



Trawl Fisheries in the Gulf of Thailand

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Translated by Thirapan Bhukaswan

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Abstract

The maximum sustainable yield of demersal fishery resources in the Gulf of Thailand to a depth of 50 m is estimated to be 750,000 tonnes. On this basis the Gulf has been overfished since 1973. There were over 4,000 trawlers registered in the Gulf in 1972; over 10,000 in 1982.

The total catch of food fish has increased only slightly since 1963, most increases being of trash fish. However, the trash fish component includes increasing numbers of juvenile food fish. Trash fish are now mostly processed into fish meal. The number of fish meal factories has increased from six in 1967 to 95 in 1980. The total quantity of trash fish has been declining since 1978.

The Thai Department of Fisheries proposed controlling trawler numbers in 1969, but received Government approval only in November 1979. The Department issued licences for trawlers until September 1982.

Introduction

As stated in the Fifth National Economic and Social Development Plan (1982-1986), the Department of Fisheries has set a target to maintain total fish landings at 1.4 million tonnes (t) per annum through sound management techniques. In 1977, the maximum marine fish catch in Thailand was recorded at 2.067 million t. Thereafter, marine landings gradually decreased to 1.6 million t in 1980 (Table 1 and Fig. 1). The decline was not only due to poor catches, but was also closely related to the potential of

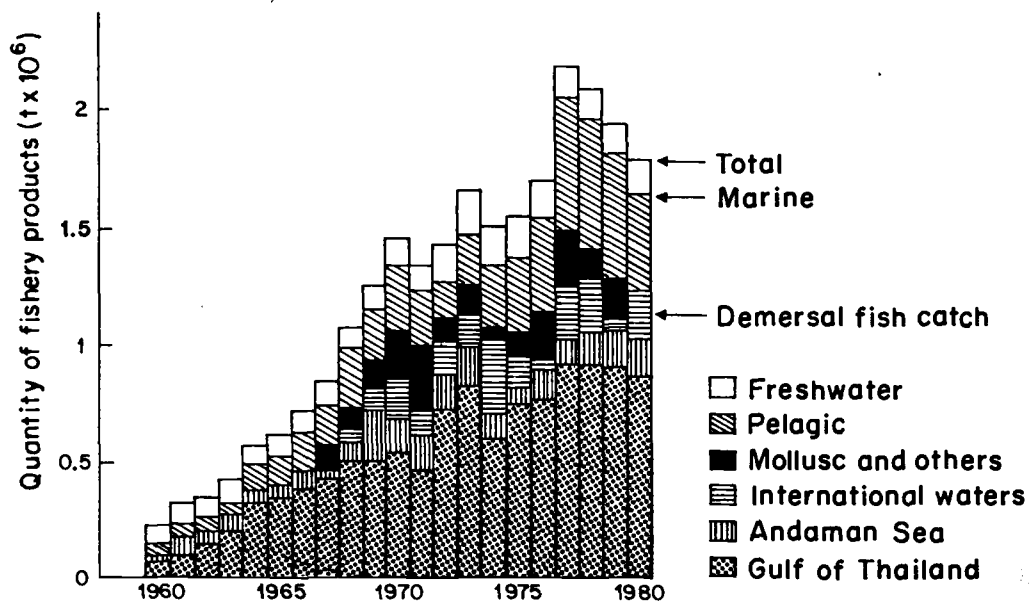


Fig. 1. Total catch of Thai fisheries, 1960-1980.

Table 1. Total fisheries catch in Thailand, in tonnes, 1947-1980.

