

7. ANCHOVY PRODUCTION AND STATUS OF THE FISHERIES

The time series of total landings of anchovy in the Gulf of Thailand is shown in Fig. 29. The landings increased gradually from the years 1971 to 1980 and then suddenly increased to more than 100,000 tonnes in 1985, which might be due to using light luring in capturing anchovy and developments of the gears. From the years 1986 to 1987, there was a downward trend and then again a sharp increase to around 120,000 tonnes during the years 1990 up to 1996 (Table 25, Fig. 29).

Time series of catch and effort from the statistics of DOF were used to estimate the surplus production of anchovy in the Gulf of Thailand using Schaefer and Fox Models. The estimation was made on data from 1971 to 1990, using APS as a standard fishing gear. The MSY was estimated at 100,839 tonnes at an optimum effort of 53,379 days of APS with quite a low coefficient of determination, r^2 equal to 0.2 (Saikliang, 1995).

Saikliang (1999) tried to investigate and he arrived at a new estimate by eliminating data that were uncertain due to the development of the gears since 1982, which reduced the time series to years 1984 to 1995. The new estimate of MSY was 120,070 tonnes at an optimum effort of 54,396 days of APS and the r^2 was 0.6 (Resources and Environment Working Group of the National Fishery Policy Board, 1999).

Other estimates of the MSY of anchovy were 101,000 tonnes (Chullasorn, 1993), 106,118 tonnes (Saikliang and Boonragsa, 1997) and 106,000 tonnes (Chullasorn, 1999). All these estimates are very similar, except the one determined in 1999 by Working Group which was a higher by some 15,000 tonnes.

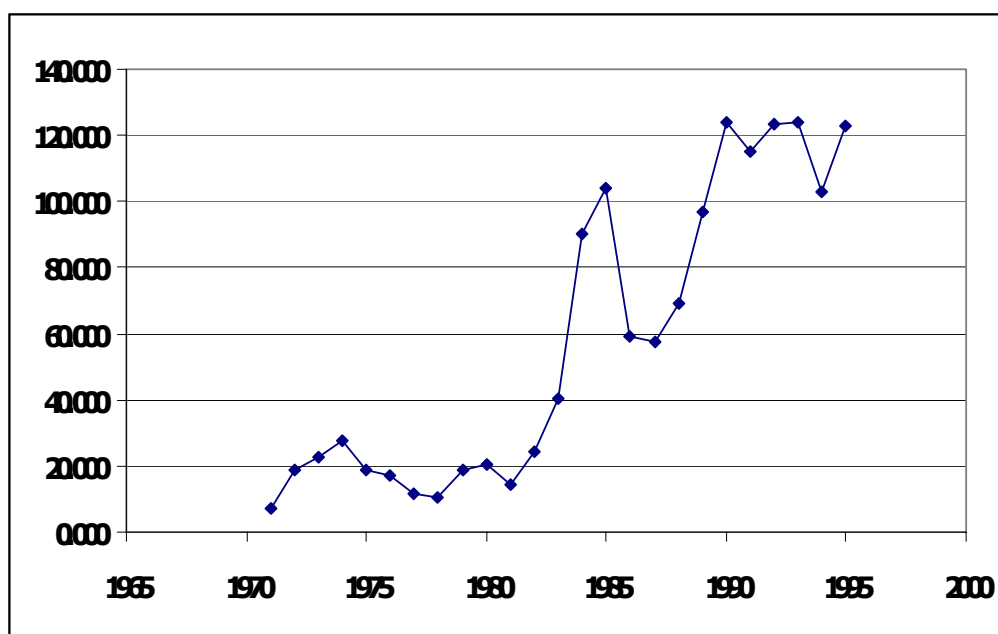


Fig. 29 The total production of anchovy in the Gulf of Thailand, 1971 to 1995. (Y-axis indicates quantity in thousand tonnes and X-axis indicates years)

**Table 25. Anchovy caught by types of fishing gear in the Gulf of Thailand, 1971-1995
(in tonnes)**

Year	APS	BST	PAT	PUN	PS	TPS	LPS	Others	Total
1971	0	7,173	0	0	0	0	0	0	7,173
1972	6,784	6,001	0	0	0	0	0	6,109	18,894
1973	10,093	7,644	0	4,588	0	0	0	170	22,495
1974	3,108	13,496	0	2,446	466	178	288	7,908	27,424
1975	3,071	6,764	523	1,131	3,047	2,759	288	4,204	18,740
1976	3,854	5,564	1,751	2,208	1,940	0	1,940	1,960	17,277
1977	2,011	4,869	541	320	1,820	178	1,642	2,097	11,658
1978	2,492	567	800	1,024	3,635	127	3,508	2,094	10,612
1979	7,540	5,228	1,119	3,302	210	57	153	1,666	19,065
1980	4,490	5,049	983	3,342	1,914	0	1,914	4,447	20,225
1981	5,185	4,260	1,355	687	608	0	608	2,376	14,471
1982	13,553	6,027	686	2,806	121	0	121	1,424	24,617
1983	32,667	4,124	723	494	133	0	133	2,410	40,551
1984	79,158	4,183	279	35	5,149	5,149	0	1,235	90,039
1985	79,752	5,199	328	596	14,827	14,827	0	3,464	104,166
1986	39,689	3,338	881	770	13,269	13,269	0	1,228	59,175
1987	22,003	2,996	539	589	14,430	14,430	0	17,211	57,768
1988	53,232	2,105	759	1,508	4,472	4,472	0	7,302	69,378
1989	86,894	4,335	304	908	141	141	0	4,278	96,970
1990	114,942	2,361	252	467	432	432	0	5,504	123,958
1991	106,017	1,875	338	673	746	746	0	5,433	115,082
1992	117,248	1,073	51	966	269	269	0	3,681	123,288
1993	110,298	820	149	1,247	3,451	3,451	0	7,786	123,751
1994	92,395	707	103	959	0	0	0	8,565	102,729
1995	109,810	733	265	462	761	761	0	11,064	123,095

Sources: Department of Fisheries, Fisheries statistics of Thailand, 1971 – 1995

Remarks: APS = Anchovy purse seine PS = Purse seines (TPS + LPS)
 ST = Bamboo stake traps TPS = Thai purse seine
 AT = Pair trawl LPS = Luring purse seine
 UN = Push net Others = Other gears

Anchovies are landed by several gears but the most popular one, according to statistical records, is APS (Table 25). It is noted that the statistical data did not always provide a clear separation by gear. Anchovy catches selective fishing gears for anchovy, e.g. APS, APSL, LNL and FNL were often lumped under the heading APS, while anchovy catches by non- anchovy gears e.g. BST, PT, PUN, PS, were often included under the bycatch.

8. ANCHOVY UTILIZATION AND MARKETING

The fishermen of medium and small-sized FNL boats in the southern part of the Gulf of Thailand had to land anchovy catches at local landing places. Fresh anchovy was landed in the afternoon and processed into boiled-dried fish mostly by groups of housewives at home. Circular shaped pans are used to boil water using gas or wood of rubber trees as fuel. About five kg of anchovies are added to the pan of boiling, salted water. The processors wait for the fish to float up to the surface, which takes about three minutes, before lifting the fish out and preparing it for drying in the sun. It is noted that the processing phase has to be completed quickly to maintain a good quality. If the handling process takes longer the fish might become damaged, misshapen or rotten. Normally, the process of boiling and drying will only take 1 to 2 days, one of the reasons that it gives the highest profit.

The fishing grounds are fairly near the coastal areas where the plants for boiled-dried anchovy are located. The utilization of anchovy for the production of fish sauce is inversely related to the production of boiled-dried fish. If plants for boiled-dried fish anchovy need more raw material then the production of fish sauce will decline and vice versa. This will inspire fishermen to find ways to catch more and more anchovy. In the province Rayong, about 800 tonnes of fresh anchovy was needed each month to supply the processing plants for boiled-dried anchovy in order to meet the demand for export to Malaysia, which amounted to Baht 30 million annually (Chullasorn, 1993).

Table 26. Utilization of fresh anchovy in Thailand, 1982 – 1995
(Note: no data on domestic fresh consumption) (in tonnes)

Year	Fresh anchovy used for fish sauce			Type of processing products			Total fresh anchovy used
	Total	Anchovy	Others ^{1/}	Fish sauce	Budu ^{2/}	Others ^{3/}	
1982	30,055.1	18,393.7	11,661.4	18,393.7	118.2	6,114.1	24,626
1983	28,516.6	17,492.1	11,024.5	17,492.1	137.0	22,989.9	40,619
1984	24,226.9	18,431.8	5,795.1	18,431.8	175.5	71,479.7	90,087
1985	19,066.3	16,168.2	2,898.1	16,168.2	355.8	87,672.0	104,196
1986	47,246.7	33,762.5	13,484.2	33,762.5	368.3	24,869.2	59,363
1987	41,755.3	31,057.6	10,697.7	31,057.6	254.1	26,488.3	57,769
1988	27,345.8	23,977.9	3,367.9	23,977.9	250.9	45,171.2	69,378
1989	31,466.5	27,775.2	3,691.3	27,775.2	347.3	68,977.5	97,454
1990	35,989.4	31,615.6	4,373.8	31,615.6	359.3	92,025.1	124,740
1991	37,549.5	34,595.0	2,954.5	34,595.0	368.7	75,118.3	127,089
1992	34,761.5	31,572.0	3,189.5	31,572.0	351.9	127,960.1	159,884
1993	38,671.0	34,990.0	3,681.0	34,990.0	346.4	129,998.7	165,335
1994	32,855.3	30,381.3	2,474.0	30,381.3	325.3	138,652.4	169,359
1995	50,745.0	47,136.4	3,608.6	47,136.4	318.4	120,532.2	167,987

Source: Department of Fisheries of Thailand, 1982-1995; 1984-1998

Notes ^{1/}: Sardinellas; Mackerel and other species.

^{2/}: Fermented fish

^{3/}: Dried; boiled - dried and fish meal.

According to the statistical records, anchovy used for the production of fish sauce amounted to 24,626 tonnes or about 75% of total anchovy catches in the year 1982, with a gradual increase to 33,762 t in

1986 (Department of Fisheries of Thailand, 1982-1986). From 1984 till now the utilization of anchovy has developed further, while the demand for and the production of boiled-dried anchovy has increased markedly (Tables 26, 27 and 28).

**Table 27. The quantity of fresh fish used for fish sauce production, 1982 – 1995,
(unit: tonnes)**

Year	Total	Anchovy	%	Sardines	%	Mackerel	%	Others	%
1982	30,055.1	18,393.7	61.2	6,616.8	22.0	3,319.2	11.0	1,725.5	5.7
1983	28,516.6	17,492.1	61.3	7,274.5	25.5	2,312.8	8.1	1,437.3	5.0
1984	24,226.9	18,431.8	76.1	3,906.2	16.1	894.7	3.7	994.2	4.1
1985	19,066.3	16,168.2	84.8	1,095.5	5.8	447.7	2.4	1,354.9	7.1
1986	47,246.7	33,762.5	71.5	3,731.8	7.9	8,253.1	17.5	1,499.3	3.2
1987	41,755.3	31,057.6	74.4	3,519.0	8.4	3,346.3	8.0	3,832.4	9.2
1988	27,345.8	23,977.9	87.7	1,996.4	7.3	570.5	2.1	801.0	2.9
1989	31,466.5	27,775.2	88.3	2,267.5	7.2	602.5	1.9	821.3	2.6
1990	35,989.4	31,615.6	87.9	2,294.8	6.4	532.8	1.5	1,546.3	4.3
1991	37,549.5	34,595.0	92.1	1,003.5	2.7	1,251.0	3.3	700.0	1.9
1992	34,761.5	31,572.0	90.8	57.5	0.2	2,432.0	7.0	700.0	2.0
1993	38,671.0	34,990.0	90.5	39.0	0.1	3,318.0	8.6	324.0	0.8
1994	32,855.3	30,581.3	93.1	0.0	0.0	2,125.0	6.5	149.0	0.5
1995	50,745.0	47,136.4	92.9	0.0	0.0	3,525.6	7.0	83.0	0.2

Source: Department of Fisheries, Statistics of Fisheries Factory, 1982 - 1995. 1984 - 1998.

