Kafkas Univ Vet Fak Derg
17 (1): 13-20, 2011
DOI:10.9775/kvfd.2010.2279

RESEARCH ARTICLE

The Forecast of the Future Production Amounts of the Some Fish Species Being Cultivated in Turkey

Hülya SAYGI * Aysun KOP * Bahar BAYHAN **

* Ege University, Faculty of Fisheries, Department of Aquaculture, TR-35100 Izmir - TURKEY
** Ege University, Faculty of Fisheries, Department of Hydrobiology, TR-35100 Izmir - TURKEY

Makale Kodu (Article Code): KVFD-2010-2279

Summary

In this study, current output of some fish species which are commonly cultivated in Turkey, such as Seabream *(Sparus aurata)*, Seabass *(Dicentrarchus labrax)*, Rainbow trout *(Oncorhynchus mykiss)* and Carp *(Cyprinus carpio)* is estimated for the future until 2008-2030. The year 2030 is taken as base since it provides parallelelism with The Food and Agriculture Organization of the United Nations and the results of European Union. Current output of seabream, seabass, salmon, carp of the Turkish Statistical Institute of 1986-2007 and additionally, total aquaculture cultivation extents of Turkey were used for this purpose. Using the Genstat for Teaching Package Program on these data, autoregressive modeling was made with the Method of Time Series Analysis. Box-Cox transformation was applied for the data which do not comply with the normal distribution. Autocorrelation coefficients were calculated, the statistical significance of these coefficients were controlled at the level of 5% and tested whether they were stable or not. As a consequence, the probable estimation values determined for the species of Seabream, Seabass, Salmon and Carp are respectively, 70015, 88050, 126272 and 1391 ton for 2030. The total probable cultivation estimation value of Turkey was found as 284337 ton/year.

Keywords: *Aquaculture, Fish, Future production, Forecast, Box-Cox transformation*

Türkiye'de Yetiştiriciliği Yapılan Bazı Balık Türlerinin Üretim Miktarlarının Tahmini

Özet

Bu çalışma, Türkiye de yaygın olarak yetiştiriciliği yapılan Çipura *(Sparus aurata)*, Levrek *(Dicentrarchus labrax)*, Alabalık *(Oncorhynchus mykiss)* ve Sazan *(Cyprinus carpio)* gibi bazı balık türlerinin gelecekteki üretim miktarları 2008-2030 yılına kadar tahmin edilmiştir. 2030 yılı Birleşmiş Milletler Gıda ve Tarım Örgütü ve Avrupa Birliği sonuçlarına paralellik sağlaması açısından esas alınmıştır. Bu amaçla, Türkiye İstatistik Kurumu'nun 1986-2007 yıllarına ait Çipura, Levrek, Alabalık, Sazan üretim miktarları ve ilaveten Türkiye toplam su ürünleri yetiştiricilik miktarları kullanılmıştır. Bu verilere Genstat for Teaching Paket Programı kullanılarak Zaman Serileri Analiz Yöntemiyle otoregresif modellemesi yapılmıştır. Normal dağılıma uymayan verilere Box-Cox dönüşümü uygulanmıştır. Otokorelasyon katsayıları hesaplanmış, bu katsayıların %5 seviyesinde istatistik açıdan anlamlılığı kontrol edilmiş ve kararlı olup olmadıkları test edilmiştir. Sonuçta, 2030 yılı için Çipura, Levrek, Alabalık ve Sazan türleri için tespit edilen olası tahmin değerleri sırasıyla 70015, 88050, 126272 ve 1391 tondur. Türkiye toplam yetiştiricilik olası tahmin değeri ise 284337 ton/yıl olarak bulunmuştur.

Anahtar sözcükler: *Yetiştiricilik, Balık, Gelecek üretim, Tahmin, Box-cox dönüşümü*

INTRODUCTION

Time series is a series of measurements observed in due course. If we have data about the previous years, we can make estimations about the coming years by using these data with the help of the time series and make plannings, accordingly. Since it develops models that estimate the variables in the future, the analysis of the time series is important. Time series are used for examining one or a few more incidents which vary according to time [1,2]. Some of the application areas of the time series are economy [3], commerce [4], sociology [5-7],

İletişim (Correspondence)
+90 232 3111306
hulya.saygi@ege.edu.tr

meteorolgy [8] and ecology [9-11].

Aquaculture is a basic industry that meets a great part of the world's food necessity. Aquaculture sector has been determined by FAO (The Food and Agriculture Organization of the United Nations) as the most rapidly growing food sector in the world [12,13]. Cultural fish breeding is increasing in Turkey and other part of the world [14]. The production of aquaculture, that is provided by cultivation in the world, has reached to 55 million ton. This proportion meets nearly 37% of the world aquaculture production. The aquaculture, that is provided by cultivation in Turkey, has been determined to be 140 thousand ton. The culture studies on aquaculture come to the forefront as a significant sector in meeting the prudential food necessity. Thus, the protection of the species that are in danger of extinction as a result of excessive fishing and enabling their continuity could only be possible through cultivation.

The species that are commonly cultivated in Turkey, primarily from sea fish are; Gilthead seabream, European seabass, and from freshwater fish; Rainbow trout and Common carp.

