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ANALYSIS OF THE DEVELOPMENT OF CAPTURE FISH AND AQUACULTURE PRODUCTION IN EGYPT (1996–2005)

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Abstract

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The paper describes the characteristics of fish growing and fish-production development in Egypt, and focused on the analysis of contribution of aquaculture production by environment in total fish production within the defined reference period 1996 to 2005. Statistical methods were applied to evaluate the state of aquaculture production including mean coefficient of growth and mean coefficient of change. There is also presented short-time point and interval extrapolation prediction of studied events. Methods of regression and correlation analysis and development trends were applied for the mathematical-statistical analysis. The aim of this paper is to present prospective analysis to help both policy maker and technical specialist to improve the development of national aquaculture sector.

aquaculture, inland, capture fish, marine, environment, Egypt, development trends, prediction

Global production of capture fisheries and aquaculture including food fish, crustaceans, molluscs and other aquatic animals continues to grow during the past half-century (FAO 2006), and reach 140.5 million tones in 2004, In this period the process of fish capture will developed, and the new techniques of aquaculture is introduced including artificial propagation of fish, farming of new specious in different environments. The challenge of fish production in the new millennium is to expand to enhanced food security as world population continues to expand. Aquaculture continues to grow more rapidly than all other animal food-producing sectors, with an average annual growth rate for the world of 8.8 percent per year since 1970, compared with only 1.2 percent for capture fisheries and 2.8 percent for terrestrial farmed meat production systems (FAO 2006), this significant growing of aquaculture production is expected to play a crucial role in forthcoming decades in compensating for stagnant capture fisheries and in meeting increased demand for aquatic products.

Collection of fisheries and aquaculture production date as quantitative information from different areas and classify it in category such as fishing region, specious groping or inland and marine environments is important to apply some of Statistical methods to evaluate the status and trends of fish capture and aquaculture production development (CWP).

Egypt is the largest fisheries and aquaculture producer in Near East and North Africa region (FAO 2005[3]), which is about 2022047 tones in 2005, the aquaculture has been known since the beginning of written history, as evidence by the 2500 BC tomb frieze in Egypt showing the harvest of tilapia from ponds, development and expansion of modern aquaculture has taken place relatively recently, since the 1980s, aquaculture production increased five fold between 1996 and 2005, from about 91137 tons in 1994 to approximately 539748 tons in 2005. This represent well developed aquaculture sub-sector of national economy in Egypt.

MATERIAL AND METHODS

The basic quantitative data of capture fish and aquaculture production in Egypt from 1996–2005 were collected from the State of World Fisheries and Aquaculture (SOFIA) year book, which published every two years by food and agriculture organization of the united nation (FAO), and fish state database of

the FAO Fisheries Department. The collective data are classified in to two main category according to the process of production, the first one is the total capture fishes (fishery) and the second one is total aquaculture production (fish culture), and four sup-category according to the environment of production which is inland, marine, freshwater, and brackish water environment (Tab. I).

I: *Fish production (in tons) of the EGYPT during the period 1996–2005*

Year	Aquaculture production			Capture production			Total fish production
	Brackish water	Fresh water	Total	Marine	Inland	Total	
1996	24993	66144	91137	99535.4	271429.8	370965.2	462102.2
1997	9037	76667	85704	109939.2	388948.7	498887.9	584591.9
1998	15492	123897	139389	124781	541744.4	666525.4	805914.4
1999	35405	192870	228275	171430	761962.6	933392.6	1161668
2000	36520	305573	342093	130845	1178166	1309011	1651104
2001	42743	302122	344865	133202	1236277	1369479	1714344
2002	45841	330455	376296	132509	1136943	1269452	1645748
2003	50641	394540	445181	117382	1112695	1230077	1675258
2004	69686	401849	471535	111396	1173593	1284989	1756524
2005	39914	499834	539748	107454	1374845	1482299	2022047
Total	37027.2	269395.1	306422.3	123847.4	917660.5	1041508	1347930

The collective data summarized in tables, illustrated in charts to interpret the stat of fish production, production share and annual growth in short-time extrapolation prediction, for the calculation of mean coefficient of growth ($\bar{k}$) and mean coefficient of change ($\bar{\delta}$) was used the following formula:

$$\bar{k} = \sqrt[n-1]{\frac{y_n}{y_1}}$$

$$\bar{\delta} = \bar{k} - 1.0.$$

Analysis of the trend of assessed time series is bazed on the application of models of devlopmental tendencies of the following type:

$$y' = a + b.t \quad (1)$$

$$y' = a + b.t + c.t^2 \quad (2)$$

$$y' = a + b.t + c.t^2 + d.t^3. \quad (3)$$

Methodical procedures of processing data of analysed time series are based on methods presented in papers of Box and Jenkins (1976), Kendall (1984), and Palát et al. (2005).