Table 28. Exports of fish sauce and boiled-dried anchovy, 1980-1998

Year	Fish sauce ¹		Dried anchovy ² and boiled-dried anchovy ³	
	Quantity (tonnes)	Value (mill. Baht)	Quantity (tonnes)	Value (mill. Baht)
1980	5,432.0	68.04	ND	ND
1981	6,313.0	90.58	ND	ND
1982	7,534.0	112.00	ND	ND
1983	7,823.0	110.50	ND	ND
1984	8,754.3	132.10	470.7 ³	27.06
1985	9,109.1	145.70	599.1 ³	34.45
1986	10,710.6	169.50	541.4 ³	31.13
1987	9,985.0	166.50	477.4 ⁴	27.45
1988	12,016.5	202.90	1,692.3 ⁴	97.31
1989	13,203.2	233.84	1,197.4	68.89
1990	16,002.0	288.41	18,439.3	389.75
1991	17,152.0	308.68	20,458.0	452.18
1992	18,966.0	345.51	22,064.1	594.00
1993	18,321.0	342.94	14,812.1	416.11
1994	20,826.0	383.44	12,673.5	441.89
1995	25,242.0	472.92	13,929.3	500.31
1996	24,061.0	466.45	16,744.8	501.15
1997	26,262.0	606.23	19,113.1	530.39
1998			12,613.7	451.17

Notes: 1. Department of Fisheries of Thailand, 1980-1995

2. Department of Customs of Thailand, 1984-1998

3. Boiled-dried anchovy, only at Sadoa border of Songkhla Province

Boiled anchovy, only in Chumphon and Surat Thani Provinces

ND = No data available

9. SOCIO-ECONOMIC ASPECTS OF ANCHOVY FISHERIES

9.1 Costs and benefits of anchovy purse seine fisheries (APS, APSL)

Juntarashote, Kaewnern and Saikliang (1995) reported that the cost component (fixed cost and variable cost) of the day and night catching anchovy purse seines were similar. The net benefits per month of small and medium daytime fishing boats were 1,794 and 1,845 Baht respectively, while the larger nighttime fishing boats earned 5,640 Baht per month (Table 29). The total catches of small and medium sized, daytime fishing boats were 12,429 and 40,000 kg per month per boat respectively, while the total catches of the large sized, nighttime fishing boats were 71,780 kg per month per boat. Anchovy prices were lower for the larger boats. The price ranged from 3.00 to 4.35 Baht per kg.

Table 29. The cost and benefit of anchovy purse seine fisheries (APS, APSL)

Items	Day time fishing	Day time fishing	Nighttime fishing
	Small boats	Medium boats	Large boats
Total catches per month (kg)	12,429	40,000	71,781
Net benefit per month (Baht)	1,794	1,845	5,640
Net benefit per year (Baht)	15,795	12,915	57,527
Anchovy price (Baht/kg)	4.35	3.00	3.43
Boat (size, engine, crew)	8 m, 40 hp, 7	15.5 m, 150 hp, 20	17.8 m, 300 hp, 21
Operating days per month	18	20	22
Operating months per year	8.8	7	10.2

Source: Juntarashote, Kaewnern and Saikliang, 1995.

9.2 Economic losses caused by anchovy boats catching other valuable fish

Juntarashote, Kaewnern and Saikliang (1995) also reported that an economic loss caused by the anchovy fisheries was due to catch of other economically valuable fish. The estimation of daytime operation showed that the social cost created by an anchovy purse seiner was 1,580 Baht per day per boat, broken down as follows: squid 1,020, scad 388, mackerel 139, *Caranx* 25.6 and common jacks 7.7.

The social cost of the nighttime operation was 5,914 Baht per night per boat, broken down as: sardines 3,476, mackerel 2,014, squids 126, caranx 20 and scads 8. It was concluded that the light luring anchovy purse seine created a higher social cost than the daytime anchovy purse seine. These were due to the higher catches of sardines and mackerels in nighttime capture. The cost would be higher if the juveniles of economically valuable species had been taken into account in the results of the study.

Pramokechutima (1998) reported an economic loss by area of fishing, month and distance from the shoreline in Songkhla Province. The results of the studies were concluded as follows:

Apart from anchovy, there were several small-sized economical fishes caught as bycatch in the anchovy fisheries in Songkhla Province, as follows: *Selariodes leptolepis*, *Caranx* sp., *Atule mate*, Indo-Pacific mackerel, Indian mackerel, *Scomberomorus* spp., sardine, squid, etc. (Pramokechutima, 1998).

The economic loss to Songkhla due to the mobile fishing boats from outside of Songkhla Province was estimated at 5,600 Baht per boat per day. The economic loss caused by local anchovy boats in Tapa district was estimated at 8,100 Baht per day per boat, mainly due to high catches of Spanish mackerel, whereas in the Jana district it was estimated at 2,000 Baht per day per boat. The total economic losses

in one year from the mobile fishing boats, local Tapa and local Jana were 73.441, 16.639 and 21.184 million Baht per year, totalling more than 111 million Baht in a year (Table 30).

Table 30. The economic losses of anchovy fisheries in each area at Songkhla (Baht per boat per day)

Items	Mobile boats	Local Tapa boats	Local Jana boats	Totals
Mackerels	4.6	0.1	0.2	4.64
Sardine	392.8	65.7	70.3	528.8
<i>Caranx</i>	9.3	5.1	0.5	14.9
<i>Selariodes leptolepis</i>	2.5	1.4	0.2	4.1
Spanish mackerel	4,831.3	7,752.5	1,910.0	14493.8
Squid	364.0	284	43.1	691.1
Totals (economic loss in Baht/day/boat)	5,604.5	8,108.8	2,024.3	15,737.6
Number of boats	84	19	91	194
Fishing days in a year	156	108	115	379
Economical loss per year	73,441,368	16,639,340	21,184,300	111,265,667

Sources: Pramokechutima, 1998.

Data by month show that the economic loss was the highest in September due to the high quantity of Spanish mackerel in the catches. It was estimated at 9,203 Baht per day in the high season of Spanish mackerel, while the lowest was in October amounting to 1,766.9 Baht per day (Table 31).

Table 31. The economic loss (Baht per day per boat) in each month

Items	May	Jun	Jul	Aug	Sep	Oct
Mackerels	7.7	1.5	2.5	0.0	2.1	32.2
Sardine	1,070.5	248.6	224.0	178.6	85.3	1,223.1
Caranx	8.8	7.2	4.0	0	14.2	15.6
<i>Selariodes leptolepis</i>	0.6	2.6	2.4	0.4	0.2	0.8
Spanish mackerel	786.5	4,606.6	4,157.1	3,820.1	8,988.4	0
Squid	9.2	293.3	373.2	190.7	112.8	495.3
Total losses	1,883.3	5,159.8	4,763.2	4,190.0	9,203.0	1,766.9

Source: Pramokechutima, 1998.

Table 32. The economic loss (Baht per day per boat) by fishing zone off Songkhla

Items	< 5 mile	>5-10 mile	>10-15 mile	>15-20 mile	>20 mile
Mackerels	0.1	2.7	1.0	1.4	8.8
Sardine	66.8	132.4	404.2	213.1	478.6
Caranx	5.3	10.4	9.3	4.3	4.7
<i>Selariodes leptolepis</i>	0.3	0.5	2.0	2.9	3.1
Spanish mackerel	12,359.1	2,247.1	1,910.0	8,539.0	3,802.1
Squid	31.8	231.7	376.3	243.0	350.7
Total loss	12,463.4	2,624.8	2,702.9		4,665.9

Source: Pramokechutima, 1998.

At a distance from shoreline of less than 5 miles, the Spanish mackerels were abundantly caught together with the anchovy. The economic loss in the inshore areas were the highest, followed by the areas of deeper zone at the distance from shoreline more than 20 miles.

The income of the fishermen in Songkhla Province averaged 22,200 Baht per month; about 47% of the fishermen had an income of more than 30,000 Baht per month. The expense of each family was about 11,500 Baht per month; for the majority of the expenses about 47% was spent on food. In the period of high season of anchovy capture, during May to October, the income of the fishermen averaged 28,300 Baht per month while in the low season (November to April) the income averaged 18,700 Baht per month. During the low season, some fishermen were hired as workers.

The initial investment of anchovy fisheries averaged 138,900 Baht, about 42% was less than 100,000 Baht. The average debt of each family was 167,000 Baht, about 51% was more than 200,000 Baht. About 50% of the processors (boiled-dried anchovy processing) in Songkhla Province had an income ranging from 5,000 to 10,000 with an average of 8,400 Baht per month. The average debt per family was 29,800 Baht, about 49% of the households were in debt by 10,000 – 50,000 Baht.

9.3 Results of socio-economic surveys

Three surveys were conducted on the socio-economics of anchovy fisheries, fishermen and small-scale processors during 1993-1994, 1996 and 1997, as follows:

1. The socio-economic aspects of anchovy fisheries in Choburi, Rayong, Trad, Chumphon, Surat Thani and Songkhla Provinces in 1993-1994.
2. The socio-economic aspects of fishermen and small scale processors in Songkhla Province in 1996.
3. The socio-economic aspects of anchovy fisheries in Prachuab Khiri Khan, Chumphon and Songkhla Provinces in 1997.

9.3.1 The socio-economic aspects of anchovy fisheries in the year 1993-1994

In 1993-1994, the surveys were aimed at the cost and benefit of the anchovy fishing and processing products. A total of 37 fishermen and 48 processors were interviewed and questionnaires completed from Choburi, Rayong, Trad, Chumphon, Surat Thani and Songkhla Provinces. Table 33 shows the sample sizes, types of fishing gear and areas surveyed in detail. Results of the studies are shown in Table 34.

Table 33. Number of interviewed samples (boats), fishermen and survey areas in the years 1993-1994

Items	Large Scale		Small Scale	
	Day Time	Nighttime	Day Time	Nighttime
Sample size (no. boats)	5	7	16	9
Fishing gears	Anchovy Purse Seine (Large APS)	Anchovy Purse Seine with light luring (Large APSL)	Anchovy Purse Seine (Small APS)	Lift Net & Falling Net with light luring (Small LNL and small FNL)
Survey areas: Province (District)	Chumphon (Pak Num) Surat Thani (Donsak)	Trad (Muang) Rayong (Muang)	Rayong (Klang) Songkhla (Te-Pa)	Cholburi (Sattaheep)

Table 34. Cost and benefit of anchovy fishing during the years 1993-1994

	Title	Large Scale		Small Scale	
		Daytime	Nighttime	Daytime	Nighttime
1	Fishing experience (years)	8.6	8.1	11.7	5.9
2.	Length of boat (m)	20.2	16.5	11.9	11.1
3	No. of fishing days per month	24.4	23.3	24.9	19.9
4.	No. of fishing months in a year	9.2	10.8	8.9	9.2
5.	No. of fishing days per year	224.5	252.0	220.3	183.4
6.	Initial investment in Baht	3,215,920	3,063,422	427,279	268,344
	in US\$	86,917	82,795	11,548	7,253
6.1	Boat (US\$)	27,027	39,216	3,243	3,499
6.2	Engine (US\$)	12,000	13,267	1,236	1,841
6.3	Net (US\$)	23,784	18,413	5,259	643
6.4	Other (US\$)	24,106	11,899	1,811	1,271
7.	Quantity of fish (kg/trip)	4,175	3,414	562	423
7.1	By Anchovy fishing gear	4,175	3,414	500	403
7.2	By other fishing gear	0	0	62.4	19.2
8.	Total costs (Baht/kg)	4.0	3.7	4.6	4.9
8.1	Fixed costs	0.7	0.7	0.7	0.8
	Depreciation cost	0.2	0.2	0.3	0.3
	Opportunity cost	0.5	0.5	0.5	0.5
8.2	Variable costs	3.3	3.0	3.8	4.1
	Lubricant & gasoline	1.0	0.9	0.7	1.5

	Title	Large Scale		Small Scale	
		Daytime	Nighttime	Daytime	Nighttime
	Wages	1.1	1.0	2.1	1.1
	Cost of repairs/maintenance	0.5	0.5	0.4	0.6
	Food	0.3	0.2	0.3	0.4
	Ice & Salt	0.2	0.2	0.3	0.2
	Others	0.3	0.1	0.1	0.3
9.	Average sale price (Baht/kg)	7.1	4.1	5.3	5.8
	Anchovy price	7.1	4.1	5.4	3.9
	Other fish price	0	0	4.1	45.1
10.	Net fishery income (Baht/kg)	3.1	0.4	0.7	0.9
11.	Processed product price (Baht/kg)	35.0	19.0	55.3	0
	Dried fish	0	19.0	0	0
	Boiled-dried fish	35.0	0	55.3	0
	Net family income in Baht	408,354	42,911	60,413	7,397
	In US\$	11,037	1,160	1,633	200
	Net fishery income in Baht	312,710	31,832	9,500	7,397
	In US\$	8,452	860	257	200
	Net processing product income	95,643	11,079	50,914	0
	In US\$	2,585	299	1,376	

The highest level of fishing experience was the small anchovy purse seine (APS) at 11.7 years while the lift net (LNL) and falling net with light luring (FNL) were the lowest at 5.9 years.

The boat sizes of day and nighttime fishing were a little different in length over all (LOA); daytime fishing boats were larger, having LOA 20 m, the nighttime fishing boats were of medium size, LOA 16.5 m on average. The smaller boats showed no difference between day and nighttime fishing, having almost the same LOA, about 11-12 m.

The number of fishing days in a month ranged from 20 to 25, the number of fishing months in a year from 8.9 to 10.8.

The initial investment for boat, engine, net and other fishing equipment was for the larger boats from US\$82,800 to 86,900 and for the smaller boats from US\$7,300 to 11,500.

The average catch per trip of the larger boats was approximately 8 times that of the smaller boats. The smaller boats, however, also used other gears such as gill net and squid cast net to catch other fish and squid alternatively.

Lubricants and gasoline constituted the major fishing cost. The total fishing cost (Baht per kg) comprised fixed cost (depreciation cost, opportunity cost) and variable cost (lubricant, gasoline, wages, repairs, food, ice, salt, etc.). Labour cost was more significant in the daytime fishing of larger boats, which needed more fishermen, about 8 to 10 crew per trip.

