

THE IN A HURRY SERIES

Shipwrecks

in a Hurry

The archive at the bottom of the sea

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The Whole Thing in One Page

A shipwreck is usually pictured as a ship with the water added: hull upright, masts leaning, treasure waiting in the hold. Almost every part of that image is wrong. Most wrecks are broken, scattered, buried, eaten, corroded, trawled, salvaged and rearranged. What remains is less like a preserved ship than a crime scene that has spent centuries outdoors.

The useful model begins before the sinking. A ship floats because weight, buoyancy, balance and watertight boundaries are being held inside narrow margins. Wind, waves, cargo, fire, collision, grounding, bad maintenance and bad decisions do not need to destroy the vessel at once. They need only consume those margins faster than the crew can restore them. Water entering a compartment adds weight, reduces freeboard and can create a moving surface that weakens stability. A list becomes a deeper list. Openings immerse. Pumps lose power. One failure recruits the next. The dramatic plunge is often the last act of a much longer sequence.

Then the archive begins. The ship hits the bottom, perhaps intact, perhaps already divided across kilometres. Currents roll light objects away. Heavy cargo punches downslope. Sediment buries one side and exposes the other. Shipworms eat timber where oxygen reaches it. Iron corrodes into concretions. Fishing gear and propellers add a modern layer. Salvors remove what is obvious and valuable. The seabed keeps editing after the witnesses are dead.

That damage is also the source of the wreck's value. Ships carried whole systems through the world: metals, food, weapons, tools, animals, letters, clothes, beliefs and people. A wreck can preserve an ordinary sailor's comb beside a king's cannon, or reveal that Bronze Age ports separated by thousands of kilometres belonged to one trading network. The cargo matters, but its position matters more. An object without context is a possession. An object recorded in relation to the hull, the ballast, the crew's equipment and every neighbouring find is evidence.

Finding the site creates a second emergency. Sonar, magnetometers,

divers, remotely operated vehicles and photogrammetry can locate and record what darkness concealed. They can also make destruction efficient. Recovery moves material from a stable wet environment into air, where wood shrinks, salts crystallise and corrosion accelerates. Raising a wreck may begin decades of conservation. Leaving it in place may expose it to looting, trawling, erosion or leaking fuel. Law then asks questions the seabed never settled: who owns the cargo, whether a warship remains sovereign property, whether a grave should be entered, and whether a salvor deserves reward.

The lost ship cannot be recovered as a complete truth; it can only be reconstructed from disciplined attention to what survived. The central fact is that a wreck is made twice. First the casualty turns a working ship into a site. Then nature, salvage, archaeology and law turn the site into a history. The better the second transformation is controlled, the more of the first can be understood. The same discipline that might have saved the ship is needed again to save its evidence: know the margins, watch the cascade, and do not remove more than you can care for.

That is the book.

Why You Should Care

In 1982, a Turkish sponge diver working off the coast near Kaş saw rows of objects he described as metal biscuits with ears. They were copper ingots, shaped for lifting and stacked in a ship that had sunk more than three thousand years earlier. Eleven excavation seasons and more than twenty-two thousand dives later, the wreck at Uluburun had produced copper and tin, glass ingots, resin, ivory, jewellery, weapons, pottery and personal possessions drawn from across the eastern Mediterranean and beyond. A cargo lost in about 1320 BCE showed a connected world that no surviving royal inscription had bothered to describe.

England alone records about 37,000 shipwrecks and documented losses, yet physical remains have been identified on the seabed for only about

6,000. The gap between a known sinking and a located site is a warning: much of the archive exists only as a report, a name, or an obstruction on a chart.

The first reason is the record itself. Most history was written by institutions able to pay scribes, preserve archives and decide what counted. Ships carried the material life underneath those records. Their holds contain the things people bought, ate, repaired, taxed, stole, gifted and fought over. Their cabins and bilges contain what official inventories omitted. A wreck can catch an economy in motion and pin it to one day.

The second reason is that wrecks are unusually honest about systems. A standing ship is the finished claim made by its builders and owners. A wreck is the test result. It shows where a hull opened, how cargo shifted, which doors were shut, where people gathered and how quickly order failed. Modern accident investigation and maritime archaeology ask different questions, but both work backwards from physical consequences. The habit is useful well beyond ships: disasters rarely have one cause, and surviving evidence is never the whole event.

The third reason is human. A shipwreck compresses the distance between global structures and individual lives. The *Mary Rose* carried guns, rigging and royal power, but its seabed also yielded combs, bowls, shoes, tools and the remains of men who had expected to eat supper. The *Clotilda* was burned and sunk to hide an illegal voyage that brought 110 captive Africans to Alabama in 1860. Its identification did not uncover a romantic relic. It attached physical evidence to testimony, crime, survival and the community later built at Africatown. In the Canadian Arctic, the searches that found HMS *Erebus* in 2014 and HMS *Terror* in 2016 combined modern survey with Inuit oral histories and local knowledge that had preserved crucial evidence about where the Franklin ships had gone. The discoveries corrected a long habit of treating that knowledge as peripheral to an imperial mystery.

There is also a practical reason. Old wrecks are not inert. Steel corrodes. Munitions remain dangerous. Fuel can leak decades after a sinking. Trawls, dredges, cables, storms and looters can destroy a site in an afternoon.

Decisions about whether to recover, rebury, monitor or leave alone require a clear model of what the wreck has become, not nostalgia for what it was.

The limits matter. A wreck is a biased sample. Successful voyages leave no debris field. Poor people's vessels were less likely to carry durable cargo. Wood, cloth, food and bodies vanish unevenly. A spectacular find can make one route look more important than it was, and a named ship can draw attention away from thousands of anonymous losses. The seabed is an archive, but it is an archive selected by catastrophe and decay.

Read wrecks properly and the ocean stops looking empty. It becomes a layered record of trade, war, migration, labour, technology and error. This book will show how ships are lost, how their remains change, how archaeologists reconstruct them, why ownership is rarely obvious, and why the most responsible discovery may be the one that leaves almost everything where it lies.

The Core Ideas

A Ship Floats on Margins

A ship is heavy enough to seem as though floating should be impossible. It stays up because its hull displaces a mass of water equal to its own mass, and because the upward force of buoyancy meets the downward force of weight in a workable arrangement. That first statement explains flotation. It does not explain survival.

Survival depends on stability. Weight acts through the ship's centre of gravity. Buoyancy acts through the centre of the underwater volume, which moves as the vessel heels. In a stable condition, the change produces a righting lever that tends to bring the ship upright. Raise the centre of gravity with guns, cargo, ice, passengers or badly placed equipment, and the righting capacity shrinks. Remove low ballast and it may shrink further. A ship can still float while possessing little ability to recover from a roll. Naval architects express part of this behaviour through metacentric height and righting-arm curves, but no single number guarantees safety. A vessel may

be stiff, snapping upright so sharply that cargo and people are punished, or tender, rolling slowly but approaching angles from which recovery becomes uncertain. Stability changes with every loading condition, fuel transfer and alteration. A safe design can be operated outside its assumptions, while a marginal design may survive for years because crews learn its limits.

The margins are visible in other measurements. Freeboard is the distance between the water and the deck edge or other vulnerable opening. Reserve buoyancy is the enclosed volume still above water. Watertight subdivision limits how far flooding can spread. Pumps buy time. Hatches, doors and ports keep the sea outside. None of these is absolute. Each is a store of tolerance that an accident can spend. The load line painted on a merchant hull makes one limit public: how deeply the vessel may be loaded in particular waters and seasons. It is a small mark carrying a large claim that profit must stop before reserve buoyancy does.

Water loose inside a partly filled compartment is especially dangerous. As the vessel heels, the water runs towards the lower side. Its moving surface shifts the effective centre of gravity and weakens the ship's ability to right itself. This free surface effect is why flooding can become self-reinforcing: the water causes a list, the list immerses another opening, and the new opening admits more water. Cargo can perform the same betrayal if it shifts.

Vasa demonstrated the narrowness of the bargain in Stockholm harbour in 1628. The new warship carried heavy upper works and guns, heeled in a gust, took water through open lower gunports and sank during its first voyage. The Mary Rose, by contrast, had served for thirty-four years before she was lost in 1545. The strongest contemporary account says she was turning after firing when wind pressed her open gunports under. Similar visible ending, different prior system. One was dangerously tender from the start; the other reached a fatal combination of turn, wind, loading and openings after decades of service.

This is why simple labels such as storm, collision or human error are weak explanations. They name the pressure, not the failed margin. The useful questions are what kept the vessel safe before the event, which protection

was consumed first, and why the remaining protections could not arrest the sequence. A wreck begins when a ship's tolerances are spent faster than they can be rebuilt.

Sinking Is a Sequence

The sea rarely takes a ship in one clean action. Even an explosion or torpedo strike begins a sequence between damage and final loss. The hull opens, compartments flood, electrical systems fail, fire spreads, cargo moves, visibility collapses, communications fragment and people act with incomplete information. Some sequences last seconds. Others last days. The difference is often not the violence of the first event but the number and quality of barriers still working afterwards.

