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"Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand"

NATIONAL REPORTS on the Fish Stocks and Habitats of Regional, Global and Transboundary Significance in the South China Sea

"Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand"
National Reports on the Fish Stocks and Habitats of Regional, Global and Transboundary Significance in the South China Sea

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Cover Photo: Coastal fishing village of Phu Quoc Island, Viet Nam, by Mr. Christopher Paterson.

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Reversing Environmental Degradation Trends
in the
South China Sea and Gulf of Thailand

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INTRODUCTION

The South China Sea and Gulf of Thailand is a global centre of shallow water marine biological diversity, supporting a significant world fishery that is important to the food security of, and as a source of export income for, Southeast Asian countries. Landings from this area contribute approximately 10 percent of reported global fisheries production per annum and make significant contributions to the economies, of countries bordering the Gulf of Thailand and the South China Sea.

The majority of fisheries are small-scale in nature, and fish are landed in a large number of decentralised locations for distribution through complex marketing networks at the community level. As a consequence estimates of fisheries production are considered to be gross underestimates and do not adequately reflect the importance of the artisanal or subsistence production to the fisheries sector as a whole.

The majority of Southeast Asian countries are among the top 20 capture fisheries producing countries in the world, with some experiencing annual increases in production of up to 5 percent. Pelagic fishes dominate landings by volume and value, as most demersal fisheries are over-exploited. It is well accepted, however, that regional fisheries statistics rarely reflect: (a) production from small-scale coastal fisheries, (b) the high level participation of coastal communities in fishing, or (c) the social and economic importance of artisanal and subsistence fishing to coastal communities.

Fish stocks in the South China Sea and Gulf of Thailand are subject to high levels of fishing effort, such that stocks of most economically important species are considered to be fully fished or overexploited. Increasing global demand for fisheries products, and the dependence of coastal communities on fish for food and income results in a continued increase in fishing effort. This has led to "fishing down the marine food chain in the region", coupled with an increasing dependence of the artisanal sector on small pelagic species due to declining availability of demersal species.

The fisheries and habitat components of the UNEP/GEF South China Sea Project focus on the critical role that habitats such as mangroves, coral reefs, seagrass, and wetlands play in sustaining fisheries production in the South China Sea and Gulf of Thailand. These habitats are known to act as refuges for most economically important fish species during critical stages of their life-cycles including as larvae, for spawning, and for feeding. These habitats therefore play an important role in recruitment and maintenance of fish stocks.

Declining fish availability, coupled with over-capacity and the dependence of the small-scale sector on coastal fisheries for income generation, has led to the adoption of destructive fishing practices by some fishers in order to maintain incomes and food production in the short-term. Fisheries trends suggest that production from capture fisheries will decline over coming years unless total fishing effort and capacity are reduced. The obvious problem in the reduction of fishing capacity is that most fisheries are small-scale with the majority of participants (and their families) being highly dependent on fisheries for income, food and well-being.

Whilst actions aimed at reducing the rate of loss of coastal habitats of significance to fisheries have been implemented by the countries bordering the South China Sea, the decadal rates of loss of such habitats remain high: seagrass (30%); mangroves (16%); and coral reefs (16%) (UNEP, 2007a). Increasing levels of fishing effort, coupled with continued decline in the total area of habitats critical to the life-cycles of most species, have raised serious concerns for the long-term sustainability of artisanal fisheries in the region.

The dilemma for the fisheries and environment sectors is that conservation of habitat does not necessarily result in increased fish stocks and lowering of fishing effort does not necessarily result in improved habitat condition. Although fish production is intrinsically linked to the quality and extent of habitats; and although the dependence of coastal communities on fish for food and income is high; understanding of this linkage is limited, such that intensive fishing in inshore areas has been identified as the key factor contributing to the continued loss of habitats and biodiversity in the region (UNEP, 2006a). The use of inappropriate and destructive gear and practices, such as the use of demersal trawls and push nets in seagrass areas, and the use of poisons and explosives to catch fish in coral reef areas, is of continuing concern with respect to the degradation and loss of habitats and biodiversity.

The expert members of the regional working groups on fisheries and coastal habitats of the South China Sea Project have agreed that intensive, inshore fishing presents numerous threats to coastal habitats and biodiversity in the South China Sea and Gulf of Thailand including:

- Degradation and loss of habitats and biodiversity caused by intensive use of inappropriate and destructive fishing gear and practices in sensitive habitat areas;
- Reduced biomass of fish species of transboundary significance caused by growth and recruitment over-fishing resulting from the targeting and capture of juvenile fish, fish in spawning aggregations, and pre-recruits;
- Changes in marine community structure caused by direct reductions of populations representing specific trophic levels of the community; and
- Decreased abundance and geographical range of rare and endangered species caused by fishing activities conducted in critical habitat areas.

These threats coupled with the fact that many marine fisheries in Southeast Asia are over-capitalised, unregulated, and subjected to illegal fishing have provided the impetus for the development of innovative approaches to the management of fisheries in the region. Significant efforts are being made in most countries to decentralise the responsibility for fisheries management to the local level with the aim of establishing co-management particularly of demersal fish stocks. However, the intrinsic relationship between fish stocks and their habitats necessitates that fisheries management involving decentralised and rights-based systems will need to incorporate strategies that foster the improved management of fish life-cycle and critical habitat linkages.

The key focus of the fisheries component of the UNEP/GEF South China Sea Project has been to develop a mechanism to facilitate improved management of the critical linkages between fish stocks and their habitats in the South China Sea and Gulf of Thailand. In this connection the UNEP/GEF Regional Working Group on Fisheries has collaborated with SEAFDEC to establish a system of fisheries *refugia* in the South China Sea and Gulf of Thailand that focuses on the critical links between fish stocks and their habitats.

The "*National Reports on the Fish Stocks and Habitats of Regional, Global and Transboundary Significance in the South China Sea*" contained in this publication were prepared during the preparatory phase of the South China Sea project by the government designated focal points for fisheries from Cambodia, Indonesia, Philippines, Thailand, and Viet Nam. Each focal point for fisheries has compiled in their respective National Reports, available information relating to: the status and threats of important fish stocks; habitats and areas of importance in the maintenance of exploited fish stocks; and existing management regimes. The reports were utilised during the operational phase of the project as an important information resource in the identification of fisheries *refugia* sites and development of a regional strategy for the establishment and management of fisheries *refugia*.

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United Nations Environment Programme

UNEP/GEF South China Sea Project

Global Environment Facility

NATIONAL REPORT

on

The Fish Stocks and Habitats of Regional, Global and Transboundary Significance in the South China Sea

CAMBODIA

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1. BACKGROUND

1.1 Overview of Cambodia's Fisheries Sector

Cambodia's fisheries and aquaculture play an important role in the national economy and contribute to food security. The sector provides employment and economic benefits to Cambodians involved in its activities. The Ministry of Planning estimated in 2002 that Cambodia derives 16% of its GDP from the fisheries sector.

During recent decades, the productivity of Cambodia's fisheries resources, including fishes, crustaceans, and molluscs, has declined significantly. This is largely due to increased pressures on fish stocks and their habitats associated with burgeoning coastal populations in Cambodia. Increased demand for fisheries products, and the associated improvements in fishing technology, have contributed to this problem. Cambodia is an ASEAN country bordering the Gulf of Thailand, with a coastline of 435km extending from the Thai border in the north to the border with Viet Nam in the south.

Cambodia's fisheries are divided into inland and marine capture fisheries. Inland capture fisheries are significantly more important to Cambodians than marine fisheries, accounting for more than 70% of Cambodia's total volume of fish production. In terms of value, however, marine fisheries account for nearly 40% of the country's fisheries production (Try, 2001).

A few comments regarding the accuracy of Cambodian fisheries statistics are necessary. The statistics presented in this report are the most accurate available to the Department of Fisheries (DoF), however, a reliable system for the systematic collection of fisheries information and data has not yet been established in Cambodia. The fact that fish are not landed at central locations, together with direct exports by foreign vessels and other factors, contribute to inaccuracies. Fish caught by subsistence fishers are often not included in the official statistics, and as such, the statistics do not adequately reflect the importance of fisheries to small-scale subsistence fishers in Cambodia.

1.1.1 Total catch by fishing area, port of landing or province (by species/species group, 1990 onwards)

The coastal area of Cambodia is divided into two provinces, Koh Kong in the north and Kampot in the south, and two municipalities, Sihanoukville and Kep (Figure 1). Cambodia's marine capture fisheries are characterised by a multitude of species and the use of a range of fishing gears. Reference to DoF fisheries statistics (Table 1) indicates that fisheries production in Cambodia has developed considerably since 1988 when changes to government policy created free market and free election systems.

Marine fisheries production as recorded by DoF has not yet shown a decrease by species and landing place, although anecdotal infromations suggests that the average size of many economically important fish species traded in domestic markets is declining. The records of production from marine capture fisheries have been irregular in some periods (Table 1).

Table 1 indicates that total fisheries production increased significantly after 1999. This is a result of modifications to the DoF's system for the collection of inland fisheries statistics made through the Freshwater Capture Fisheries Management Project. A corresponding system for the collection of marine capture fisheries statistics does not exist. The DoF is seeking assistance from NGOs and regional and international organisations in resolving this problem.

Marine fisheries production by province and municipality from 1992 to 2001 is shown in Tables 2 to 5. These statistics are not at the species level, but grouped according to higher taxa and commercial or market names. The data in these tables do not include catches made by local and foreign fleets operating legally or illegally in Cambodia and then landed in ports of other countries such as Thailand or Viet Nam. The DoF estimates that fish caught outside Cambodian waters constitute around one quarter of the recorded production. For Kep municipality there are no data from 1980 to 1996, due to the institution of the administrative structure for this municipality only occurring in 1996.

The aquaculture of shrimp was introduced to Cambodia in 1993, however, this business collapsed in 1998. At present, all shrimp farms are closed. The culture of seaweed began in 2001.

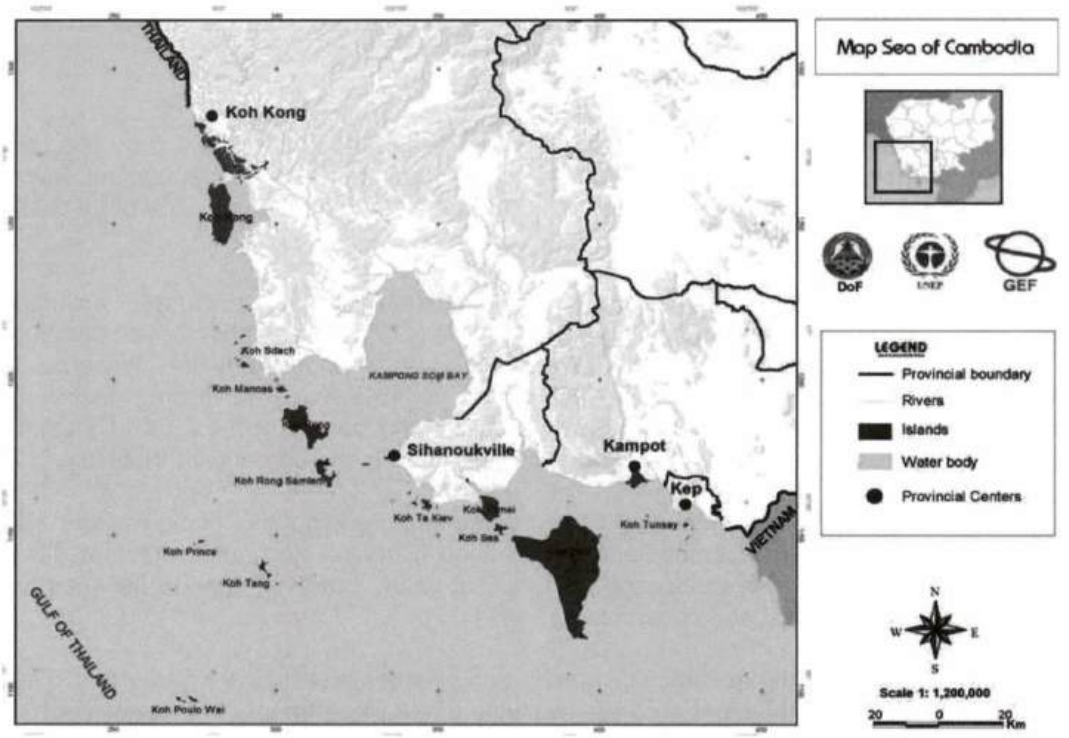

Figure 1 Map of Cambodia's Coastal Waters.

Table 1 Cambodia's fisheries production from 1990 to 2001.
(fish and shrimp unit = tonnes; and crocodile unit = heads).

Years	Total Production	Inland Fisheries	Marine Fisheries	Aquaculture Production		
				Fishes	Shrimp	Crocodile
1990	111,400	65,100	39,900	6,400		5,654
1991	117,800	74,700	36,400	6,700		6,100
1992	111,150	68,900	33,700	8,550		3,664
1993	108,900	67,900	33,100	7,400	500	4,816
1994	103,200	65,000	30,000	7,640	560	6,194
1995	112,510	72,500	30,500	8,779	731	14,691
1996	104,310	63,510	31,200	9,000	600	20,200
1997	114,600	73,000	29,800	11,534	266	17,000
1998	122,000	75,700	32,200	13,903	197	40,700
1999	284,100	231,000	38,100	14,938	62	25,380
2000	296,030	245,600	36,000	14,410	20	26,300
2001	444,500	385,000	42,000	13,682	143	36,000

(Source: DoF 2002).

Table 2 Marine capture fisheries production in Kampot province from 1992 to 2001 (tonnes).

Year	Fishes	Low Value Fishes	Shrimp	Ray	Cepha -lopod	Slipper lobster	Crabs	Snails	Blood cockle	Sea cucum -ber	Krill	Fresh-water Fish	Total
1992	1,064	1,058	993	669	296	162	1,040	1,346	1,472	-	-	-	8,100
1993	654	1,134	229	678	236	156	1,020	1,465	1,507	-	861	-	7,940
1994	2,148	1,430	529	427	418	89	1,531	450	423	132	23	-	7,600
1995	2,895	2,000	625	176	310	36	900	118	180	60	-	-	7,300
1996	3,020	2,125	538	181	284	26	992	104	179	51	-	-	7,500
1997	2,974	2,045	591	167	320	28	1,120	138	172	45	-	-	7,600
1998	2,610	1,620	501	184	291	22	992	144	208	63	15	100	6,750
1999	2,720	3,025	340	135	199	7	801	104	135	34	-	-	7,500
2000	2,600	1,755	402	176	284	-	1,077	129	166	11	-	100	6,700
2001	2,703	1,786	284	165	247	-	870	176	199	-	-	100	8,100

(Source: DoF 2002).

Table 3 Marine capture fisheries production in Sihanoukville municipality from 1992 to 2001 (tonnes).

Year	Fishes	Low Value Fishes	Shrimp	Ray	Cepha -lopod	Slipper lobster	Crabs	Snails	Blood cockle	Krill	Sea cucum-ber	Fresh water fish	Total
1992	6,132	1,117	600	-	173	-	430	-	48	-	-	100	8,600
1993	6,090	1,004	641	-	146	-	428	-	56	-	-	195	8,560
1994	6,162	999	682	-	161	-	504	-	7	-	-	185	8,700
1995	5,675	1,600	820	50	225	-	610	-	38	-	-	182	9,200
1996	5,780	1,920	1,100	-	290	-	590	-	60	-	200	160	10,100
1997	4,345	3,155	1,150	-	476	-	592	-	54	-	68	160	10,000
1998	6,510	4,840	1,300	-	719	6	719	5	61	60	-	180	14,400
1999	7,295	4,455	1,570	-	1,800	40	1,080	80	150	70	-	260	16,800
2000	6,850	4,690	1,580	-	1,830	45	1,000	120	35	50	-	300	16,500
2001	6,943	4,287	1,730	-	1,496	40	897	1,236	226	210	-	535	17,600

(Source: DoF 2002).

Table 4 Marine capture fisheries production in Koh Kong province from 1992 to 2001 (tonnes).

Year	Fishes	Low Value Fishes	Shrimp	Ray	Cepha-lopod	Slipper lobster	Crabs	Snails	Blood cockle	Mantis shrimp	Fresh-water fish	Total
1992	5,560	6,485	3,000	318	791	-	700	-	146	-	-	17,000
1993	6,094	6,346	2,368	146	601		925	-	120	-	-	16,600
1994	5,093	4,845	2,395	133	487	-	612	-	135	-	-	13,700
1995	5,230	5,700	2,000	120	450	-	300	-	200	-	-	14,000
1996	5,185	4,997	2,064	110	390	-	644	-	110	-	-	13,500
1997	4,966	3,403	2,380	108	445	-	574	-	194	-	-	12,070
1998	4,020	3,600	1,840	30	510	-	520	-	180	-	-	10,700
1999	7,206	3,317	1,115	40	480	-	458	696	82	-	6	13,400
2000	5,938	3,307	815	69	498	4	1,348	26	325	10	10	12,350
2001	7,104	4,764	1,606	42	604	-	1,410	1,082	762	-	26	17,400

(Source: DoF 2002).

Table 5 Marine capture fisheries production in Kep municipality from 1996 to 2001 (tonnes).

Year	Fishes	Low Value Fishes	Shrimp	Ray	Cepha-lopod	Slipper lobster	Crabs	Krill	Fresh-water Fish	Total
1996	20	-	5	-	5	-	70	-	-	100
1997	43	5	23	1	5	-	53	-	-	130
1998	62	100	30	-	10	-	146	2	-	350
1999	150	70	30	-	6	-	140	-	4	400
2000	138	81	50	-	15	-	168	8	-	460
2001	123	10	42	2	8	-	285	-	-	470

(Source: DoF 2002)

1.1.2 Fishing effort by gear (number of fishing days/number of boats)

Fishing Gear

Many types of small-scale or artisanal, middle-scale, and large-scale fishing gear are used in Cambodia. According to a proclamation made by the Ministry of Agriculture, Forestry and Fisheries, small-scale or artisanal and middle-scale fishing gears are distinguished by the capacity of boat engines and fishing gear size. The term commercial fishery is used only for inland fisheries and is rarely used in relation to Cambodia's marine fisheries.

Marine capture fisheries in Cambodia are divided into two categories, namely middle-scale fisheries and small-scale or artisanal fisheries. Middle-scale fisheries are those utilising highly efficient fishing gear and vessels with capacity to fish both offshore and inshore using a variety of gear types, with the exception of trawling in inshore waters (Table 6). These fisheries are required to pay tax to the government. After the government declared a reform of the fisheries sector in October 2000, middle-scale inland fishers do not have to pay tax. However, fishers operating middle-scale fishing gears in marine waters are required to pay tax as usual, albeit at rates lower than those prior to the government reform.

Table 6 Commercial fishing gears used in the coastal waters of Cambodia.

No.	Type of Fishing Gear		No.	Type of Fishing Gear	
	English Name	Khmer name		English Name	Khmer name
1	Trawl	Uon Ohs	7	*Scomberomorus* gill net	Mong Trey Beka
2	Purse seine/Ring net	Uon Tith	8	Mackerel gill net	Mong Trey Kamong
3	Anchovy encircling seine	Uon Ka Koeum	9	Shrimp gill net or Trammel net	Mong Bang Kear
4	Beach seine	Uon Khow	10	Crab gill net	Mong Kdam
5	Encircling seine	Uon Houm	11	Horizontal longline	Santouch Ro Noung
6	Gill net	Mong Paehk	12	Clupea gill net	Mong Trey Kbork

(Source: DoF 2002)

The number of fishing gear units used in any given area varies according to the distribution and abundance of natural resources, as well as socioeconomic and market conditions. For example, dredging for short-neck clam began in Cambodia at the end of 1999 following identification of a market for this species in Thailand. Similarly, the intensity of small trawl fisheries increased in 1997, leading to serious concern for the longer-term sustainability of marine fish stocks and conflicts over resource use between small-scale and middle-scale fishers.

The use of trawl nets, mackerel encircling seines, and short-neck clam dredges is most common in Sihanoukville and Koh Kong as these areas have deep-water areas suitable for the use of these gear types. In Kep and Kampot, traditional fishing gear, including gill nets, crab nets, and longlines, are more commonly used.

Small-scale fisheries are those utilising traditional and/or passive fishing gear (Table 7), non-power boats, or power boats with a capacity lower than 5 HP. Generally, these fisheries operate in inshore waters up to 3 nautical miles from the shore and small-scale fishers are not required to pay tax.

Table 7 Small-scale or artisanal fishing gears used in the coastal waters of Cambodia.

No.	English Name	Khmer name	No.	English Name	Khmer name
Gill net (Mong Paehk)					
1	Crab gill net	Mong Kdam	3	Fish gill net	Mong Paehk
2	Shrimp gill net	Mong Bang Kear	4	Seabass gill net	Mong Trey Spong
Stationary Gear					
5	Squid trap	Lop Meuk	8	Bamboo crab trap	Lop Kdam Roeusey
6	Fish trap	Lop Trey	9	Small winged set bag	Pong Pang
7	Crab trap	Lop Kdam	10	Circular net crab trap	Lop Mong Kdam
Mobile gear					
11	Push net	Thnorng Os Ky	13	Drift gill net	Mong Bandet
12	Hook	Santouch			

(Source: DoF 2002).

The total number of units for all types of gear commonly used in coastal Cambodia for each year from 1992 to 2001 is shown in Table 8.

Table 8 Number of units of fishing gears used in all coastal provinces and municipalities of Cambodia combined from 1992 to 2001.

N°	Fishing gears	Unit	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	Trawl net	Set	422	442	549	634	560	460	545	654	1,516	1,310
2	Purse seine	Set	13	14	15	16	16	15	15	8	10	10
3	Anchovy encircling seine	Set	13	13	9	15	10	2	-	3	5	3
4	Beach seine	Set	18	19	6	6	1	26	7	20	26	21
5	Encircling seine	Set	15	-	-	6	1	26	7	7	7	2
6	Gill net	m	65,180	8,940	6,730	29,991	31,491	13,779	6,200	190,730	231,835	325,500
7	Mackerel gill net	m	3,700	9,800	36,050	12,050	15,550	131,220	140,500	198,200	178,300	64,700
8	*Scomberomorus* gill net	m	31,403	31,202	59,595	7,000	51,300	66,800	85,000	140,100	148,000	184,000
9	Shrimp gill net	m	114,705	93,450	110,950	161,486	694,563	469,100	469,050	996,055	653,890	323,200
10	Crab gill net	m	43,852	32,100	37,450	95,728	580,439	393,200	426,000	538,545	961,370	635,200
11	Clupea gill net	m	500	1,200	3,000	8,850	10,250	23,900	23,900	33,600	38,000	27,500
12	Trap	No. trap	60	637	2,277	1,902	26,761	23,200	23,242	33,960	51,249	66,255
13	Horizontal longlines	No. hook	16,000	760	920	1,950	14,620	4,750	4,750	8,600	15,360	15,600

(Source: DoF 2002).

1.1.2.1 Trawl (Khmer name Uon Ohs*)*

Two types of trawl fishing is conducted in Cambodian waters, namely demersal otter board trawling and pair trawling. Trawl fishing was introduced to Cambodia in 1960 and was used to target a multitude of pelagic and demersal species (MoE 1998). Non-commercial species were usually discarded, although following the establishment of a fishmeal factory in 1993, trawl operators have begun targeting low value fish for use in the production of fishmeal. Low-value fish is composed of small-size fish that previously had no value in the market, non-edible species, and juveniles of economically important species that are unacceptable in the market. During the 1980s, catches of fish in Cambodia's trawl fisheries contained about 30 to 40% low value fish, although low value fish now represents about 60 to 65% of the total catch.

Approximately 95% of trawl fishing vessels are single trawlers. They typically only spend one or two days fishing inshore or offshore waters during each fishing trip. Catches of target species are typically preserved with ice. Some commercial species are kept alive. Trawl fishing is more common in Sihanoukville (Table 9) as this municipality has a good road (national road number 4) connection with Phnom Penh. Furthermore, it has tourist facilities, electricity and many fish processing factories, including the fishmeal factory discussed above. Pair-trawling has been conducted illegally in Cambodian waters by both local and foreign fishers.

Table 9 Number of trawl nets used in the coastal provinces and municipalities of Cambodia from 1992 to 2001 (set).

Province/ Municipality	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Kep	-	-	-	-	-	-	5	7	52	52
Kampot	31	16	5	186	186	20	30	22	89	89
Sihanoukville	227	242	276	262	244	226	296	283	656	756
Koh Kong	164	184	268	186	130	214	214	342	719	413
Total	**422**	**442**	**549**	**634**	**560**	**460**	**545**	**654**	**1,516**	**1,310**

(Source: DoF 2002).