The average sale price of anchovy caught by daytime larger boats was highest due to the good quality of fish bringing in a higher income. The sale price of fresh anchovy caught by smaller and larger nighttime boats was a little low, about 3.9 to 4.1 Baht per kg. For the small boats using lift nets and falling nets with light luring (LNL & FNL), the average sales price was higher than that of the larger anchovy purse seiners with light luring (ASPL), due to alternative catching of other fish species and squid.

Table 35. Cost and return of boiled-dried anchovy during the years 1993-1994
Unit: Baht/kg, unless otherwise indicated

	Title	Large Scale		Small Scale	
		Daytime	Nighttime	Daytime	Nighttime
1.	Total cost	24.8	16.6	31.9	25.8
1.1	Fixed cost	0.4	0.2	0.5	0.03
	Depreciation cost	0.4	0.2	0.5	0.03
1.2	Variable costs	24.4	16.5	31.4	25.8
	Raw material (fresh fish)	20.3	15.2	28.0	24.0
	Wages	2.1	0.7	1.7	1.0
	Gas	0.5	0.4	1.7	0.8
	Others	1.5	0.1	0	0
2.	Price of fresh fish	4.5	3.9	7.0	6.0
3.	Price of boiled-dried fish (average)	35.0	21.9	38.0	28.0
4.	Profit	10.2	5.2	6.1	2.2
5.	Net return (Baht/year)	188,820	86,270	13,992	80,623
6.	Initial investment (Baht)	1,800,000	120,000	15,000	5,400
7.	Profit (Baht/year)	1,914,635	451,192	85,071	174,952
8.	Profit/Total cost	0.41	0.3	0.2	0.1

The processing methods for the catches of each type of fishing were different. Anchovy caught by larger daytime boats was processed into boiled-dried products, while anchovy caught by nighttime boats was mostly processed into a dried product. Some anchovies caught by daytime boats were processed into boiled-dried anchovy and the rest was sold to other processors. Basically, the fishermen wanted to process all their fish into a boiled-dried product, which could be sold at a high price, but there were limitations of time and labour. All anchovies caught by nighttime small boats were sold directly to the processors by passing through the fish agents. The fishermen of this type did not have any processing activities. Thanks to the processing of fish, the family income could increase by 23%, for larger daytime, by 26% for nighttime boats and by 84% for small daytime boats.

The total cost of the dried anchovy caught by small daytime purse seine was the highest. The lowest was the larger boat capturing in nighttime (Table 35). The major cost was the raw material (fresh fish) which was variable depending on the quality and size of fish. The average dried fish price of the small daytime fishing boat was the highest, followed by large daytime fishing boats, small nighttime fishing boats and large nighttime fishing boats. The net return (or profit) of dried fish of large anchovy purse seine was the highest, while the small purse seine was the lowest. The net return of boiled-dried anchovy per year was 188,800 Baht for larger daytime anchovy purse seiners; 86,300 Baht for larger nighttime anchovy purse seiners, 14,000 Baht for small daytime anchovy purse seiners and 80,600 Baht for small nighttime lift netters and falling net.

It was noted that the profits (Baht/kg) of daytime fishing were higher than nighttime fishing for both larger and smaller boats. The profits of daytime fishing of the larger boats and smaller boats were 10.2 and 6.1 Baht per kg whereas the profits for nighttime fishing of larger and smaller boats were 5.2 and 2.2 Baht per kg respectively.

9.3.2 Socio-economics of fishermen and small-scale processors in Songkhla in 1996

Socio-economic surveys of small-scale fishermen and processors in Songkhla Province were conducted in August 1996. The major objectives of these surveys were to collect information re income and expenses of anchovy fishermen including small-scale processors. A total of 118 samples

of anchovy falling net fishing boats was collected by the provincial fishery officers in Songkhla at Muang, Singha-Nakorn, Ja-Na and Te-Pa district landing places, including a total sample of 110 small-scale boiled-dried anchovy processors. The results of these studies are shown in Tables 36 and 37.

Socio-economic aspects of fishermen (Table 36)

The average age of the family head was 40 years, with the majority being less than 40. About 33% of the total were in the age group 40-50 years and the rest were older than 50. As regards the education of the family head, about 70% had finished primary school (6 years) and 25% had completed secondary school (10 years). The rest was made up of those educated to lower than primary school and higher than secondary school. Years of experience in anchovy fishing was on average 1.2 years. The fishermen in Muang and Te-Pa districts had more experience than those in other districts, because some fishermen in Muang district had moved from Rayong Province and settled there permanently. Some fishermen in Te-Pa had never used a small purse seine before. The size of boats in Muang were also larger than the others. Some of them moved to fish in Satul Province depending on the start of the fishing season.

The major household income was from fishery activities, fish processing and other wages. The household income averaged 22,200 Baht per month. The income of fishermen in Muang district was on average 24,800 Baht per month, which was higher than in other districts; the lowest was the income of fishermen in Singha-Nakorn district, about 12,500 Baht per month. An average fishery income of all districts during the fishing season (May to October) was 28,300 Baht per month. The income of fishermen in Muang district was 59,400 Baht per month. The income during the low fishing season from November to April was on average 18,700 Baht per month. The income of Muang district in the low season, however, was higher because the fishermen in Muang district used squid cast net and anchovy falling net to fish simultaneously, resulting in a higher income than those using only one fishing gear. There were examples of the use of several fishing gears simultaneously due to the abundance of the specific species. Therefore, in the low anchovy fishing season, fishermen in Singha-Nakorn and Te-Pa district also used otter-board trawls and floating nets operated on the same fishing ground. In this case incomes ranged from 3,200 to 5,600 Baht per month, whereas the fishermen in Ja-Na used only otter-board trawl, in which case their income could reach 16,500 Baht per month.

The household expenses of the anchovy fishermen in Songkhla was on average 11,400 Baht per month. The expense items were food, clothing, medicines and medical care. Fishermen in Muang district who spent more on food and educational fees, earned nearly twice this figure.

The expenses incurred in changing their fishing gear to anchovy falling net ranged from 98,000 to 237,000 Baht. The household debt was on average 167,000 Baht for all districts which constituted loans from non-financial institutes such as fish agents, friends, etc.

Table 36. Socio-economic aspects of anchovy fishermen in Songkhla Province, 1996

	Title	Sub-District				Total	%
		Muang	Singha-Nakorn	Ja-Na	Te-Pa		
	Number of households sampled	16	5	80	17	118	100
1.	SOCIAL SITUATION						
1.1	Age household chief < 40	2	1	55	7	65	55.1
	Age 40-50	12	4	15	8	39	33.0
	Age > 50	2	0	10	2	14	11.9
	Average (year)	42	43	40	40	40	
1.2	Education household chief, less than primary school	0	1	0	0	1	0.9
	Primary school	10	4	60	10	84	71.2
	Secondary school	6	0	20	4	30	25.4
	Higher than secondary school	0	0	0	3	3	2.5
1.3	Previous occupation						
	Trawl fishery	12	4	65	9	90	76.3
	Other fishing gear	0	0	0	4	4	3.4
	Labour	3	1	10	0	14	11.9
	Other (non-fisheries)	1	0	5	4	10	8.5
1.4	Years of Anchovy fishing experience < 1	1	4	20	7	32	27.1
	1 - 2	11	1	45	3	70	59.3
	> 2	4	0	15	7	16	13.6
	Average (year)	1	0	1	2	1.2	
2.	ECONOMIC SITUATION						
2.1	Household income (No.)						
	< 10,000	4	3	5	9	21	17.8
	10,000-20,000	2	1	15	3	21	17.8
	20,000-30,000	2	1	15	3	21	17.8
	> 30,000	8	-	45	2	55	46.6
	Average (Baht/month)	20,344	12,500	24,844	14,539	22,229	
2.2	Household expenses (No.)						
	< 10,000	1	4	45	15	65	
	10,000-20,000	5	1	15	2	23	19.5
	20,000-30,000	7	0	20	0	27	22.9
	> 30,000	3	0	-	-	3	2.6
	Average (Baht/month)	22,588	9,200	10,292	6,822	11,413	
2.3	Household expenses TOTAL (Baht/month)	22,588	9,200	10,292	6,822	22,578	100

	Title	Sub-District				Total	%
		Muang	Singha-Nakorn	Ja-Na	Te-Pa		
	Number of households sampled	16	5	80	17	118	100
	Food	9,487	4,324	5,764	3,206	9,487	47.0
	Clothing	4,292	1,932	823	341	4,292	31.0
	Medicine and Medical care	1,355	1,196	515	1,842	1,355	5.0
	Education Fees	6,776	1,104	2,779	614	6,776	12.0
	Others	678	644	412	819	668	5.0
2.4	Fishing income (May-Oct.) (No.)						
	< 10,000	0	1	10	5	16	13.6
	10,000-20,000	2	2	10	1	15	12.7
	20,000-30,000	1	1	35	5	42	35.6
	> 30,000	13	1	25	6	45	38.1
	Average (Baht/month)	59,429	21,333	24,214	20,530	28,342	
2.4	Other income (Nov.-April) (No.)						
	Anchovy, other fishing ground	10	0	0	7	17	14.4
	Trawl	6	5	80	10	101	85.6
2.5	Income (Nov.-April) (No.)						
	< 10,000	3	5	10	10	28	23.7
	10,000-20,000	0	0	35	6	41	34.8
	20,000-30,000	0	0	35	1	36	30.5
	> 30,000	13	0	0	0	13	11.0
	Average (Baht/month)	48,586	3,250	16,481	5,667	18,716	
2.6	Fishing investment (No.)						
	<100,000 Baht	0	0	50	0	50	42.4
	100,000-200,000 Baht	4	2	30	5	41	34.8
	> 200,000 Baht	12	3	0	12	27	22.9
	Average (Baht)	237,378	234,300	98,127	210,000	138,897	
2.7	Household debt (No.)						
	<100,000 Baht	0	0	0	1	1	0.9
	100,000-200,000 Baht	3	2	50	2	57	48.3
	> 200,000 Baht	13	3	30	14	60	50.9
	Average (Baht)	356,467	307,600	136,875	391,250	167,084	

Socio-economics of small-scale processors (Table 37)

Table 37 shows the results of the survey in Songkhla Province: Average age of the processor 39.2; more than 40% of the total had been educated to a level below primary school and 32% had finished primary school (4 years). The others had graduated to higher than primary school (6 years). The number of children in a family averaged 3.4. The family income of all districts ranged from <5,000 to >30,000 Baht per month with a mode ranging from 5,000-10,000 Baht per month. It was shown that the income of a processor in Singha-Nakorn was generally lower than 5,000 Baht per month. The

average household expenses were 8,400 Baht per month of which 41% was spent on food, 25% on school fees and the remainder was spent on clothing, medicines, medical care, etc.

The high season of processing product was from May to October when the production of boiled-dried anchovies was 100 kg per day on average. Family labour was generally used to process, but some processors hired 1 or 2 labourers from outside. Out of season, only 32.2% of processors still operated using fresh fish from other sources, while 67.8% hired workers for other types of processing such as grading dried fish, taking crabs off the net and other fishing gears. The household debt, by borrowing from non-financial institutes such as friends and council, was on average 29,800 Baht per year.

Table 37. Socio-economic aspects of anchovy processors in Songkhla Province, 1996

Units: numbers and % (last column) or otherwise indicated

	Title	Sub-District			Total	%
		Singha-Nakorn	Ja-Na	Te-Pa		
1.	SOCIAL SITUATION					
	Age (year) Total no.	26	45	32	103	100.0
	< 35	7	18	11	36	35.0
	35-40	13	17	9	39	37.9
	> 45	6	10	12	28	27.2
	Average (year)	39.2	37.2	41.8	39.2	
	Education Level (total)	27	50	32	109	100.0
	Uneducated	2	1	9	12	11.0
	Patom 1 - 4	17	19	11	47	43.1
	Patom 5 - 6	6	20	9	35	32.1
	Matayom 1 - 3	0	7	2	9	8.3
	Matayom 4 - 6	2	3	1	6	5.5
	Number of children	3.5	3.5	3.5	3.4	
2.	ECONOMIC SITUATION					
2.1	Income (Baht) Total no.	27	49	32	108	100.0
	< 5,000	13	3	12	28	25.9
	5,001-10,000	9	30	15	54	50.0
	10,001-20,000	4	11	4	19	17.6
	20,001-30,000	1	2	1	4	3.7
	> 30,000	0	3	0	3	2.8
2.2	Average expenses (Baht/year)	8,595	9,081	7,171	8,377	100.0
	Food	3,600	3,715	3,047	3,452	41.2
	Water supply and electricity	304	302	418	341	4.1
	Clothing	577	671	762	662	7.9
	Children education	2,539	2,039	1,660	2,070	24.7
	Medicine	575	584	322	544	6.5
	Others	1,000	1,770	962	1,308	15.6
	Other Jobs (Nov.-April) (No.)	24	57	32	107	100.0

	Title	Sub-District			Total	%
		Singha-Nakorn	Ja-Na	Te-Pa		
	Labourer	12	37	22	71	66.4
	Crew	3	3	1	7	6.5
	None	7	10	3	20	18.7
	Processing	2	0	5	7	6.5
	Others in fisheries	0	7	1	2	1.9
2.4	Debt (Baht/year) (No.)	21	24	21	66	100.0
	< 10,000	7	11	8	26	39.4
	10,000-50,000	9	10	13	32	48.5
	> 50,000	5	3	0	8	12.1
	Average debt (Baht/year)	46,224	30,808	12,286	29,820	
	Raw material (kg/day)					
	Period May-October (No.)	26	49	32	107	100.0
	< 500	24	45	26	95	88.8
	501-1,000	2	3	4	9	8.4
	1,001-3,000	0	1	2	3	2.8
	Source of raw material (Nov -Apr) (No.)	24	51	32	107	100
	Buy by themselves	8	14	2	24	22.4
	Agents	3	3	5	11	10.3
	None	13	34	25	72	67.3
2.7	Number of labourers	22	50	32	104	100
	1 - 2	8	30	26	64	61.5
	3 - 4	10	16	3	29	27.9
	5 - 6	3	2	1	6	5.8
	7- 10	1	1	1	3	2.9
	> 10	0	1	1	2	1.9

Table 38. Cost and return of processing products setting at 25 kg per day

	Title	Baht/day	%	Baht/kg
1.	Fixed Costs	9.0	1.4	0.4
	Stove	4.8	0.8	0.2
	Pan	2.2	0.4	0.1
	Tray	2.0	0.3	0.1
2.	Variable Costs	575.0	98.5	23.0
	Fresh fish (4:1)	550.0	94.2	22.0
	Gas	15.0	2.6	0.6

	Other	10.0	1.7	0.4
3.	Total Costs	584.0	100.0	23.4
4.	Average Return	750.0		30.0
5.	Profit	166		6.6

The average cost of the processed product was 23.4 Baht per kg (Table 38) of which the main expense was the raw material (fresh fish). The average sales price, depending on the quality of the product, was 30 Baht per kg. Therefore, the return of labour effected by the household was 6.6 Baht per kg or on average 166 Baht per day.

