

## INTRODUCTION

### 1. Taxonomy and Morphology

The bluefin tuna is a very large species that commonly reaches lengths greater than 200 cm weighing several hundred kilograms (Colette & Nauen, 1983). The all tackle angling record is a 304 cm bluefin tuna weighing 679 kg caught in 1979 off Nova Scotia (IGFA, 1995).

The colour of the back of the bluefin tuna is a dark metallic blue. The lower sides and the belly are silvery white with colorless transverse lines alternated with colorless dots. The first dorsal fin is yellow or bluish, the second is reddish brown. The anal and dorsal finlets are dusky yellow edged with black whilst the median caudal keel is black in adults.

The bluefin tuna is deepest near the middle of the first dorsal fin base. The second dorsal fin is higher than the first one. The pectoral fins are short (17 to 21% of fork length). They never reach the inter space between the dorsal fins.

Internal distinctive features of the bluefin tuna include 34 to 43 gill rakers on the first arch. The ventral surface of the liver is striated whilst the swimbladder is absent. 39 vertebrae are present i.e. 18 precaudal plus 21 caudal (Colette & Nauen, 1983).

### 2. Dynamics

#### *2.1. Geographical Distribution*

Adults bluefin tuna are encountered in temperate and subtropical waters. The Atlantic subspecies is found in the western Atlantic from Labrador and Newfoundland south into the Gulf of Mexico and the Caribbean Sea. In the eastern Atlantic, it is found from the Lofoten Islands off Norway south to the Canary Islands (Colette & Nauen, 1983). Adult bluefin tuna are also found in the Mediterranean Sea (**Fig. 0.1**).

Larvae and juveniles are found in the Mediterranean Sea and in the Gulf of Mexico. Small bluefin tuna have been found in the eastern part of the Atlantic but no larvae were encountered (Aloncle, 1964). In the western Atlantic, juveniles are thought to occur in the summer over the continental shelf, primarily from about 34°N to 41°W and offshore of that area in the winter (ICCAT, 1996).

## 2.2. Stock Structure

Scientists assume that there are 2 stocks in the Atlantic (**Fig.0.2**), considering the differences in several biological parameters (growth rates, spawning grounds and periods and age of first maturity) between the western and the eastern bluefin tuna populations and the failure of genetic studies to detect heterogeneity (ICCAT, 1995). However, small exchanges between the two stocks have been proved by:

- a) transoceanic recapture of tagged fish (Mather, 1980; Cort & Rey, 1985),
- b) overlapping of the stocks shown by the catch data (Mather *et al.*, 1974).

