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Oars to Sail

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Galley ships, originating in the Mediterranean, utilized oars powered by slaves for trade, war, and piracy. The successor to these galley ships was the sail ship, which utilized massive sails to propel itself themselves to different destinations. In this paper, I will argue that, although the superiority of sail ships over galley ships seems self-evident, in reality this transition was long-drawn out, because oars-driven ships proved well suited for certain conditions in sea battles. Thus, similar to the Military Revolution of the age on land, as traced by Michael Roberts and especially Geoffrey Parker, the change from oars to sail was not a quick process merely based on evident technological advantages.[1] On land, too, disciplined volley fire and *Trace Italienne* were not everywhere as effective or important as in Western Europe (take for example the East European Plain).[2] Perhaps an analogy can be drawn with the robust survival of trains in an apparent automobile age in a country such as the Russian Federation today.

Despite the relative length of the transition, I suggest in my essay that a crucial juncture occurred in the sixteenth and seventeenth centuries. It became manifest for the first time at the Battle of Lepanto in 1571, but was not quite understood by the Venetians, Turks and other powers located along the Mediterranean shores until the seventeenth century. Perhaps the clearest evidence of the passing of the age of the galley came in the Venetian-Ottoman war in the middle of the seventeenth century.[3] Even after that, King Louis XIV of France still maintained a sizeable galley fleet, perhaps more as a floating jail on which convicts rowed, and

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[1] Geoffrey Parker, *Military Revolution* (Cambridge: Cambridge University Press, 1996), 89; Roberts, *Essays on Swedish History* (Minneapolis: University of Minnesota Press, 1968),
[2] Ibid., 156.
[3] Roger Charles Anderson, *Oared Fighting Ships: From Classical times to the Coming of Steam* (London: P. Marshal, 1962), 28.

in the Great Northern War (1700-21), the new Russian navy of Tsar Peter the Great successfully defeated Swedish naval detachments with the help of galleys (at the battle of Gangut/Hanko/Hangoudd 1714). It shows that certain conditions still made oars-driven vessels useful in naval warfare, but they were rapidly falling out of use.

In this essay, I will begin with outlining the "terrain" (kind of sea; natural environment) where galleys had been most prevalent before 1571 and where they never quite had been used in the first place, both by Europeans and by Asians. Then, I will sketch the opening salvo heralding the end of the galley era by discussing the Battle of Lepanto, and the advantages and disadvantages of the galleys and sail ships used at that time. Linked to this is an aspect of galley ships that informed their use since the Classical Age: the deployment of slaves as oarsmen, a practice flourishing in the Mediterranean in the sixteenth and seventeenth century, and possibly responsible for the survival of galley-galleas warfare longer than was militarily advantageous (and perhaps caused the Ottomans to underestimate the importance of the sail ships, not unlike their underestimation of Western military changes on land at this time). I will proceed to outline the intermediate phase of galleasses, which ultimately did not amount to the best of both worlds. Then I will focus on the long-drawn out war between Venetians and Turks, and the growing role of sail ships in it. I will conclude my discussion by tracing the gradual disappearance of the galleys in the course of the early eighteenth century. I will also then determine in how far the "triumph of sail" was another element of the military revolution that caused the West (or Europe) to forge ahead in military-technological terms in global terms, allowing it to establish its hegemony/dominance over the non-Western world.

Galleys were seafaring ships utilized by the Mediterranean powers and were designed to be dependent on oars powered by crewmen, particularly slaves, instead of depending on the wind through sails. Galley ships were first invented, and deployed in the eastern Mediterranean in the early 3rd millennium BCE by Egypt into Lebanon and Palestine.[4] In the following century, the Egyptian pharaoh Thutmose III (1479-1425 BC) solidified transport of troops by sea as a common practice.[5] Despite their usage in military transport, galleys were first used by unknown sea raiders in military operations such as capturing merchant ships, and assaulting and blocking settlements and ports around 1500-1300 BCE.[6] In these attacks, the galleys of the sea raiders were manned by marines of javelin throwers and archers as well as fighting rowers. As nations began to develop a seafaring culture, it became possible for large naval fleets to emerge.