Year	Freshwater fish	Marine fish		Percentage of marine fish	Total catch
		Culture	Capture		
1947	40,851	—	120,173	74.63	161,024
1948	44,460	—	151,380	77.30	195,840
1949	44,900	—	108,800	70.79	153,700
1950	42,200	—	115,600	73.26	157,800
1951	46,000	—	141,000	75.40	187,000
1952	53,000	—	138,500	72.32	191,500
1953	56,300	—	148,200	72.47	204,500
1954	63,400	—	166,400	72.41	229,800
1955	61,570	—	151,400	71.09	212,970
1956	65,720	—	152,240	69.84	217,960
1957	63,670	—	170,900	72.86	234,570
1958	51,300	—	145,000	73.87	196,300
1959	57,020	—	147,770	72.16	204,790
1960	72,574	—	146,471	66.87	219,045
1961	72,330	—	233,275	76.33	305,605
1962	70,079	—	269,709	79.38	339,788
1963	95,311	—	323,374	77.24	418,685
1964	82,790	—	494,196	85.65	576,986
1965	85,637	—	529,483	86.61	615,120
1966	85,117	—	635,165	88.18	720,282
1967	85,255	—	762,188	89.94	847,443
1968	85,245	—	1,004,058	92.17	1,089,303
1969	90,439	—	1,179,595	92.88	1,270,034
1970	112,714	—	1,335,690	92.22	1,448,404
1971	116,788	—	1,470,289	92.64	1,587,077
1972	131,383	105,108	1,443,139	92.18	1,679,540
1973	140,885	43,264	1,494,752	91.61	1,678,901
1974	158,876	38,298	1,313,292	89.48	1,510,466
1975	160,692	81,705	1,312,903	89.67	1,555,300
1976	147,294	140,278	1,411,514	91.33	1,699,086
1977	122,374	134,174	1,933,359	94.48	2,189,907
1978	141,496	110,532	1,847,253	87.54	2,099,281
1979	133,176	99,914	1,713,244	93.16	1,946,334
1980	143,895	68,357	1,579,596	91.97	1,791,848

existing fishery resources, the oil crisis and the declaration of the new sea regimes (200-mile Exclusive Economic Zone) of neighboring countries. Evidence indicates that despite increased fishing effort in 1980, total marine fish landings decreased. Landings of *Decapterus*, *Sardinella* and demersal fish from international waters decreased (Table 2) together with catch per unit of effort from trawling in the Gulf of Thailand (Table 4).

In 1980, total marine catch was 1,647,953 t. Only 1,280,440 t (77.7%) were from the Gulf of Thailand. The remainder included 140,626 t (8.5%) from the Andaman Sea; 123,368 t (7.5%) from international waters; and 103,519 t (6.3%) from coastal aquaculture.

Total fishing effort in the Gulf of Thailand in 1980 was 87% commercial scale and 13% small scale or artisanal fishing. Commercial fishing accounted for 813,049 t, which comprised 63.5% of the total catch from the Gulf.

Table 2. Demersal fish catch in tonnes in Thai and international waters, 1960-1980.

Year	Thai waters			International waters	Total catch
	Gulf of Thailand	Andaman Sea	Total		
1960	58,852	7,487	66,339	—	66,339
1961	106,552	4,217	110,769	—	110,769
1962	129,702	6,563	136,263	—	136,263
1963	198,190	6,695	204,885	—	204,885
1964	320,614	13,864	334,478	—	334,478
1965	343,141	10,258	353,399	—	353,399
1966	363,842	23,791	387,633	—	387,633
1967	437,424	59,183	496,607	—	496,607
1968	513,380	84,543	597,923	67,990	665,913
1969	518,650	201,892	720,542	94,129	814,671
1970	530,890	169,803	700,693	167,060	867,753
1971	608,580	16,646	625,226	84,539	709,765
1972	737,949	168,143	906,086	127,595	1,033,681
1973	830,873	187,497	1,018,370	130,245	1,148,615
1974	604,853	118,258	723,111	313,019	1,036,130
1975	752,107	88,247	840,354	133,627	973,981
1976	787,914	116,927	934,841	39,528	944,369
1977	848,103	123,473	971,576	202,108	1,173,684
1978	814,054	152,063	966,117	232,157	1,198,274
1979	832,392	(150,000)	(982,392)	(61,000)	(1,043,392)
1980	798,035	138,742	936,777	103,042	1,039,819

Trawling is the most effective fishing activity for catching demersal fish. The total catch from trawling in 1980 was 91% of total demersal fish landings; the rest were caught by other fishing gears. Demersal fish were a major portion of total catch, comprising 90% of total marine catch; 10% were pelagic species.

Demersal fish caught from the Gulf of Thailand comprised food fish, 13.6%; trash fish, 63.3%; cephalopods, 7.7%; shrimp, 13.1%; crabs, 3.3% (Table 3).

Table 3. Demersal fish and invertebrate catch in tonnes from the Gulf of Thailand, 1960-1980.

