



Thunnus Thynnus* ***The Atlantic Bluefin Tuna***



An amazing, fishy feat of nature.

****Thunnus thynnus.*** Derived from the Latin “thyno”, “to rush, to dart”.



Image courtesy of Chris Gill, Aquila Charters Mevagissey.

The return of Atlantic Bluefin Tuna (ABFT) to UK waters in the last few years has generated great interest in this iconic fish from anglers and non-anglers alike. Fishermen will spend thousands and travel across the globe for a chance to hook up to a Bluefin. They are one of the most desirable opponents in the angling world.

ABFT are the largest of all the Tuna and can grow to over 700kg, (1,500lbs), and live for up to fifty years. They can attain speeds of 70kph and dive to depths of over 1000 metres. They undertake great migrations each year, some on a par with those other great ocean travellers, Blue Whales.

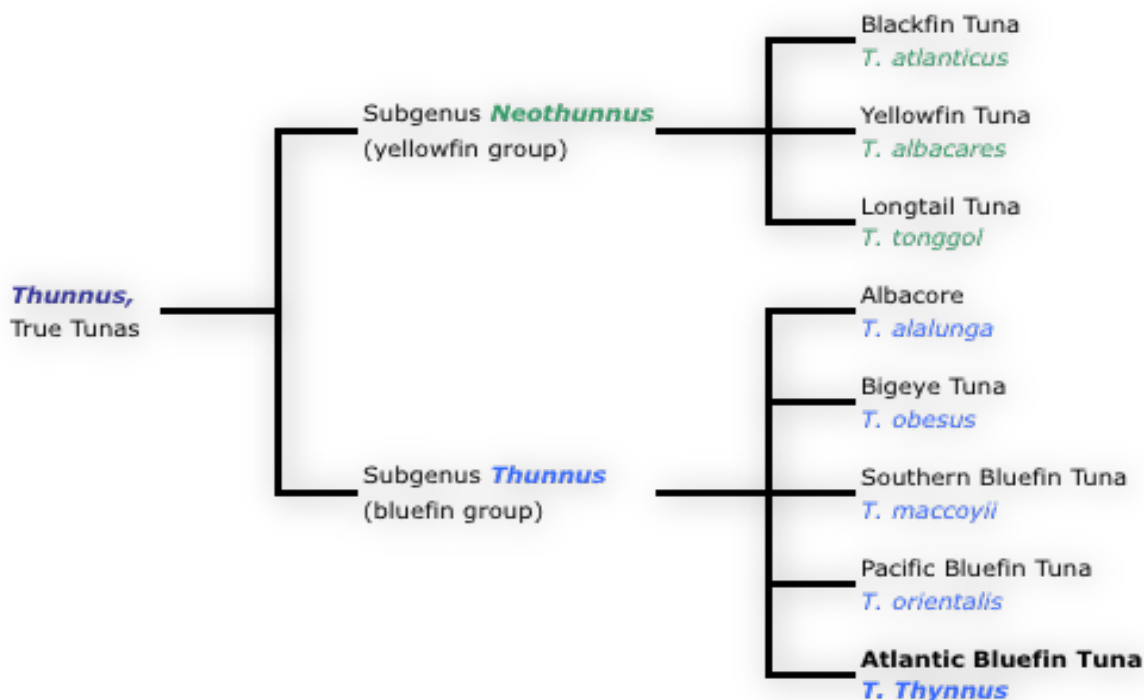
Their flesh is prized around the world for the finest grades of Sushi, creating a huge global industry that can attach incredible price tags to the best quality fish.

Their unique physiology allows them to populate a very wide geographical range. In the Western Atlantic you can find them from the Gulf of Mexico, across the Caribbean, all along the Eastern seaboard of the US, and way up into the cold waters of Canada. In the East, they are found from Morocco, across all of the Mediterranean, and closer to home, Ireland, Wales, Cornwall, Norway, Sweden and Denmark.....

Bluefin are almost unique in the geographical and water temperature range of waters they can operate in. Just how do they do this? Through a combination of physical characteristics that are unique in the fish world in their range and scale. Let's have a look at this very special fish in a bit more detail.

Their Physiology

Atlantic Bluefin are one of the 'True Tunas', the Tribe 'Thunnus'.



Perhaps the most important characteristic of the Thunnus tribe, and the one that most often surprises people, is that they are Warm Blooded.

Crucially, in addition to this, the “True Tunas” all have an ability to control their body temperature, a capability found in a very small number of fish, including some Billfish and Shark species. They are said to have an *Endothermic* capability.

