# POLYDACTYLUS INDICUS (SHAW) IN THE LANDINGS BY BULL TRAWLERS OPERATING IN BOMBAY AND SAURASHTRA WATERS DURING 1956-63

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In the commercial exploitation of marine fishes along the Bombay and Saurashtra coasts, *Polydactylus indicus* (locally called 'Dara'), one of the widely distributed polynemid species in the tropical waters, has always occupied a prominent place, as is revealed in the accounts by Mohamed (1955), Jayaraman *et al* (1959), Nayak (1959) and Deshpande (1962). During the last decade and a half there has been regular trawl fishing in these waters. Nayak (*loc. cit.*) has given a detailed account of 'Dara' catches from the otter-trawl operations of the Japanese vessel 'Taiyo Maru No. 17' and from the otter-trawl and bull-trawl operations of the cutters M.T. 'Ashok' and M.T. 'Pratap' belonging to the Government of India Deep Sea Fishing Station, Bombay, for the period 1950-57.

The purpose of this paper is to make a fair assessment of the 'Dara' fishery based on the catches from the two sets of bull-trawlers, 'Arnaila'—'Paj' and 'Satpati'— 'Pilotan' of the New India Fisheries Co. Ltd., operating in the waters from Bombay to Kutch continuously for the period of nearly eight years from April 1956 to October 1963. The demarkation of the six regions, namely, Bombay, Cambay, Veraval, Porbundar, Dwarka and Kutch, and also the areas fished under each of them have been fully described by Kagwade (1967).

# ESTIMATION OF CATCH

The log books of New India Fisheries trawlers record 'Dara' in individual pieces and in cases. The pieces are described as big 'Dara' when they measure roughly above 90 cm. and 'Dara' without a qualifying prefix when they measure below that length up to about 60 cm. Fish below 60 cm. are all put in wooden or metal cases (58 cm.  $\times$  36 cm.  $\times$  12½ cm.) and entered as small 'Dara' or 'Chelna'. In the catch analysis a big 'Dara' is allotted a weight of 9 kg., a medium-sized 'Dara' 7 kg., and a case of small 'Dara' 18 kg.

Small juveniles of *P. indicus* are commonly known as 'Chelna'. Big 'Dara' is an adult sexually mature, whereas 'Dara' includes both the juvenile and the

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adult. To avoid confusion only those that are accounted in cases and not in pieces are considered as 'Chelna'. The term 'Dara' used in this paper refers to *P. indicus*, irrespective of its size and state of maturity. When it is used in the sense of adult it is made known accordingly.

# ANNUAL 'DARA' CATCH

As is indicated in Table I, the highest 'Dara' catch of 175,575 kg. and the highest percentage catch of 5.36 for the New India Fisheries trawlers have been in 1957, the highest catch rate of 38.96 kg. per hour being in 1956. There is a steady decline in the catch, catch rate and percentage catch year after year for this species with the result that the catch is reduced to 24,120 kg. with a percentage of 0.89 and a catch per hour of 6.80 kg. in the year 1963. This trend of decline noticed in the catch is discussed in the following account in the light of fishing effort, area and season of fishing.

# REGIONAL ABUNDANCE OF 'DARA' CATCH

It is obvious from Table I that the regions Bombay to Porbundar, in conformity with the earlier observations by Nayak (*loc. cit.*), have continued to remain poor with their low percentage catches and catch rates.

Bombay region, the least exploited of all, has recorded no 'Dara' in most of the years. The highest percentage catch of 2.25 and the catch rate of 5.51 kg. per hour have been in 1960. Excepting this, the percentages have not gone beyond 0.26 and the catch rate 1.21 kg. per hour in the rest of the years. However, 'Dara' contribution from this region has been 0.77% in 1956 and it is next only to that from Dwarka for that year.

In Cambay region the catch and the catch rates have been very poor all through, the maximum percentage catch of 0.26 in all fish with a catch rate of 1.25 kg. per hour being in 1960. This region has contributed its highest percentage of 3.44 to the total 'Dara' landings in 1963.

Like Cambay, Veraval also has been very poor for 'Dara', the maximum of 0.35% in all fish with a catch rate of 2.27 kg. per hour being in 1963 when the yield from this region has been found to be 3.32% of the total 'Dara' catch.