Today, while the production of alternative fish species has started, the species in question still have an economic significance. The production amount of Gilthead Seabream from 1986, in which aquaculture cultivation in Turkey was statistically recorded, to 2007 respectively increased from 86 ton to 33500 ton; and the production amount of Rainbow Trout, on the other hand, increased from 990 ton to 61173 ton. However, the production amount of Common Carp decreased from 2050 ton to 600 ton. For Seabass, on the other hand, the first statistical data belongs to 1987 and it is 25 ton; the production amount of the same species reached to 41900 ton in 2007 [15]. Such kind of information help understand the consumption preferences of people and the status of the sub-sectors that develop together with these productions. Therefore, it is necessary that the cultivation amount of the species being cultivated from past until today and the data directed at production be constituted and leaning on these data, their status in the future be determined [16]. For this purpose, the contingent production amount estimations until 2030 has been calculated by applying time series analysis into the production amount values of some fish species, which were regularly cultivated between 1986-2007, in the study.

MATERIAL and METHODS

The data, used in the study are gained from the secondary data of TUIK 1986-2007. Applying the Time Series Analysis Method to the data with the help of Genstat for Teaching Packet Program, Box-Cox transformation was performed and as a result, the contingent estimations of the fish species, being cultivated in Turkey the most, was made considering that optimistic, pessimistic and current conditions would continue until 2030. Similarly, the estimation studies of FAO and European Union (EU) are made by targeting the year 2030. Therefore, the year 2030 was taken as base in order to provide parallelism with these institutions.

The autoregressive modelling of all data was made, and for that, Genstat computer program was used. Firstly, whether the data was convenient for the normal distribution was checked and the ones with skew distribution were rendered into normal distribution with the help of Box- Cox transformation. The statistical parameters of the data, being rendered into normal distribution were recalculated. And then the correlogram calculation was made; determining the numbers (k) of the ones, exceeding the estimated limits, partial autocorrelation coefficients were calculated for them. The meaningfulness of these coefficients were controlled statistically at the level of 5% and were tested whether they were constant or not.

Box - Cox Transformation

In order to render the series with skew distribution into normal distribution, Box- Cox transformation could be applied [17]. In this method, the data which are found to be not symmetrical as a result of the skewness coefficient calculation, is applied with,

$$y_i = \frac{x_i^{\lambda}}{\lambda} \qquad \lambda \neq 0$$

$$y_i = \log x_i \qquad \lambda = 0$$

transformation.

Here, y_i: is the new data with a skewness removed, x_i: is the data with original skewness, λ: is the parameter to render the y_i data into zero skewness. λ could be estimated with the method of trial-and-error. Box- Cox transformation could only be applied for the positive data [18].

Linear Autoregressive Model

In the linear autoregressive models (AR), also known as Markov models, the connection of any data with the prior data is searched. The general expression of the models is as follows;

$$x_i = \sum_{j=1}^{m} \alpha_j x_{i-j} + \varepsilon_i$$

Here, x_i: is i's data, α_j: autoregressive coefficients, which are the parameters of the model, ε_i: is the random variable with a normal distribution, being time independent, having an average of zero and a variance of σ^2, m: shows the degree of the model. The m's degree is depicted with the Markov model, AR (m) and it connotes that the data embraced is dependent on the previous observation data [19,20]. The autoregressive constants of the model could be calculated by the method of autocorrelation function [21].

$$\rho_k = \sum_{i=1}^{d} \alpha_i \rho_{k-i}$$

Here, ρ_k: are defined as the autocorrelation coefficients of the series, k: is defined as the delayed step (lag), d: is defined as the model degree, α_i: are defined as the autoregressive constants. r_k autocorrelation coefficients of the series are used for ρ_k values.

$$r_k = \frac{A}{B * C}$$

Here;

$$A = \left[\frac{1}{N-k} \sum_{i=1}^{N-k} x_i x_{i+k} - \frac{1}{(N-k)^2} \left(\sum_{i=1}^{N-k} x_i \right) \left(\sum_{i=1}^{N-k} x_{i+k} \right) \right]$$

$$B = \left[\frac{1}{N-k} \sum_{i=1}^{N-k} x_i^2 - \frac{1}{(N-k)^2} \left(\sum_{i=1}^{N-k} x_i \right)^2 \right]^{1/2}$$

$$C = \left[\frac{1}{N-k} \sum_{i=1}^{N-k} x_{i+k}^2 - \frac{1}{(N-k)^2} \left(\sum_{i=1}^{N-k} x_{i+k} \right)^2 \right]^{1/2}$$

r_k: is the correlation coefficient of the k's series, N: length of the series, x_i: i's observation value, x_{i+k}: i+k's observation value. In literature, the diagram, that shows the alteration of r_k according to the k value (delayed) is called correlogram. Whether the calculated r_k values are meaningful or not is examined through Anderson tolerance limits.

$$TL(r_k) = \frac{-1}{N-k} \pm z \frac{\sqrt{N-k-1}}{N-k}$$

Here, TL (r_k): is the limit of r_k's coefficient, z: is the critical value (for 95% meaningfulnes level, z = 1.645) from standardised normal distribution table. In case that r_k values are statistically meaningful, it is understood that the terms, having a k delay between the data in the series are dependent on each other [8,17]. The first d item of α_i value could be calculated by being regulated in the form of matrix.