The Persian Empire became the first state to be capable to afford and man a vast fleet that eventually engaged in combat with the Athenian navy.[7] In fact, the wars between the Persian Empire and the Greek city-states were the first large scale naval battles.[8] However, oared ships were also used in both northern Europe as well as in Asia. Viking longships which have both oars and sails for propulsion were a type of galley ship. In Asia, China was so prosperous that they were capable of featuring a vast variety of vessels including the galley and Chinese junk on their way to being the world's greatest power. Meanwhile, French and Castile

[4] R. G. Grant, *Battle at Sea: 3,000 Years of Naval Warfare* (London: DK Publishing, 2011), 26.
[5] Grant, *Battle at Sea*, 26.
[6] Ibid., 26.
[7] Ibid., 26-27.
[8] Ibid., 27.

kings sent their galleys into battles in the English Channel and Bay of Biscay against various English kings as stated by Sir Jean Froissart.[9]

Originally, galleys were derived from the Medieval Greek, *galea,* which was a type of small Byzantine galley.[10] Scholars, such as Lionel Casson, group galleys as oar-powered ships, and classify them together with other oar-driven ships like the Viking longships.[11] But they are generally recognized as ships belonging to a specific Mediterranean tradition.[12] Since 1450, the Mediterranean powers (the Ottomans, the Venetians, and the Habsburg Empire) featured galley ships in their naval fleets.[13]

However, using galley ships outside of the Mediterranean region faced many obstacles and proved to be hazardous. Because of their limited space, galley ships were unable to carry enough provisions to support a large number of marines and oarsmen for long journeys at sea.[14] Another noticeable problem for galley ships was the nature of the seas. Galley ships were forced to remain in the calmer coaster waters instead of sailing in harsher waters.[15] For nations with shores on the Atlantic, cogs were utilized instead of galley warships. These round sail ships were originally used as merchant vessels before becoming warships as naval fleets began

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[9] Jean Froissart, *Sir John Froissart's chronicles of England, France, Spain, and the adjoining countries: from the latter part of the reign of Edward II to the coronation of Henry IV*, ed. T. Johnes, (London: W Smith, 1803-05), 26.
[10] Anderson, *Oared fighting ships*, 37.
[11] Lionel Casson, *The Ancient Mariners: Seafarers and Sea Fighters of the Mediterranean in Ancient Times* (Princeton, NJ: Princeton University Press, 1991), 123.
[12] Anderson, *Oared Fighting Ships*, 1.
[13] Jan Glete, *Navies and nations: Warships, Navies and State Building in Europe and America, 1500-1860* (Stockholm: Almqvist & Wiksell International, 1993), 114.
[14] Grant, *Battle at Sea*, 27.
[15] Ibid., 27.

including the warships in times of war.[16] Because of these limitations, galley ships were prominently utilized in naval warfare almost exclusively in the Mediterranean until the Battle of Lepanto before being slowly phased out for their successor, the sail ship.

In the Battle of Lepanto, merchant ships from both the Ottoman Empire as well as the Holy League, specifically Spain, Venice, the Pope and Holy Roman Empire, clashed not only in a battle of Christianity and Islam but also of Western and Eastern supremacy. This battle is distinctly known in history as the largest gathering of galley ships in any naval battle. Moreover, it turned out to be one of Europe's largest battles before the Napoleonic Wars.[17] In fact, this battle exclusively featured the largest number of galleys in history.[18]

On October 7, 1571, a Christian fleet of two hundred eight galleys as well as six galleasses engaged with two hundred thirty galleys of the Ottoman Empire at Lepanto.[19] Even though both the Christian and Ottoman fleets featured more sturdy ships, the general strategy of naval combat in the Mediterranean remained virtually identical to the tactics employed by the Greek city states and the Persian Empire. The main tactic in naval conflict remained using the speed of the galley ship to ram other enemy ships.[20] Even though the ram was primarily used in combat, there were other methods of attacking enemies in the form of carried artillery such as hurling rocks or using "Greek fire".[21] After three hours of battle, the Holy League