1.1.2.2 Purse seine/ring net (Khmer name Uon Tith*)*

Two types of purse seine are used in Cambodian waters. Purse seining without the use of lights is a legal fishing method. Cambodian coastal fishers have used this gear for many years, in both shallow water and offshore areas. The use of light luring purse seines is illegal in Cambodian waters, although is a method used in offshore water areas of Cambodia largely by fishers from neighbouring countries.

The use of light luring purse seines in Cambodian waters is very difficult to control as fishers typically use high-powered vessels that can easily leave Cambodian waters upon sighting Cambodian fisheries inspection vessels. This fishing practice is legal in Thailand and Viet Nam.

Purse seines used in Cambodian waters typically have a mesh size of 1 cm. The main species caught using this gear type are pelagic fishes such as mackerel (i.e. *Rastrelliger* spp.), sardines, and other small fishes, although mackerel comprises around 80 to 90% of the total catch. Purse seines and anchovy encircling seines are operated in the same manner but differ in mesh size.

Cambodia's purse seine fleet is based in Sihanoukville. The number of units of this gear in use has decreased (Table 10) due to overexploitation of the target species, and the increased use of pair trawls and light luring purse seines in the offshore waters of Cambodia. This gear type is now most commonly used at night, and most fishers using purse seines also use other fishing gear such as trawl or gill nets.

Table 10 Number of purse seine/ring nets used in the coastal provinces and municipalities of Cambodia from 1992 to 2001. (set)

Province/ Municipality	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Kep	-	-	-	-	-	-	-	-	-	-
Kampot	-	-	-	-	-	-	-	-	-	-
Sihanouk-ville	13	14	15	16	16	15	15	8	10	10
Koh Kong	-	-	-	-	-	-	-	-	-	-
Total	**13**	**14**	**15**	**16**	**16**	**15**	**15**	**8**	**10**	**10**

(Source: DoF 2002).

Other types of seine used in Cambodian waters are listed below.

Anchovy encircling seine (Khmer name *Uon Ka Koeum*)
The use of anchovy encircling seines began in Cambodia during the 1960s. This gear type is used to catch anchovy during the daytime. This gear type is mostly used by fishers based in Sihanoukville and Koh Kong (Table 11), and is constructed using meshing similar to that of a mosquito net. Anchovy encircling seines are now rarely used due to the declining availability of target species, and increased prevalence of pair trawling and light luring purse seines.

Table 11 Number of anchovy encircling seine nets used in the coastal provinces and municipalities of Cambodia from 1992 to 2001. (set)

Province/ Municipality	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Kep	-	-	-	-	-	-	-	-	-	-
Kampot	-	-	-	7	7	-	-	-	-	-
Sihanoukville	1	-	1	1	1	1	-	1	3	3
Koh Kong	12	13	8	7	2	1	-	2	2	-
Total	**13**	**13**	**9**	**15**	**10**	**2**	**-**	**3**	**5**	**3**

(Source: DoF 2002).

Beach seine (Khmer name *Uon Khow*)

Beach seines are widely used in shallow water or along beaches. Fishers operate this gear with non-motorised boats or pull them along sandy beaches without the assistance of hauling devices. All beach seines used in coastal areas of Cambodia have the same design and are effective in capturing small fishes, including anchovy, sardine, and shrimp inhabiting shallow water areas with sandy substrate. This fishing gear is most commonly used by fishers based in Kampot province and Kep municipality (Table 12).

Table 12 Number of beach seines used in the coastal provinces and municipalities of Cambodia from 1992 to 2001. (set)

Province/ Municipality	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Kep	-	-	-	-	-	-	3	3	3	2
Kampot	3	19	6	-	-	22	-	13	19	19
Sihanoukville	14	-	-	6	1	4	-	-	-	-
Koh Kong	1	-	-	-	-	-	4	4	4	-
Total	**18**	**19**	**6**	**6**	**1**	**26**	**7**	**20**	**26**	**21**

(Source: DoF 2002).

Encircling seine (Khmer name *Uon Houm*)

Fishers use encircling seines to capture a variety of fish species. The use of this gear relies on the deployment of an anchor lure, or a branch of a tree, to aggregate schools of fish. This fishing gear is used infrequently in Cambodian waters and only 2 units were recorded to be in use during 2001 (Table 13).

Table 13 Number of units of encircling seine used in coastal provinces and municipalities of Cambodia from 1992 to 2001. (set)

Province/ Municipality	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Kep	-	-	-	-	-	-	3	3	3	2
Kampot	-	-	-	-	-	22	-	-	-	-
Sihanoukville	14	-	-	6	1	4	-	-	-	-
Koh Kong	1	-	-	-	-	-	4	4	4	-
Total	**15**	**-**	**-**	**6**	**1**	**26**	**7**	**7**	**7**	**2**

(Source: DoF 2002).

1.1.2.3 Gill net (Khmer name Mong Paehk*)*

Many types of gill net with various mesh sizes are used in Cambodian waters. The use of gillnets in Cambodia is common and they are typically used in inshore water areas to target a multitude of species. For example, drift gill nets are set just below the surface to target and catch various pelagic species, including mackerel, barracuda, shark, and trevally. Most gill nets are set on the bottom using anchors or heavily ballasted leadlines to target and catch a variety of demersal species. These fishing gears are used during the night and day, largely depending on the availability of target resources.

Table 14 Number of units of gill net used in the coastal provinces and municipalities of Cambodia from 1992 to 2001. (metres)

Province/ Municipality	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Kep	-	-	-	-	500	700	800	1,000	1,000	4,200
Kampot	61,055	3,940	2,780	27,091	27,091	9,479	1,800	1,800	1,800	20,900
Sihanoukville	4,125	3,200	3,950	2,900	3,900	3,600	3,600	49,100	41,900	50,400
Koh Kong	-	1,800	-	-	-	-	-	138,830	187,135	250,000
Total	**65,180**	**8,940**	**6,730**	**29,991**	**31,491**	**13,779**	**6,200**	**190,730**	**231,835**	**325,500**

(Source: DoF 2002).

Species-specific gill nets are also used in Cambodian waters. These fishing gear are typically named according to the species they are used to target.

Mackerel gill net (Khmer name *Mong Trey Kamong*)

This fishing gear is designed to catch pelagic species, including mackerel, which represents more than 80 to 90% of the total catch in this gear. Article 27 of Cambodia's Fisheries Law (in Khmer called *Kret Chhbab Lek 33 Kra. Chor*), enacted on 9 March 1987, prohibits the fishing for mackerel from 15 January to 31 March each year, as it is believed this is the period in which mackerel spawn. Most fishers use more than one gear type, enabling them to target other species during the closed season for mackerel. Mackerel gill nets are mainly used by fishers based in Sihanoukville municipality and Koh Kong province (Table 15).

Table 15 Number of units of mackerel gill net used in coastal provinces and municipalities of Cambodia from 1992 to 2001. (metres)

Province/ Municipality	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Kep	-	-	-	-	-	-	-	-	-	-
Kampot	-	-	9,450	-	-	-	-	-	-	-
Sihanoukville	3,700	9,800	26,600	12,050	15,550	17,620	26,900	84,600	64,700	64,700
Koh Kong	-	-	-	-	-	113,600	113,600	113,600	113,600	-
Total	**3,700**	**9,800**	**36,050**	**12,050**	**15,550**	**131,220**	**140,500**	**198,200**	**178,300**	**64,700**

(Source: DoF 2002).

Scomberomorus gill net (Khmer name *Mong Trey Beka*)

This type of gill net is widely used in Sihanoukville municipality and Koh Kong province (Table 16). Single fishing boats use between 1 to 10km of net, depending on the size of the boat. The nets used by smaller vessels (10-90 HP) are approximately 9 m in depth, whilst those used by larger vessels (>90 HP) range between 9 and 18 m in depth. Scomberomorus gill nets are set on the seafloor to target and catch various pelagic fish species. The main species caught by this gill net type are *Scomberomorus* spp., scads, and sharks.

Table 16 Number of units of Scomberomorus gill net used in the coastal provinces and municipalities of Cambodia from 1992 to 2001. (metres)

Province/ Municipality	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Kep	-	-	-	-	-	-	-	-	-	-
Kampot	-	-	-	1,200	1,200	-	8,700	-	-	-
Sihanoukville	29,600	30,000	44,700	46,600	50,100	43,800	45,800	86,600	100,000	100,000
Koh Kong	1,800	1,200	14,895	1,200	32,100	23,000	30,500	53,500	48,000	84,000
Total	**31,400**	**31,200**	**59,595**	**7,000**	**83,400**	**66,800**	**85,000**	**140,100**	**148,000**	**184,000**

(Source: DoF 2002).

Shrimp gill net or Trammel net (Khmer name *Mong Bang Kear*)

Trammel nets are widely used throughout Cambodian waters and most commonly in Sihanoukville and Koh Kong province (Table 17). This gear type consists of two or three panels of netting of different mesh sizes. In a trammel net with three panels, the two outer panels typically have a mesh size of 8 to 10 cm, whilst the inner panel has a 3.8 to 4.2cm mesh size. Fishers use trammel nets to target and catch a variety of demersal species of all shapes and sizes, as this gear type is most often set on the seafloor and is not selective for fish size or shape. Trammel nets are considered highly effective fishing gear for shrimp, catfish, and silver and black pomfrets.

Table 17 Number of units of shrimp gill net or trammel net used in the coastal provinces and municipalities of Cambodia from 1992 to 2001. (metres)

Province/ Municipality	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Kep					200	300	1,000	1,000	2,000	1,200
Kampot	9,775	4,050	1,600	13,143	13,143	10,500	9,750	4,100	4,100	27,100
Sihanoukville	102,905	86,800	109,350	135,200	168,700	145,700	145,700	121,900	104,900	104,900
Koh Kong	2,025	2,600		13,143	512,520	312,600	312,600	869,055	542,890	190,000
Total	**114,705**	**93,450**	**110,950**	**161,486**	**694,563**	**469,100**	**469,050**	**996,055**	**653,890**	**323,200**

(Source: DoF 2002).

Crab gill net (Khmer name *Mong Kdam*)

This is another type of gill net constructed with various mesh sizes and sufficient ballast to enable it to be set on the seafloor of inshore water areas. Mesh sizes used range from 4 to 10cm depending on water depth or fishing area. Nets used in shallow water areas have mesh sizes from 4 to 8 cm and 80% of the nets have a mesh size of 6cm. Approximately 80 to 95% of total catches in this net type is swimming crab (*Portunis pelagicus*). For deeper inshore waters, a mesh size of 8-10 cm is used and 80 to 90% of the catch is crab. The length of crab gill nets used in coastal areas is shown in Table 18.

Table 18 Number of units of crab net used in coastal provinces and municipalities of Cambodia from 1992 to 2001. (metres)

Province/ Municipality	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Kep					300	500	20,000	10,000	10,000	10,000
Kampot	34,042	11,500	21,450	30,364	30,364	10,900	24,200	40,755	27,600	27,600
Sihanoukville	7,450	18,000	16,000	35,000	38,500	87,500	87,500	219,500	204,000	225,000
Koh Kong	2,360	2,600		30,364	511,275	294,300	294,300	268,290	719,770	372,600
Total	**43,852**	**32,100**	**37,450**	**95,728**	**580,439**	**393,200**	**426,000**	**538,545**	**961,370**	**635,200**

(Source: DoF 2002).

Clupea gill net (Khmer name *Mong Trey Kbork*)

This is yet another type of gill net constructed with various mesh sizes for use in shallow or inshore waters. It has a mesh size of 3.5cm and is used to capture demersal and pelagic fishes, especially *Clupea* spp.. Single small-scale fishing boats carry 150 to 200m of this gill net and it is used throughout the year, mainly by fishers based in Sihanoukville municipality (Table 19).

Table 19 Number of units of Clupea gill net used in coastal provinces and municipalities of Cambodia from 1992 to 2001 (metres).

Province/ Municipality	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Kep									2,500	
Kampot								5,700	7,600	7,600
Sihanoukville	400	1,200	3,000	8,850	10,250	15,900	15,900	19,900	19,900	19,900
Koh Kong	100					8,000	8,000	8,000	8,000	
Total	**500**	**1,200**	**3,000**	**8,850**	**10,250**	**23,900**	**23,900**	**33,600**	**38,000**	**27,500**

(Source: DoF 2002).

1.1.2.4 Other (push nets, trolling, hand line, long line, trap)

Push nets (Khmer name *Chhep Yun*)
Push nets are recognised as a destructive fishing gear and it is prohibited to deploy this gear using an engine-powered vessel in Cambodia. Despite this, the illegal use of push nets is widespread. Push nets usually have a mesh size smaller than 1 cm, and are unselective in terms of the size and species of fish caught. The use of push nets in areas of sensitive habitat areas is thought to be a key contributing factor to seagrass loss in Cambodia.

Traps (Khmer name *Lop*)
There are many types of traps used in Cambodian waters. They are constructed from different types of material. For example, crab traps (Khmer name *Lop Kdarm*), previously made from bamboo and very big, are now made from netting and are collapsible. This enables a single fisher to use more than 100 traps. Bamboo fish traps (Khmer name *Lop Trey*) are also commonly used. This gear type is constructed in a variety of sizes and is used in conjunction with a bamboo-fender.

Octopus and squid traps (Khmer name *Lop Meuk*) are used widely in Cambodia, and bamboo framed octopus and squid traps are common small-scale fishing gear. In some areas fishers have begun covering trap frames with netting in order to catch fish. The data recorded by the DoF does not differentiate between trap types (Table 20).

Table 20 The number of traps (crab trap, squid trap and fish trap combined) used in the coastal provinces and municipalities of Cambodia from 1992 to 2001.

Province/ Municipality	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Kep	-	-	-	-	100	200	1,000	500	11,550	10,000
Kampot	-	-	997	151	151	2,303	1,745	1,745	1,745	6,175
Sihanoukville	-	320	1,280	1,600	1,450	1,620	1,420	2,300	2,080	2,080
Koh Kong	60	317		151	25,060	19,077	19,077	29,415	35,874	48,000
Total	**60**	**637**	**2,277**	**1,902**	**26,761**	**23,200**	**23,242**	**33,960**	**51,249**	**66,255**

(Source: DoF 2002).

Horizontal longlines (Khmer name *Santouch Ro Noung*)
This is the simplest of fishing gear and requires only a line and a baited hook. The line is equipped with hooks, which may be single or multiple, big or small, depending on the species desired. Horizontal longlines are commonly used in Sihanoukville and Koh Kong (Table 21).

Table 21 Number of units of horizontal longlines used in the coastal provinces and municipalities of Cambodia from 1992 to 2001 (hooks).

Province/ Municipality	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Kep	-	-	-	-	-	-	-	-	-	-
Kampot	-	-	-	-	-	-	-	-	-	-
Sihanoukville	-	750	590	1,950	1,650	1,450	1,450	7,500	14,150	14,300
Koh Kong	16,000	10	330		12,970	3,300	3,300	1,100	1,210	1,300
Total	**16,000**	**760**	**920**	**1,950**	**14,620**	**4,750**	**4,750**	**8,600**	**15,360**	**15,600**

(Source: DoF 2002).

Ranking by type of fishing gear
The relative importance of fishing gear types to fishing communities and fish production has not been investigated in Cambodia. The Coastal Zone Management Project ranked major species by specific fishing gears (Table 22).

Table 22 The species targeted by different fishing gears in Cambodia.

Fishing gear		Target group	Secondary group
English Name	Khmer Name		
Mackerel gill net	Mong Trey Kamong	*Rastrelliger brachysoma*	*Rastrelliger kanagurta, Megalaspis cordyla, Thunnus tonggol*
Anchovy encircling seine	Uon Ka Koeum	*Stolephorus indicus*	
Shrimp gill net	Mong Bang Kear	*Penaeus merguiensis*	
Fish gill net	Mong Trey	*Scomberomorus guttatus, Thannus thannus, Ariidae thalassinus, Eleuteronema tetradactilum, Liza argentea, Valamugil ceheli, Rastrelliger brachysoma, Rastrelliger kanagurta, Megalaspis cordyla, Formio niger, Lates calcarifer,* Dasyatidae	Serranidae, Lutjajisdae, Nemipteridae, Sciaenidae, Drepanidae, Siganidae, Trichiuridae, Stromatoidae, Chirocentridae and Synodontidae.
Crab gill net	Mong Kdam	*Portunus* spp., *Scylla serrata*	
Crab trap	LopKdam	*Portunus* spp., *Scylla serrata*	
Squid trap	Lop Meuk	*Sepioteuthis lessoniana, Loligo* spp.	
Fish stake trap		Mixed fish species	
Horizontal longline	Santouch Ro Noung	Orectolobidae, Carcharinidae, Dasyatidae, Serranidae, Lutjanidae	
Push net	Chhep Yun	Mixed fish, *Metapenaeus* spp. Sepiolidae, *Octopus* spp.	
Shellfish dredge	Chhneang os khchorng	Arcidae, Veneridae	
Beach seine net	Uon Khow	Mixed fish, Sepiolidae, *Loligo* spp.	

Note: For common names of the species mentioned in Table 22 see Table 28.
(Source: MoE 1996).

Fishing vessel effort

The number of fishing vessels in Cambodian waters fluctuates according to the distribution and abundance of natural resources and broader socioeconomic, market and political conditions. Unfortunately, existing data does not enable the estimation of the number of fishing vessels by the different types of fishing gears used. This is because each fishing vessel may operate more than one type of fishing gear and they change the type of gear used according to the season. The number of fishing vessels by coastal province and municipality is summarised in Tables 23 to 26.

Table 23 Number of marine fishing vessels in Kampot province, Cambodia.

Year	Boats without engines and less than 5T		Boats with engines									
			<10 HP		10-30 HP		30-50 HP		>50 HP		Total	
	Number	Stock	Unit	HP	Unit	HP	Unit	HP	Unit	HP	Unit	HP
1992	200	-	-	-	227	-	-	-	-	-	227	-
1993	100	0.2-0.5	64	227	35	560	-	-	2	460	101	1,247
1994	110	-	60	-	23	-	-	-	-	-	83	-
1995	-	-	-	-	-	-	-	-	-	-	-	-
1996	100	-	50	-	30	-	25	-	-	-	105	-
1997	110		50	-	30	-	25	-	-	-	105	-
1998	110	110	119	810	102	1,408	-	-	-	-	221	2,218
1999	120	-	67	392	111	1,471	-	-	-	-	178	1,863
2000	136	-	67	392	111	1,471	-	-	-	-	178	1,863
2001	133	66	151	823	252	3,379	1	40	12	1,154	416	5,396

(Source: DoF 2002).

Table 24 Number of marine fishing vessels in Sihanoukville municipality, Cambodia.

Year	Boats without engines and less than 5T		Marine boats with engines									
			<10 HP		10-30 HP		30-50 HP		>50 HP		Total	
	Number	Stock	Unit	HP	Unit	HP	Unit	HP	Unit	HP	Unit	HP
1992	432	-	-	-	720	-	187	-	-	-	907	-
1993	452	0.2-0.5	-	-	552	52,274	163	25,273	-	-	715	77,547
1994	391	-	-	-	656	-	177	-	-	-	833	-
1995	423	-	-	-	646	5,900	174	27,580	-	-	820	33,480
1996	180	-	-	-	692	6,720	167	26,211	-	-	859	32,931
1997	310	-	-	-	654	7,265	150	24,249	-	-	804	31,514
1998	237	47	198	1,208	467	6,043	23	875	162	26,630	850	34,756
1999	-	-	-	-	855	10,736	245	34,928	-	-	1,100	45,664
2000	-	-	144	894	727	10,111	33	1,223	266	37,417	1,170	49,645
2001	286	57	167	1,054	809	11,503	33	1,223	269	37,415	1,278	51,195

(Source: DoF 2002).

Table 25 Number of marine fishing vessels in Koh Kong province, Cambodia.

Year	Boats without engines and less than 5T		Marine boats with engines									
			<10 HP		10-30 HP		30-50 HP		>50 HP		Total	
	Number	Stock	Unit	HP	Unit	HP	Unit	HP	Unit	HP	Unit	HP
1992	-	-	-	-	215	1,076	-	-	178	27,765	393	28,841
1993	330	0.2-0.5	1,018	4,120	14	348	87	6,142	111	24,551	1,230	35,161
1994	245	-	1,207	-	26	-	96	-	182	60,200	1,511	60,200
1995	-	-	260	1,820	12	237	71	5,567	138	29,752	481	37,376
1996	2,932	-	282	2,138	132	3,460	8	356	156	26,158	578	32,112
1997	71	-	2,110	22,495	311	6,097	31	1,275	140	18,855	2,592	48,722
1998	71	-	2,110	-	311	-	31	-	140	-	2,592	-
1999	-	-	1,622	9,759	562	7,921	34	1,240	225	35,972	2,443	54,892
2000	19	-	2,787	17,902	406	5,658	32	1,410	271	31,390	3,496	56,360
2001	71	-	2,518	14,723	597	8,446	93	2,920	217	25,861	3,425	51,950

(Source: DoF 2002).

Table 26 Number of marine fishing vessels in Kep municipality, Cambodia.

Year	Boats without engines and less than 5T		Marine boats with engines									
			<10 HP		10-30 HP		30-50 HP		>50 HP		Total	
	Number	Stock	Unit	HP	Unit	HP	Unit	HP	Unit	HP	Unit	HP
1996	100	-	60	320	-	-	-	-	-	-	60	320
1997	110	-	60	-	-	-	-	-	-	-	60	-
1998	110	110	61	305	8	116	-	-	-	-	69	421
1999	120	-	60	300	4	60	-	-	-	-	64	360
2000	136	-	135	675	58	870	-	-	-	-	193	1,545
2001	133	66	140	700	52	780	-	-	-	-	192	1,480

(Source: DoF 2002).

1.1.3 Economic value of catch (estimated or actual)

According to the marine fisheries statistics in Table 1, as well as a survey by Tana and Todd (2002), it can be estimated that the total volume of marine capture fisheries production in Cambodia is between 30,000 to 50,000 tonnes per year.

Seafood from Cambodia is exported to several countries in South-east Asia, including China, Thailand, Viet Nam, and Singapore. Thus far, many kinds of seafood have been exported (Table 27).

Approximately 15 to 25% of the total marine catch is exported annually. It should be noted that these exports are almost exclusively unprocessed (live or chilled) products.

Table 27 Volume and values of marine fishery product exports from Cambodia in 2000.

Items	Export volume (tonnes)	Total cost (US$)	Total export value (US$)	Value added (US$)
Chilled shrimp meat	500	625,000	875,000 - 1,000,000	250,000 - 375,000
Chilled crab meat	500	1,500,000	2,250,000	750,000
Frozen pealed shrimp	320	2,400,000	3,000,000	600,000
Frozen squid/octopus	140	140,000	250,000	110,000
Live ornamental fish	10	19,000 - 20,000	29,000 - 31,200	10,000 - 11,200
Live mantis shrimp	10	44,000	66,000	22,000
Live short neck clam	5,000	1,250,000 - 1,500,000	2,500,000 - 2,750,000	1,000,000 - 1,250,000
Live blood cockle spat	500	220,000	475,000	255,000
Dried seaweed	120	50,000	72,000	22,000
Total	**7,100**	**6,250,000 - 6,500,000**	**9,500,000 - 9,900,000**	**4,770,000 - 5,420,000**

Note: Export values expressed as Free on Board (F.O.B.).
(Source: Tana and Todd 2002).

1.1.4 Importance of the fisheries sector in terms of employment and dependence

The coastal population of Cambodia is approximately 1 million people. Estimates of the number of people involved in coastal and marine fisheries differ widely. One estimate is that about 40% of the coastal population are full-time fishers and 30% are part-time fishers. Another estimate is that only 10% of the coastal population is involved in fisheries, including processing and marketing. The majority of fishers are operating on the small-scale or subsistence level, and these fishers do not need to be licensed. Moreover, the majority of fisher households also have small farming plots. The civil war and the Khmer Rouge regime severely disrupted the traditional fishing community system in Cambodia. During this period, coastal and marine fisheries were almost completely abandoned and only rice farming was encouraged. In recent years, there has been a significant migration of poor people from inland rural areas to the coast. These people mostly engage in fisheries because it requires little investment and is open access, although they typically have no experience in marine fisheries.

