ÜBER-FISH

Among the World's Most Popular Game Fishes, Tunas Are Also Some of the Most Highly Evolved and Sophisticated of All the Ocean's Predators

BY

DANIEL GOEZ

That the ocean's most advanced and highly developed swimming machines are also among the most popular of game fishes with the world's saltwater angling enthusiasts is hardly a coincidence. As anglers, we have tremendous respect for the spirited fighting qualities of tunas — difficult to release, should we wish to, because they truly will fight their hearts out when hooked. So what is it that makes tunas the über-fish of our oceans? The more we learn about our favorite game fish, the more fascinating they are.

The Family Tree

Tunas are part of the family Scombridae, which also includes mackerels, large and small. But there are tunas, and then there are, well, "true tunas."

That is, two groups (sometimes known as "tribes") dominate the tuna clan. One is Thunnini, which is the group considered true tunas, characterized by two separate dorsal fins and a relatively thick body. The 15 species of Thunnini are albacore, bigeye, black skipjack, blackfin, bluefin (three species: Atlantic, Pacific, southern), bullet, frigate, kawakawa, little tunny, longtail, skipjack, slender and yellowfin.

The other tribe is Sardini; these tunas — the dogtooth tuna and several species of smaller true bonitos — are somewhat more mackerel-like (notably, with a more elongated body and a row of sharp, conical teeth).

Swimming Machines

Sport fishermen know that when they hook a large tuna, they're in for a long, drawn-out, relentless battle. Nothing characterizes tunas more than their powerful, tireless swimming. In fact, these fish have no choice but to swim endlessly: As explained more thoroughly below, they're ram ventilators, meaning forward motion is required as they move with mouth open to force water past their gills.

Most fishes, such as groupers, snappers and jacks, can remain motionless and respire by opening and closing their mouths to push water through their gills. Tunas have lost the ability to do that (even if they could, such small pushes of water wouldn't offer their large gills the tremendous flow they require to supply their systems with oxygen). A suitable motto for tunas, then, is "swim or die."

How tunas have evolved to move efficiently through the water is reflected in their design, both externally and internally. As the illustration (page 81) shows,

JASON STEMPLE (TOP), LANDON COHEN (BOTTOM)

a number of highly specialized features facilitate these swimming machines.

Of their fusiform body shape (tapering fore and aft), *Sport Fishing* Fish Facts expert Ben Diggles says, "Their almost perfect hydrodynamic shape minimizes drag with a very low drag coefficient," optimizing efficient swimming both at cruise and burst. While most fishes bend their bodies side to side when moving forward, tunas' bodies don't bend. They're essentially rigid, solid torpedoes.

And these torpedoes are perfectly streamlined, their larger fins fitting perfectly into grooves so no part of these fins protrudes above the body surface. They lack the convex eyes of most fish; rather, a membrane covering tuna eyes remains flush with their heads, maintaining a surface with minimal drag.

Keels and finlets in front of the tail provide stability and help reduce the turbulence in the water ahead of the tail.

Unlike most fishes with broad, flexible tails that bend to scoop water to move a fish forward, tunas derive tremendous thrust with thin, hard, lunate (crescent-moon-shaped) tails that beat constantly, capable of 10 to 12 or more beats per second. That relentless thrust accounts for the unstoppable runs that tuna make repeatedly when hooked. Anyone who has gaffed a tuna, large or small, will recognize the staccato rat-a-tat-tat its tail continues to beat out on deck after its capture, as even then it keeps on "swimming," because,

