



The Atlantic bluefin tuna

Thunnus Thynnus*

Derived from the Latin "thyno", "to rush, to dart".

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Atlantic bluefin tuna are now in the seventh year of their seasare an iconic fish, one that seems to defy the conventional thinking around what a fish can do. They have many attributes unique to them and their favourite sub genus Thunnus cousins.

Consequently there is much misunderstanding and myth about Atlantic bluefin, and we get a lot of questions about how and why they exhibit certain behaviours and attributes. To try to answer some of those questions we put together the article here. We hope you find it of interest and that it answers some of the questions you may have.

Who are 'we'?

The UK Bluefin Tuna Association is a not-for-profit membership organisation established by anglers, charter skippers and fishing organisations to represent anglers interests in relation to bluefin.

Its mission is to campaign for a sustainable management strategy, to support research into their presence here, and to seek the establishment of a **recreational catch and release fishery** for them our waters.

The people behind the UKBFTA set up 'BFT UK' back in 2018 and engaged with government bodies, lobbying to have anglers voices heard. We gathered cross party political support and a seat at important policy making tables and meetings with senior UK Government officials including Fisheries Ministers.

We won, co-designed and delivered with DEFRA, CEFAS and other bodies the hugely successful English 2021 Catch And Release Tagging ('CHART') programme. We have subsequently secured an expansion of the English programme in size and season length, and the establishment of CHART programmes in Wales and Northern Ireland in 2022.

We claim no monopoly on representing anglers and skippers interests, but believe we incorporate in our ranks the greatest combined expertise in the UK, on the science, regulations and fishing for bluefin, have a proven track record in working with political representatives, government departments, E-NGO's and other bodies to ensure that an evidence based approach is used in determining policy.

An amazing fishy feat of nature

They're here!

From around 2013 reports of Atlantic bluefin tuna (ABFT) in UK waters began to appear in the media. The last consistent sightings of this iconic species in our waters had been in the mid 1950's, bringing to an end a 20/25 year period when hundreds of bluefin were caught

led to the establishment of a Catch And Release Tagging programme ('CHART') in the SouthWest of England in 2021.

'CHART' illustrated the extent of the presence of bluefin with over 700 being caught, tagged and released in a limited scale three month effort. The English programme was expanded in 2022 and



each autumn off the North East coast. In October 2016 I heard reports that large numbers of Atlantic bluefin had been present in Falmouth Bay for some days.

I saw for myself dozens of 200-300lb bluefin chasing prey, leaving behind great slicks of oil from their unfortunate targets.

2016 really marked the beginning of a shift in their migratory patterns that has seen increasing numbers of bluefin visiting the Western waters of the UK from late summer each year, often staying into the depths of winter.

A research programme 'ThunnusUK' was established in 2018 to gather data on these fish, and increasing interest from anglers in the following few years

joined by similar operations in Wales and Northern Ireland.

Some seven years after their return to our waters, anglers, tourists and locals are still catching their breath at the sight of thousands of these fish leaping from the surface in pursuit of their prey, from the South West of England, through Welsh waters and on into the waters off the Scottish Outer Hebrides.

But just what do we know about these amazing creatures? Whilst the angling based research seeks to gain knowledge regarding the When? Where? Why? of their presence, those of us who are fortunate enough to have had 'close encounters' with them in the research fisheries continue to be amazed by the physical attributes of these majestic fish.

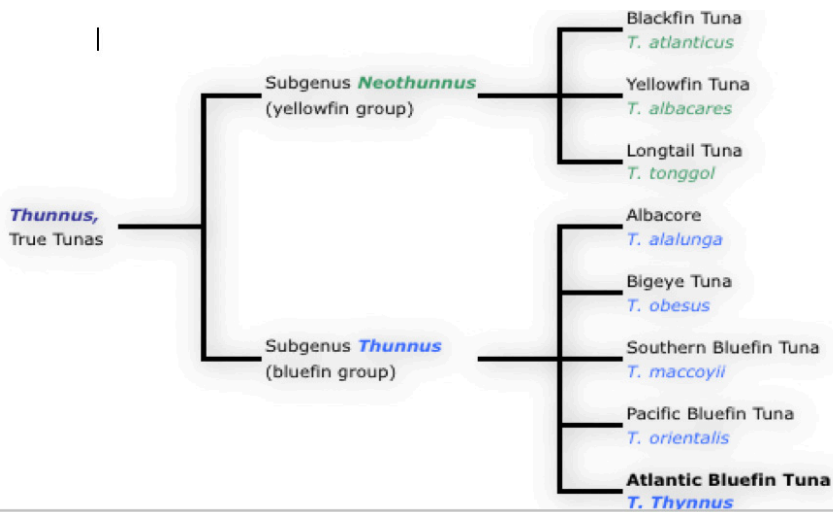


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A very Special Fish



Atlantic bluefin 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 around 70kph (45mph) and dive to depths of over 1000 metres, (1,100 yards or 3,300ft). 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, Cornwall, Devon, Wales, Scotland, Ireland, 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.

Physiology

Atlantic Bluefin are one of the 'True Tunas', the tribe 'Thunnus'!

Perhaps the physical attribute of the 'True Tunas' 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.