Information regarding the socioeconomic dependence of Cambodians on marine fisheries is scarce. In terms of income, people in the coastal provinces have average per capita incomes slightly below the national average of US$21 per month and somewhat above the average for the rural population (Ministry of Planning 1999). Most households obtain income from more than one occupation, and there are no estimates of the number of households with fishing as their main source of income.

Cambodian people traditionally prefer freshwater fish to seafood. This is true even in the coastal areas. It has been estimated that only about 20% of products from marine capture fisheries are used for local consumption. The shrimp fishery developed rapidly after 1981, but declined dramatically during the 1990s. Most shrimp fishers changed from using trawl nets to gill nets, although catches are continuing to decline. Due to a lack of infrastructure and the taxation system, a large part of the marine catch in Koh Kong province is (illegally, and hence unrecorded) exported directly to Thailand. There are very few facilities for processing of seafood and, with the exception of a Hong Kong based company operating a factory in Sihanoukville for production and export of frozen shrimp, most are operating on a small scale. The shrimp factory only operates during the shrimp season. It has about 100 local employees, mostly women. Other industries include fish-sauce production and processing of steamed mackerels. There is also a fishmeal factory in Sihanoukville, which produces fishmeal from dried trash fish, and most of the employees are women.

The Cambodian fishing fleet is generally low technology, and most vessels operate only in inshore waters on one-day trips. In addition, they use only ice for storing the catch. Interest from foreign and local private investors in Cambodia's fisheries has mostly focused on freshwater fisheries, due to the importance and value assigned to this sector. There is very little private sector investment in Cambodia's marine fisheries, with most vessels operated by the owner and a hired crew.

A social survey in Kampot province found that from among 26 fishing communities, 70% of 7,001 households were involved in marine fishing. Those families could earn an average monthly income of US$25 to 30 from fishing, and a maximum of US$64, depending on their ability, capacity, and financial resources. Incomes are better for fishing communities in Sihanoukville and Koh Kong than those of the Kampot social survey group, due to the availability of wider and more productive fishing grounds (Tana and Todd 2002).

2. SPECIES OF REGIONAL, GLOBAL AND/OR TRANSBOUNDARY SIGNIFICANCE

According to the fisheries statistics collected from provincial and municipal Fisheries Offices and the DoF, catches are not sorted by species, although some species are sorted by higher taxon. Therefore, it is difficult to identify trends relating to species of transboundary significance and effects of exploitation and management. Based on existing data and information collected by the DoF, it may be concluded that Cambodian waters are characterised by high levels of species diversity, and that this diversity is similar to that observed for marine areas of other regional countries.

According to Tana (1999), Cambodia's commercially important fish species include about 30 species from the Mackerel, Scad, Anchovy and Snapper groups. Those species are abundant from September to January, whereas the peak period for *Penaeus* and *Metapenaeus* shrimps is May-August. Blue swimming crab, squid and cuttlefish are available throughout the year. There is a diverse range of important mollusc species in Cambodia, and the most important commercial species, such as green mussel and oysters are mainly found in the Koh Kong estuary. Blood cockle is abundant in Thmar Sar of Kampong Som Bay and Trapeang Ropov of Kampot Bay. Marine mammals and reptiles, including dugong, sea turtles and dolphins, also inhabit Cambodian waters. Dugong is usually found in sea grass beds of Kampot bay from November to December, whilst a variety of dolphin species are present throughout the year within the region. Sea turtles, especially Hawksbill, Green, and Loggerhead turtles are observed in inshore waters adjacent to nesting beaches.

2.1 Ranking of Importance in Terms of Landings, Value, Status and Food Security

2.1.1 Landings

As mentioned previously, data on landings is not broken down by species or species group. The total catch has been broken down by province as shown in Tables 2 to 5. It is very difficult to make any inferences from these data as the changes may reflect changes in effort and market demand, rather than changes in stock availability. For example, catch of low value fish in Koh Kong province decreased drastically in the 1990s, whereas it increased in the other provinces. This probably coincided with the collapse of shrimp farming in Koh Kong and the declining catches may not be indicative of localised depletion of finfish stocks in Koh Kong. Overall, finfish rank highest, followed by low-value fish, shrimps, cephalopods, and crabs.

2.1.2 Local Market Value (local currency, year)

Informal surveys of market prices for marine fishes, crustaceans and molluscs (Table 28) have provided values in the range of 1,000-28,000 Riels per kg for fish species, and 500-50,000 Riels per kg for invertebrates (3,800 Riels = 1 US$). These prices only cover species used for human consumption. Given that up to 60% of the catch is low-value fish, and further assuming an average price for edible species of US$1 per kg, the total value of the annual marine catch is estimated at US$15 to 30 million. This value does not include the returns for fisheries products landed outside the country (illegally) nor the value to the subsistence or artisanal sector.

Only a few species of fish, molluscs, and crustaceans have high value in the domestic market. The domestic market for reef fish, especially groupers, is very strong. Reef fish are also an important export commodity. As such, reef fish catches have grown rapidly in Cambodia. Price for reef fish in Cambodia's domestic markets is responsive to market conditions in Hong Kong, Singapore, Thailand, Taiwan, and Japan, as these countries represent the major export markets for Cambodian seafood.

Field studies conducted in Sihanoukville municipality by Jensen & Try (2002) found over 21 fish species, 12 bivalve species, 7 gastropod species, 10 crab species, and 1 horseshoe crab species with high value in the domestic market (Table 28). Among the molluscs and crustaceans, cephalopods, short-neck clam, shrimp, mantis shrimp, mud crab and swimming crab are the most valuable products domestically, as local price is responsive to price for these products in international markets. International demand and price for these products continues to grow.

Table 28 The marine fishery resources of high value in the Psar Loeur Market, Sihanoukville, Cambodia in 2002. (Approximate Exchange Rate: 3850 Riel/USD)

Fishes

No.	Scientific name	Common name	Khmer name	Price (Riel/Kg)
1	*Cromileptes altivelis* (Valenciennes, 1828)	Humphack grouper	Trey Tok Ke Chrouk	24,000-28,000
2	*Pomacanthus annularis* (Bloch, 1787)	Bluering angelfish	Trey Me Ham Boa	23,000-25,000
3	*Epinephelus coioides* (Hamilton, 1822)	Orangespotted grouper	Trey Tok Ke Koa	22,000-28,000
4	*Pampus argenteus* (Euphrasen, 1788)	Silver pomfret	Trey Chab Sor	20,000-26,000
5	*Epinephelus faciatus* (Forsskål, 1775)	Blacktip grouper	Trey Tok Ke Kra horm	18,000-20,000
6	*Plectropomus oligocanthus* (Bleeker, 1854)	Highfin grouper	Trey Tok Ke Uch Kiev	18,000-25,000
7	*Epinephelus quoyanus* (Valenciennes, 1830)	Longfin grouper	Trey Tok Ke Para	11,000-16,000
8	*Diagramma pictum* (Thumberg, 1792)	Yellowdot sweetlips	Trey Ka chii	10,000-15,000
9	*Pampus chinensis* (Euphrasen, 1788)	Chinese silver pomfret	Trey Chab Khmao	4,000-6,000
10	*Atelomycterus marmotatus* (Bennett, 1830)	Coral catshark	Trey Chhlam Khla	2,000-3,000
11	*Chiloscyllium punetatum* Müller & Henle, 1838	Brown-banded catshark	Trey Chham Chhmar	2,000-3,000
12	*Scarus quoyi* Valenciennes, 1840	Quoy's parrotfish	Trey Sek Khiev	2,000-2,500
13	*Himantura imbricata* (Bloch & Schneider, 1801)	Scaly whipray	Trey Bor Bel	1,500-2,000
14	*Sargocentron rubrum* (Forsskål, 1775)	Redcoat	Trey Kror horm sraka tom	1,500-2,000
15	*Strabozebrians cancellatus* (McCulloch, 1916)	Harrowed Sole	Trey An Dat Chhek	1,500-2,500
16	*Siganus virgatus* (Valenciennes,)	Doublebarred spinefoot	Trey Korn Taing Tmor	1,500-2,200
17	*Cephalopholis formosa* (Shaw & Nodder, 1812)	Bluefined grouper	Trey Tok Ke Kroeum	1,300-1,800
18	*Diploprion bifaciatum* Kuhl & Van Hasselt, 1828	Yellow emperor	Trey Sek Loeung	1,100-1,500
19	*Siganus argenteus* (Quoy & Gaimard, 1825)	Silver spinefoot	Trey Korn Tang Pe	1,100-1,500
20	*Siganus canaliculatus* (Park, 1797)	Whitespotted spinefoot	Trey Korn Tang Kro Ub	1,100-1,500
21	*Siganus guttatus* (Bloch, 1727)	Goldenspotted spinefoot	Trey Korn Tang Phoeung	1,100-1,500

(Source: Jensen and Try 2002).

Bivalves

No.	Scientific name	Common name	Khmer name	Price (Riel/Kg)
1	*Anadara nodifera* (Martens, 1860)	Nodular ark	Kreng Chhiem	1,800-3,000
2	*Amusium pleuronectes* (Linnaeus, 1758)	Asian moon scallop	Khchorng plate	1,800-2,500
3	*Meretrix lyrata* (Sowerby, 1851)	Lyrate hard clam	Kreng Sor	1,500-2,500
4	*Paphia undulata* (Born, 1778)	Undulate venus	Krum Kror Lar Hol	1,500-2,500
5	*Scapharca inaequivalvis* (Bruquière, 1789)	Inequivalve ark	Kreng Chheim Meat Viech	1,500-2,500
6	*Anadara binakayanensis* (Faustino, 1932)	Globose ark	Kreng Chheim Mor Mis	1,500-2,500
7	*Pteria penguin* (Röding, 1798)	Penguin wing oyster	Krum se	1,500-2,000
8	*Pinna bicolor* Gmelin, 1791	Bicolor pen shell	Krum Chorb Chik	1,500-2,000
9	*Meretrix lusoria* (Röding, 1798)	Poker-chip venus	Ngeiv Hol	1,000-2,000
10	*Perna viridis* (Linnaeus, 1758)	Green mussel	Krum Cham Puch Tea	500-1,000
11	*Donax cuneatus* Linnaeus, 1758	Cradle or cuneate donax	Ngeav Sor	500-1,500
12	*Polymesoda erosa* (Solander, 1786)	Common geloina	Ngeav Puok	500-1,500

(Source: Jensen and Try 2002).

Gastropods

No.	Scientific name	Common name	Khmer name	Price (Riel/individual)
1	*Turbo marmoratus* Linnaeus, 1758	Green Turbo or Green snail	Khchorng Prak	15,000-30,000
2	*Haliotis asinina* Linnaeus, 1758	Donkey's ear abalone	Khchorng Pav Hoeur Vieng	7,000-10,000
3	*Haliotis ovina* Gmelin, 1791	Oval abalone	Khchorng Pav Joeur Khey	7,000-10,000
4	*Turbo petholatus* Linnaeus, 1758	Tapestry turban	Khchorng Kror La Proum	3,000-6,000
5	*Strombus canarium* Linnaeus, 1758	Dog conch	Khchorng Choeung Muoy	2,000-4,000
6	*Babylonia areolata* (Link, 1807)	Maculated ivory whelk	Khchorng Pong Krouch	1,500-3,000
7	*Melo melo* (Lightfoot, 1786)	Indian volute	Khchorng Dong	1,500-3,000

(Source: Jensen and Try 2002).

Marine Crabs & Horseshoe crab

No.	Scientific name	Common name	Khmer name	Price (Riel/Kg)
1	*Scylla serrata* (Forsskål, 1775)	Giant mud crab	Kdam Thor	45,000-50,000
2	*Charybdis feriatus* (Linnaeus, 1758)	Crucifix crab	Kdam Khlar	25,000-40,000
3	*Thalamita crenata* (Latreille, 1829)	Crenate swimming crab	Kdam Thor Kiev	25,000-40,000
4	*Charybdis anisodon* (de Haan, 1850)	Two spined arm swimming crab	Kdam Dorng Kieb Sor	7,000-20,000
5	*Portunus pelagicus* (Linnaeus, 1758)	Flower crab or swimming crab	Kdam Se	7,000-20,000
6	*Tachypleus gigas* (Müller, 1785)	Traingular-tail horseshoe crab	Balang Kak	7,000-15,000
7	*Charybdis natator* (Herbst, 1789)	Hairy swimming crab	Kdam Neak	4,000-6,000
8	*Episesarma singaporenes* (Tweedie, 1936)	Singapore vinegar crab	Kdam Chorr	4,000-6,000
9	*Episesarma versicolor* (Tweedie, 1940)	Violet vinegar crab	Kdam Chorr	4,000-6,000
10	*Podophthalmus vigil* (Fabricius, 1798)	Sentinel crab	Kdam Phneak Vieng	3,000-6,000
11	*Ozius quttatus* Milne Edward, 1834	Spottedbelly rock crab	Kdam Pkor lienn	1,500-2,500

(Source: Jensen and Try 2002).

A socio-economic survey conducted in Kep, Sihanoukville and Koh Kong found that the price of commercial fisheries products differs from one location to another, and from one year to the next (CZM 1999). The prices for fish, shrimp and crabs, in the villages selected for the surveys, showed significant variation due to different size and species compositions of landings. Futhermore, the prices observed were lower than those of the actual market, because the villages involved in the survey have monopoly position traders (Khmer and Thai) who come to buy different products. The villagers do not have other options for selling their products. Some fishers have their own traders, as the traders and fishers can sell or buy products from one another on a credit basis. In these cases, the fishers know that the price they obtain for the fishery products sold to traders are lower than the prices they could obtain in the market. However, they have little choice other than to continue on this basis as they rely on the availability of credit. The villages involved in the study also have some small processing factories (e.g. for fish sauce and for packing shrimps, crabmeat and fishes for export to Hong Kong, Taiwan and Macau).

In Sihanoukville: Six villages participated in this survey, including Village I, Village II, Bot Korki, and Koh Khchorng villages. The results from the survey are shown in Table 29. Price was not collected at the species level.

Table 29 The prices of marine fisheries products in six villages of Sihanoukville, Cambodia in 1998.

Village	Fish (Riel/Kg)	Crab (Riel/Kg)	Shrimp (Riel/Kg)	Mantis shrimp (Riel/Kg)	Blood Cockle (Riel/Kg)	Squid (Riel/Kg)
Village I, quarter III	600-40,000	2,000-4,000	10,000-40,000	-	-	3,000-4,000
Village I, quarter I	300-30,000	-	1,800-40,000	-	-	2,000-7,000
Village II, O Tress quarter	100-6,000	1,300-2,000	F: 7,000-30,000 D: 22,000-30,000	22,000-30,000	-	500-3,000
Village I, Tomnup Rolort Thmei quarter	200-7,000	1,000-3,300	1,000-20,000	1,000-8,000	-	500-3,000
Bot Korki	200-4,000	2,000-14,000	5,000-30,000	-	700-1,500	3,000-3,500
Koh Khchorng	300-8,000	2,000-15,000	5,000-35,000	-	1,000-2,000	-

(F: Fresh shrimp, D: Dried shrimp).

In Kep municipality: 5 villages participated in the survey, namely Kep, Angkaul, Thmei, O Krosar and Ampeng (Table 30).

Table 30 The prices of marine fisheries products in five villages of Kep municipality, Cambodia in 1998.

Village	Fish (Riel/Kg)	Crab (Riel/Kg)	Shrimp (Riel/Kg)	Squid (Riel/Kg)
Kep	300-3,000	F: 1,500-2,500	7,000-1,7000	2,000-3,000
Angkaul	1,000-3,000	F: 3,000-3,500	1,000-13,000	-
Thmei	300-3,000	F: 1,000-3,500	5,000-10,000	2,000-5,000
O Krosa	300-5,000	F: 1,000-3,000	800-8,000	2,000-5,000
Ampeng	200-3,000	F: 800-1,300 M: 3,800	1,000-15,000	-

(F: fresh; M: meat).

In Koh Kong: 3 villages participated in the survey, namely Koh Sdech, Chhroy Svaiy Khang Lech and Chhroy Phroh (Table 31).

Table 31 The prices of marine fisheries products in three villages of Koh Kong province, Cambodia in 1998.

Village	Fish(Riel/Kg)	Crab(Riel/Kg)	Mud crab (Riel/Kg)	Shrimp (Riel/Kg)	Squid (Riel/Kg)
Koh Sdaech	1,500- 5,000	F: 1,500-4,000	-	4,000-33,000	1,000-5,500
Chhroy Svaiy Khang Lech	800-2,500	M:4,000-7,000 F: 6,000	7,000-10,000	7,000-16,000	500-10,000
Chhroy Phroh	300-3,000	M: 4,000-5,000 F: 2,000	4,000-17,000	4,000-17,000	2,500

Note: all expenditure in Koh Kong involved Thai Baht (1 Thai Baht = 100 Riel).

2.1.3 Status

Many species of marine living resources are under threat from human activities and natural phenomena. These species require protection and conservation for future generations. The DoF considers the CITES resolution as a priority. Therefore, in order to manage, conserve and protect these resources, the DoF has qualitatively studied marine species diversity in Cambodia. However, there is insufficient information to determine the status of most marine species in Cambodia, making the classification of species as endangered, threatened or rare difficult. Some species of fish, reptiles, marine mammals, and cnidarians (corals) listed in CITES have been recognised as endangered species and are protected under national law. Several listed species occuring in Cambodian waters are described below. Table 32 summarises the species occurring in Cambodian waters that were listed on the IUCN Red List in 2003.

Marine reptiles

Marine reptiles were studied in Cambodian waters during the early 1940s by Bourret (1941) and Le Poulain (1941). These studies concerned the exploitation, trade, consumption and cultural value of these species. According to Groombridge and Luxmoore (1989), and Tana (1997), only two species of sea turtle have been found in Cambodia, namely the hawksbill turtle (*Eretmochelys imbricata*) and green turtle (*Chelonia mydas*). However, a field survey conducted by Try (1999) indicates that there are five species of sea turtle in Cambodia, namely the olive ridley (*Lepidochelys olivacea*), hawksbill turtle (*Eretmochelys imbricata*), loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas*), and leatherback turtle (*Dermochelys coriacea*).

Recent surveys resulted in the observation of a number of marine reptiles, including crocodiles and 3 species of sea turtles (hawksbill turtle, green turtle and leatherback turtle), 2 of which (the hawksbill turtle and green turtle) nest on Cambodia's inshore and offshore islands. The single crocodile was observed in the coastal area around Sre Ambel. Information from local fishers suggests that this was either the coastal crocodile species (*Crocodylus porosus*) or the Siamese crocodile (*Crocodylus siamensis*).

Marine mammals

There have been few studies of marine mammals in Cambodia. Tana (1997) reported that there are three species of marine mammals in Cambodian coastal waters, including the Irrawadi dolphin (*Orcaella brevirostris*), Spinner dolphin (*Stenella longirostris*) and Dugong (*Dugong dugon*). According to a recent study, there are 12 species of marine mammals of which 11 species are cetaceans (whales, dolphins, etc.) and 1 dugong (Annex 4) (Beasley *et al.* 2001). Longdy (2002) mentioned that otter had been observed in Koh Kong province, although no information exists regarding otter population size in that area.

Marine fishes

Several species of sharks, rays and bony fishes occurring in Cambodian waters have been included in the IUCN Red List, however, there is a paucity of information regarding their local status. Except for the groupers, there is no specific targeting of listed species in Cambodia.

Cnidaria

According to Tana (1997), 24 species of hermatypic corals and 14 species of soft corals have been identified in Cambodian waters. This figure is very low if compared to neighbouring countries. According to an unpublished report of Jensen and Try (2002), the number of hard coral species is 58 (probably

including non-hermatypic species) and 30 species of soft coral. Corals are threatened by destructive fishing methods (dynamite), collection for sale to tourists, as well as their crushing for use in the filtration of water used in holding tanks for live seafood species (fishes, mantis shrimps and slipper lobsters).

Table 32 Threatened or near threatened marine species in Cambodian waters.

Species	Common name	Occurrence in Cambodia (Jensen & Try, 2002)	IUCN category
Chelonia mydas	Green turtle	common, nesting	En
Eretmochelys imbricata	Hawksbill turtle	present, nesting	Cr
Caretta caretta	Loggerhead turtle	present? (unconfirmed)	En
Lepidochelys olivacea	Olive ridley	present? (unconfirmed)	En
Dermochelys coriacea	Leatherback turtle	present, rare	Cr
Batagur baska	Mangrove terrapin or Royal terrapin	present, rare	Cr
Feresa attenuata	Pygmy killer whale	present	DD
Grampus griseus	Grey dolphin	present	DD
Lagenodelphis hosei	Fraser's dolphin	present	DD
Neophocaena phocaenoides	Black finless porpoise	present	DD
Orcaella brevirostris	Irrawadi dolphin	present	DD
Sousa chinensis	Indo-Pacific Humpback Dolphin	present	DD
Stenella longirostris	Spinner dolphin	present	LR/cd
Tursiops aduncus	Indian Ocean bottlenose dolphin	(as *T. truncatus*)	DD
Dugong dugon	Dugong	present	Vu
Atelomycterus marmoratus	Coral catshark	?	NT
Carcharhinus amblyrhynchoides	Graceful shark	?	LR/nt
Carcharhinus amblyrhynchos	Grey reef shark	?	LR/nt
Carcharhinus dussumieri	Whitecheek shark	?	NT
Carcharhinus leucas	Bull shark	?	LR/nt
Carcharhinus limbatus	Blacktip shark	present	NT
Carcharhinus longimanus	Oceanic whitetip shark	?	LR/nt
Carcharhinus melanopterus	Blacktip reef shark	?	LR/nt
Chiloscyllium indicum	Slender bamboo shark	present	NT
Chiloscyllium punctatum	Brownbanded bamboo shark	present	NT
Galeocerdo cuvier	Tiger shark	present, rare?	LR/nt
Isurus oxyrhinchus	Shortfin mako	present, rare?	LR/nt
Prionace glauca	Blue shark	?	LR/nt
Pristis zijsron	Green sawfish	?	En
Rhincodon typus	Whale shark	present, rare	Vu
Scoliodon laticaudus	Spadenose shark	present	LR/nt
Sphyrna lewini	Scalloped hammerhead	present	LR/nt
Stegostoma fasciatum	Leopard shark	present	Vu
Triaenodon obesus	Whitetipped reef shark	?	LR/nt
Aetomylaeus nichofii	Banded eagle ray	present	Vu
Mobula japanica	Japanese devilray	(as *Manta birostris*)	NT
Tæniura lymma	Bluespotted fantail stingray	present, by-catch	NT
Hippocampus kuda	Seahorses	present (+2 other species)	Vu
Cephalopholis boenack	Chocolate hind	present	DD
Cromileptes altivelis	Humpback seabass	present	DD

Source: Jensen and Try (2002) and IUCN (2003).

2.1.4 Food security (locally)

Identification of the fish species important for food security is difficult, as coastal Cambodians typically select species of lowest market value for consumption purposes, including high value species of low quality (not fresh). High value species, including grouper, seabass, and mackerel are mostly exported to foreign markets. Cambodia has a richness of inland fisheries resources, which generally have lower prices than marine fisheries products. Information regarding the contribution of marine fisheries to food security in Cambodia is scarce.

2.2 Biology and Ecology of the Priority Species

Fish

A study identified 435 marine fish species from 202 genera and 97 families in Cambodian waters. It is estimated that approximately 70% of the annual catch is dominated by *Atule mate* (yellowtail scad), *Selar crumennophthalmus* (bigeye scad), *Decapterus maruadsi* (round scad) and other species of Leiognathidae (pony fishes), Scombridae (tunas, mackerels) and Lutjanids (snappers).

Elasmobranchiata (rays and sharks) represented 5.6% of the total catch. A small component of the total catch in terms of volume included other unidentified fish species and invertebrates. Large fish including Lutjanidae (snappers), Terapontidae (grunters), *Scomberomorus* spp. (king mackerels), *Thunnus* spp. (tunas), Carangidae (black pomfrets), *Platax pinnatus,* and *Rachycentron canadum* (trevally) were abundant in catches from shallow water areas (20-30m depth). Mackerels and Clupeidae dominated catches in the northeast part, and Leiognathidae dominated in the southeast part of the Gulf. Stingray occurred throughout the Gulf during the research period (Tana 1996).

There were 33 fish species that were common in the catches, although only 5 species were very abundant, namely *Megalaspis cordyla* (hardtail scads), *Scomberomorus commersoni* (Spanish mackerel), *Rastrelliger brachysoma* (short-bodied mackerel), *Rastrelliger kanagurta* (Indian mackerel) and *Atule mate* (yellowtail scad). In Khmer, the above species are called *trey kantuy roeung, trey sampan, trey camong* or *phlathu*, *trey palang* and *trey kalang*, respectively (Tana 1997). According to Tana (1999), another 39 fish species are present in Cambodian waters. Most of these fishes are coral and rocky reef dwelling species, such as groupers, parrot fishes and scorpion fishes. The study of Jensen and Try (2002) identified an additional 17 fish species. A further 80 species have been collected although are yet to have been identified.

