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AN ANALYSIS OF THE FISH POPULATIONS BY USING ANN AND WAVELET TECHNIQUES

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Abstract- *Air – sea climate, environmental and biological conditions show various differences on several spatio-temporal scales. Climate change associated with anthropogenic activity and natural global multi-decadal climate variations effects on air-sea interactions and water surface–atmosphere–biosphere climate system. In the first part of this paper is related with Artificial Neuro Network analyses for prediction of fish stocks in Marmara and Black Sea. The second part of this study is based on wavelet analyses and, the results were compared with former wavelet and harmonic analyses to explain seasonal effects of NAO and ENSO on fish population. The influence of climatic oscillations (based on NAO and ENSO) on monthly catch rates of fish population such as sea bass, Atlantic bonito,blue fish sea (pomatomus population between 1991-2012) in Black Sea and Marmara have been analyzed by discrete wavelet transform (DWT) with Meyer and Daubechie's. Wavelet analysis is an efficient method of time series analysis to study non-stationary data. Wavelet analyses allowed us to quantify both the pattern of variability in the time series and non-stationary associations between fish population and climatic signals. Phase analyses were carried out to investigate dependency between the two signals. We reported strong relations between fish stock and climate series for the 4- and 5-yr periodic modes, i.e. the periodic band of the El Niño Southern Oscillation signal propagation in the Black Sea and Marmara Sea. These associations were non-stationary, evidenced from 1995 to 2012. It is recognized that other factors in small, meso and large scales may modulate fish stocks beginning from 1995 and more clearly from 2005.*

Keywords: *Fish Stocks Management, Climate Signals, ANN, Wavelet Analysis, ENSO, NAO.*

1. INTRODUCTION

In recent years, annual total fish production shows an increasing trend. Climatic effects on fluctuations of fish populations and fisheries have long been recognized and continue to be critical. Understanding these effects is an essential step toward conserving and managing marine resources. The most widely studied climatic forcing impacts on fishes include those at an inter-annual scale, such as El Niño/Southern Oscillation (ENSO), [1-5].

The Japanese eel is a catadromous fish, widely distributed in the western Pacific, from the Philippines in the south, through Taiwan, mainland China, Korea, to Japan in the north. The passive migration from the spawning area to the estuaries of Taiwan takes approximately four to six months [6-11]. While it is speculated that climate variability might have crucial impacts on the Japanese eel recruitment, direct comparisons between the long-

term data for both recruitment and climate are scarce. In this study, they took advantage of the unique long-term (1967–2008) record of glass eels caught in the estuaries of Taiwan [11-13].
The possible influence of particular climate patterns on the annual production may not be stationary, and each climate pattern may affect the recruitment dynamics at a different scale. Therefore used wavelet analyses that require no assumption of stationary and have the ability to determine the dominant modes of variability in frequency and how those modes vary over time. The spectral slope was obtained empirically from the time series data [14-20].
In recent years, increasing ration of fish production causes the important of Artificial neural networks (ANN) analyses [19-27].
The first part of the paper presents some statistical analyses of three regional fish types (levrek: sea bass, lüfer: blue fish and palamut: Atlantic bonite in Marmara and Western Black Sea.

2. DATA AND METHOD

Data for the annual total levrek (sea bass), lüfer (blue fish) and palamut (Atlantic bonite) at Marmara and Western Black Sea have been analyzed by using two different methodologies (Wavelet and Artificial Neuro Network),
To analyze the role of climate changing on the fish-stock related from 1991-2012 were compiled from monthly reports in the Turkish Fisheries Yearbook.

2.1. ANN

Artificial neural networks (ANN) detect patterns too complex to be recognized by humans and can be applied to breast mass malignancy classification when evaluating.
Feed-forward Configuration
Another step in understanding of ANN dynamics was made with introduction and analysis of a perceptron, a simple neural network consisting of input layer, output layer, and possibly one or more intermediate layers of neurons.
Once the input layer neurons are clamped to their values, the evolving starts. And, layer by layer, the neurons determine their output. This ANN configuration is often called *feed-forward* because of this feature. The dependence of output values on input values is quite complex and includes all synaptic weights and thresholds. Usually this dependence does not have a meaningful analytic expression. However, this is not necessary: there are *learning* algorithms that, given the inputs, adjust the weights to produce the required output.
So, simply put, we created a thing which learns how to recognize certain input patterns. There is a training phase when known patterns are presented to the network and its weights are adjusted to produce required outputs. Then, there is a recognition phase when the weights are fixed, the patterns are again presented to the network and it recalls the outputs Figs. 2.1 and 2.2).

2.1. Wavelet

The fundamental idea behind wavelets is to analyze according to scale. Indeed, some researchers in the wavelet field feel that, by using wavelets, one is adopting a whole new mindset or perspective in processing data. It has a very wide spread application from medicine to industry.

3. ANALYSES

Time series analyses of Sea Bass, Blue Fish and Atlantic bonito are presented here in this study. Later on 2002, monthly total Sea Bass population and their variation are presented, (Figs. 3.1-3.4).
Annual variation and linear trends of annual total sea bass population are given as below:

3.2. Analyses of Fish Population by using Wavelet Techniques- Annual Total Sea Bass Production

Low level (high frequency) fluctuations increases beginning from 2005 (approx. data number 160). In the second part of the study period, large, meso and small scale fluctuations are all higher than the values observed in the first term.
The first signal on sea bass population is recorded in 1995. Meso scale fluctuations observed every two year periods (blue, at point 160; in 1995) effect increasing ratio of sea bass population. Large scale effects (60 months, half decadal) and 4 months (seasonal) periodicity, have been observed at the second term of the study period on sea bass population. These factors result in important increasing ratio on fish population.

Important role of large scale fluctuations on blue fish production is more clear on this graph, in the second part of period.

Atlantic Bonito:

Blue fish:

3.3. Analyses of Fish Population by using ANN

This part of the study covers, analyses of ANN based on fish production.

4. Conclusion and discussion

This study is some applications of wavelet and ANN to estimation of fish production in Marmara and West Black sea region. Large scale evens are associated with increasing of annual fish production in study area. The next study will consider ANN analyses of wavelet outputs.

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