Grounding shows the pattern well. Contact with rock may tear plating or open seams, but the vessel may remain upright and afloat. The tide changes. Waves lift and drop the hull against the obstruction. Attempts to reverse off can enlarge the damage. A flooded tank creates free surface. Engines stop when cooling, fuel or electrical systems fail. The ship settles until openings designed to be above water immerse. The original grounding has become progressive flooding, loss of power and structural failure. Time is the hidden variable. A pump need not defeat the sea forever; it may only need to hold the level until a patch is fitted or assistance arrives. A watertight door need not prevent all flooding; it may slow it enough to preserve power and communications. Casualty control is the art of converting a runaway process into one that moves slowly enough to manage.

Collision, fire and heavy weather recruit their own chains. A collision can rupture fuel lines, disable pumps or trap people behind distorted doors. Firefighting water may accumulate high in the ship and reduce stability. A storm can shift cargo, damage steering, sweep away ventilators and make outside work impossible. Small fishing vessels often lose the battle through combinations of deck water, blocked freeing ports, heavy gear, icing and inadequate stability information. Accident reports repeatedly show maintenance, loading, training, commercial pressure and design interacting

with weather rather than sitting in separate boxes.

People matter inside the sequence, but not as a convenient final cause. A captain chooses speed, route and response, yet those choices are constrained by forecasts, charts, schedules, company practice, bridge design, crew fatigue and what the instruments appear to show. Blame may be legally necessary. Explanation requires a larger field of view. The question is not who touched the last control. It is how the system made that action possible, persuasive or hard to reverse.

The Titanic, which has its own volume in this series, belongs here only as a familiar example of the distinction. The iceberg opened the casualty. The pattern of flooding, the limits of subdivision, the time and position of rescue, communications, evacuation practice and lifeboat capacity shaped what followed. Saying iceberg is true and radically incomplete.

Abandoning ship is part of the same mechanism. Survival depends on warning, access to exits, lifejackets, launchable boats or rafts, lighting, discipline, weather and proximity of rescuers. In cold water, the first danger may be the involuntary gasp and rapid breathing of cold water shock, long before deep hypothermia develops. A person who enters water without flotation may drown while still warm enough to be rescued. The loss therefore continues after the hull disappears. A casualty ends only when the people are safe, missing, or beyond reach. The best emergency decisions therefore preserve options: transmit distress before power is lost, contain flooding before the list blocks access, ready survival craft before decks become impassable, and keep people out of the water where possible. Delay can be wise while the ship remains the safest lifeboat. Delay can also close every exit.

The Seabed Rewrites the Event

A wreck site is not the moment of sinking held still. It is the result of everything that happened during descent, impact and the years afterwards. Archaeologists call these site formation processes, a dry phrase for a violent fact: the seabed edits the evidence.

The first edit can occur before contact. A vessel may break at the surface, spilling cargo across a long drift line. Boilers, engines and guns drop quickly. Timber, containers and bodies may float away. A ship that descends intact can accelerate, rotate, implode in deep water or strike a slope and slide. Heavy objects keep moving after the hull stops. Masts and upper works collapse. Trapped air escapes. A single named loss may leave a central hull, several debris fields and isolated objects kilometres away.

The second edit comes from the local environment. Currents winnow light sediment and expose material, then bury it again in another season. Sand can scour a hole around a projecting object. Mud can seal timber from oxygen. Rock holds a site open to waves. A steep slope moves cargo downhill. Storms rearrange shallow wrecks repeatedly, while deep sites may be physically quieter but harder to inspect. Fresh water, salt water, cold, warmth, oxygen, chemistry and biology create different archives from the same ship.

The third edit is human. Historic salvors returned for guns, anchors, cargo and metal. Harbour authorities blew up wrecks that obstructed navigation. Fishing gear dragged across them. Dredging, pipelines, cables and aggregate extraction cut through sites. Sport divers removed souvenirs, sometimes leaving a trail of empty spaces no later archaeologist can interpret. A modern object caught in old timbers may mark contamination rather than the date of loss.

This is why a wreck's shape cannot be read as a direct diagram of the accident. A missing bow may have broken away during sinking, been salvaged, decayed in oxygenated water or been torn off by a trawl. Neat rows of amphorae may preserve original stowage, or may be the dense residue left after lighter material vanished. A cannon separated from the hull may have fired loose in the casualty, fallen through collapsing decks or been dragged during an abandoned recovery attempt.

Keith Muckelroy gave maritime archaeology its basic discipline here: separate the ship as a working system, the wrecking event, and the processes that transform the site. The distinction prevents false confidence.

It also turns disorder into information. Scatter direction can indicate current or slope. Fracture can distinguish explosion from gradual collapse. Burial can explain exceptional survival. Biology can add a further layer. Wrecks create hard structure on soft seabeds and become habitat for corals, sponges, fish and microbes. That ecological community may protect surfaces, accelerate corrosion or make intrusive work damaging to living systems. Cultural and natural histories occupy the same object.

The wreck is not untouched evidence, but neither is it random. It is a history written by forces that can be reconstructed if their signatures are recognised.

Absence can then be used, but carefully. A gap in a row of cargo may mark a salvaged object, a container that floated, or a position never filled. Timber surviving beneath ballast does not prove the upper hull was absent at impact. Archaeologists test competing sequences against fracture, corrosion, sediment and distribution rather than choosing the neatest story. The site is strongest when it can eliminate explanations, not when it supplies a dramatic reconstruction no surviving trace could disprove.

Context Is More Valuable Than Treasure

Treasure hunting asks what can be removed. Archaeology asks what the relationships mean. That difference is the centre of the subject.

An object gains explanatory power from provenience: its exact three-dimensional position and its relation to other material. A coin can date a deposit only if its location is trustworthy. A cooking pot beside a hearth says something different from the same pot packed as cargo. Tools clustered around a work area may identify a crew member's task. Bones, shoes and exits can show where people were trapped or where currents moved remains after death. The value lies in the pattern, and excavation destroys that pattern as it proceeds. Recording must therefore happen before removal. That reverses the normal instinct of rescue. The object that can be lifted fastest may need to wait while the surrounding deposit is photographed, sampled and drawn. A fragile item may have to remain partly

buried until a lifting support and conservation route are ready. Archaeology measures success by information retained, not by the number of crates sent ashore.

Underwater archaeologists establish control points, grids or digital reference systems, then map the site through measured drawings, photography, video, acoustic positioning and photogrammetry. Sediment may be removed with a water dredge that carries spoil to a controlled screen. Finds are tagged and their position logged. Samples of wood, sediment, residue, pollen, insects or corrosion products can answer questions that a polished artefact cannot. The aim is not to collect everything. It is to preserve enough relationships that another researcher can test the interpretation. Underwater conditions make that standard expensive. Bottom time may be measured in minutes, visibility in centimetres, and every measurement must be made by people breathing from a limited system or by machines with limited touch. Method replaces speed because speed cannot be trusted.

Cape Gelidonya in 1960 became a landmark in scientific underwater excavation, with George Bass directing work on a Late Bronze Age wreck off Turkey. Earlier underwater archaeology and recovery had already existed, but this project demonstrated that a wreck could be excavated on the seabed to the recording standards expected on land rather than treating archaeology as something done after objects reached a boat. Uluburun later showed what the method could deliver at greater scale. Its copper and tin suggested bronze production, but the cargo's combination with glass, resin, ivory, luxury goods, weapons, foodstuffs and personal objects revealed a network of ports, courts, merchants and craftspeople. The wreck was evidence for a system because the assemblage stayed an assemblage.

Antikythera offers the seductive counterexample. Sponge divers recovered statues and an unpromising bronze lump in 1900. The lump proved to contain interlocking gears capable of modelling astronomical cycles, changing the history of ancient technology. It is a magnificent object. Yet modern teams returned because the wider site still holds questions about the vessel, cargo, passengers and route. The mechanism is more intelligible

as part of a luxury-laden Roman-period voyage than as a marvel floating free of place.

Commercial recovery often argues that sale finances rescue. Sometimes it does bring material ashore that would otherwise remain unseen. The cost is that market value rewards coins, bullion and display pieces, not ballast, broken pottery, seeds, rope fibres or negative space. Once a site is mined selectively, the cheap evidence that gave the expensive objects meaning is gone. Treasure can survive without archaeology. History cannot.

Water Chooses What Survives

Water is not a preservative. It is an environment, and its chemistry and biology select materials with brutal inconsistency.

Exposed wood in warm, oxygenated seawater is attacked by bacteria, fungi, gribble and shipworm. A wooden hull may disappear until only ballast, metal fittings and a dark stain remain. Burial changes the odds. Sediment can reduce oxygen, slow biological activity and support weakened timbers. The surviving starboard side of the Mary Rose was protected beneath organic silt, while exposed portions were consumed or eroded. In the cold, brackish Baltic, shipworm is limited, which helped Vasa retain more than ninety-eight per cent of its original structure. Some Great Lakes wrecks preserve standing masts and cargo because cold fresh water lacks marine borers and can be chemically gentle.

