WORKSHOP ON STOCK ASSESSMENT OF YELLOWFIN TUNA IN THE INDIAN OCEAN

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YELLOWFIN LENGTH-WEIGHT RELATIONSHIPS FROM WESTERN INDIAN OCEAN PURSE SEINE FISHERIES

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RESUME : Les derniers résultats sur les relations longueurs-poids pour l'albacore (Thunnus albacares) avaient été présentés en 1990 lors du comité d'expert qui s'était tenu à Bangkok en juillet 1990. L'échantillonnage était alors insuffisant pour les petits albacores (poissons inférieurs à 22 cm de LD1). La serie de données a été complétée et les analyses ont conduit à plusieurs relations qui sont données ici avec les tableaux correspondants longueurs-poids.

SUMMARY: The last informations on yellowfin length-weight relationships (Thunnus albacares) have been issued during the Expert Committee which took place in Bangkok in July 1990. At that time, sampling data on small yellowfin (fish less than 22cm in FLD) were insufficient. Since then, data have been updated and new relationships are given thereafter with the corresponding length-weight tables.

1. DATA AVAILABLE

To data previously collected at the Victoria cannery we added data collected in Port during transhipment operations and a few more made at the cannery. They all were collected on small yellowfin in order to complete the series already in hands.

Altogether the samples reach now 2393 yellowfins for Fork Length (FL) and First Dorsal Length (FDL); 2242 for FL and Weight (WT) and 2228 for FDL and WT.

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2. STATISTICAL METHODS

Relationships are calculated using linear regression (least square method), and different models are tested (exponential, logarithmic, power), after having converted data. In order to detect uncertain plots, an analysis of standardized residual was made. If data fit properly with the model, standardized residual values must be approximately between -2 and +2. Every plot beyond these values can be suspected and has to be checked and then be deleted from the sample. Residuals are reported in accordance with independant variable and if they show a particular tendency structure, that means there is a link between residuals and independant variable, therefore, regression equation must be rectified (Sherrer, 1984). Regression lines are compared by using a covariance analysis.

3. RESULTS AND DISCUSSIONS

3.1 Analysis of data collected

Among the different relationships calculated, the best correlation was obtained with an equation of the type $y = ax+b$ after a log to log transformation of the variables. However, as previously noted (de MONTAUDOUIN et al, 1991) relationships are more properly described when samples are separated between small size fish on one side and medium size and large size fish on the other side.

3.2 Relationships FL - FDL

The general relationship, described by figure 1, responds to the equation:

$$Y = 1.1477\,x + 0.3195 \quad (n = 2393)$$

y = Log FL in cm

x = Log FDL in cm

When data are separated in the two data groups easily recognizable from figure 1, we obtain the two following equations:

(1) $y_1 = 0.9899\,x_1 + 0.5113$ (n = 679)
y_1 = Log FL in cm
x_1 = Log FDL for FDL $\leq$ 17.5 cm

Figure 2 shows these results.

(2) $y_2 = 1.1647\,x_2 + 0.2942$ (n = 1714)
y_2 = Log FL in cm
x_2 = Log FDL for FDL $\geq$ 17.5 cm

These results are illustrated in figure 3

FDL of 17.5 cm is the crossing point of the two regression lines.

3.3. Relationship FL-WT

A general relationship taking into account all available data (n = 2242) is shown in figure 4 and the equation given below :

$y = 2.9773\ x - 4.6607$
y = Log WT in kg.
x = Log FL in cm.

These data have been divided into two groups on both sides of 64 cm FL, the crossing point of the two regression lines:

(1) $y_1 = 2.7537\ x_1 - 4.2747$ (n =716)
y_1 = Log WT in kg.
x_1 = Log FL for FL ≤ 64 cm
Figure 5

(2) $y_2 = 3.0450\ x_2 - 4.8001$
y_2 = Log WT in kg.
x_2 = Log FL for FL ≥ 64 cm
Figure 6

3.4. Relationship FDL-WT

A general relationship with all data available (n = 2228) is shown in figure 7 and the equation is as follows :

$y = 3.4157\ x - 3.7086$
y = Log WT in kg.
x = Log FDL in cm.