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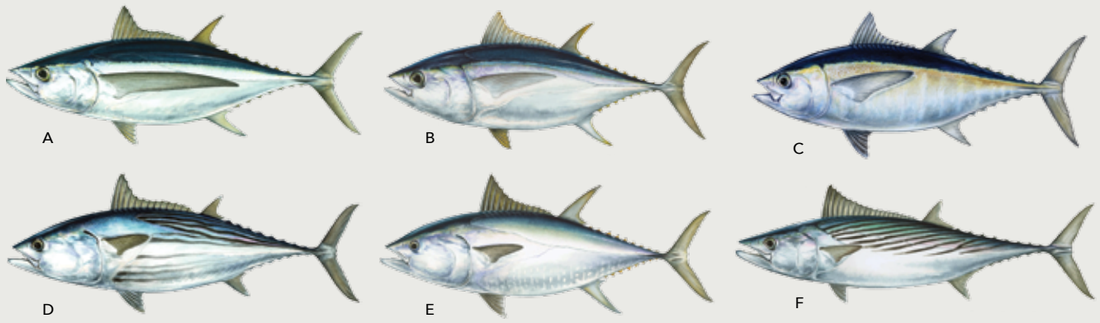
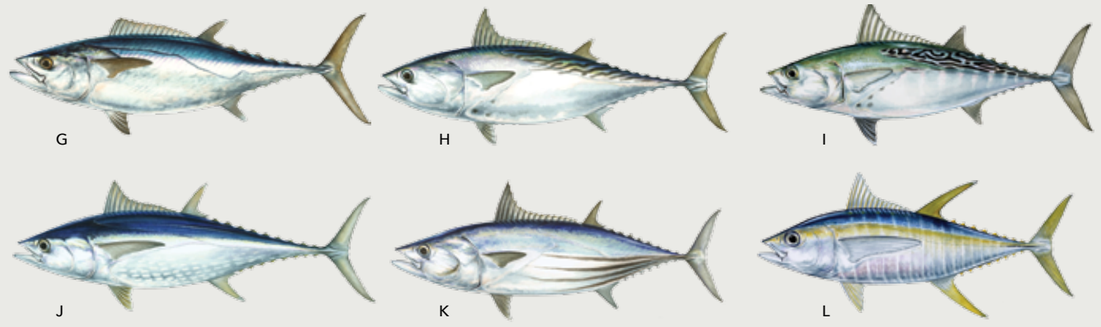
WHILE MOST FISHES BEND THEIR BODIES SIDE TO SIDE WHEN MOVING FORWARD, TUNAS' BODIES DON'T BEND. THEY'RE ESSENTIALLY RIGID, SOLID TORPEDOES.

Above: The similarity of this small tuna to a model airplane is no accident. Both bear similarities in streamlined design for efficient, rapid forward motion. Right: The king of tunas, Atlantic bluefin may range from "small giants" like this one to at least 1,500 pounds.

The Tuna Tribe





(A) ALBACORE
(Thunnus alalunga)

IGFA all-tackle record: 88 pounds, 2 ounces – Canary Islands, 1977

Easily identified, having by far the longest pectoral fins of any tuna, albacore are also noted for the lightest, whitest flesh among tunas. Circumglobal, albacore prefer temperate (versus tropical) seas and rarely venture near shore. They've long been a popular target for California anglers, particularly off the central part of the state, but their availability in the summer varies greatly from year to year. Later in summer and fall, albacore move up into waters off Oregon, Washington and British Columbia but are often too far offshore for most.

(B) BIGEYE
(Thunnus obesus)

IGFA all-tackle records: Atlantic – 392 pounds, 6 ounces, Canary Islands, 1996; Pacific – 435 pounds, Cabo Blanco, Peru, 1957

Bigeye may be confused with yellowfin, but their yellow finlets are edged in black and their eyes may indeed be a bit larger. The bigeye may also be more robust in its body shape. But the single sure way to distinguish the two species is underneath the skin: The bigeye's liver is striated (striped or streaked); the yellowfin's is not. Found worldwide, this prized game fish is also an important target for commercial longliners.

(C) BLACKFIN
(Thunnus atlanticus)

IGFA all-tackle record: 49 pounds, 6 ounces – Marathon, Florida Keys, 2006

Blackfin are also similar in appearance to small yellowfin, but the blackfin's finlets are dark rather than bright yellow. The species is limited to the western Atlantic, most commonly from the mid-Atlantic states south to Brazil, including the Gulf of Mexico. Blackfin often form large schools, sometimes mixed with little tunny, around offshore structure and reef drop-offs. They're an important and popular sport fish for the South Atlantic and Gulf states.