9.3.3 Socio-economic aspects of anchovy fisheries in the year 1997

A study on the socio-economic aspects of anchovy fisheries was conducted during November 1997 at landing places in Prachuab Khiri Khan, Chumphon, Songkhla (Table 39). The major objectives of the study were to collect cost and economic return data of anchovy fisheries, fishing grounds, fishing seasons and anchovy products distributed by fishermen.

Table 39. Number of samples, type of gear and sampling places

	Songkhla	Prachuab Khiri Khan	Chumphon
1. Number of samples	16	12	10
2. Fishing gear	Falling net	Falling net	Purse Seine
3. Districts	Te-Pa, Ja-Na Singha-Nakorn	Bang-Saphan	Pak-Num

Table 40 shows the results of the study in detail. The total number of family members in three provinces ranged from 3.8 to 4.8, including 3 children (babies and school children) not involved in the labour process. The age of the family head ranged from 36 to 39, and most of them had finished primary school.

The household assets (land and house) in Prachuab Khiri Khan, Songkhla and Chumphon amounted to 600,000; 322,143 and 257,500 Baht, respectively. The household debts in Prachuab Khiri Khan were lowest (125,250 Baht), while in Chumphon they were the highest (290,000 Baht). The major debt of fishermen in Prachuab Khiri Khan and Chumphon was through borrowing from financial institutes, while in Songkhla mainly through borrowing from non-financial institutes (friends and council).

Before entry into the anchovy fishery the fishermen in Songkhla used otter-board trawls (85.7%) and floating nets including fish and crab gill nets (14.3%), while the fishermen in Prachuab Khiri Khan

Table 40. Socio-economic aspects of anchovy fishing in the year 1997

	Landing place	Songkhla	Prachuab Khiri Khan	Chumphon
	Title	Anchovy Falling Net	Anchovy Falling Net	Anchovy Purse Seine
1.	SOCIAL SITUATION			
	Number of family members	4.6	4.8	3.8
	Number of school going children	1.6	1.5	1.3
2.	Number of workers in fisheries	2.0	3.0	2.5
	Fishing	1.3	1.5	1.0

	Landing place	Songkhla	Prachuap Khiri Khan	Chumphon
	Title	Anchovy Falling Net	Anchovy Falling Net	Anchovy Purse Seine
	Fish processing	0.7	1.5	1.5
	Other (not in fisheries sector)	1.0	0.3	0
3.	Average age of household leader	39.0	35.3	36.0
4.	Education of household leader (%)	100	100	100
	< Pratom 4	0	25.0	0
	Pratom 4 – 6	85.7	50.0	100
	> Pratom 6	14.3	25.0	0
5.	ECONOMIC SITUATION			
6.	Household assets (Baht)	322,143	60,000	257,500
	Land	142,857	30,000	190,000
	House	179,286	30,000	67,500
	Other assets	0	0	0
7.	Household debt (Baht)	238,857	125,250	290,000
	Financial institution	76,000	92,750	201,250
	Non - financial institutes	162,857	32,500	88,750
8.	Fishing gear used before anchovy gear (%)	100	100	100
	Trawl	85.7	0	0
	Floating net	14.3	50.0	50.0
	Other	0	50.0	50.0
9.	Experience in anchovy fishing (years)	3.0	5.0	5.0
10.	Boat length (m)	12.2	9.8	11.3
11.	First investment (Baht)	321,429	246,750	445,000
	Boat and accessories	211,429	122,500	282,500
	Engine	56,143	50,000	37,500
	Net	53,857	74,250	125,000
12.	Fishing period (no. days/year)	183.2	167.0	172.8
	Anchovy fishing gear	112.1	167.0	172.8
	Other fishing gear	71.1	0	0
13.	Quantities of fish (kg/trip)			
	Anchovy fishing gear	663.1	449.8	250.3
	Other fishing gear	281.9	0	0
14.	Return of fishing (Baht/trip)			
	Anchovy fishing gear	3,315.7	2,191.4	3,003.0
	Other fishing gear	2,973.0	0	0
15.	Fish distribution (%)	100	100	100
	Sale of fresh fish	25.7	25.0	35.0
	Processed by themselves	74.3	75.0	65.0

	Landing place	Songkhla	Prachuap Khiri Khan	Chumphon
	Title	Anchovy Falling Net	Anchovy Falling Net	Anchovy Purse Seine
16.	Cost of fishing (Baht/year)	470,754	335,273	516,416
	Variable cost	443,997	318,023	484,416
	Petrol and gasoline	171,213	121,075	137,254
	Food	70,662	41,750	125,287
	Ice and salt	32,714	31,730	38,450
	Wage	107,302	70,975	86,405
	Repairing cost	56,871	52,283	75,850
	Other	5,234	211	21,169
	Fixed cost	26,757	17,250	32,000
	Depreciation cost	26,757	17,250	32,000
	Opportunity cost			
17.	Return of fishing (Baht/year)	733,802	450,457	628,985
	Anchovy fishing gear	371,757	365,960	518,948
	Floating net or trawl	186,961	0	0
	From processing product	175,084	84,497	110,037
18.	Net income (Baht/year)	263,049	115,184	112,569

owned gill nets and some of them were hired as crews in large-scale fisheries and/or by dried-fish collectors. In Chumphon about 50% of fishermen used to be hired as crews for large-scale purse seiners and some of them fished with gill nets. The fishing experience of the fishermen in anchovy fisheries ranged from 3 to 5 years, which was the lowest in Songkhla (only 3 years).

The fishing boats in these three provinces were almost all of the same small size with LOA ranging from 9.75-12.21 m. The initial investments, which comprised boat, engine, net and equipment were 445,000; 321,428.57 and 246,750 Baht of the fishermen in Chumphon, Prachuab Khiri Khan and Songkhla Provinces respectively.

In Prachuab Khiri Khan and Chumphon Provinces, fishing gear could be operated the whole year round with an average of 167 and 173 days per year, respectively. The fishing operations in Songkhla were on average 183 days per year, the fishermen using anchovy fishing gear for about 112 days and other fishing gears for about 71 days. Catches per trip in Songkhla were mainly from anchovy fishing gears (falling net, FNL) and other fishing gears (gill nets)., In Prachuab Khiri Khan (anchovy lift net, LNL) and Chumphon (anchovy purse seine, APS) only anchovy fishing gears were used.

The return of fishing in Songkhla was 6,200 Baht per trip (3,300 Baht from anchovy gear and 2,900 Baht from other gears). The returns of fishing in Prachuab Khiri Khan and Chumphon were only 2,200 and 3,000 Baht per trip, respectively. Most of the anchovy fishermen processed their products by themselves, which was about 65-75% of the total catches and the rest (25-35%) was sold to other local processors.

In one year, the fishing costs of fishermen in Songkhla, Prachuab Khiri Khan and Chumphon were 470,800; 335,300 and 516,400 Baht, respectively. The returns of fishing were 733,800; 450,500 and 629,000 Baht per year in Songkhla, Prachuab Khiri Khan and Chumphon respectively. The net income from fishing was 263,000; 115,000 and 12,600 Baht per year in Songkhla, Prachuab Khiri Khan and Chumphon respectively.

10. BYCATCH OF THE ANCHOVY FISHERIES AND OTHER PROBLEMS

10.1 Intensive experiments to determine the bycatch in anchovy fisheries

Fishery conflicts between anchovy fisheries and other fisheries, e.g. other purse seines in Surat Thani Province, gradually began in March 1981. The conflict was not such an important issue until a Fishery Notification was issued on 11 January 1988, which allowed anchovy fishing boats to operate during the closed season (from 15 February to 15 May) in Prachuab Kiri Khan, Chumphon and Surat Thani Province. The anchovy fisheries boomed and earned quite a lot of money, using one big boat to catch anchovy during daytime and another smaller boat for on-board processing of anchovy into boiled-dried products, which fetched a high price.

In September 1988, the Lang Suan Fishery Society condemned the anchovy fishermen as intruders catching fish in Thai waters. The Fishery Society of Thailand and Samuth Songkram Fishery Society requested DOF to implement the Notification issued on 11 January 1988 and to set up management regulations, not allowing anchovy fisheries to fish within 3 km from the shore and to limit the depth of the anchovy net to 20m. The reason was that since anchovy was a pelagic fish there was no need to fish near the sea bottom. However, these requests were disregarded by DOF due to the lack of supporting research. Afterwards, there were several arguments which induced the Ministry to issue another Notification on 14 November 1991, to the effect that there was to be no fishing by APSL with mesh sizes of less than 2.5 cm.

Now the Anchovy Group suffered as a result of this Notification, especially the fishermen on the east coast of the Gulf of Thailand who challenged the DOF to prove that the other economical small-sized fish caught by anchovy fishing did not exceed 10% of the total catches. Subsequently DOF postponed enforcement of the Notification of 14 November 1991 and researchers were requested to conduct some experiments together with the anchovy fishermen over a period of one year.

Intensive experiments to determine the bycatch of anchovy fishing boats were carried out in three different ways

- 1) By taking samples at the landing places;
- 2) By taking samples using motor boats and
- 3) By placing researchers on board with the anchovy fishermen.

The anchovy fishing gears considered in these experiments were APS (anchovy purse seine daytime fishing), APSL (anchovy purse seine with light, nighttime fishing) and LNL (lift net or cast net with light, nighttime fishing). Table 41 gives an overview of all experiments.

Table 41. Summary of all experiments carried out from 14 January 1992 to 29 July 1993

Gear type	Dates Region	Places	Number of boats sampled	Anchovy %	Other economical small fish %	Trash fish %
APSL¹	14-28 Jan 92; 18 Nov 92–21 May 93	Rayong	11	88.9	8.4	2.7
		Trad	11	93.1	6.9	0.0
APSL¹	17 – 26 Aug 92 Prachuab Kiri Khan	Ao Noi	54	83.3	11.1	0.6
		Tab Sakae	17	61.3	22.1	16.6
		Bo Thong Laung	37	57.0	19.5	23.5
APSL¹	27 Aug – 5 Sep 92 Prachuab Kiri Khan	Ao Noi	114	80.3	11.4	0.3
		Tab Sakae	71	90.2	9.0	0.8
		Bo Thong Laung	42	68.9	20.0	11.1
APSL¹	6 – 9 Sep 92 Prachuab Kiri Khan	Ao Noi	76	90.4	9.6	0.0
		Tab Sakae	7	95.0	5.0	0.0
		Bo Thong Laung	6	86.7	13.3	0.0
APSL¹	18 Nov – 21 May 93	Rayong	625	74.8	24.0	1.2
		Trad	640	91.8	7.7	0.5
APSL¹	18 May – 4 Jun 93 Prachuab Kiri Khan	Ao Noi, Ta Sakar, Bo Thong Laung	341	83.5	16.3	0.2
APSL¹	14 Jun – 29 Jul 93 Prachuab Kiri Khan	Ao Noi, Ta Sakar, Bo Thong Laung	404	79.6	20.1	0.3
APSL²	18 Nov – 21 May 93	Rayong	13	84.3	14.3	1.4
		Trad	54	91.9	7.5	0.6
APSL²	14 Jun – 29 Jul 93	Prachuab Kiri Khan	54	77.2	22.7	0.1
APSL³	Feb – Sep 92	Chumphon	39	68.9	23.2	7.9
APS³	Jan – Dec 92	Chumphon	59	94.0	4.0	2.0
LNL³	Dec 92 – Jun 93	Cholburi	439	96.7	2.8	0.5

Source: Mar. Fish. Div., 1993. APSL¹ Samples were taken from fish landing places; APSL² Samples were taken using petrol boats of DOF;

APSL³, LNL³ Samples were taken by researchers on board with fishermen

10.2 Effects of light luring on fish larvae

Other fishermen attacked the use of strong lights by the anchovy fishermen. They maintained that the light intensity caused an increase in the water temperature to levels that were not tolerated by the larvae of valuable species, causing a high mortality that would have an effect on the capture of adult fish of those species.