As for other relationships, two data groups have been identified on both sides of 19.0cm FDL :

(1) $y_1 = 2.7641\ x_1 - 2.9131$ (n = 692)
y_1 = Log WT in kg.
x_1 = Log FDL for FDL ≤ 19.0 cm
Figure 8.

(2) $y_2 = 3.5837\ x_2 - 3.9612$ (n = 1536)
y_2 = Log WT in kg.
x_2 = Log FDL for FDL ≥ 19.0 cm
Figure 9.

4. CONCLUSIONS

All relationships used for Western Indian Ocean purse seine fisheries are listed in tables 1.

Tables 2, 3 and 4 are giving the yellowfin relationships respectively for FDL-FL, FDL-WT and FL-WT.

REFERENCES

MONTAUDOUIN (de) X., J.P. HALLIER and S. HASSANI, 1991. Length-weight relationships for yellowfin (*Thunnus albacares*) and skipjack (*Katsuwonus pelamis*) from Western Indian Ocean. IPTP Collective Volume of Working Documents, Vol 4, TWS/90/48 : pp 47-65.

Table 1 : YELLOWFIN LENGTH-WEIGHT RELATIONSHIPS

FDL ≤ 17.5 cm	Log FL = 0.9899 Log FDL + 0.5113
FDL ≥ 17.5 cm	Log FL ■ 1.1647 Log FDL + 0.2942
FDL ≤ 19.0 cm	Log WT = 2.7641 Log FDL - 2.9131
FDL ≥ 19.0 cm	Log WT = 3.5837 Log FDL - 3.9612
FDL ≤ 64.0 cm	Log WT = 2.7537 Log FL - 4.2747
FDL ≥ 64.0 cm	Log WT = 3.0450 Log FL - 4.8001

b) in exponential equation

FDL ≤ 17.5 cm	$FL = 3.2456\ FDL^{0.9899}$
FDL ≥ 17.5 cm	$FL = 1.9688 FDL^{1.1647}$
FDL ≤ 19.0 cm	$WT = 1.2215 \times 10^{-3}\ FDL^{2.7641}$
FDL ≥ 19.0 cm	$WT = 1.0935 \times 10^{-4}\ FDL^{3.5837}$
FDL ≤ 64.0 cm	$WT = 5.3125 \times 10^{-5}\ FL^{2.7537}$
FDL ≥ 64.0 cm	$WT = 1.5845 \times 10^{-5}\ FL^{3.0450}$

Table 2 : YELLOWFIN FIRST DORSAL LENGTH - FORK LENGTH RELATIONSHIP

FDL cm	FL cm
10.0	32
10.5	33
11.0	35
11.5	36
12.0	38
12.5	40
13.0	41
13.5	43
14.0	44
14.5	46
15.0	47
15.5	49
16.0	50
16.5	52
17.0	54
17.5	55
18.0	57
18.5	59
19.0	61
19.5	63
20.0	64
20.5	66
21.0	68
21.5	70
22.0	72
22.5	74
23.0	76
23.5	78
24.0	80
24.5	82
25.0	84
25.5	86
26.0	88
26.5	90
27.0	91
27.5	93
28.0	95
28.5	97
29.0	99
29.5	101
30.0	103
30.5	105

FDL cm	FL cm
31.0	107
31.5	109
32.0	111
32.5	114
33.0	116
33.5	118
34.0	120
34.5	122
35.0	124
35.5	126
36.0	128
36.5	130
37.0	132
37.5	134
38.0	136
38.5	138
39.0	140
39.5	142
40.0	145
40.5	147
41.0	149
41.5	151
42.0	153
42.5	155
43.0	157
43.5	159
44.0	162
44.5	164
45.0	166
45.5	168
46.0	170
46.5	172
47.0	174
47.5	177
48.0	179
48.5	181
49.0	183
49.5	185
50.0	187