(D) BLACK SKIPJACK
(Euthynnus lineatus)

IGFA all-tackle record: 26 pounds – Baja California, Mexico, 1991

This species is one of the few tunas limited to the eastern Pacific, found in waters off California to Peru. The black skippy can be identified by the four or five broad, straight stripes that extend horizontally along its back. A hard-hitting, fast-moving predator, smaller skipjack are popular among anglers for use as live bait for billfish and large yellowfin. The strong dark-red flesh is not appealing to most fishermen.

(E) BLUEFIN
(Thunnus thynnus)

IGFA all-tackle record: 1,496 pounds – Nova Scotia, Canada, 1979

The king of tunas, giant bluefin are for many anglers the ultimate prize among all game fishes. Ditto for sushi eaters, who at market may bid hundreds of thousands of dollars for a single giant. (In 2013, a Japanese businessman coughed up $1.76 million for a 488-pound bluefin during a bidding war in Tokyo's first auction of that year.) There's some irony in the fact that before the latter part of the 20th century, sport fishermen had no use for giant bluefin, which at best were reduced for pet food, being considered unpalatable. Go figure. Bluefin mature at about six years of age, around 300 pounds. Atlantic bluefin spawn in the Mediterranean and Gulf of Mexico, and are now believed – per the research of scientist Molly Lutcavage – to spawn in the western Atlantic as well. They're not terribly picky eaters, devouring even very small baitfish, and invertebrates, including starfish, have shown up in stomach analyses. Bluefin range from far offshore to near-coastal waters. The three species of bluefin (Atlantic, Pacific and southern) tolerate a great range of temperatures and migrate great distances, across both oceans. Satellite tags have revealed transatlantic crossings in less than 60 days. Decades ago, giants made a reliable migration each May off Bimini and down the Florida Strait, but that suddenly came to an end after the 1960s.

(F) BONITOS
(Sarda spp)

IGFA all-tackle records: Atlantic – 18 pounds, 4 ounces, Azores, 1953; Pacific – 21 pounds, 5 ounces, Southern California, 2003

In addition to the Atlantic bonito, there are three other species of Sarda (Pacific, striped and Australian). These four true bonitos are related to dogtooth tuna and share that species' shape – more elongated than other "true" tunas – and somewhat non-tuna-like sharp-toothed dentition. All are small coastal pelagics; all make outstanding light-tackle game fish and (even if not universally appreciated) fine table fare as sashimi or cooked.

(G) DOGTOOTH
(Gymnosarda unicolor)

IGFA all-tackle record: 236 pounds, 15 ounces – Tanzania, 2015

That the Indo-Pacific dogtooth (along with true bonitos – basically smaller versions) belong in a different group from bluefin, yellowfin and relatives isn't hard to imagine. Unlike those true tunas, dogtooth are longer, leaner and maybe even meaner. Per its name, check out its dentures, most impressive of any tuna. Also, dogtooth are far more solitary, and unlike most tunas are not a schooling species. Finally, they prefer to haunt steep reef slopes; anglers needn't travel far offshore to tangle with doggies. A fine eating fish, dogtooth are known for their brutal power when hooked.

(H) KAWAKAWA
(Euthynnus affinis)

IGFA all-tackle record: 33 pounds, 3 ounces – Hawaii, 2014

Known as mackerel tuna in Australia, the kawakawa – native to the Indo- and western Pacific – is similar to the little tunny of Atlantic waters. It is also a dark-meat species, though popular among many anglers for food, as in Hawaii. Kawakawa are, typically, tremendous fighters for their size. Kawakawa mostly inhabit coastal reefs and may even move into estuaries.

(I) LITTLE TUNNY
(Euthynnus alletteratus)

IGFA all-tackle record: 36 pounds – Washington Canyon, New Jersey, 2006

A fish of many names, little tunny are known as false albacore off the U.S. Northeast and mid-Atlantic states, where they're a very popular game fish among light-tackle and fly anglers. In the Southeast and Gulf, they're mislabeled bonito, and generally avoided. Yet they are tremendous fighters for their size, battling in classic tuna fashion. Little tunny are readily identified by the wavy lines along their upper back, behind the dorsal, and the spots between pectoral and ventral fins. Small tunny are also popular as baitfish, drifted live or trolled dead. They form and feed in tight schools, often churning the surface as they gorge on baitfish. The dark-red, bloody meat of little tunny keeps them out of fish boxes.