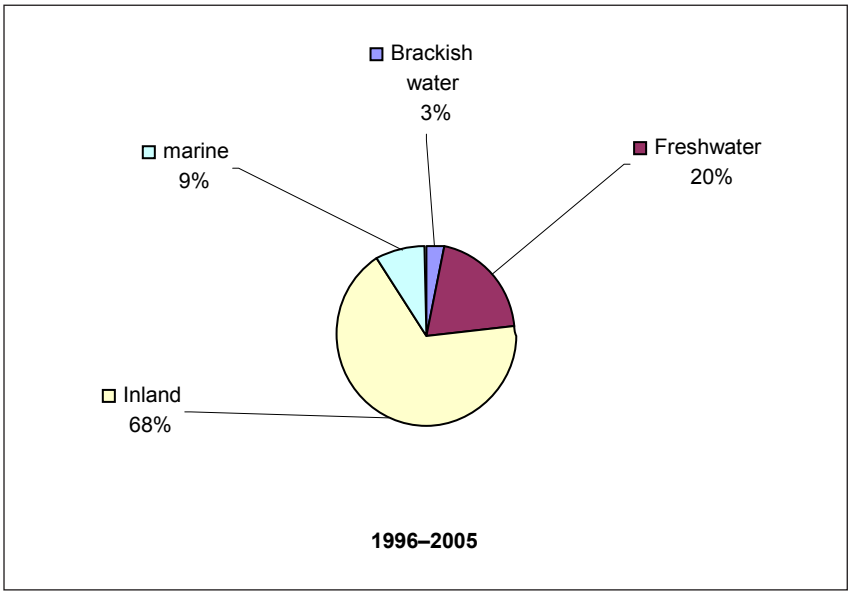
RESULTS AND DISCUSSION

Describing the average level and variability of fish production structure based on one-dimensional characteristic included in Tab. II and illustrated in

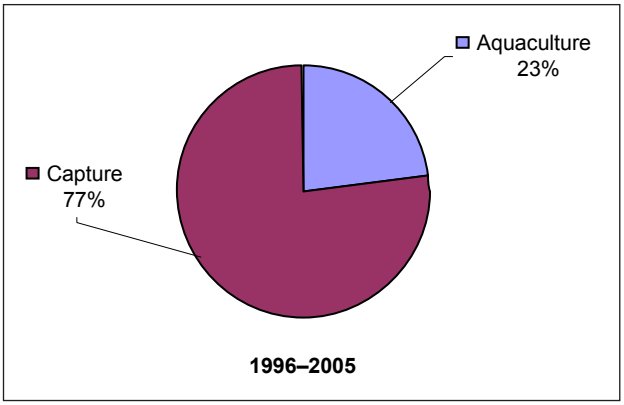
II: *Characteristics of proportion and annual rate of growth of fish production by environment (tons) in the Egypt in the period 1996–2005*

Category and Sub-category		Production in tons		Mean in 1996–2005 $\bar{y}$	Proportion in total production		Annual growth (%)
		y_0 1996	y_n 2005		(%)	(%)	
A	Aquaculture	91137	539748	306422.3	100	22.73	22
A1	Brackish water	24993	39914	37027.2	12.08	2.75	5
A2	Freshwater	66144	499834	269395.1	87.92	19.98	25
B	Capture	370965.2	1482299	1041508	100	77.27	17
B1	Inland	271429.8	1374845	917660.5	88.11	68.08	20
B2	marine	99535.4	107454	123847.4	11.89	9.19	1
Total fish production		462102.2	2022047	1347930		100	18

Fig. 1 and 2, for the period 1993–2005, in this period from the viewpoint of a defined territorial it is possible to conclude that inland capture is dominant production (68.08%) representing highest production by sub-categories. The descending order of production by sub-categories is as follows: freshwater aquaculture (19.98%), marine capture (9.19%), and brackish water aquaculture (2.75%) Fig. 1, the proportion of main category is (77.27%) for capture fish production and (22.73%). The average annual growth of total fish production is (18%), aquaculture production and capture fish production represents a high average annual growth about (22%) and (17%), respectively.