Experiments were carried out to investigate the elements of this accusation. An anchovy fishing boat was hired to conduct the experiments using light power of 12 kW and a series of different fishing times. The water temperature at different depth levels was measured. The results of the experiment are shown in Table 41 and prove that the light intensity did not contribute significantly to increasing the temperature of the environment.

Table 41. Results of the experiment of the anchovy fishing with light luring

Time (hr)	Light intensity (LUX)	Temperature in C°		
		At 20 cm distance from light bulb	At the surface	At 1m below the surface
19.00	12	29	28	27.3
20.00	12	29	28	26
21.00	12	28	28	26
22.00	12	28	27	26
23.00	12	28	27	26
24.00	12	27	27	26

Source: Resources and Environment Working Group of the National Fishery Policy Board, 1999.

10.3 Anchovy fishing's effect on the income of small-scale fishermen

The small-scale fishermen in Songkhla Province also accused the anchovy fisheries of destroying the foodweb, resulting in lower income as shown in recent catches. Compiled data (Songkhla Marine Fisheries Development Center, 1990-1998 in: Resources and Environment Working Group of the National Fishery Policy Board, 1999) from the sales slip of fish agent of the small-scale fisheries in Songkhla Province in which the predominant gear is shrimp gill net, showing the following results:

1. During the years 1990 to 1994, the rate of total catches averaged 7-9 kg per boat per day, accounting for Baht 500-550 per boat per day. During the years 1995 to 1998, a slightly lower catch rate was recorded but with an ever decreasing income.
2. The catch consisted of high-priced species, e.g large-sized shrimp, large-sized cephalopods which decreased in catch rate during the last period due to increases in fishing effort resulting in growth overfishing.
3. The target species of those small-scale fisheries were not directly related to the anchovy fisheries.

11. EXISTING FISHERY MANAGEMENT AND RELATED REGULATIONS

11.1 Marine fishery monitoring

Activities in fishery research monitoring are the responsibility of the Marine Fisheries Division (Department of Fisheries, 1998) and can be concluded as follows:

1. To carry out monitoring surveys and research regarding marine resources, fisheries and the environment;
2. To provide management measures for sustainable development of the marine resources and environment including rehabilitation of coastal fishery resources and development of small-scale fisheries;
3. To conduct experiments and develop non-destructive fishing gears and appropriate fishing gears compatible with the present situation of fisheries;
4. To cooperate with internal and external organizations and the private sector in fishery research and to promote community-based fishery management, as well as teaching;
5. To provide fishery information and services requested by the private sector, students, researchers from other institutions, universities, etc.

11.2 Marine fisheries research

The research follows five areas:

1. **Marine resource exploratoration.** Major research work concerns taxonomy of marine animals and aquatic plants, fish stock abundance, biomass estimation, spatial distribution, mapping of the species composition and species distribution including estimation of catching capacity.
2. **Stock assessment of fish and invertebrates.** Studies concerning population analysis, change in population structures, assessment of the fishery resources both by groups of species and single species, analyses of the status of resources and fisheries, fishing grounds including evaluation of changes in fisheries affecting resources. Results are used, together with other biological information, to propose management measures for sustainable fishery development.
3. **Marine fauna life history.** Major research concerns the identification of fish eggs, larvae and juveniles related to the spatial distribution, studies on recruitment, growth, maturity, life history, spawning ground and seasons, fecundity, food and feeding behaviour, food chains, and parasites and diseases of important marine species.
4. **Marine fishery environment.** Major tasks concern the analysis of primary production, studies on phytoplankton, zooplankton and their relation to fishery, spatial distribution, culturing of marine algae and plankton species which cause red tide, benthos community study, bottom topography, chemical and physical characteristics of seawater, marine pollution and heavy metal residues, effects of changes in the environment on marine life. Research vessel surveys are routinely conducted to collect data, the results are applied to environmental protection, fisheries aquaculture including guarantee for export fish processing products.
5. **Fishing Ground Improvement.** The major tasks are to improve the fishing grounds and rehabilitation of coastal fishery resources; to develop and increase the income of small-scale fishermen by means of cage culture and rearing local fish species, assessing the coastal resources and fisheries situation, providing information on types and sites of artificial reef installation are also necessary. The purpose of the installation of artificial reefs is to enhance coastal resources by

releasing the native aquatic species into the artificial reefs, to reduce conflicts between commercial fishing and small-scale fishing because the artificial reefs obstruct near-shore trawl fishing. They are also used to provide fishery facilities, local fishing piers for small-scale fisheries, establishing the fishermen group in order to introduce community-based fishery co-management.

11.3 Fishing regulations and control in Thailand

Thailand enacted the Fisheries Act of 1947 which was composed of 73 articles. These articles dealt with fishing areas, licences, fishery statistics, fish culture, and fishery control and prosecution of offenders. Some sections of this Act have been amended by Fisheries Act No. 2 of 1953 and Fisheries Act No. 3 of 1985 (Department of Fisheries, 1998).

Chapter 1, Section 6 of the Fisheries Act of 1947, states that fisheries were divided into four categories: Preservation fisheries; Leasable fisheries; Reserved fisheries; and Public fisheries.

Section 7 states that “the Provincial Council with the approval of the Minister is empowered to make notification determining fisheries within their province and to which category of preservation fisheries they belong, leasable or reserved fisheries. Fisheries which are not included in the notification under paragraph one shall be regarded as public fisheries.”

Therefore the Minister of Agriculture and Cooperatives or the Provincial Governor, in his jurisdiction and with the approval of the Minister, is empowered to make the notification, under Section 32 of Fisheries Act of 1947, determining: -

1. The size of mesh and the dimension of every kind of fishing implement, and size, type, number and parts of fishing implements which are permitted in fisheries;
2. Any kind of fishing implement whose use is absolutely forbidden;
3. The distance between each stationary gear;
4. The methods of use for all fishing implements;
5. The spawning and breeding seasons, fishing implements, and methods of fishing in any fisheries during the specified seasons;
6. The kind, size and maximum number of aquatic animals which may be fished;
7. The aquatic animals which are forbidden to be fished.

11.4 Important notifications relevant to anchovy resource management

Ministerial rules and regulations directly and indirectly concerning the conservation and management of anchovy have been issued as follows:

1. The prohibition and restriction on mesh size used with light luring fishing was issued on **14 February 1983** and the enforcement would be effective after 30 days from the issued date;
 - a) Contents: Purse seines have recently been modified with small mesh sizes and are used with attracting electric lights which negatively affect other fishery resources. These modified fishing methods are catching too many juvenile fish species, resulting in fish stock depletion. The management of economically valuable fish species is essential for conservation and sustainable development.
 - b) Regulations in detail: The night-time operation of purse seines using light luring devices and a mesh size of smaller than 2.5 cm is forbidden in the Gulf of Thailand as the luring lamps attract large amounts of small fish compared to traditional fishing methods.

2. The prohibition of certain fishing gears during the spawning and nursing seasons within specific locations for specific periods of time was issued in **29 November 1984**.
 - a) Contents: The waters in the vicinity of Prachuab Khiri Khan, Chumphon and Surat Thani Provinces are the spawning and nursing grounds for Indo-Pacific mackerel *Rastrelliger brachysoma* (Pla-tu), an economically important species. Pla-tu and many aquatic species spawn in February to March and small-sized fish are abundant in April to May. Consequently, the following fishing restrictions should be applied:
 - i) The spawning season shall be set to begin on 15 February and end on 31 March;
 - ii) Subject to the season specified in i), no person shall fish with any pair trawls, otter-board trawls, any purse seines using a motorized boat (exceptions are made for bamboo stake trap) or gill nets, with mesh sizes of smaller than 4.7 cm, in the waters of Prachuab Khiri Khan, Surat Thani, and Chumphon extending from latitude 11° 49' 40" N to latitude 9° 15'00" N and longitude 99° 44' 52"E to longitude 100° 50' 00"E. Exceptions are made for beam trawls or otter-boom trawls using a motorized boat operating during the nighttime.
 - iii) The nursing seasons shall be set to start from 1 April and end on 15 May.
 - iv) Subject to the season specified in iii), no person shall fish with any pair trawls, otter-board trawls, purse seines using a motorize boat (exception is made for bamboo stake traps) or gill nets, with mesh size of smaller than 4.7 cm, used in the areas designated in ii). However, this shall not be applied to any beam trawls or otter-boom trawls using motorized boats.
 - v) This regulation shall not be applied to any activities for scientific research carried out by government authorities holding written permission issued by the Director-General of the Department of Fisheries.
3. The prohibition of certain types of fishing gears from spawning and nursing grounds during the spawning and nursing seasons (second issue), 1988. This notification was issued in **11 January 1988**.
 - a) Contents: Scientific research indicates that there is presently a sufficiently large stock of anchovy in the waters of Prachuab Khiri Khan, Surat Thani and Chumphon Provinces to be exploited. Consequently, anchovy purse seiners can fish in the waters off Prachuab Khiri Khan, Surat Thani, and Chumphon Provinces in daytime, during 15 February to 31 March, regardless of the regulation set out in 1984 prohibiting the use of specified fishing gear within the spawning and nursing grounds in a specific period.
4. The prohibition of use of any type of purse seine with an electric generator to fish in the water areas of Trad Province. The notification was issued in **24 January 1985**.
 - a) Contents: At present, the fishermen have modified purse seines by using a light luring device to increase their catch efficiency. This method has resulted in a large number of juveniles and small-sized economic fish being caught. Therefore it is considered as a destructive fishing technique. Hence, the management notification was issued as follows:
 - i) No person shall use any type of purse seines with an electric generator to fish within specified areas of Trad Province extending from latitude 11° 37' 04" N to latitude 12° 2' 50"N and longitude 102° 35' 00"E to longitude 102° 47'02"E.
 - ii) Scientific research will be exempted with written permission from Director-General of the Department of Fisheries.
5. The designation of prohibited areas within Prachuab Khiri Khan and Chumphon Provinces for the use of certain fishing gear in order to restore the condition of the fishery after Typhoon Gay. The notification was issued in **16 April 1990**.

- a) Contents: It was recognized that fishermen in the Districts of Tub-Sakae, Bangsapan, Bangsapan Noi of Prachuab Khiri Khan Province as well as in the Districts of Muang and Pa-tue of Chumphon Province were seriously affected by typhoon Gay which occurred on 3-4 November 1989. Due to the drastic loss of fishermen's lives and property, resulting in hardship, the Minister of Agriculture and Co-operatives decided to restore access to the aquatic resources in order to resume the normal fishing operations of the fishermen as soon as possible. The agreement to provide the financial support for new fishing boats and fishing gears were made. The fishing grounds and aquaculture sites for fishermen were also reserved for fishermen. Consequently, the notification was issued as follows:
- i) No person shall use the following fishing gear;
 - (1) all kinds of trawls,
 - (2) push nets,
 - (3) all kinds of purse seines,
 - (4) all kinds of dredges with motorized boats,
 - (5) any nets or any fishing gears using an electric generator for fishing any fish and squid to fish within 3,000m from shoreline in the Districts of Tubsakae, Bangsapan, and Bangsapan Noi of Prachuab Khiri Khan Province as well as in the Districts of Muang and Pa-Tue of Chumphon Province designated on the map extending from latitude 10° 21' 00" N to latitude 11° 28' 00" N and longitude 99° 16' 50" E to longitude 99° 39' 36" E.
 - ii) Any scientific activities including the collection of aquatic species for aquaculture purposes or for other benefits must have written permission from the Director-General of the Department of Fisheries.
6. As regards the designation prohibiting nighttime fishing of purse seines with mesh sizes smaller than 2.5 cm, the notification was issued in **14 November 1991**.
- a) Contents: nighttime fishing of purse seines with a mesh sizes smaller than 2.5 cm were considered inappropriate as it would severely damage the reproductive potential of the fishery by removing juvenile economic fish, possibly driving them to extinction. In order to conserve these fish, the following regulations were issued:
 - i) No person shall fish by using any purse seine with mesh sizes smaller than 2.5 cm during the nighttime in the waters or the bays located in all coastal provinces.
 - ii) Scientific research shall be exempted from the requirements of this regulation with written permission from the Director-General of the Department of Fisheries.
7. Regarding the designation of any net mesh size used to fish with electric light luring device, the notification was issued in **15 March 1996**.
- a) Contents: Lift nets and falling nets representing small-scale fishing operate with an electric light luring device which has only a minor effect on anchovy species and other fish species. The fishermen will be permitted to use the fishing gear described above but they must be aware of the regulations of the fishery resource conservation. This regulation refers to: -
 - i) The cancellation of the permission to use any mesh size of net used with an electric light luring device for any fishing, issued on 14 February 1983.
 - ii) No person shall use any net or any fishing gear with a mesh size smaller than 2.5 cm and an electric light luring device to fish in the waters or bays in all coastal provinces.
 - iii) Subject to ii), it will not be applied to fishing by lift nets or falling nets used with an electric light luring device to fish anchovy. However, lift net and falling net fishing must comply with the following regulations: -

- (i) The above-mentioned types of fishing must be used with a motorized boat whose length over all (LOA.) does not exceed 16 m, which has been shown in the attachment of this notification;
- (ii) No fishing by any lift net or falling net is allowed within 3,000m from the shoreline except around islands.
- (iii) No fishing is allowed in specified areas of Phang-nga Bay as shown in the map attached to this notification. However, any fishing using lift nets or falling nets can be operated in these areas with respect to the regulations issued in some cases.
- iv) Scientific research will be exempted from the restrictions of this regulation with the written permission of the Director-General of the Department of Fisheries.