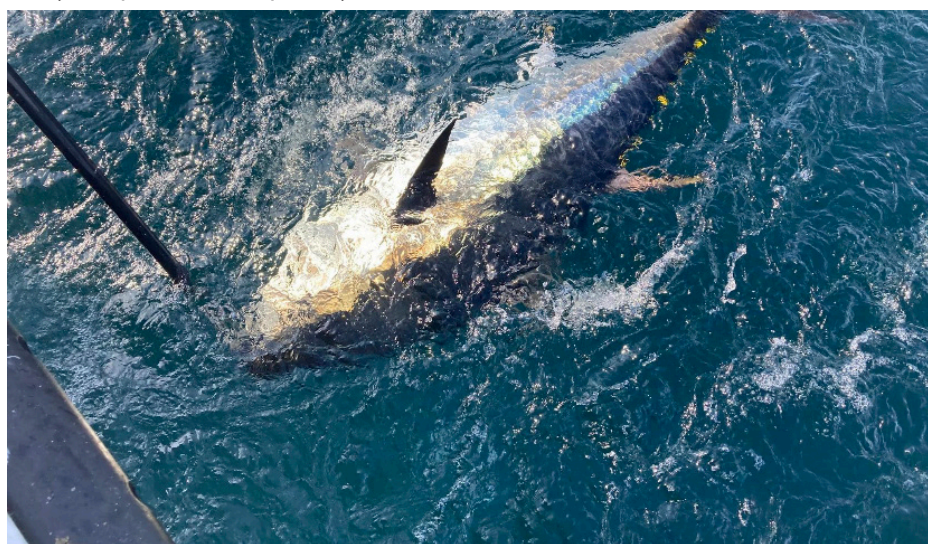
Endothermic. "dependent on or capable of the internal generation of heat".

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

Atlantic Bluefin are the masters of this amongst all tuna and explains why they can be found from the equator to the arctic circle, in waters varying from 6 to 33 degrees Celsius in temperature.

In addition to the geographical range this permits them to inhabit, it also allows them to undertake deep dives to over 1,000 metres in search of prey. The range, depth tolerance, speed and stamina of Atlantic bluefin are 'off the scale' in the fish world, just how do they do this?

Well it is a function of a combination of remarkable features, internal and external, below we will briefly examine these features.





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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. They are 'ram ventilators'. Simply put, they have to swim to breath, and spend their lives in constant motion.

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. In contrast, us humans only extract 25% of the oxygen that is present in the air we breathe.

Their super-oxygenated blood is vital to bluefin and combined with the huge amounts of high calorie prey they consume, powers the incredible machinery of their bodies. This oxygen however needs to be delivered and utilised effectively to help fuel those vital processes.

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 and intense pressure.

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. Even at 1,000 metres deep, they can keep pumping that vital blood around their bodies.

A central heating system....

Perhaps the most impressive feature of Bluefin however, is the "Rete mirabile", ("wonderful net"). This is not only at the heart of that 'Endothermic' capability we mentioned, the ability to control

their inner temperature, but carries out several other important roles.

The venous blood of a bluefin has been warmed by the activity of all those huge red muscles, and the veins carrying that warmer blood are intertwined with the arteries, carrying the fresh, cold, highly oxygenated blood from the heart. This intertwining allows residual heat from the venous blood to transfer to the arterial blood, pre-warming it 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.

This 'prewarming' of the blood improves the efficiency of many physical operations in the bluefin's system, from

the ability to warm the gills, improving efficiency regarding O₂ extraction, of muscles to turn 'fuel' into 'energy' and the warming of the brain and eyes, (maintaining their incredible visual acuity).

Vitality the 'tweaking' of this system allows Atlantic bluefin to vary their internal body temperature between 25 and 33 degrees Celsius, (subject to their age and size).

As long as they have a source of energy rich food to fuel all these processes their range of unique features, (such as that amazing heart structure), allow them to tolerate ambient water temperatures of up to 21 degrees cooler than their internal temperature. This allows them to be found in water ranging from 4-5 degrees up to 33 degrees and explains their broad geographical presence.

It is worth noting that species such as yellowfin tuna (that observers often claim to see in UK waters), do not exhibit these characteristics to anywhere near the same degree as the bluefin family, especially the Atlantic bluefin. In terms of physiological development they parted company with the bluefin family tens of thousands of years ago and occupy a very different ecological niche.

They are more accurately described as a 'tropical tuna' and require a consistent minimum temperature of around 18 degrees celsius to function effectively. Whilst late summer water temperatures in the UK may reach and exceed those levels at the surface, even 100 feet down this is not the case. Never say never, but Yellowfin are an unlikely and probably very rare visitor to UK waters.

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.



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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 also acts as an oxygen reserve which is especially helpful 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 depths 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, aided by powerful, thick tendons, providing great thrust.

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

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 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, discovered as recently as 2017, another incredible feature of bluefin physiology. 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, a biological hydraulic system if you like, they can alter the resistance of their fins as required by the speed they are swimming at.

What next?

In the same way that research in just the last 6-7 years is causing a major rethink in the 'received wisdom' regarding many aspects of Bluefin 'lifestyle', we may well yet have more to discover regarding the physical attributes of these amazing fish.

Some scientists are questioning whether Atlantic bluefin have additional spawning areas, some of which may lead to a rethink regarding the habitat and environmental conditions required for spawning, others that bluefin may not spawn every year.

Both of these may yet cause a re-examination of what we thought we knew about their reproductive systems and be of great importance for the stock assessments and management of this species.

What is known for sure is that we are now in a period when much of the knowledge we thought we had re Bluefin is being questioned and re-examined. New technologies and platforms for science are contributing to a renaissance in research into Atlantic bluefin.

Anglers are at the forefront of that change with the unique platforms they provide to examine and monitor bluefin via their fishing activities.