These studies indicate that 520 fish species have been recorded in Cambodian waters, with a number of species yet to be identified. Scientists have estimated that Cambodian waters contain over 600 species of marine fish, which is similar to that observed for other countries in the region. The fish species recorded in the above studies are listed in Annex 1.

Echinoderms

According to a survey conducted by Tana (1997), 2 species of sea star, *Choriaster granulatus* and *Protoreaster nodosus*, 3 species of sea cucumber, *Holothuria fuscopunctata, H. edulis* and *H. leucospilota*, and 2 species of sea urchin, *Diadema savignyi* and *D. setosum*, are present in Cambodian waters.

More recent surveys conducted by Jensen & Try (2002), have added several species, including: 3 species of sea star, *Astropecten polyacanthus, Luidia maculata,* and *Craspidaster hesperus*; sea cucumbers, *Holothuria scabra, H. fuscogilva, H. spinifera*, *Actinopyga mauritiana*, *Stichopus variegatus*, *Acaudina molpadioides*, *Bohadschia marmorata* and *Actinopyga miliaris*; and 5 species of sea urchin, 2 irregular, 1 of which is the sand-dollar, *Laganum decagonale,* and 3 regular as yet unidentified species. The total number of echinoderm species recorded in Cambodian waters includes 5 species of sea star, 11 species of sea cucumbers, and 7 species of sea urchins, of which 4 species have not yet been identified.

Crustaceans

According to Tana (1997) and Jensen and Try (2002), about 50 species of crustaceans are present in Cambodian waters. Of these, 10 species are shrimps, *Penaeus canaliculatus, P. semisulcatus, P. merguiensis, P. latisulcatus, P. monodon, P. japonicus, Metapenaeus affinis, M. spinulatus, Parapenaeopsis sculptilis, Parapenaeopsis* sp., 1 stomatopod, *Miyakea neap,* and one slipper lobster, *Thenus orientalis.* Approximately 30 species of crabs are present and annex 2 contains a list of these species. There are 4 species of barnacles, *Lepas* sp., *Tetraclita squamosa*, and 2 unidentified, and several species of hermit crabs.

Molluscs

About 250 species of this group are present in Cambodian waters, although the "Survey of Coastal Marine Living Resources" and "Tropical Marine Mollusc Programme (TMMP)" identified only 170 species. Of these, about 100 were gastropods, 50 bivalves, and 8 cephalopods. Early collections of shelled molluscs listed 165 species of gastropods and 63 bivalves (Morlet 1889; Crosse and Fischer 1892; Fischer and Fischer-Piette 1972). Lynge (1909) identified another 360 species of bivalves as being present in northern Gulf of Thailand waters. However, the number of species identified by the latter study may be somewhat inflated as new species were described according to a single, very small shell valve. Mollusca are probably the most well documented marine group in Cambodia. Several of the very old collections are still present in museums, including the National Museum of Natural History in Paris, France. Giant clams, *Tridacna squamosa* and *T. gigas*, require protection from illegal fishing in Cambodian waters. Similarly, the large gastropod, *Cassis cornuta* (horned helmet), is very common in shell shops. However, it is not possible to determine if fishers collect this species in the dead (shell-only) or live form. Annex 3 contains a list of mollusc species identified in Cambodia's marine waters.

Seaweeds
Sixteen species of seaweed have been recorded in Cambodia, of which 1 species has been imported from Malaysia for culture (Jensen & Try 2002). At present, seaweed culture is a very popular marine activity. Local intermediaries collect the entire production and export it to Malaysia.

Only 12 of Cambodia's seaweed species have been identified. These include *Caulerpa lentillifera, Caulerpa racemosa, Halimeda* sp., *Ulva reticulata, Dictyosphaeria cavernosa, Enteromorpha* sp., *Hormophysa cuneiformis, Padina* sp., *Sargassum polycystum, Turbinaria conoides, Turbinaria decurrens* and *Turbinaria ornata*. The cultured species is *Eucheuma cottonii.*

Seagrasses
Nine species of seagrasses are present in Cambodian waters, including *Cymodecea rotundata, Cymodocea serrulata, Halodule pinifolia, Halodule uninervis, Ruppia maritima, Syringodium isoetifolium, Thalassia hemprichii, Halophila ovalis* and *Enhalus acoroides* (Jensen and Try 2002). Among these, *Halodule pinifolia* is an important food source for dugong (Tana 1997). Seagrass beds exist in sheltered estuaries found along the coastline of Kampot province, and near the mouths of the Steung Hao and Andong Tuk streams in Kampong Som Bay.

2.2.1 Pelagic species

According to Ibrahim (1999), Cambodia's pelagic fisheries began modestly, using simple fishing gears such as bamboo stake traps and set bag nets in inshore waters. In 1925, the Chinese purse seine was introduced to Southeast Asian countries, specifically Thailand, for catching the Indo-Pacific mackerel. This gear quickly gained popularity in the region and was modified to become the Thai purse seine in Thailand and purse seine/ring net (Khmer name *Uon Tith*) and anchovy encircling seine (Khmer name *Uon Ka Koeum*) in Cambodia. Since the early 1960s, marine fisheries in the region have rapidly modified fishing gear, introduced new fishing technology, and improved fishing vessels. Onshore improvements to facilities and infrastructure have supported these developments. So far, Thailand's marine fishing sector has developed more rapidly than Cambodia's, partly due to the serious problems experienced throughout Cambodia's civil war.

Pelagic fisheries intensified during the 1970s and early 1980s, mostly due to the use of luring purse seines and the 1973 discovery of fishing grounds for round scads in the central part of the Gulf of Thailand. The use of large purse seines for catching coastal tunas and hard-tail scads in deeper water areas began in 1982. The use of light luring purse seines to target anchovies began in 1983. It was not until later that other more modern fishing gears were introduced (Ibrahim 1999). However, the use of some of these modern fishing gears is illegal in Cambodian waters according to Cambodia's Fisheries Law (in Khmer called *Kret Chhbab Lek 33 Kra. Chor*).

The total catch of pelagic fishes in the Gulf of Thailand increased from 63,000 tonnes in 1971 to 676,000 tonnes in 1994. The annual catch increased rapidly from 1971 to 1977, followed by slight declines in landings until 1980. After 1980, landings increased gradually over time, reaching 676,000 tonnes in 1992. The small decline in pelagic fish catches observed for the few years after 1977 was a result of a redirection of fishing effort, and increased catches of round scads and sardines by light luring purse seines. Generally, the recovery of Indo-Pacific mackerel stocks, combined with the introduction of anchovy encircling seines and regular purse seines for catching anchovies and coastal tunas, were the key factors contributing to the large increases in total landings of pelagic fish from the Gulf of Thailand (Ibrahim 1999).

The fisheries statistics of the DoF do not separate pelagic fish landings by species or group of fish. Therefore, the accurate interpretation of DoF data, and that from other studies, is difficult. Some investigations have indicated that five species of pelagic fish are often present in trawl catches, including hard-tail scads (*Megalaspis cordyla*), yellow queenfish (*Scomberoides commersonnianus*), short-bodied mackerel (*Rastrelliger brachysoma*), Indian mackerel (*Rastrelliger kanagurta*) and yellowtail scad (*Atule mate*) (EVS Environment Consultants 1996).

Studies of the fisheries biology of Cambodia's commercially important fish species, conducted from 1983 to 1986, provide some information about the dynamics of pelagic fish species in Cambodian waters (Tana 1996). The following is a summary of this information.

Yellowtail scad (*Atule mate*) (Khmer Name *Trey Kaun Kum*)
Yellowtail scad (*Atule mate*) spawns throughout the year, however, a peak was observed during May 1985 (58.7% of the females in spawning condition) and in April 1986 (26.6% of females in spawning condition). Sex ratios of this species are observed to vary distinctly, such that during December the proportion of females is higher than males (1.38:1) and during May the sex ratio is equal. For the remainder of the year, the proportion of males tends to be higher than females (with ratios ranging from 1:1.1 to 1:1.4).

Stomach content analyses indicate that this species prefers to feed on fish (anchovies and other fish fingerlings) and squid. Yellowtail scad have been observed to feed most actively from September to December, and least actively from July to August (Table 33).

Table 33 The percentage fullness of yellowtail scad (*Atule mate*) stomachs caught in Cambodian waters from 1983 to 1986.

Period (Month)	Fullness of the stomach (Food in the stomach)	Conclusion
Jul. to Aug. 1983	24% full	Inactive feeding as stomachs only 25% of full.
Feb. to Apr. 1985	54% full	Active feeding as stomachs 50% full.
May to Jun. 1985	83% full	More active feeding as stomachs over 75% full.
Sep. to Dec. 1985	Full (maximum)	Very active feeding as stomachs 100% full.

Note: All fish were obtained from trawl net catches taken during both the day and night.
(Source: Tana 1996).

Selar scad (*Selaroides leptolepis*) (Khmer Name *Trey Si Ki*)
The majority of selar scad spawn from February to April, as 54.4% of mature female specimens collected during this period were ripe and another 24.3% were spent. From May to June, approximately 21.3% of mature females were ripe, and by July, only 4% of collected mature females contained eggs and 14% had recently spawned. Selar scad reached an early stage of maturity during September to December in 1985. The sex ratio observed for this species is nearly equal.

Hard-tail scad (*Megalaspis cordyla*) (Khmer Name *Trey Kantuy Roeung*)
Surveys of the hard-tail scad in April 1985 found this species in two different habitats. The study concluded that juvenile fish prefer to inhabit shallow water due to the domination of juveniles in catches within this habitat type. In its adult form, this species prefers to inhabit deep-water areas (>40 m). Juveniles were not caught in water deeper than 30m. This may have been due however, to the selectivity characteristics of the sampling equipment used.

Stomach content analyses identified a dietary preference for fish (fish fingerlings) and squids. Selar scad were not observed to be feeding actively from July to August 1983, as gonad development during this period was at stage II and most specimens had empty stomachs. This species was observed to be feeding actively from September to December 1985 and February to April 1986, as stomach content analysis of fish caught during these periods indicated that most fish had full stomachs.

Round scad (*Decapterus maruadsi*) (Khmer Name *Trey Kuon Kum*)
The proportion of mature females was 18% in 1983, 6.5% from September to December 1985, and 40.2% from February to April 1986. Sex ratio (male:female) was 1.68:1 in 1983, 1:1.58 in 1985, and 1.28:1 in 1986. Stomachs were half-full during July 1983 and nearly full in September to December 1985. Analyses identified fish fingerlings and zooplankton as the preferred dietary items for this species.

Jack, Cavalla (*Alectis kalla*) (Khmer Name – not available)
The gonads of this species were at stage II to III from October to December, and by mid-December, only 6% of specimens were at stage I. In 1985, this species spawned from May to June. During this period, 54% of mature females were at stage I or II, and 5.8% were recently spent or at stage VI. The sex ratio at this time was 1.5:1.

The stomachs of this species were full from February to April 1986. The main food items identified during stomach content analysis of fish collected from May to June 1986 were detritus, phytoplankton, and copepods.

Trevally (*Alectis indicus*) (Khmer Name *Trey Chen Chas*)
Analysis of the stomach contents of specimens of this species collected from May to June 1986 indicated a dietary preference for zoobenthos (small crabs were most abundant).

Golden toothed trevally (*Scomberoides lysan*) (Khmer name *Trey Kalang*)
Studies of this species from February to April 1986 revealed that all the females were at the spawning stage with an equal male to female sex ratio.

2.2.2 Demersal species

Demersal fishes are not as significant as pelagic species in terms of their contribution to total fisheries production in Cambodia. Stingrays are the only demersal fishes listed separately in the official statistics. However, coral reef fishes have high economical value. Traps and illegal fishing methods, involving explosives or poisons, are mostly used to catch these species. Fishers use demersal trawls to catch other important demersal fishes, including snappers and threadfin bream.

2.2.3 Commercially exploited invertebrates

Crustaceans
Fisheries for shrimp in Cambodia have high economic value. Prior to 1989, annual production of shrimp was approximately 10,000 tonnes. Since then, shrimp catches have declined dramatically due to degradation of habitats and overfishing. *Metapenaeus affinis* and *M. spinulatus* comprise around 60% of the total catch. A large proportion of the shrimp catch is exported in peeled and frozen form. There is also a considerable fishery for crabs, especially mud crab and swimming crabs. Most of the crab consumption occurs locally. The fishery for mantis shrimp and slipper lobster is small, although economically important.

Molluscs
There is an increasingly large fishery for cephalopods in Cambodia. Bigfin reef squid (*Sepioteuthis lessoniana*), cuttlefish, and octopus are caught in traps. The capture of Lologinid squid occurs in trawl nets. Light luring is a banned fishing method in Cambodia, therefore a majority of the squid landings represent by-catch from pelagic fisheries. Eggs of bigfin reef squid are collected for use as "bait" in squid traps. The presence of these eggs has led scientists to believe that this species spawns in Cambodian waters. Dredging and the hand-collection of bivalves are also important fishing methods. Fishers operate dredges from small "long-tail" canoes, with the target species often representing less than 50% of the total catch. Women are mostly involved in the hand collection of molluscs. Rock oysters are an important bivalve species and sold mostly to local restaurants. Some gastropod species, including abalone (*Haliotis* spp.) and *Strombus* spp., are important for human consumption, although collection of these species is mostly for ornamental purposes (Try 2001). Subsistence fishers use almost any type of bivalve or gastropod for food (Try 2001).

3. CURRENT STATUS & THREATS

3.1 Status of the Fishery in Terms of CPUE

So far, there have been no fish stock assessments conducted in Cambodian waters. However, comments from fishers and the results of several related studies indicate that the threat of overfishing in the Gulf of Thailand is now at a critical stage.

The collection of catch per unit effort (CPUE) data for Cambodia's marine fisheries does not occur. Thus, the status of marine fisheries in terms of CPUE is unknown. Surveys from neighbouring countries, such as Thailand, may give some indication. The results of long-term systematic surveys conducted by the Department of Fisheries (Thailand) indicate that daytime CPUE in the Gulf of Thailand declined from 290kg/hr in 1963 to 50kg/hr in 1993. CPUE of night time fishing operations declined almost 60% from 1976 to 1995 (Ibrahim 1999). Results of studies in Viet Nam also highlight rapid declines in yield (Ibrahim 1999). However, the scale of operation and types of fishing gears used differ between Thai and Cambodian fisheries. Hence, Cambodia has decided not to use data available for Thai fisheries in the Gulf of Thailand to make inferences about the Cambodian fisheries situation.

It is possible to make assumptions about CPUE from socioeconomic surveys and comments from fishers. For instance, a socio-economic survey conducted by CZM Project in Kep from 1996 to 1998 (CZM 1999a) indicated that there was a significant reduction in abundance of some living marine resources. The survey found that a reduction in the abundance of shrimp had occurred, such that the capacity of a typical small fishing boat to catch shrimp had declined from 20kg of shrimp per night to 5 kg per night. In O Krosa village, some species including smaung fish, white sparrow fish, mantis shrimp and other species of crustaceans have disappeared or become very rare. Similarly, the survey indicated that it is now very difficult to find mantis shrimp in waters adjacent to Angkaul village. Mantis shrimp and many species of crabs have disappeared from these areas.

3.2 Status of Fish Stocks Based on Historical Review of Landings and CPUE

In Cambodia, as in other countries of Southeast Asia, marine capture fisheries are multi-species and multi-gear. The main fishing gears used are trawls, purse seines, and gillnets. The operation of these gears mostly occurs in inshore waters. Unfortunately, a paucity of information regarding fish stocks and CPUE in Cambodia makes it difficult to conduct any historical review of the status of fish stocks. Results of research conducted from 1983 to 1986 indicate that the total stock of marine fishes in Cambodia's EEZ is approximately 500,000 tonnes (Tana 1996; 1999). There have been no further studies of fish stocks in Cambodia, however, total catch is recorded each year by DoF. This information reveals that production in Cambodia's marine capture fisheries increased from 7,247 tonnes in 1986 to 39,900 tonnes in 1990. Catches then declined from 36,400 tonnes in 1991 to 29,800 tonnes in 1997. Catches recovered to 32,100 tonnes in 1998, and then increased rapidly to 42,000 tonnes in 2001. No CPUE data is available for review.

Scientific investigations into Cambodia's commercial fisheries from 1983 to 1986 identified changes in the species composition of catches during that period (Tana, 1996). It is unclear whether information regarding low-value fish was recorded during this period. Stingrays and octopus are ubiquitous in Cambodian waters.

Yellowtail scad (*Atule mate*)
This is the main species and has a wide distribution in Cambodian marine waters. It was observed to be most abundant from May to October in 1985 (7.3 to 12.6% of the total catch). In comparison, the abundance of this species was much lower from December 1985 to April 1986 (3.2 to 4.4% of the total catch). Furthermore, variations in the length frequency distribution of this species in catches are interesting. During 1985, 74.6% were 20 to 23cm in length from May to June, 71.1% were 17 to 21cm in length from July to August, 51% were 20 to 23cm in length from September to December, and from February to March 1986, 7% were 13 to 20cm in length. The weight of individuals of this species in catches varies from 80 to 250g, however, the most common weight range is 86 to 113g.

Selar scad (*Selaroides leptolepis*)
This species comprised 6.8 to 12.7% of the total catch from February to April, and 1.8 to 3.2% during the winter. This species is common in shallow water and very rare in deep water.

The length of this species in catches varied from 8 to 14cm in July 1983, 4 to 17cm during May to June 1985, 7 to 13cm during September to December 1985, and 6 to 16cm during February to April. During this latter period, 63.2% of this species were in the 11 to 13cm size range. The weight of individuals varied from 6 to 70g over the whole study period.

Hard-tail scad (*Megalaspis cordyla*) (Khmer name *Trey Kantuy Roeung*)
This study indicated that hard-tail scad comprised 4.9% of the total catch in September 1985, 3.1% of the total catch in April 1986, 2.2% of the total catch in May 1985, and was very rare (0.1% of the total catch) in July 1983.

The length of this species ranged from 14 to 21cm from July to August 1983, and their weights ranged from 50 to 120g. In May to June 1985, lengths ranged from 21 to 36cm, although 75% of individuals were from 21 to 28cm, with weights between 100 to 480g. During September to December 1985, lengths ranged from 14 to 28cm, and from February to April 1986, from 19 to 28cm, with individual weights from 60 to 400g.

Round scad (*Decapterus maruadsi*) (Khmer Name *Trey Kuon Kum*)
Between 50 to 68% of round scad were caught in water deeper than 27m and it was most abundant at depths of 40 to 50m. The size of fish ranged from 11 to 23cm, although fish from 14 to 17cm dominated catches (71.2%) during July 1983, whilst fish from 16 to 20 cm dominated from 1985 to 1986. The weight of individual fish ranged from 20 to 180g during 1983 and 1985.

Jack, Cavalla (*Alectis kalla*)
This species was caught in depths less than 30m and was most abundant from October to December 1985 in southern Cambodian waters. Generally, catches of this species were low during February, with a catch rate of 0.008 tonnes/hour of trawling close to Kampong Som Bay. In 1986, catch rates reached 0.15 tonnes/hour. During other months of the year, catch of this species was insignificant. Lengths ranged from 10 to 15 cm during February to April 1985 and May to June 1986.

Trevally (*Alectis indicus*) (Khmer Name *Trey Chen Chas*)
This species occurred at depths of less than 20m in February. In April, the fish moved to depths between 20 and 27m, and the catch rate observed was approximately 0.014 tonnes/hour of trawling. During 1985, 1.4% of the total catch occurred at a depth of 35m, with an average catch rate of 0.01 tonnes/hour of trawling.

Lengths ranged from 20 to 104cm, and for the group between 63 and 85 cm, individual weights ranged between 3.1 and 8.5kg.

Golden toothed trevally (*Scomberoides lysan*) (Khmer name *Trey Kalang*)
Golden toothed trevally comprised around 1% of total catches made during the rainy season at depths of 30m. Average CPUE was 0.008 tonnes/hour trawling. In February 1986, during resource surveys conducted in waters less than 20 m deep, this species comprised 2.3% of the total catch, with an average CPUE of 0.012 tonnes/hour. In April, catch rates were highest in depths from 20 to 28m, with an average catch rate of 0.014 tonnes/hour trawling. Lengths ranged from 32 to 120cm, and weights ranged from 2.7 to 9kg for individual fish in the size group between 67 and 90cm.

3.3 Threats

3.3.1 Current

Stock depletion
Many indicators are available to identify the problem of overexploitation and threats to marine fisheries resources. These include increases in fishing effort, decreases in the annual catch, changes in the species composition of catch, and increases in the percentage of low-value fishes in the catch. Scientists know the causal relationships between these indicators and overfishing, however, there remains a need to extend such information to the general community.

Many fishers in Cambodia do not realise that high levels of fishing effort can lead to negative outcomes, including stock depletion, instead blaming such situations on mistakes made by government or managers. However, it is becoming clear that both fishers and government officials have played important roles in the creation of fisheries problems. In Cambodia, questions such as *"why is the production of fish decreasing?"* and *"how can we solve this problem?"* are frequently asked by fishers and members of the general community.

Typical answers to these questions in Cambodia have referred to fishers breaking fisheries laws, and the use of illegal fishing gears. However, changes in the distribution and abundance of natural resources, such as fisheries, are often a result of natural variation in the environment, as well as the impacts of fishing and other human activities. Examples of phenomena driving this natural variation include climate change, global warming, El Niño, and sea level rise. According to Ibrahim (1999), human activities with potential to negatively effect fisheries and other resources include:

a. destruction of habitats for spawning, nursing and feeding due to rapid development of costal areas and development of new, efficient fishing technology and population growth;
b. land and sea-based pollution that tends to reduce fish recruitment and increase mortalities; and
c. over-capitalisation and exploitation of coastal marine living resources.

As highlighted previously, there is a paucity of information regarding the status of Cambodia's marine fisheries resources. There are concerns about stock depletion in the marine fishery, although with no substantial stock assessments conducted, the status of the resource is largely unknown. Catch statistics have varied substantially, reporting 1,200 tonnes in 1980, 39,900 tonnes in 1990, and 29,800 tonnes in 1997. While the DoF collects harvest data from commercial fisheries, there are concerns relating to the accuracy of these figures, as they do not include catches from illegal fishing vessels, both foreign and domestic. Similarly, they do not include catches from fishing vessels that did not land their catches at Cambodian ports. Finally, there are no reports of the amounts caught by subsistence fishers. The main threats to fisheries production in Cambodia are habitat destruction, overfishing, and pollution, which have led to the rapid decline of coastal fish stocks, and the degradation of the marine environment and other coastal resources. Increased fishing effort, as evidenced by increasingly high numbers of large fishing boats, has contributed to the recent trend of increasing annual catches.

Habitat destruction

According to the 1982 United Nations Convention on the Law of the Sea (Law of the Sea Convention), adopted in Montego Bay, Jamaica on 10 December 1982, Cambodia has rights and responsibilities for the management and use of marine resources within the Cambodian Exclusive Economic Zone (EEZ). Cambodia's Fisheries Law (in Khmer called *Kret Chhbab Lek 33 Kra. Chor*), enacted on 9 March 1987, aims to reflect the provisions of the Law of the Sea Convention. Article 28 of Cambodia's Fisheries Law prohibits trawl fishing in waters less than 20 m deep, as these areas typically contain fragile and critical habitats. In addition, sections D and E of Article 18 prohibit the destruction or cutting of inundated or mangrove forest, and the transport or sale of inundated or mangrove forest wood.

However, despite Cambodia's Fisheries Law, Royal decrees, sub-decrees and proclamations for protecting ecosystems and habitats, many illegal activities still take place. According to Tana (1997), mangrove forests cover an area of 85,100ha, of which approximately 63,700ha are located in Koh Kong province, 13,500ha in Sihanoukville and 7,900ha in Kep and Kampot provinces (Table 34). So far, 74 species belonging to 35 families and 53 genera of mangrove trees have been identified. From 1993 to 1996, the exploitation of Cambodian mangrove forests for charcoal and firewood production, as well as the construction of shrimp, salt, and rice farms, was common. Rapid exploitation of mangrove forests for firewood and charcoal took place during the war after 1979. The introduction of intensive shrimp culture in Cambodia from 1993 to 1996 resulted in the construction of aquaculture ponds with an approximate area of 1,000 ha in the mangroves of Koh Kong and Kampot provinces (Table 34).

