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The flyingfish fishery of Trinidad and Tobago

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Abstract: The flyingfish fishery of Trinidad and Tobago is of significant commercial importance accounting for about 83% of the pelagic landings at beaches on the leeward side of Tobago from November to July. The flyingfish fleet consists of about 75 pirogues and one ice-boat, and employs approximately 125 fishermen. Fishing practices involve the use of gillnets, dipping with small dipnets and the occasional hook-and-line method. The latter is used to obtain fresh bait to catch larger pelagics. Landings for the 1990-1991 fishing season were estimated at about 359 mt, with a wholesale value of at least TT$ 395,000 and a retail value in excess of TT$ 790,000. Catches are landed at five locations where they are transported by jeeps and "pick-ups" to the three processing plants on the island. About 75-80% of the processed flyingfish is exported with the vast majority going to Barbados and other Caribbean islands. In 1991 one processor secured an order of 40 mt whole flyingfish to Japan. Management strategies pertaining to this fishery focus on defining the limits of foreign fishing effort. In November 1990 Trinidad and Tobago and Barbados signed a fishing agreement which includes provisions for Barbadian flyingfish vessels to operate off Tobago.

DESCRIPTION OF THE FISHERY

Fishing techniques, past and present

The flyingfish fishery of Tobago began prior to 1960 when flyingfish (*Hirundichthys* spp.) was scooped out of the sea using baskets. The fish caught was then used as bait in the trolling fishery for dolphinfish (*Coryphaena hippurus*) and other large pelagics such as wahoo (*Acanthocybium solandri*) and albacore (*Thunnus alalunga*).

The technique for catching flyingfish was introduced to Tobago by Barbadian fishermen in 1962 (Morsehead pers. comm.). The fishing method called "drifting" or "lurking" was learnt by Tobago fishermen who worked with the Barbadians on wooden "bumboats" (6-9 m in length) with outboard engines not larger than 25 hp. On reaching the fishing ground the fisherman would shut off the engine and allow the boat to drift. The method for catching flyingfish involved the use of a multifilament gillnet (6-8 m long, 2-3 m deep with a stretched mesh size of 44 mm) which was tied to the boat and suspended in the water. A "chum" was made by crushing flyingfish or some other oily species of fish. The bits of macerated fish and fish oils floating in the water served to attract the flyingfish around the boat. Devices called "rafts", consisting of palm fronds tied together, were sometimes set out in the water to attract the flyingfish and keep them around the boat. The flyingfish when trying to spawn on the gillnets were trapped by the gills or entangled. Flyingfish were also caught using hook and line. In addition, other pelagics which were attracted to the netted flyingfish were caught using floating lines extending 150-200 m from the boat (Jordan 1983a).

Today the flyingfish fishery is pursued by about 125 fishermen from about 75 pirogues (6-10 m in length), most of which are made of fibreglass and generally powered by two 40 hp outboard engines. Fishermen usually leave the beach between 6.00 am and 8.00 am and set off for the fishing grounds that are on average a one-hour journey away (ECFFP[1] data sheets 1988-1991). When they arrive on the fishing ground the boats are usually positioned with their bows in a southerly direction and the engines are then shut off. Fishing practices include the use of multifilament gillnets of similar dimensions to those used in the early fishery. However, some fishermen also use monofilament gillnets which are larger (up to 10 m long and 3-4 m deep) than the multifilament gillnets, but are of the same mesh size. The nets are hung over the port (windward) side of the boat and the "chum" is put into a container which is hung overboard and occasionally shaken in the water. Traditionally, chum was placed in a bamboo basket known as a "roseau". In recent times, plastic four-gallon cooking oil containers with holes

[1] Eastern Caribbean Flyingfish Project

drilled into them, or rubber car tyre tubes tied at one end, have become more popular for holding the chum. A raft, also referred to as a "screeder" is also used to attract the flyingfish. From time to time the nets are taken up, fish removed and the nets reset. During peak spawning periods, the flyingfish congregate around the boats in such large quantities that they can be caught by hand. At such times dipnets (1.0 m in diameter) are used to scoop the fish out of the water and into the boat.

While waiting for flyingfish to enter the nets, as many as six floating lines are placed over the port side of the boat. These lines are usually about 150-200 m in length and each possesses a single hook which is baited with a flyingfish. These lines are used to catch larger pelagics such as dolphinfish (*Coryphaena hippurus*), sharks (*Mustelus* spp. and *Carcharinus* spp.), tuna (*Thunnus* sp.), wahoo (*Acanthocybium solandri*) and billfish (Istiophoridae). Bottom lines are put out by some boats to catch snappers (Lutjanidae) and groupers (Serranidae) while drifting. Depending on the sea conditions, some fishermen troll one or two lines behind the boat when travelling to and from the fishing grounds. The fishermen usually fish for seven to eight hours and then return to the beach between 4.00 pm and 6.00 pm to land their catch (ECFFP data sheets 1988-1991).

Fishing area and landing sites

The flyingfish fishing grounds of Trinidad and Tobago are located off the leeward side of Tobago from Charlotteville to Pigeon Point covering an area about 50 km long and 20 km wide (Figure 1). Although flyingfish is available on the windward side of Tobago, the resource has not been as heavily exploited as on the leeward side. This is mainly due to lack of logistical support in terms of transport, refrigeration and proper marketing arrangements. Fishermen generally fish in an area 8 to 12 km from shore using geographical formations as landmarks for the fishing grounds.

Flyingfish is landed at three main locations: Buccoo, Pigeon Point and Mt. Irvine (Figure 1). The Buccoo landing site, established by the Government of Trinidad and Tobago is well equipped with a concrete table comprising three areas for scaling and gutting fish and two sinks with running water. There are also sixteen lockers for storage of nets and other fishing equipment and a shower. Fishermen dock their boats at the concrete jetty to land their catch. This is offloaded using standard 40 kg (90 lb) baskets and is transferred into large 200 gallon bins provided by the processors for transport to the processing plants. Some fishermen who have their own "pick-ups" and jeeps are able to transport their catch to the processing plants or the cold storage warehouses at the National Insurance Property Development Company (NIPDEC) and the Central Marketing Agency (CMA).

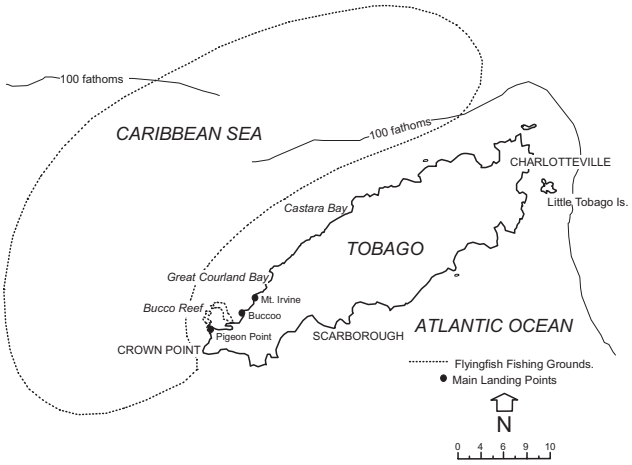


Figure 1. Main flyingfish fishing ground and landing sites in Tobago.