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[16] Ibid., 27.
[17] Glete, *Navies and Nations*, 114-115.
[18] Paul W. Bamford, *Fighting Ships and Prisons* (St. Paul: North Central Publishing Co., 1973), 12.
[19] Carlo M. Cipolla, *Guns, Sails, and Empire* (New York: Pantheon Books, 1965), 100.
[20] Grant, *Battle at Sea*, 27.
[21] Ibid., 27.

emerged victorious over the Ottoman Empire as eighty Turkish galleys were destroyed, one hundred thirty galleys were captured, and only a small remnant of forty galleys escaped.[22]

Both sides reacted quite differently to the battle. On one side, the Christian world was relieved over this victory over their Eastern foe. Pope Pius V (Pope 1566-1572) was even noted to have boasted that he "had seen the whole course of the battle while sitting in his chair in St. Peter's at Rome".[23] However, Sultan Selim II (R. 1566-1574) of the Ottoman Empire merely viewed this defeat as minor setback in the overall big picture of expanding to Western Europe. In fact, Selim II utilized the event as a source of propaganda by stating, "The infidels only singed my beard; it will grow again."[24] Perhaps, Selim II's nonchalant attitude towards this defeat was because the Turks had the necessary resources to quickly rebuild their recently destroyed galley fleet.[25]

A more distinct reason was the knowledge that the military strength of the Ottoman Empire was in their land armies, not their navy. The galley ships of the Ottoman Empire were in every way outclassed in comparison to the galley ships of Christian fleets. Moryson points out how the Turkish galley ships were built of lower quality timber and, as a result, were slower, less combat capable, and more brittle as evidence.[26]

At first glance, the Battle of Lepanto appeared to be a significant step in the Christian powers pushing back the Ottoman Empire. Yet, it wasn't. Instead, the Christian victory at

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[22] Cipolla, *Guns*, 100.
[23] Ibid., 100.
[24] Ibid., 100.
[25] Ibid., 100.
[26] Fynes Moryson, *Shakespeare's Europe: Unpublished Chapters of Fynes Moryson's Itinerary*, ed. Charles Hughes (London: London Sherratt & Hughes, 1903), 58.

Lepanto was pyrrhic; essentially, both the Holy League and the Ottoman Empire lost.[27] Cipolla, moreover, suggests that the battle of Lepanto was anachronistic where the victors were not only no different from the losers but also "prisoners of outdated traditions and techniques."[28]

Despite the arrival of more modern weaponry and ships, naval combat between the two sides at the Battle of Lepanto remained outdated and involved the same strategy used in previous battles as the crews of galley ships trying to board and ram their adversaries.[29] The Battle of Lepanto proved to be a pivotal point in history in the transition of warships in ancient history to the more modern warships of today.[30] Specifically, the Battle of Lepanto proved to be the final high point in the Age of Galleys. In hindsight, the results of the Battle of Lepanto were extremely significant because it marked the end of the galley era.

However, galley ships didn't immediately transition into sail ships. In fact, galley ships proved to be far more superior to sail ships when guns were introduced. In the 16th century, Mediterranean galleys typically were capable of firing one sixty pounder bronze cannon, two sixteen pounders, and fifteen smaller guns at the prow and poop.[31] The Naval Museum of Venice has recorded that the sixty pounder guns were one hundred seventy-five millimeter

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[27] Roger Crowley, *Empires of the Sea: The Siege of Malta, the Battle of Lepanto, and the Contest for the Center of the World* (New York: Random House Bertelsmann, 1996), 275.
[28] Cipolla, *Guns,* 101.
[29] Ibid., 101.
[30] Fernand Braudel, *The Mediterranean and the Mediterranean World in the Age of Philip II* (Berkeley and Los Angeles: University of California Press, 1995), 2: 1088.
[31] Parker, *Military Revolution*, 87.

caliber weapons with a minimum range of six hundred forty meters and around three kilometers at maximum range.[32]

By aiming with the centerline gun, the recoil from a shot was absorbed by a sledge that slides back to the mast for reloading.[33] With this amount of firepower, sail ships were regularly captured or sunk by galley ships because the galley ship's fighting ability surpassed the fighting ability of sailing ships at the time in the calm conditions of the Mediterranean. "In windless conditions, oared fighting ships were able to hold their own against any sailing vessel, for they were far more mobile, and their main weapon had a longer range, delivered a much larger shot, and fired on a more dangerous trajectory."[34]

