

## Trends in NE Atlantic and Mediterranean Bluefin Abundance

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### Historical Catches from Trap Fisheries

For ages, fishermen benefited from the seasonal migrations of bluefin in the Mediterranean by setting traps along its routes (Doumenge, 1998). The traps were fixed, passive tools (see Figure 1) that were only slightly modified over the centuries. Used since the Middle Ages, they belonged to aristocrats and bankers, who kept detailed accounts of their catches over several centuries.

We carried out an intensive search through national and naval archives, scientific libraries, and various Mediterranean laboratories to collect historical records about the traps. The pertinent information was retrieved from diverse sources, including:

- ancient books published by local authorities or clergy (e.g., Padre Sarmiento, 1757);
- books devoted to historical analysis (e.g., Cancila, 1972);
- owners' archives (e.g. Duchy of Medina Sidonia); or,
- personal archives accumulated by passionate, relentless scientists (e.g. Sella, Scaccini, and Rodriguez-Roda; for more details on data collection, see Ravier and Fromentin, in press).

We gathered more than 100 time series of catch records, but only the 54 that were at least 20 years long were retained for analysis. The oldest time series dated to the early 17th century in Sicily, while others dated to the 18th century in Portugal, the 19th century in Sardinia and Tunisia, and the 20th century in Spain and Morocco (see Figure 2). About a third of the time series were more than 50 years long, and 6 provided catch records for more than a century.

### Short- and Long-term Variations

Fluctuations in trap catches appear to be of large magnitude, with periods during which the large catches were as much as 10 times greater than the small catches. This temporal variability may be broken down into three main periods: pseudo-cyclic fluctuations of 100 to 120 years, cycles of 15 to 30 years with a peak around 20 years, and year-to-year fluctuations. The middle- to long-term trends accounted for 45% to 80% of the total variability in catch volume (Figure 2), which has been rarely documented

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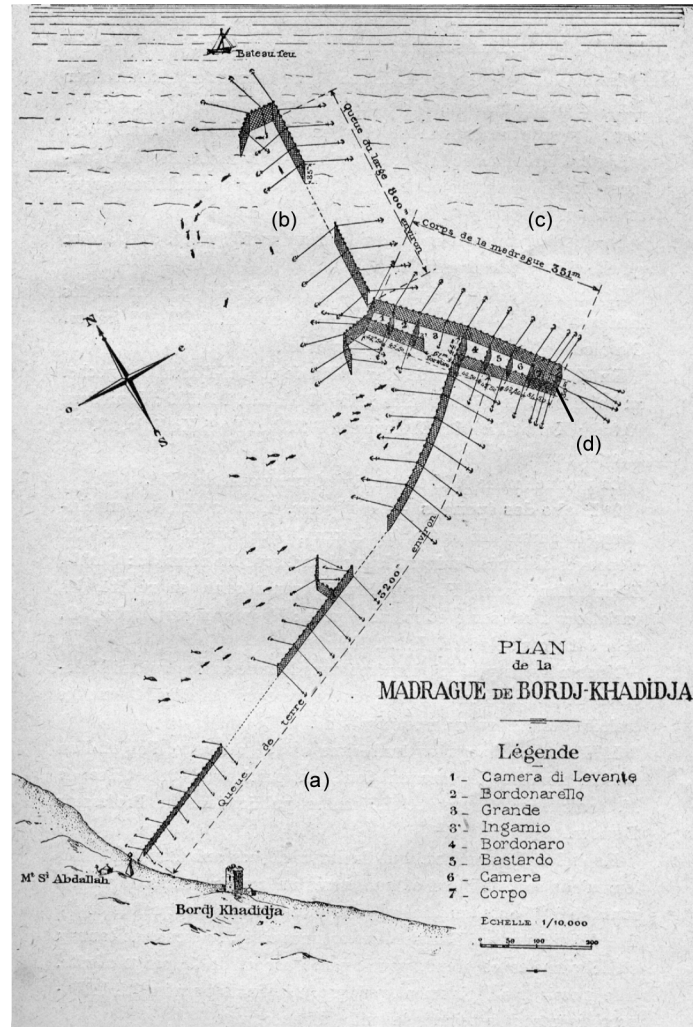


Figure 1. The Tunisian trap of "Bordj Khadidja," from Parona, circa 1919. Tunas, hugging the coast in their spawning migration, were guided by the two net barriers (a, b) up to the body of the trap (c). There they passed through several "rooms" up to the final compartment, the "death room" (d), where the net floor could be lifted. Tunas were gaffed here by fishermen and brought on board Khadidja's boat.

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in either marine or terrestrial ecology; this highlights the importance of maintaining time series of population abundance over long periods, to detect and describe the principal sources of variability.