Table 34 Estimates of mangrove forest degradation in the coastal provinces and municipalities of Cambodia up to 1996.

Province/ municipality	Total area (ha) (LANDSAT, 1994)	Area that has been cleared for shrimp farms and other purposes (ha)	Degradation due to firewood and charcoal production (%)
Koh Kong	63,700	1,500	60-70
Sihanoukville	13,500	800	35-40
Kampot and Kep	7,900	1,000	50-60
Total	**85,100**	**3,300**	**48-57**

(Source: Tana 1997).

Trawl fishing, push nets, and grouper fishing activities threaten coral reef and seagrass habitats in Cambodia. Coral reefs are amongst the most diverse marine ecosystems. So far, reductions in species diversity and the abundance of reef fishes because of overfishing are unstudied in Cambodian waters. Fishers claim that they have not yet detected a decline in fish abundance in coral reef areas. At present, approximately 80 to 90% of marine fishing occurs in coastal or inshore areas. Socioeconomic circumstances, including the financial situation of most fishers, restrict the adoption of new technologies and the development of offshore fisheries. Similarly, investors focus on freshwater fishing lots and the dai fishery, and investment in marine fisheries is very rare.

Increases in fishing effort

Historically, consideration was rarely given to small-scale fisheries in Cambodia. Observers never envisaged serious problems with this type of fishing. However, due to improvements in the efficiency of fishing gear, living standards and infrastructure, rapid expansion of middle-scale fisheries has occurred. Many inshore fisheries are facing problems associated with overexploitation and degradation of coastal habitats.

Recently, there appears to have been a shift in the type of vessels used in marine capture fisheries. Traditionally, most fishers were small scale, using small, non-motorised vessels in inshore waters. However, a significant shift from the use of these smaller vessels, to slightly larger motorised vessels, capable of fishing further offshore and taking larger catches of fish, has occurred. The number of small, motorised vessels (<30 HP) increased from about 1500 in 1993 to almost 4500 in 2000 (APIP 2001).

There is currently no cap in place on fishing effort for subsistence fishers or licensed small and middle scale fishers. As such, there appears to be a growing number of fishers participating in the marine fishery and this is likely to increase further with increases in coastal populations. The low initial investment and open access nature of fisheries attracts impoverished people to begin fishing for food and income.

Illegal fishing
Illegal fishing in Cambodia consists of foreign vessels fishing in Cambodian waters without a licence and/or using illegal fishing gear. In addition, the use of illegal fishing gear by Cambodian fishers is becoming more common. The Royal Government of Cambodia prohibits the use of artificial light and pair trawls to fish in marine waters, although foreign fishers utilise these fishing gear and practices in offshore waters.

The use of trawls is prohibited in waters less than 20m deep, yet reports of fishers trawling close to shore are common. Use of illegal mesh sizes in gill nets, and dynamite and cyanide fishing methods are also common. Illegal fishing activities have led to conflicts within fishing communities, some resulting in violence. There are many reports of fishers (both foreign and local) operating on an unlicensed basis. The DoF has very few resources for enforcement and very little capacity to patrol offshore. The size and seaworthiness of the government vessels is inadequate. The lack of consistent enforcement between the DoF and other coastal government agencies is resulting in inequitable access to fisheries resources, community conflicts, reduction in fish stocks through overfishing, and habitat degradation by allowing fishing activities to continue in areas of sensitive marine habitats.

Effects of trawling
Trawling is a very destructive fishing method in Cambodia. Trawl nets disrupt benthic communities, especially in areas where the intensity of trawling is high. Trawl fishing is typically not selective for species or sizes of fish. As a result, trawl vessels are responsible for taking substantial catches of unwanted catch (bycatch). Whilst fishers in the Sihanoukville area sell unwanted bycatch and low-value fish to the fishmeal factory in Sihanoukville, fishers from other coastal areas continue to discard unwanted catch.

Trawlers are also capable of catching large marine mammals and sea turtles. Bycatch is thought to be one of the main threats to Cambodia's marine mammals and reptiles. Accidental catches of these species are usually discovered after the animal has died. Other countries have been testing devices to reduce unwanted capture of sea turtles with some success. However, it is not a requirement for Cambodia's trawl vessels to be equipped with devices such as Turtle Excluder Devices (TEDs). The TEDs currently used in the region are not suitable for use aboard Cambodia trawl fishing vessels because the boats are too small.

Bycatch
A large proportion of fish caught in Cambodia can be categorised as bycatch or low-value fish. Until recently, unwanted and low-value catch was either discarded at sea or left at the landing-site for people to rummage through. A fishmeal factory is now in operation, and fishers can sell almost all trash fish to this factory. In the past, the decomposition of unwanted fish at landing sites contributed to localised water pollution problems, however, most large landing sites now have areas where fish are set aside for collection by fishmeal factory trucks.

Ghost fishing
Fishing nets lost at sea often continue to catch fish. This is referred to as ghost fishing. Such nets are considered a threat to Cambodia's fisheries resources, especially in coral reef areas, where torn nets are often abandoned. It is estimated that small scale gill net fishers lose about 10 to 20km of monofilament net/year. Endangered species such as sea turtles can be caught in these unattended fishing nets.

3.3.2 Potential

The collapse of Cambodia's fisheries
Cambodia is experiencing increases in competition for access to fisheries resources, largely due to increases in the number of fishers, improvements in gear technology, and the upgrading of fishing capacity. A continued uncontrolled harvest will most likely lead to the decline and possible collapse of Cambodia's marine fisheries.

Population growth, pollution and tourism development
Apart from overexploitation of resources, Cambodia's coastal and marine ecosystems face a number of threats. Population growth in coastal areas is higher than in other parts of the country. This is in part caused by migration to the coast from further inland. Most fishing communities discharge all sewage and waste into the sea in an untreated form. This is not only a threat to coastal ecosystems, but also to human health and the safety of fisheries products.

There is limited water quality monitoring in coastal areas. Runoff from agricultural land and wastewater from coastal villages probably contains high concentrations of nutrients and possibly pesticides. Since there is limited sewage treatment, industrial wastewater is often discharged directly into the sea, or indirectly via streams. Industrial wastewater may contain heavy metals as well as toxic organic compounds. So far, there are few large industrial activities in the coastal areas of Cambodia. However, there is a large oil refinery and storage facility near Steung Hao in Kampong Som Bay, Sihanoukville.

The port of Sihanoukville may also be a pollution hazard. Marine anti-fouling paints leak toxins into the water, which can cause reproductive disorders such as imposex in many marine organisms. Ballast water discharged in or near the port may contain alien organisms, which may be a threat to local communities. At present, development of the port is taking place and it will soon double in size. This involves significant land reclamation, with associated potential for the suspension of particulate matter and its transportation outside the port area, where deposition may damage coral reefs and benthic communities.

Tourism development may also present significant threats. Many hotels are located along the waterfront and have inadequate facilities for wastewater treatment. Restaurants require increased supplies of fresh seafood, and tour-boat operations and diving activities may have negative impacts on coastal ecosystems. However, this tends to be self-regulatory in the sense that tourism benefits decrease if the environment becomes degraded. In addition, the creation of new job opportunities in the tourism sector may assist in the reduction of fishing effort if fishers can earn more money in tourism related employment than from fishing.

4. HABITATS & AREAS OF IMPORTANCE IN THE MAINTENANCE OF EXPLOITED FISH STOCKS

The recent surge in development and human settlement along Cambodia's coastline has caused concern within the Ministry of Environment and amongst biodiversity scientists regarding coastal and marine habitat degradation. These concerns focus on the environmental impact of logging inundated forests and mangroves, illegal and destructive fishing, increased inshore fishing pressure, and clearing of mangrove forests for shrimp farms. The efficacy of existing coastal management arrangements have also been the focus of concern. Emerging issues include the damming of coastal watersheds, the careless dumping of solid waste such as plastic bags and containers, and the ghost fishing of nets lost accidentally at sea.

4.1 Description of the physical, chemical and biological characteristics of known spawning, nursery, feeding, and fishing grounds

Little information is available about the exact locations of spawning, nursery and feeding grounds of fish species in Cambodian waters. Hence, we describe the general environments where fishing takes place. Information about fish habitats for species of transboundary significance has been taken from the literature, as no information exists for Cambodia.

Pelagic environments

The hydrographical data collected during the 1959 to 1961 Naga Expedition is still the most comprehensive in existence. Temperature and salinity show only minor variations with either depth or season. Surface temperatures vary between 27°C and 31°C and salinity between 27.4‰ and 34‰ (Tana 2000). Water temperatures at a depth of 30 m off the coast of Koh Kong province varied between 28°C and 28.5°C. Salinity at that depth varied between 31.5‰ and 33.5‰. There was a distinct halocline between 5 and 10m in August 1960 and a thermocline between the same depths in April 1960. There may be oxygen depletion at depths over 30m during the dry season (Robinson 1974).

There are no studies on phytoplankton productivity. Tana (2000) mentions that phytoplankton comprises only 3 to 5% of the total suspended organic matter. There are no quantitative studies of zooplankton in Cambodian waters. According to Tana (2000), zooplankton is composed of amphipods, decapods, and chaetognaths. The Naga Expedition observed plankton densities of 0.6 to 1.9 ppb off Koh Rong in April 1960, 0.2 ppb in August 1960, and 0.4 ppb in November 1960.

For pelagic species, including anchovies, mackerel, and tuna, there are some studies on the occurrence of larvae in plankton samples. Cambodia's offshore waters are considered important spawning and nursing grounds for regional stocks of Indian and short mackerels (*Rastrelliger kanagurta*

and *R. brachystoma*). The 1959 to 1961 Naga Expedition collected 100 to 1000 larvae per 1000m^3 just off Koh Rong in April 1960 (Matsui 1970).

Coral reefs

Many economically important species, such as groupers and snappers, are associated with coral reefs. Some fishes are permanent reef inhabitants and use the reef for spawning, nursery areas, and feeding. Other species use coral reefs for feeding or spawning/nursery areas. Coral reefs are part of the physical and biological environment, and they influence the chemical environment as their photosymbiosis with zooxanthellae produces oxygen. They also influence precipitation of calcium carbonate in the structural skeleton of the corals.

Coral reefs occur in many areas of Cambodia's waters. There is very limited information about species diversity and live coral cover on most reefs. Coral reefs are most common around offshore and inshore islands, and species diversity appears to be higher offshore. Tana (1997) mentioned that only 24 species of hermatypic corals and 14 species of soft corals (octocorals) had been identified. In 1998, a limited number of surveys were carried out in the Sihanoukville area (CZM 1999c). Here 45 species of hermatypic corals were identified. Surveys in Koh Kong province identified 67 species of hard corals and 17 soft corals (CZM 2002a). A survey around Koh Tang, one of the offshore islands, in 1998, reported "at least 70 species" of hard corals (Nelson 1999).

Reefs at Risk estimated the total reef area in Cambodia to be less than 50km^2, and highlighted that all coral reefs in Cambodia were at high or very high risk, mostly from overfishing. Other threats are destructive fishing methods (dynamite and cyanide), sedimentation, and pollution, especially from marine-based sources (Burke *et al.*, 2002). Based on individual species distributions, Reefs at Risk estimated that 272 species of coral might be present in Cambodia, although only about 70 to 80 species have been recorded. The reefs are dominated by solid forms, e.g., *Porites*, which makes physical damage from blast fishing greater and the time for recovery high. There are some signs of coral bleaching, but no quantitative data exist. However, it appears that only small local areas are affected, indicating that this is most likely caused by physical stress from predation (crown-of-thorns sea stars have been reported), use of cyanide in fishing, and collection for the souvenir trade. Many high value fish species, including groupers, are associated with coral reefs. Most reef fishes are caught in traps. Trawling in coral reefs can damage both nets and corals. In addition, invertebrates such as abalone, some crabs, bigfin reef squid, and octopus species occur on or near coral reefs.

Mangrove forests

Tidal changes in water level and variable salinity characterise mangrove forest habitats. Salinity generally decreases from the seaward edge of the mangrove forest towards the landward edge. However, salinity also depends on exposure, air temperature (evaporation), and rainfall. Organisms living within mangroves are adapted to these changes. Some feed only during low tide, when the mudflats and sediments between mangrove roots are exposed. Others feed only during high tide.

Many invertebrates burrow into sediments, and some may form deep and complex burrows. This biological activity is important for the availability of oxygen in the sediment. The high organic content of mangrove mud usually means that only the upper few millimetres are oxygenated, with anaerobic processes prevailing underneath this thin surface layer. Bioturbation and permanent burrows bring oxygenated water into the burrows and, as a result, the walls of burrows usually contain a diverse meio- and micro-fauna and -flora. Unfortunately, there are no studies of this in Cambodia.

Mangrove forests are important breeding and nursery grounds for many species of fish and crustaceans. They are resting and feeding grounds for wading and other fish-eating birds. The main fishing activity in mangrove forests is for crabs, especially mud crab (*Scylla serrata*). The mudflats in front of mangrove forests harbour a rich fauna of bivalves, which are commercially exploited in Cambodia. By collecting spat (juvenile bivalves) and transporting them to enclosed areas, natural stocks can be enhanced. In Cambodia, there is some dredging for bivalves, including blood cockle (*Anadara* spp.), short-neck clam *(Paphia undulata*), and hard-shelled clams (*Meretrix* spp.). In brackish parts of mangrove forests, *Polymesoda* sp. can be collected.

It is estimated that Cambodia has already lost more than 50% of its mangrove forests. The main causes of this loss include the cutting of wood for firewood and charcoal production, as well as the clearing of forests to establish shrimp farms (Talaue-McManus, 1999).

Seagrass beds
Seagrass beds occur on sediments in shallow water areas. In Cambodia, 9 species of seagrasses have been observed. Seagrass communities are important for stabilising sediments and preventing coastal erosion. The dense network of rhizomes and roots function as sediment traps, and because seagrasses are higher plants, the roots can take up nutrients trapped in the sediment. Seagrass beds occur in several places in Cambodia, mostly in small patches along the mainland coast and around most islands. There are a few more extensive seagrass beds in waters off Kep municipality near the Vietnamese border, and along the coast of Kampot province. There are reports that a dense seagrass bed once covered Kampong Som Bay. Now only a few small patches exist. Unfortunately, quantitative data about coverage does not exist. Seagrass beds generally have a highly diverse invertebrate fauna, which forms the food of commercial fishes and crustaceans. Seagrass beds are also the main habitat for dugong. Stingrays often occur in seagrass beds, and fishers use specialised hooked lines to target this group. Unfortunately, these lines can entangle sea turtles. Some species of shark are believed to use seagrass beds for spawning.

Soft bottom communities
The majority of Cambodia's seafloor is composed of soft sediments, ranging from almost pure sand along exposed beaches to very fine, waterlogged mud. Shell fragments often comprise a high proportion of the sediment, and clumps of consolidated clay, probably of terrestrial origin, are encountered in bottom samples. Trawl fishing in Cambodia mostly occurs over soft bottom habitats, and apart from shrimp and demersal fish species (such as snappers, threadfin breams, and siganids), squid and cuttlefish, slipper lobster, and mantis shrimps (stomatopods) are important parts of catches taken in these areas.

The invertebrates living on and in the soft sediments are important as food for commercial species. Trawling may cause significant impacts on the species composition, growth rate, and maximum size of these animals. In parts of Kampong Som Bay, the seapen (*Pteroides* sp.) dominates the invertebrate community. This may be due to this species having a higher tolerance to repeated disturbances than most bivalves. Brittlestars, seastars, and predatory gastropods are also very common in these communities.

According to Tana (2000), there are four main coastal ecosystems in Cambodia, including the:
1. Koh Kong Bay ecosystem;
2. Botum Sakor National Park ecosystem;
3. Kampong Som semi-enclosed bay ecosystem; and the
4. Kampot Bay ecosystem.

- Koh Kong Bay ecosystem
This is the largest estuarine ecosystem in Cambodia. It is influenced by freshwater from the continent during the rainy season. There are two streams influencing this estuary, namely Dong Tong and Trapeang Roung. This estuary has a large mangrove forest covered delta with an area of approximately 60,000ha. The species diversity of the estuary is high (74 species). *Rhizophora mucronata* and *Rhizophora conjugata* are significantly important because their roots are the main habitats of green mussel, mangrove oyster and hermit crabs. Seagrass, especially *Enhalus* sp., is present at the delta of Trapeang Roung stream and the muddy beaches of the eastern part of the bay. *Halodule* sp. occurs in the area between the shoreline and Koh Kong Island, especially during the dry season. These areas are important habitat for mud and swimming crabs, cuttlefishes, and *Penaeus* and *Metapenaeus* shrimp. Shallow water mammals, including the Irrawaddy dolphin (*Orcaella brevirostris*), utilise this area throughout the year. The collection and culture of the green mussel (*Perna viridis*) takes place in Peam Krasob, Koh Kong Bay. Fishers harvest hard-shell clams (*Meretrix* spp.) and the short-neck clam (*Paphia undulate*) in Thmor Sor.

Sea turtles nest in this area. Interviews with experienced fishers in Koh Kapic indicate a dramatic decrease in sea turtles since 1975. Approximately 100 nesting females existed in the area in 1975; however, there were only 28 in 1998. More than 1000 hatchlings per year were estimated in 1975 compared to only 200 in 1998 (Try 1999).

- Botum Sakor National Park ecosystem
Botum Sakor National Park is an excellent habitat for resident and migratory birds and a safe habitat for the brackish water crocodile (*Crocodilus porosus*); however, this species has never been positively identified (see section 2.1.3 Marine Reptiles). The coastal portion of the park is comprised of rocky and white sandy beaches and is a main location for coral reef habitats, as continental freshwater does not influence the area. Reef fishes are highly diverse (about 50 species). During November to January, this area is the main habitat of the *Penaeus* shrimp species, especially white shrimps, as they seek refuge from storms and strong northern winds.

- Kampong Som semi-enclosed bay ecosystem
Kampong Som Bay is the deepest of the bay ecosystems but depth does not exceed 20m. The northeastern coastal habitat is defined as Dong Peng Multiple-Use Area, where 2 major estuaries and mangrove wetland forest are located. The estuaries are fed by the Andong Tuk and Sre Ambel streams during the wet season, which leads to reduced salinity levels. These areas are the main habitats of dolphins, octopus, and other sea animals such as hawksbill, loggerhead, and green turtles. The latter often enter this area for nesting on the eastern beaches.

These areas are also the main habitat of jellyfish and molluscs. Koh Khchorng is the main harvesting area for blood cockle (*Anadara* spp.) and short-neck clam (*Paphia undulate*). Koh Khchorng is also a nursing ground for mud crabs. Fishers collect large quantitities of juvenile mud crabs (*Scylla serrata*) for fattening in local areas or in Viet Nam. Vinegar crabs (*Episesarma* spp.) are also caught in this area. These species spawn in mangrove areas around the full moon during September and October. Fishing grounds for the sentinel crab (*Podophthalmus vigil*) and mud crab are inside Kampong Som Bay (landed in Steung Hao). In offshore waters adjacent to Sihanoukville, fishers target blue swimming crab (*Portunus pelagicus*) (Jensen & Try 2002; Fishers pers. comm.). Nesting grounds for sea turtles are located in Koh Rong, Koh Rong Salem and Koh Polowai. The offshore islands, including Koh Tang and Koh Pring, are important nesting areas (Try, 1999; 2000; Fishers, pers. comm.).

- Kampot Bay ecosystem
This area is characterised by swampy and rocky habitats with little freshwater influence. Salinity near the shore varies between 30.5 ppt and 32 ppt during the rainy season and increases up to 32.5 ppt to 33.4 ppt during dry season. The deepest area (< 20m) is in the transboundary water area near Phu Quoc Island (Koh Tral Island). This bay contains the main area of seagrass, which extends from Trapeang Ropov and Steung Kampot estuaries. The seagrasses *Enhalus* and *Halodule* grow on the sandy sea floor. They are the main habitat of dugong, which migrates to this area from November to January. These seagrasses are a main habitat of molluscs such as blood cockle, clam and cone shell, and the feeding ground for a number of resident and migratory fishes, squids, octopus and crustaceans.

In Kampot province, there are many areas where fish spawn. Koh Kataing Island is the main spawning ground for crabs and some species of fishes. Koh Tror Ngou is a spawning ground for some species of fishes and shrimps. Koh Thmey is a major spawning ground for shrimps, fishes, and crabs. Brek Tror Peng Ror Paov and Koh Ro Si Ta are also major spawning grounds for shrimps, crabs, molluscs, and some species of fish such as snappers (CZM 2002b). The Brek Ampil area contains habitats important to sea turtles, dugong, and molluscs. Chong Kos Prek Tnout is a key habitat area for shrimps, crabs, and some species of fish.

4.2 Unknown issues such as stocks with undefined spawning grounds

The section above describes the information known about important spawning and fishing grounds. However, a paucity of information exists for most commercial fish species. This issue will need addressing via future research projects or increased use of fisher knowledge in fisheries management. Typically, fishers possess considerable knowledge about the distribution and abundance of different species, and in many cases, where and when these species spawn. However, fishers are often reluctant to provide this information, mostly due to concerns regarding increased competition and the introduction of fishing restrictions in their important fishing areas.

In order to solve this problem and obtain information regarding CPUE, Cambodia's DoF aims to collaborate with foreign experts and donor agencies in seeking financial assistance for the development of research facilities and activities. In addition, the collaboration of countries bordering the Gulf of Thailand in managing exploited fish stocks should be a key priority for the future.

4.3 Threats, current and potential

The current and potential threats and impacts to coastal and marine habitats in Cambodia are summarised in Table 35. The coastal provinces of Cambodia are separated from the remaining part of the country by the mountains of the Cardamom and Elephant ranges. Only a few small rivers and several streams enter the sea through shallow semi-enclosed bays. Slope from mountain to coastline differs widely between the provinces. Mountainous areas are characterised by dense forest, however, agricultural activities dominate the lower catchments. Population density is low. Koh Kong province has a population density of only 12 persons/km², Kampot province 108 persons/km², Sihanoukville municipality 179 persons/km², and Kep municipality 85 persons/km² (country average is 64 persons/km²). Migration to coastal areas is high and development of new settlements is rather haphazard. Property value has increased significantly for waterfront land in Sihanoukville in recent years, partly because of perceived opportunities for developing facilities for tourism. The construction of new buildings directly on the beach is common, although concrete or brick seawalls often protect them. The landowners are often high-ranking government officials, so local authorities are usually powerless in attempting to prevent such activities. So far, there is little or no sewage treatment, and in many cases, there are only open sewers, which discharge directly into streams, rivers, or the sea. This may present health problems especially in densely populated fishing villages.

All freshwater discharge to the sea is via shallow semi-enclosed bays. This means that all suspended particulate material remains trapped in these bay areas for some time. Increased siltation and particulate organic material increase turbidity, leading to reductions in primary production, especially that of benthic plants such as seagrass. Deposition of organic particles may provide an additional food supply for benthic deposit-feeders such as polychaete worms and some species of bivalves. However, such particles tend to decrease growth rates in suspension feeding bivalves, including oysters and mussels. Generally, increased levels of organic matter may result in an increased biological oxygen demand leading to diminished dissolved oxygen concentrations in the water column.

There are two zones concerning fisheries in Cambodia's EEZ: (1) from the high water mark to a depth of 20m is the inshore zone; and (2) from the outer boundary of the inshore zone to the border of the claimed EEZ is the offshore zone. As maximum depth in the Gulf of Thailand is only 80m, there is no true offshore zone (deeper than 200m).

Table 35 Summary of threats and impacts to marine and coastal habitats in Cambodia.

Zone	Inland (coastal provinces)	Coastal (0-20m)	Offshore (>20m)
Threats	Land development Agriculture Tourism Freshwater supply Waste disposal Damming Sewage discharge	Fishing Illegal gears & vessels Aquaculture Mangrove cutting Port activities Land reclamation Sewage discharge Tourism	Fishing Illegal gears & vessels Oil & gas exploitation Marine transport
Impacts	Habitat destruction Pollution Eutrophication Flooding or lack of freshwater Siltation Health problems	Stock depletion Habitat destruction Eutrophication Pollution Siltation Oxygen depletion Alien species Red tides/algal blooms Health problems	Stock depletion Pollution Eutrophication Oxygen depletion

4.4 Ranking of Habitats

4.4.1 Ranking for association with species of importance to food security

Habitats can be ranked according to several different criteria. Due to lack of information about species that are important for local food security, it has not been possible to rank Cambodia's marine habitats according to their usage by species of importance to food security.