At Pigeon Point there are no facilities provided by the Government. However, there are some sheds which were built by the fishermen for storage of fishing equipment. Flyingfish is landed on the beach at two different locations in the Pigeon Point area. The landed catch is transported to the processing plants in the same manner as at Buccoo. Fishermen also land their catch at the slipway in the Bon Accord lagoon to supply one of the processing plants located nearby.

At Mount Irvine, flyingfish is landed at two locations on the beach. At one location there is a concrete table used by the fishermen for sale of fish. Facilities at this landing point are minimal because the catch is transported directly to the processing plants and cold storage warehouses immediately after it is landed.

Estimated current flyingfish catch and effort

Catch and effort data for the flyingfish fishery were collected for two four-year periods during the last 13 years (1979-1982 and 1987-1991) and are given in Table 1. Prior to this, the catch was landed on the beaches but there are no records available for analysis.

Catch and effort data were recorded for a little over three fishing seasons (May 1979 to July 1982) as a result of the Collector Vessel System (CVS) which was operating during this period. This provided an avenue

for the collection of catch and effort data. Two local processors were also operating at this time but there are no records to indicate what percentage of the total flyingfish catch was landed for them. The operation of the collector vessel was discontinued at the end of the 1981-1982 season (Yeates pers. comm.), and there were no data recorded for the next five flyingfish seasons (1982-1987). Catch and effort data collection resumed in January 1988 as a result of Trinidad and Tobago's participation in a regional project (the Eastern Caribbean Flyingfish Project). This data collection system has continued to date.

Although the flyingfish season extends from November to July, catch and effort data were not recorded for all months of the fishing seasons (Table 1). For example, data were only collected for the last two months of the 1978-1979 flyingfish season because the Collector Vessel System, from which landings were recorded, commenced in late May.

Monthly mean flyingfish catch per boat trip was calculated from the data in Table 1, summarised in Table 2, and shown in Figures 2 (for 1979-1982) and 3 (for 1987-1991). There is a consistent seasonal trend in catch per trip, indicating that flyingfish have a bimodal seasonality, with a decrease in catchability in April of each year (Figures 2 and 3).

Interannual variation in the flyingfish catch per trip data is also apparent (Table 2). The particularly high flyingfish catch per boat trip for the period 1978 to 1982 can be attributed to the Collector Vessel System which was in place during this period and allowed fishermen to land their catch at the collector vessel in the vicinity of the fishing grounds. This meant that fishermen could fill their boats, sell the catch to the collector vessel and continue fishing. In one day a fisherman could fill his boat two to three times before returning to land. The average catch of flyingfish per boat trip was also relatively high for the 1989-1990 fishing season since the data include catch per trip of an ice-boat (11.5 m long with an engine of 130 hp) which was contracted to Tobago Sea Products, a fish processing plant.

Table 1. Flyingfish catch (kg) and the corresponding fishing effort (no. of boat trips) recorded for the periods 1979-1982 and 1988-1991. Fishing effort is given in parentheses; - represents months with no data collection.

Flyingfish season	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
1978-1979	-	-	-	-	-	-	5,951 (23)	1,300 (19)	-
1979-1980	-	-	-	482 (5)	69,488 (363)	27,398 (176)	91,493 (368)	37,639 (165)	51 (2)
1980-1981	-	-	14,006 (105)	10,691 (108)	20,316 (104)	3,415 (38)	10,070 (48)	7,059 (36)	-
1981-1982	-	-	-	-	66,237 (265)	16,778 (78)	8,263 (67)	650 (5)	-
1987-1988	-	-	-	14,144 (128)	13,005 (233)	4,084 (149)	8,957 (159)	10,614 (186)	243 (32)
1988-1989	55 (5)	201 (10)	13,930 (72)	11,878 (97)	11,203 (114)	7,991 (178)	14,743 (213)	4,305 (141)	103 (12)
1989-1990	-	-	33,389 (117)	17,506 (160)	23,566 (236)	3,490 (250)	31,473 (346)	13,362 (157)	57 (16)
1990-1991	-	-	5,628 (101)	20,683 (130)	13,108 (179)	15,306 (188)	16,183 (135)	23,092 (147)	1342 (22)

Data source: CVS data sheets 1979-1982 and ECFFP data sheets 1987-1991 (see Appendices 1a-c).

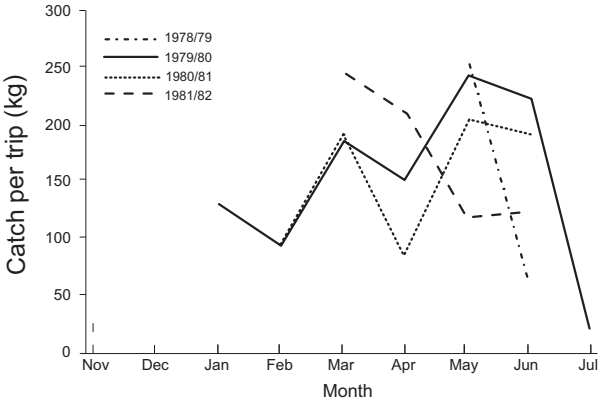


Figure 2. Variation in monthly mean flyingfish catch per trip for commercial boats landing at the Collector Vessel (1979-1982; see Table 2).

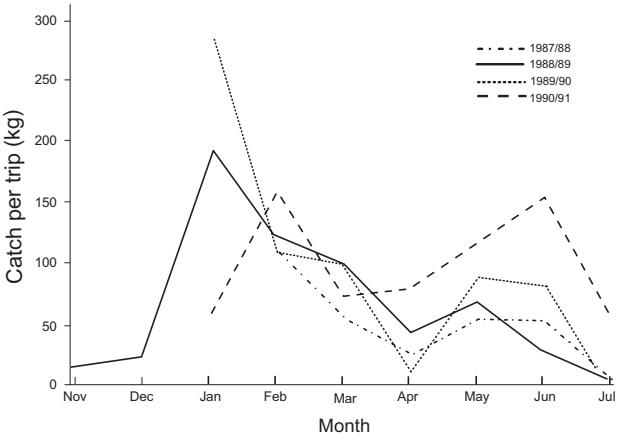


Figure 3. Variation in monthly mean flyingfish catch per trip for commercial boats landing at Pigeon Point, Buccoo and Mt. Irvine (1987-1991; see Table 2).