Year	Finfish	Food fish	Trash fish	Cephalopods	Shrimp	Mixed trash fish	Crabs	Total catch
1960	46,845				8,225		3,782	58,852
1961	91,219				10,563		4,770	106,552
1962	111,775				13,461		4,464	129,702
1963	166,329				22,806		9,055	198,190
1964	283,173				28,420		9,021	320,614
1965	298,230				34,046		10,865	343,141
1966	308,256				43,017		12,569	363,842
1967	355,337	113,743	241,594	18,452	50,563		13,070	437,424
1968							23,817	513,380

Continued

Table 3. Continued

Year	Finfish	Food fish	Trash fish	Cephalopods	Shrimp	Mixed trash fish	Crabs	Total catch
1969							11,886	518,650
1970							47,241	530,174
1971								608,580
1972	610,942							737,949
1973	677,008	126,321	550,687	51,033	86,434		16,398	830,873
1974	465,002	88,551	376,451	48,436	66,767		24,648	604,853
1975	603,642	121,205	482,437	53,477	74,732		20,256	752,107
1976	635,574	117,771	517,803	58,203	75,181		18,956	787,914
1977	554,862	130,362	424,500	76,894	134,428	87,352	24,567	848,103
1978	536,854	125,094	411,760	71,274	100,245	83,369	22,312	814,054
1979	544,998	127,601	417,397			103,220		832,392
1980	523,908	109,193	414,715	61,439	96,280	90,248	26,160	798,035

Estimation of the Potential of Demersal Fish Resources in the Gulf of Thailand

The potential (maximum sustainable yield) of demersal fish resources in the Gulf of Thailand within 50 m depths is estimated at 750,000 t per annum. The corresponding fishing effort was calculated at 8.6 million hours of *Pramong 2* (a research vessel of the Department of Fisheries) and the catch per unit of effort was 87 kg/hr (Fig. 2, Table 4; Fox 1970).

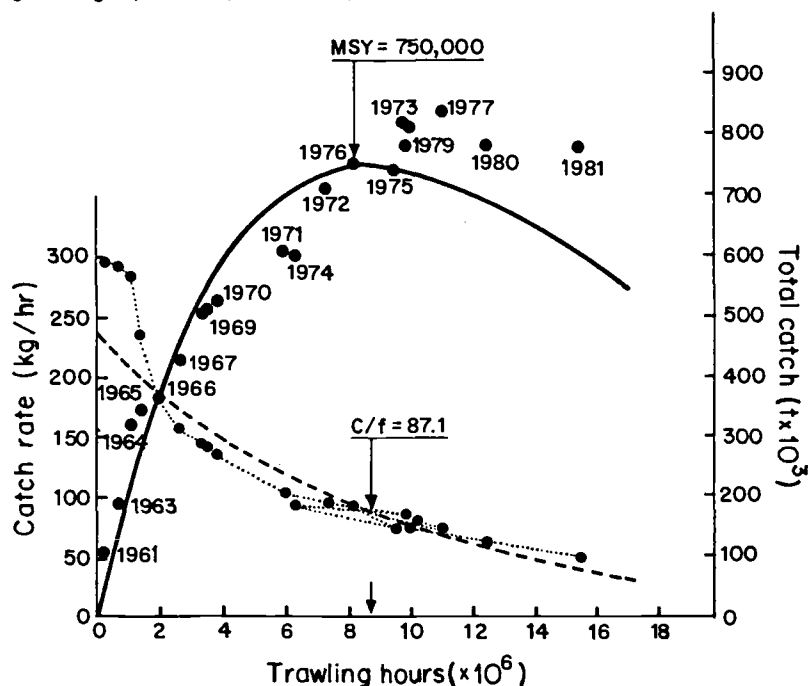


Fig. 2. The relationships between catch per unit of effort and number of trawling hours (broken line) and between total demersal catch and fishing effort (solid line) in shallow areas up to 50 m depths in the Gulf of Thailand, 1963-1981.

Table 4. Number of trawlers, demersal fish yields, catch per unit of effort (CPUE) of the *Pramong 2*, and trawling hours of Thailand up to 50 m depths, 1960-1981.