1: *Structure of proportion of fish production by sub-category (1996–2005)*



2: *Structure of proportion of fish production by main category (1996–2005)*

Variation coefficients (v_y) as values of percentage proportion of standard deviation (s_y) and arithmetic means ($\bar{y}$) arranged in ascending order as suitable rates of variability of indicators of analysed events reached 47% in the brackish water aquaculture and 55% in the freshwater aquaculture; 53% in the aquaculture production; 43% in the Inland capture; 16% in the marine capture and 38% in the capture production Tab. III.

Here, it is clear high differentiated informative potential of the average level of indicators under consideration in the assessed reference period.

The result of analytical functions and their parameters are presented in Tab. IV, where "t" serves as an explaining (exogenous) variable is a tool of the description of development tendencies of analysed time serious of fish production for the examined time interval. In addition to parameters of applied models of a linear, quadratic and cubic type they also present the degree of dependence of assessed endogenous variables on a time variable and the information potential of applied models including their statistical significance on selected level.

III: *Characteristics of selected indicators of fish production (in tons) and its movement in the Egypt in the period 1996–2005*

Category and sub category		Variation domain		Mean in 1996–2005 $\bar{y}$	Variation coefficient v_y (%)
		y_{min}	y_{max}		
A	Aquaculture	85704 1997	539748 2005	306422.3	53
A1	Brackish water	9037 1997	69686 2004	37027.2	47
A2	Freshwater	66144 1996	499834 2005	269395.1	55
B	Capture	370965.2 1996	1482299 2005	1041508	38
B1	Inland	271429.8 1996	1374845 2005	917660.5	43
B2	Marine	99535.4 1997	171430 1999	123847.4	16
Total fish production		462102.2 1996	2022047 2005	1347930	41

IV: *Parameters of models of development trends of fish production (thousand tons) indicators and its movement in the Egypt in the period 1996–2005*

Category		Model parameters					I
		f	a	b	C	d	
A	Aquaculture	2	314.1218	26.4065	–0.2333		0.9849^{++}
A1	Brackish water	2	39.5289	2.3397	–0.0758		0.8189^{+}
A2	Freshwater	2	274.5928	24.0666	–0.1575		0.9833^{++}
B	Capture	3	1183.125	51.9271	–4.2914	0.1166	0.9571^{++}
B1	Inland	3	1042.854	54.6285	–3.7937	0.0741	0.9550^{++}
B2	Marine	1	123.848	–0.2121			0.0632
Total fish production		3	1497.244	81.0152	–4.5247	0.0709	0.9681^{++}

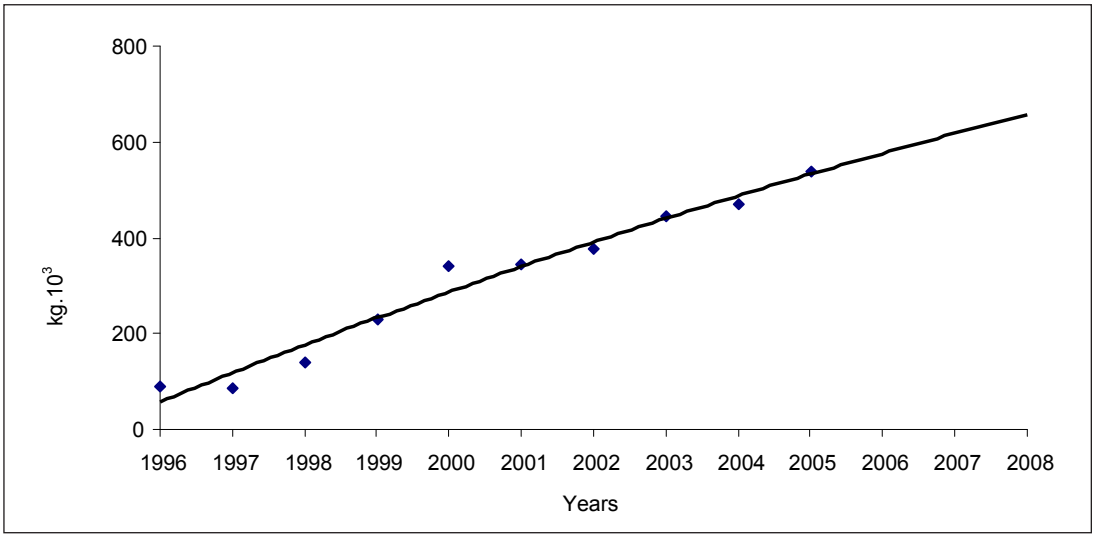
Type of the function: (1) – linear, (2) – quadratic, (3) – cubic
Correlation index *I* significant on the level: + α = 0.05; ++ α = 0.01