Table 2. Monthly mean flyingfish catch (kg) per trip for the periods 1979-1982 and 1988-1991. - Represents months with no data collection.

Flyingfish season	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Mean catch per trip *
1978-1979	-	-	-	-	-	-	259	68	-	-
1979-1980	-	-	-	96	191	156	249	228	26	206
1980-1981	-	-	133	99	195	90	210	196	-	173
1981-1982	-	-	-	-	250	215	123	130	-	180
1987-1988	-	-	-	111	56	27	56	57	8	49
1988-1989	11	20	193	122	98	45	69	31	8	61
1989-1990	-	-	285	109	100	14	91	85	4	73
1990-1991	-	-	56	159	73	81	120	157	61	108

* *Mean catch per trip was calculated for the period March to June since data were only recorded over this period for all fishing seasons except 1978-1979.*
Data source: CVS data sheets 1979-1982 and ECFFP data sheets 1987-1991 (see Appendices 1a-c).

This contributed to an increase in the catch per trip and total catch of flyingfish for the season (see Tables 2 and 12). Average catch per trip and total catch were even higher in the 1990-1991 fishing season. This can be attributed to the processor of Tobago Sea Products seeking to fill an order of 40 mt of flyingfish to Japan.

Estimates of total flyingfish landings are summarised in Table 3 for the fishing seasons 1979-1980 and 1981-1982. This is based on reports by La Croix (1978, 1980 and 1981). The total flyingfish catch per fishing season from 1987 to 1991 was calculated using catch per pirogue data recorded by two staff from the Marine Affairs (Fisheries) Section of the Tobago House of Assembly (THA) and data on purchases of flyingfish from the three main processors.

Table 3. Total catch of flyingfish (kg) per fishing season as recorded by the Collector Vessel System for the period 1978-1982.

Flyingfish season	Total catch per season
1978-1979	115,511
1979-1980	237,896
1980-1981	79,873
1981-1982	91,928

Data source: La Croix 1979, 1980 1981 and1981-1982 CVS data sheets (see Appendix 1b).

The data recorded by THA were on catch weights per pirogue landing at Pigeon Point, Buccoo and Mount Irvine. However, there were two additional landing sites for which data were not recorded. These were Bon Accord and a second site at Pigeon Point located near the beach resort. The former facilitates a nearby processor. These data collection were not sufficient to calculate total catch since data were not recorded for all months of the fishing season. Also, on an enumerated day not all the landing sites were visited. These problems were due to only two staff being responsible for the data collection.

The underlying principle in determining total number of boat trips was to estimate the total catch per season. The analyses were conducted on a monthly basis and then summed to give total seasonal values for the last four fishing seasons (1987-1988 to 1990-1991).

In an attempt to determine the total number of trips per season, the number of trips per day was calculated for the enumerated days as indicated in Tables 4 to 7. The assumption is that the enumerator working at a landing site records catches from all the boats landing at that site for that day. However, since data were not collected for the other site at Pigeon Point and Bon Accord the following assumptions were made. The rate of fishing at the two Pigeon Point sites was similar and the rate of fishing at Bon Accord was similar to the average rate of fishing at the three recorded landing sites. In Table 6, for the 1989-1990 season no data were recorded for Mount Irvine in January and March. These values were estimated using a raising factor k_1 where k_1 = *average rate of fishing at Pigeon Point and Buccoo / average rate of fishing at Mount Irvine* (for the months February and April to June).

Given the estimated number of trips per day *(t)* and the assumed number of fishing days per month *(d)*, the assumed number of trips per month (t_m) is calculated where $t_m = t*d$. From the total number of trips per month, the total catch per month *(c)* is calculated from the ratio of recorded number of trips (t_r) and the equivalent recorded catch (c_r) where $c = t_m * c_r / t_r$. Total seasonal catch is the sum of the monthly values of *c*. Total catch for the four fishing seasons is given in Tables 8 to 11.

For the months when data were not recorded by THA, the processor's monthly purchases were used to determine a raising factor k_2 to estimate the total catch for the missing months. The raising factor was equal to the ratio of the total raised catch for recorded months to the total flyingfish purchases by the processor for this period of time. This raising factor was considered a constant for the entire season such that the missing monthly catch (c) was equal to k_2 times the processor's flyingfish purchases for the said month.

For the last two seasons (1989-1990 and 1990-1991) an ice-boat was operated in the Tobago fleet but only catches for the 1990-1991 fishing season were recorded. As a result, catches had to be estimated for the 1989-1990 season. The assumption was that the ratio of ice-boat catches to pirogue catches was the same for each year.

The total catch of flyingfish for the last four fishing seasons is indicated in Table 12. There appears to be a general increase in the total catch of flyingfish from 189 mt in 1987-1988 to 359 mt in 1990-1991. The average total catch for the last four seasons was 282 mt.

Table 4. Estimated number of trips per day for each month of the 1987-1988 fishing season. n/n_1 = no. of trips / no. of enumerated days.

Area	No. of boats	N	D	J	F	M	A	M	J	J	Mean
Pigeon Point	22	-	-	-	83/15	87/23	60/16	51/14	53/13	4/3	4.30
					5.5	3.8	7.5	3.6	4.1	1.3	
Buccoo	22	-	-	-	37/9	142/21	77/11	95/16	131/19	26/9	5.58
					4.1	6.7	7	5.9	6.9	2.9	
Mt. Irvine	12	-	-	-	8/5	4/3	12/5	13/6	2/1	2/1	1.92
					1.6	1.3	2.4	2.2	2	2	
Other site at Pigeon Point	12	-	-	-	3	2.1	4.1	2	2.2	0.7	2.35
Bon Accord	4	-	-	-	2	1.5	3	1.5	1.5	0.5	1.67
Total	72	-	-	-	16.2	15.4	24	15.2	16.7	7.4	15.8

Table 5. Estimated number of trips per day for each month of the 1988-1989 fishing season. n/n_1 = no. of trips / no. of enumerated days.

Area	No. of boats	N	D	J	F	M	A	M	J	J	Mean
Pigeon Point	22	-	-	23/14	35/10	41/9	54/12	78/16	29/12	-	4.28
				5.8	3.5	4.6	4.5	4.9	2.4		
Buccoo	22	4/3	7/5	47/17	61/13	60/14	123/18	125/19	111/16	12/4	4.21
		1.3	1.4	2.8	4.7	4.3	6.8	6.6	7	3	
Mt. Irvine	12	1/1	3/3	2/2	1/1	13/3	1/1	10/4	1/1	-	1.6
		1	1	1	1	4.3	1	2.5	1		
Other site at Pigeon Point	12	-	-	3.2	1.9	2.5	2.5	2.7	1.3	-	2.35
Bon Accord	4	-	-	3	1.5	2.5	2.5	2.5	1	-	2.17
Total	72	2.3	2.4	15.8	12.6	18.2	17.3	19.2	12.7	3	14.6

Table 6. Estimated number of trips per day for each month of the 1989-1990 fishing season. n/n_1 = no. of trips / no. of enumerated days.