Metals follow different paths. Iron corrodes, combining with surrounding minerals and marine growth to form thick concretions that can hide the original object. The apparent cannon may be a shell of corrosion, sand and organisms around a fragile core. Copper alloys survive better in some conditions but generate their own corrosion products. Contact between different metals can accelerate galvanic corrosion. Burial can slow one reaction and create another. A sealed bottle, leather shoe or seed may survive beside a vanished deck beam. Human remains vary as sharply. Bone can dissolve in acidic sediment, remain articulated under rapid burial, or be dispersed by current and animal activity. Clothing may vanish while

buckles, buttons and shoes preserve the outline of a body. The result can look orderly without having been orderly at death, which is why biological and sedimentary evidence must be read together.

The archive changes again at recovery. Waterlogged wood has lost much of the substance that once held its cells rigid. Water now occupies that space. Let it dry without treatment and surface tension pulls the weakened structure inward, causing shrinkage, warping and cracking. Salts inside ceramics and metal crystallise as water evaporates, exerting pressure and driving further corrosion. Organic material can deteriorate within hours. The object is therefore most vulnerable when it appears to have been saved. Field teams need wet storage, labels, lifting trays, refrigeration or chemical treatment ready before excavation. A find without a conservation route is not rescued material. It is material moved from slow decay into fast decay.

Conservation replaces uncontrolled change with slow, managed change. Waterlogged wood may be impregnated with polyethylene glycol, a water-soluble wax that supports the cellular structure, then dried gradually or freeze-dried. Salts are washed from ceramics. Iron is kept wet until chlorides can be reduced and corrosion stabilised. Large structures demand controlled humidity, supports, monitoring and money for generations.

Vasa shows the afterlife of a successful recovery. Raised in 1961, the hull was sprayed with polyethylene glycol for seventeen years and dried gradually. Iron and sulphur absorbed during three centuries underwater later contributed to acidic deposits and weakened wood, while replacement bolts and the ship's own weight created structural problems. Mary Rose was raised in 1982, sprayed first with water and later with polyethylene glycol, then dried under controlled conditions. Neither operation ended when the hull cleared the surface. That moment transferred the wreck from one unstable environment to another.

Preservation is therefore not luck alone. It is a chain of environments. The sea decides what enters the archive. Burial decides what remains. Recovery decides whether the surviving material reaches the future.

Wrecks Make Networks Visible

Ships are moving bundles of relationships. Their wrecks expose those relationships all at once.

A port archive may record taxes, owners and declared cargo. The seabed can add undeclared goods, packing materials, repairs, food remains, personal possessions and the vessel itself. Timber species can indicate where a hull was built or repaired. Isotopes and chemical signatures can trace metal, glass or stone. Amphora shapes and residues can identify routes and contents. Insect remains may reveal provisions. Wear on tools can show work. The ship becomes a cross-section through production, exchange and life aboard. It can also expose regulation and evasion. Cargo quantities may conflict with a manifest. Repairs may use timber from an unexpected region. Standardised containers can reveal taxation or state supply, while mixed measures and improvised packing reveal trade operating below official categories. Wreck evidence is powerful because shipboard order had a practical purpose before it became an archaeological pattern.

Uluburun is the clearest ancient case. Its cargo joined copper from Cyprus, tin needed for bronze, glass ingots, Canaanite jars, resin, ebony, ivory, jewellery and objects connected with Egypt, the Levant, the Aegean and lands farther east. Whether the voyage was royal exchange, elite commerce or a mixture remains debated. The secure conclusion is larger: the Late Bronze Age eastern Mediterranean was tied together by maritime movements of raw materials, prestige goods, techniques and people. One wreck made connections visible that texts had divided by kingdom.

The Mary Rose performs the same work at human scale. Its guns and hull illuminate Tudor naval war, but more than nineteen thousand recovered objects also document food, medicine, carpentry, archery, music, clothing and grooming. Dozens of nit combs are a better route into ordinary bodily life than another portrait of Henry VIII. The wreck preserves hierarchy and discomfort in the same deposit. Calling such a site a time capsule can mislead, because the deposit has been filtered and disturbed. Yet wrecks do

offer unusually tight association: thousands of objects entered the water through one event, allowing activities, status and supply to be compared within a narrow slice of time.

Some wrecks recover histories that powerful people tried to erase. The *Clotilda* entered Mobile in 1860 after the United States had banned the importation of enslaved people. Those responsible burned and sank the schooner to destroy evidence. Archaeology identified the remains in 2019 through construction details, location and documentary research. The wreck matters because it connects the crime to the testimony of the people carried aboard and to Africatown, formed by survivors after emancipation. The ship is not the whole story, and treating it as such would repeat the owners' perspective. It is physical evidence inside a living community's history.

War wrecks create another network: production, strategy, violence, death and memory. A merchant hull converted for wartime service can show how civilian economies were pulled into conflict. Cargo fields reveal supply routes. Damage records weapons and tactics. Human remains turn a technical site into a grave. Fuel and munitions can make the same wreck an environmental hazard decades later. The tanker *Coimbra*, torpedoed in 1942, still held enough oil for responders to remove more than 450,000 gallons in 2019.

A wreck never represents all traffic. Catastrophe selects the sample, durable materials select the survivors, and famous names attract research. Used carefully, however, wrecks restore movement to history. They show that distant places were connected by specific loads, specific labour and specific risks, not by arrows on a map.

The Find Creates a Second Emergency

Discovery feels like the end of a search. For the site, it can be the beginning of danger.

Modern tools can cover seabed at a scale early divers could not imagine. Side-scan sonar sends sound sideways and produces image-like records of texture and shape. Multibeam sonar measures depth across a swath.

Magnetometers detect disturbances caused by ferrous material, including objects buried beneath sediment. Autonomous and remotely operated vehicles work beyond normal diving depth. Once a target is found, divers or cameras establish whether it is geology, rubbish or a wreck. Photogrammetry can turn overlapping images into a measurable three-dimensional model. None of these tools identifies a wreck by itself. Sonar can mistake geology, pipelines or dumped machinery for a hull. Magnetometers detect iron, not history. Identification comes from combining position, dimensions, construction, cargo, damage, documents and dated material, then stating how much uncertainty remains. Discovery is an argument built from converging traces.

Every gain in access increases the need for restraint. A published position can attract looters. Anchoring a survey boat can damage the site. Clearing growth to obtain a better image can remove evidence. Lifting an object commits somebody to conservation, storage, research and security. Raising a hull commits institutions that may not yet exist to centuries of care. The technically possible action may be the least responsible one.

The UNESCO 2001 Convention makes preservation in place the first option for underwater cultural heritage covered by its regime, and its Annex has influenced professional practice beyond the States Parties. The principle is not that the seabed is safe in every case. It is that excavation is destructive and recovery creates new risks. A site threatened by trawling, erosion, development or theft may need stabilisation, reburial or selective excavation. A stable deep site may be best recorded and monitored. A corroding modern wreck may demand intervention for a different reason. Fuel, chemicals and munitions can threaten coasts and fisheries, forcing managers to disturb a historic site to prevent a new casualty. Heritage protection and environmental safety can point in opposite directions. Human remains require respect. A warship may remain the sovereign property of its flag state. A merchant cargo may have owners, insurers, salvors, descendant communities and national claims competing across different laws.

The 2007 recovery of coins from the Spanish frigate *Nuestra Señora de las Mercedes* shows how quickly treasure becomes jurisdiction. A commercial company brought the recovered material to the United States and claimed salvage or ownership. Spain established that the wreck was its naval vessel, sunk in 1804 and never abandoned. United States courts recognised sovereign immunity and ordered the material returned. The seabed's silence had not erased the state's claim.

Domestic rules vary. Under the United Kingdom wreck-reporting system, a person who recovers wreck material is generally required to report it to the Receiver of Wreck within twenty-eight days. Reporting allows ownership to be investigated and can lead to a salvage award without transferring title to the finder. Separate regimes protect designated historic wrecks and military remains. The UK has not ratified UNESCO's 2001 Convention, although its government has adopted the Convention's Annex rules as best practice for underwater archaeology. Elsewhere, abandoned-wreck statutes, territorial jurisdiction, sovereign immunity and heritage codes produce different answers. Location changes law as decisively as it changes preservation.

The opening logic returns in a different form. A ship can be lost when damage outruns the margins available to contain it. A wreck can lose much of its evidential value when access outruns the capacity to record, conserve and govern what has been exposed. In both cases, a small breach can recruit a larger failure. The first duty after finding a wreck is therefore not possession. It is control: establish what is there, what threatens it, what law applies and what can be cared for before anything is removed.

How It Actually Works

Before the water enters

Most wrecks begin before the hull is breached. A vessel leaves port carrying a particular loading condition, maintenance history, crew, weather forecast and schedule. Fuel has been consumed unevenly. Ballast has been shifted. Cargo has been lashed, trimmed or left able to move. Hatches and doors are open for work. Pumps, alarms, radios, charts and survival equipment are either ready or assumed to be ready. The ship is already a set of decisions.

That set changes throughout the voyage. A fishing vessel hauls heavy gear onto deck and raises its centre of gravity. A tanker transfers liquid between partly filled tanks. A sailing ship reduces canvas too late. A passenger vessel approaches shallow water under pressure to maintain time. Ice forms high on exposed structure. A small leak fills a bilge unnoticed because the alarm is faulty or because repeated false alarms have trained people to ignore it.