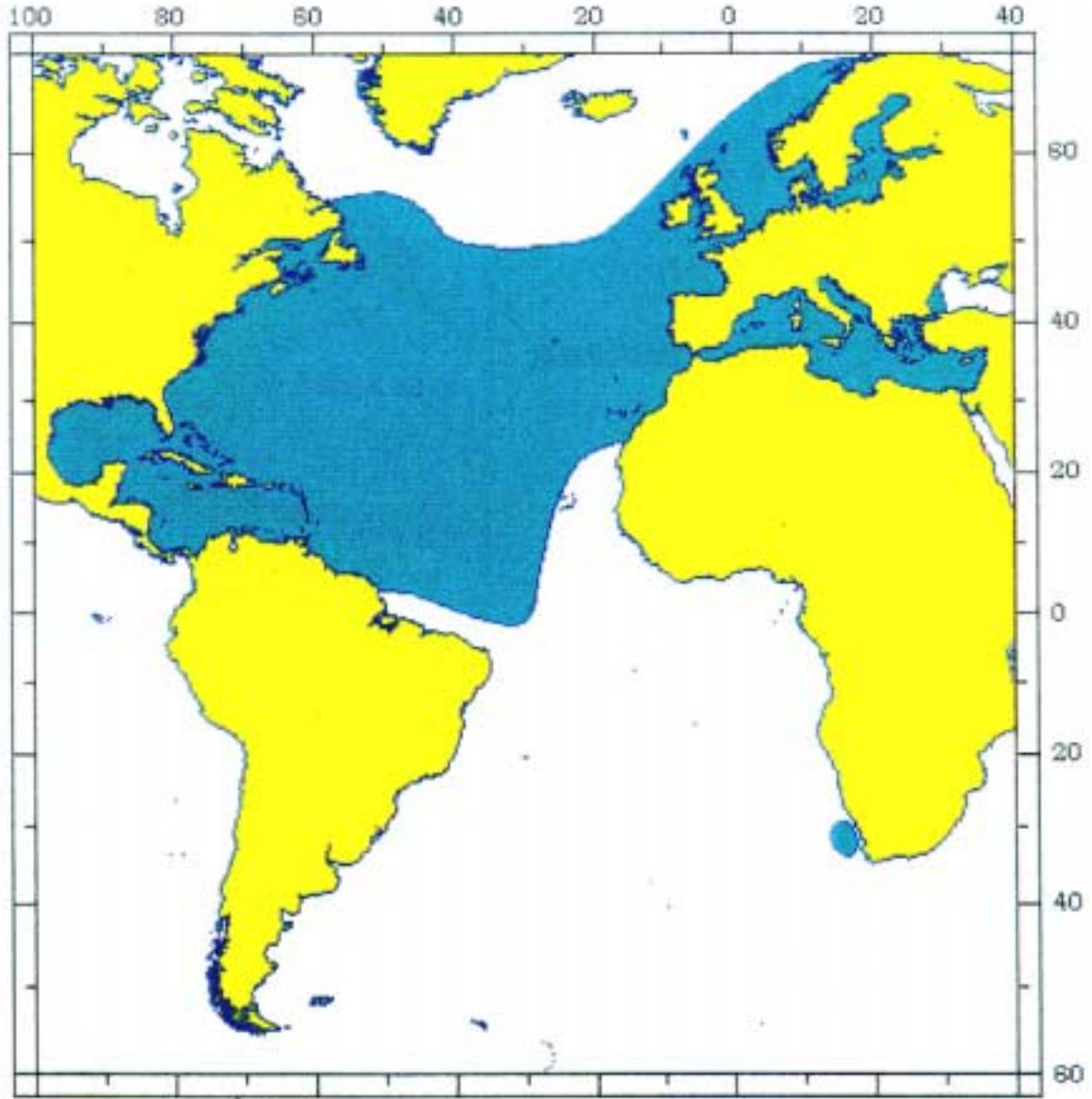


Fig. 0.1 Geographical Distribution of Bluefin Tuna in the Atlantic Ocean

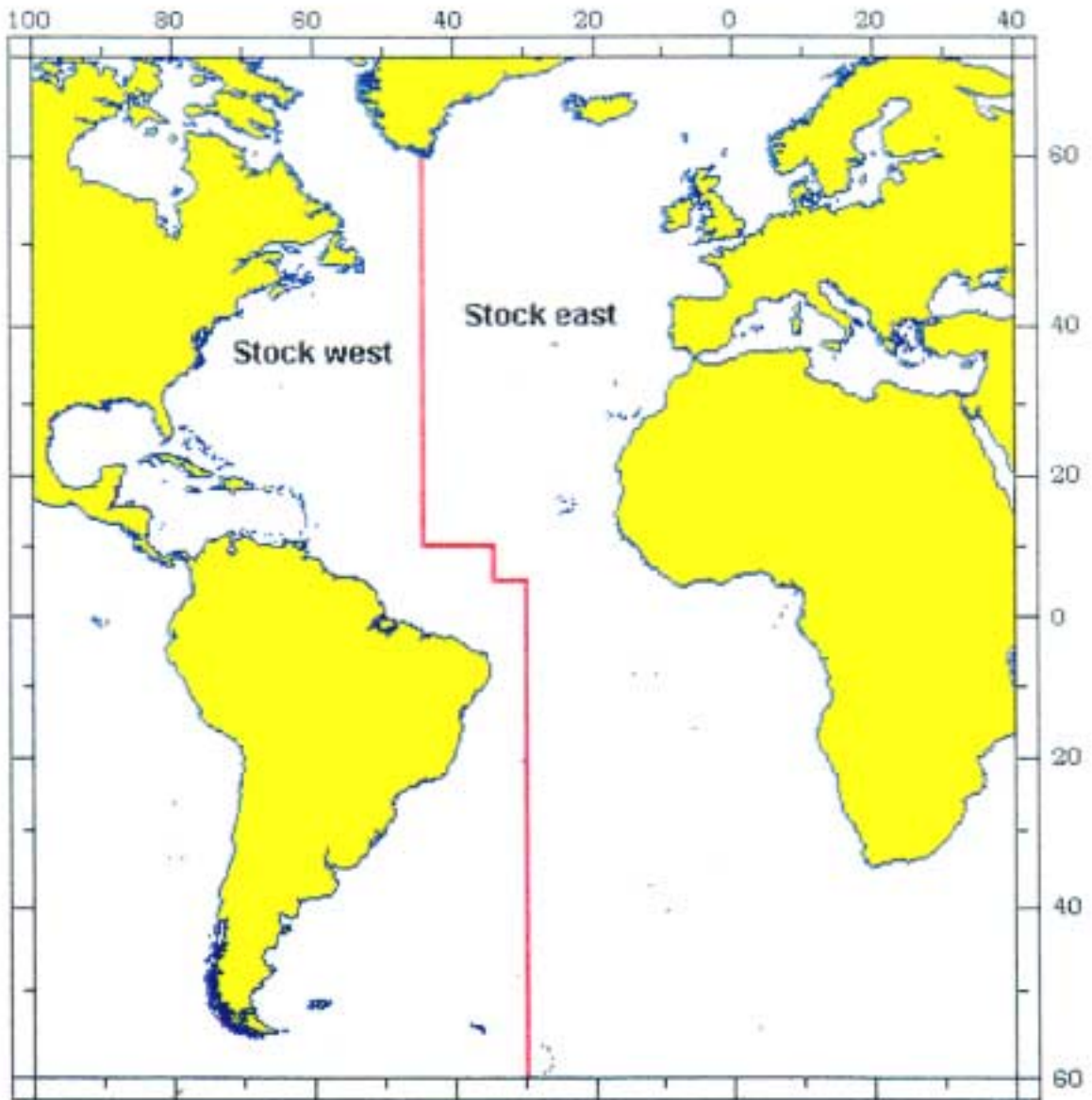


Fig.0.2 Separation of Bluefin Tuna Stocks

Therefore, knowledge of these small exchanges could affect the conclusion of future stock assessments (ICCAT, 1995).

### **3. Ecology**

The northern bluefin tuna is an epipelagic species, usually oceanic but seasonally coming close to shore and living in temperate waters (Colette & Nauen, 1983). Adult northern bluefin tuna tolerate a wide range of temperatures from 6°C to 30°C (Sharp & Dizon, 1978) and the highest catches are made in waters between 15°C and 22°C (Rivas, 1978).

Up to a size of 40 to 80 kg, northern bluefin tunas school by size, sometimes together with albacore, yellowfin, bigeye, skipjack or frigate tuna (Colette & Nauen, 1983).

Giant bluefin tuna exhibit in some cases, a rigidly defined school structure, whose degree of organisation and rules are functions of the number of individuals in the school. When hunting, the bluefin tuna can form a parabolic shape school that suggests co-operative predation. Also, the position of the fish within the schools is such that individuals benefit from hydrodynamical interactions with their neighbours (Partridge *et al.*, 1983).

### **4. Feeding and Predation**

Bluefin tunas feed on a large variety of preys, and this variation in the food spectrum is mainly attributed to behavioural differences (Colette & Nauen, 1983).