Endothermic. “dependent on or capable of the internal generation of heat”.

This ability, most evident in the Bluefin sub-genus, allows them to travel and feed in a wide range of water temperatures.

Atlantic Bluefin are the masters of this amongst all Tuna. They can vary their internal body temperature between 25 and 33 degrees C, (subject to their age and size), and tolerate ambient water temperatures of up to 21 degrees cooler than their internal temperature, as long as they have a source of energy rich food.

This trait allows them to be found in waters from 6 to 33 degrees Celsius, and explains their broad geographical presence.

How do they do this? Well it is a function of a combination of remarkable features. Those features also contribute to the Bluefin’s great speed and strength.

Internal Engineering

O2, the stuff of life....

It all starts with Oxygen, lots of it! Tunas do not 'flap' their gills, but in common with billfish and some shark species, rely upon constant motion to pass water over their gills.

The gills of Bluefin are huge in relation to their size. TEN TIMES larger than those of Rainbow Trout (kg for kg). They are also incredibly thin. This huge surface area allows them to extract 50% of the Oxygen present in the water that flows across their gills, a phenomenal feat. Humans only extract 25% of the oxygen that is present in the air we breathe.

This super-oxygenated blood, like hi-octane aviation fuel if you like, then needs to be delivered and utilised by the 'engine'.

All heart....

Bluefin Tuna have big hearts, but being near their gills, close to the incoming cold water, it has to operate effectively at very low temperatures. Bluefin hearts have a super efficient intra-cellular trigger mechanism that allows them to continue pumping at very low temperatures. Their heart does slow markedly in colder water, but it continues to operate when most others would fail, and keeps that super-oxygenated blood flowing.

And a central heating system....

Perhaps the most impressive feature of Bluefin however, is the "***Rete mirabile***", ("wonderful net"). The veins of a Bluefin, carrying warmer blood that has already circulated through the body, are intertwined with the arteries, carrying the fresh, cold, oxygenated blood from the heart. This intertwining allows residual heat from the veins to transfer to the arteries, pre-warming the arterial blood on its way to the muscles. There is also an intracellular transfer of some residual O2 in the venous blood, to 'top up' the arterial flow.

So we have all this pre-warmed, super-oxygenated blood, pumped by their super efficient heart, but we need the right muscles to extract it and turn it into other forms of energy.

Nice guns....

Bluefin have a LOT of red muscle, deep into their bodies, unlike most fish which have only a narrow band below their lateral line. This red muscle is primarily for sustained motion, whilst their lesser amount of white muscle is used for high speed bursts. This extensive red muscle may also act as an oxygen reserve for when the blood flow slows at colder depths. They are also super efficient at utilising this oxygen in the 'power cells' or mitochondria and converting it into muscle energy.

All of these features, coupled with the ability to raise and lower their body temperature give Bluefin this great flexibility and stamina that allow them to travel widely across the oceans, as well as dive to great depth in search of energy rich food.

In addition to these incredible internal features, Bluefin are also special on the outside.

External Engineering

All the 'True Tunas' have a super streamlined body shape that reduces drag. Their eyes are perfectly flush with their bodies, and their dorsal and pectoral fins can fold flat into grooves on their bodies, accentuating this streamlining.



They have an ability to tense their red muscles, stiffening their body. This accentuates the power transfer of their white muscle, designed for high speed bursts. This means that at anything over a low cruising speed their bodies do not move sinuously like most fish, but instead the large tail, or caudal fin oscillates at phenomenal speeds, providing great thrust.

It is generally accepted that Bluefin can attain speeds of up to 70/80kph (45/50mph).

Studies of the small yellow caudal finlets on the rear end has shown how they move to direct water flow down around the sides of the body, and across the narrow caudal keels at the base of the tail. This effectively turbo boosts the water flow, providing more thrust. The action of the finlets may also help reduce cavitation and turbulence in the water flow. The speed and pressure of this water flow is so great that some Tuna have been found with lesions over their tail area from it.

In addition, researchers at Stanford University in California, studying the bio-mechanics of various big tunas, have discovered another feature they believe unique amongst fish. It has been found that these tuna are able to alter the stiffness of their fins by the unique use of their lymphatic system. By controlling the flow of fluid into their fins, they can alter the resistance of their fins as required by the speed they are swimming at.

Inside and out, Atlantic Bluefin Tuna are incredible engineering feats of nature, and are truly a king amongst fishes.

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