The vessel still looks normal. That is why risk accumulates. Most defences are invisible until called upon, and successful voyages reward the belief that the current practice is safe. The ship may have crossed the same bar, sailed with the same door open or accepted the same weather many times. Repetition proves only that the previous margin was sufficient. Formal safety systems try to make the hidden condition legible through loading manuals, maintenance schedules, drills, passage plans and checklists. These devices do not remove judgement. They create occasions on which assumptions can be challenged before the sea challenges them. Their weakness is cultural: a checklist completed as ritual records obedience, while a checklist used to ask whether the ship has changed records risk.

The casualty opens

The initiating event changes the problem. A grounding tears the bottom. A collision opens the side. Fire damages cables and drives people from machinery spaces. A wave breaks windows or hatches. A torpedo or mine combines flooding, blast, fire and structural damage in seconds. In older vessels, seams open and fastenings fail. In every case, water seeks the lowest available path and air seeks escape.

The first reports are often poor. Noise, darkness, smoke and heel make distance hard to judge. Water entering one compartment may be discovered somewhere else after passing through ducts, cable runs or doors. The bridge may know the ship has struck but not the length or position of the damage. An engine-room team may know the flooding rate but not whether the list is caused by water, shifted cargo or both. Early action is taken from a model that is changing faster than information can reach it.

The geometry then turns hostile. Added water increases displacement and lowers freeboard. Flooding on one side produces list. Free surface reduces righting ability. A listed ship immerses openings that were never designed to be watertight. Water reaches electrical systems, pumps and engines. Compartments thought separate become connected through ventilation, damaged bulkheads, open doors or pipes. If the bow settles, water can move aft over internal boundaries. If the stern settles, steering and propulsion may disappear when they are most needed.

Damage control tries to interrupt this chain. Crews close watertight boundaries, start pumps, counter-flood, transfer ballast, shore damaged structure and reduce sources of ignition. They may beach the vessel deliberately on a safe bottom. Tugs can hold it against wind or current. A distress call brings rescue and towing capacity into the problem. Every measure has a cost. Counter-flooding corrects list by adding more water and weight. Turning towards shelter may expose damage to greater pressure. Opening a boundary for access can spread flooding. The good action is the one that preserves enough stability and time for the next action. Flooding rate matters more than the mere presence of a hole. Pressure

increases with depth below the waterline, so a low opening can admit water with startling force. The opening may also grow as plates flex or timber works. Pump capacity written on a specification assumes working power, clear strainers and a route for discharge. Debris blocks intakes, hoses kink, batteries flood and the quoted capacity disappears. Damage-control arithmetic is performed in a dark compartment whose numbers are deteriorating.

Structural strength can become the next limit. Uneven flooding places bending loads on a hull, especially when waves support the bow and stern differently. A ship may remain afloat yet be close to breaking. Moving cargo or counter-flooding can improve stability while worsening longitudinal stress. The crew is managing several margins at once, and an action that rescues one can spend another.

The decision to leave

Abandoning a ship is not a clean threshold. A damaged vessel may remain safer than boats or rafts in heavy weather. It provides height, shelter, communications and a large target for rescuers. Leaving too early can scatter people across water. Leaving too late can make survival craft impossible to launch from a heeled deck.

The order must travel through a noisy, frightened system. Passengers need routes, clothing and lifejackets. Crew need to release boats, rafts and emergency beacons. Fire or flooding may have removed the intended assembly area. A list can place one side's boats too high and the other's against the hull. Power loss removes lifts, lighting and public-address systems. People return for possessions, search for family or follow familiar routes into danger.

Once in the water, flotation and breathing dominate. Sudden cold can produce an involuntary gasp, rapid breathing and panic. Swimming hard in the first moments can worsen the problem. A lifejacket keeps the airway higher while the person regains control. After the initial response, cooling, fatigue, waves, injury and loss of dexterity reduce survival. Rafts and boats

keep people out of the water, concentrate them for rescue and provide protection from wind. The distance to help, not the distance to shore, often decides the result. Emergency position-indicating radio beacons and search-and-rescue transponders are designed to reduce that distance by making survivors easier to locate. Immersion suits slow heat loss. Lifeboat provisions extend endurance. None helps if equipment is inaccessible, maintenance has failed, or the casualty gives no time to use it. Survival equipment is part of the ship until the instant it must become an independent system.

Wreck evidence can preserve parts of this phase. Lifeboats absent from davits may have been launched, torn away or salvaged later. Shoes and personal objects near exits can indicate movement, but currents complicate the pattern. Bodies may remain inside, be carried away or never be recovered. Survivor testimony supplies action and sequence that the site cannot, while the site can contradict memories formed under shock.

Descent and impact

The ship's transformation accelerates after it loses support at the surface. Flooded spaces collapse under pressure as depth increases. Trapped air escapes through openings, sometimes tearing structure. Loose cargo moves towards the lowest point. A vessel may turn upside down, descend bow first, spiral or break apart. In deep water, pressure can crush enclosed spaces. In shallow water, waves may continue breaking the hull after it rests.

Impact is a second wrecking event. A flat seabed may receive the hull on one side. A rocky slope can split it and send engines, guns or cargo downhill. The bow can bury itself while the stern collapses. Heavy machinery may punch through decks. Masts fall across the site. Sediment displaced by impact settles over smaller objects. The ship has ceased to operate, but its parts still move according to weight, shape, current and slope.

The first hours create much of the debris field. The following years make it

harder to read. Timber loses fastenings and spreads. Decks collapse into lower spaces. Corrosion weakens metal plate until sections fold. Nets snag and drag objects. Salvors remove propellers, condensers, guns, anchors and cargo. Harbour authorities may flatten the remains with explosives. A charted obstruction can become an archaeological site only after practical users have altered it for generations. Shallow and deep wrecks therefore present opposite illusions. A shallow site looks accessible but may be repeatedly battered, dispersed and visited. A deep site looks sealed away but can have suffered implosion, collapse and corrosion, and modern remotely operated vehicles can reach it. Depth changes the agents of disturbance; it does not suspend time.

Some vessels never form a compact site. Wooden ships can disintegrate until ballast and durable fittings mark the route of collapse. Explosions scatter metal and cargo widely. A steel hull may remain recognisable while its interior floors fold down through corroded decks. The archaeologist searches for a process footprint, not a silhouette.

The search

A search begins by narrowing water. Documents supply last known positions, routes, weather, distress messages, insurance records, cargo, construction and previous salvage. Charts reveal shoals and wreck symbols, but coordinates may be imprecise or copied from older reports. Fishermen know where gear snags. Divers know anomalies that never reached an archive. Oral history can preserve locations dismissed by formal searchers, as Inuit knowledge did in the hunt for Franklin's ships.

Survey then converts an area into lines. A vessel runs planned tracks while sonar and other sensors collect data. Side-scan sonar shows differences in texture and relief, casting acoustic shadows behind objects. Multibeam sonar maps depth and shape. A magnetometer records local changes in the magnetic field caused by ferrous material. Sub-bottom profilers can detect buried layers. In deeper water, autonomous vehicles fly close to the seabed without a cable, while remotely operated vehicles provide live video and manipulation.

The result is not a labelled wreck. It is a set of anomalies. A long shadow may come from rock. A magnetic response may be a pipeline, anchor or dumped machinery. Searchers compare dimensions, orientation, bottom conditions and location with the expected vessel. Ground-truthing by diver or camera looks for diagnostic construction, machinery, cargo or name plates. Identification strengthens when independent clues converge and weakens when it relies on one attractive object. Search design must also account for uncertainty in the last position. A dead-reckoned coordinate can be wrong through current, clock error, chart error or a final unreported movement. Searchers model a probability area, then choose line spacing and sensor altitude that should detect a target of the expected size. Missing the wreck once does not prove it is absent; the sensor may have passed too high, the track may have a gap, or sediment may hide the strongest features.

Historical searches fail when the desired answer controls the survey. A famous vessel attracts anomalies that resemble it. Teams reduce that bias by recording rejection criteria in advance and retaining data on targets that do not fit. The unidentified wreck is still part of the maritime record, even when it disappoints the expedition.

HMS Erebus appeared on sonar in 2014 after years of searching. The technical achievement mattered, but the decisive geography came from Inuit testimony and artefacts cached on an island. HMS Terror was found in 2016 in a bay whose name had become attached to the story long before the wreck was seen. The discoveries were not machines defeating mystery. They were documentary, Indigenous, geographical and acoustic evidence finally made to agree.

Recording before removal

The first archaeological task is to establish what is present and what threatens it. Divers or vehicles make an initial visual survey, mark the extent, assess stability and identify hazards such as entanglement, unexploded ordnance, unstable structure or fuel. A baseline record allows later change to be measured. If the site can remain in place, that record may be the main intervention.

Detailed work creates a coordinate system. Fixed control points anchor measurements. Overlapping photographs are processed into a three-dimensional model. Acoustic positioning tracks divers and tools. Sediment cores reveal burial conditions. Samples identify timber, fibres, residues and corrosion. Objects are numbered only after their relationship to the site is recorded.