V: *Point prediction of fish production of the Egypt for years 2006, 2007 and 2008*

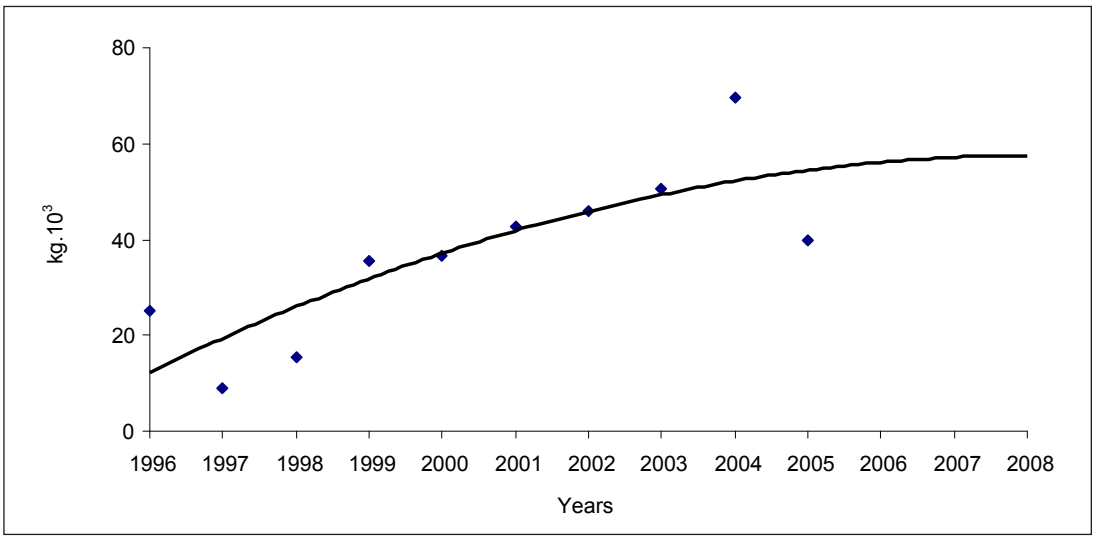
Category		f	Prediction		
			2006	2007	2008
A	Aquaculture	quadratic	576.364	597.4046	617.9786
A1	Brackish water	quadratic	56.0938	56.6901	57.1348
A2	Freshwater	quadratic	520.2679	540.712	560.8411
B	Capture	cubic	1390.2582	1389.7733	1389.101
B1	Inland	cubic	1283.357	1280.1481	1274.687
B2	Marine	linear	121.5149	121.3028	121.0907
Total fish production		cubic	1935.2901	1940.3845	1941.534

The development trends of fish production for Egypt in the reference period applied different models are illustrated in graphical form in Fig. 3–9.

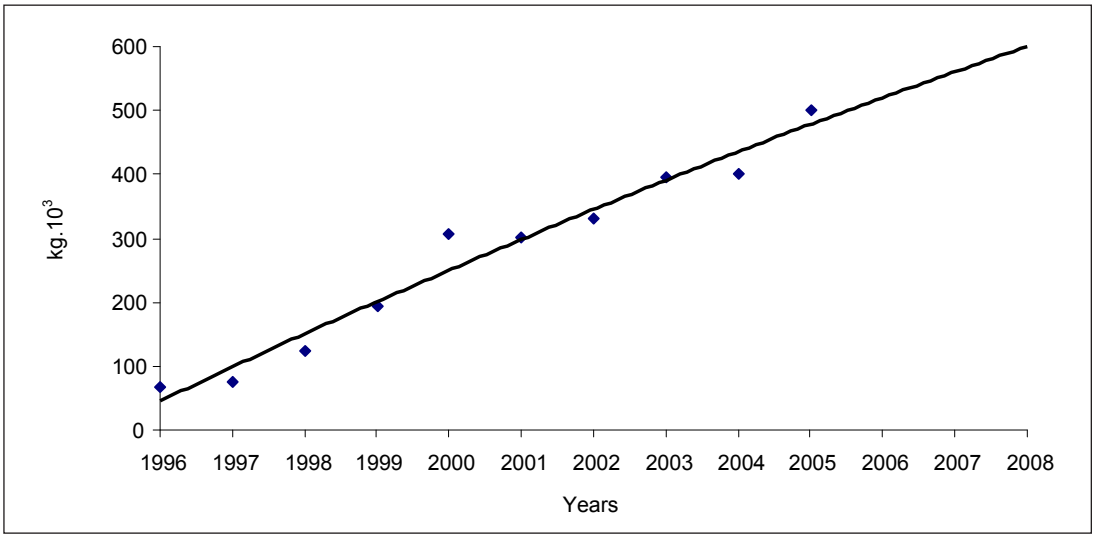
The short-term prediction of studied of fish production in Egypt based on trend function as a tool of the description of the development of analyses time series, are presented in Tab. V. The result shows increase of production of fresh water, brackish water aquaculture and inland capture, where slightly decrease in marine capture.