Year	No. of trawlers	Total demersal catch (t x 10 ³)	CPUE (kg/hr)		No. of trawling hours	
			Cod-end 4 cm	Cod-end adjusted to 2.5 cm***	(x 10 ³)	Two years' average (x 10 ³)
1960	99	58.85	—	—		
1961	201	106.55	—	297.80*	358	
1962	976	102.70	—	—	515	437
1963	2,026	198.20	231.60	194.92***	672	594
1964	2,360	320.60	225.60	287.85***	1,114	893
1965	2,393	343.10	179.20	233.24***	1,471	1,293
1966	2,695	363.80	131.77	177.42***	2,051	1,761
1967	3,077	437.42**	115.06	157.75***	2,773	2,412
1968	3,182	513.38**	105.92	146.99***	3,493	3,133
1969	3,185	518.65**	102.74	143.25***	3,621	3,557
1970	3,114	530.89**	97.44	137.01***	3,875	3,748
1971	3,338	608.58**	66.30	100.35***	6,065	4,596
1972	4,114	711.30	63.12	96.61***	7,362	6,714
1973	5,284	829.15	51.92	84.52	9,810	8,586
1974	4,792	600.26	57.68	93.22	6,439	8,124
1975	4,530	746.24	46.99	77.07	9,683	8,061
1976	4,833	757.33	57.22	92.53	8,185	8,934
1977	5,834	841.29	44.78	75.01	11,216	9,700
1978	5,780	810.76	48.40	81.25	9,978	10,597
1979	7,930	791.49	47.16	79.69	9,932	9,955
1980	7,933	781.68	43.67	61.99	12,610	11,271
1981	6,633	780.00	37.61	49.77	15,672	14,141

*Surveyed by commercial trawlers.

**Adjusted to total catch by using catch statistics of *Pramong 2*.

***Adjusted catch rate during 1963-1972 using the equation CPUE (2.5 cm) = 6.053 + 1.51129 CPUE (4 cm). Since 1973 estimations have been made from the annual monitoring surveys.

Total catch from 1977 does not include pelagic species; catch rate from 1977 does not include pelagic species.

Status of Demersal Fishing in the Gulf of Thailand

The status of the demersal fishery in the Gulf is summarized as follows:

1. In 1981, the total demersal fish catch was recorded at 780,000 t, 4% higher than the estimated maximum potential yield.
2. Trawling was heavy in the Gulf (down to 50 m depths)—82% higher than the recommended fishing effort.
3. Catch per unit of effort decreased to 52 kg/hr (February to August) in 1982 (Tables 5 and 6, Fig. 3) or only 17% of the catch per unit of effort in 1963.
4. Overfishing has occurred in the Gulf since 1973.
5. Demersal fish resources in the Gulf in 1981 were estimated at 0.98 t/km² or only one-sixth of 1963 resources.

Table 5. Annual trawl catch by research vessels *Pramong 2* and *Pramong 9*, density and standing stock of demersal resources in the Gulf of Thailand, 1961-1981.

Year	CPUE (kg/hr)		Relative catch rate 1963 = 100	Density (t/km ²)	Standing stock (t x 10 ³)
	Cod-end 4 cm	Cod-end adjusted to 2.5 cm			
1961	—	297.80	—	—	—
1962	231.60	294.92	100	5.79	618
1963	225.60	287.85	97	5.66	604
1964	179.20	233.24	77	4.41	471
1965	131.77	177.42	57	3.31	353
1966	115.06	157.75	50	2.87	307
1967	105.92	146.99	46	2.66	204
1968	102.74	143.25	44	2.57	275
1969	97.44	137.01	42	2.42	258
1970	66.30	100.35	29	1.65	176
1971	63.12	96.61	27	1.57	168
1972	51.92	84.52	22	1.30	139
1973	57.68	93.22	25	1.45	155
1974	46.99	77.07	20	1.17	125
1975	57.22	92.53	20	1.42	152
1976	47.28	77.51	20	1.17	125
1977	52.15	85.00	22	1.30	139
1978	51.63	84.16	22	1.28	137
1979	47.52	65.84	20	1.18	127
1980	39.80	52.37	17	0.98	105
1981		52.60*			

*Monitoring survey was conducted from February to August 1982.

Table 6. Mean catch per unit of effort of research trawlers (*Pramong 2* and *Pramong 9*) with 2.5-cm cod-end mesh, February to August 1982.