Area	No. of boats	N	D	J	F	M	A	M	J	J	Mean
Pigeon Point	22	-	-	93/18	96/15	104/17	102/16	109/17	45/11	16/2	6.08
				5.17	6.4	6.12	6.38	6.41	4.09	8	
Buccoo	22	-	-	24/161	58/12	132/20	98/14	122/20	35/10	-	4.75
				.5	4.8	6.6	7	6.1	3.5		
Mt.Irvine	12	-	-	3.3*	6/1	6.29*	50/10	115/22	77/19	-	5.28
					6		5	7.04	4.05		
Other site at Pigeon Point	12	-	-	2.82	3.49	3.34	3.48	3.5	2.23	4.36	3.32
Bon Accord	4	-	-	2	2.5	2.5	2.5	2.5	2	2	2.29
Total	72	-	-	14.79	23.19	24.85	24.36	25.55	15.87	14.36	20.42

* *Estimated values*

Table 7. Estimated number of trips per day for each month of the 1990-1991 fishing season. n/n_1 = no. of trips / no. of enumerated days.

Area	No. of boats	N	D	J	F	M	A	M	J	J	Mean
Pigeon Point	22	-	-	50/9	78/12	86/15	38/6	89/12	110/13	9/3	6.14
				5.56	6.5	5.73	6.33	7.42	8.46	3	
Buccoo	22	-	-	18/7	34/9	52/10	85/13	41/10	35/7	7/3	-
				2.57	3.78	5.2	6.54	4.1	5	2.3	
Mt. Irvine	12	-	-	33/6	18/5	41/11	13/4	5/3	2/2	6/3	2.95
				5.5	3.6	3.73	3.25	1.6	1	2	
Other site at Pigeon Point	12	-	-	3.03	3.5	3.13	3.45	4.05	4.61	1.64	3.34
Bon Accord	4	-	-	2.2	2.2	2.2	2.5	2.2	2.2	1.8	2.16
Total	72	-	-	18.82	19.58	19.99	22.07	19.37	21.27	10.74	18.83

Table 8. Estimation of total catch of flyingfish (kg) for the 1987-1988 fishing season.

1987-1988	N	D	J	F	M	A	M	J	J	Total
Recorded catch (c_r)	-	-	-	14,144	13,005	4,085	8,957	10,614	243	51,048
Recorded no. of trips (t_r)	-	-	-	128	233	149	159	186	32	887
Estimated no. of trips (t_m)	-	-	-	356	385	600	410	434	44	2,229
Raised catch (c)	414*	7,169*	5,591*	39,382	21,489	16,450	23,119	24,777	337	18,9047
Assumed no. of fishing days (d)	-	-	-	22	25	25	27	26	12	137
Estimated no. of trips per day (t)	-	-	-	16.2	15.4	24	15.2	16.7	7.4	

*Data source: ECFFP data sheets (see Appendix 1c). * Estimated values*

Table 9. Estimation of total catch of flyingfish (kg) for the 1988-1989 fishing season.

1988-1989	N	D	J	F	M	A	M	J	J	Total
Recorded catch (c_r)	55	201	13,930	11,878	11,203	7,991	14,743	4,305	103	64,409
Recorded no. of trips (t_r)	5	10	72	97	114	178	213	141	12	843
Estimated no. of trips (t_m)	14	29	379	277	455	433	518	330	18	2458
Raised catch (c)	154	683	7,336	3,390	44,714	19,439	35,854	10,076	155	21,8321
Assumed no. of fishing days (d)	5	14	24	22	25	25	27	26	6	175
Estimated no. of trips per day (t)	2.3	2.4	15.8	12.6	18.2	17.3	19.2	12.7	3	

*Data source: ECFFP data sheets (see Appendix 1c). * Estimated values*

Table 10. Estimation of total catch of flyingfish (kg) for the 1989-1990 fishing season.

1989-1990	N	D	J	F	M	A	M	J	J	Total
Recorded catch (c_r)	-	-	33,389	17,506	23,566	3,490	31,473	13,362	57	122,843
Recorded no. of trips (t_r)	-	-	117	160	236	250	346	157	16	1,282
Estimated no. of trips (t_m)	-	-	355	510	621	609	690	413	86	3,284
Raised catch (c)	400*	7,704*	101,309	55,800	62,011	8,502	62,764	35,150	306	333,946
Assumed no. of fishing days (d)	-	-	24	22	25	25	27	26	6	155
Estimated no. of trips per day (t)	-	-	14.79	23.19	24.85	24.36	25.55	15.87	14.36	

*Data source: ECFFP data sheets (see Appendix 1c). * Estimated values*

Table 11. Estimation of total catch of flyingfish (kg) for the 1990-1991 fishing season.

1990-1991	N	D	J	F	M	A	M	J	J	Total
Recorded catch (c_r)	-	-	5,628	20,638	13,108	15,306	16,183	23,092	1,342	95,297
Recorded no. of trips (t_r)	-	-	101	130	179	188	135	147	22	902
Estimated no. of trips (t_m)	-	-	452	431	500	552	523	553	129	3,140
Raised catch (c)	-	191*	25,187	68,423	36,615	44,941	62,694	86,870	7,869	33,4510
Assumed no. of fishing days (d)	-	-	24	22	25	25	27	26	12	161
Estimated no. of trips per day (t)	-	-	18.82	19.58	19.99	22.07	19.37	21.27	10.74	

*Data source: ECFFP data sheets (see Appendix 1c). * Estimated values*

Table 12. Estimated total catch of flyingfish (kg) for the fishing seasons 1987-1988 to 1990-1991 by the Tobago flyingfish fleet

Fishing season	Months with catch records	Recorded catch *(Based on ECFFP data)*	Recorded catch as % of estimated total catch *(Based on TSP data)*	Estimated total catch from pirogues	Recorded catch from ice-boat	Estimated total catch from all fleet
1987-1988	Feb-Jul	51,048	27	189,047	-	189,047
1988-1989	Nov-Jul	64,409	30	218,321	-	218,321
1989-1990	Jan-Jul	122,843	34	333,946	28,789	362,735
1990-1991	Jan-Jul	95,297	27	334,510	24,609	359,119
Average						282,306

Data source: ECFFP data sheets 1988-1991 (see Appendix 1c) and Tobago Sea Product (TSP) data 1988-1991 (Ice-boat began operating in 1989).

Proportion of the total fish catch

The flyingfish fishery of Tobago is commercially significant, accounting for approximately 83% of the pelagic landings on the leeward side of the island (Table 13). The proportion of flyingfish caught was higher for the period 1979 to 1982 as a result of the Collector Vessel System which provided fishermen with a strong incentive to target flyingfish while "drifting", since there was a ready buyer on the fishing grounds.