8. The designation of prohibited nets used with an electric light luring device to fish in some areas of Songkhla Province. The notification was issued in **30 March 1998** by the Governor of Songkhla Province.

- a) Contents: Since the designation of any net mesh size used to fish with an electric light luring device which was issued on 15 March 1996 the numbers of lift nets and falling nets has greatly increased in the Songkhla Province. This has resulted in a decline in catch which has directly affected the local small-scale fishermen using small gill nets and small trawl nets. Therefore, in order to protect the aquatic fauna resources from overfishing in some parts of Songkhla Province waters, the designation of prohibiting lift nets and anchovy falling nets to fish in some parts of Songkhla Province waters were considered. The notification was issued and detailed regulations were as follows:
 - i) Electric light fishing with nets of a mesh size smaller than 2.5 cm is prohibited in the waters of Songkhla Province from latitude 7° 14' 10" N to latitude 7° 55' 30" N and longitude 100° 20' 20" E to longitude 100° 50' 10" E, as shown in the map attached to this notification.
 - ii) The statement in item 3 of the notification of "The designation of any net mesh size used to fish with an electric light luring device" which was issued on 15 March 1996 will no longer apply once this notification is enforced.
 - iii) Scientific research will be exempted from the requirements of this regulation with the written permission of the Director-General of the Department of Fisheries.

9. The designation of prohibited nets used with an electric light luring device to fish in waters of Songkhla Province. The notification was issued on **28 July 1998** by the Governor of Songkhla Province.

- a) Contents: Since the designation of any net mesh size used to fish with an electric light luring device which was issued on 15 March 1996, the numbers of lift nets and falling nets has greatly increased in the Songkhla Province. This has resulted in a decline in catch which has directly affected the local small-scale fishermen using small gill nets and small trawl nets. Therefore, in order to protect the aquatic fauna resources from overfishing, the designation of prohibiting lift nets and anchovy falling nets to fish in Songkhla waters was considered. The detailed regulation was as follows:
 - i) The cancellation of the notification of the prohibited net used with an electric light luring device to fish in Songkhla water issued on 30 March 1998 was implemented.
 - ii) No person shall use lift nets and falling nets with an electric light luring device to fish anchovy in Songkhla waters.
 - iii) The statement in item iii) of the notification of "The designation of any net mesh size used to fish with an electric light luring device" which was issued on 15 March 1996 will no longer apply once this notification is enforced.

- iv) Scientific research will be exempted from the requirements of this regulation with the written permission of the Director-General of the Department of Fisheries.

11.5 Fishery surveillance

The Fishery Resource Conservation Division (FRCD) of the Department of Fisheries is the main agency responsible for preservation and conservation of both marine and freshwater resources by means of surveillance. Several Divisions, i.e. Marine Fisheries Division, Inland Fisheries Division, Fisheries Economics Division, Conservation Committee and others, propose management measures and other recommendations. The FRCD, under the present rules and regulations, has the authority to practice law enforcement. The fishery officers of the Patrol Boat Unit are empowered to arrest fishermen who violate the rules and regulations, then refer them to the police. The courts will impose an appropriate penalty. Additionally, in order to strengthen law enforcement, provincial and district fishery officers are also authorized to arrest the offending fishermen.

The FRCD has two branches of fisheries monitoring, surveillance and enforcement including (i) Marine Fisheries Patrol Sub-Division, and (ii) Inland Fisheries Patrol Sub-Division. The Inland Fisheries Patrol Sub-Division is responsible for patrolling and enforcing fisheries laws and regulations in inland waters such as rivers, canals, reservoirs, lakes, etc., whereas, the Marine Fisheries Patrol Sub-Division is responsible for patrolling and enforcing fisheries laws and regulations in coastal and sea areas of both the Gulf of Thailand and the Andaman Sea.

The Marine Fisheries Patrol Sub-Division consisted of 9 stations, 320 staff, and 80 patrol boats. The patrol boats include 26 boats of 19-29 ft in length, 13 boats of 30-49 ft in length, 2 boats of 50-59 ft in length, 21 boats of 60-79 ft in length, 3 boats of 80-99 ft in length, 3 boats of over 100 ft in length, and 12 boats with outboard engines.

11.6 Monitoring, surveillance and enforcement

The coastal and marine fisheries in Thailand face more serious problems compared with inland fisheries. These problems include the depletion of fish stocks, overfishing, the use of destructive fishing gears, conflicts between many resource users and the deterioration of the coastal and marine environment from pollution, etc. Consequently, the DOF must place greater emphasis on the regulation of coastal and marine fisheries. In this regard, three important regulations are given priority in coastal areas: (i) prohibition of trawls and push nets with motorized fishing boats within three kilometers from the shoreline, (ii) specific area and season closure in the Gulf of Thailand during spawning season of the Indo-Pacific mackerel and other fish, and (iii) closed area and season in the Andaman sea.

FRCD boats patrol the closed fishing areas along the coasts of Thailand to ensure that trawlers and push netters do not violate the regulations. The areas extending to three kilometers from shoreline will be reserved for small-scale fishermen. During the closed season, the DOF will establish a special monitoring force to conduct surveillance and enforcement within the areas set aside for small-scale fishermen. Surveillance will be performed with patrol boats, aircraft, radar, and satellite technology (Department of Fisheries, 1998).

11.7 Limitations of fishery management

The success of the fishery management programme is dubious because of several limitations. Those limitations are: 1) the number of personnel engaged in law enforcement is very small compared with the size of the fishing grounds; 2) the number of patrol boats is inadequate. There are less than 100 patrol boats for the whole country's EEZ; 3) the enforcement cost is very high and it is doubtful if the benefits derived from the enforcement programme justify the cost; 4) the fishermen are reluctant to co-operate with the fishery management programme; 5) there are some loopholes in the laws and regulations. Fishery patrol boats could arrest the poachers only while they were operating the fishing gear. Thus, very few poachers were arrested and taken to court.

11.8 Other measures for compliance

The Department of Fisheries recognizes that an effective management programme cannot rely only on an expensive enforcement campaign. Successful management is also linked to public awareness and acceptance of the benefits of a conservation and management plan. Providing information to fishermen and their families and establishing a voluntary conservation group may lead to more effective compliance. The fisheries training and teaching programme may also help in this regard (Department of Fisheries, 1998).

12. FISHERIES PROBLEMS AND CONFLICTS

In the past, a special management programme for anchovy fishery had not been well developed for the following reasons:

1. The biological studies of anchovy were not so concentrated.
2. Some statistical data and information on catch and effort were not fully reliable.
3. Socio-economical studies of the anchovy fishery had not been made.

Before 1983 the anchovy fishery was loosely managed with regulations that were primarily aimed at the pelagic fish species. However, in the 1980s anchovy fishing rose dramatically responding to the increased demand for export of boiled-dried anchovy. A series of regulations, relating specifically to the anchovy fishery, were consequently issued to ensure the continued survival of anchovy. These regulations were periodically amended based on new biological fishery information to ensure continued compliance by fishermen (Juntarashote, Kaewnern and Saikliang, 1995).

Hongskul (1990) reported the First Anchovy Working Group of the Department of Fisheries proposing the management measures of anchovy fisheries as:

1. The notification issued in 1984, 1988 (number 2), and 1985 of the Andaman Sea and Pang-Nga Bay, with the contents re no fishing in some seasons and some areas should be reconsidered and improved to prohibit every type of fishing in the said area and season. Small-scale fisheries were allowed to fish within 3 km from shoreline.
2. The notification which was issued in 1981, 1983 and 1985, prohibiting squid light luring fishing with mesh sizes smaller than 3.2 cm and light luring purse seines with mesh sizes of less than 2.5 cm should be reconsidered and improved to control fishing with light luring.
3. Monitoring and control should be expanded and enforced strictly as in some closed areas and seasons where management measures were effectively implemented.

Due to the rapid development of marine fisheries, two severe problems occurred: the depletion of fishery resources and conflicts among fishermen. These two problems have become more and more serious and need to be solved (Juntarashote, Kaewnern and Saikliang, 1995).

The anchovy fishery is one of the examples of conflicts arising among fishermen. During the last decade, the demand for boiled-dried anchovies, particularly the small-sized ones, has increased. Japan and Taiwan are the major countries importing these anchovies for which they are prepared to offer a high price. This has resulted in a change in fishing activities. Some fishermen have changed their fishing gear from conventional purse seines to specialized anchovy purse seines while at the same time using a light luring device. Trawl operators have also modified their gears in order to catch anchovy. The catches from trawlers are young anchovy the so-called Saimai. The efficiency of each fishing effort has thus been improved with a consequent increase in total catches. This increased fishing effort coupled with a limited anchovy resource has inevitably led to bitter competition amongst fishermen. Furthermore, purse seines using the light luring device also catch other young economically important species as bycatches. Thus, the conflicts have extended from fishermen who exploit the anchovy resource to fishermen who exploit other resources. The numbers of conflicts are dramatically increasing day by day. At that time, the DOF was the only government agency responsible for solving these problems.

From the year 1980 onwards anchovy purse seine fishery expanded rapidly. The fishery was more concentrated around the coastal areas of Chumphon and Surat Thani Provinces due to allowing fishing in closed areas and during the closed season (15 February to 31 March) in the Provinces Prachaub Kiri Khan, Chumphon and Surat Thani. Fishermen from the other places also moved to fish in these areas using small mesh sizes. Unreliable reports by several media caused much more confusion among the fishermen than the real situation in the said areas and seasons warranted (Hongskul, 1990). The expansion of the anchovy fisheries from Satul Province in the Andaman Sea to the Gulf of Thailand in Surat Thani Province as well as fishermen coming from the eastern side of the Gulf of Thailand

created several problems and conflicts among “invaders” and local fishermen. During the period 1984 to 1989, conflicts and unsolved problems of the fishermen could be summarized as follows:

A) On 14 April 1989, the Fisheries Society of Thailand requested the DOF to implement the Notification which was issued in 1988 allowing anchovy purse seine fishing in the closed areas and seasons during daytime. This was the output of the 1st National Seminar on Thai Fisheries held by the DOF and the Fisheries Society of Thailand at Surat Thani Province in 1989.

For the non implementation of this notification, the DOF had several reasons based on research works, that:

- i) Anchovy fishing in daytime on the western coast of the Gulf of Thailand could catch anchovy to the extent of more than 90% of the total catch, or other words, the other young economic fish composition of the total catches was less than 10%.
- ii) The anchovy size caught in daytime fishing was the adult size which could be exploited without destroying the stock.
- iii) In the process of boiled-dried for exporting, if there was so much mixing of other fish, the exporter would not accept it and the economic return would be less profitable.

B) On 10 September 1988, the Fisheries Society of Lang Suan requested the DOF to consider and be aware of the Thai-Malaysian fishing boats in Chumphon water. These 200 boats which were condemned as foreign boats used small mesh size for both daytime and nighttime catches. This request was sent to the DOF again in August 1989 to solve the problem urgently.

The mystery of these foreign-designed boats was solved: all of the 200 numbers of anchovy boats were legally registered as Thai fishing boats. The fact was that, Thai fishermen had bought the boats from Malaysians, thus the shapes of the boats were not familiar to Thai fishermen.

C) On 20 July 1989, a Member of Parliament of the House of Representatives of Chumphon Province requested the Minister of Agriculture and Co-operatives to prohibit anchovy fishing with light luring due to the young economic fish being caught as bycatch leading to the destruction of the overall fisheries. At the same time, the Fisheries Society of Prasae in Rayong Province requested to be allowed to fish at nighttime. The reason was that in their area, the anchovy fishing at nighttime had a bycatch of juvenile economic fish of less than 10%.

The reaction to this request was that the anchovy fishing with light luring with mesh size less than 2.5 was strictly prohibited and being enforced effectively in every fishing ground.

D) A request not to allow fishing in the coastal area by the anchovy fishermen, as well as the output of the 1st National Seminar in 1989, that no anchovy purse seine fishing should be allowed within 3 km from shoreline and the proposal of the fishermen in Chumphon Province to prohibit anchovy fishing within 1.5 km from shoreline, were sent to the DOF.

The reply was that the anchovy fishing grounds were in the coastal areas and the areas around islands, so there was no need to push the fishing further offshore. Anchovy fishing was justified by the species' short life span of one year. The protection of coral around the island of the touring spots could be done by the Provincial Notification.