Excavation proceeds in units, not as a general clearing. A water dredge removes loose sediment through a hose while screens catch small finds. Archaeologists leave baulks or sections where layers need to be read. Delicate material may be block-lifted with surrounding sediment. Heavy objects need slings or custom cradles that spread load across weakened surfaces. Human remains require legal authority, specialist planning and respect for the people and communities concerned.

Time underwater is expensive and dangerous. At the Uluburun wreck, work at depths beyond 45 metres demanded more than twenty-two thousand dives over eleven seasons. The achievement was not the number alone. It was maintaining a consistent record while hundreds of people, seasons and decisions passed through the same site. Archaeology works only if today's removal can still be understood by somebody who was not present. That requires recording absence as well as finds. The edge of a timber, a void beneath cargo, a change in sediment or a line of fastenings can define a vanished structure. Samples need links to their precise locations. Dive logs must distinguish observation from interpretation. If a season ends halfway through a deposit, the protected surface and control network must allow work to resume without inventing continuity.

Not every site warrants excavation. Research questions must justify disturbance. A survey may establish date, extent and condition without opening the deposit. Test trenches can answer whether a hull survives. Selective recovery may protect diagnostic or threatened material while leaving the rest. The scale of intervention should follow the question and threat, not the fame of the name.

Recovery becomes conservation

Every lifted object enters a chain. It is kept wet, labelled, packed, transported and assessed. Water from the site may be retained initially to prevent abrupt chemical change. Wood and leather need support. Ceramics need controlled desalination. Iron objects may remain hidden inside concretions until imaging and careful mechanical work reveal their form. Organic residue can be lost through careless cleaning.

Large hulls turn the chain into an institution. Vasa was raised in 1961 and sprayed with polyethylene glycol for seventeen years. Mary Rose was raised in 1982 on a supporting cradle, kept wet, treated with polyethylene glycol and dried over decades. Both require climate control, structural monitoring and continuing research. The public moment of lifting was the shortest part of the rescue. Smaller projects can fail more quietly through a conservation backlog. Hundreds of concreted objects arrive while laboratory staff and storage remain fixed. Labels separate from containers. Water evaporates. Funding ends after the field season because discovery photographs attract support more readily than years of desalination. Responsible excavation budgets for treatment, documentation and permanent curation before the first object is disturbed.

Conservation also controls interpretation. A mass of concretion can be X-rayed before removal. Timber can be sampled for species and tree-ring dating. Tool marks and repairs can be recorded. Digital models preserve shapes before treatment changes them. The laboratory does not tidy archaeological material into museum objects. It extracts evidence while trying to keep the object stable.

Publication closes the loop. Plans, databases, photographs, samples and reasoning must be available for scrutiny. A recovered collection without records becomes a cabinet of curiosities. A well-recorded site can continue producing knowledge after excavation ends, and digital records can give public access without placing every fragile object on display.

Stewardship after discovery

The final operating question is not how to get the wreck up. It is how to keep the archive available. Management may mean leaving the site untouched, placing protective coverings, reburial, restricting anchoring and fishing, monitoring corrosion, removing leaking oil or licensing limited excavation. Conditions can change, so in situ preservation is a decision to manage, not a decision to forget.

Ownership and authority must be settled before intrusive work. A salvor may have saved property without owning it. A state may retain a warship centuries after sinking. Cargo owners or insurers may have claims. Heritage law can remove an abandoned wreck from ordinary finds rules. Descendant and local communities may possess moral claims that property law fails to express. Where people died, access and display carry obligations beyond title.

The right outcome can therefore look frustratingly inactive. A team locates a wreck, records it, withholds exact coordinates and leaves the material below. Nothing enters a museum. Yet the site survives with its relationships intact, and future researchers may return with better questions and less destructive tools. Restraint is work. So is public access. A protected coordinate may need to stay confidential, but secrecy alone cannot build stewardship. Virtual models, museum displays, licensed dive trails and community monitoring can make a wreck known without turning it into a source of souvenirs. The people most likely to notice new damage are often fishers and divers. Treating them only as threats wastes the strongest local surveillance network available.

Long-term management also accepts that no option is permanent. Sediment

shifts, fishing changes, new construction approaches and conservation science improves. Monitoring compares the present site with a baseline and triggers action when loss accelerates. Stewardship is repeated judgement under changing conditions, not a plaque fixed to a chart.

How we know

Shipwreck knowledge comes from three records that fail differently. Documentary evidence includes logs, charts, inquiries, insurance files, cargo lists, court records and testimony. It supplies names and intentions but may hide undeclared cargo, blame convenient people or place a loss inaccurately. Survivor accounts preserve action and experience, yet shock, darkness and later retelling alter memory.

The physical site records consequences. Hull damage, scatter, cargo position, sediment, corrosion and human remains can test a written account, but each has been transformed by descent, decay, salvage and later disturbance. Experimental archaeology, naval architecture, materials science and accident modelling help separate possible sequences from attractive stories.

Identification is strongest when independent evidence converges: construction matches the vessel, dated artefacts fit the voyage, location fits the loss, cargo fits documents, and damage fits testimony. It remains weaker where a famous name rests on one gun, coin or approximate coordinate. Much of the world's wreck record consists of documented losses with no located remains, unidentified sites with no secure name, and collections recovered before context was recorded. The gaps are part of the evidence and must remain visible.

What People Get Wrong

“A shipwreck is a ship sitting on the seabed”

The museum model and the upright sonar image have trained people to expect a recognisable hull. Some wrecks do survive that way, especially in cold, quiet or oxygen-poor water. They are exceptional enough to become famous. Vasa, the Franklin ships and some Great Lakes wrecks dominate visual culture because cameras can still recognise decks, rails or masts. Their clarity creates a sampling error: the sites easiest to picture become the model for all the sites that no longer resemble vessels.

Most sites are distributions. A vessel may break before impact, slide down a slope, collapse as fastenings corrode, or be dispersed by storms, salvage and fishing. Wooden structure can vanish while ballast and fittings remain. A single loss can create several debris fields. Even an apparently intact steel hull may contain decks that have folded into one another.

This matters because searching only for a ship shape misses wrecks, and interpreting every scatter as random misses the casualty. Archaeologists map where material went and ask which movement belongs to sinking, environment or later interference. The wreck is a process footprint. Its disorder is often the evidence.

“The sea preserves whatever sinks”

Water can preserve material that would rot or burn on land, which makes the claim feel plausible. It can also erase a ship with remarkable efficiency.

Warm salt water supports organisms that eat exposed timber. Oxygen drives biological decay and corrosion. Waves and currents scour sites. Iron expands into concretion and loses metallic strength. Cloth, food, rope and bodies survive only under particular conditions. Burial beneath low-oxygen sediment may protect one side of a hull while the exposed side disappears. Cold fresh water may preserve timber but still leave metals corroding.

The correction changes how absence is read. No sailcloth does not prove a

vessel lacked sails. Few human remains do not prove everyone escaped. A surviving cargo may be the dense, durable fraction of a much larger load. The seabed does not store the past impartially. It selects by material, position and environment. Exceptional preservation can mislead in the opposite direction. One sealed chest or articulated skeleton may be treated as typical when it survived through rapid burial that protected little else. The question is always why this material survived here, not whether water is good or bad for preservation.

“Treasure is the most valuable part”

Gold, coins and statues survive well, photograph well and finance headlines. They also arrive with prices attached, so value appears measurable. Broken pottery, ballast and sediment look like the waste around the story. Commercial recovery reinforces the hierarchy by displaying the saleable material and leaving the remainder invisible. The public then sees treasure as the find because the unglamorous evidence never reaches the auction catalogue or television shot.

Archaeologically, the reverse can be true. Ballast may identify a source region. Cheap containers can reveal trade at scale. Residue can identify food or medicine. The location of a coin within a sealed layer may date the deposit, while a loose coin stripped from a site becomes little more than a collectible. At Uluburun, the force of the evidence came from the association of metals, raw materials, luxury goods, provisions, ship structure and personal objects.

Treasure hunting extracts items. Archaeology preserves relationships. Once the high-value pieces are removed selectively, the low-value evidence that explained them cannot be bought back.

“The captain causes the wreck”

A named person provides moral clarity. Inquiries need responsibility, newspapers need a face, and captains possess formal authority. The final order can therefore swallow the whole causal history.

Captains do make fatal decisions. They do so within a vessel designed, loaded, maintained and operated by many others. Weather information may be poor. Company schedules can reward risk. Crew fatigue, training, bridge layout, alarm design, maintenance and normalised shortcuts shape what looks reasonable. After damage, a choice may fail because a pump, door or communication system did not perform as assumed.

A serious explanation separates accountability from mechanism. Punishing the last person in the chain may be justified and still leave the chain intact. Accident investigation asks what defences should have prevented one error from becoming total loss. The purpose is not to dissolve responsibility. It is to prevent the same system from finding another captain. This is why good inquiries examine near misses and ordinary practice as well as the final voyage. A dangerous routine is easier to change before it produces a dead crew, and a safe outcome does not turn the routine into a sound one.