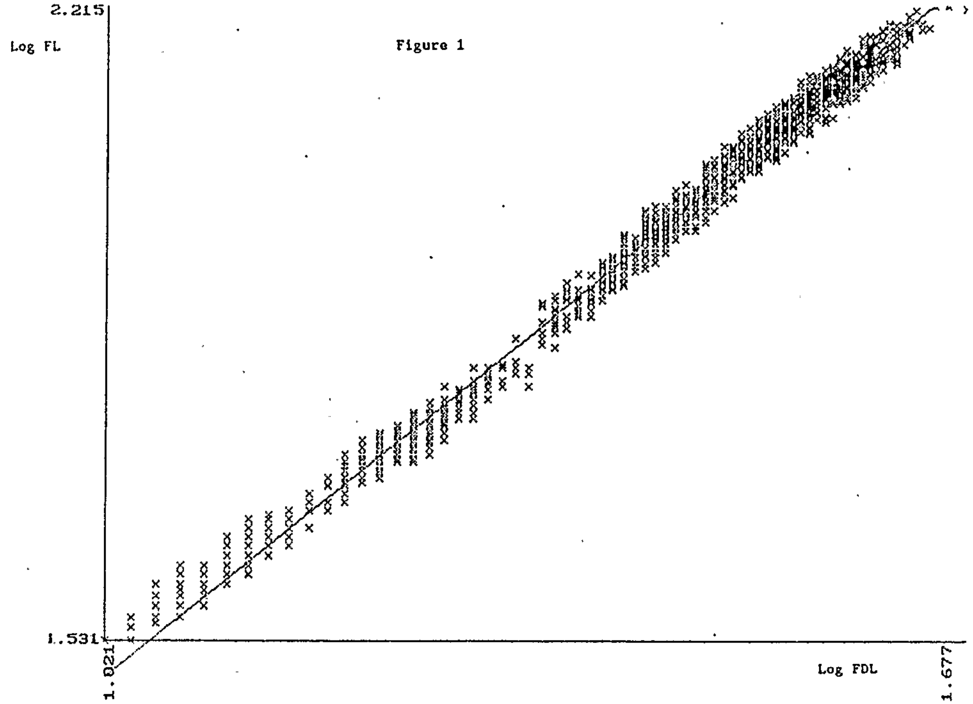
Table 3 : YELLOWFIN FIRST DORSAL LENGTH-WEIGHT RELATIONSHIP

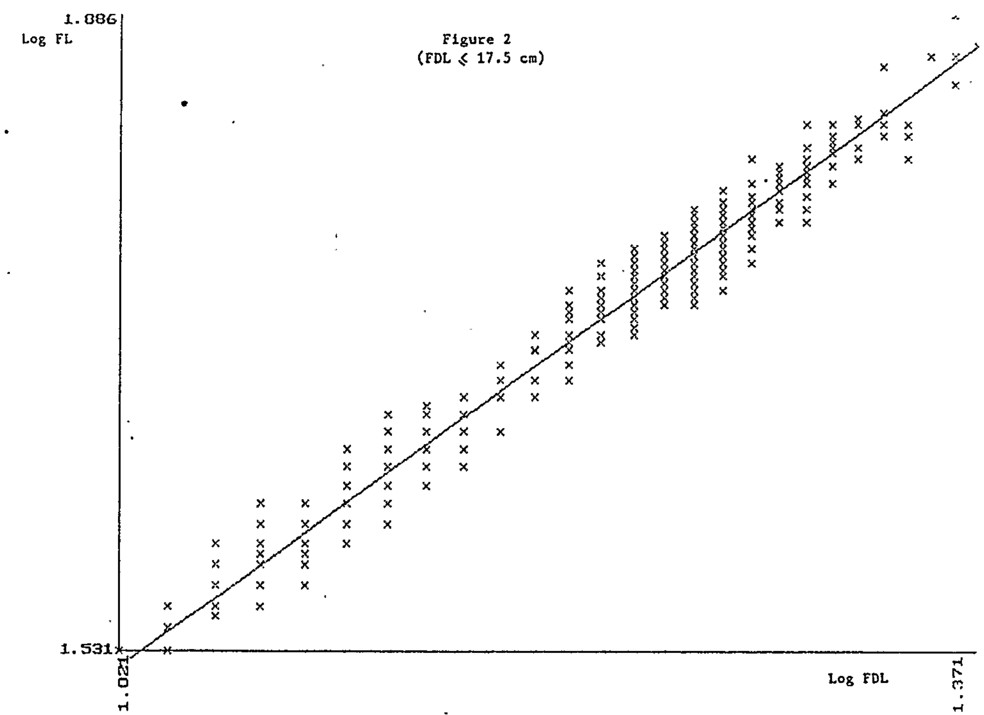
FDL cm	WT kg
10.0	0.7
10.5	0.8
11.0	0.9
11.5	1.0
12.0	1.2
12.5	1.3
13.0	1.5
13.5	1.6
14.0	1.8
14.5	2.0
15.0	2.2
15.5	2.4
16.0	2.6
16.5	2.8
17.0	3.1
17.5	3.3
18.0	3.6
18.5	3.9
19.0	4.2
19.5	4.6
20.0	5.0
20.5	5.5
21.0	6.0
21.5	6.5
22.0	7.1
22.5	7.7
23.0	8.3
23.5	8.9
24.0	9.6
24.5	10.4
25.0	11.2
25.5	12.0
26.0	12.9
26.5	13.8
27.0	14.7
27.5	15.7
28.0	16.8
28.5	17.9
29.0	19.0
29.5	20.2
30.0	21.5
30.5	22.8