### Synchronization in Long-Term Fluctuations

With records in hand, we proceeded to test whether there was any synchronization in long-term trends between series from the Western Mediterranean and near Atlantic. Simple visual scrutiny of the time series did indeed suggest synchronization between the long-term fluctuations in catches of different traps (Figure 2). To verify this, we compared pairs of different sites using a correlation coefficient (see Figure 3)—and the distributions of cross-correlations between long-term time series were clearly shifted to positive values of the correlation spectrum; this indicated the presence of similar long-term fluctuations in trap catches. We conducted other statistical analyses as well (see Ravier and Fromentin, in press), which led to the same conclusions: long-term trends in trap catches are synchronous all around the Western Mediterranean and near Atlantic coasts, whereas short-term variability appears only on a local scale.

### Catch Fluctuations as Indicators of Abundance

As explained at the outset, traps are passive tools, only slightly modified over the centuries, that catch bluefin during their yearly spawning migrations. In this sense, a trap can be thought of as a sampling mechanism that each year catches the same proportion of the bluefin population. These facts and preliminary analyses (Sella, 1929; Fromentin et al., 2000), led us to suggest that long-term fluctuations in trap catches could reflect fluctuations in species abundance if they vary in the same way all around the Western Mediterranean and near Atlantic.

This suggestion led to development of a hypothesis in which long-term fluctuations in trap catches are a good proxy for fluctuations in population abundance. Indeed, if the traps did not catch a representative proportion of the bluefin population, there would have been no reason for the long-term fluctuations to appear synchronous throughout the Western Mediterranean and along the South coasts of Spain and Portugal.

Finally, a synthetic time-series was calculated to depict the general temporal pattern in abundance of Mediterranean bluefin; a filter was applied to this series to depict the long- and medium-term fluctuations. The trend of this series, which explained 78% of the total variance, can summarize the long-term fluctuations in Mediterranean bluefin abundance from 1634 to 1960: i.e., three 120-year cycles with peaks around 1635, 1760 and 1880, and troughs around 1710, 1820 and 1930, on which cycles of about 20 years are superimposed (see Figure 4).

(continued on page 6)

## Upcoming Events

### November 25–30, 2001

*6th Asian Fisheries Forum: Asian Fisheries: Diversification and Integration*

National Sun Yat-Sen University, Kaohsiung, Taiwan

Information: <http://www.tfrin.gov.tw/AFS/2nd-announce/index.html>

Contact: John Cooksey, Conference Manager / 2423 Fallbrook Place / Escondido, CA. 92027 / USA / Tel: 1-760-432-4270 / Fax: 1-760-432-4275 / E-mail: [meeting-manager@aol.com](mailto:meeting-manager@aol.com)

### January 21-May 24, 2002

*The 2002 SPC/Nelson Polytechnic Pacific Island Fisheries Officers Training Course*

This course will be held at the School of Fishing, Nelson Polytechnic, in Nelson, New Zealand, from January 21 to May 24, 2002; this will be followed by a practical fishing course at a Pacific Island venue from May 27 to June 28, 2002.

The course is designed to provide selected Pacific Islanders with extensive practical training in a variety of fisheries skills and knowledge. Instruction is under the technical scrutiny of senior fisheries officials gathered at the Regional Technical Meeting on Fisheries.

The course fee for selected participants is payable to the Secretariat of the Pacific Community. Contact: Director General, Secretariat of the Pacific Community / B.P. D5 98848 Noumea Cedex, New Caledonia / Tel: (687) 26 20 00 / Fax: (687) 26 38 18 / E-mail: [spc@spc.int](mailto:spc@spc.int).