“Hypothermia is the first danger in cold water”

Stories of long exposure make hypothermia the obvious killer. Deep cooling is a major threat, but many people never reach that stage.

Sudden immersion in water below about 15 degrees Celsius can trigger cold water shock: involuntary gasping, rapid breathing, increased heart rate and panic. A person who inhales during the gasp or loses breathing control in waves can drown within minutes. Cold also strips strength and dexterity, making swimming, holding a line or climbing into a raft harder before core temperature has fallen to the level associated with severe hypothermia.

The correction changes immediate action. Flotation, airway control and a pause to regain breathing come before an ambitious swim. Getting out of the water remains critical, as does insulation once aboard. The sequence matters: survive the first minute, then the next ten, then the longer wait for rescue. The RNLI advice to float until breathing comes under control is built around that order. A lifejacket improves the chance of keeping the airway clear when thought and movement are least reliable. Strong swimmers are not exempt from the initial response.

“If you find it, you own it”

The phrase feels ancient because ordinary lost property can become abandoned and because salvage law rewards people who save property at sea. Neither principle creates a universal finders-keepers rule for wrecks.

Ownership depends on location, status, abandonment, cargo, national law and international rules. A sunken warship may remain sovereign property. Historic wreck legislation may place a site under state management. Human remains and protected sites carry separate duties. Under United Kingdom law, recovered wreck material must normally be reported to the Receiver of Wreck within twenty-eight days; a finder may receive a salvage award without acquiring ownership. UNESCO's 2001 Convention rejects commercial exploitation of underwater cultural heritage and requires in situ preservation to be considered first. The coins recovered from Nuestra Señora de las Mercedes did not become the salvor's property merely because they had crossed the Atlantic in its custody. United States courts recognised Spain's continuing sovereign claim to the naval wreck and ordered their return.

The correction matters before recovery, not after. Lifting an object can create legal liability, damage evidence and commit the finder to conservation. Ask permission before possession.

“Raising a wreck saves it”

The image of a hull breaking the surface is irresistible. It looks like rescue completed. In material terms, it is exposure begun.

Waterlogged wood may depend on water for its shape. Dry it quickly and it can shrink, warp and crack. Salts crystallise. Iron corrosion accelerates in oxygen. Large structures need cradles, chemical impregnation, controlled drying, stable humidity and monitoring for decades. Vasa and Mary Rose are triumphs because institutions accepted that burden, not because lifting solved it. Many collections suffer when excavation funding ends before treatment and curation do. Even successful treatment can create later problems. Polyethylene glycol supports weakened wood, but humidity, iron,

sulphur, structural weight and ageing supports still require research and adjustment. Conservation substitutes managed deterioration for uncontrolled deterioration; it does not stop chemistry.

Leaving a wreck below is not neglect where the site is stable, documented and monitored. Recovery is justified when research, access or threat outweigh the damage and when aftercare is secured. A wreck should not be raised because technology can lift it. It should be raised only when the future above water is safer than the future below.

Use It

Follow the cascade, not the headline cause

When a system fails, the first explanation offered is usually an event: storm, collision, bad decision, cyberattack, market shock, component failure. Treat it as the opening rather than the answer.

Ask what the system was relying on immediately before the event. Which margin absorbed the first damage? Which barrier should have stopped progression? What made the next failure possible? A ship can survive a hole if subdivision, pumps, power, information and crew action hold. It can be lost through a modest leak if each defence arrives late or performs below assumption. The same logic applies to businesses, hospitals, data systems and public institutions.

This lens prevents two errors. One is fatalism, where an external shock is treated as overwhelming by definition. The other is scapegoating, where the last person to act carries every prior design choice. Accountability still matters. The better operational question is what change would prevent a different person from producing the same outcome under the same conditions. Then test the answer against a near miss. If the same weakness existed on ten previous occasions, luck was part of the safety system. A remedy aimed only at the final voyage has probably arrived too late in the chain.

Ask what the archive selected out

Every dataset is a wreck site. It contains what survived the process that created, stored and exposed it.

Shipwreck evidence favours failed voyages, durable materials, located sites and objects somebody chose to record. Business records favour completed transactions and measurable activity. Medical records contain people who reached care. Published research favours positive, legible and interesting results. Institutional memory favours decisions important enough to document and people powerful enough to keep documents.

Before treating the record as the past, ask four questions. What could not survive? What was never recorded? What was removed before observation? What kind of case is missing because success leaves no trace? The aim is not to dismiss evidence as biased. It is to model the bias so that silence is not mistaken for absence.

Wrecks add a useful discipline: explain the preservation mechanism. If timber survives only beneath ballast, the survival itself tells you about burial. If a database contains only customers who complained, its structure tells you what behaviour generated an entry. Selection is information when its cause is understood. Compare records produced by different filters. A cargo list, insurance claim and excavated hold may disagree for useful reasons. A customer survey, refund log and payment record may reveal different populations. Triangulation is strongest when the sources fail in different ways.

Read relationships before objects

An isolated object invites naming, pricing and admiration. A relationship invites explanation.

On a wreck, a bowl beside a hearth, stacked among cargo or lying near human remains performs three different historical jobs. Remove it without recording position and those distinctions disappear. In organisations, the equivalent mistake is to assess a metric without the process around it, a

message without timing, or a person's action without authority and constraints.

Use context at three scales. The immediate scale asks what touches or surrounds the item. The system scale asks what role it served aboard the whole ship. The network scale asks where the material, design or cargo connects beyond the vessel. A copper ingot becomes more informative when linked to tin, packing, route and production; a single sales result becomes more informative when linked to lead source, price, stock and follow-up.

This does not mean context excuses everything. It means interpretation begins with position. Preserve relationships before optimising, moving or judging the parts. In practice, take a baseline before intervention. Photograph the arrangement, record dependencies, note what cannot be measured and preserve identifiers through every move. The habit feels slow until a decision must be reversed and the original state no longer exists.

Price the aftercare before the rescue

Discovery and launch attract attention. Maintenance inherits the bill.

Raising waterlogged wood without funded conservation accelerates its destruction. A new software system without migration, training and support can do the same to institutional information. A public programme without long-term staffing becomes a collection of stranded commitments. In each case, the visible intervention transfers an asset into an environment where it depends on new support.

Before beginning, define the full chain: recovery, stabilisation, documentation, storage, access, monitoring and eventual disposal or renewal. Identify the institution that owns each step and the budget after the opening phase. Ask what happens if funding falls by half, a specialist leaves or the temporary store becomes permanent. A project that cannot answer these questions may be extracting value from the future to create a success photograph in the present.

The strongest action may be partial. Record the site, recover only threatened material, stabilise the rest and return later. Scope is a safety device. So is reversibility. Prefer actions that leave later choices open when uncertainty is high. A survey can precede excavation, a pilot can precede a full programme, and a temporary support can be monitored before a permanent reconstruction. Irreversible action should require the strongest evidence and the longest funding horizon.

Ask whose wreck it is

Property law gives one answer. History, death and community can give others.

A warship may belong to a state. Cargo may have owners or insurers. A salvor may deserve reward. Archaeologists claim a public interest in context. Families may see a grave. Indigenous or descendant communities may see evidence embedded in a history that outsiders once controlled. None of these claims automatically cancels the others.

The useful question is not who can win title. It is who bears loss if a decision is wrong. Commercial recovery can disperse a collection. Total secrecy can exclude the public and local knowledge. Raising human remains can cause harm even where lawful. Leaving hazardous fuel in place can protect heritage while threatening fisheries. Good stewardship makes these costs explicit and gives affected communities standing before the machinery arrives.

Clotilda and the Franklin wrecks show why this matters. Archaeology was strongest when the vessel was treated as part of a continuing community history, not as a famous object waiting for expert ownership. Consultation is not decorative permission. It changes the questions asked and the evidence recognised. It can also expose conflicts within a community, which should not be hidden behind a single appointed voice. The aim is not unanimity. It is a decision process in which legal power does not masquerade as the only form of connection.

The limits

Shipwreck thinking has limits because systems are not all ships and records are not all seabeds. A vessel has physical boundaries, measurable stability and a moment of loss. Social and political failures can unfold without a clear hull, crew or end state. The cascade model can tempt you to draw a neat chain through events that remained contingent. Hindsight makes every signal look louder than it was.

Archaeological context can also become an excuse for paralysis. Sites deteriorate. Oil leaks. Trawlers arrive. A rigid preference for leaving everything in place may preserve nothing. Intervention must compare risks rather than pretend that non-action has no consequences.

The evidence will stay incomplete. Exact positions can be disturbed, testimony can conflict, legal ownership can remain contested and conservation can fail despite care. The goal is a better bounded judgement, not a perfect reconstruction.

The one thing to keep

Keep the record connected.

A wreck teaches two different lessons about failure. The first is operational: disaster is usually a sequence in which margins and barriers are consumed. The second is evidential: once the failure has happened, the remains do not explain themselves. Position, absence, disturbance and later intervention determine what can still be learned.

That second lesson is the one to carry away. Failure leaves fragments, and fragments acquire meaning from relationships. The urge to extract the most dramatic object, blame the most visible actor or compress the event into one cause can destroy the information needed to understand it. Good reconstruction begins by asking what survived, what vanished, what moved and who has had the power to alter the record.