Porbundar region has not proved to be better than the three regions described earlier. Generally the catch rates and percentage catches have been very low. However, the highest yield of 5,967 kg. for this region forming 0.16% of all fish with a catch rate of 3.74 kg. per hour was obtained in 1958. This catch has formed 7.75% of the total 'Dara' from all regions.

'Dara' yields from Dwarka by way of catch, catch rates and percentage catches have been the highest of all other regions except in 1963 when the percentage catch of 1.75 with the catch rate of 15.24 kg. per hour have been slightly higher in Kutch region. The steady decline in 'Dara' fishery is a matter of great concern in Dwarka region where the percentage catch of 22.09 in 1957 has shown a steep fall to 1.16 in 1963. The fishing in Dwarka region has been more intensive till 1959 when the catch rates ranged between 78.30 kg. and 145.0 kg. per hour and the percentage catches between 10.85 and 22.09. During this period, about 90 to 99% of the annual 'Dara' yield has been from this region. In the rest of the years the fishing has been very much less, thus reducing its catch contribution from 39.94% in 1960 to 4.88% in 1963.

The percentage yields of 'Dara' in the total catch of all fish in the Kutch region have been less than 1.98 except in 1957 when they formed 12.34. The catch rates with an exception of 87.96 kg. per hour in 1957 have not gone beyond 20 kg. per hour. Nevertheless the percentage catches and the catch rates are better than those in the regions Bombay to Porbundar. The bulk of the catch from Kutch has exceeded even that of Dwarka from 1960 onwards in view of the considerably high amount of fishing effort expended.

From the point of view of very high catch rates in almost all the years and percentage occurrence of 'Dara' in all fish, Dwarka continues to be the best of all regions, Kutch ranking next.

# RELATIVE RICHNESS OF THE AREAS FOR 'DARA'

Since the regions from Bombay to Porbundar have proved to have very poor trawling grounds for this species, a detailed study of the catch in different areas under them has not been attempted. The study on the relative abundance of the catch has been concentrated in the areas under Dwarka, the most productive region for this species and also under Kutch since the catches obtained in the latter part of the fishing period from this region are even better than those from Dwarka.

The areas 'K' and 'M' (Table II) in Dwarka region have yielded in most of the years high catch rates of over 100 kg. per hour, the maximum of 203.08 kg. per hour being in 1959 from the area 'M'. The highest of 277.06 kg. per hour of fishing from 'K' has been in January 1957. In the area 'M' the record catch rate of 338.33 kg. per hour has been in February 1959 and most of the monthly catch rates in different months have been over 200.0 kg. per hour.

The area 'N' has been exploited the most in this region by the New India Fisheries trawlers and the annual catch rates have been comparatively low except in 1960 when the catch rate of 98.63 kg. per hour from it has been the highest

of all areas fished. But during certain months like January of 1957 and 1960 and December 1961, the catch rates from this area have been over 230.0 kg. per hour.

The area 'L' has been the least exploited and is the poorest of the four areas in this region. Very often the catch has been found to be nil and whenever catch is present, the catch rates have always been less than 40.0 kg. per hour of fishing. It is therefore obvious that the areas 'M', 'K', 'N', and 'L' come in that order of merit in respect of 'Dara' yields in the 'Dwarka' region.

The New India Fisheries trawlers have covered all the areas P-Z in Kutch region during 1957 to 1963 (Table III). The effort expended has been very high in the areas 'Q' and 'R'. The areas 'S', 'U' and V' have been moderately fished whereas the rest, only occasionally.

A very high catch rate of 175.93 kg. per hour for a catch of 234 kg. has been registered from the area 'P' in 1957. The area 'Q' appears to be the best of all with generally the highest catch rates in almost all the years. The maximum catch rate recorded in this area has been 63.18 kg. per hour for the highest yield of 23,562 kg. in 1962.

Though the catch is nil in many areas in different years high catch rates of 55.71 kg. and 32.21 kg. per hour have been noted in 1960 in the areas 'S' and 'U' respectively. The area 'R' with the highest yield of 28,331 kg. in 1961 has shown a catch rate of 23.62 kg. per hour. Thus it can be stated that the areas 'P' to 'U' except 'T' are good to moderate and all the others poor in their yields of 'Dara'.