4.4.2 Ranking for species of high value

The fish that have the highest market value are the groupers, angelfish, and silver pomfret. The first two species are associated with coral reefs. Similarly, the gastropods of highest economic value are associated with coral reef habitats. Hence, coral reefs should be given the highest rank. Mud crab is the most highly valued crab species. This species depends heavily upon mangrove habitats. Mangroves are also an important nursery area for shrimp. Hence, mangroves received the second highest rank. Clearly the majority of commercial fisheries, and hence the highest total value, arises from benthic soft bottoms and pelagic environments. Although trawling is a highly destructive fishing method, it is difficult to impose protective measures for open water over soft bottom habitats. Regulation should occur in recognition of the total number of licences issued or the maximum number of fishing days in a given area.

4.4.3 Ranking for endangered, rare and threatened species

The DoF and the Ministry of Environment have prioritised the protection of habitats important to endangered and threatened species, especially those relevant to key international conventions such as CITES, Ramsar, CMS, and others. At present, there are 2 National Parks (Ream or Preah Sihanouk and Botum Sakor) containing coastal components. Similarly, the Multiple Use Area of Dong Peng includes some mangrove forests. The identification of several sites as potential Marine Protected Areas has occurred. These sites contain important nesting areas for sea turtles, coral reefs, and seagrass beds. They are located around barrier islands, including Koh Rong, Koh Rong Saleum and Koh Sdach. Hence, coral reef habitats again receive the highest ranking. Clean sandy beaches suitable for the nesting of sea turtles and horseshoe crabs are given high priority in this connection. The protection of some of Cambodia's mangrove sites does occur on paper, although enforcement of regulations has been weak.

5. CURRENT MANAGEMENT REGIMES

5.1 Legal instruments

Following the Pol Pot regime, there was a complete restructure of Cambodia's legal and administrative arrangements for natural resource use. Therefore, in order to manage and control the use of Cambodia's natural resources, specifically aquatic resources, the DoF instituted Cambodia's Fisheries Law (in Khmer called *Kret Chhbab Lek 33 Kra Chor*) for the Management and Administration of Fisheries Resources in Cambodia. The DoF administered this law, which aimed to conserve and regulate the exploitation of Cambodia's fishery resources. It represents a modified and upgraded version of Cambodia's fisheries law of 1965. The enactment of this legal instrument occurred on 9 March 1987.

This law aims to enable the achievement of Cambodia's obligations under the 1982 United Nations Convention on the Law of Sea. This international instrument gives the rights and responsibilities for the management and use of marine resources within the Cambodian EEZ to the Cambodian Government. The modification of Cambodia's law has occurred in response to changes in political situations. This law is currently under review and it is aimed that a draft will be finished, signed, and come into force during 2004. Similarly, other existing legal instruments instituted prior to 1993 are under revision. A revised version is in the process of community and stakeholder consultation. Several sub-decrees, proclamations, and other regulations are being drafted.

The existing law provides a broad legislative framework for the management and development of marine capture fisheries in Cambodia. Management tools such as the requirement to licence boats of a specified size, closures to protect some species during their spawning seasons, and gear restrictions are commonly used. The law contains some conservation measures such as banning the use of trawls in inshore areas less than 20 meters deep, and the prohibition of the use of explosives and poisons for commercial fish capture.

There are many legislative instruments and regulations currently in force for the management, conservation, and sustainable development of Cambodia's fisheries resources. These include:

- Fishing permits for commercial fishing
- Boat licenses (see above)
- Licences for foreign vessels fishing inside Cambodian EEZ
- Prohibition of illegal fishing gears such as electro-fishing, explosives and poisons (see above)

- Prohibition of trawling in water less than 20m deep (see above)
- Protection of mangrove areas and fish sanctuaries (spawning areas)
- Closed season during the spawning season of mackerels from 15 January – 31 March
- Listing of nationally threatened wildlife species for which collection/harvesting is prohibited
- Prohibition of the trade in Cambodia's reptiles
- Prohibition of exploitation and harvesting of corals and other species in the CITES appendices

5.2 Institutional arrangements (research, monitoring, control & enforcement)

There are 4 provincial/municipal fisheries offices in the coastal areas of Sihanoukville, Koh Kong, Kampot and Kep. One marine inspection unit is located at Sihanoukville to control all illegal activities along the Cambodian coastline. The marine inspection unit consists of 2 vessels, each about 14 to 15 metres in length, with maximum speeds of 12 to 15 knots. The vessels are often unable to match the speed of foreign fishing vessels (APIP 2001), and the unit has insufficient funds to operate and maintain the vessels. In 2002, about 80 staff were employed within the inspection sector. This includes all staff in the coastal provinces/municipalities and the marine inspection unit.

There is no research and monitoring unit for marine fisheries within the DoF, although there are some specific research projects now underway in collaboration with donor agencies. A marine research group is operating under the DoF, but unfortunately, the members have to attend to other duties as well, and may be transferred (promoted) to inland provinces. So far, the DoF has proposed the establishment of a marine and coastal national research institute in Sihanoukville municipality. The project is now seeking assistance from donors. A small marine reference collection in Sihanoukville has been established under the DoF mandate. This reference collection will extend its activities for public awareness and may become a marine natural museum in the future.

There is some institutional overlap between the DoF and Ministry of Environment (MoE). The MoE is responsible for the conservation of biodiversity and protected areas. However, the DoF, as part of the Ministry of Agriculture, Forestry, and Fisheries, is responsible for the protection and sustainable use of marine natural resources and for establishing fisheries management areas.

5.3 Overview of patterns of resource ownership and traditional utilisation

Marine fishers in Cambodia are generally from poor communities, operating on a subsistence level or as small-scale commercial fishers. In the late 1970s, the Cambodian population was moved from the larger metropolitan areas into the provinces. Under the Khmer Rouge rule period (from 1975 to 1979), government was likewise moved from the big cities to the rural areas. Farming rice and clearing forests for the development of rice fields were the main priorities of the government, whereas fisheries had low priority and very little fishing or aquaculture was conducted. Political instability and lack of resources in the following years resulted in only small amounts of marine production and management by government.

Today, the marine fishery remains largely open access. Middle to large-scale participants require a licence, which provides them with a 1-year access right to the resource (within the conditions of their licence). However, subsistence and small-scale fishers are not required to be licensed and have no defined resource access rights. These fishers mostly use traditional methods. However, more fishers are adopting modern methods to maximise their catches.

There are increasing numbers of migrants from poorer rural areas moving to coastal areas to start new livelihoods as fishers. These people have very few traditional ties to marine fisheries. Efforts should be made to find alternative employment for these people to ease the pressure on fisheries resources.

5.4 Human and Institutional Capacity

The mandate of DoF is to be responsible for aquatic fauna and flora. This means that the DoF is responsible for managing Cambodia's marine and inland fisheries resources, including management of fishers, information, and operations. The DoF employed 1557 staff throughout Cambodia in 2000, with 845 of those holding a qualification.

There are few research activities conducted in the coastal areas. Most research (and qualified staff) is conducted for freshwater fisheries. There is very little capacity within the DoF to assist in the management and research of marine fisheries. There are also very few institutional resources, particularly in provincial offices, to assist in resource management and research. The staff of provincial/municipal fisheries offices are responsible for all fisheries activities, including aquaculture and inland fisheries in the coastal provinces. Most of them have little formal training, although DoF has recently increased educational opportunities for provincial staff.

There have been several projects conducted that have assisted in building government level human resource capacity. These projects have focused on community fisheries development (capacity building within government and communities), marine living resources or marine biodiversity, mangrove rehabilitation, coral and seagrass research, marine mammal and turtle research. All of these projects have received financial assistance from donor agencies and have been implemented in collaboration with either the Department of Fisheries or the Ministry of Environment. Unfortunately, most of the projects stop when donor funding runs out. There are no incentives and insufficient local capacity to continue successful projects.

5.5 Review of stakeholders

There are a wide range of participants and interested stakeholders in Cambodia's marine fisheries. Community members, large and middle scale fishers, processors, traders, transporters, provincial and national government staff, local and international NGOs, and scientists are increasingly being involved in government decision-making processes. However, it will be important to include the participation of small-scale commercial fishers as well as subsistence fishers in the future. It appears that most private sector stakeholders, including large and middle-scale fishers, are mostly interested in getting maximum profits in a short time, even if they know that this will damage the environment and eliminate their future possibilities of utilising these resources. Marine fishers in Cambodia do not form fisher associations, and so it is up to each individual to make decisions about when and how often to fish, as well as appropriate times to take up loans for investing in improved technology.

6. RECOMMENDED ACTIONS

Research and monitoring

This report has identified some major gaps in scientific knowledge about marine fisheries resources. This highlights the importance of initiating collaborative research activities in the Cambodian section of the Gulf of Thailand. Areas of specific importance are reproductive biology, population dynamics, and ecology of commercial fish species. In addition, quantitative studies of benthic and pelagic invertebrates, which constitute food for commercial species, should be given high priority.

Fisheries dependent and independent surveys should be conducted at regular intervals to assess CPUE for commercially important species. Where possible, this should be carried out in collaboration with Thai, Vietnamese, and regional fisheries research institutions.

A regular monitoring program should be established for water quality parameters, hydrography, phytoplankton production, and zooplankton biomass. In order to carry out all these activities, a marine research facility should be established in the coastal area of Cambodia.

Education and Public Awareness

The educational level of fishers and their families is typically low. It is important that information about marine ecosystems and biodiversity be disseminated to these people. Increased community participation in fisheries management requires that stakeholders make informed decisions, and this is only possible if the stakeholders have all the available information. Due to the prevalence of illiteracy among subsistence fishers, all information should be given as visual presentations, such as videos. Fishers should also be offered training about boat handling, safety, and navigation.

It is important that the educational level of the staff of the provincial fisheries offices be improved. Junior staff with reasonable English skills can receive formal training abroad if scholarships are available. However, senior staff members often have little or no command of English, and will need to be trained locally. Special training should be given to technical staff in connection with implementation of a monitoring program, for handling accidental catches of endangered species and other special issues.

There is also an urgent need to change the catch recording system in order to ensure the reliability of fisheries statistics. This will probably require international assistance as well as special training of technical staff, especially in the provincial offices and the Marine Fisheries Inspection Unit.

Management measures

The DoF needs to change the recording system for official fisheries statistics. Catches need to be separated to species (for the most abundant ones) or groups of species. In addition, the value for each of these categories needs to be recorded.

The DoF should also allocate qualified technical staff with specific responsibilities for the marine fisheries sector. Problems and issues within this sector differ from those of the freshwater fisheries sector, and with the current staff rotation system, knowledge gained by some staff members "disappears" when they are promoted to other duties.

Management measures should be implemented to conserve endangered species, and protocols should be established for the handling of accidentally captured cetaceans, dugongs and sea turtles. Support from the UNEP/GEF South China Sea Project should facilitate the establishment of management areas to safeguard important species during critical phases of their life-cycles, such as when they form spawning aggregations or utilising inshore coastal nursery areas.

As overfishing is already prevalent in Cambodian waters, measures should be taken to regulate catches. This will likely be best achieved throigh the establishment of spatial and temporal management measures, and the regulation of the number of licences issued. Efforts should also be taken to reduce the use pair-trawlers and light-luring purse seine methods by foreign fishers in Cambodian waters.

Law enforcement

At present, there is little compliance with existing regulations. Trawling takes place in shallow water, illegal gears are used, and catches are landed outside the country. It is therefore important that measures be taken to ensure adequate monitoring, control, and surveillance of fishing activities in Cambodia's EEZ.

Economic measures

To control or reduce the number of subsistence fishers, alternative income sources should be explored. The establishment of processing facilities for marine fisheries products should be promoted. Presently, most of the fisheries products are exported fresh, chilled or frozen. Processing generally adds value to landings and it creates local employment opportunities.

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ANNEX 1

List of Marine Fish Species of Cambodia

(Sources: Tana, 1998; Jensen & Try, 2002)

No.	*Scientific name: (Species)*	Vernacular name	Local name
	Rhincodontidae		
1	*Rhincodon typus* Smith, 1828	Whale shark	Chlarm Yaak
	Hemiscylliidae	Longtail carpetsharks	
2	*Chiloscyllium indicum* (Gmelin, 1789)	Slender bamboo shark	Chlarm sangha
3	*Chiloscyllium griseum* (Muller & Henle, 1839)	Grey bamboo shark	Chlarm russey
4	*Chiloscyllium puntatum* Muller & Henle, 1818	Brown-banded catshark	Chlarm Chkuot
5	*Chiloscyllium plagiosum* (Bennett, 1830)		
	Stegastomatidae	Zebra sharks	
6	*Stegostoma varium* (Seba, 1761)		Chlarm Chkuot
7	*Stegostoma fasciatum* (Hermann, 1783)	Leopard shark	Chlarm Chkuot
	Ginglymostomatidae	Nurse sharks	
8	*Nebrius ferrugineus* (Lesson, 1830)	Tawny nurse shark	Chlarm
	Lamnidae	Mackerel sharks	
9	*Isurus oxyrhinchus* Rafinesque, 1809	Shortfin mako	Chlarm
	Scyliorhinidae	Catsharks	
10	*Cephaloscyllium fasciatum* Chen, 1966	Reticulated Swellshark	Chlarm Chkuot
	Carcharhinidae	Ground or Requiem sharks	
11	*Galeocerdo cuvier* (Peron & LeSueur, 1822)	Tiger shark	Chlarm kla
12	*Scoliodon laticaudus* (Muller & Henle, 1838)	Spadenose shark	Chlarm
13	*Scoliodon sorrakowah* (Civier, 1829)	Shark	Chlarm
14	*Scoliodon walbeehmi* (Bleeker, 1856)	Blacktail reef shark	Chlarm Chkuot
15	*Carcharhinus limbatus* (Valenciennes, 1839)	Blacktip shark	Chlarm
16	*Carcharhinus sorrah* (Valenciennes, 1839)	Spottail shark	Chlarm och kantuy
	Triakidae	Houndshark	
17	*Mustelus kaneckonis?*	Shark	Chlarm
18	*Negogaleus longicaudatus?*	Shark	Chlarm
	Sphyrnidae	Hammerhead sharks	
19	*Sphyrna zygaena* (Linnaeus, 1758)	Smooth Hammerhead shark	Chlarm Ek
20	*S. lewini* (Griffith & Smith, 1834)	Scalloped hammerhead	
21	*Rhinobatidae*		
22	*Rhinobatos typus* Bennett, 1830	Giant Shovelnose Ray	Chlarm Truoch
23	*Aptychotrema* sp.?	Spotted shovelnose Ray	Chlarm Truoch
24	Rhynchobatidae		
25	*Rhynchobatus djiddensis* (Forsskal, 1775)	White-spotted Shovelnose Ray	Chlarm Truoch Och Sar
	Dasyatidae	Ray	Bobel
26	*Dasyatus akejei ?*		
27	*Dasyatus kuhlii* (Muller & Henle, 1841)	Blue-spotted Stingray	
28	*Dasyatus uarnak* (Forsskal, 1775)		
29	*Dasyatus zugei* (Muller & Henle, 1841)		
30	*Dasyatus leylandi* Last, 1987	Brown reticulated stingray	Bobel Spoan
31	*Dasyatus bennetti* (Muller & Henle, 1841)		
32	*Himantura toshi* Whitley, 1939	Black-spotted Stingray	
33	*Himantura undulata* (Bleeker, 1852)	Leopard Whipray	
34	*Pastinachus sephen* (Forsskal, 1775)	Cowtail Stingray	
35	*Tæniura melanospila* (Bleeker,1853)		
36	*Tæniura lymma* (Forsskal, 1775)	Blue-spotted Fantail Stingray	Bobel Khla
37	*Urolophus flavomosaicus* Last & Gomon, 1987	Patchwork Stingray	
	Gymnuridae		
38	*Gymnura australis* (Ramsay & Ogilby, 1886)	Rat-tailed Ray	
	Myliobatidae		
39	*Aetomyleus nichofii* (Bloch & Schneider, 1801)	Barbless Eagle Ray	
40	*Æ. milvus ?*		
41	*Aetobatus narinari* (Euphrasen, 1790)	Spotted Eagle ray	
42	*Myliobatis tobijei ?*		
43	*Rhinoptera javanica* (Muller & Henle, 1841)	Spotted eagle Ray	Bobel Ork

No.	*Scientific name: (Species)*	Vernacular name	Local name
	Mobulidae		
44	*Manta birostris* (Donndorff, 1798)	Manta Ray	
	Torpedinidae		
45	*Narcine timlei* (Bloch-Schneider, 1801)		
46	*Narcine lingula* (Richardson, 1846)		
47	*Narcine maculata?*		
	Megalopidae or Elopidae		
48	*Megalops cyprinoides* (Broussonnet, 1782)	Indo-pacific tarpon or Oxeye Herring	
	Clupeidae		
49	*Anadontostoma chacunda* (Hamilton, 1822)	Chacunda gizzard-shad	Trey Yipun
50	*Dussumieria acute* (Valenciennes, 1822)	Round Herring or Rainbow sardine	
51	*Ilisha elongata* (Bennett, 1830)	Elongate ilisha	
52	*I. melastoma* (Schneider, 1801)	Indian ilisha	
53	*Pellona ditchela* Valenciennes, 1847	Indian pellona	
54	*Pellona amblyuropterus* (Bleeker, 1852)	Javan ilisha	
55	*Ilisha macrophthalma* (Swainson, 1838)	Bigeyes Ilisha	Trey Sloeuk Russey
56	*Ilisha sladeni?*		
57	*Sardinella albella* (Valencienness, 1847)	White sardinella	
58	*Sardinella aurita?*		
59	*Sardinella brachysoma* (Bleeker, 1852)	Deepbody sardinella	
60	*Sardinella (Amblygaster) clupeoides* (Bleeker, 1849)	Bleeker's smoothbelly saedinella or Round belly Sardinella	Trey Kun
61	*Sardinella fimbriata*		
62	*Sardinella gibbosa* (Bleeker, 1849)	Goldstripe sardinella	
63	*Sardinella [?Amblygaster] leiogaster* (Valenciennes, 1847)	Smoothbelly sardine	
64	*Sardinella longiceps* (Valenciennes, 1847)	Indian oil-sardinella	
65	*Sardinella melanura* (Cuvier, 1829)	Blacktip sardinella	
66	*Sardinella sirm* (Walbaum, 1792)	Spotted sardinella	
67	*Sardinella jussieui* (Valenciennes, 1847)		
68	*Herklotsichthys punctatus* (Ruppell, 1837)	Spotted herring	
	Engraulidae		
69	*Stolephorus bataviensis* (Hardenberg, 193?)	Batavian anchovy	
70	*Stolephorus commersoni* (Lacepede, 1803)	Commerson's anchovy	
71	*Stolephorus indicus* (van Hasselt, 1823)	Indian anchovy	Trey Kakeum
72	*Encrasicholina heterolobus* (Ruppell, 1837)	Shorthead anchovy	
73	*Thryssa hamiltonii* (Gray, 1835)	Hamilton's anchovy	
74	*Thryssa mystax* (Schneider, 1801)	Moustached Thryssa	
75	*Thryssa vitrirostris* (Gilchrist & Thompson, 1908)	Orange-mouth thryssa	
76	*Thryssa setrirostris* (Broussonet, 1782)	Longjaw thryssa	
	Chirocentridae	Wolf-herring	
77	*Chirocentrus dorab* (Forsskal, 1775)	Dorab-wolf Herring	Trey Srom Dav
78	*Chirocentrus nudus* (Swainson, 1839)	Whitefin wolf-herring	Trey Srom Dav
	Synodontidae	Lizardfish	
79	*Saurida micropectoralis* (Shindo & Yamada, 1972)	Shortfin Lizard fish	
80	*Saurida tumbil* (Bloch, 1795)	Greater lizardfish or Common Grinner	
81	*Saurida gracillis* (Quoy & Gaimard, 1824)	Gracile lizardfish	
82	*Saurida undosquamis* (Richardson, 1848)	Brushtooth Lizard fish	Trey Kdor Chein
83	*Saurida longimanus* (Norman, 1939)	Longfin lizardfish	
84	*Trachinocephalus myops* (Bloch & Schneider, 1801)	Bluntnose lizardfish	
	Ariidae	Sea catfish	
85	*Arius caelatus* (Valenciennes, 1840)	Engraved catfish	
86	*Arius venosus* (Valenciennes, 1840)	Veined catfish	
87	*Arius maculatus* (Thunberg, 1792)	Spotted catfish	
88	*Arius thalassinus* (Ruppell, 1837)	Salmon catfish	Trey Kaok
89	*Arius sagor* (Buchanan, 1822)	Sagor catfish	
90	*Osteogeniosus militaris* (Linnaeus, 1758)	Soldier catfish	
	Plotosidae	Stinging catfish, Coral catfish, Eel catfish or barbel eels	Trey Andeng samot
91	*Plotosus lineatus* (Thunberg, 1787)	Striped eel catfish	Trey Andeng Karang

No.	*Scientific name: (Species)*	Vernacular name	Local name
92	*Plotosus canius* (Hamilton-Buchanan, 182?)	Eel catfish	Trey Andeng poy
	Muraenidae	Morays	
93	*Siderea thrysoidea* (Richardson, 1844)		Antong Samot
94	*Siderea picta* (Ahl, 1789)	Speckled siderial moray	Antong Samot
95	*Lycodontis [?Gymnothorax] fimbriatus* (Bennett, 1831)		Antong Samot
96	*Lycodontis [?Gymnothorax] undulatus* (Lacepede, 1803)	Mottled moray	Antong Samot
	Muraenesocidae	Pike congers	
97	*Congresox talabon* (Cuvier, 1829)	Yellow pike conger	
98	*Muraenesox cinereus* (Forscal, 1775)	Daggertooth pike conger	
	Ophichthidae	Snake eels and worm eels	
99	*Pisodonophis boro* (Hamilton, 1822)	Rice-paddy eels or estuarine snake eel	Antong
	Belonidae	Needlefish	Trey Phtong
100	*Ablennes hians* (Valenciennes, 1846)	Flat needlefish or Barred Longtom	Trey Phtong Sampet
101	*Strongylura strongylura* (van Hasselt, 1823)	Spottail needlefish	Trey Phtong Samot
	Bregmacerotidae	Codlets, Codlings	
102	*Bregmaceros macclellandi* (Thompson, 1840)	Spotted codlets	
	Fistulariidae	Cornetfish, flutemouth	
103	*Fistularia petimba* Lacepede, 1803	Red cornetfish or Rough Flutemouth	
104	*Fistularia serrata* (Cuvier, 1817)		
	Centriscidae	Razorfish	
105	*Aeoliscus strigatus* (Gunther, 1860)	Razorfish	Chay Krapeu
106	*Centriscus scuttatus* Linnaeus, 1758	Grooved razorfish	
	Syngnatidae	Sea Horse, pipefishes	
107	*Hippocampus japonicus?*		Ses Samot
108	*Hippocampus kuda* Bleeker, 1852	Spotted seahorse	Ses Samot
109	*Syngnathus acus?*		Ses Samot
	Holocentridae	Squirrelfish, soldierfish	
110	*Holocentrus ruber?*	Squirrelfish	
111	*Myripristis murdjan* (Forsskal, 1775)	Pinecone soldierfish or Crimson Soldierfish	Trey Krahom
	Monocentridae	Pineapplefish, Pinecone fish, Knight fish	
112	*Monocentrus japonicus* (Houttuyn, 1782)	Japanese Pineapplefish	Trey Manaas
	Sphyraenidae		
113	*Sphyraena barracuda* (Walbaum, 1792)	Great barracuda or Spotbase Burrfish	Trey Ang Re Kantuy Khmao
114	*Sphyraena forsteri* (Cuvier, 1829)	Bigeye barracuda or forster's barracuda	Trey Ang Re Chnuot
115	*Sphyraena jello* (Cuvier, 1829)	Pickhandle barracuda, Banded barracuda or Giant seapike	Trey Ang Re
116	*Sphyraena obtusata* (Cuvier, 1829)	Obtuse barracuda or striped seapike	Trey Ang Re Loeung
117	*Sphyraena langsar ?*		Trey Ang Re
118	*Sphyraena pinguis ?*		Trey Ang Re
119	*Sphyraena qenie* Klunzinger, 1870	Military Seapike	Trey Ang Re
	Mugilidae	Mullets	
120	*Liza alata* (Steindachner, 1892) = *L. vaigiensis* (Quoy & Gaimard, 1824)	Diamond scaled grey mullet	Trey Kbak Khmok
121	*Valamugil cehell* (Forsskal, 1775)	Bluespot grey mullets	Trey Kbak Kong Kang
122	*Valamugil speigleri* (Bleeker, 1858)	Speigler's mullet	Trey Kbak Samot
	Polynemidae	Threadfins, tasselfishes	
123	*Eleutheronema tetradactylum* (Shaw, 1804)	Fourfinger threadfin or Giant Threadfin	Trey Karav
124	*Polydactylus sextarius* (Bloch & Schneider, 1801)	Blackspot threadfin	
125	*Polydactylus plebius* Broussonet, 1782	Striped threadfin or Northern threadfin	
	Centropomidae	Barramundis, sea perches	
126	*Lates calcarifer* (Bloch, 1790)	Barramundi or Giant sea perch	Trey Spong Prak
127	*Psammoperca waigiensis* (Cuvier, 1828)	Waigeu sea perch or Sea Bass	Trey Spong Toch
	Serranidae	Groupers, rockcod, hind, comber, coral trout, lyretail	Trey Tocke
128	*Anyperodon leucogrammicus* (Valenciennes, 1828)	Slender grouper or white-lined rockcod	Trey Tocke
129	*Cephalopholis analis* (Valenciennes, 1828)	Strawberry hind	Trey Tocke