In fact, the first real threat to the galley ship was the galleass in the 16th century in the Mediterranean Sea not the sail ship. The galleass was originally seen as the invention that would keep the oared fighting ships on the naval frontlines.[35] Despite its three masts, the galleass relied on its oarsmen to transport itself, and only utilized the sails to increase its speed.[36] The galleass was an intermediate between the galley ship and the sail ship as it was propelled by oars and sails yet it carried eight heavy guns at the stem and the stern along with at least seven antipersonnel weapons on either side.[37]

However, the galleass design of combining the propulsion capabilities of galley ships and sailing ships as an upgrade to the galley ship was unsuccessful. Chazelles states how the galleass

[32] Ibid., 87.
[33] Ibid., 87.
[34] Ibid., 87.
[35] Angus Konstam, *Renaissance War Galley 1470-1590* (Oxford: Osprey Publishing, 2002), 18.
[36] Konstam, *Renaissance War Galley*, 18.
[37] Parker, *Military Revolution*, 87.

appears to have an advantage in speed and maneuverability through the harbor over the common galley ship.[38] However, at seventy-four meters long and eleven meters wide, the galleass proved to be incapable of being used effectively in real life.[39] This is proven in Chazelles' experiment conducted by Monsieur Du Quet as the common galley ship was still capable of matching the galleass in speed and maneuverability.[40]

The transition from galley ships to sail ships became more prominent with the incorporation of more modern weapons in maritime wartime. Grant stated that "war galleys remained in use until the end of the 18th century, but their role in naval warfare became increasingly specialized and localized."[41] As the Age of Galleys began to give way to the Age of Sail, galley soldiers had to understand that their way of combat was beginning to evolve with the times.

Cannons and firearms became much more vital in naval combat as opposed to the use of outdated tactics such as ramming and boarding enemy ships.[42] The galley ship was originally equipped with heavy naval artillery, but was easily overmatched when sailing ships equipped cannons more efficiently.[43] Sail ships could use cannon more efficiently than galley ships.

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[38] Monsieur Du Quet, "A method for rowing Men of War in a calm. Communicated by Monsieur Du Quet," *Philosophical Transactions* 31 (1720-1721): 243.
[39] Parker, *Military Revolution*, 87.
[40] Du Quet, *method for rowing Men of War*, 243.
[41] Grant, *Battles at Sea*, 29.
[42] Ibid., 29.
[43] Nicholas A.M. Rodger, *The Safeguard of the Sea: A Naval History of Britain 660–1649* (New York: Norton, 1997), 68.

Broadside salvoes sailing in line were far more devastating, while sailships were faster.[44] A big reason that galleys were not as successful as sailing ships at carrying cannons and guns was because of their small size and increased mobility, the same calling card that allowed for their success in ancient and medieval history.[45]

Moreover, many scholars state that the English were the first to use cannon during the times of the Spanish Armada, when it was, in fact, the Genoese were the first to utilize cannons in naval warfare.[46] Much of these inaccurate statements originated from publication of Sir Nicholas Harris Nicolas's book on the history of the Royal Navy.[47] Thomas Frederick Tout disproved that the ships Edward III (1312-1377) were the first ships equipped with cannons.[48] In fact, Guglielmotti, referencing the Genoese chronicle by Giorgio Stella, asserted that a Genoese ship utilized a bombard in 1319.[49] However, the Genoese text "*Artificium longum et ingens ad instar tubae in quo ignis magna quantitas et frequenter accendibilis ferebatur*" stated that the so-called bombard was more of a weapon that ejected fire at its enemies.[50]

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[44] As the demise of the Armada of 1588 and the Dutch victory over the Spaniards at the 1639 Battle of the Downs prove; see Parker, *Military Revolution*, 160, 171.
[45] Grant, *Battles at Sea*, 29.
[46] Jeremy Black, *European Warfare* (London: Routledge, 2002), 173.
[47] Cipolla, *Guns*, 75; Sir Nicholas Harris Nicolas, *A History of the Royal Navy* (Charleston: Nabu Press, 2011), 177.
[48] Thomas Frederick Tout, *Firearms in England in the fourteenth century* (Oxford: University of Oxford Press, 1911), 668-669.
[49] Alberto Guglielmotti, *Storia della marina pontificia nel medio evo* (Vatican: Rome Printing Office, 1871), 37-38.
[50] Guglielmotti, *Storia della marina* 37-38.