#### PROPORTION OF 'CHELNA' IN 'DARA' CATCHES

Nayak (loc. cit.) has shown that 'Chelna' catch in the total 'Dara' was high and varied between 92.2% and 97.1% in the landings by 'Taiyo Maru No. 17' during 1951-54 and between 97.3% and 99.9% in those by M.T. 'Ashok' and M.T. 'Pratap' when they were bull-trawling during 1953-57. However, when these cutters had done otter-trawling in the earlier period of 1950-53, the maximum percentage of 'Chelna' was only 36.8. The low percentage in these years was due to very inadequate coverage of Dwarka and the low fishing effort expended.

It is seen from Table IV that the percentage of 'Chelna' has continued to be high in the landings of New India Fisheries trawlers during 1956-63. The 'Chelna' percentages in 'Dara' catches in the years between 1956 and 1962 have varied from 88.91 and 98.56. In 1963 in most of the months the fishing was low and the operations had stopped by October before the commencement of the 'Dara' season. Hence during that year the percentage was only 69.85. No data separately for 'Chelna' in 1959 are available from the log sheets.

Whenever they occurred, 'Che'na' have formed extremely small percentage in the southern regions, up to 18.95% in Bombay, 46.16% in Cambay and 62.24% in Veraval during the eight-year period. The position of 'Chelna' catch has been much better in Porbundar where the percentages have ranged between 22.95% in 1962 and 87.70% in 1958 (with the exception of 1.33% in 1957).

In Dwarka except in 1962 and 1963 and in Kutch except in 1963, the percentage of 'Chelna' in the 'Dara' catch has been of a very high order, being always above 90% for both the regions.

Regarding the breeding grounds of 'Dara', it may be stated that the observations of the earlier workers (Shrivatsa, 1953; Mohamed, 1955 and Nayak, 1959) indicate that the species spawns in the shallow inshore waters of the Gulf of Kutch. No information is available whether this species breeds in other regions also, particularly in the south between Arnalla and Daman where the inshore fishery is of a fairly high magnitude. While specimens in roe were observed by some of the workers cited above from the Gulf of Kutch, such material has till now not been available from the southern regions for the reason that fish are all gutted at the fishing grounds to prevent spoilage of the catch before it is landed.

In the trawler landings from Bombay and Cambay regions the present writer has often found maturing and spent specimens of 'Dara'. During January of 1956 and also of 1957 two very young juveniles measuring 6.0 and 5.6 cm. in furcal length respectively have been collected by Nayak (loc. cit.) from the fish landing place Versova, Bombay. It stands to reason that the breeding grounds of 'Dara' are in the southern regions also, for these young stages could not have possibly migrated from the far off northern region in the Gulf of Kutch where, as stated earlier, there is conclusive evidence of spawning.

From the results of the analysis of the catch data of 'Taiyo Maru No. 17', M.T. 'Ashok', M.T. 'Pratap' and New India Fisheries vessels, the abundance of 'Chelna' in Dwarka region in trawler catches is now a proven fact. It is not surprising to find high catches of 'Chelna' in Kutch region because that region has been proved to be the breeding ground for the species. In Porbundar the catches are fairly high possibly because 'Chelna' may be moving south from the northern regions especially Dwarka, which is believed to be the nursery for the growing young (Jayaraman et al. loc. cit.).

# GENERAL REMARKS

In the eight-year period of 1956-'63 the catch data of the New India Fisheries vessels show a steady decline of 'Dara', especially after 1959. Usually the 'Dara' catches by the trawlers being fairly high during November to May, this period may be considered as the season for this fishery. In the present and the earlier

findings, the 'Dara' catches and the catch rates obtained from Dwarka are by far better than those from any other region in Bombay-Saurashtra waters. The fishing effort expended in Dwarka during the season of the fishery till 1959 has been fairly high, but in the subsequent years, it has been considerably reduced. From 1960 onwards the fishing has been more intensive all round the year in Kutch, because it has proved to be the most productive of all regions for the total landings. This intensification of fishing in Kutch has obviously resulted in low fishing in Dwarka. The areas yielding good catches in Dwarka have not been adequately fished during the season.