Flyingfish landings could not be calculated as a proportion of the total fish catch in Tobago since there are no catch records available for landing sites along the windward coast.

Table 13. Total flyingfish catch as a percentage of the total pelagic fish catch landed at Pigeon Point, Buccoo and Mt. Irvine, Tobago.

Fishing season	% of total pelagic catch
1979-1980	95
1980-1981	92
1981-1982	97
1987-1988	64
1988-1989	77
1989-1990	79
1990-1991	78

Data source: CVS data sheets 1979-1982 and ECFFP data sheets 1987-1991 (see Appendices 1a-c).

Landed value of catch

Whole flyingfish are purchased directly from the fishermen by processors at wholesale prices. From 1979 to 1982 the main wholesale purchaser was the National Fisheries Company Limited. Since 1987 the major wholesale purchasers have been the commercial processors based in Tobago. Filleted flyingfish are then retailed to the local public, to exporters based in Trinidad, or directly to overseas markets (thereby earning foreign exchange) for about twice the wholesale price paid to fishermen.

For the last four fishing seasons, whole flyingfish have sold at TT$ 1.10 / kg wholesale, and filleted flyingfish have retailed at TT$ 2.20 / kg. A summary of flyingfish prices and estimated total value of the catch is given in Table 14. The value of the flyingfish catch in Tobago over the last four seasons (1987-1991) has averaged TT$ 310,500 (wholesale) and TT$ 620,000 (retail).

Employment generated by the flyingfish fishery

There are approximately 125 flyingfish fishermen who each make an average of 25 trips per season. Of these, there are about 25 full time fishermen who average about 35 trips per season (ECFFP data sheets 1991; see Appendix 1c).

In addition to the fishermen, employment is provided for persons who transport flyingfish from the landing sites to the attendants at the cold storage facilities at NIPDEC and CMA, the staff at the processing plants and fish vendors. Employment includes pump attendants at fuelling stations near to the

fishing beaches, flyingfish exporters and persons involved in the maintenance of fishing gear and equipment.

There are also three main fish processors in Tobago: Mr. Emile Louis (Tobago Sea Products), Mr. Roy Jacob (Jacob Fishing Enterprises) and Mr. Harold Charles (Harold's). The processing of flyingfish provides employment for persons skilled in deboning flyingfish as well as "gutters" and "scalers". This work force comprises mainly women, while men are employed for packing, weighing and storing the flyingfish. Tobago Sea Products and Jacob Fishing Enterprises each employ a regular staff of about 40 persons during the flyingfish season. This number is often increased during the peak catching periods. Harold's employs a regular staff of about 18 persons and as many as 25 persons during the peak catching periods.

Processors retail flyingfish either through exporters in Trinidad or on their own to Barbados and other Caribbean islands. Flyingfish is also exported to Canada, the United States of America and Europe. In 1991, one processor secured an order for 40 mt whole flyingfish to Japan.

Tobago Sea Products has secured the services of two boat builders (one from Trinidad and one from Barbados). The boat builder from Trinidad was employed to remodel a fibreglass pirogue to include cold storage facilities. The Barbadian boat builder is currently building a prototype fibreglass vessel capable of undertaking a three-day fishing trip with a crew of three, for use in the Tobago flyingfish fishery. There is another boat builder from Trinidad who services the vessels of flyingfish fishermen, repairing and remodelling existing boats and building new fibreglass boats.

Flyingfish species composition and size structure of the catch

The flyingfish catch comprises mainly *Hirundichthys affinis*. The mean length and size range of individuals in the catches are given in Table 15. The size range of flyingfish in the catch varies very little since the flyingfish stock mainly consists of adult, spawning fish, and the majority of the fish are taken by gillnets which are size-selective.

DEVELOPMENT AND MANAGEMENT OF THE FLYINGFISH FISHING INDUSTRY

Catch and effort data collection system

The official collection of flyingfish landing data began in the early 1970s in the Swallows/Pigeon Point area. This was done by the gate attendant at the entrance to the Pigeon Point Resort and a record was kept of the date, boat registration number, amount of flyingfish and other species which were landed. However, these data sheets cannot be located for analysis.

Table 14. Total value of the flyingfish catch (TT$) as estimated rom wholesale and retail prices.

Fishing Season	Wholesale price per kg	Retail price per kg	Total catch (kg)	Wholesale value of total catch ($TT)	Retail value of total catch ($TT)
1978-1979	.66	*	115,511	76,237	
1979-1980	.66	1.32	237,896	157,011	314,023
1980-1981	1.00	1.76	79,873	79,873	140,577
1981-1982	1.00	1.76	91,928	91,928	161,793
1987-1988	1.10	2.20	189,047	207,952	415,903
1988-1989	1.10	2.20	218,321	240,153	480,306
1989-1990	1.10	2.20	362,735	399,009	798,017
1990-1991	1.10	2.20	359,119	395,031	790,062

** No price was set for this catch since the poor quality of the fish rendered it unsuitable for sale. D ata source: La Croix (1980, 1981, 1982); Jacob and Louis (pers. comm.).*

Table 15. Mean length and size range (mm) of *Hirundichthys affinis* in the commercial catches for 1981, 1982 and 1991.

Year	1981			1982			1991		
Month	Total length	Size range	n	Fork length	Size range	n	Total length	Size range	n
February	-	-	-	-	-	-	264	231-295	200
March	-	-	-	222	195-286	905	267	226-303	200
April	-	-	-	-	-	-	266	241-305	200
May	263	209-305	160	220	200-255	275	265	241-305	200
June	256	220-295	142	221	200-240	232	261	211-290	200
July	263	235-290	49	222	205-254	17	261	206-295	200
October	-	-	-	-	-	-	-	233-278	5
November	-	-	-	-	-	-	262	228-288	200
December	-	-	-	-	-	-	266	222-295	204
January	-	-	-	-	-	-	262	215-294	164

Data source: Fish. Div., MALMR 1981, 1982, 1992.

Existing records of flyingfish catch and effort go back to 1979. During the period 1979-1982 the Government of Trinidad and Tobago introduced a Collector Vessel System, in an effort to instigate the development of the flyingfish fishery in Tobago. This was used to provide a marketing outlet for the flyingfish caught by the Tobago fishermen and was done in collaboration with the Fisheries Division of the Ministry of Agriculture, Lands and Fisheries, the Industrial Development Co-operation, the National Fisheries Company (NFC) Limited, the Tobago Marketing Co-operative Society Limited and the Agricultural Development Bank (La Croix 1980). The introduction of the Collector Vessel System also allowed for a comprehensive data collection on flyingfish landings. In the first full year of its operation (1979), five commercial shrimp trawlers each with a cold storage capacity of 1365 kg (3000 lb) were chartered by the National Fisheries Company to act as collector vessels for the flyingfish fleet. At least two vessels at a time were located at Plymouth (La Croix 1980).