On one hand, bluefin tunas can exhibit a chasing behaviour where preys such as small schooling fishes (anchovies, sauries, hakes) or squids are vigorously chased by either isolated fish or a structured school. On the other hand, bluefin tunas can exhibit a modified filter feeding behaviour to feed on crabs and other less agile organisms (Colette & Nauen, 1983).

Bluefin tuna are usually preyed by killer whales, pilot whales and black fish (Colette & Nauen, 1983).

### **5. Growth and Natural Mortality**

Atlantic bluefin tuna can grow to over 300 cm and reach 650 kg. Western Atlantic bluefin tuna grow more slowly but generally reach a larger maximum size (ICCAT, 1996).

The oldest age considered reliable is 30 years, based on an estimated age of 2 years at tagging and about 28 years at liberty, although it is believed that bluefin tuna may live to older ages (ICCAT, 1996).

Until 1990, annual natural mortality rate was assumed to be 0.1 for assessment purposes for western Atlantic bluefin tuna and 0.18 for eastern Atlantic bluefin tuna. However since then, ICCAT assessments are calculated with a constant natural mortality for all age groups and all years equal for both stocks to 0.14 (Clay, 1991).

## 6. Reproduction

### *6.1. Spawning*

For the Atlantic bluefin tuna, only two spawning areas have been detected; the Gulf of Mexico / Florida Strait area and the Mediterranean sea (**Fig 0.3**).

Evidence of spawning in the Gulf of Mexico has been reviewed by Richards (1976 and 1987). Larvae and juveniles are found primarily in the northern region of the Gulf, with sporadic occurrences in the Florida Straits and off the Texas coast (NRC, 1994).