$$\vec{\alpha} = \vec{R}_m^{-1} . \vec{\delta}_m$$

$$\vec{\alpha} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \vdots \\ \alpha_m \end{bmatrix} \qquad \vec{\delta}_m = \begin{bmatrix} \delta_1 \\ \delta_2 \\ \vdots \\ \delta_m \end{bmatrix}$$

$$\vec{\mathbf{R}}_{\mathbf{m}} = \begin{bmatrix} \mathbf{1} & \boldsymbol{\delta}_{\mathbf{1}} & \boldsymbol{\delta}_{\mathbf{2}} & \cdots & \boldsymbol{\delta}_{\mathbf{m-1}} \\ \boldsymbol{\delta}_{\mathbf{1}} & \mathbf{1} & \boldsymbol{\delta}_{\mathbf{1}} & \cdots & \boldsymbol{\delta}_{\mathbf{m-2}} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \boldsymbol{\delta}_{\mathbf{m-1}} & \boldsymbol{\delta}_{\mathbf{m-2}} & \boldsymbol{\delta}_{\mathbf{m-3}} & \cdots & \mathbf{1} \end{bmatrix}$$

The determination of the calculated α_i value, on the other hand, is tested on condition that the b absolute values of the roots of;

$$1 - \alpha_1 \beta - \alpha_2 \beta^2 - \cdots - \alpha_m \beta^m = 0$$

equation is smaller than 1.

The determination could be tested by the conditions;

For AR (1); $-1 < \alpha_1 < 1$
For AR (2); $\alpha_1 + \alpha_2 < 1$, $\alpha_2 - \alpha_1 < 1$, $-1 < \alpha_2 < 1$ [20].

RESULTS

The data, used in the study are gained from the secondary data of TUIK 1986 - 2007 *(Table 1)*.

λ values, used for Box - Cox transformation, descriptive statistics, parameter of model, Durbin-Watson and Determination coefficient are given in the *Table 2*.

It is supposed to cut zero on the 1st or the 2nd delay, and then fluctuate around zero for a stable auto-correlation function. On the correlogram of the variable obtained from the data of Seabream, Seabass, Salmon and Carp, it is seen that autocorrelation values cut zero. The result diagram of these fish are as they are given in *Fig. 1, Fig. 2, Fig. 3* and *Fig. 4,* respectively and stability of the variable is understood from the correlogram *(Table 3)*. Anderson tolerance limits are given in *Table 2*. Consistence conditions were controlled with the help of autocorrelation functions and it was seen that the parameters of the chosen models provide the consistence

Table 1. *Current Output of the Analysed Fish (Ton) (TUIK, 1986-2007)*
Tablo 1. *İncelenen Balıkların Üretim Miktarları (Ton) (TÜİK, 1986-2007)*

Year	Gilthead Seabream	European Seabass	Rainbow Trout	Common Carp
1986	*34*	*0*	*990*	*2050*
1987	*65*	*25*	*1105*	*2100*
1988	*100*	*5*	*1765*	*2200*
1989	*798*	*51*	*2471*	*1033*
1990	*1031*	*102*	*3212*	*1025*
1991	*910*	*777*	*4146*	*364*
1992	*937*	*808*	*6396*	*251*
1993	*1029*	*3158*	*6848*	*544*
1994	*6070*	*2229*	*6977*	*288*
1995	*4847*	*2773*	*12689*	*424*
1996	*6320*	*5210*	*18510*	*780*
1997	*7500*	*6300*	*28500*	*800*
1998	*10150*	*8660*	*34630*	*950*
1999	*11000*	*12000*	*38570*	*900*
2000	*15460*	*17877*	*44533*	*813*
2001	*12939*	*15546*	*38067*	*687*
2002	*11681*	*14339*	*34553*	*590*
2003	*16735*	*20980*	*40868*	*543*
2004	*20435*	*26297*	*45082*	*683*
2005	*27634*	*37290*	*49282*	*571*
2006	*28463*	*38408*	*57659*	*668*
2007	*33500*	*41900*	*61173*	*600*

Table 2. Autoregressive calculation results and the chosen model (N= the number of year, used in the estimation, k = lag, ATL (LL; UL) = Anderson tolerance limit (Lower Limit; Upper Limit), se = standard error, AR (1), AR (2) = parameter, R^2 = Determination coefficient, D-W = Durbin-Watson test)
Tablo 2. *Otoregresif hesap sonuçları ve seçilen model (N= tahminde kullanılan yıl sayısı; k = gecikme, ATL(LL; UL) = Anderson tolerans limiti (Alt Limit; Üst Limit), se = standart hata, AR (1), AR (2) = parametre, R^2 = Determinasyon katsayısı, D-W = Durbin-Watson testi)*