When something important breaks, preserve the relationships before moving the pieces. Record the position, identify the missing material, follow

the cascade, and make sure any rescue has somewhere safe to arrive. A wreck cannot be returned to the voyage. It can still remain a richer record than the first headline allowed.

Terms

Ballast. Weight carried low to control trim and stability. It may be stone, iron or water. Too little, too much or badly distributed ballast can make a vessel unsafe.

Bilge. The lowest internal space of a hull, where leaked water collects. Bilge pumps and alarms provide an early defence only when the space is inspected and the equipment works.

Buoyancy. The upward force exerted by displaced water. A vessel floats when buoyancy balances weight, but flotation alone says little about its ability to recover from heel or flooding.

Capsize. A loss of stability in which a vessel rolls onto its side or turns upside down. Capsizing may be rapid, leaving little time to transmit distress or launch survival craft.

Casualty. In maritime use, an accident involving a vessel, such as collision, grounding, fire, flooding, loss of life or serious damage. It covers more than the final sinking.

Cargo shift. Movement of goods or bulk material away from their intended position. The shift moves the centre of gravity and can turn an existing list into an unrecoverable one.

Concretion. A hard mass formed when corrosion products combine with sand, shells and marine growth around metal. It can preserve an object's outline while concealing a weak or vanished core.

Conservation. The controlled treatment and care of recovered material. It includes stabilisation, desalination, chemical treatment, drying, storage, monitoring and documentation, often over many years.

Context. The physical and interpretive relationship between a find and its surroundings. Context turns an object into evidence by linking it to structure, cargo, activity, sequence and date.

Corrosion. Chemical or electrochemical deterioration of metal. Oxygen, salts, acidity, metal contact, burial and biology influence its rate, both underwater and after an object reaches air.

Debris field. The area over which parts of a vessel, cargo and equipment are distributed. Its shape can record break-up, drift, impact, slope, explosion, salvage and later disturbance.

Displacement. The mass of water a floating vessel pushes aside, equal to the vessel's own mass. Loading, flooding and fuel use change displacement and the ship's position in the water.

Draught. The vertical distance from the waterline to the lowest part of the hull. Greater draught reduces clearance beneath the keel and can bring openings closer to the water.

Free surface effect. The loss of stability caused by liquid moving across a partly filled tank or flooded space as a vessel heels. The shifting surface raises the effective centre of gravity.

Foundering. Sinking through flooding or loss of buoyancy, often without the vessel first capsizing. Historical accounts use the word loosely, so the physical sequence still needs reconstruction.

Freeboard. The distance from the waterline to the deck edge or another defined point. Low freeboard leaves less margin before waves or heel immerse vulnerable openings.

Grounding. Contact between a vessel and the seabed, rock or shore. A grounding may stop the ship safely, tear the hull, or become worse as tide and waves move it.

Hydrography. The measurement and description of water depth, seabed, tides, currents and coastal features for navigation and study. Hydrographic

surveys often reveal wreck targets as hazards or anomalies.

In situ. In the original place of deposition. In situ preservation leaves a wreck or object on the seabed, normally with recording, monitoring and protection rather than abandonment.

Law of finds. A legal doctrine that can award abandoned property to a finder who takes possession. Its application to wrecks is limited by heritage law, sovereign immunity and national rules.

Law of salvage. The law governing voluntary rescue of maritime property in danger. A successful salvor may earn an award without acquiring ownership. Historic wrecks may fall under different protections.

List. A persistent lean to port or starboard caused by uneven weight, flooding, cargo shift or damage. It differs from temporary heel produced by wind, waves or turning.

Magnetometer. An instrument that detects local disturbances in the Earth's magnetic field. Marine surveys use it to locate ferrous material, including anchors, guns, engines and buried wreck remains.

Maritime archaeology. The study of human interaction with seas, rivers and lakes through material remains, landscapes and records. Shipwreck archaeology is one part of the wider field.

Photogrammetry. The creation of measurable two-dimensional or three-dimensional records from overlapping photographs. It allows a wreck to be mapped and revisited digitally before or after disturbance.

Provenience. The precise recorded location of an artefact or sample within a site. Good provenience includes depth and relationship, not merely the name of the wreck.

ROV. Remotely operated vehicle, a tethered underwater machine controlled from the surface. ROVs carry cameras, sonar, lights and tools into water too deep or dangerous for divers.

Side-scan sonar. A survey instrument that sends sound to both sides and

records seafloor reflectivity and shadows. It is effective for finding objects but does not by itself establish identity.

Site formation. The combined processes that create and transform an archaeological site, from wrecking and impact through burial, decay, salvage, biology, fishing and excavation. Understanding them prevents snapshot thinking.

Stability. A vessel's capacity to resist or recover from heel under a given loading and damage condition. It depends on hull form, centres of weight and buoyancy, free surfaces and openings.

Go Deeper

George F. Bass, *Archaeology Under Water* (1966)

Start here for the moment underwater archaeology became a discipline rather than salvage with better manners. Bass explains how the Cape Gelidonya excavation adapted terrestrial recording, measurement and conservation to divers working on a Late Bronze Age wreck. The equipment is dated, which is part of the value: the intellectual standard arrived before modern sonar, digital photography and remotely operated vehicles made access easier. Read it for the governing idea that excavation under water must preserve the same evidential relationships expected on land. Bass also captures the physical courage and repetitive labour hidden behind a clean site plan.

Keith Muckelroy, Maritime Archaeology (1978)

Read this for the model beneath the book. Muckelroy separates the working ship, the wrecking event and the natural and human processes that form the surviving site. His diagrams and terminology can feel compressed, and later scholarship has revised parts of the framework, but the central move remains indispensable. A wreck is not a frozen vessel. It is a transformed assemblage whose scatter, absences and survival need explanation before historical claims are made. Read slowly around the diagrams; they repay more attention than the surrounding terminology first suggests.

Margaret Rule, The Mary Rose: The Excavation and Raising of Henry VIII's Flagship (1982)

Read this for one project in full: search, excavation, organisation, engineering, risk and the public raising of a large hull. Rule directed the archaeological work and writes from inside the decisions rather than after they have become heritage legend. The book appeared in the year of the lift, so it cannot cover the later decades of conservation. That limitation makes a useful pairing with current Mary Rose research, which shows how recovery transferred the problem from seabed to laboratory and museum. The account also shows why a raising can be both archaeological work and national theatre.

Alexis Catsambis, Ben Ford and Donny L. Hamilton, eds., *The Oxford Handbook of Maritime Archaeology* (2011)

Use this as the field's map after the introductory books. Its chapters cover theory, survey, excavation, conservation, landscapes, law, ethics and regional traditions, showing how far maritime archaeology extends beyond named wrecks. It is large, expensive and designed for reference rather than a straight read. Choose chapters according to the question raised here: site formation, remote sensing, submerged landscapes, communities, war graves or conservation. It is the best route from one-hour understanding into specialist practice. Its range is also a warning against treating the Mediterranean treasure wreck as the whole discipline.

Notes and Sources

Scope, numbers and terminology

What counts as a shipwreck. The book uses shipwreck broadly for the physical remains and archaeological site created by a lost, stranded, scuttled or abandoned vessel. Legal definitions vary. UNESCO's 2001 Convention covers underwater cultural heritage more widely, including aircraft, structures, sites and human remains that have been submerged for at least one hundred years. This book stays with vessels except where broader law or ecology changes the explanation.

How many wrecks. UNESCO materials often repeat an estimate of about three million shipwrecks worldwide. It is an order-of-magnitude estimate, not a global inventory, and is not used as a measured total in the narrative. Historic England's National Marine Heritage Record provides the firmer comparison: about 37,000 recorded shipwrecks and losses in English waters, of which roughly 6,000 have identified physical remains on the seabed. The larger number includes documentary losses as well as located sites.

Maritime and nautical archaeology. Usage differs by institution. Maritime

archaeology commonly covers human relationships with seas, rivers and lakes, including ships, ports, submerged landscapes and coastal communities. Nautical archaeology often places more emphasis on vessels and seafaring. No theoretical distinction in the book depends on choosing one label.

Why ships sink

Buoyancy, stability and watertight integrity. The technical account follows the International Maritime Organization's material on ship design, intact stability and damage stability, including the effects of free surfaces, watertight integrity, righting levers and progressive flooding. The language has been simplified. Stability is condition-specific, and the book avoids implying that one measure such as metacentric height can describe the whole safety state.

Casualties as sequences. The Marine Accident Investigation Branch and United States Coast Guard casualty reports repeatedly show initiating events interacting with loading, maintenance, weather, open boundaries, alarms, training and decision-making. The generic sequences in the book are syntheses rather than reconstructions of one unnamed accident. The Coast Guard investigation of *Golden Ray* is a particularly clear modern example of loss of stability followed by flooding through openings after heel increased. MAIB reports and safety digests supply examples involving fishing-vessel stability, deck water, blocked freeing ports and rapid capsizes.

Load lines and freeboard. The load line is used as a visible example of regulated reserve. The book does not provide the legal or seasonal details of the International Convention on Load Lines, which belong in a specialist treatment of shipping regulation.