FDL cm	WT kg
31.0	24.1
31.5	25.6
32.0	27.1
32.5	28.6
33.0	30.2
33.5	31.9
34.0	33.6
34.5	35.4
35.0	37.3
35.5	39.2
36.0	41.3
36.5	43.3
37.0	45.5
37.5	47.8
38.0	50.1
38.5	52.5
39.0	55.0
39.5	57.5
40.0	60.2
40.5	62.9
41.0	65.8
41.5	68.7
42.0	71.7
42.5	74.8
43.0	78.0
43.5	81.3
44.0	84.7
44.5	88.2
45.0	91.8
45.5	95.5
46.0	99.3
46.5	103.2
47.0	107.3
47.5	111.4
48.0	115.7
48.5	120.0
49.0	124.5
49.5	129.2
50.0	133.9

Table 4 : YELLOWFIN FORK LENGTH-WEIGHT RELATIONSHIP

FL cm	WT kg	FL cm	WT kg	FL cm	WT kg
30	0.6	82	10.7	134	47.5
31	0.7	83	11.1	135	48.6
32	0.7	84	11.5	136	49.7
33	0.8	85	11.9	137	50.8
34	0.9	86	12.3	138	52.0
35	0.9	87	12.8	139	53.1
36	1.0	88	13.2	140	54.3
37	1.1	89	13.7	141	55.5
38	1.2	90	14.1	142	56.7
39	1.3	91	14.6	143	57.9
40	1.4	92	15.1	144	59.2
41	1.5	93	15.6	145	60.4
42	1.6	94	16.1	146	61.7
43	1.7	95	16.7	147	63.0
44	1.8	96	17.2	148	64.3
45	1.9	97	17.8	149	65.6
46	2.0	98	18.3	150	67.0
47	2.1	99	18.9	151	68.4
48	2.3	100	19.5	152	69.8
49	2.4	101	20.1	153	71.2
50	2.5	102	20.7	154	72.6
51	2.7	103	21.3	155	74.0
52	2.8	104	22.0	156	75.5
53	3.0	105	22.6	157	77.0
54	3.1	106	23.3	158	78.5
55	3.3	107	24.0	159	80.0
56	3.5	108	24.6	160	81.5
57	3.6	109	25.3	161	83.1
58	3.8	110	26.1	162	84.7
59	4.0	111	26.8	163	86.3
60	4.2	112	27.5	164	87.9
61	4.4	113	28.3	165	89.6
62	4.6	114	29.1	166	91.2
63	4.8	115	29.8	167	92.9
64	5.0	116	30.6	168	94.6
65	5.3	117	31.4	169	96.3
66	5.5	118	32.3	170	98.1
67	5.8	119	33.1	171	99.8
68	6.0	120	34.0	172	101.6
69	6.3	121	34.8	173	103.4
70	6.6	122	35.7	174	105.3
71	6.9	123	36.6	175	107.1
72	7.2	124	37.5	176	109.0
73	7.5	125	38.5	177	110.9
74	7.8	126	39.4	178	112.8
75	8.1	127	40.4	179	114.8
76	8.5	128	41.3	180	116.7
77	8.8	129	42.3	181	118.7
78	9.1	130	43.3	182	120.7
79	9.5	131	44.4	183	122.8
80	9.9	132	45.4	184	124.8
81	10.3	133	46.5	185	126.9