Parameter	Total Production of Aquaculture in Turkey (Thousand Ton)	Gilthead Seabream (Ton)	European Seabass (Ton)	Rainbow Trout (Ton)	Common Carp (Ton)
λ	0.502	0.414	0.400	0.451	0.310
N	22	22	22	22	22
Average	47.933	9.892	11.578	24.456	0.857
Standard Deviation	44.096	10.162	13.593	20.522	0.556
Skewness	0.675	0.936	1.083	0.277	1.504
Kurtosis	2.271	2.831	2.913	1.606	4.201
k	2	1	2	2	1
ATL(LL;UL)	- 0.406; 0.306	-0.397; 0.303	-0.406;0.306	- 0.406; 0.306	-0.397; 0.303
Constant(se)	31.500(16.500)	8.010(5.44)	8.540(3.440)	12.180(8.090)	0.560(1.130)
AR(1)(se)	0.242(0.250)	-0.301(0.224)	-0.343(0.263)	0.349(0.247)	-0.119(0.241)
AR(2)(se)	-0.134(0.248)		-0.164(0.253)	-0.109(0.245)	
R^2	0.867	0.201	0.224	0.14	0.354
D-W	2.207	2.069	2.292	1.972	2.229

conditions. Accordingly, since $-1<\alpha_1= -0.301<1$ for the Seabream cultivation with a model degree of AR (1), $\alpha_1= -0.343 + \alpha_2= 0.164 <1 \Rightarrow -1<-0.278 <1$, $\alpha_2= 0.164 - \alpha_1 = -0.343 <1 \Rightarrow 0.507 <1$, $-1< \alpha_2= 0.164 <1$ for the Seabass with a model degree of AR (2), $\alpha_1 = 0.349 + \alpha_2= -0.109 <1 \Rightarrow -1<-0.240<1$, $\alpha_2= -0.109 - \alpha_1= 0.349<1 \Rightarrow -0.458<1$, $-1< \alpha_2= -0.109 <1$ for the Salmon with a model degree of AR (2) and $-1<\alpha_1= 0.560 <1$ for the Carp with a model degree of AR (1), consistence conditions are provided. Results of the established models are given in *Table 2*.

Table 3. *AC and PAC correlograms for the data of European seabass, Gilthead seabream, Rainbow trout and Common carp*
Tablo 3. *Levrek, Çipura, Alabalık ve Sazan verilerinin AC ve PAC Korelogramları*

k	European seabass				Gilthead seabream				Rainbow trout				Common carp			
	AC=r_k	PAC	Q-Stat	Prob	AC=r_k	PAC	Q-Stat	Prob	AC=r_k	PAC	Q-Stat	Prob	AC=r_k	PAC	Q-Stat	Prob
1	0.215	0.215	1.1145	0.291	-0.024	-0.024	0.0144	0.905	0.353	0.353	3.0054	0.083	-0.106	-0.106	0.2715	0.602
2	0.116	0.073	1.4562	0.483	0.186	0.186	0.8955	0.639	-0.008	-0.152	3.0071	0.222	0.212	0.203	1.4126	0.493
3	-0.074	-0.119	1.6026	0.659	-0.084	-0.078	1.0837	0.781	0.001	0.067	3.0071	0.391	0.116	0.164	1.7762	0.620
4	0.019	0.052	1.6128	0.806	0.046	0.010	1.1437	0.887	-0.425	-0.529	8.1346	0.087	-0.308	-0.350	4.4782	0.345
5	0.228	0.251	3.1780	0.673	0.056	0.090	1.2389	0.941	-0.387	-0.010	12.660	0.027	0.030	-0.106	4.5053	0.479
6	0.004	-0.124	3.1786	0.786	0.015	-0.001	1.2459	0.975	-0.101	-0.072	12.990	0.043	-0.103	0.051	4.8479	0.563
7	0.164	0.156	4.1086	0.767	0.028	0.006	1.2728	0.989	0.016	0.159	12.999	0.072	-0.263	-0.209	7.2319	0.405
8	-0.053	-0.061	4.2112	0.838	-0.146	-0.143	2.0643	0.979	0.137	-0.099	13.694	0.090	0.053	-0.092	7.3348	0.501
9	-0.068	-0.117	4.3954	0.884	0.123	0.120	2.6693	0.976	0.072	-0.197	13.902	0.126	-0.064	0.080	7.4973	0.585
10	-0.102	-0.077	4.8543	0.901	-0.060	-0.010	2.8250	0.985	-0.003	-0.079	13.902	0.178	0.043	0.091	7.5783	0.670
11	-0.157	-0.102	6.0440	0.870	0.153	0.089	3.9508	0.971	0.075	0.171	14.175	0.223	0.084	-0.091	7.9214	0.720
12	-0.025	-0.055	6.0775	0.912	-0.197	-0.177	6.0395	0.914	-0.000	0.038	14.175	0.290	-0.004	-0.052	7.9223	0.791
13	-0.146	-0.092	7.3578	0.883	0.003	-0.029	6.0401	0.945	0.000	0.012	14.175	0.362	-0.020	-0.051	7.9455	0.847
14	-0.052	-0.020	7.5442	0.912	-0.067	0.010	6.3455	0.957	0.072	-0.117	14.537	0.411	-0.002	-0.052	7.9458	0.892
15	-0.147	-0.079	9.2919	0.862	-0.111	-0.150	7.3456	0.947	-0.023	-0.013	14.578	0.482	-0.155	-0.179	9.8840	0.827
16	-0.172	-0.097	12.155	0.733	-0.142	-0.183	9.3057	0.900	-0.094	-0.028	15.426	0.494	0.044	0.060	10.075	0.863
17	-0.132	-0.056	14.271	0.648	-0.123	-0.040	11.130	0.850	-0.066	0.064	15.952	0.527	-0.077	0.026	10.798	0.867
18	-0.097	0.020	15.772	0.608	-0.082	-0.062	12.204	0.837	-0.057	-0.035	16.476	0.559	0.010	-0.028	10.815	0.902
19	-0.007	-0.025	15.783	0.672	-0.032	0.021	12.452	0.865	-0.055	-0.102	17.204	0.576	0.009	-0.106	10.836	0.929
20	-0.015	0.041	15.893	0.723	-0.041	-0.108	13.274	0.865	-0.006	-0.071	17.221	0.639	0.000	0.010	10.836	0.950