Vasa. The Vasa Museum's history and preservation research support the account of the 1628 sinking, the ship's poor stability, water entering through open gunports, recovery in 1961 and the later conservation problems involving polyethylene glycol, iron, sulphur, humidity, bolts and structural support. The museum states that more than 98 per cent of the original

structure survives. That exceptional figure helps explain why Vasa should not become the mental model for an ordinary wreck site.

Mary Rose. The Mary Rose Trust's history pages support the date of loss, 19 July 1545, and the strongest contemporary account: the ship was turning after firing when wind heeled open lower gunports beneath the water. The Trust also presents other possibilities and rejects the claim that a vessel which had served for thirty-four years sank on its maiden voyage or was proven to have been fundamentally defective. The description therefore presents a strong account, not a final single-cause verdict.

Titanic boundary. Titanic appears only to illustrate the difference between an initiating event and the sequence that shapes loss. The iceberg, flooding, subdivision, evacuation, communications, rescue and regulation belong to the separate Titanic title and are not retold here.

Survival

Cold water shock. The Royal National Lifeboat Institution defines cold water for this purpose as water below about 15 degrees Celsius and describes involuntary gasping, rapid breathing, increased heart rate and blood pressure after sudden immersion. Its Float to Live guidance supports the recommendation to control breathing and use flotation before attempting a difficult swim. Survival depends on water temperature, clothing, injury, sea state, body size, flotation and rescue time, so no universal minute-by-minute timetable is given.

Hypothermia. The correction does not minimise deep cooling. It distinguishes the immediate respiratory and cardiovascular response, short-term loss of swimming and dexterity, and later hypothermia. The order is drawn from modern sea-survival teaching rather than from a claim that every cold-water death follows the same path.

From vessel to archaeological site

Site formation. Keith Muckelroy's *Maritime Archaeology* supplies the foundational separation between the ship as a working system, the wrecking event, natural transformations and cultural transformations. Later work has made site formation more dynamic and less diagrammatic, especially for deep-water scatter, trawling and wreck ecology, but the distinction remains useful.

Wreck ecology and decay. Kirstin S. Meyer-Kaiser and Calvin H. Mires, "Underwater Cultural Heritage Is Integral to Marine Ecosystems", supports the account of shipworm attack, ballast reefs, metal corrosion, burial and the reciprocal relationship between wreck structure and biological communities. NOAA and Historic England guidance supports the list of threats from storms, currents, trawling, fishing gear, development, pollution, looting and salvage.

Fresh water and the Baltic. NOAA's Great Lakes maritime heritage material documents exceptional wooden preservation in cold fresh water, including intact cargo and standing structure. The Vasa Museum explains the Baltic combination of cold, darkness, low oxygen and limited shipworm. Neither environment stops corrosion or guarantees preservation.

Impact and debris fields. The narrative uses principles common to deep-water site-formation research: descent attitude, implosion, hydrodynamic separation, slope, mass and impact shape the initial distribution, while later collapse and current alter it. No specific deep-water wreck is reconstructed from these generic principles.

Archaeology, context and famous sites

Cape Gelidonya. The Institute of Nautical Archaeology presents the 1960 Cape Gelidonya project as a foundational demonstration that a shipwreck could be excavated on the seabed to terrestrial archaeological standards under a diving archaeologist, George F. Bass. Earlier underwater recovery and archaeological work existed, so the manuscript avoids turning that landmark into a claim that Bass invented all underwater archaeology.

Uluburun. The Institute of Nautical Archaeology and Cemal Pulak's 1998 overview support the dating to the late fourteenth century BCE, discovery by a Turkish sponge diver in 1982, eleven excavation seasons from 1984 to 1994, more than 22,000 dives beyond 45 metres, and the diverse cargo. Provenance assignments and interpretations of royal gift exchange remain subjects of specialist work. The book states the secure network conclusion while leaving the voyage's precise commercial or diplomatic status open.

Antikythera. Woods Hole Oceanographic Institution and the Greek Ministry of Culture support the first recovery by sponge divers in 1900, the presence of sculpture and luxury cargo, the geared mechanism, the site's depth and later systematic survey. The mechanism's exact functions and reconstruction continue to be studied. The book uses only the well-established conclusion that it modelled astronomical cycles and changed assessments of ancient mechanical capability.

Mary Rose collection. The Mary Rose Trust records more than 19,000 recovered objects. Its collection material supports the examples of tools, food, medicine, clothing, music and personal care, including more than eighty nit combs. These items are used to show ordinary life within a warship, not to claim the crew formed a complete demographic sample of Tudor England.

Clotilda. The Alabama Historical Commission and Smithsonian National Museum of African American History and Culture support the identification announced in 2019, the illegal transport of 110 captive Africans to Mobile in 1860, the attempt to destroy evidence by burning and sinking the vessel, and the connection to Africatown. The notes follow the institutions' emphasis that the wreck is one part of a history centred on the captives, survivors and descendants.

Franklin wrecks. Parks Canada supports the discovery of HMS Erebus in 2014 and HMS Terror in 2016, the material contribution of Inuit oral histories and knowledge to the search area, and cooperative management with Inuit. The book rejects a machine-centred discovery story because the official account makes the evidential partnership clear.

Preservation and conservation

Mary Rose conservation. The Mary Rose Trust records the 11 October 1982 raising on a cradle, continuous wetting to prevent uncontrolled drying, fresh-water spraying, treatment with polyethylene glycol from 1994, and controlled drying. Its conservation account states that untreated waterlogged timber could have undergone severe shrinkage, warping and cracking.

Vasa conservation. The Vasa Museum records seventeen years of polyethylene-glycol spraying from 1962 to 1979, gradual drying, later acidic salt deposits, iron and sulphur chemistry, replacement of corroding bolts and continuing structural monitoring. The treatment history is used to show that a successful recovery does not end material change.

General conservation methods. Donny L. Hamilton's *Methods of Conserving Archaeological Material from Underwater Sites* and Jeremy Green's technical handbook support the accounts of wet storage, desalination, concreted iron, polyethylene glycol, freeze-drying, documentation and the need to plan laboratory capacity before excavation. Treatments vary by material and condition; the narrative describes principles, not instructions for conserving finds.

Search and recording

Remote sensing. NOAA guidance supports the descriptions of side-scan sonar, multibeam sonar, magnetometers, remotely operated vehicles and autonomous underwater vehicles. Side-scan sonar produces image-like records of seafloor reflectivity and acoustic shadow but does not supply a complete depth model. Magnetometers detect disturbances associated with ferrous material and can reveal buried objects that sonar cannot see.

Photogrammetry and excavation. George F. Bass, Jeremy Green and the *Oxford Handbook of Maritime Archaeology* support the account of control networks, measured recording, water dredges, screening, block lifting, sampling and photogrammetry. The exact method depends on depth, visibility, current, substrate, threat and research question.

Law, ownership and stewardship

UNESCO 2001 Convention. For States Parties, the Convention on the Protection of the Underwater Cultural Heritage treats in situ preservation as the first option, requires proper respect for human remains, rejects commercial exploitation and restricts the application of salvage and finds law to covered heritage unless authorised and consistent with maximum protection. It does not replace all national law or settle every sovereignty dispute. Its one-hundred-year definition is a legal threshold, not a claim that younger wrecks lack historical or ethical importance. The United Kingdom had not ratified the Convention at the 11 August 2026 audit date, but UK authorities continue to use the Rules in its Annex as best practice for underwater archaeology.

United Kingdom wreck law. The Merchant Shipping Act 1995 and Maritime and Coastguard Agency guidance require recovered wreck material within the relevant United Kingdom system to be reported to the Receiver of Wreck. Current guidance requires reporting within twenty-eight days of recovery. Reporting allows ownership to be investigated and may result in a salvage award. Separate regimes include the Protection of Wrecks Act 1973 and the Protection of Military Remains Act 1986. The book gives a general explanation, not legal advice.

Nuestra Señora de las Mercedes. The legal account follows *Odyssey Marine Exploration, Inc. v. Unidentified Shipwrecked Vessel*, 657 F.3d 1159 (11th Cir. 2011), and the underlying district-court record. The courts accepted that the recovered material came from the Spanish naval frigate, that Spain had not abandoned it, and that sovereign immunity defeated the commercial claims. The case does not create one global rule for all wrecks.

Sunken military craft. The United States Naval History and Heritage Command's material on the Sunken Military Craft Act supports the general statement that state vessels can retain sovereign status and that permits may be required for disturbance. International practice and domestic law vary.

Polluting wrecks. NOAA's Potentially Polluting Wrecks programme supports the account of ageing steel wrecks, fuel and cargo risks, and the 2019 removal of more than 450,000 gallons of oil from Coimbra, a tanker torpedoed in 1942. Pollution response can conflict with archaeological preservation and may require controlled disturbance.

Evidence limits

Named wrecks are over-represented because documents, public interest and funding make them easier to identify and study. Wreck evidence is also a casualty sample: safe voyages, perishable cargo and unlocated losses remain under-represented. The book's central archive model is therefore conditional. A wreck can correct written history, but it cannot stand for all ships, all trade or all people who went to sea.

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