E) A request was made for limitations of the boat length and the depth of anchovy purse seines which might destroy young polyps of corals and sea fans during fishing, especially in the touristic spots of Samui Island, Surat Thani Province. The request was in alignment with the agreement of the 1st National Seminar to limit the depth of the net to 20 m.

The reply was that the depth of the net is usually twice the water depth in order to catch anchovy effectively. In addition, fishermen also try to not damage their nets by not fishing near coral, sea fan or other rough bottom. The limitation of the depth of the net will lead to the fishermen fishing in the shallow waters and create much more conflicts with other small scale fisheries.

F) Unpleasant odours created during the boiled-dried processing on board the anchovy fishing boats and drainage of hot waste water directly into the sea would pollute seawater and interfere with tourism at Samui Island.

Response: The First Working Group had found that each anchovy fishing boat had about 7-8 pans with a diameter 60cm and 27cm in depth, which could produce about 400-500 liter per day of waste water per boat. The drainage water had a temperature of 40°-50°C. It did not create any problem when compared to the smell of trash fish or trash fish processing procedures.

G) The boiled-dried anchovy production was leading to over-exploitation which might reduce the availability of anchovy as food for other species, and in general to destruction of the food chain of the community, resulting in a lower abundance of economically valuable species.

Response: The Working Group had reconsidered the food chain and foodweb of the community, it was noted that anchovy was only a fraction of the foodweb. The destruction of demersal fish was not caused by fishing on anchovy, but the foodweb was reduced by using other destructive gears such as trawls and push nets.

H) There were several challenges to proving the percentage of the anchovy in the total catches, the percentage of the other juvenile valuable fish, as well as questions regarding the species and sizes of the fish caught by anchovy fishing gears in the various fishing zones.

Response: The challenges led to investigations on board of the anchovy fishing boats by researchers of the DOF in co-operation with the fishermen. The experiments were made during the year 1990 to 1993 on three different fishing grounds of the Gulf of Thailand (west coast, east coast and in Trad Province). In this period the Fisheries Society of Thailand, the Minister of the Agriculture and Cooperatives, the Deputy Minister of the Agriculture, the Director-General of DOF and Deputy Minister of Commerce were concerned with the problems and conflicts.

Arguments about the anchovy fisheries were long-lasting and have existed up till now. Various problems were tabled and several protests occurred all over the country including in the Andaman Sea. Most of the problems were based on the unwillingness to let the anchovy fishermen fish in their local fishing grounds. Likewise, the fishery conflict in Songkhla Province created much confusion and serious problems.

The Songkhla coastal area is one of the most productive areas for harvesting various marine and brackish resources as well as an excellent fishing ground for anchovy. The anchovy fishing boats in Songkhla comprise local boats and mobile boats from other places, e.g. from the east coast of the Gulf. Some of fishermen from Rayong Province move to fish in Songkhla and then settle down permanently. The anchovy fisheries based in Songkhla used the luring falling net (FNL) with small-sized boats and medium-sized boats.

D) Fishery conflicts erupted in Songkhla Province early 1995, following the arrest of anchovy fishermen fishing in Singha Nakorn district. The small-scale fishermen requested the Fisheries Society of Thailand to free the Songkhla area of anchovy fishing. On 16 October 1997, the small-scale fishermen gathered at the Provincial Town Hall again with a request to free the Songkhla area of anchovy fishing. The governor of Songkhla promised to solve the problem within 90 days.

On 10 November 1997, the Agricultural Committee in Songkhla held a meeting between the small-scale fishermen and anchovy fishermen. Five from each group including related persons were invited to make an agreement after the small-scale fishermen blocked the waterway of Songkhla. The meeting was postponed to 29 November 1997. Results of the agreement were that anchovy fishing was allowed by zone with exact geographical lines - zone of non-fishing and zone of fishing (Fig. 30). A Provincial Notification was issued on 30 March 1998 to be enforced after 30 days from the date of issue. A number of 40-60 small-scale fishing boats blocked the water way again. This water way is the only entrance for fishery production, fuel and essential goods of Songkhla Province. All people in Songkhla were affected by this action, of which increases in the price of gasoline, cooking oil, seafood and other essential goods were the most troublesome. Fresh anchovy became spoilt because the fishing boats could not land to sell. All this occurred due to the unwillingness of the small-scale fishermen to let the anchovy fishermen fish in some parts of Songkhla as described in the Provincial Notification. The real objective was to make Songkhla a free anchovy fishing zone. The Governor of Songkhla promised to solve the problem within 90 days.

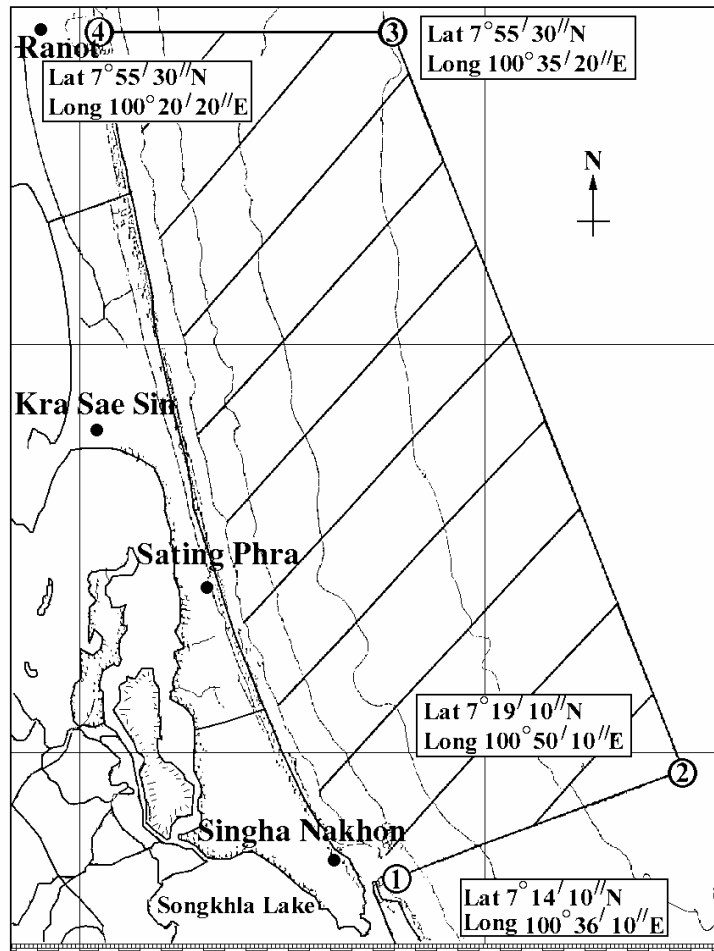


Fig. 30. Area of no anchovy fishing in some parts of Songkhla Province (area surrounded by four points indicating of no fishing area, about 1,655 km²). (Redrawn from the appendix of Songkhla Notification, 30 March 1998).

From 13 to 15 June 1998, a group comprising the Governor of Songkhla Province, representatives of small trawl fishermen, local anchovy fishermen, mobile anchovy fishermen, anchovy processors and others related to anchovy fisheries, was set up to consider the problems which had occurred. The group agreed:

- a) to **maintain the Provincial Notification issued on 30 March 1998** (anchovy fisheries can be operated in some parts of Songkhla Province).
 - b) to designate the district administration to find out the constraints if the anchovy fisheries were extending to 15 nm from the shoreline in the Jana and Taepa Districts. If that could be done the problems were solved. However, if in reality the small boats could not go out to fish in a deeper zone, then the administration should find a way to help them. The problem should be solved within 3 weeks or before 10 July 1998.
 - c) If there were any doubt concerning the anchovy fishery destroying the marine resources, two representatives of each fishery would be sent jointly to inspect the real situation regarding anchovy fisheries.
- J)** On 29 June 1998, the Thai purse seine and squid light luring fishermen in Chumphon Province requested the Fisheries Society of Thailand to consider the difficulties involved in lower catches due

to the destruction of the resources by the anchovy fisheries and also complained about the negligence of fishery officers.

K) From 25 to 28 July 1998 about 200 small-scale fishing boats, especially small trawlers from Sting Pra, Singha Nakorn, Maung and Jana Districts in Songkhla Province, were again blocking the water way of the province. The objective of the move was to ban any type of anchovy fisheries in Songkhla Province. The pressure resulted in the Governor issuing a **Provincial Notification on 28 July 1998** for which he got permission from the Deputy Minister of Agriculture and Co-operatives. Anchovy fishing with light luring could not be operated in Songkhla Province. This Provincial Notification was difficult to enforce due to lack of a description of the waters falling under Songkhla, since there are no legal geographical limits for the waters of a Province.

L) On 31 July 1998 the Fisheries Society of Pasae, Rayong Province requested DOF to consider the difficulties caused by the Notification of Songkhla Province as a consequence of which the anchovy fishing boats from the eastern coast of the Gulf could not move to fish in Songkhla. A fleet of about 150 local anchovy fishing boats from Singha Nakorn, Jana, and Tepa in Songkhla Province, gathered at the Songkhla Gulf. The representative of the fishermen proposed three items to the Governor as:

- i) To cancel the Provincial Notification issued on 28 July 1998;
- ii) Anchovy fishing can be operated in Songkhla Province;
- iii) At the upper part of Noo Island, the limit of the fishing zone should be changed from 15 to 8 nautical miles from the shore and the area in between should be reserved for small anchovy fishing boats.

After negotiations an agreement was reached as follows:

- i) An assignment was proposed to study the effects of anchovy fisheries;
- ii) The results of the studies would be used as data in the public hearing procedure;
- iii) The public hearing conference should be held on 27 August 1998. If the date was not appropriate it could be postponed.

A memorandum was recorded with the commitment of the Director-General of the DOF, the Governor and a local Member of Parliament, representative of small-scale fishermen, who agreed to:

- i) Maintain the Provincial Notification issued on 28 July 1998;
- ii) Allow the sale of fresh anchovy in Songkhla Province;
- iii) Designate the Governor to establish a special working group of staff together with volunteer fishermen;
- iv) Designate small-scale fishermen to assist the volunteer fishermen.

The **Public Hearing Project was set for 21 August 1998**. The committee comprised the Rector of Rachapat University or representative, the Rector of Prince of Songkhla University or representative, the Rector of Taksin University or representative, the President of the Fisheries Society of Songkhla, Representative from NGOs, Representative of the Southern Press of Thailand, the Provincial Fishery Officer. This project had been implemented by several other working groups, such as a secretariat staff, experts in fishery, fishery economic, fishery laws and regulation.

M) A **Public Hearing Conference was held on 26 December 1998**, it was a pity that the small-scale fishermen did not attend this conference even though announcements were made several times. About 650 (450 registered and 200 observers) persons attending the conference, five topics were considered and discussed during the conference. The results of discussions on each option were as follows:

Appropriate laws and regulations

1. **The Provincial Notification issued on 28 July 1998** was not legal since it did not include signs or lines indicating the provincial territorial areas, hence it would have created confusion.
2. This notification could not be accepted due to its limiting the personal earning rights as described in the New Constitution of the Kingdom of Thailand 1997, Article 46 and Article 56.
3. In some parts of Songkhla Province, especially in Jana, the fishermen used anchovy fishing boats and trawlers simultaneously in their daily life. The types of fishing gears were changed depending on the season of target species. They want the Governor to reconsider and improve this Provincial Notification.
4. The former Notification issued on 15 March 1996, allowing a fishing boat length of no longer than 16 m to fish anchovy, should be modified by allowing only small-sized fishing boats.

Appropriate fishing gears to be used

5. To ban trawls and push nets all over the country, it was shown that trawls and push nets were more destructive gears than anchovy fishing gears.
6. Small trawls have been changed into anchovy fishing gears, since it was no longer possible to use trawls near the shore because of the installation of artificial reefs.
7. Open access should be given to any kind of fishing and that will lead to reducing gear conflicts.
8. The anchovy fisheries have also created jobs, more income and exporting products to foreign countries at high prices.

Fishery management and fishing zone

9. The fishing zones should be established and managed by indicating the type of fishing to be allowed in each zone. The size of boats permitted to fish in each zone should be as follows: small-sized boats should fish outside 3 km from the shore, medium-sized boats with LOA 10-16 m should fish at a distance of more than 10 nm from the shore.
10. Usually, the anchovy fishermen want to fish at a distance between 6 to 10 km from the shore.
11. Fishing zones should also be established to separate local fishing boats and mobile fishing boats which have moved from other places.

Background and community-based fishery management

12. The anchovy fishermen want personal rights as described in the New Constitution of the Kingdom of Thailand, 1997, Article 46, Article 56 and Article 59.

Development of sustainable management

13. Since there is no scientific evidence that supports the destruction of the resources by anchovy fisheries, the anchovy fishermen want to fish from May to October.
14. The fishermen need the government to control the number of fishing boats.
15. The fishermen need the government to establish closed areas and seasons, wherever the juvenile economic fishes occur abundantly.