No.	*Scientific name: (Species)*	Vernacular name	Local name
130	*Cephalopholis argus* Bloch & Schneider, 1801	Peacock grouper	Trey Tocke
131	*Cephalopholis aurantia* (Schneider, 1801)	Golden hind	Trey Tocke
132	*Cephalopholis boenack* Bloch, 1790	Brown-barred grouper or chocolate hind	Trey Tocke
133	*Cephalopholis formosa* (Shaw & Nodder, 1812)	Bluelined hind	Trey Tocke
134	*Cephalopholis hemistiktos* (Ruppell, 1830)	Yellowfin hind	Trey Tocke
135	*Cephalopholis leopardus* (Lacepede, 1802)	Leopard grouper or leopard hind	Trey Tocke
136	*Cephalopholis miniata* (Forsskal, 1775)	Coral grouper or vermilion seabass	Trey Tocke
137	*Cephalopholis nigripinnis* (Valenciennes, 1828)	Duskyfin hind	Trey Tocke
138	*Cephalopholis oligosticta* Randall & Ben Tuvia, 1983	Roughcheek hind	Trey Tocke
139	*Cephalopholis sexmaculata* (Ruppell, 1830)	Sixspot grouper or sixblotch hind	Trey Tocke
140	*Cephalopholis sonnerati* (Valenciennes, 1828)	Tomato grouper or tomato hind	Trey Tocke
141	*Cephalopholis pachycentron* (Valenciennes, 1828)	Brown-banded seabass	Trey Tocke
142	*Cromileptes altivelis* (Valenciennes, 1828)	Barramandi cod or Polkadot grouper or humpback seabass	Trey Tok Ke Chrouk
143	*Variola louti* (Forsskal, 1775)	Coronation Trout	Trey Tocke
144	*Epinephelus andersoni* (Boulenger, 1903)	Catface grouper	Trey Tocke
145	*Epinephelus awoara* (Temminck & Schlegel, 1842	Yellow grouper	Trey Tocke
146	*Epinephelus bleekeri* (Vaillant, 1877)	Duskytail grouper	Trey Tocke Khmao
147	*Epinephelus brunneus* (Bloch, 1793)	Mud grouper	Trey Tocke
148	*Epinephelus caeruleopunctatus* (Bloch, 1790)	White-spotted grouper or Ocellated Rockcod	Trey Tocke
149	*Epinephelus chlorostigma* (Valenciennes, 1828)	Brown-spotted grouper	Trey Tocke
150	*Epinephelus cyanopodus* (Richardson, 1846)	Blue Maori grouper	Trey tocke
151	*Epinephelus diacantus* (Valenciennes, 1828)	Thorny cheek grouper	Trey Tocke
152	*Epinephelus epistictus* (Temminck & Schlegel, 1842)	Broken-line grouper	Trey Tocke
153	*Epinephelus fasciatus* (Forsskal, 1775)	Black-tipped grouper or redbanded grouper	Trey Tocke Krahom
154	*Epinephelus fuscoguttatus* (Forsskal, 1775)	Brown-marbled grouper or Flowery cod	Trey Tocke
155	*Epinephelus guaza* (Linnaeus, 1758)		Trey Tocke
156	*Epinephelus hexagonatus* (Bloch & Schneider, 1801)	White-specked grouper or Hexagon Rockcod	Trey Tocke
157	*Epinephelus maculatus* (Bloch, 1790)	Bar-Cheeked Coral Trout	Trey Tocke Ach Phkay
158	*Epinephelus malabaricus* (Bloch & Schneider, 1801)	Malabar grouper	Trey Tocke Thmar
159	*Epinephelus megachir* (Richardson, 1846)	Honeycomb grouper	Trey Tocke
160	*Epinephelus merra* Bloch, 1793	Dwaft-spotted grouper or Honey comb cod	Trey Tocke
161	*Epinephelus microdon* (Bleeker, 1856)	Camouflage grouper	Trey Tocke
162	*Epinephelus ongus* (Bloch, 1790)	White-streaked grouper or Spekled-fin Rockcod	Trey Tocke
163	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Six-banded rockcod	Trey Tocke
164	*Epinephelus summana* (Forsskal, 1775)	Summan grouper	Trey Tocke
165	*Epinephelus tauvina* (Forsskal, 1775)	Greasy grouper or Reef cod	Trey Tocke Khmao
166	*Epinephelus tukula* Morgans, 1959	Potato grouper	Trey Tocke och Thom
167	*Epinephelus undulosus* (Quoy & Gaimard, 1824)	Midwater grouper	Trey Tocke
168	*Diploprion bifasciatum* (Kuhl & van Hasselt, 1928)	Yellow emperor	
169	*Plectropomus aerolatus* (Ruppel, 1775)	Polkadot cod	Trey Tocke phkay
170	*Plectropomus leopardus* (Lacepede, 1802)	Coral trout or Leopard grouper or bluedotted coral-trout	Trey Tocke och khiev
171	*Plectropomus maculatus* (Bloch, 1790)	Spotted coral trout	
172	*Plectropomus punctatus* (Quoy & Gaimard, 1824)	Mottled coral-trout	
173	*Plectropomus truncatus* Fowler & Bean, 1930	Squaretail coral-trout	Trey Tocke
174	*Promicrops lanceolatus* (Bloch, 1790)	Brindle grouper	
175	*Variola louti* (Forsskal, 1775)	Moontail seabass or Coronation grouper	
	Teraponidae	Therapons, terapon-perches	
176	*Pelates quadrillineatus* (Bloch, 1790)	Fourlined terapon or Trumpeter	Trey Trasak trachiek khmao
177	*Pelates oxyrhynchus* (Temminck & Schlegel, 1842)	Blotched therapon	Trey Trasak
178	*Terapon theraps* Cuvier, 1829	Largescaled terapon or Banded grunter	Trey trasak Pruy Khmao
179	*Terapon jarbua* (Forsskal, 1775)	Jarbua therapon or Crescent perch	Trey Trasak Thom
180	*Terapon puta* Cuvier, 1829	Smallscaled terapon or trhee-lined Grunter	Trey Trasak

No.	*Scientific name: (Species)*	Vernacular name	Local name
	Priacanthidae	Bigeye snappers	
181	*Priacanthus blochii* (Bleeker, 1853)	Bloch's big eye or Paeony bulleye	Trey Krahom Phnek Thom
182	*Priacanthus hamrur* (Forsskal, 1775)	Crescent-tail bigeye or Moontail bulleyes	Trey Kahom
183	*Priacanthus macracanthus* Cuvier, 1829	Red bigeye snapper	Trey Krahom
184	*Priacanthus sagittarius* Starnes, 1988	Robust bigeye	Trey Krahom
185	*Priacanthus tayenus* Richardson, 1846	Purple spotted bigeye snapper or Threadfin bigeye	Trey Krahorm Phnek Thom
	Apogonidae	Cardinalfishes	
186	*Apogon lineatus?*		
187	*Apogon semilineatus* Temmink & Schelgel, 1843	Black-tipped cardinalfish	
188	*Apogon thermalis* Valenciennes, 1829	Thermal cardinalfish	
189	*Apogon notatus* (Houttuyn, 1782)	Spotnape cardinalfish	
190	*Apogon aureus* (Lacepede, 1802)	Ring-tailed cardinalfish	
191	*Apogon fleurieu?*		
192	*Apogon niger?*		
	Sillaginidae	Sillago whitings	Trey Prolos Phka
193	*Sillago maculata burrus* Richardson, 1842	Trumpeter whiting	Trey Prolos och
194	*Sillago sihama* (Forsskal, 1775)	Silver sillago or Northern whiting	Trey Prolos
	Lactariidae		
195	*Lactarius lactarius* (Bloch & Schneider, 1801)	False Trevally	
	Rachycentridae	Cobias	
196	*Rachycentrum canadus* (Linnaeus, 1766)	Cobia	
	Carangidae	Round scads	
197	*Alectis ciliaris* (Bloch, 1788)	African pompano or Pennantfish	Trey Chein Chas
198	*Alectis indicus* (Ruppell, 1828)	Indian threadfin or diamond trevally	Trey Cheim Chas
199	*Atule mate* (Cuvier, 1833)	Yellowtail scad	Trey Kuon Kum kantuy loeung
200	*Atule djedaba* (Forsskal, 1775)	Solar scad or Shrimp scad	Trey kuon kum
201	*Caranx para* Cuvier, 1833	Banded scad	
202	*Alepes melanoptera* (Swainson, 1839)	Blackfin trevally or Small mouth scad	
203	*Atropus atropus* (Bloch & Schneider, 1801)	Kuweh trevally	
204	*Carangoides cilliarius* (Ruppell, 1830)	Longfin Cavalla	Trey Kalock Boeuv ?
205	*Carangoides chrysophrys* (Cuvier, 1833)	Longnose trevally or Club-nosed trevally	Trey Kaloch Boav
206	*Carangoides equula* (Temminck & Schlegel, 1844)	Whitefin trevally	
207	*Carangoides ferdau* (Forsskal, 1775)	Blue trevally	
208	*Carangoides fulvoguttatus* (Forsskal, 1775)	Yellow spotted trevally	
209	*Carangoides malabaricus* (Bloch & Schneider, 1801)	Malabar trevally	
210	*Carangoides caeruleopinnatus* (Ruppell, 1830)	Coastal trevally	
211	*Carangoides dinema* (Bleeker, 1851)	Shadow trevally	
212	*Carangoides plagiotaenia* (Bleeker, 1857)	Barcheek trevally	
213	*Caranx ignobilis* (Forsskal, 1775)	Giant trevally	
214	*Caranx helvolus*	Trevally	
215	*Caranx sexfasciatis* Quoy & Gaimard, 1824	Bigeye trevally	Trey Chuor Khmao
216	*Caranx tille* Valenciennes, 1833	Tille trevally	
217	*Caranx lugubris* Poey, 1860	Black jack	
218	*Caranx melampygus* Cuvier, 1833	Bluefin trevally	
219	*Caranx speciosus* (Forsskal, 1775)	Golden toothed trevally	Trey Kam Kuoch
220	*Decapterus maruadsi* (Temminck & Schlegel, 1842)	Round scad	Trey Kaun Kum
221	*Megalaspis cordyla* (Linnaeus, 1758)	Torpedo scad or Hard-tail scad	Trey Kantuoy Roeung
222	*Scomberoides commersonnianus* Lacepedes, 1802	Yellow queenfish or Talang queenfish	Trey Sampan / Kalang
223	*Scomberoides lysan* (Forsskal, 1775)	Double-spotted queenfish	Trey Kalang
224	*Scomberoides tol* (Cuvier, 1832)	Needle-scaled queenfish	
225	*Selar crumenophthalmus* (Bloch, 1793)	Bigeye scad or Purse-eyed scad	
226	*Selar tala* (Cuvier, 1832)	Barred queenfish	
227	*Chorinemus sanctipetri* (Cuvier, 1832)	Spotted queenfish	
228	*Selaroides leptolepis* (Kuhl & Van Hasselt, 1833)	Yellow-stripe scad or Smooth-tailed trevally	

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229	*Seriolina nigrofasciata* (Ruppell, 1829)	Black-banded trevally	
230	*Trachinotus blochii* (Lacepede, 1801)	Snubnose pompano or Snub-nosed dart	
231	*Ulua mentalis* (Cuvier, 1833)	Long-rakered trevally	
232	*Uraspis helvola* (Forster, 1801)	White-tongue jack	
	Carangidae		
233	*Parastromateus niger* (Bloch, 1795)	Black Pomfret	Trey Chap Khmao
	Menidae	Moonfish	
234	*Mene maculata* (Bloch & Schneider, 1801)	Moonfish	
	Caesionidae		
235	*Dipterygonatus balteatus* (Valenciennes, 1830)	Mottled fusilier	
236	*Pterocaesio chrysozona* (Cuvier, 1830)	Goldband fusilier	
237	*Caesio coerulaureus* Lacepede, 1801	Blue and gold fusilier	
238	*Caesio erythrogaster* (Cuvier, 1830)	Yellow tail fusilier	
	Lutjanidae	Snappers, jobfishes	
239	*Lutjanus argentimaculatus* (Forsskal, 1775)	Mangrove red snapper	Trey Spong Krahom
240	*Lutjanus bohar* (Forsskal, 1775)	Twospot red snapper or Red bass	Trey Spong Krahom
241	*Lutjanus fulviflammus* (Forsskal, 1775)	Blackspot snapper	Trey Ang Koeuy prachruy
242	*Lutjanus lineolatus* (Ruppell, 1828) = *Lutjanus lutjanus* Bloch, 1790	Bigeye snapper	Trey Krahom
243	*Lutjanus malabaricus* (Bloch & Schneider, 1801)	Malabar red snapper or Saddle-tailed seaperch	Trey Spong Krahom
244	*Lutjanus johni* (Bloch, 1792)	John's snapper or Fingermark seaperch	trey Spong
245	*Lutjanus russelli* (Bleeker, 1849)	Russell's snapper	
246	*Lutjanus sanguineus* (Cuvier, 1828)	Blood snapper	Trey Krahom
247	*Lutjanus sebae* (Cuvier, 1828)	Emperor red snapper	trey Korm
248	*Lutjanus vitta* (Quoy & Gaimard, 1824)	Brown striped snapper	Trey Krahom
249	*Lutjanus erythropterus* Bloch, 1790	Crimson snapper	Trey Ang Koeuy Krahom Khnaong
250	*Lutjanus gibbus* (Forsskal, 1775)	Humback red snapper or Paddletail snapper	Trey Ang Koeuy Krahom
251	*Lutjanus lemniscatus* (Valenciennes, 1828)	Yellow-streaked snapper or Dark-tailed seaperch	Trey Ang Koeuy Kantuy Kramao
252	*Pinjalo pinjalo* (Bleeker, 1850)	Pinjalo snapper	
253	*Pristipomoides typus* (Bleeker, 1852)	Sharptooth snapper	
254	*Pristipomoides filamentosus* (Valenciennes, 1830)	Blue-spotted jobfish or Rosy snapper	
	Nemipteridae	Threadfin breams	Trey krahom
255	*Nemipterus bathybius* Snyder, 1911	Yellow-belly threadfin bream	Trey Krahom
256	*Nemipterus bleekeri* (Day, 1875)	Delagoa threadfin bream	
257	*Nemipterus flavivantris?*		
258	*Nemipterus hexodon* (Quoy & Gaimard, 1824)	Ornate threadfin bream	Trey Krahom
259	*Nemipterus japonicus* (Bloch, 1791)	Japanese threadfin bream	
260	*Nemipterus marginatus* (Valenciennes, 1830)	Pale-finned threadfin bream	
261	*Nemipterus mesoprion* (Bleeker, 1853)	Redfilament threadfin bream	
262	*Nemipterus metopias* (Bleeker, 1852)	Slender threadfin bream	
263	*Nemipterus nemurus* (Bleeker, 1857)	Redspine threadfin bream	
264	*Nemipterus nematophorus* (Bleeker, 1853)	Doublewhip threadfin bream	
265	*Nemipterus peronii* (Valenciennes, 1830)	Rosy threadfin bream	
266	*Nemipterus tambuloides* (Bleeker, 1853)	Fivelined threadfin bream	
267	*Nemipterus tolu* (Valenciennes, 1830)	Notched threadfin bream	Trey Krahom
268	*Nemipterus virgatus* (Houttuyn, 1782)	Golden threadfin bream	
269	*Scolopsis bilineatus* (Bloch, 1793)	Twolined monocle bream	
270	*Scolopsis bimaculatus* (Ruppell, 1828)	Thumbprint monocle bream	
271	*Scolopsis monogramma* (Kuhl & van Hasselt, 1830)	Monogrammed monocle bream	
272	*Scolopsis frenatus* (Cuvier, 1830)	Seychelles monocle breams	
273	*Scolopsis taeniopterus* (Kuhl & van Hasselt, 1830)	Lattice or Redspot monocle bream	
274	*Scolopsis vosmeri* (Bloch, 1792)	Whitecheek monocle bream	
275	*Pentapodus porosus* (Valenciennes, 1830)	False Whiptail	
	Lobotidae	Tripletails	
276	*Lobotes surinamensis (Bloch, 1790)*	Tripletail	

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	Leiognathidae	Ponyfishes	
277	*Gazza minuta* (Bloch, 1797)	Toothed ponyfish	Trey Sambor Hea / Kie
278	*Leiognathus bindus* (Valencienes, 1835)	Orangefin ponyfish	
279	*Leiognathus daura* (Cuvier, 1829)	Goldstripe ponyfish	
280	*Leiognathus elongatus* (Gunther, 1874)	Slender ponyfish	
281	*Leiognathus equulus* (Forsskal, 1775)	Common ponyfish	
282	*Leiognathus fasciatus* (Lacepede, 1803)	Striped ponyfish	
283	*Leiognathus leuciscus* (Gunther, 1860)	Whipfin ponyfish	
284	*Leiognathus smithursti* (Ramsay & Ogilby, 1886)	Smithurst's ponyfish	
285	*Leiognathus splendens* (Cuvier, 1829)	Splendid ponyfish	
286	*Leiognathus* sp.	Yellowspot ponyfish	
287	*Leiognathus elociscus?*		
288	*Leiognathus linealatus?*		
289	*Leiognathus nuchalis?*		
290	*Leiognathus rivulatus?*		
291	*Secutor insidiator* (Bloch, 1787) ?*S. ruconius* (Hamilton, 1822?)	Pugnose ponyfish	
	Gerreidae	Mojarras, silver-biddies	
292	*Gerres abbreviatus* (Bleeker, 1850)	Deepbody mojarra	
293	*Gerres filamentosus* Cuvier, 1829	Whipfin mojarra	Trey Do Angkor
294	*Gerres oyena* (Forsskal, 1775)	Common mojarra	
295	*Gerres poiti?*		
296	*Pentaprion longimanus* (Cantor, 1850)	Longfin mojarra	
	Haemulidae	Grunters, Sweetlips	
297	*Plectorhinchus nigrus?*		
298	*Plectorhinchus pictus* (Thunberg, 1792)	Yellowdot sweetlips	
299	*Plectorhinchus lineatus* (Linnaeus, 1758)	Diagonal-banded sweetlips	
300	*Pomadasys guoraka?*		
301	*Pomadasys hasta* (Bloch, 1790) = *P. kaakan* (Cuvier, 1830)	Lined silver grunt	
302	*Pomadasys maculatum* (Bloch, 1797)	Blotched grunt or Blotched javelinfish	
303	*Pomadasys opercularis* (Playfair, 1866)	Small-spotted grunt	
	Sciaenidae	Croakers, drums	
304	*Pennahia argentata* (Houtuyn, 1782)	Silver pennah croaker	
305	*Pennahia macrocephalus* (Tang, 1937)	Big-head pennah croaker	
306	*Pennahia pawak* (Lin, 1940)	Pawak croaker	
307	*Pennahia macrophthalmus* (Bleeker, 1850)	Bigeye croaker	
308	*Aspericorvina jubata* (Bleeker, 1855)	Prickly croaker	
309	*Dendrophysa russelli* (Cuvier, 1830)	Goatee croaker	
310	*Johnius vogleri* (Bleeker, 1853)	Sharp-toothed hammer croaker or Little jewfish	
311	*Johnius belangerii* (Cuvier, 1830)	Belanger's croaker	
312	*Johnius dussumieri* (Valenciennes, 1833)	Bearded croaker	
313	*Nibea semifasciata* Chu, Lo & Wu, 1963	Sharpnose croaker	
314	*Nibea soldado* (Lacepede, 1802)	Soldier croaker	
315	*Otolithes ruber* (Schneider, 1801)	Tiger-toothed croaker	Trey Chang-caum Bey
316	*Otolithes cuvieri (new name proposed here by E. Trewavas)*	Lesser tiger-toothed croaker	Trey Chang-caum Bey Toch
317	*Protonibea diacanthus* (Lacepede, 1802)	Spotted croaker or Black jew	Trey Pama Samot
318	*Pseudosiaena polyatis?*		
	Lethrinidae	Emperors, scavengers	trey Kroab Khnuor or Ang Koeuy
319	*Lethrinus baematopterus?*		
320	*Lethrinus choerorhynchus* (Bloch & Schneider, 1801)	Bluestreak emperor	Trey Ang Koeuy
321	*Lethrinus harak* (Forsskal, 1775)	Blackspot emperor or Thumbprint emperor	Trey Ang Koeuy Khnao khmao
322	*Lethrinus lentjan* (Lacepede, 1802)	Redspot emperor or Purple-headed emperor	Trey Ang Koeuy Sar
323	*Lethrinus miniatus* (Schneider, 1801)	Longface emperor or Sweetlip emperor	Trey Ang Koeuy
324	*Lethrinus ornatus* Valenciennes, 1830	Ornate emperor	Trey Spong Chnot

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	Pentapodidae	Large-eye breams	
325	*Gymnocranius griseus* (Schlegel, 1843)	Grey large-eye bream	
326	*Gymnocranius robinsoni* (Gilchrist & Thompson, 1908)	Blue-lined large-eye bream	
	Mullidae	Goatfishes	
327	*Parupeneus cyclostomus* (Lacepede, 1801)	Goldsaddle goatfish	
328	*Parupeneus heptacanthus* (Lacepede, 1801)	Spotted golden goatfish	
329	*Parupeneus indicus* (Shaw, 1903)	Indian goatfish	
330	*Parupeneus chrysopleuron* (Schlegel, 1843)	Yellow striped goatfish	
331	*Parupeneus barberinoides* (Bleeker, 1801)	Swarthy-headed goatfish	
332	*Parupeneus rubescens* (Lacepede, 1801)	Rosy goatfish	
333	*Upeneus bensasi* (Temminck & Schlegel, 1842)	Bensasi goatfish	
334	*Upeneus sulphureus* Cuvier, 1829	Yellow goatfish	
335	*Upeneus sundaicus* (Bleeker, 1855)	Ochrebanded goatfish	
336	*Upeneus tragula* Richarson, 1846	Freckled goatfish or darkband goatfish	
337	*Upeneus taeniopterus* (Cuvier, 1829)	Fin-stripe goatfish	
338	*Upeneus vittatus* (Forsskal, 1775)	Yellow-striped goatfish	
	Ephippidae	Spadefishes	
339	*Ephippus orbis* (Bloch, 1787)	Spadefish	
	Platacidae	Batfishes	
340	*Platax pinnatus* (Linnaeus, 1758)	Pinnate batfish or Long-finned batfish	
	Drepanidae	Sicklefishes	
341	*Deprane longimana* (Bloch & Schneider, 1801)		
342	*Deprane punctata* (Linnaeus, 1758)	Spotted Sicklefishes	Trey Trachiek Damrey
	Scatophagidae	Scats	
343	*Scatophague argus* (Linnaeus, 1766)	Spotted scat	
	Chaetodontidae	Butterflyfishes	
344	*Chaetodon collare* Bloch, 1787	Collare butterflyfish	
345	*Chaetodon modestus* (Temminck & Schlegel, 1842)		
346	*Chaetodon ornatissimus* Cuvier, 1831	Ornate butterflyfish	
347	*Parachaetodon ocellatus* (Cuvier, 1831)	Ocellate coralfish	
348	*Heniochus acuminatus* (Linnaeus, 1758)	Longfin bannerfish	
349	*Coradion chrysozonus* (Cuvier, 1831)	Orange-banded coralfish	
	Pomacanthidae	Angelfishes	
350	*Pomacanthus annularis* (Bloch, 1787)	Blue-ringed angelfish	Trey Me Ham Boa
351	*Pomacanthus imperator* (Bloch, 1787)	Emperor angelfish	
352	*Pomacanthus semicirculatus* (Cuvier, 1831)	Semicircle angelfish or Blue angelfish	
	Cepolidae	Bandfishes	
353	*Cepola schlegeli?*		
	Pomacentridae	Damselfishes	
354	*Pomacentrus planifrons?*		
355	*Pomacentrus tripunctatus* Cuvier, 1830	Threespot damsel	
356	*Neopomacentrus cyanomos* (Bleeker, 1856)	Regal demoiselle	
357	*Abudefduf sordidus* Forsskal, 1775	Blackspot sergeant major	
	Labridae	Wrasses, hogfishes, razorfishes, coris, tuskfishes	
358	*Bodianus macrourus* (Lacepede, 1801)	Black-banded hogfish	
359	*Choerodon anchorago* (Bloch, 1791)	Orange –dotted tuskfish	
360	*Choerodon robustus* (Gunther, 1862)	Robust tuskfish	
361	*Choerodon* sp.	Tuskfish	
362	*Labroides dimidiatus* (Valenciennes, 1839)	Cleaner wrasse	
363	*Pseudolabris gracillis?*		
	Scaridae	Parrotfish	
364	*Scarus ghobban* Forsskal, 1775	Yellowscale or Blue-barred parrotfish	Trey Sek Loeung
365	*Hipposcarus harid* (Forsskal, 1775)	Candelamoa parrotfish	Trey Sek
	Pinguipedidae	Sandmelts, sandperch, grubfishes	
366	*Parapercis nebulose* (Quoy & Gaimard, 1824)	Barfaced sandmelts or Red-barred grubfish	
367	*Parapercis pulchella* (Temminck & Schlegel, 1843)		