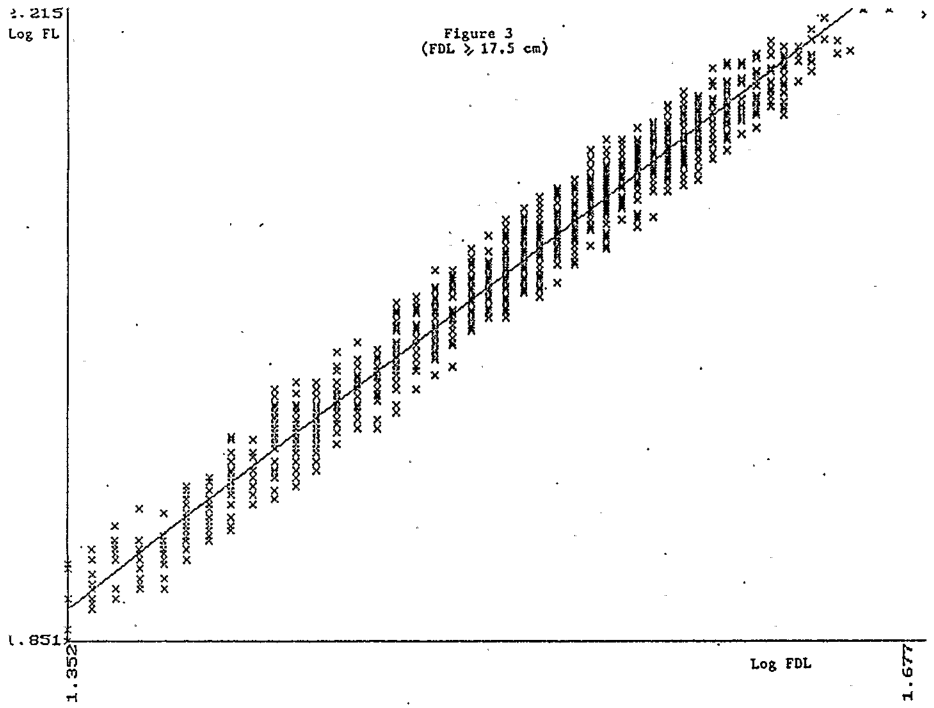


Figure 3
(FDL ≥ 17.5 cm)