(J) LONGTAIL
(Thunnus tonggol)

IGFA all-tackle record: 79 pounds 2 ounces – New South Wales, Australia, 1982

The longtail inhabits the Indo-Pacific, quite near shore, even prowling estuaries and river mouths, where it often roams in large shoals. A popular game fish among Australians, the species is there labeled northern bluefin, though it is not a species of bluefin.

(K) SKIPJACK
(Katsuwonus pelamis)

IGFA all-tackle record: 45 pounds, 4 ounces – Baja California, Mexico, 1996

With distinct horizontal stripes limited to its lower half (and no stripes dorsally), the skipjack is readily distinguished from other small tunas. One of the most widely dispersed of small tunas, the skipjack is found in all temperate and tropical seas, where it often forms huge schools. Not all anglers realize that its light meat should make it a preferred species for the fish box. The skipjack is of huge importance globally as a commercial species, with great tonnage ending up canned.

(L) YELLOWFIN
(Thunnus albacares)

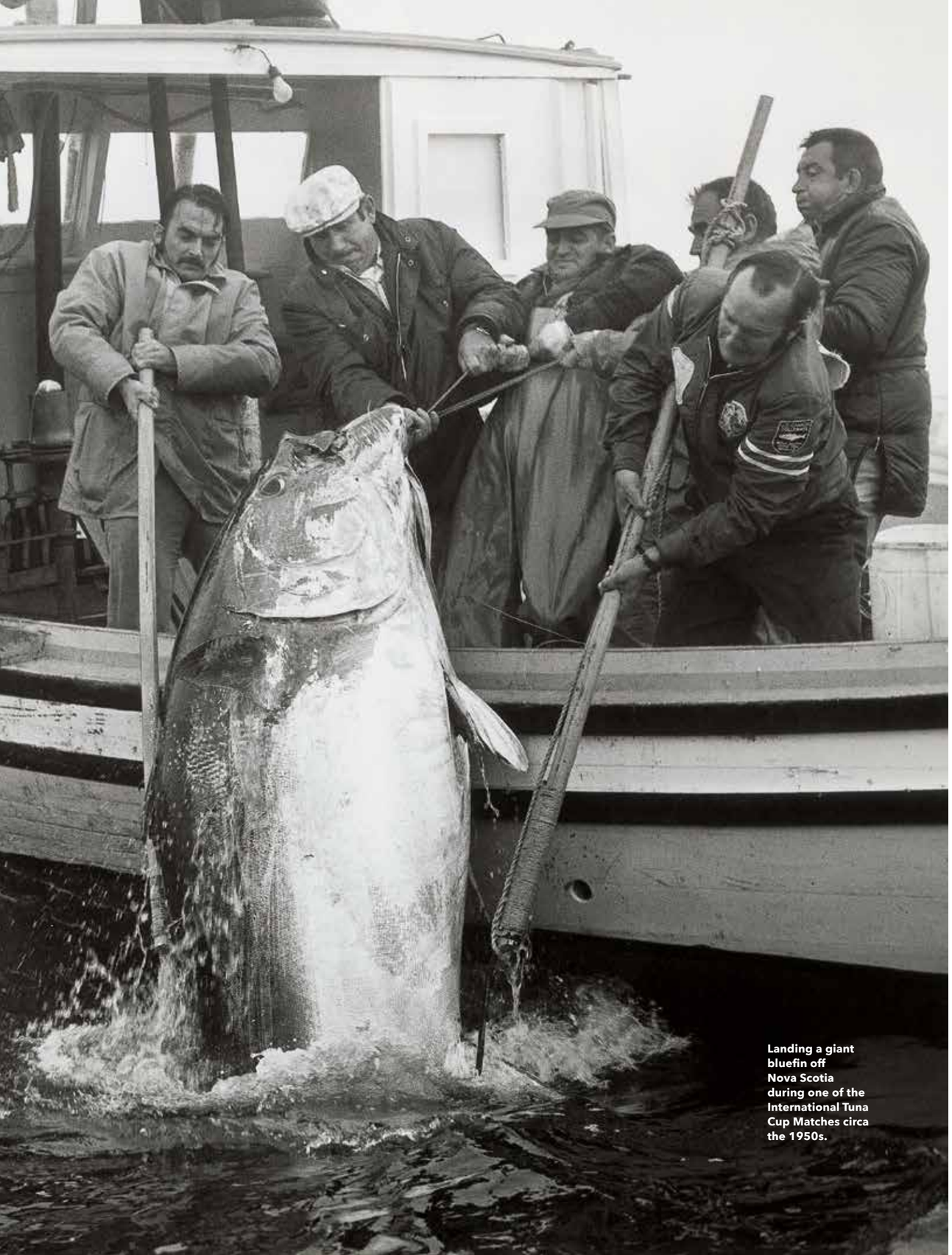
IGFA all-tackle record: 427 pounds – Cabo San Lucas, Mexico, 2012