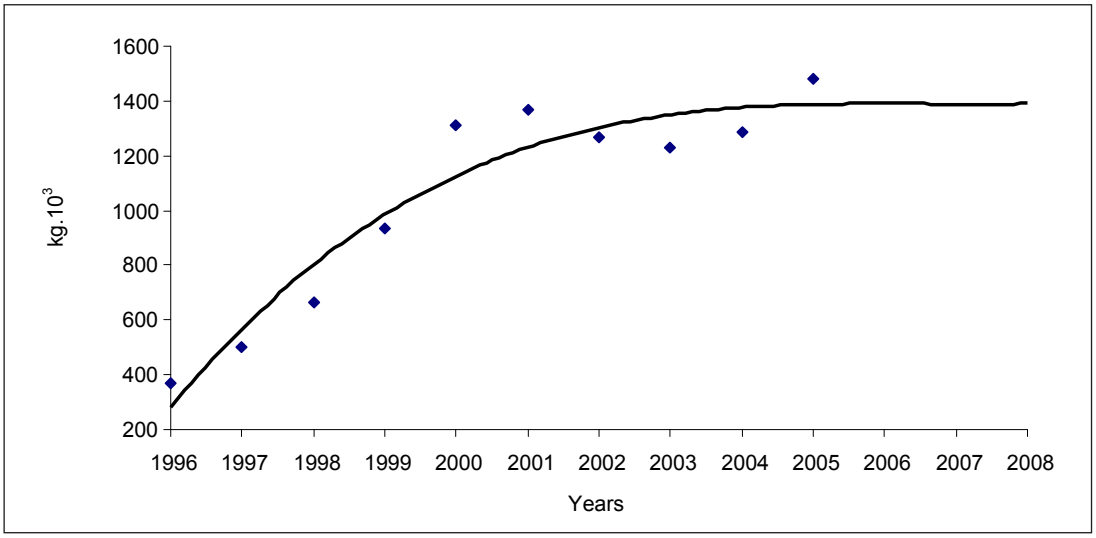
3: *Development function (quadratic) of total aquaculture production of Egypt*



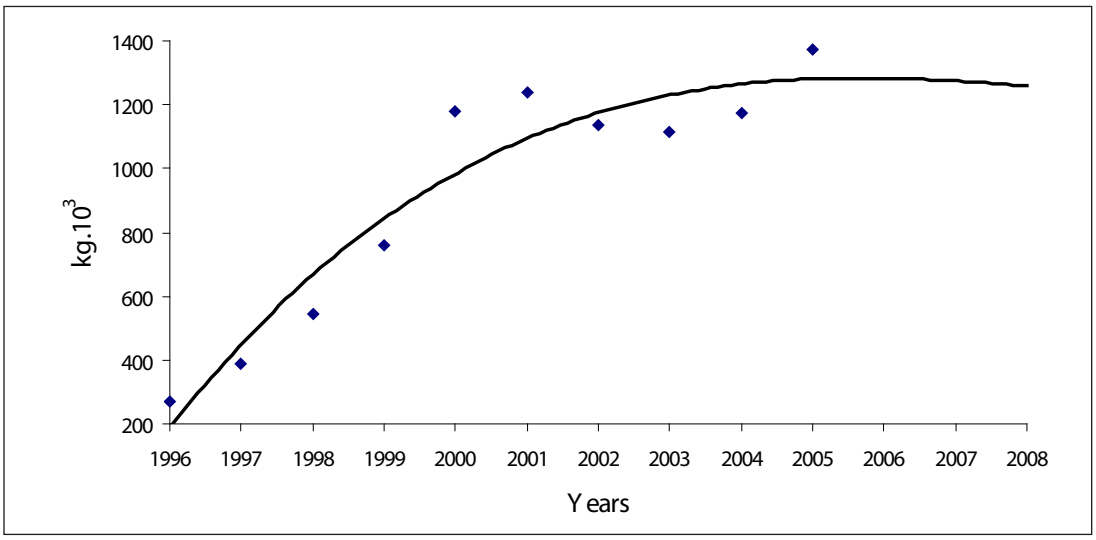
4: *Development function (quadratic) of brackish water aquaculture production of Egypt*