From 1980 to 1982 a factory/collector vessel capable of blast freezing 9090 kg (20,000 lb) of fish per day with a cold storage capacity of 100,000 kg (220,000 lb) was the main vessel used in the operation (La Croix 1981, 1982, Jordan 1983b). A shrimp trawler was occasionally used to relieve this vessel when it was offloading at NFC Limited, Trinidad (La Croix 1981, 1982). Catch data were collected during this period by two data collectors stationed onboard the collector vessel to assist the captain with recording information. During the first two years of this system (i.e. May 7-June 28, 1979 and February 29-June 8, 1980) information on the date, boat registration number and the quantity of flyingfish and other species landed per trip by individual fishermen, was collected. An example of the data sheets used for this is given in Appendix 1a. In the latter years (i.e. January 16-June 14, 1981 and March 6-June 7, 1982) more detailed information was collected. Additional information included the number of drift and bottom lines being used, time spent fishing, area fished, whether dipping and/or chum was used and the number of times the net was set. An example of the data sheets used for this is given in Appendix 1b.

During the period November 1982 to July 1988 no data on flyingfish landings were recorded due to problems in the data collection system.

In 1988, under the Eastern Caribbean Flyingfish Project, a programme for collection of flyingfish catch data at landing sites was initiated. This programme has remained in place to the present time. Two officers from the Fisheries Division Tobago House of Assembly, who were trained by the Marine Fishery Analysis Unit, Ministry of Agriculture, Land and Marine Resources (MALMR) are responsible for collecting catch data from the three main landing sites: Pigeon Point, Buccoo and Mount Irvine. Catch data are taken either from vendors weighing the fish or from eye estimates. Eye estimates are based on the “fullness” of a standard basket used for handling flyingfish (i.e. basket full and bulging = 45 kg (90 lb); basket full = 36 kg (80 lb); basket about 4" below rim = 32 kg (70 lb). Data are

collected on a daily basis for weekdays only (Thomas and Nichols pers. comm.). Data sheets designed for use by beach collectors are essentially the same as the latter ones used on the collector vessel, and an example of the sheet is given in Appendix 1c.

A database for flyingfish landings has been established by the Fisheries Division, MALMR, and the Tobago House of Assembly. Data from the two four-year periods (1979-1982 and 1988-1991) have been entered onto a specially designed flyingfish programme written in RBase, System 5 (Ramkissoon 1990). The total number of days for which catch data have been collected over the years is given in Table 16. The "number of boat trips per season" is used as an indication of the total fishing effort.

Table 16. Total number of days and percentage of total fishing days sampled for flyingfish catch data during the fishing seasons* of 1979-1982 and 1988-1990.

Fishing season	Sampling period	No. days sampled	% of total fishing days
1978-1979	May 7 - Jun 28	42	23
1979-1980	Feb 29 - Jun 8	106	58
1980-1981	Jan 16 - Jun 14	76	42
1981-1982	Mar 6 - Jun 7	51	28
1987-1988	Feb 4 - Jul 26	111	62
1988-1989	Nov 16 - Jul 27	124	70
1989-1990	Jan 2 - Jul 3	124	70
1990-1991	Jan 3 - Jul 5	103	58

* *November 15 to July 15, excluding Sundays and public holidays = 178 days. Data source: CVS data sheets 1979-1982 and ECFFP data sheets 1987-1991 (see Appendices 1a-c).*

Recent fishing agreements and negotiations

In November 1990 an agreement was made between the Government of the Republic of Trinidad and Tobago and the Government of Barbados. This came about as a result of initiatives taken since April 1986. The Trinidad and Tobago/Barbados Fishing Agreement (1990) was for the duration of one year (November 23, 1990 to December 31, 1991).

The Agreement stated that the Government of Trinidad and Tobago granted 40 Barbadian vessels to fish in the Exclusive Economic Zone of Trinidad and Tobago at a licence fee of US$ 800.00. These vessels were not allowed to fish within 12 nautical miles from the straight archipelagic baselines from which the territorial sea of Trinidad and Tobago is measured. Fishing was allowed to occur only from January 1 to April 30, 1991 for flyingfish and associated pelagics. The gear was restricted to surface gill nets, hand dip nets and not more than six drifting surface hand-lines, with not more than one hook each. Vessel characteristics should be no longer than 15 m with a maximum power of 350 hp and a storage capacity up to 5 mt of net effective catch. The number of Barbados vessels fishing at any one time was restricted to not more than two groups of 13 and one group of 14.

Each vessel was allowed a maximum crew of four including the master. On arrival in the stated Tobago fishing grounds the master of the vessel had to report to the coast guard of Trinidad and Tobago or any other designated station by radio. The vessel master was also required to report at least once within a twelve hour period on their position while in the fishing area. The Agreement also stated that the Government of Barbados would grant licences for the importation of 300 mt of whole and processed flyingfish and associated pelagic species at a price to be agreed between Trinidad and Tobago vendors and authorized Barbados purchasing companies.

Finally, the Agreement required that a Barbados/Trinidad and Tobago Fisheries Commission consisting of four representatives from each country be established. The Commission would be responsible for supervising the Agreement, coordinating the exchange of research data resulting from research programmes and fishing activities and establishing a Joint Technical Team to deal with research on flyingfish and associated pelagic species and their resource assessment (Government of Trinidad and Tobago and Government of Barbados 1990).

Although not a part of the fishing Agreement, there is a Barbados registered fishing vessel (ice-boat) which is contracted to Tobago Sea Products. This boat has been given official approval by the Government of Trinidad and Tobago to fish for flyingfish which is to be sold directly to Tobago Sea Products.

Planned future directions for the industry

In order to effectively manage the flyingfish resource, research is being conducted by the Marine Fishery Analysis Unit, MALMR, and the Fisheries and Aquaculture Research Programme of the Institute of Marine Affairs in Trinidad on the flyingfish stock of Tobago. This project began on January 1, 1991 as a sub-project of the main UNDP/FAO/GOV'T of the Republic of Trinidad and Tobago (GORTT) project "Establishment of Data Collection Systems and Assessment of Marine Renewable Resources"

(TRI/91/001). The objectives of the sub-project "Assessment of the Flyingfish Stocks of Tobago" (Samlalsingh MALMR/IMA 1991) are outlined as follows:

- To analyse commercial catch and effort data to determine trends in the flyingfish catch and a suitable unit of effort for catch per unit effort.
- To determine the pattern of recruitment of flyingfish to the Tobago fishing grounds from the age composition of the commercial catch.
- To determine a method to sample flyingfish pre-recruits to the fishery in an effort to predict the potential commercial catch.