Named for its bright-yellow finlets, the yellowfin is fantastically popular among anglers who fish tropical seas around the world. Their habit of schooling and feeding at the surface makes yellowfin particularly exciting targets for run-'n-gunners. Yellowfin are decidedly bluewater pelagics but may move into coastal waters at times. The fast-growing tuna can reach 200 pounds in seven years. Anglers in eastern Pacific waters take advantage of the yellowfin symbiotically feeding with dolphin (porpoise). From years spent as an observer for the Inter-American Tropical Tuna Commission, California photographer, writer and angler Bill Boyce says tuna definitely follow dolphin (not vice versa). The tuna seem to understand that dolphin will find the baitfish; the tuna then help corral the bait, pushing it to the surface.

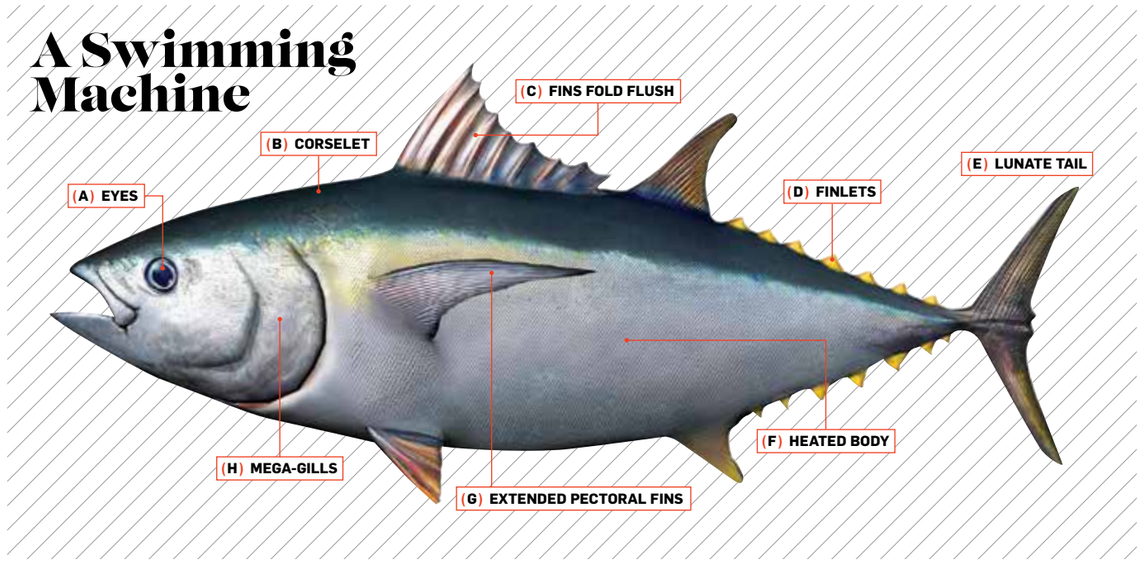
OTHER TUNAS

There are several other species of very small tuna, generally not commonly caught or of less interest to anglers. These include the little bullet tuna (*Auxis rochei*), frigate tuna (*Auxis thazard*) and slender tuna (*Allothunnus fallai*), the latter found in cooler waters of southern oceans (one was caught in Los Angeles Harbor, though as pelagic-fish expert John Graves, of the Virginia Institute of Marine Science, speculates, it was likely dumped from the baitwell of a boat returning to port).