During the off season, June to September, there has been no fishing in Dwarka prior to 1960, but during that year and in the later years up to 1963, a certain amount of fishing effort was spent during those months. The catch rates being very low during the off season, the overall catch rates show a decrease for the years when there is fishing during the off season.

It may also be mentioned here that June to September are also the monsoon months when conditions for fishing are adverse due to inclement weather and the catches therefore are generally poor. The effort expended in Kutch region being very high in all the years from 1960 onwards, the 'Dara' yields are of a high order but the overall catch rates and the percentages are low for the reason that the fishing effort is spread all round the year.

The different grounds in Dwarka when fished during 'Dara' season have yielded good catch rates. Thus the area 'K' has given, per hour, 169.37 kg. in April 1961 and 199.99 kg. in 1962; 'M' 100.90 kg. in January 1962 and 194.68 kg. in February 1963; 'N' 261.09 kg. in January 1960, 194.36 kg. in February of the same year and 141.90 kg. and 245.64 kg. in February and December of 1961 respectively.

Similarly in Kutch region fairly high catch rates from the area 'Q', 66.44 kg. per hour in March 1960, 109.20 kg. in December of the same year, 125.04 kg in January 1962 and from 'R' area 86.00 kg. in February and 45.67 kg. in December 1960, have been registered.

The steady decline noticed in 'Dara' fishery can thus be attributed to insufficient exploitation of 'Dara' grounds during the season. The present data do not permit assessment of the extent to which the fishing mortality is responsible for this decline. However, the impact of fishing mortality on 'Dara' fishery should not be overlooked and efforts should be made to investigate it.

# **SUMMARY**

The region-wise catches, catch rates and percentages of 'Dara' Polydactylus indicus have been studied from the landings of the bull-trawlers belonging to the

New India Fisheries Co., which have been operated in the waters from Bombay to Kutch during April 1956 to October 1963.

Up to 1959 the yields of 'Dara' in Dwarka have been found to be the highest of all the regions. From 1960 onwards, Kutch has recorded the highest catches. The effort expended in Dwarka up to 1959 was much higher than that in Kutch, from 1960 onwards the fishing effort in Kutch exceeded that in Dwarka.

The catch rates and percentage catches have been the highest in Dwarka except in one year when they were the highest in Kutch.

The trawling grounds from Porbundar to Bombay have been found to be comparatively poor for this species.

In Dwarka the areas 'M' and 'K' are rich, 'N' moderate and 'L' poor and in Kutch the areas 'P' to 'U' except 'T' are good to moderate and the rest 'V' to 'Z' including 'T' are poor for this species.

The catch of 'Chelna' in the total 'Dara' landings has been very high all through in Dwarka and Kutch and fairly high in most of the years in Porbundar.

The exploitation of the offshore fishing grounds for 'Dara' has been very insufficient during the season and hence the present decline in catches cannot be attributed to overfishing.

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Polydactylus indicus in trawler landings

TABLE I

Regional distribution of 'Dara' catch, catch-rate (in brackets) and percentage catch in the landings of New India

Fisheries bull-trawlers during 1956—1963

Year		1956	1957	1958	1959	1960	1961	1962	1963
All fish Kg (Kg/hr)	•	2277817 (801·11)	3273909 (602·00)	3579690 (710·11)	2720007 (631·73)	4248202 (822·26)	3938547 (853·67)	3549540 (899·66)	2681337 (756·22)
Dara' Kg (Kg/hr)	•	110790 (38·96)	175575 (32·28)	76947 (15·26)	100408 (23 · 32)	86065 (16·65)	63840	35368 (8·96)	24120
%		4.86	5.36	2.14	3.69	2.02	1 62	1.62	0.89
Bombay				<u> </u>					
Kg (Kg/hr)	•	855 (1·21)	34 (0·45)	72 (0·90)	. 0	62 (5·51)	. 0	. 0	0
% in the regional catch	•	0.17	0.13	0.26	. 0	2.25	0	0	0
% in the annual 'Dara' catch	•	0.77	0.02	0.09	. 0	0.08	0	0	0
Cambay						-			<u> </u>
Kg (Kg/hr)		297	189	441	768	180	117	198	828
		(0.24)	(0.94)	(0.25)	(0.59)	(1 · 25)	(0.17)	(0.27)	(1 · 09)
% in the regional catch .	•	0.20	0.01	0.03	0.11	0.26	0.03	0.03	0.16
% in the annual 'Dara' Catch	•	0.27	0.11	0.58	0.77	0.20	0.18	0.55	3.44

TABLE I—Contd.