Location	February		July		August		February-August	
	No. of trawlers	CPUE (kg/hr)	No. of trawlers	CPUE (kg/hr)	No. of trawlers	CPUE (kg/hr)	No. of trawlers	CPUE (kg/hr)
Trad	5	28.17	—	—	5	113.80	10	70.99
Chantaburi-Rayong	6	31.88	1	43.00	7	61.00	14	47.23
Inner Gulf	7	15.49	5	21.57	5	29.75	17	21.47
Prachuap Khiri								
Khan	9	41.46	4	38.59	8	99.83	21	63.15
Chumphon	14	61.97	11	78.38	8	92.75	33	74.90
Surat Thani	17	48.38	15	49.97	17	56.58	49	51.71
Nakhon Si Tham-								
marat	8	39.66	8	44.96	6	42.49	22	42.36
Nakhon Si Tham-								
marat-Songkhla	8	46.22	8	41.86	7	36.26	23	41.81
Songkhla-Narathivas	9	37.87	9	53.99	8	65.15	26	51.85
Trad-Narathivas	83	42.59	61	50.78	71	65.88	215	52.60

In 1972, there were 4,114 trawlers in the Gulf of Thailand which were registered with the Department of Fisheries. By 1982, there were over 10,000 trawlers. Details of the composition of the fleet are given in Table 8.

Thai trawlers have fished in international waters since 1967. The numbers of big trawlers in international waters and small trawlers for catching shrimp in the Gulf have doubled. There has also been an increase in medium-sized trawlers (14-18 m long) and pair trawlers catching cephalopods.

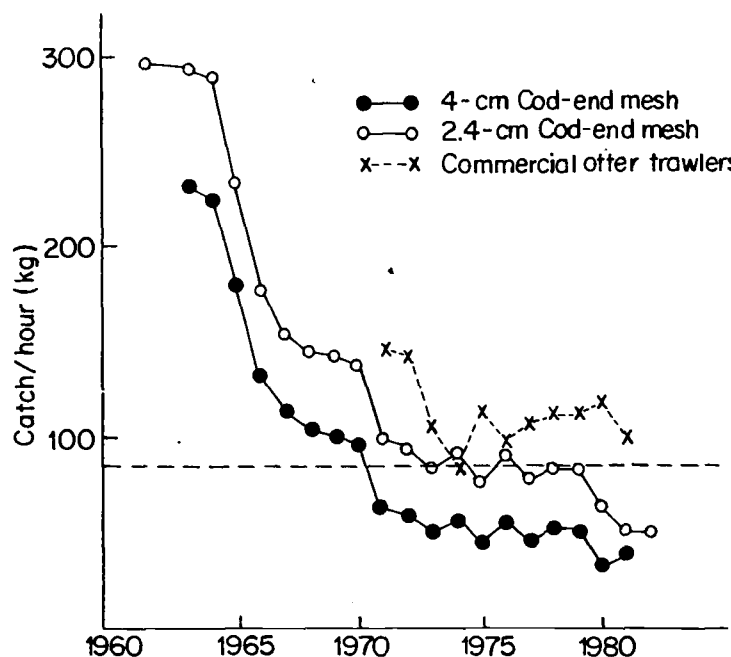


Fig. 3. Catch per unit of effort of research vessel *Pramong 2* (solid lines) and of Thai commercial otter trawlers (broken line), 1961-1981.

Available data indicate that trawling in the Gulf of Thailand in 1981 had put too much fishing effort on available resources. It was almost double the recommended fishing effort. The main reason is that there was no regulation limiting or controlling the number of trawlers in Thailand, resulting in too many trawlers in the Gulf. At the same time, big trawlers which used to fish in international waters have gone back to the Gulf to fish due to problems of sea boundaries and the oil crisis. This resulted in over-fishing of demersal fish stocks in the Gulf. Size and number of valuable economic species continuously decreased, while the amount of trash fish rapidly increased. This phenomenon alarmed both the public and private sectors and led to a temporary decline of registered trawlers in 1981.

Changes in Species Composition of Demersal Species

Although the total landings of demersal fish increased with increased fishing effort, the amount of food fish has hardly increased since 1967. Only a slight increase was observed for shrimps and cephalopods (Table 3).

The major part of the demersal catch is trash fish which was 50% of total catch in 1967, 66% in 1973 and 63% in 1980. On the other hand, the proportion of food fish declined from 26% in 1967 to 14% in 1980.

The increase of total demersal fish landings in the past 15 years did not provide more food fish for consumers, but rather promoted the fish meal industry in this country.