There are plans to improve the data collection system for recording flyingfish landings in Tobago under the UNDP/FAO/GORTT project. The information collected is to be fed into an Information Management Centre which will soon be established at the Fisheries Division, MALMR, Trinidad and Tobago. Since the flyingfish resource is shared among the eastern Caribbean islands, it is necessary for data to be exchanged on a regional level. To effect this, Trinidad and Tobago has established a Joint Technical Team under the Trinidad and Tobago/Barbados Fishing Agreement (Government of Trinidad and Tobago and Government of Barbados 1991) and proposed the adoption of a Joint Research Protocol with Barbados to allow for continuous research activities in the future.

Trinidad and Tobago will also be involved in the eight-year Caribbean Fishery Resource Assessment and Management Programme (CFRAMP) scheduled to begin in 1992. In this project consideration will also be given to the resource assessment and management aspects of the flyingfish Fishery.

In order to support the development of the flyingfish industry in Tobago several initiatives are being pursued which include:

- The development of a Fish Port at Scarborough.
- The establishment of a blast freezer at The National Insurance Property Development Company (NIPDEC).
- The availability of funds for the purchase of boats about 15 m in length which can carry ice to sea and stay out for longer periods.
- Suggestions for the modifications of existing boats for carrying ice to sea on their day trip.
- A proposal for the provision of ice at the fishing beaches.
- Upgrading existing fishing facilities and building new facilities where none exist at present.

The fish processors are also interested in assisting the future development of the flyingfish fishery. To this end, Tobago Sea Products has offered to:

- Pay higher prices for flyingfish stored in ice while at sea.
- Rent containers for storing the flyingfish in ice while at sea.
- Sell ice at a cheaper price than at present.
- Consider an award scheme for the most productive fishermen.

Training is essential if the flyingfish industry is to achieve its full potential. This would include training for fishermen in the use of ice for prevention of fish spoilage while at sea, and training of fish processors with respect to quality control. The development of new fish products using flyingfish as the raw material and the manufacture of fishmeal from flyingfish "trash" would be an asset to processors. To this effect some training was offered through the Government to the two main processors "Tobago Sea Products" and "Jacob's Fishing Enterprises" in the methodology for manufacturing fish silage from flyingfish "trash" and the smoking of flyingfish respectively.

If results from present studies being carried out on the flyingfish fishery, indicate that the Tobago fleet is fishing below the maximum sustainable yield, then it would be possible for the fleet to increase its fishing effort by merely increasing the number of fishing days for the season. However, this increased fishing effort and yield can only be justified if there are ready markets for the flyingfish and the possible by-products. To this effect there would be a need for the Government to work with processors in seeking foreign markets and manufacturing flyingfish by-products.

REFERENCES

Government of Trinidad and Tobago and Government of Barbados. 1991. Trinidad and Tobago/Barbados Fishing Agreement (Draft), 26 pp.

Jordan, C. 1983a. The flyingfish industry of Trinidad and Tobago: a continuing case study. Proc. Gulf Caribb. Fish. Inst. 36: 177-182.

Jordan, C. 1983b. Report of the 1982 activities of the Flyingfish Project. Ministry of Food Production and Marine Exploitation, 3 pp.

La Croix, M. 1980. Report on the 1979 activities of the Flyingfish Project and proposals for the 1980 season. Tobago Marketing Co-operative Society Limited, 4 pp.

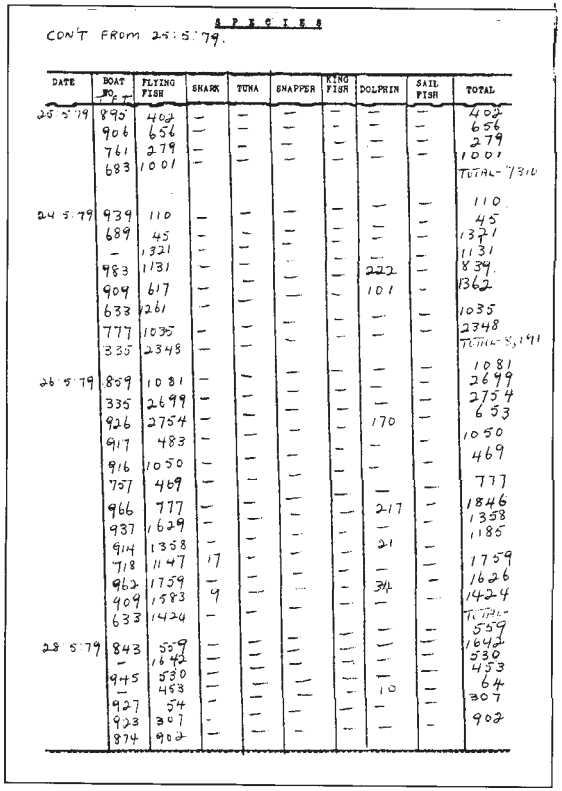
La Croix, M. 1981. Report on the 1980 activities of the Flyingfish Project and proposals for the 1982 season. Tobago Marketing Co-operative Society Limited, 5 pp.

La Croix, M. 1982. Report on the 1981 activities of the Flyingfish Project and proposals for the 1981 season. Tobago Marketing Co-operative Society Limited, 6 pp.

Ramkissoon, D. 1990. Flyingfish Project manual - (R Base System 5). Fisheries Division, Ministry of Food Production and Marine Exploitation, 64 pp.

Samlalsingh, S. 1991. Draft proposal for a project on the assessment of the flyingfish stock of Tobago. Ministry of Food Production and Marine Exploitation/Institute of Marine Affairs, 20 pp.

APPENDIX 1

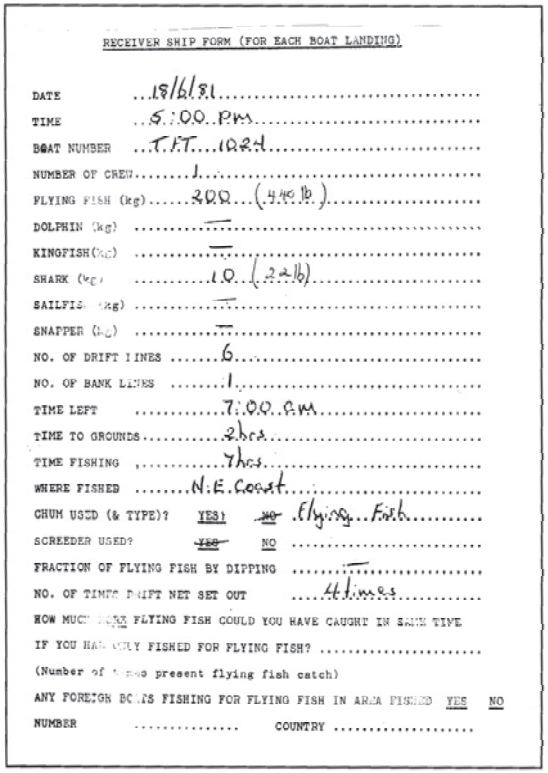


CONT FROM 25:5:79.