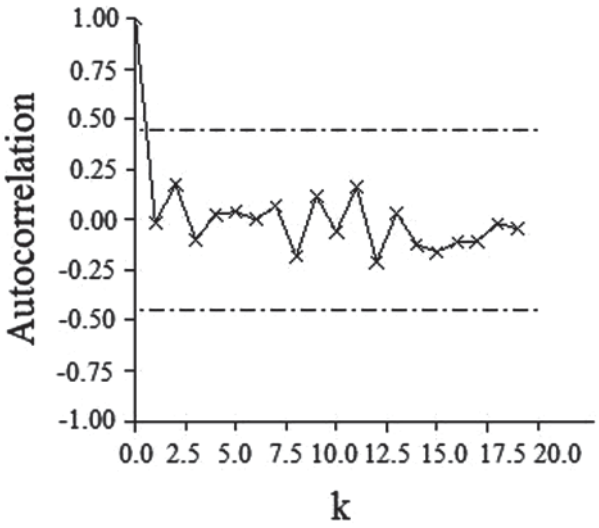

Fig 1. Correlogram graphic of Gilthead seabream
Şekil 1. Çipura korelogram grafiği

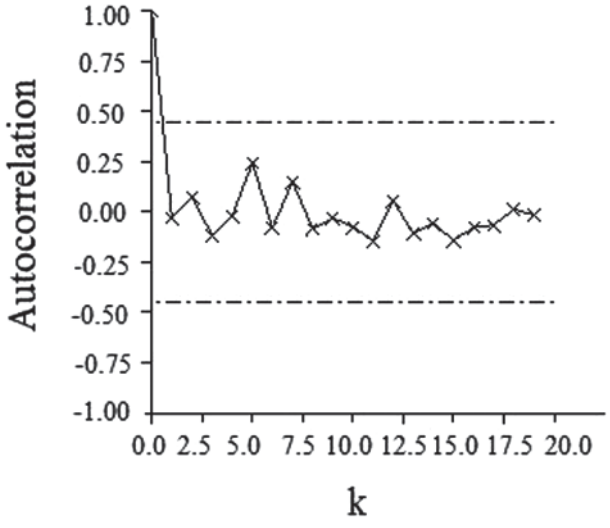

Fig 2. Correlogram graphic of European seabass
Şekil 2. Levrek korelogram grafiği

According to these values, the models of the production amounts of the main fish species, being cultivated in Turkey were resolutely confirmed. In the direction of this model, the contingent optimistic and pessimistic estimations of the species until 2030 were made.

Accordingly, the Gilthead Seabream production was estimated as 30694 ton pessimistically, 35002 ton for the contingent estimation, 39309 ton optimistically, for the year 2008. For the year 2030, these values were respectively calculated as; 49857, 70015, 90173 *(Fig. 5)*. According to TUIK(2008) the Gildhead Seabream production was 31670 ton.

The pessimistic estimation of the production of the

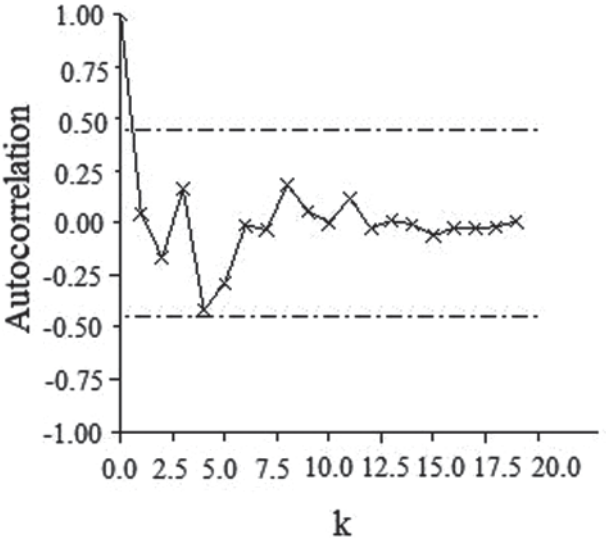

Fig 3. Correlogram graphic of Rainbow trout
Şekil 3. Alabalık korelogram grafiği

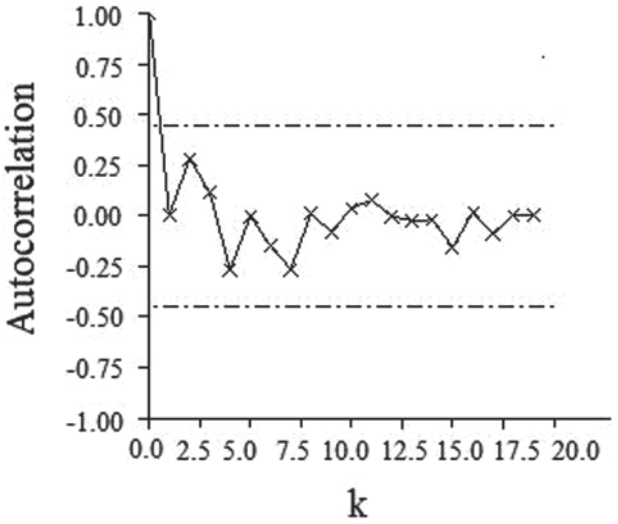

Fig 4. Correlogram graphic of Common carp
Şekil 4. Sazan korelogram grafiği

Seabass is 39057 ton, contingent estimation is 44207 ton and the optimistic estimation is 49356 ton for 2008. For the year 2030, these values are determined respectively as; 57075, 88050, 119024 ton *(Fig. 6).* According to TUIK (2008) the Seabass production was 49270 ton.