The increase in total trash fish landings was the result of using smaller meshed nets. It was evident that 37% of trash fish were juvenile food fish. Thus, the increase in trawling is severely damaging the food fish stocks. Data collected from the survey of the DOF research fishing boats (*Pramong 2* and *Pramong 9*) showed that percentage of food fish juveniles in the trash fish increased from 17% in 1979 to 27% in 1981. The size of food fish caught was found to be decreasing and most of those from the nearshore areas and the inner Gulf are now counted as trash fish. Juveniles of food fish and real trash fish (small and valueless fish) were found to aggregate in dense numbers in areas deeper than 30 m offshore of Prachuap Khiri Khan, Chumphon, Rayong, Songkhla, Pattani and Narathivas (Table 7, Figs. 4 and 5).

Table 7. Catch rate of demersal fish in kg/hr in relation to depth in the Gulf of Thailand, 1961-1981.

Year	Depth (m)				
	<20	21-30	31-40	41-50	>50
1961	—	—	100	100	100
1962	100	100	99	—	—
1963	76	94	96	—	—
1964	—	—	—	—	—
1965	—	—	—	—	—
1966	43	49	58	73	—
1967	38	33	53	99	—
1968	35	38	44	72	—
1969	37	35	46	69	—
1970	41	32	45	57	—
1971	22	25	29	37	—
1972	23	42	28	42	—
1973	18	18	24	37	—
1974	18	20	30	38	—
1975	14	16	21	37	—
1976	13	19	24	42	59
1977	13	15	19	37	38
1978	12	19	21	39	70
1979	13	14	21	40	54
1980	11	15	19	38	45
1981	10	12	15	28	34

The percentage of trash fish in the total catch from various types of fishing gears are: pushnets, 65%; pair trawl, 57% and otter trawl, 33% (Kuanthanom 1980a, 1980b, 1980c).

In 1981, trawlers caught 719,000 t of trash fish. It consisted of 37% or 264,000 t of food fish juveniles (70,000 t of which were juveniles of pelagic species; 161,000 t of juveniles of demersal species; 33,000 t of juvenile crustaceans and shellfish) and 455,000 t of real trash fish.

Table 8. Number of registered trawlers in the Gulf of Thailand, 1971-1982.

Year	Type of trawler	Boat length (m)				Total	Total (all trawlers)
		< 14	14-18	18-25	> 25		
1971	OBT	730	1,008	331	81	2,203	3,338
	PT	73	201	243	3	522	
	BT	533	15	1	—	613	
1972	OBT	1,241	1,124	371	77	2,813	4,114
	PT	124	303	272	3	702	
	BT	588	11	—	—	599	
1973	OBT	1,816	1,586	433	92	3,927	5,284
	PT	153	381	288	2	824	
	BT	533	—	—	—	533	
1974	OBT	1,577	1,481	423	114	3,595	4,792
	PT	117	395	339	3	854	
	BT	341	2	—	—	343	
1975	OBT	1,551	1,313	416	117	3,397	4,530
	PT	112	379	354	5	850	
	BT	283	—	—	—	283	
1976	OBT	1,927	1,314	405	89	3,735	4,833
	PT	98	350	362	4	814	
	BT	277	7	—	—	284	
1977	OBT	2,637	1,331	468	100	4,536	5,834
	PT	68	410	399	1	878	
	BT	420	—	—	—	420	
1978	OBT	2,557	1,336	594	128	4,610	5,780
	PT	67	379	356	2	804	
	BT	489	—	—	—	489	
1979	OBT	3,346	1,695	1,057	175	6,273	7,930
	PT	86	497	537	—	1,120	
	BT	534	3	—	—	537	
1980	OBT	4,040	1,773	1,192	187	7,192	9,344
	PT	54	476	557	5	1,092	
	BT	1,060	—	—	—	1,060	
1981	OBT	2,707	1,481	868	171	5,227	6,633
	PT	53	358	489	10	910	
	BT	494	2	—	—	496	
1982	OBT	4,720	1,898	1,227	185	8,030	10,047
	PT	44	528	707	7	1,306	
	BT	701	10	—	—	711	