The use of cannons initially allowed for galley warships to become effective "mobile artillery platforms."[51] Moreover, the amphibious abilities of galleys were enhanced as soldiers were able to efficiently assault fortresses with the galleys' artillery support as well defend the beached galley ship in combat.[52] Some of the greatest drawbacks for cannons in land warfare were less of an issue when utilized in naval warfare. For example, the cannon's lack of mobility was limited it when it came to land artillery. Instead, European vessels proved to have been successful in incorporating guns as the Count of Flanders, Louis de Male sent guns equipped with Tournai guns to attack Antwerp in 1336.[53]

There was evidence that Genoese and Venetian galleys used cannons more prominently in maritime warfare in the same century. The cannon on these European warships were made specifically for both securing current and new trade routes as well as attacking distant naval bases.[54] This allowed for many European powers to fortify on their respective claims on maritime links where they can control the flow and access of trade routes between nations.[55]

What truly gave European naval powers an edge over other naval powers was the eventual usage of sailing ships with cannons. This advantage became prevalent as sailing ships were capable of carrying multiple heavy cannons on the sides while galley ships had to use this

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[51] Black, *European Warfare,* 168.
[52] John Francis Guilmartin, *Gunpowder and Galleys: Changing Technology and Mediterranean Warfare at Sea in the Sixteenth Century* (London: Cambridge University Press, 1974), 264-266.
[53] Cipolla, *Guns*, *75*.
[54] James D. Tracy, *The Political Economy of Merchant Empires* (Cambridge: Cambridge University Press, 1991), 143-144.
[55] Black, *European Warfare,* 168.

area of the ship for oarsmen.[56] Because of this, sailing ships were finally able to wrest away control over trade routes to the Americas and the East from galley ships as many galley ships were incapable of making long voyages across the Atlantic Ocean.[57]

Portugal, when ruled by King John II (1455-1495), researched and utilized naval guns on her caravels. Portuguese fleets of small caravels proved to be highly effective against larger ships because the caravels were smaller and easy to maneuver while also possessing great destructive power.[58] However, the design of sailing ships had to be tweaked in order for them to utilize cannons as weapons both efficiently and effectively. At first, the cannons were placed on the decks of the castles.[59] As the cannons became much heavier and more destructive, navies began to utilize the heavier guns on the higher decks, while leaving the lighter guns inside the fore castle and the after castle.[60] Eventually, in the sixteenth century, European naval engineers discovered that cutting into the ports of the actual hull of the ships allowed for cannons not only on the upper deck of the castles but also on the main deck.[61] Because of these adaptations, defense against European navies proved to be troublesome as European powers were not only improving their manufacturing of guns but also their construction of more modern sailing ships such as the men of war.

While cannons provided fleets with great power, many nations were faced with a problem of how much manpower was needed for each ship. Maritime galley fleets faced an

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[56] James Patrick, *Renaissance and Reformation*, (New York: Marshall Cavendish, 2007), 717.
[57] Patrick, *Renaissance and Reformation*, 717.
[58] Cipolla, *Guns*, 81.
[59] Black, *European Warfare,* 170.
[60] Cipolla, 81.
[61] Ibid*.,* 81-82.

increased demand for crewmen because larger ships were required to be able to feasibly support the use of cannon along with the previously needed amount of crewmen needed to maximize the use of the galleys' oars. The solution of this problem for galley ships required the application of slaves as the required muscle power for naval fleets. Many of the rowers on the galleys were slaves who were captured as prisoners of war. However, slaves were not limited to prisoners of war as sold slaves but could also include peasants from shore raids, fishermen, common sailors, and convicts.[62] Slaves were utilized as rowers as many galleys required around 150 to 300 oarsmen per ship.[63]

The Battle of Lepanto was for a long time considered the greatest naval battle in history as hundreds of galleys and galleots powered by eighty thousand rowers were utilized by each side against each other.[64] These numbers from the Battle of Lepanto are clear evidence that galley ships needed far greater amounts of crewman. In fact, it is particularly interesting because it shows how it is erroneous to consider the use of galley slavery a predominantly Islamic practice, for at Lepanto both the Christian and Muslim galley fleets were rowed by slaves.

