of purchasing fishing boats. The objectives of this new policy should also be clearly stated in light of the above findings. Finally, yet importantly, one should not forget that the size of the catch is market determined and various policies aiming at supply will not reduce the catch should it still be a primary aim.

REFERENCES

Chang, Tsa Yao (1998) Could the Benefit-Cost Analysis in Industry be Adopted to the Government Public Investment, **Huashin Finance Journal**, No.4,145-150.

Chen, Yi Ta (2001)**The Management of Fishing Effort - The Study of Reducing Fishing Vessels in Taiwan**, Unpublished Master Degree Paper, National Taiwan Ocean University.

China Institute of Ship Inspection Research (1982) **The Research of the Amend Tonnage Measurement of Ship**, China Institute of Ship Inspection Research.

Lin, Hsueh Hua (1995) The Plan's Evaluation and Benefit-Cost Analysis, **The Technology of MRT**, No.12, 7-12.

Song, Yen Hui (1997) Focus on Taiwan's Fishery Development Topics from the View of EU Common Fishery Policies, **Chinese Fisheries**, No.538, 3-23.

Taiwan Fisheries Bureau (TFB) (1992) The Report of Purchasing Old Fishing Vessels Program in 1991.

Taiwan Fisheries Bureau (TFB) (1995A) The Report of Purchasing Old Fishing Vessels Program in 1992.

Taiwan Fisheries Bureau (TFB) (1995B) The Report of Purchasing Old Fishing Vessels Program in 1993.

Taiwan Fisheries Bureau (TFB) (1998A) The Report of Purchasing Old Fishing Vessels Program in 1994.

Taiwan Fisheries Bureau (TFB) (1998B) The Report of Purchasing Old Fishing Vessels Program in 1995.

Tseng, Qing Zhu (1995) **The Benefit-Cost of Near Coast Fishery Policy in Taiwan - Take Purchasing Old Fishing Vessels for Example**, Unpublished Master Degree Paper, National Sun Yat-Sen University.

Weng, Ping Sheng (1994) **The Study of Taiwan Fishery Policy: The Analysis of Fishery Policy Now,** Unpublished Master Degree Paper, National Taiwan Ocean University.

Wu, Ren Fen (1995) **The Effectiveness of the Reduction Program on the production of Taiwan Offshore Fisheries,** Unpublished Master Degree Paper, National Taiwan Ocean University.