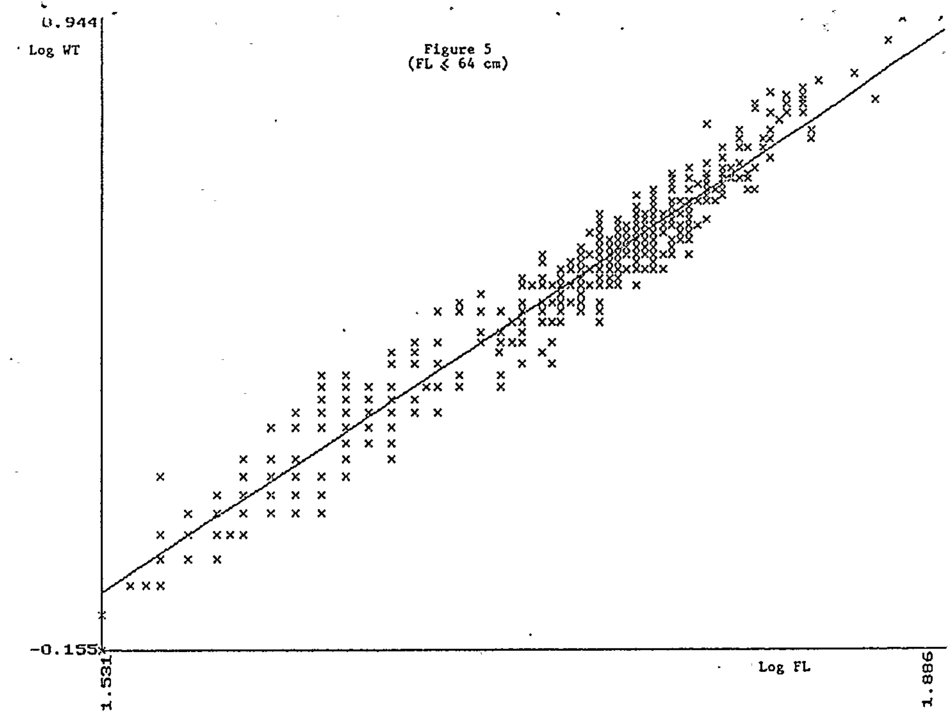


Figure 5
(FL ≤ 64 cm)