The pessimistic estimation of the production of the Rainbow Trout is 58103 ton, contingent estimation is 64229 ton and the optimistic estimation is 70335 ton for 2008. For the year 2030, these values are determined respectively as; 82290, 126272, 170254 ton *(Fig. 7).* According to TUIK (2008) the Rainbow Trout production was 65928 ton.

The Common Carp production is expected to be

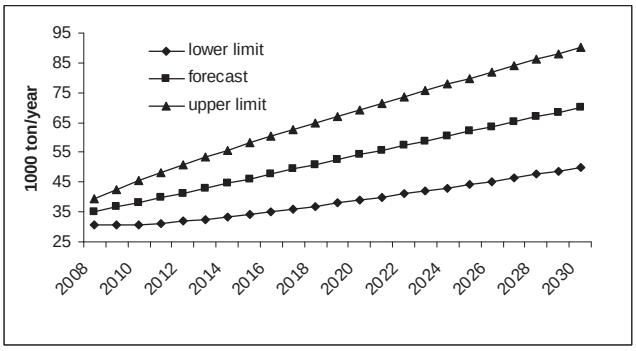

Fig 5. Approximate amount of gilthead seabream production by years
Şekil 5. Yıllara göre tahmini çipura üretim miktarı

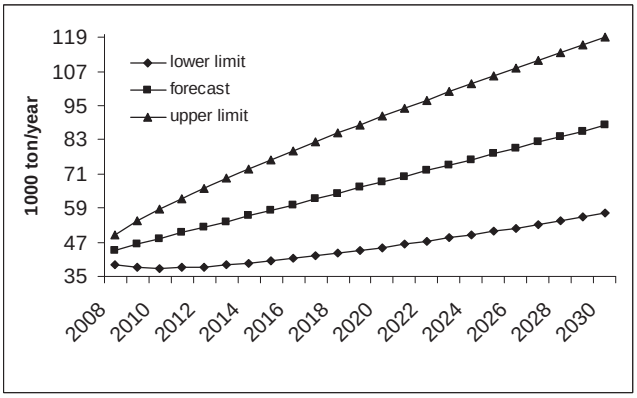

Fig 6. Approximate amount of seabass production by years
Şekil 6. Yıllara göre tahmini levrek üretim miktarı

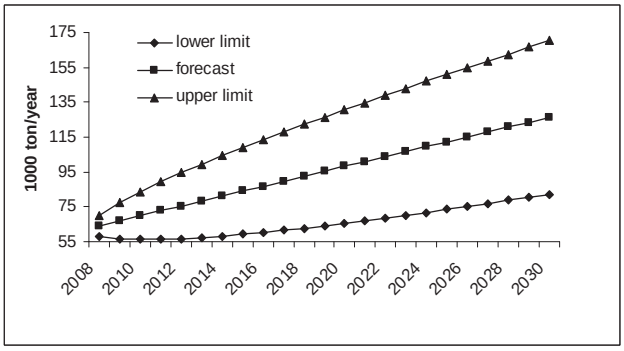

Fig 7. Approximate amount of rainbow trout production by years
Şekil 7. Yıllara göre tahmini alabalık üretim miktarı

completely over in 2008 according to the optimistic estimation and according to the contingent estimation, it is expected in 2016. Additionally, the contingent estimation is calculated as 530 ton and the optimistic estimation is calculated as 1078 for 2008. It is expected that only the optimistic estimation result shall reach to the value of 1391 for the year 2030 *(Fig. 8).* According to TUIK(2008) the Common Carp production was 629 ton.

As a result of the modeling study, estimations of 2008

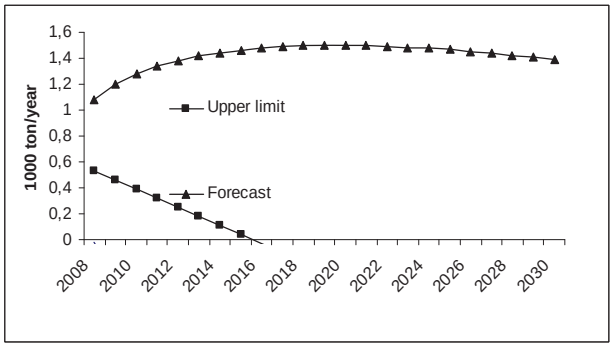

Fig 8. Approximate amount of the common carp production by years

Şekil 8. Yıllara göre tahmini sazan üretim miktarı

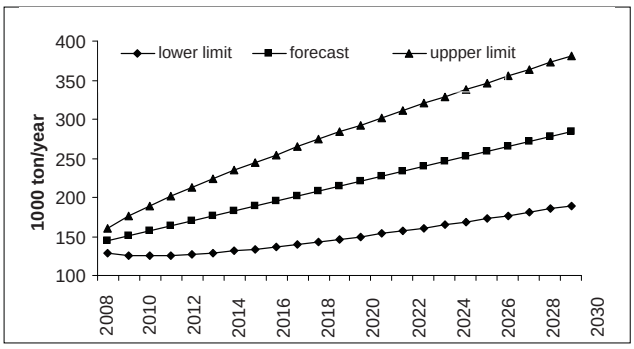

Fig 9. Approximate amount of the total production of aquaculture in Turkey by years

Şekil 9. Yıllara göre Türkiye tahmini toplam su ürünleri yetiştiricilik miktarı

show parallelism with the production results obtained by TUIK (2008).