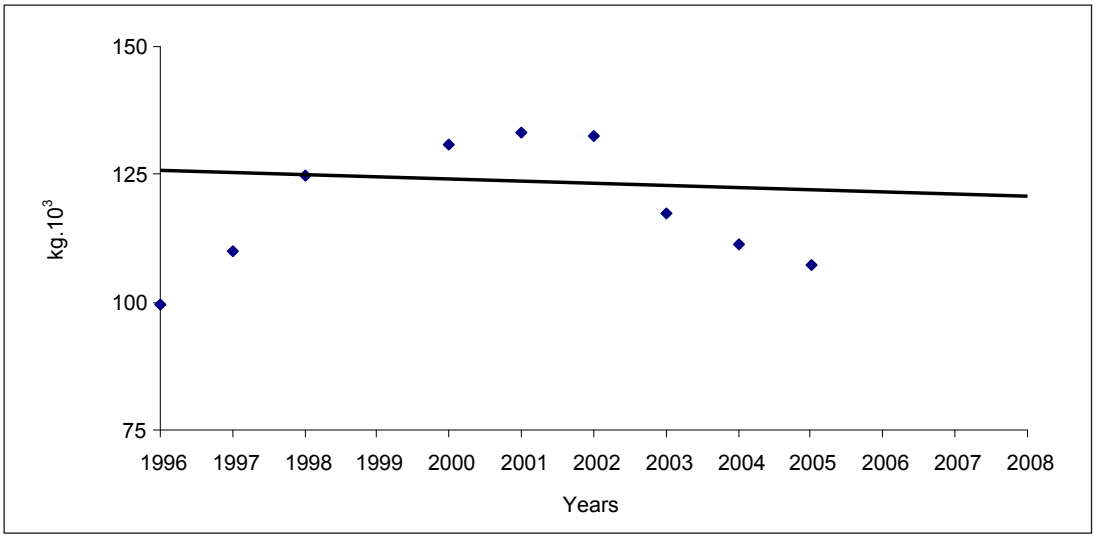
5: *Development function (quadratic) of freshwater aquaculture production of Egypt*



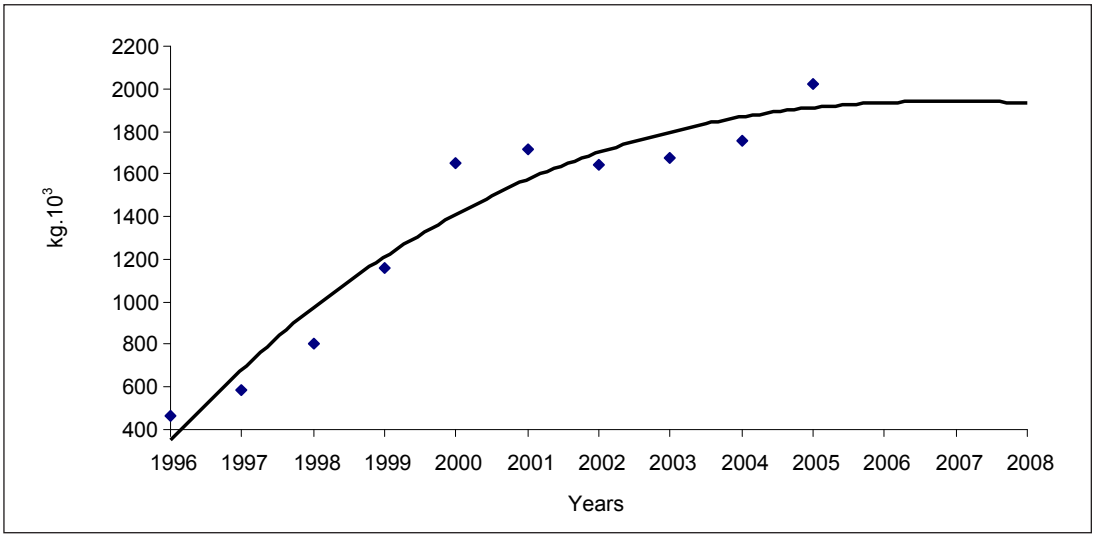
6: *Development function (cubic) of total fish capture of Egypt*