OBT = otter trawler
PT = pair trawler
BT = beam trawler

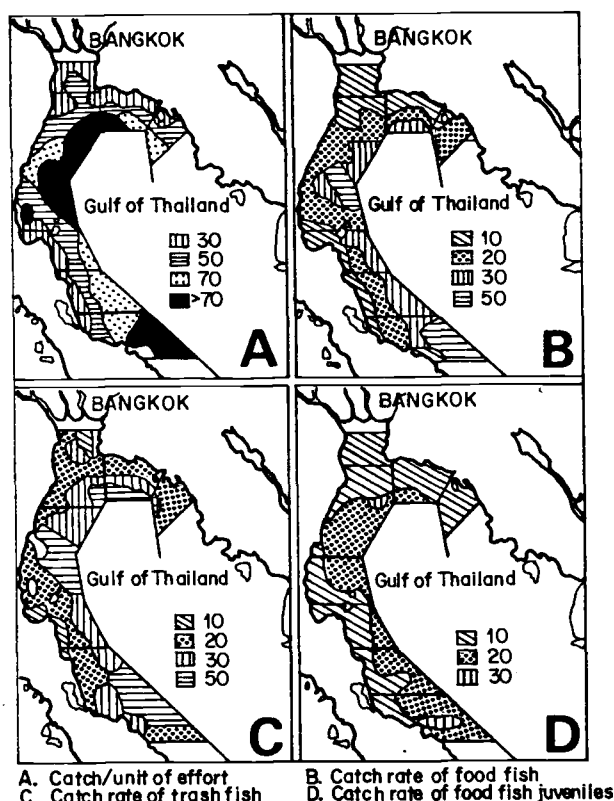


Fig. 4. Distribution of demersal fish in the Gulf of Thailand as surveyed by research vessels *Pramong 2* and *Pramong 9* in 1980.

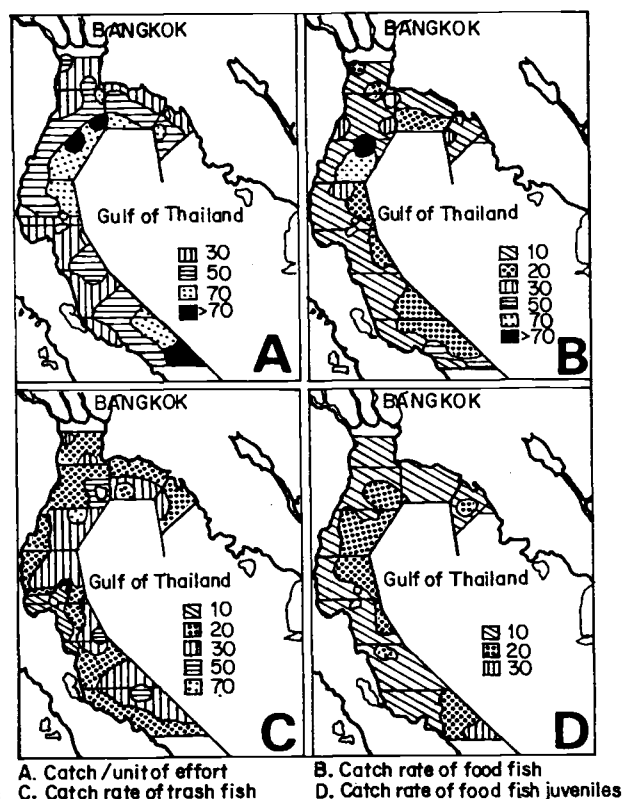


Fig. 5. Distribution of demersal fish in the Gulf of Thailand as surveyed by research vessels *Pramong 2* and *Pramong 9* in 1981.

Utilization of Demersal Food Fish

Most demersal food fish are sold fresh. Sharks and rays are sometimes processed for smoked fish. Lizardfish (*Saurida*) and sand whiting (sillaginids) are sun-dried. For demersal fish caught in large quantities, such as threadfin bream (polynemids), croakers (sciaenids), big-eye (*Priacanthus*), lizardfish and hairtail (*Trichiurus*), the selling price in 1981 ranged between 3 and 10 baht/kg (auction prices of the Bangkok Fish Market Organization). They are cheap protein sources for consumers. Some demersal fish command good prices in the market: silvery lactarid, pomfret (stromateids), sea bass (lutjanids) and sand whittings were sold at around 25 baht/kg in 1981. (US\$1.0 = 20.0 baht in 1981).