ILLUSTRATIONS: DIANE PEEBLES



Landing a giant bluefin off Nova Scotia during one of the International Tuna Cup Matches circa the 1950s.



(A) EYES: Flush with body; no protrusion to cause additional turbulence. (B) CORSELET: A patch of specially modified (larger, thicker, hollow) scales just behind the head of large tunas may break up turbulence around the widest part of the body to reduce drag when swimming and may also help heat conservation. (C) FINS FOLD FLUSH: Dorsal and pectoral fins fit perfectly into grooves so no part of them protrudes to avoid any extra drag, but they can be extended when needed for greater maneuverability. (D) FINLETS: Create slight turbulence to create a smoother path for the tail. (E) LUNATE TAIL: A rigid design that maximizes thrust and efficiency. (F) HEATED BODY: Larger tunas are warmblooded; vascular heat exchangers that maintain temperatures in selected body regions higher than surrounding water offer many advantages, including stabilizing body temps and warming the cool blood coming from the gills when cruising (but when chasing prey or fighting an angler, working in reverse to dissipate heat to surrounding water to prevent overheating). (G) EXTENDED PECTORAL FINS: Act as lifting hydrofoils (compensating during their ceaseless forward motion for lack of a swim bladder). (H) MEGA-GILLS: Roughly 10 times larger than gills of most (ectothermic, or coldblooded) fishes, these meet huge, incessant demands for oxygen.

ILLUSTRATION: KEVIN HAND; PHOTOS: © SCOTT KERRIGAN / WWW.AQUAPAPARAZZI.COM (BOTTOM RIGHT), COURTESY IGFA / IGFA.ORG (OPPOSITE)

well, that is what tunas do.

As with other fast-swimming fishes, a primary limitation on top speed for tunas is cavitation, which at high speeds can slow them and even damage fins. (Cavitation is caused when negative pressure forms tiny air bubbles, which then collapse and form shock waves. Just as cavitation can damage the metal in propellers, it can cause lesions in the fins of fish that swim "too fast," such as tunas.)

Under the Hood

While many of the characteristics that account for the tuna's remarkable swimming ability are visible externally, some of the most astonishing adaptations are internal.

Certainly, that includes their extensive aerobic red muscle. Many fishes are ambush predators, relying on bursts of speed to feed but swimming slowly otherwise. Their bodies are mostly filled with white muscle — glycolytic fibers used in infrequent burst swimming. Tunas employ far more red muscle; their oxidative fibers prove ideal for long-haul, constant swimming without fatigue. Also, red muscle is full of myoglobin, which stores oxygen in the muscle tissues, for use as needed.

With so much red muscle demanding that much more oxygen, tunas' gills — their organs for respiration, of course — are huge. For example, a tuna has seven to nine times more gill area for its size compared to relatively sedentary trout. And, not surprisingly, you've gotta have heart: Moving great amounts of oxygenated blood through their bodies requires tunas to have far larger hearts than most fish. Not only that, but another way tunas have advanced beyond most fishes — which have a constant heart rate — is their ability, like mammals, to vary their heart rate, maximizing efficiency.

Hotblooded

Arguably the most striking and sophisticated adaptation we can't see — but science has revealed — is the ability of larger true tunas to heat certain areas of their bodies. They do this through what are known as the retia mirabilia ("wonderful net"), an ingenious counter-current vascular heat-exchange system. Basically, parallel veins and arteries exchange blood, allowing tunas to conserve metabolic heat via what

Unlike the white meat of often motionless ambush predators such as grouper, the red-pink muscle of tuna is designed for tireless, long-haul swimming.

Top: The astounding annual run of giant bluefin off Bimini every year into the 1960s thrilled anglers to see (and hook) such huge fish in the clear shallows. Above: Few fish better suggest the proverbial junkyard dog than the dogtooth tuna. Right: While they don't jump when hooked, yellowfin often launch repeatedly when chasing baitfish.

is called regional endothermy, warming their red muscle tissue, brain, eyes and viscera well above ambient water temperatures.