Year		1956	1957	1958	1959	1960	1961	1962	1963
Veraval		*							
Kg (Kg/hr) · ·	•	0	23 (0·04)	1077 (1·55)	90 (0·17)	302 (0·78)	723 (1·75)	54 (0·20)	801 (2·27)
$% = \frac{1}{2} $ in the regional catch $% = \frac{1}{2} $	•	. 0	0	0.24	. 0.03	0.13	0.25	0.03	0.35
% in the annual 'Dara' Catch	.•	. 0	0.01	1 · 40	0.08	0.36	1 14	0.15	3 · 32
Porbundar					The state of the s	•			<del></del>
Kg (Kg/hr) · ·	٠	153 (3·41)	1356 (0·95)	5967 (3·74)	440 (0·48)	451 (0·49)	388 (0·59)	549 (0·59)	999 (1·01)
% in the regional catch ·	•	0.87	0.15	0.16	0.08	0.06	0.07	0.06	0.14
% in the annual 'Dara' catch	. •	0 · 14	0.77	7.75	0.44	0:52	0.60	1 · 58	4.14
Dwarka									
Kg (Kg/hr)	•	109485 (145·00)	173739 (124·23)	69372 (78·30)	93665 (112·68)	34373 (93·21)	11409 (47·76)	3600 (25·62)	1179 (9·94)
% in the regional catch ·		18.20	22.09	10.85	19.41	12.01	5.72	3.06	1.16
% in the annual 'Dara' catch	٠	98.82	98.95	. 90.15	93.28	39.94	17.88	10.17	4.88
Kutch							***************************************		
Kg (Kg/hr)	•	• • - •,	234 (87·96)	18 (0·48)	5445 (7·98)	50697 (15·14)	51203 (19·26)	30967 (16·41)	20313 (15·24)
% in the regional catch ·		• •	12.34	0.10	0.78	1 · 70	1.98	1 · 68	1.75
% in the annual 'Dara' catch		• •	0.14	0.03	5.43	58.90	80 · 20	87.55	84 · 22

Polydactylus indicus in trawler landings

TABLE II

Area-wise distribution 'Dara' catch and catch-rate (in brackets) at Dwarka region during 1956—1963

Year				<b>K</b>	L	M	N
1956	•	•		17046		84222	8217
				(153-91)	• *	(184.95)	(63 · 19)
1957				7,7570	. 2203	65608	28304
				(147-61)	(39.06)	(144 · 87)	(77 · 80)
1958		•		7299	864	55377	5832
				(46.83)	(30·55)	(126·34)	(19·47)
1959		•	•	58236	180	23929	11320
				(138·13)	(37 · 89)	(203 · 08)	(39 · 42)
1960			• '	3591	0	14	30768
	•			(69.90)		(3.05)	(98 · 63)
1961				3672	36	573	7128
				(177·04)	(11 · 07)	(104 · 18)	(49.96)
1962	:			1386	•	162	2052
				(110.88)		(41 · 43)	(16.68)
1963				423	0	405	351
				(43.69)		(125.00)	(3·35)

Table III

Area-wise distribution of 'Dara' catch and catch-rate (in brackets) in Kutch region during 1956—1963

	Year		P	Q	R	'S	Т	U	V	W	X	Y	Z	
1956			• •	• •		••	• •	• •	. • •		••			
1957	•		234 (175·93)	0					••		••	••		
1958		•		18 (3·91)	0	0	••	0	0	••	0			
959	•		0	2538 (10·07)	2889 (8·30)	0		18 (0·32)	0	••	••	••	•	
19 <b>60</b>		•	·. 0	21654 (25·32)	18243 (10·03)	6840 (55·71)	36 (1·95)	3789 (32·21)	135 (0·40)	••	0	0	0	
961	•.	•		21995 (36·53)	28331 (23·62)	0	21 (3·93)	748 (3·45)	99 (0·68)	0	0	9 ( <b>0</b> ·17)	••	
962		•		23562 (63·18)	6606 (8·03)	0	••	736 (2·08)	63 (0·83)	••	0	0	••	
963	•	•.	· · ·	5850 (18·39)	12204 (18·73)	0	••	2151 (13·12)	108 (0·72)	••	• •	••	••	

Polydactylus indicus in trawler landings

Table IV

Catch and catch per hour (in brackets) in kg and percentage composition of adult 'Dara' and juvenile 'Chelna' in different regions during 1956—1963.