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	Uranoscopidae	Stargazers	
368	*Uranoscopus guttatus* (Cuvier, 1829)		
	Champsodontidae	Gapers	
369	*Champsodon snyderi?*		
370	*Champsodon microphthalmus* (Regan, 1908)		
	Callionymidae	Dragonets	
371	*Callionymus calliste?*		
	Blenniidae	Combtooth and sabertoot blennies	
372	*Salarias fasciatus* (Bloch, 786)	Banded blenny	
373	*Xiphasia setifer* Swainson, 1839	Hair-tail blenny	
	Derepodichthydae	Cutlassfishes, hairtailtail fish, frost fishes, scabbardfish	
374	*Derepodichthys alepidotus?*		
	Brotulidae		
375	*Hoplobrotula armata?*		
	Siganidae	Spinefeet, Rabbit fishes	
376	*Siganus canaliculatus* (Park, 1797)	White-spotted spinefoot or Smudgespot spinrfoot	Trey Kantang Ploeung
377	*Siganus javus* (Linnaeus, 1766)	Streaked spinefoot or Java spinefoot	Trey Kantang
378	*Siganus fuscescens* (Houttuyn, 1782)	Black spinefoot	Trey Kantang Phes
	Trichiuridae	Hairtails	
379	*Trichiurus lepturus* Linnaeus, 1758	Largehead hairtail	Trey Kok
380	*Eupheurogrammus muticus* (Gray, 1831)	Smallhead hairtail	
	Scombridae	Tunas	
381	*Auxis rochei* (Risso, 1810)	Corseletted frigate mackerel	Trey Chheam
382	*Auxis thazard* (Lacepede, 1803)	Frigate mackerel, Bullet tuna	
383	*Rastrelliger brachysoma* (Bleeker, 1851)	Short-bodied mackerel	Trey Kamong / Pla Thu
384	*Rastrelliger kanagurta* (Cuvier, 1817)	Indian mackerel	Trey Palang
385	*Scomberomorus commerson* (Lacepede, 1800)	Narrow-barred Spanish mackerel	Trey Beka
386	*Scomberomorus guttatus* (Bloch & Schneider,	Indo-Pacific Spanish mackerel	Trey Beka
387	*Scomberomorus lineolatus* (Cuvier, 1831)	Streaked Spanish mackerel	Trey Beka
388	*Scomberomorus sinensis?*		Trey Beka
389	*Sarda orientalis* (Temminck & Schlegel, 1844)	Striped bonito or Oriental bonito	Trey Chheam
390	*Thunnus maccoyii* (Castelnau, 1872)	Southern bluefin tuna	Trey Beka
	Xiphiidae	Indo-Pacific swordfishes, Sailfishes, Marlins	
391	*Xiphias gladius* Linnaeus, 1758	Swordfish	
	Stromateidae	White pomfrets	
392	*Pampus argenteus* (Euphrasen, 1788)	White pomfret, Silver pomfret	Trey Chap Sar
	Ariommidae	Ariommas	
393	*Ariomma indica* (Day, 1870)	Indian ariomma(= Indian driftfish)	
	Gobiidae	Gobies	
394	*Gobiodon histrio* (Valenciennes, 1837)	Broad-barred Maori goby	
395	*Acentrogobius gracilis* (Bleeker, 1875)	Mangrove goby	
396	*Istigobius ornatus* (Ruppell, 1830)	Ornate goby	
	Gobioididae		
397	*Ctenotrypauchen microcephalus?*		
398	*Laenioides gracilis?*		
399	*Odontamblyopus rubicunchus?*		
	Scorpaenidae	Scorpion fishes	
400	*Apistops coloundra* (De Vis, 1886)	Shortfinned waspfish	
401	*Pterois antennata* (Bloch, 1787)	Ragged-finned firefish	
402	*Pterois russellii* Bennett, 1831	Plaintail turkeyfish or Spotless firefish	
403	*Synanceja verrucosa* (Bloch & Schneider, 1801)	Reef stonefish	Trey Khmoch
404	*Sinanceja horrida* (Linnaeus, 1766)	Estuarine Stonefish	
405	*Sebastapistes cyanostigma* (Bleeker, 1856)	Yellow- spotted scorpionfish	
406	*Scorpaena aquabe* (Flower & Steinitz, 1956)	Scorpion fish	Trey King Kuok
407	*Scorpaenodes littoralis* (Tanaka, 1917)	Shore scorpionfish	Trey King Kuok
408	*Scorpaenopsis gibbosa* (Bloch & Schneider, 1801)	Humpbacked scorpionfish	Trey King Kuok

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409	*Inimicus sinensis* (Valenciennes, 1833)	Spotted Stinger	
	Triglidae	Gurnards & Searobin	
410	*Lepidotrigla argus* Ogilby,1910	Long-Finned Gurnard	
	Platycephalidae	Spiny flatheads	
411	*Cociella crocodilus* (Tilesius, 1812)	Crocodile flathead	Trey Kantuy Krabey
412	*Platycephalus indicus* (Linnaeus, 1758)	Bartail flathead	Trey Kantuy Krabey
413	*Suggrundus macracanthus* (Bleeker, 1869)		
414	*Trysanophrys cirronasus?*		
415	*Trudis arenarius?*		
416	*Plalycephalidae gen sp.?*		
	Exocoetidae		
417	*Cypselurus* sp.?	Flyingfish	Trey Chap
	Dactylopteridae	Flying gurnards	Trey Chap
418	*Dactyloptaenia orintalis* (Cuvier, 1829)	Oriental flying gurnard	
419	*Dactyloptaenia peterseni* (Nystrom, 1887)	Starry flying gurnard	
	Psettodidae	Spiny turbots, halibut	
420	*Psettodes erumei* (Bloch & Schneider, 1801)	Indian spiny turbots, Indian halibuts	Trey Oob Tuuk Kmao
	Bothidae	Lefteye Flounders	Trey Andat Chke
421	*Arnoglossus profundud* (Kotthaus, 1977)		
422	*Chascanopsetta lugubris* (Alcock, 1894)	Pelican flounder	
423	*Engyprosopon grandisquama* (Temminck &	Largescale flounder	
424	*Grammatobothus polyophthalmus* (Bleeker,1866)	Three-spot flounder	
425	*Pseudorhombus arsius* (Hamilton, 1822)	Largetooth flounder	Trey Oob Tuuk Krahom
426	*Pseudorhombus dupliocellatus* (Regan, 1905)	Ocellated flounder	
427	*Pseudorhombus elevatus* Ogilby, 1912	Deep flounder	
428	*Pseudorhombus javanicus* (Bleeker, 1853)	Javan flounder	
429	*Pseudorhombus malayanus* (Bleeker, 1866)	Malayan flounder	
430	*Pseudorhombus quinquocellatus* (Weber & de	Fivespot flounder	
431	*Pseudorhombus triocellatus* (Gilchrist, 1905)	Natal flounder	
	Pleuronectidae	Righteye flounders	
432	*Samaris cristatus* Gray, 1831	Cockatoo flounder	
433	*Samariscus inornatus* (Lloyd, 1909)		
	Soleidae	Soles	
434	*Aseraggodes cyaneus* (Alcock, 1890)		
435	*Pardachirus pavoninus* (Lacepede, 1802)	Peacock sole	
436	*Solea ovata* (Richardson, 1849)		
437	*Zebrias quagga* (Kaup, 1858)	Fringefin zebra sole	
	Cynglossidae	Tongue soles	Trey Andat Chke
438	*Cynoglossus abbreviatus* (Gray, 1834)	Threelines tongue sole	Trey Andat Chke
439	*Cynoglossus bilineatus* (Lacepede, 1802)	Fourlined tongue sole	Trey Andat Chke
440	*Cynoglossus cynoglossus* (Ham. Buch., 1822)	Bengal tongue sole	Trey Andat chke
441	*Cynoglossus puncticeps* (Richardson, 1846)	Speckled tongue sole	Trey Andat Chke
	Echeneidae	Remoras, sharksucker, discfishes	
442	*Echeneis naucrates* Linnaeus, 1758	Live sharksucker or Slender suckerfish	
443	*Remora remora* (Linnaeus, 1758)	Remora	
	Triacanthidae	Tripodfish, triplespine	
444	*Triacanthus strigilifer* (Cantor, 1849)	Long-spined tripodfish	
	Balistidae	Triggerfish	
445	*Abalistes stellatus* (Bloch & Schneider, 1801)	Starry trigger fish	Trey Kuor
446	*Balistapus undulatus* (Park, 1797)	Red-lined triggerfish	
447	*Balistes fuscus? Pseudobalistes fuscus* (Bloch & Schneider, 1801)	Yellow-spotted triggerfish	
448	*Melichthys vidua* (Solander, 1844)	Pinktail triggerfish	
	Monacanthidae	Filefishes, leather jackets	
449	*Chaetoderma penicilligera* (Cuvier, 1817)	Prickly leatherjacket	
450	*Paraluteres prionurus* (Bleeker, 1851)	Mimic leatherjacket	
451	*Aluterus monoceros* (Linnaeus, 1758)	Yellow finned or Unicorn leatherjacket	Trey Kuor
452	*Aluterus scriptus* (Osbeck, 1765)	Scribbled leatherjacket	

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453	*Paramonacanthus japonicua* (Tilesius, 1809)		
	Psilocephalidae		
454	*Psilocephalus barbatus?*		
	Ostraciidae	Boxfishes, cowfishes	Trey Kuor
455	*Lactoria cornuta* (Linnaeus, 1758)	Longhorn cowfish	
456	*Ostracion cubicus* Linnaeus, 1758	Yellow boxfish	
457	*Ostracion gibbosus?*		
458	*Tetrasomus gibbosus* (Linnaeus, 1758)	Hunchback boxfish or Black-blotched turretfish	
	Tetraodontidae	Puffer fish, blow fish, tobies	Trey Kampot
459	*Arothron hispidus* (Linnaeus, 1758)	Bristly puffer or Stars and Stripes toadfish	
460	*Arothron stellatus* (Bloch & Schneider, 1801)	Star puffer	
461	*Arothron leopardus* (Day, 1878)		
462	*Chelonodon patoca* (Hamilton-Buchanan, 1822)	Milk-spotted toadfish	
463	*Fugu rubrispes?*		
464	*Fugu oblongus* (Bloch, 1786)		
465	*Fugu niphobbes?*		
466	*Lagocephalus inermis* (Temminck & Schlegel, 1844)	Smooth golden toadfish	
467	*Lagocephalus lunaris* (Bloch & Schneider, 1801)	Rough golden toadfish	
468	*Lagocephalus scleratus* (Gmelin, 1788)	Silver toadfish	
	Diodontidae	Porcupine fishes	
469	*Diodon holacanthus* (Linnaeus, 1758)	Freckled porcupine fish	
470	*Diodon hystrix* Linnaeus, 1758	Porcupine fish	
	Batrachoididae	Frogfishes	
471	*Batrichthys grunniens?*		
	Antennariidae	Frogfishes (also sea mice, anglerfish)	
472	*Antennarius hispidus* (Bloch & Schneider, 1801)	Shaggy anglerfish	
473	*Histrio histrio* (Linnaeus, 1758)	Sargassum fish	
	Pegasiidae		
474	*Pegasus elongatus?*		
475	*Apogon volitans* (Linnaeus, 1758) = *Pegasus volitans* Linnaeus, 1758	Slender seamoth	
476	*Apogon umitengu?*		

ANNEX 2

List of Marine Crabs of Cambodia

(Sources: Jensen & Try, 2002).

No.	Scientific name	Common name	Khmer name
1	*Chryptopodia fornicate* (Fabricius, 1781)		Kdam Snok
2	*Ozins quttatus* Milne Edward,1834	Spottedbelly rock crab	Kdam Phkor Loin
3	*Scylla serrata* (Forsskål, 1775)	Giant mud crab	Kdam Thmor
4	*Thalamita crenata* (Latreille, 1829)	Crenate swimming crab	Kdam Thmor khiev
5	*Episesarma singaporenes* (Tweendie, 1936)	Singapore vinegar crab	Kdam Choi
6	*Episesarma versicolor* (Tweendie, 1940)	Violet vinegar crab	Kdam Choi
7	*Matuta victor* (Fabricius, 1781)	Common moon crab	Kdam Sor/Loeng Khchal
8	*Dorippe frascome* (Herbst, 1785)		Kdam Saka Do
9	*Parthenope longispinis* (Mier, 1879)		Kdam Ping Peang Ban Lar
10	*Charybdis natator* , Hrebst	Hairy swimming crab	Kdam Neak
11	*Podophthalmus vigil* (Fabricius, 1798)	Sentinel crab	Kdam Phnek Veng
12	*Charybdis feriatus* (Linnaeus, 1758)	Crucifix crab	Kdam Khla
13	*Portunus pelagicus* (Linnaeus, 1758)	Flower crab	Kdam Ses
14	*Doclea tetraptera* Walker, 1890		Kdam Ping Peang Kut Srouch
15	*Charybdis anisodon* (de Haan, 1850)	Two spined arm swimming crab	Kdam Dang Kieb Sor
16	*Dorippe granulate* de Hann, 1841		Kdam Saka Do
17	*Lincosia rhomboidalis* de Hann, 1850	Haswell's button crab	Kdam Khlok
18	*Hyastenus pleione* (Herbst, 1803)		Kdam Ping Peang
19	*Ixa cylindricus* (Fabricius, 1777)		Kdam Dom Bong
20	*Arcania sagamiensis* Sakai, 1969		Khdam Pong Peang

ANNEX 3

List of Marine Molluscs of Cambodia

(Sources: Jensen & Try, 2002).

MARINE BIVALVES

No.	Scientific name	Common name	Khmer name
1	*Amusium pleuronectes* (Linnaeus, 1758)	Asian moon scallop	Khchorng/Krom Plet
2	*Malleus albus* Lamarck, 1819	White hammer oyster	Khchorng/Krom PoThav Dai
3	*Trisidos tortuosa* (Linnaeus, 1758)	Prepellor ark	Kreng Chheam Korng Har
4	*Placamen calophyllum* (Phillipi, 1846)	Frilled venus clam	Ngeav/Krom Sror kar Neak
5	*Anadara nodifera* (Martens, 1860)	Nodular ark	Kreng Chheam
6	*Pteria penguin* (Röding, 1798)	Penguin wing oyster	Khchorng/Krom Tror Ses
7	*Pinna bicolor* Gmelin, 1791	Bicolor pen shell	Khchorng/Krom Chorb Chik
8	*Tridacna squamosa* Lamarck, 1819	Fluted giant clam	Krom Yaik
9	*Vepricardium sinese* (Sowerby, 1841)	Chinese cockle	Kreng Chheam Moit Viech
10	*Meretrix lyrata* (Sowerby, 1851)	Lyrate hard clam	Kchorng/Kreng Sor
11	*Perna viridis* (Linnaeus, 1758)	Green mussel	Khchorng/Krom Chom Pus Tea
12	*Scapharca inaequivalvis* (Bruquière, 1789)	Inequivalve ark	Kreng Chheam Moit Viech
13	*Pharella javanica* (Lamarck, 1818)	Javanese razor clam	Khchorng Bam Pung/Krom Veng
14	*Anadara binakayanensis* (Faustino, 1932)	Globose ark	Kreng Chheam Mo Mis
15	*Meretrix lusoria* (Röding, 1798)	Poker-chip venus	Ngeav Sor/Ngeav Hol
16	*Polymesoda erosa* (Solander, 1786)	Common geloina	Ngeav Phouk
17	*Donax cuneatus* Linnaeus, 1758	Cradle or cuneate donax	Ngeav Sar/Lies Sa Mort
18	*Paphia undulata* (Born, 1778)	Undulate venus	Ngeav/Krom Kra la Hol
19	*Anomalocardia squamosa* (Linnaeus, 1758)	Squamose venus	Ngeav Khloy/Kreng Moit Viech
20	*Gafrarium tumidum* Röding, 1798	Tumid venus	Ngeav Phlet
21	*Modiolus metcalfei* (Henley, 1843)	Yellowbanded horse mussel	Krom Chorng Chak/ Ta Puk
22	*Asaphis violascens* Forsskål, 1775	Pacific asaphis	Kreng Chheam/Sor
23	*Grassostrea belcheri* (Sowerby, 1871)	Belcher's oyster	Khchorng Dam Rey/Bei Dom
24	*Anadara granosa* (Linnaeus, 1758)	Blood cockle or Granular ark	Kreng Chheam

MARINE GASTROPODS

No.	Scientific name	Common name	Khmer name
1	*Turbo marmoratus* Linnaeus, 1758	Green Turbo or Green snail	Khchorng Brak/Kuch
2	*Turbo petholatus* Linnaeus, 1758	Tapestry turban	Khchorng Kror La Prum
3	*Rapana rapiformis* (Born, 1778)	Turnish shaped rapa	Khchorng Ban La Choeung Muoy
4	*Strombus canarium* Linnaeus, 1758	Dog conch	Khchorng Choeung Muoy
5	*Haliotis asinina* Linnaeus, 1758	Donkey's ear abalone	Khchorng Pao Hoeu Veang
6	*Haliotis ovina* Gmelin, 1791	Oval abalone	Khchorng Pao Hoeu Khley
7	*Cypraea tigris* Linnaeus, 1758	Tiger cowrie	Khchorng Beer Leak
8	*Strombus luhuanus* Linnaeus, 1758	Strawberry conch	Khchorng Thnot/Khbal Khla

No.	Scientific name	Common name	Khmer name
9	*Harpa major* Röding, 1798	Major harp	Khchorng Kam Bau/Spoeu
10	*Cypraea talpa* Linnaeus, 1758	Mole cowrie	Khchorng Beer Thnot
11	*Turritella terebra* (Linnaeus, 1758)	Screw turret	Khchorng Sang/Dek Kol
12	*Vexillum taeniatum* Lamarck, 1811	Banded vexillum	Khchorng Dek Khoung Poir
13	*Phallium glaucam* (Linnaeus, 1758)	Grey baonnet	Khchorng Kan Dul
14	*Cymbiola nobilis* (Lightfoot, 1786)	Nodle volute	Khchorng Thnot
15	*Lambis chiragra chiragra* (Linnaeus, 1758)	Chiragra spider conch	Khchorng Bat Dai/Ban La
16	*Ellobium aurisjudae* (Linnaeus, 1758)	Judas ear cassidula	Khchorng Moit Viech
17	*Melo melo* (Lightfoot, 1786)	Indian volute	Khchorng Dong
18	*Natica lineata* (Röding, 1798)	Lined moon snail	Khchorng Phnek Broeus Chnot
19	*Cassis cornuta* (Linnaeus, 1758)	Horned helmet	Khchorng Khla/Som Bol Bei
20	*Chicoreus ramosus* (Linnaeus, 1758)	Ramose murex	Khchorng Ban La/Khchorng Sang
21	*Cellana testudinaria* (Linnaeus, 1758)	Turtoiseshell limpet	KhchorngDong/Dors Kra Mom
22	*Cellana radiata* (Born, 1778)	Indo-Pacific limpet	Khchorng Doun/Dors Kra Mom
23	*Ficus subintermedia* (Orbigny, 1852)	Underlined fig shell	Khchorng Choeung Moiy Kror La Sam Nanh
24	*Bufonaria rana*Linnaeus, 1758	Common frog shell	Khchorng Ban La Kley
25	*Conus straitus* Linnaeus, 1758	Straited cone	Khchorng Thnot Kror La Kom
26	*Conus textile* Linnaeus, 1758	Textile cone	Khchorng Kror La Sam Nanh
27	*Babylonia areolata* Link, 1807	Maculated ivory whelk	Khchorng Pong Kroch
28	*Conus betulinus* Linnaeus, 1758	Beech cone	Khchorng Ang Re
29	*Strombus urceus* (Linnaeus, 1758)	Little pitcher conch	Khchorng Sang Toch
30	*Chicoreue brunneus* (Link, 1807)	Adusta murex	Khchorng Ban La Teal
31	*Phalium bisulcatum* (Schuber&Wagner, 1829)	Sophia's bonnet	Khchorng Huch
32	*Murex trapa* Röding, 1798	Rarespined murex	Khchorng Ban La Vieng
33	*Telebralia palustris* (Linnaeus, 1758)	Mud creeper	Khchorng Deak Kol
34	*Cerithidae quadrata* (Sowerby, 1866)	Quadrate horn shell	Khchorng Chak Chreang
35	*Archetectonica perspectiva* (Linnaeus, 1758)	Clear sundial	Khchorng Rong Vel
36	*Pugilina cochlidium* (Linnaeus, 1758)	Spira melongena	Khchorng Ban La Teal
37	*Polinices didyma* Röding, 1798	Bladde moon snail	Khchorng Phnek Broeus Leat
38	*Turbo bruneus* (Röding, 1798)	Brown pacific turban	Khchorng Brak
39	*Natica vitellus* (Linnaeus, 1758)	Calf moon snail	Khchorng Phneak Broeus/ Khchorng Pong Chab
40	*Monodonta labio* (Linnaeus, 1758)	Labio monodont	Khchorng Kror Ob Moit Chrok
41	*Pugilina ternatana* (Gmelin, 1791)	Ternate melongena	Khchorng Kam bor
42	*Pugilina colosseus* (Lamarck, 1860)	Colossal melongena	Khchorng Kam Bor Kout Moul

ANNEX 4

List of Marine Mammals of Cambodia

(Sources: Tana, 1997; Beasley et al., 2001; Longdy & Sokhannaro 2002).

No.	Scientific name	Common name	Khmer name
1	*Orcaella brevirostris*	Irrawaddy dolphin	Psoit Kbal Trorlok
2	*Neophocaena phocaenoides*	Finless porpoise	Psoit Oet Bruy Khanorng
3	*Sousa Chinensis*	Indo-Pacific Hump-backed dolphin	Psoit Khaleach
4	*Dugong dugon*	Dugong	Chrouk Toeuk
5	*Tursiops aduncus*	Indo-Pacific bottlenose dolphin	Psoit Chror Mos Dorb Chompus Khley
6	*Tursiops truncatus*	Common bottlenose dolphin	Psoit Chror Mos Dorb Chompus Veng
7	*Stenella attenuata*	Pantropical spotted dolphin	Psoit Uch
8	*Delphinus capensis*	Long-beaked common dolphin	Psoit Khamao Leoung
9	*Stenella longirostris roseinventris*	Dwarf spinner dolphin	Psoit Chhanaut Phanek
10	*Globicephala macrorhynchus*	Short-fined pilot whale	Ba Lenn Kbal Thom
11	*Balaenoptera edeni*	Bryde's whale	Ba lenn Yairk
12	*Pseudorca Crassidens*	False killer whale	Ba LennKam Nach or Ba Lenn Kror Bey

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