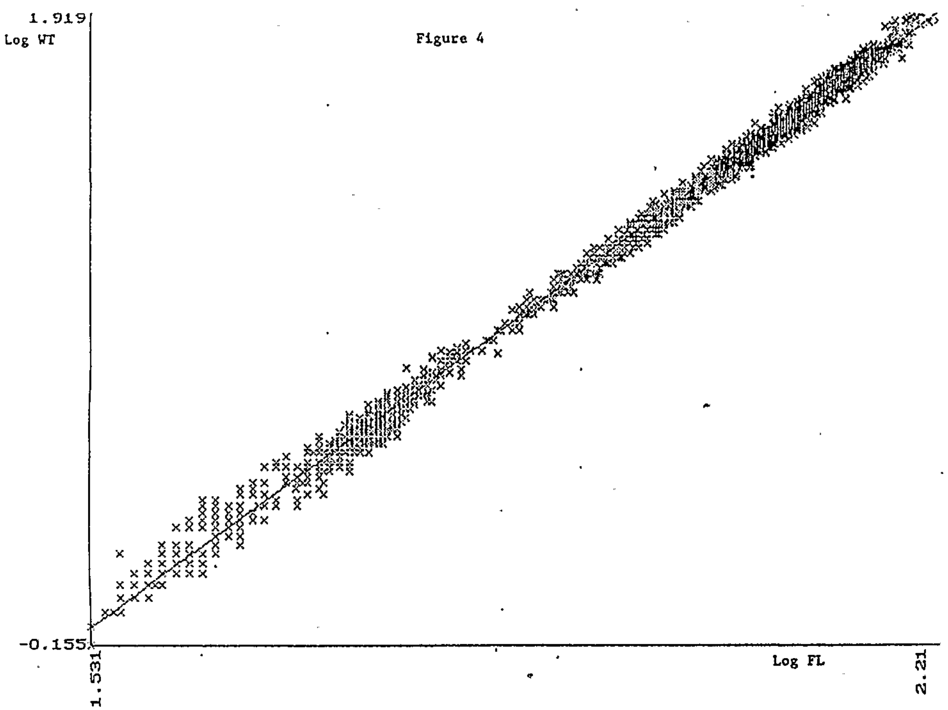


Figure 4

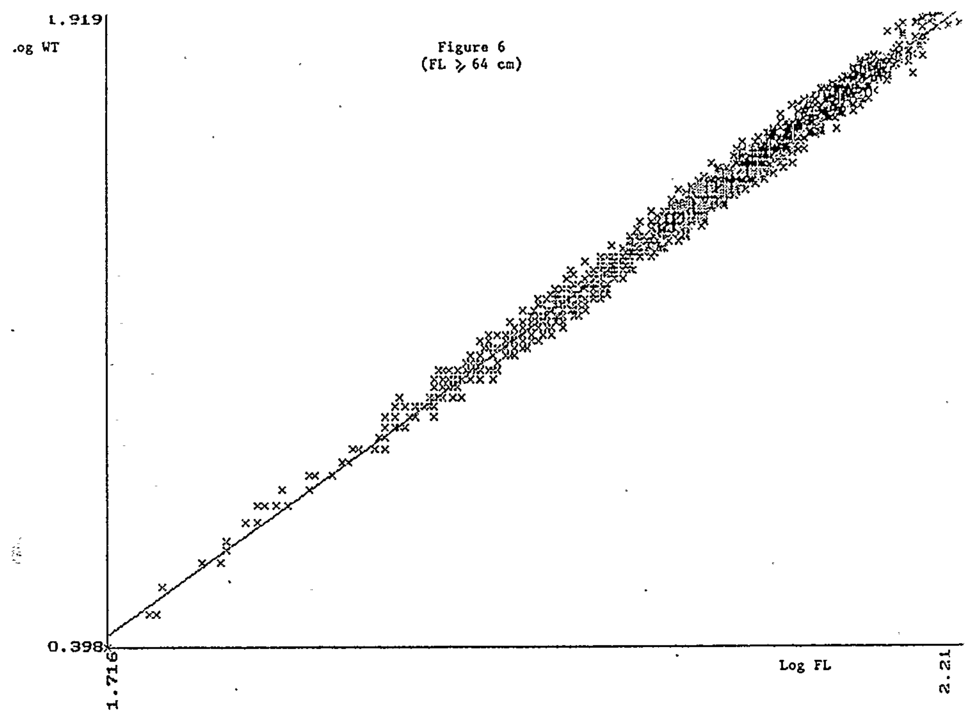


Figure 6
(FL ≥ 64 cm)