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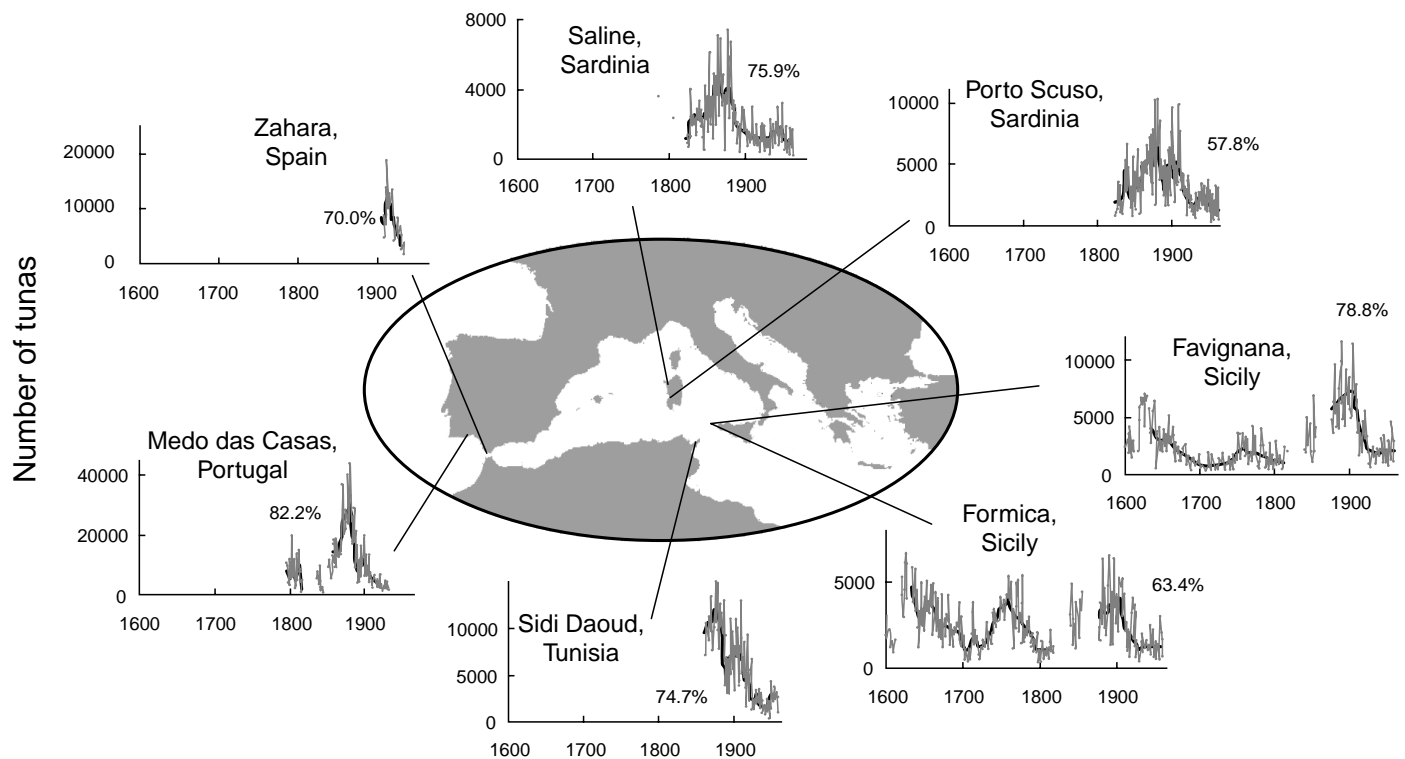


Figure 2. Time series of trap catches from the Western Mediterranean and near Atlantic (grey lines), smoothed by a filter (black line). The percentages shown are of variance explained by the trend.

### Management Implications

The International Commission for the Conservation of Atlantic Tunas (ICCAT) convention uses maximum sustainable yield as a reference point for tuna management. The search for a unique and absolute reference point with which to manage a stock implicitly supposes that the stock's population is at equilibrium or steady state. However, our results show that long-term variations in population abundance are important, so the concept of MSY would be irrelevant for species populations with complex dynamics, such as bluefin in the Northeast Atlantic and Mediterranean. It appears critical then, to define a suitable precautionary approach that will take into account the natural temporal variability of this stock, by determining, for example, a level of reference that is time dependent, rather than a simple reference point.

### References

Doumenge, F. 1998. L'histoire des pêches thonières. ICCAT Scientific Papers 50(2): 753-802.  
 Fromentin, J.-M., Fonteneau, A., and Farrugio, H. 2000. Biological key reference points and natural long-term fluctuations: the case of the Atlantic bluefin tuna. ICCAT Scientific Papers 51: 2072-2084.

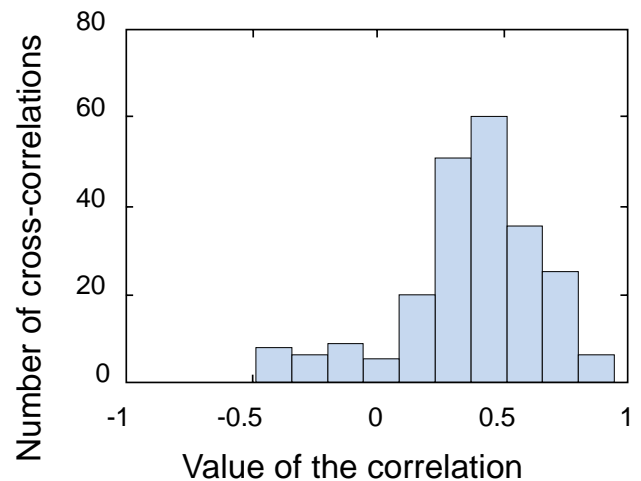


Figure 3. Distribution of correlation coefficients between long-term time-series series (those that overlapped over more than 50 years).