For the eastern Atlantic bluefin, spawning occurs in the entire western Mediterranean Sea and in the Adriatic.

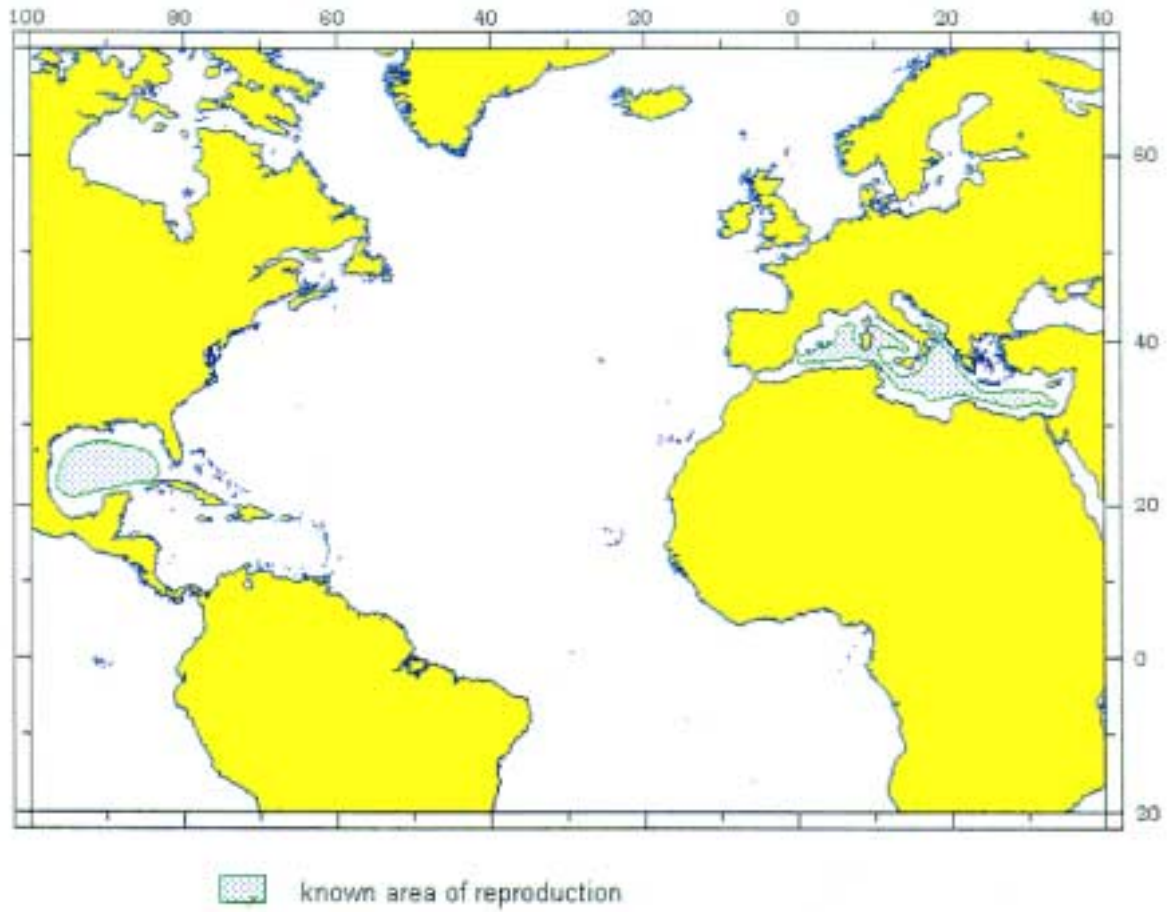


Fig.0.3 Areas of reproduction for *Thunnus thynnus* in the Atlantic Ocean and the Mediterranean Sea

No bluefin tuna larvae have been found in the eastern Atlantic ocean (Cort & Liorzou, 1990a) and therefore it is assumed that bluefin tuna do not spawn in the eastern Atlantic Ocean.

Spawning in the Gulf of Mexico occurs from mid April to mid June (Richards, 1990). In the Mediterranean Sea, it is thought to occur from June to August. Knowing that bluefin tuna can cross the Atlantic in less than 60 days, it would therefore be possible for a bluefin to spawn in the Gulf of Mexico in April, migrate to the east, and arrive in time to spawn in the Mediterranean Sea the same year (NRC, 1994).

Spawning occurs in waters of 24.9°C to 29.5°C in the Strait of Florida and in waters of 21°C in the Mediterranean Sea (Rivas, 1954).