The pessimistic estimation of the cultivation production in Turkey is 127854 ton, the contingent estimation is 143968 ton, the optimistic estimation is 160098 ton for 2008. For the year 2030, these values are determined respectively as; 189222, 284337, 380842 ton *(Fig 9).*

DISCUSSION

World aquaculture production rate is around 143.6 million ton and nearly 36% of this rate is acquired from aquaculture, which means nearly 51.7 million ton[22]. Additionally, while a production of total 176 million ton is expected for the year 2030, 83 million ton of this production is considered to be met by aquaculture. Similarly, according to the data of the Turkish Statistical Institute of 2008, although the aquaculture production decreased at the rate of 16.32% compared to the previous year, the cultivation production increased at the rate of 8.8% compared to the previous year and became nearly 152 thousand ton [23]. The most significant species, being cultivated are; Rainbow Trout with the rate of 43.32% in inland waters, Seabass at the rate of 32.37% and Gilthead Seabream at the rate of 20.81% in the seas. In this context, together with the increase of the aquaculture amount, gained by cultivation, the annually produced feed amount is around 200-300 thousand ton in the direction of FCR (Food Conversion Ratio) [9].

In this prudential study, as long as the available conditions continue in Turkey in 2030, it is expected to be 284337 ton. With a production of 126272 ton, the Rainbow Trout (*O. mykiss*) shall keep championship in Turkey, in 2030. It is expected that the production of Seabass (*D. Labrax*) shall accelerate and beat the production of Gilthead Seabream (*S. aurata*). Through the end of the 2016s, it is estimated that the production of Common Carp (*C. carpio*) shall come to an end, or in other words, the production of Common Carp is in danger of extinction. The businesses, making aquaculture cultivation production in Turkey had to close up due to the expenses that arose as a result of the increasing exchange rate after each economic crisis. Indeed, the readily-approved projects for aquaculture business before the crisis could not be opened as a result of the crisis [4]. Increasing feed expenses of Rainbow Trout and Common Carp farms, rapid increase of their businesses, decrease of the purchasing power of the consumer in spite of the increase of the product cost, dropped the profitability of the businesses and some small businesses with low profitability production had to close up [24,25]. It is especially presumed that the businesses, that made Common Carp production would close up, since they are small scale family businesses and they can not simply beat the increasing cost and decreasing demand as a result of the economic crisis.

Following this process, not only in the production amounts of the species in question, but also in the activities of their sub sectors, a change is inevitable. For instance, it could be said that by 2016, the production of Common Carp feed in feed factories shall be abolished and besides, Rainbow Trout and Seabass feed shall gain importance. In such a situation, feed producers shall have to rearrange their target audience in accordance with these results. Similarly, fish producers should arrange their investments by taking these processes into consideration; the Ministry, on the other hand, should organise the presented projects from this perspective, as well.

The culture trainings have approved their significance and efficiency in meeting the food requirement. However, providing the culture conditions like continuity of the ecosystem and the continuity of the culture species is very important within this context. For that reason, the

following issues shall carefully be studied;

The resource management, particularly in inland water fishery, shall be made focusing on the sustainable use of the natural resources.

In all of the aquaculture activities, the problems of sustainability from the aspect of the environment shall be taken into consideration.

In fishery politics, being parallel to EU body of knowledge, it shall be base to carry out the stock determination studies, constitute the balance of resource use in the fishing production, provide the environmental sustainability in the aquaculture activities that are rapidly developing in parallel with the supports, provided recently and the increasing demand and to arrange the administrative structure in accordance with these purposes.

The brood fish, which is necessary for the culture fishing, shall be acquired from the hatch systems, whose egg and especially brood necessity is established and managed by the government.

Since the production of C. Carpio, which is a candidate of fish species to be cultivated the most in the World, in the future, is likely to be completely over in Turkey; studies on Common Carp cultivation shall be made [26]. Any encouragement from the government in this direction, shall be significant for Common Carp production to survive.

Considering the fish consumption amount 8.6 kg/year per person in our country and the world average (13.8 kg/year) and the average of the European countries (28.3 kg/year), it is quite inadequate. The reason of it is that, the fish is not introduced enough, especially in our shoreless cities or that it is transported to these regions with greater costs. Our people, whose income level has fairly decreased in recent years, do not demand the low-priced fisheries compared to other meat types because of this reason, and mostly they can not consume fish due to financial impossibilities [27]. Advertisement and inform studies shall be made in order to increase the consumption.

REFERENCES

1. Chatfield C: The Analysis of Time Series: An Introduction, Second ed., Chapman and Hall, New York, 1980.

2. Erdoğan E: Zaman Serilerinde Arıma Modelleri. *Yüksek Lisans Tezi*, Muğla, Fen Bilimleri Enstitüsü, 2006.

3. Çiftçi M: In EU - 15 countries, elasticity of income at female labors and Turkey: Critics - econometric analysis. *Int J Hum Sci,* 7 (1): 1350-1365, 2010.