This gives them the same metabolic advantage that *Homo sapiens* and other mammals enjoy. In fact, tunas couldn't sustain the swim-or-die lifestyle nor be the relentless eating machines they are without that higher metabolic rate, allowing them to swim longer and faster, their brains and eyes to function better in cold water, and their viscera to digest more quickly and efficiently.

Further demonstrating the brilliance of their plumbing, larger tunas can shed excess heat from their bodies during periods of intense feeding (in essence, while doing wind sprints) via their retia mirabilia, which use blood from gills cooled by ambient water to reduce body heat. This system also undoubtedly comes into play as one factor in the amazing endurance that hooked tunas show to resist their capture.

Diving Deep, Wandering Wide

Much of the evolutionary success of tunas derives from their ability to transition from warm to cool waters in a way that most — less advanced, coldblooded — fishes can't manage.

Satellite tagging has revealed much about the feeding behavior and movements of large tunas, including their tendency to dive into deep, cold water. Scientists have documented that yellowfin feed at times in waters much deeper than once believed, but the bigeye is a champ in the deep-dive category, often feeding in waters exceeding 1,500 feet — and diving to more than 5,000 feet.

Apparently, these daytime deep divers are taking advantage of what's known as the deep-scattering layer, a concentration of biomass (plankton and larger organisms) typically settling by day into 1,500 to 2,000 feet of water (which rises to or near the surface nightly). This is the same DSL in which swordfish feed during the day. Perhaps not so surprisingly, daytime swordy anglers have been hooking some large tuna while dropping deep.

The other abyss-loving tuna is the bluefin. What large yellowfin, bigeye and bluefin have in common that enables them to feed at great depths is *body mass*. Juveniles and smaller species of tuna, lacking that, lose body heat too rapidly to allow them to leave near-surface waters for long.

Heat is lost in the frigid waters at depth, but rewarming occurs when tunas move up into warmer waters — where heating occurs at 100 to 1,000 times the rate that it's lost. (This may be facilitated with blood bypassing lateral heat exchangers, so blood warmed and oxygenated in the gills by ambient, warmer waters enters the red muscle directly.)

What large tunas have in common that encourages them to feed so deep is simply an abundance of food in these cold but productive waters.

The same holds true for horizontal movements as well as vertical dives into colder waters. So, for example, in the North Atlantic, the world's largest giant bluefin are caught at the most northerly edges of the species' range — the Canadian Maritimes — and in the South Pacific, the largest giants come from the most southern part of the southern bluefin's range — off New Zealand's South Island. In both instances, only the great body mass of giants provides enough thermal inertia — a small enough ratio of surface area to volume to prevent rapid cooling — so they can take advantage of vast schools of prey.

Large tunas are truly superfish, at the zenith of evolutionary design and success as predators among the ocean's fishes. Little wonder they're among the very most popular targets worldwide among saltwater recreational fishermen. The more we as anglers understand these magnificent fish, the more we can appreciate the opportunity to fish for and catch them.

LARGE TUNAS ARE TRULY SUPERFISH, AT THE ZENITH OF EVOLUTIONARY DESIGN AND SUCCESS AS PREDATORS AMONG THE OCEAN'S FISHES.

Is Disaster Imminent for Tunas?

Tunas occasionally make it into mainstream news, and when they do, the circumstances (for continued survival of the species) usually sound pretty dire. However, a scientist at the University of Washington, on cfooduw.org, found that, at least through 2014 (per available data), only eight of 22 commercial tuna stocks had an abundance below that which would produce maximum sustainable yield. Two stocks, says Ph.D. candidate Maite Pons – Pacific bluefin and bigeye in the western central Pacific – are fished hard enough to threaten their collapse. But that's two of 22. She concludes by saying, "The abundance of tunas and their relatives has declined from preindustrial levels, but in general, they are at sustainable levels," with a few noted exceptions (and some showing signs of rebuilding at this time).

COURTESY IGFA / IGFA.ORG (TOP LEFT), DAVID GRANVILLE (ABOVE LEFT), JESSICA HAYDAHL (RIGHT)