			<b>Y</b>	/ear				1956	1957	1958	1960	1961	1962	1963
P. indici (Total)	us	:	•	•	•	•	·	110790 (38.96)	175575 (32·28)	76947 (15·26)	86065 (16·65)	63840 (13·83)	35368 (8·96)	24120 (6·80)
Bombay	'Dara'	•	•	•	•	•	,•	693 (0·98) 81·05%	34 (0·45) 100·00%	72 (0·90) 100·00%	62 (5·51) 100·00%	0	0	0
	'Chelna'	•		•		•	•	162 (0·23) 18·95%	0	0	0	0	0	0
Cambay	'Dara'	•	•	•	•	•	•	297 (0·24) 100·00%	189 (0·94) 100·00%	387 (0·22) 87·75%	153 (1·06) 85·00%	63 (0·09) 53·84%	198 (0·27) 100·00%	828 (1·09) 100·0%
	'Chelna'	•	•	•	•	•		0	0	54 (0·03) 12·25%	27 (0·18) 15·00%	54 (0·08) 46·16%	0	0
Veraval	'Dara'	•	•	•	•	•	•	0	23 (0·04) 100·00%	429 (0·62) 39·84%	239 (0·62) 79·13%	273 (0·66) 37·76%	54 (0·20) 100·00%	477 (1·35) 59·55%
	'Chelna'	•	: ·•	•	•	•	٠	0	0	648 (0·93) 60·16%	63 (0·16) 20·87%	450 (1·09) 62·24%	0	324 (0.92) 40.45%

TABLE IV—Contd.

		. Y	ar					1956	1957	1958	1960	1961	1962	1963
Porbund	lar 'Dara'	•	•	•	•	•	•	63 (1·40) 41·18%	1338 (0·92) 98·67%	765 (0·47) 12·30%	217 (0·23) 48·12%	190 (0·29) 48·97%	423 (0·45) 77·05%	297 (0·30) 29·73%
	'Chelna'	•	•	•	•	•	•	90 (2·00) 58·82%	18 (0·01) 1·33%	5202 (3·26) 87·70%	234 (0·25) 51·88%	198 (0·30) 51·03%	126 (0·14) 22·95%	702 (0·71) 70·27%
Dwarka	'Dara'	•	•	•	•		•	3501 (0·46) 3·20%	3999 (2·85) 2·31%	1125 (1·26) 1·63%	95 (0·25) 0·28%	54 (0·22) 0·48%	612 (4·35) 17·00%	693 (5·83) 58·77%
	'Chelna'	•	•	•	•	•	•	105984 (140·36) 96·80%	169740 (121·37) 97·69%	68247 (77·03) 98·37%	34278 (92·95) 99·72%	11355 (47·53) 99·52%	2988 (21·27) 83·00%	486 (4·09) 41·23%
Kutch	'Dara'	•	•	•	•	•	•	• •	0	0	1110 (0·33) 2·19%	336 (0·12) 0·66%	2635 (1·39) 8·51%	4977 (3·73) 24·51%
b .	'Chelna'	•	٠	•	•	•	•	••	234 (87·96) 100·00%	18 (0·48) 100·00%	49587 (14·80) 97·81%	50867 (19·13) 99·34%	28332 (15·01) 91·49%	15336 (11·51) 75·49%
Fotal	'Dara'	•	•	•	•	•	•	4554 (1·60) 4·12%	2739 (0·50) 1·57%	2778 (0·55) 3·62%	1876 (0·36) 2·18%	916 (0·19) 1·44%	3922 (0·99) 11·09%	7272 (2·05 30·15%)
	'Chelna'	•		•	٠	•		106236 (37·36) 95·88%	172836 (31·78) 98·43%	74169 (14·71) 96·38%	84189 (16·29) 97·82%	62924 (13·63) 98·56%	31446 (7·97) 88·91%	16848 (4·75) 69·85%