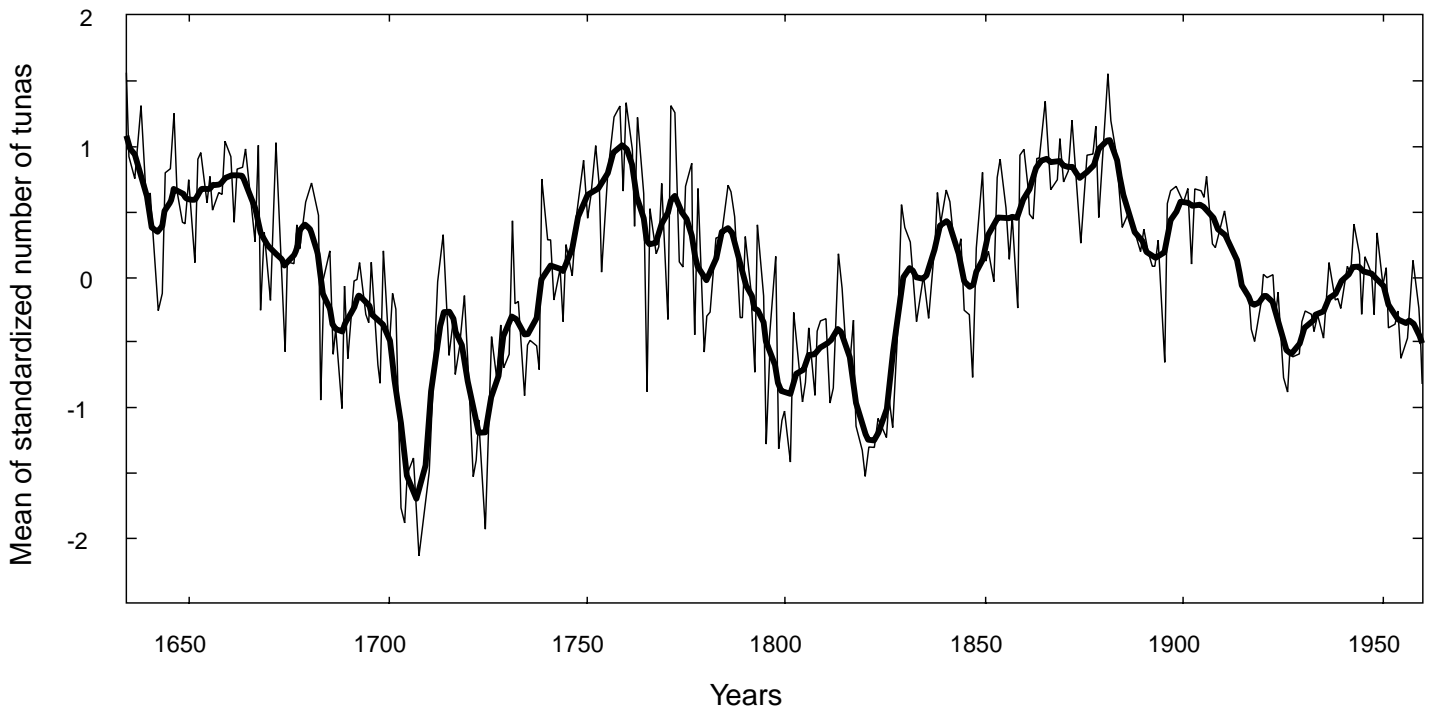


Figure 4. Synthetic series computed from the data set of trap-catches' time series (thin line). The trend (thick line) constitutes an index of long-term fluctuations in abundance.

Ravier, C., and Fromentin, J.-M. in press. Long-term fluctuations in the Eastern Atlantic and Mediterranean bluefin tuna population. ICES Journal of Marine Science.

Parona, P. 1919. Il tonno e la sua pesca. Memoria, R. Comitato Talassografico Italiano 68.

Sarmiento, F.M. 1757. De los Atunes y sus transmigraciones y conjeturas sobre la decadencia de las almadrabas y sobre los medios para restituirlas. Caixa de Pontevedra, Madrid. 105.

Sella, M. 1929. Migrazioni e habitat del tonno (*Thunnus thynnus*, L.) studiati col metodo degli ami, con osservazioni su l'accrescimento, sul regime delle tonnare ecc. Memoria, R. Comitato Talassografico Italiano 156: 511-542.

A contemporary account of the use of fish traps in Sicily, Italy, can be found in "Mattanza: Love and Death in the Sea of Sicily" by author Theresa Maggio (Perseus Books, \$25, ISBN 073820269X). Passages in the book describe the 1986 mattanza, or springtime harvest of giant Atlantic bluefin, from a "chamber of death" in a Sicilian tuna trap. For more information and photos, see a review of the book at <http://www.bookpage.com/0005bp/nonfiction/mattanza.html>, or visit the author's website at <http://www.theresamaggio.com/>.