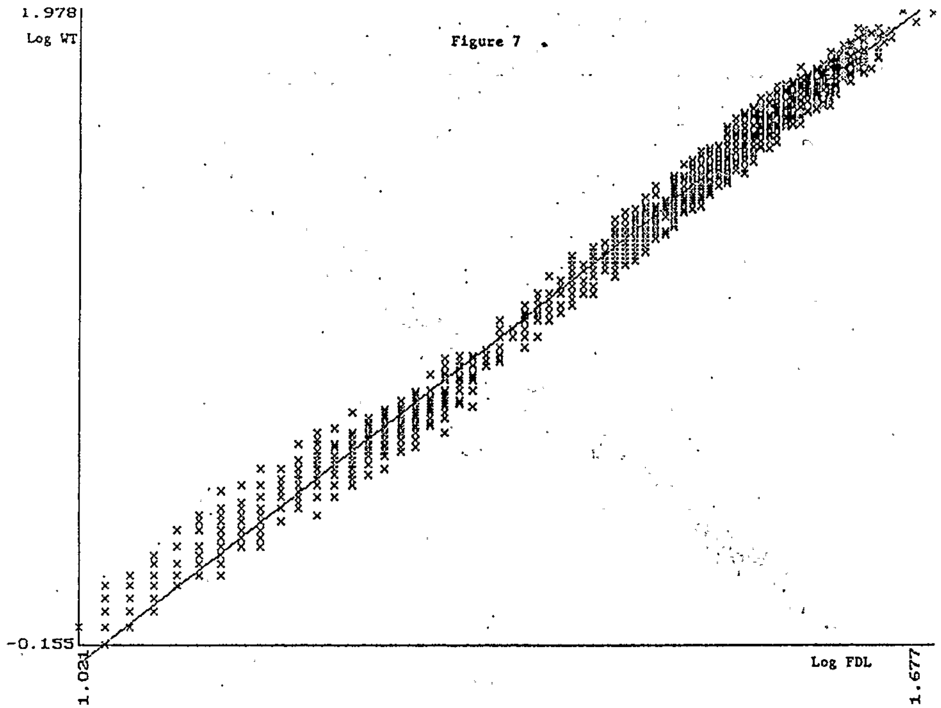


Figure 7

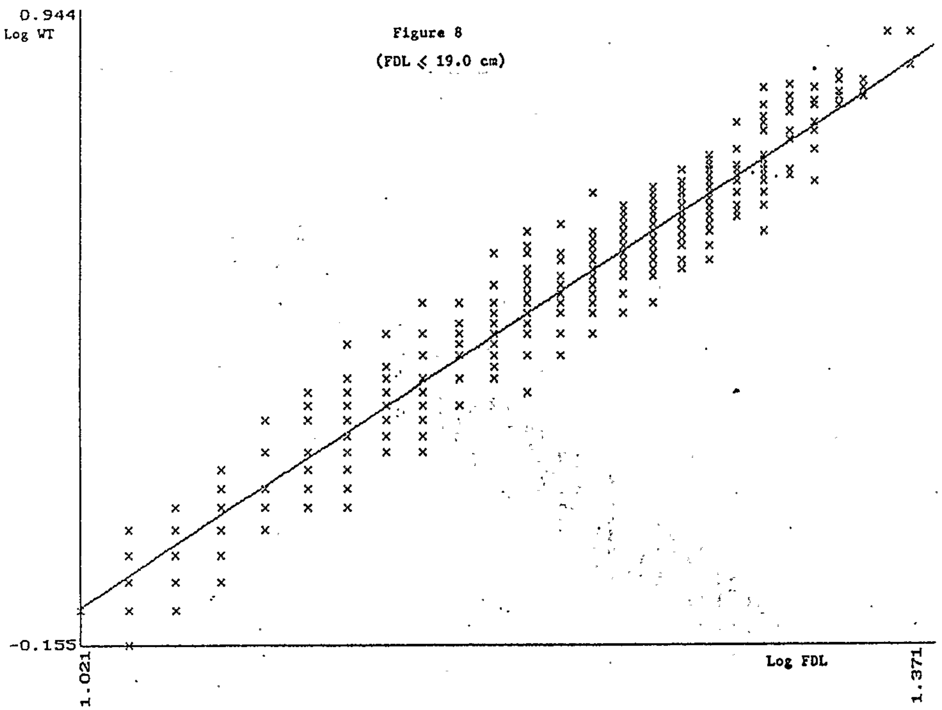


Figure 8
(FDL ≤ 19.0 cm)

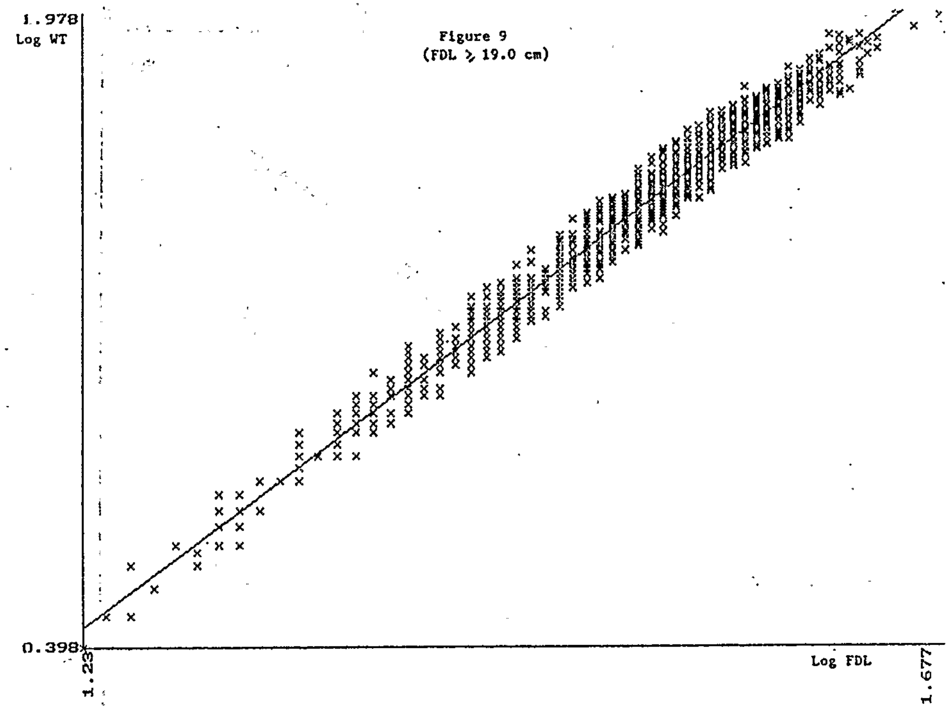


Figure 9
(FDL ≥ 19.0 cm)

INDO–PACIFIC TUNA DEVELOPMENT AND MANAGEMENT PROGRAMME

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