4. Öz Y, Güngör B: Çalışma sermayesi yönetiminin firma karlılığı üzerine etkisi: İmalat sektörüne yönelik panel veri analizi. *Atatürk Univ Sosyal Bil Enst Derg*, 10 (2): 319-332, 2007.

5. Cengiz TM, Kahya E: Türkiye göl su seviyelerinin eğilim ve harmonik analizi. İstanbul Teknik Üniv Müh Derg, 5 (3): 215-224, 2006.

6. Aslan A: Türkiye'de Suç Oranları Sürekliliğinin Analizi, Munich Personal RePEc Archive (MPRA) Paper No. 10610, posted 19, September 2008, http://mpra.ub.uni-muenchen.de/10610/, *Accessed*: 22.09.2010.

7. Önder AÖ, Candemir A, Kumral N: An empirical analysis of the determinants of international tourism demand: The case of Izmir. *Eur Plan Stud*, 17 (10): 1525-1533, 2009.

8. Büyükyıldız M, Berktay A: Sakarya Havzası aylık yağışlarının otoregresif modellemesi. *Müh Bil Derg*, 12 (1): 117-126, 2006

9. Yetişkul E, Şenbil M: Kentsel ulaşım sektöründe enerji verimliliği: Uluslararası bir karşılaştırma. *METU JFA*, 27 (1): 185-200, 2010.

10. Nicolas LZ, Karen CA, Anthony RI: Weak population regulation in ecological time series. *Ecol Lett*, 13, 21-31, 2010

11. Ward EJ, Chirakkal H, Gonza´lez-Sua´rez M, Aurioles-Gamboa D, Holmes EE, Gerber L: Inferring spatial structure from time-series data: Using multivariate state-space models to detect metapopulation structure of California sea lions in the Gulf of California, Mexico. *J Appl Ecol*, 47, 47-56, 2010.

12. Tidwell JH, Allan GL: Fish as food: Aquaculture's contribution ecological and economic impacts and contributions of fish farming and capture fisheries. *EMBO Rep,* 2 (11): 958-963, 2001.

13. Failler P, Gilles Walle V, Lecrivain N, Himbes A, Lewins R: Future Prospects for Fish and Fishery Products 4. Fish consumption in the European Union in 2015 and 2030, Part 1. European Overview, Food and Agriculture Organization of The United Nations, 2007.

14. Nazıroğlu M, İspir Ü, Yonar ME: Balıklarda E vitaminin immun cevap üzerine etkileri. *Kafkas Univ Vet Fak Derg,* 9 (1): 101-106, 2003.

15. TÜİK: Su Ürünleri istatistikleri. Ankara, 1986-2007.

16. Çavdar Y: Su ürünleri yetiştiriciliğinde desteklemeler. *Sümae - Yunus Araş Bül*, 9 (1): 13-14, 2009.

17. Yevjevich V: Stochastic processes in hydrology. Water resources publications fort collins. Colorada, USA, 1972.

18. Meloun M, Sanka M, Memec P, Kritkova S, Kupka K: The analysis of soil cores polluted with certain metals using the box-cox transformation. *Environ Pollut,* 137, 273-280, 2005.

19. Bayazıt M: Hidrolojide istatistiksel yöntemler. İTÜ, İnşaat Fakültesi Matbaası, 1981.

20. İçağa Y, Yurtcu Ş, Ulutürk Y: Yeraltı suyu seviye değişiminin stokastik modellemesi: Akarçay Afyon alt havzası örneği. *Süleyman Demirel Üniv Fen Bil Enst Derg*, 11 (2): 180-186, 2007.

21. Jones AL, Smart PL: Spatial and temporal changes in the structure of groundwater nitrateconcentration time series (1935-1999) as demonstrated by autoregressive modelling. *J Hydrol*, 310, 201-215, 2005.

22. FAO: http://www.fao.org/docrep/011/i0250e/i0250e00.HTM. *Accessed*: 22.09.2010.

23. TÜİK: Haber Bülteni, Su Ürünleri, Sayı: 125, 2009.

24. Alp A, Büyükçapar HM: Kahramanmaraş'ta su ürünleri sektörünün gelişimi ve balıkçılığa uygun su kaynakları. *KSÜ Fen ve Mühendislik Dergisi*, 9 (1): 104-110, 2006.

25. Karakaş HH, Türkoğlu H: Su ürünlerinin Dünyada ve Türkiye'deki durumu. *J Agric Fac HR U*, 9 (3): 21-28, 2005.

26. Arabacı M: LHRHa ([D-Ser(But)^6,Pro^9-NEt-LHRHa) ve Domperidonun farklı kombinasyonlarda kullanımı ile ot sazanı (*Ctenopharyngodon idellus valenciennes*, 1844) anaçlarında yumurtlamanın uyarılması üzerine bir çalışma. *Kafkas Univ Vet Fak Derg*, 15 (6): 897-902, 2009.

27. Kurtoğlu İZ, Çakmak Y: Karadeniz bölgesi kültür balıkçılığı: Alabalık yetiştiriciliği, pp: 56-68, 7 (1): 10-14, 2007.