THE COMMITTEE'S PROPOSAL

In considering the fishery situation of Thailand, the fishery conflicts occurred not only in anchovy fisheries but also other fisheries. To manage the fisheries of Thailand with a view to sustainable development and reducing conflicts, the Committee of the Public Hearing Project having considered every point of view, finally proposed three major management options as follows:

Technical Management:

1. To put limitations on mesh sizes.
2. To prohibit the use of destructive fishing gears that affect protected species.
3. To register and control the number of fishing boats as appropriate for sustainable exploitation of the resources.
4. To identify the spawning season closure, fishing method and accessories devices.
5. To extend daytime fishing.
6. To prohibit light luring fishing in the coral area.
7. To identify areas to be protected and to set up a national park.
8. To promote community-based fishery management.

Fishing Zone Management:

9. To identify the fishing zones for community-based fishery management.
10. To provide fishing zones by size of boats.
11. To introduce marking of fishing boats, indicating the type of fishing by colours or similar.

Law and Social Management:

12. To limit and divide fishery licences into two types: a small-scale fishing licence only for the owner and a non-transferable commercial fishing licence..
13. To teach fishermen co-operatives how to protecting the natural resources and environment.

It is unfortunate that the results of the Public Hearing Project have not yet been submitted to the National Fishery Policy Board due to an announcement of the Governor of Songkhla, who claimed that the public hearing was not completed because only one side had attended the conference. Since then no one knows whether it has been completed or not. It should be decided whether the Public Hearing was legally correct or not, taking into consideration that it was announced and that invitations were sent well before the Public Hearing started, even though there was only one side attending the conference. A Public Hearing Conference is quite a new concept to our people and it is the first time it was implemented in Thailand.

N) On 2 April 1999, the small-scale fishermen in Songkhla Province agreed to have no fishery volunteer but there should be some negotiations among the persons concerned directly or indirectly. At the same time the small-scale fishermen established the **Conservation Group of Marine Resources Protection of Songkhla** with a list of committees and consultants. Later on, this Group had much more power to negotiate with the Governor of Songkhla and was more active and was known as the NGO backup.

O) On 21-23 April 1999, the Department of Fisheries together with the Fishery Society of Thailand and the Fish Marketing Organization of Thailand held a **National Seminar on "The Direction of Thai Fisheries"** at the Headquarters of DOF in Bangkok. The representatives of

fishermen, fishery processors and related companies, altogether of about 400 persons, were invited to attend this seminar.

Panel discussions were held on four topics:

- 1) Fisheries with light luring;
- 2) Trawl and push net fisheries;
- 3) Possibility to change the destructive fishing gears;
- 4) Fishery management and community-based fisheries management.

The results of the discussions on the fisheries with light were concluded as:

- a) To ban the falling net with light luring (FNL) within 1 year; Fishermen will have to change fishing gear to lift nets with light luring (LNL) or cast net if they want to continue anchovy fishing.
- b) No fishing with light luring with any type of fishing gear within 12 km distance from the shoreline.
- c) To ban any type of light luring fishing with mesh sizes less than 2.5 cm within 3-5 years.
- d) To ban every fishery with light luring within 5-8 years.

The above agreements were based on the following three conditions:

1. The government has to control the number of fishing boats in case of allowing the falling net with light luring operation within 1 year.
2. The government has to find some funds to help the fishermen to change to other gear.
3. The government has to guarantee the exact date to ban the fisheries followed by a, c and d.

P) These results were presented to the National Fishery Policy Board on 3 June 1999. After considering the proposals based on the national seminar results and realizing the difficulties of the anchovy fishermen, the National Fishery Policy Board decided to postpone the implementation of this proposal. At the same time the National Fishery Policy Board designated the DOF to find a way of managing the fishery by zone, with fishing by zones to be divided as follows:

1. The zone within 5 km from the shoreline and the zone between 5-12 km are the fishing zones for **small-scale** anchovy fisheries.
2. The zone beyond 12 km is the fishing zone for **commercial** anchovy fisheries.

Another assignment for the DOF was to study the effect on changing fishing gear and to seek some funds to help the fishermen who would be affected by this measure in the medium and long term.

Q) From April to June 1999, there was some opposition to the anchovy fisheries as well as to several agreements that had been made between the Governor of Songkhla and the Conservation Group of Marine Resources Protection of Songkhla. On 28 April 1999, the Governor of Songkhla insisted on implementing the Notification issued on 28 July 1998. Some movements created a lot of confusion and several requests from the fishermen, mainly those operating small trawlers of the southern part of the Gulf of Thailand.

R) On 3 June 1999, the anchovy fishermen in Phuket requested the National Fishery Policy Board to ban all anchovy fishing with light luring. The anchovy purse seine fishery in daytime should be extended and the Committee of the National Fishery Policy Board should have representatives from the small-scale fishermen in an appropriate proportion.

S) On 9 June 1999, the Songkhla Provincial Fisheries Officer reported to the DOF about the movements and requests of the Conservation Group of Marine Resources Protection of Songkhla, the group of consultants from the Prince of Songkhla University and leader of the NGO as follows:

1. To request the government to use the Provincial Notification issued on 28 July 1998.
2. To be represented on the Committee of the National Fishery Policy Board.

If the above requests would not be met, a request will be made to NGOs all over the world and to the competitive trading countries opposing the fishery products which come from destructive fishing gears.

The small-scale fishermen from 11 provinces will gather in Songkhla on 13 June 1999.

The small-scale fishermen from Pattani Province will gather in Songkhla on 15 June 1999.

T) On 10 June 1999, the Southern Marine Fisheries Development Center reported to the Marine Fisheries Division about a gathering of the fishermen from 13 southern provinces at the Prince of Songkhla University to discuss and protest the approval of the National Fishery Policy Board on 3 June 1999 as follows:

1. No solution to compromise the conflicts.
2. Request to change the membership of the National Fishery Policy Board to include representation from small-scale fishermen.
3. To assign the date for submission of their agreements to the Prime Minister
4. To show the community sectors affected by the anchovy fishing during 13 – 14 June 1999.

This information was also reported to the DOF by the Provincial Fishery Officer on 11 June 1999.

There were several protests from 13 to 27 June 1999 and the waterway in Songkhla Province was blocked again by the small-scale fishing boats, subsequently cleared by the Navy. Several local newspapers reported on the several requests and also condemned the anchovy fisheries, which created much more serious problems and confusion; some unreliable reports were distributed as well.

U) The problems and conflicts were reconsidered by the National Fishery Policy Board on 28 June 1999 for which the representatives from anchovy fishermen, the processors, related companies and the small-scale fishermen were invited to give much more details to the Committee. To solve the problem and conflicts a **National Working Group** was set up with the following members: a leader from Chulalongkorn University, the Fishery Consultant, university lecturers and the fishermen's side was represented by the Conservation Group of Marine Resources Protection of Songkhla and anchovy fishermen.

The National Working Group has to provide all data on the anchovy fisheries and to find out which other fisheries were affected as well as to provide some reliable data on the small-scale fishermen. This assignment will take up to four months (from 1 July to 31 October 1999), but it can be prolonged if not finished within that time frame. If the results are satisfactory to both sides, the Notification issued on 15 March 1996 (lifting of the ban on anchovy fishing using light luring with mesh size lesser than 2.5 cm) will be cancelled with effect from 1 November 1999.

The National Working Group set up three Subgroups to study three aspects as follows:

Subgroup 1: To lay down appropriate management measures to regulate the anchovy fishing with light (laws and regulations).

Subgroup 2: To study the fishery resources and environment.

Subgroup 3: To study the socio-economic aspects of the anchovy fisheries.

V) On 1 July 1999, the DOF drafted a management proposal to the Deputy Minister of Agriculture and Co-operatives as follows: During the time assigned to the National Working Group to find out the problems and effects on the fishery, the following management regulations should be enforced:

1. No anchovy fishing with light luring should be permitted within 5 km from the shoreline.

2. Beyond 5 km from the shoreline, anchovy fishing with light luring with boats of lengths less than 14 m is allowed.
3. Beyond 25 km from the shoreline, anchovy fishing with light luring with boats of length less than 16 m is allowed.
4. To implement the above regulations, the following Notifications have to be improved:
5. The 3rd paragraph of the Notification issued on 15 March 1996 will be enforced from 1 July to 31 October 1999.
6. Lift nets or cast nets (LNL) and falling nets with light luring (FNL) with mesh sizes of less than 2.5 cm are allowed to fish under certain conditions, such as:
 - i) motorized fishing boats of lengths less than 14 m can fish only at a distance of more than 5 km from the shoreline.
 - ii) motorized fishing boats of lengths 14-16 m can fish only at a distance of more than 25 km from the shoreline.
7. These exceptions will concern the Provincial Notifications of Songkhla, Trang and Phang-Nga Provinces.
8. The 3rd paragraph of the Notification issued on 15 March 1996 shall cease on 1 November 1999, depending on:
 - i) the agreement of the results of the study to ban the lift net or the cast net (LNL) and the falling net with light luring (FNL).
 - ii) agreement of the Committee of the National Fishery Policy Board on the results of this study of the Working Group.
 - iii) the announcement of the Ministry of Agriculture and Co-operatives re the results of the study of the Working Group, to be approved by the Committee of the National Fishery Policy Board and made known to public.
9. This Notification will take effect when the announcement is made after 30 days.

W) On 1 July 1999, a letter from the Executive Director of Greenpeace International was sent to the Prime Minister, Minister of Agriculture and Co-operatives and Director-General of DOF, via fax in support of a permanent ban on anchovy fishing using lights. Some critics said that the livelihood of the small-scale fishermen in the south had been severely affected by the lifting of the ban on anchovy fishing using spotlights and fine-mesh nets by commercial anchovy fisheries. The lifting of the ban is not only an act of injustice against the small-scale fishermen who have seen their catches and income decline, but is also a marine ecological catastrophe, as approximately a half of the catch of the anchovy fishing fleet is unused bycatch of juveniles of a large variety of species. Therefore, they encourage the Government to take action to reinstate and strictly enforce the permanent ban on anchovy fishing using spotlights and fine-meshed nets.

X) From 21 to 23 July 1999, a workshop entitled “**Workshop on Anchovy Fisheries in the Gulf of Thailand**” was held by DOF and sponsored by FAO/NORWAY under the project FISHCODE (CGP/INT/648/NOR). Over one hundred persons attended the workshop which comprised anchovy fishermen, stakeholders, representatives from the Fishery Society of Thailand, Provincial Fishery Society, lecturers from universities, resource persons from FAO, provincial government services of DOF, lawyers and fishery economists of DOF, marine fishery researchers, local press and the press from Bangkok. The outcome of the workshop has been summarized in the Thai language and distributed to the participants, the Director General of Fisheries and the committee of the National Fishery Policy Board.

Y) On 28 October 1999 the National Working Group, divided into 3 Subgroups, presented its results at a **Seminar held by the DOF**. About 30 fishermen were attending this seminar. Furthermore, the results were also submitted to the **National Fishery Policy Board on 2 November 1999**.

Z) The final outputs and recommendations from the National Fishery Policy Board are as follows:

1. **APSL should be officially declared illegal forthwith.** The APSL is illegal but it is still operated to the extent of a total number of 216.
2. **Limiting number of anchovy fishing boats by licensing.** The production of anchovy is almost at the MSY level and the catch per unit of effort shows a declining trend. Therefore, the anchovy fisheries should be managed in a proper way. All anchovy fishing boats have to be registered within one year and only one licence per one fishing boat is allowed. If they want to change to other gear, the licence should be changed.
3. **Anchovy fisheries by zones.** The area up to 3 nm from the shoreline is reserved for small-scale fisheries; fishing with lights within the zones 3-5 nm is not allowed. In any case, due to the geographical area in each province being different, the justification of implementing fishing zones where fishing with lights is not permitted should be presented by the local governor, researchers, and local fishery societies or organizers of an Action Group.
4. **A special regulation for Songkhla** is recommended as follows:
 - i) For the zones between 5 nm to 12 nm, the anchovy fishing boats (LNL, FNL) LOA of less than 14m are allowed to fish. No fishing with lights is allowed within the zone 12-15 nm;
 - ii) The anchovy fishing boat (LNL, FNL) LOA less than 16m is allowed to fish in the zone of more than 15 nm.
5. **Mesh size limitation.** The mesh size used for anchovy fisheries should not be less than 0.6 cm. To avoid catching the young anchovy, the so-called Saimai or Kao sarn, the mesh size used should be studied, experimented and an appropriate mesh size proposed to the fishermen since there is no data on the optimum mesh size for anchovy fisheries.
6. The National Fishery Policy Board designated the concerned sectors to conduct experiments on some missing data, propose laws, regulations and practical enforcement since 2 November 1999.

13. DATA REQUIREMENTS FOR FURTHER STUDY (BIOLOGICAL, SOCIO-ECONOMIC AND MANAGEMENT DATA)

The requirements for further study are summarized as follows:

1. To conduct experiments on the optimum mesh size for anchovy fisheries as well as on losses and gains of the stakeholders when the new mesh size regulation is implemented.
2. To concentrate on the spawning season and spawning ground of anchovy in each fishing area. The proposal of spawning area closure should be made with a view to maintaining the resource for sustainable development.
3. To study the anchovy species and production by zones, there might be differences in species abundance and price.
4. To initiate and establish the Community-Based Co-management whenever convenient to the local fishermen. This will inspire the local fishermen to take care of the resource by themselves.
5. To initiate and introduce fishery management and fishery responsibility to the fishermen and young generation, such as students in fishery schools or the general public. This requirement should be implemented step by step and be conducted with time series.

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