Utilization of Trash Fish

In the early stage of trawl fisheries in the Gulf of Thailand, trash fish were a small percentage of the catch. In 1967, there were 275,364 t of total trash fish, 43% of which went to fish meal factories, 31% were sold fresh and 11% went to fish sauce factories (Fig. 6). At that time, there were only six fish meal factories; the number increased to 60 factories by 1973 coinciding with increased trash fish production. In

that year, 71% of total trash fish went to fish meal factories. Thereafter, the total amount of trash fish declined due mainly to the oil crisis. In order to fill the needs of fish meal factories, trash fish were used to produce fish meal at a high rate. They used 85% of total trash fish landed in 1976. The fish meal industry reached its peak in 1978 when 197,166 t of fish meal were produced, due to higher percentages of trash fish in the catch and the increased need for fish meal in animal husbandry in the country. The quantity of fish meal produced annually exceeds local demand; Thailand has exported fish meal to foreign markets since 1970 (Fig. 7).

Despite the rate of fish meal production in 1978, existing fish meal factories were not fully utilized; only 70% of the total capacity of 79 existing factories were used. With no controls, the number of fish meal factories increased to 95 by 1980, while the total quantity of trash fish has gradually declined since 1978.

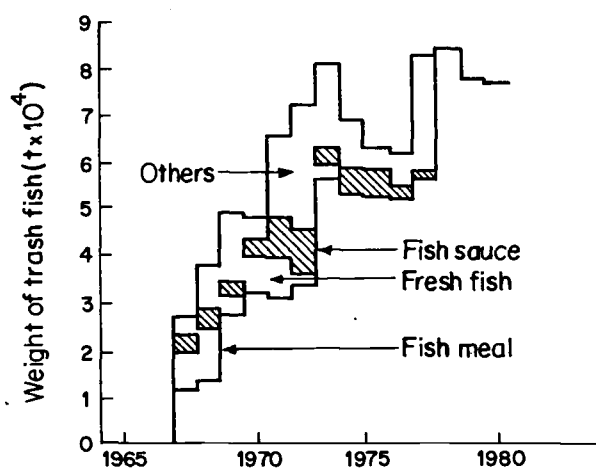


Fig. 6. Utilization of trash fish from Thai fisheries, 1967-1980.

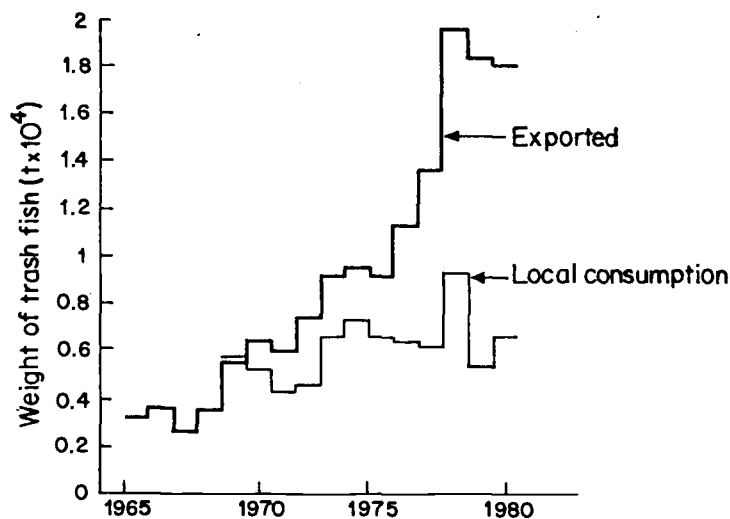


Fig. 7. Distribution of trash fish from Thai fisheries, 1965-1981.

Discussion

Since 1975, demersal fishery resources in the Gulf have been severely damaged due to the return to the Gulf of the trawlers that used to fish in international waters before the declaration of 200-mile Exclusive Economic Zones in neighboring countries.

The oil crisis also affected demersal fishery in the Gulf. Increased oil prices in 1974 were another burden to the fishing industry. The price of fish did not increase proportionally due to the declined purchasing power of consumers. These situations led the fishermen to fish in nearshore areas; the percentage of trash fish continuously increased (up to 68% if juveniles of pelagic species were included). This is also most severely damaging to demersal fishery resources in the Gulf. In 1981, the fishing effort was 82% higher than that of recommended annual fishing effort, while fish landings were 4% over the expected maximum sustainable yield.

The most effective measure in protecting the demersal fishery resources in the Gulf of Thailand is to control the number of trawlers. The DOF recommended this measure to the Government for approval in 1969 but it was approved only on 12 November 1979. Since then, the DOF had registered all types of trawlers fishing in Thai territorial waters. Licenses were issued until 31 March 1980, but the closing date was postponed to 30 September 1982.

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