SPECIES

DATE	BOAT NO.	FLYING FISH	SHARK	TUNA	SNAPPER	KING FISH	DOLPHIN	SAIL FISH	TOTAL
25 5 79	895	402	—	—	—	—	—	—	402
	906	656	—	—	—	—	—	—	656
	761	279	—	—	—	—	—	—	279
	683	1001	—	—	—	—	—	—	1001
									TOTAL-7310
									110
24 5 79	939	110	—	—	—	—	—	—	45
	689	45	—	—	—	—	—	—	1371
	—	1321	—	—	—	—	—	—	1131
	983	1131	—	—	—	—	222	—	839
	904	617	—	—	—	—	101	—	1362
	633	1261	—	—	—	—	—	—	1035
	777	1035	—	—	—	—	—	—	2348
	335	2348	—	—	—	—	—	—	TOTAL-8,191
									1081
26 5 79	859	1081	—	—	—	—	—	—	2699
	335	2699	—	—	—	—	—	—	2754
	926	2754	—	—	—	—	170	—	653
	917	483	—	—	—	—	—	—	1050
	916	1050	—	—	—	—	—	—	469
	757	469	—	—	—	—	—	—	777
	966	777	—	—	—	—	217	—	1846
	937	1629	—	—	—	—	—	—	1358
	914	1358	—	—	—	—	21	—	1185
	718	1147	17	—	—	—	—	—	1759
	962	1759	—	—	—	—	34	—	1626
	409	1583	9	—	—	—	—	—	1424
	633	1424	—	—	—	—	—	—	TOTAL-559
28 5 79	843	559	—	—	—	—	—	—	1642
	—	1642	—	—	—	—	—	—	530
	945	530	—	—	—	—	—	—	453
	—	453	—	—	—	—	10	—	64
	927	54	—	—	—	—	—	—	307
	923	307	—	—	—	—	—	—	902
	874	902	—	—	—	—	—	—	

1a: Sample of data collection sheet used by Collector Vessel System for 1979-1980



RECEIVER SHIP FORM (FOR EACH BOAT LANDING)

DATE ...18/6/81.....

TIME ...5:00 PM.....

BOAT NUMBER ...T.T. 1021.....

NUMBER OF CREW.....1.....

FLYING FISH (kg).....200...(440 lb)...

DOLPHIN (kg) .....—.....

KINGFISH(kg) .....—.....

SHARK (kg) .....10...(22lb)...

SAILFISH (kg) .....—.....

SNAPPER (kg) .....—.....

NO. OF DRIFT LINES .....6.....

NO. OF BANK LINES .....1.....

TIME LEFT .....7:00 AM.....

TIME TO GROUNDS.....2hrs.....

TIME FISHING .....7hrs.....

WHERE FISHED .....N.E.Coast.....

CHUM USED (& TYPE)? YES/~~NO~~ Flying Fish.....

SCREEDER USED? ~~YES~~/NO .....

FRACTION OF FLYING FISH BY DIPPING .....—.....

NO. OF TIMES DRIFT NET SET OUT ....4times.....

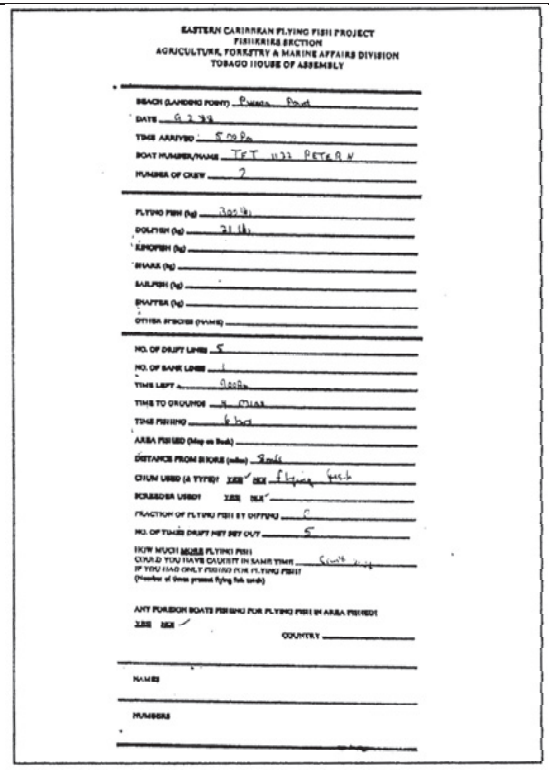
HOW MUCH ~~MORE~~ FLYING FISH COULD YOU HAVE CAUGHT IN SAME TIME IF YOU HAD ONLY FISHED FOR FLYING FISH? .....

(Number of times present flying fish catch)

ANY FOREIGN BOATS FISHING FOR FLYING FISH IN AREA FISHED YES/NO

NUMBER ..... COUNTRY .....

1b: Sample of data collection sheet used by Collector Vessel System for 1981-1982



EASTERN CARIBBEAN FLYING FISH PROJECT
FISHERIES SECTION
AGRICULTURE, FORESTRY & MARINE AFFAIRS DIVISION
TOBAGO HOUSE OF ASSEMBLY

BEACH (LANDING POINT) Pigeon Point

DATE 6.2.88

TIME ARRIVED 5.00p

BOAT NUMBER/NAME TFT 1133 PETER N

NUMBER OF CREW 2

FLYING FISH (kg) 300 lb

DOLPHIN (kg) 21 lb

KINGFISH (kg)

SHARK (kg)

SAILFISH (kg)

SNAPPER (kg)

OTHER SPECIES (Name)

NO. OF DRIFT LINES 5

NO. OF BANK LINES 1

TIME LEFT 6.00a

TIME TO GROUNDS 7 mins

TIME FISHING 6 hrs

AREA FISHED (Map on Back)

DISTANCE FROM SHORE (miles) 5mls

CHUM USED (A TYPE)? YES ✓ NO Flying Fish

SCREEDER USED? YES NO ✓

FRACTION OF FLYING FISH BY DIPPING C

NO. OF TIMES DRIFT NET SET OUT 5

HOW MUCH MORE FLYING FISH COULD YOU HAVE CAUGHT IN SAME TIME IF YOU HAD ONLY FISHED FOR FLYING FISH? Could have

(Number of times present flying fish catch)

ANY FOREIGN BOATS FISHING FOR FLYING FISH IN AREA FISHED

YES NO ✓

COUNTRY

NAMES

NUMBERS

1c: Sample of data collection sheet used by beach data collectors for 1988-1991