7: *Development function (cubic) of inland capture production of Egypt*



8: *Development function (linear) of marine capture production of Egypt*



9: *Development function (cubic) of total fish production of Egypt*

SUMMARY

The analyses of the development of capture fish and aquaculture production in Egypt during the period from 1996 to 2005. In this period the characteristics of fish growing and fish-production has demonstrated remarkable growth from just 462102.2 tons in 1996 to approximately 2022047 tons in 2005 with annual growth about 18%. The aquaculture remarked the highest annual growth 22% dominant by the increase of production of freshwater aquaculture, comparing with the fish capture in the same decade which has annual growth about 17%, the lowest growth were in marine capture approximately 1%. The capture fish is still dominant in the total fish production with proportion about (77.27%), while the proportion of aquaculture is (22.73%). In evaluating the total fish production, its remarked slightly increase has been demonstrated (v_y = 41%) at the average level of 1347930 tons with the annual average growth 18% for the given time interval.

Based on the short-term point extrapolation prediction of studied of fish production and its structure according to the environment of production Tab. V, its possible to expect an increase of production of fresh water, brackish water aquaculture and inland capture, where slightly decrease in marine capture.

SOUHRN

Analýza vývoje produkce ryb z chovu a výlovu v Egyptě v období let 1996 až 2005

V příspěvku je vyhodnocena analýza vývoje produkce z výlovu ryb a produkce z chovu ryb v Egyptě v referenčním období let 1996 až 2005. V daném období dochází k pozoruhodnému růstu produkce ryb z 462 102,2 tun v roce 1996 na přibližně 2 022 047 tun v roce 2005 při ročním růstu asi 18 %. Produkce z chovu ryb vykazuje nejvyšší roční přírůstek 22 % u sladkovodní produkce, u produkce z výlovu ryb v téže dekádě je roční přírůstek asi 17 %, nejnižší růst byl zaznamenán u produkce z výlovu mořských ryb a to přibližně jen 1 %. Produkce z úlovku ryb je stále dominantní a činí 77,27 % z celkové produkce ryb, zatímco produkce z chovu ryb činí pouze 22,73 %. Hodnotíme-li celkovou produkci ryb, střední hodnota je 1 347 930 tun, variační koeficient 41 % a průměrný růst 18 % v daném časovém intervalu. Výsledky krátkodobé bodové predikce jsou prezentovány v Tab. V. Je možno je charakterizovat jako pokračující přírůstek produkce ryb v sladkovodních i brakických vodách a produkce z výlovu ryb ve vnitrozemí, zatímco u produkce z mořského výlovu ryb je očekáván slabý pokles.

chov ryb, vnitrozemí, výlov ryb, moře, životní prostředí, Egypt, vývojové tendence, predikce

REFERENCES

AMIR D. ACZEL, 1989.: Complete Business Statistics. Richard D. Irwin, inc., pp 595–650. ISSN 1211-8516.

BRANDER, K.: Guidelines for collection and compilation of fishery statistics 1975 FAO. Fish. Tech. Pap. (148): 46 p

CWP Handbook of Fishery Statistical Standard-Coordinating Working Party on Fishery Statistics season report. ISSN 0429-9337

PALÁT, M., BODEČKOVÁ, B., MACA, E, 2007.: Development of production intensity of Czech agriculture in 1998-2004 and its short term forecast. Acta univ. Agric. et silvic. Mendel. Brun, vol. LV, No. 3, pp. 85–95. ISSN 1211-8516

RANA, K. J., 1997, Supplement on aquaculture: guidelines on the collection of structural aquaculture statistics. FAO statistical development series, No: 5b. Rome, FAO. 56 p.

STATISTICAL YEARBOOK (SOFIA), The State of World Fisheries and Aquaculture 1996-2006. ISSN 1020-5489

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