Nonetheless, Islamic war fleets, and especially those of the Ottoman Sultan, did predominantly rely on slaves to man the oars. The Barbary corsairs were much more adept than the Christian galleys in capturing slaves. Also, the Christian powers transitioned away from the galleys to sailing ships which did not require the usage of oarsmen while the Ottoman Empire

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[62] Robert C. Davis, *Christian Slaves, Muslim Masters* (New York: Palgrave MacMillan, 2004), 74.
[63] Davis, *Christian Slaves*, 74.
[64] Ibid., 74.

continued to use galley ships and made the same transition to sailing ships much later in history.[65]

Because of their slow transition, the Ottoman Empire continued to capture slaves until the eighteenth century when they belatedly shifted to more sailing ships. As much of the galley crew were slaves, pirates and corsairs had reduced incentive to capture more slaves for new crew members. Nevertheless, the severe treatment of slaves on enemy galleys continued regardless of the declining usage of war galley ships. This treatment was so horrific that even some scholars have tried to dilute saying how the living conditions of Muslim slaves were comparable to that of life as a Christian slave on their respective galley ships.[66] "Chained to each other, galley slaves suffered a 'living death' of insufficient sleep, hunger, thirst, lashings, unbelievably hard labour pulling oars, filth, and an early death; despair was enhanced by the knowledge that the Turks never released captives who had served the Venetians."[67]

John Struys in *The Voyages of John Struys* expressed this predicament after he is taken captive and deployed on a Muslim ship: "In the mean while I sat biting my nails, and scratching my head in the Vineyard. Seeing my way forelaid, and no hopes of coming to the Sea-side, I began to consult with myself what shift to make, and concluded it the greatest folly in the world to oppose myself against so many men, for which (being once in their clutches) I might expect severer usage…it was not long before they came to see what kind of a fool….they brought me first to the Hamlet, where Troy was said to stand in times of yore…….here they put

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[65] Ibid., 75.
[66] Ibid., 75.
[67] Kees Boterbloem, *The Fiction and Reality of Jan Struys A Seventeenth-Century Dutch Globetrotter*, (New York: Palgrave MacMillan, 2008), 22.

me in a Galley, stript off my Robes, shaved my head, and set me to an oar, which was work enough for six of us to tug at, allowing me only a pair of linen Breeches to cover my nakedness. I was chain'd to a Rusian, who had been 24 years in the galleys: for a stranger that they take in the Venetian Sea-Armade, are to stay in the Galleys during life, without the benefit of Redemption."[68]

It is unbelievable how slaves on galley ships survived at all in these conditions (indeed, the Russian with whom Struys eventually escaped had allegedly been a galley slave for 24 years!). In order to work the oars, the galley slaves were shackled to the oars by their wrists and ankles. These slaves were worked to the point of exhaustion by their Muslim masters only to be pushed beyond their limits as many were sleep deprived, sleeping for maybe two hours of an entire day. As if their situation could not be any worse, the slaves are not allowed for proper clothing to protect them from the cold or the heat such that "their flesh is burned off their backs."[69] Moreover, the slaves were only granted a few crumbs and drops of water while in service and were even expected to eat while rowing if required. The only liberty granted to a galley slave was the use of an opening near the hull where they could relieve themselves. However, many galley slaves were too fatigued to even do that as they sullied themselves as they sat on their rowing benches.

It is ironic the role of slaves on maritime galley fleets were to maximize productivity in combat or missions which will result in acquiring more slaves to replace the lost slaves who

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[68] Jan Janszoon Struys, *The perilous and most unhappy voyages of John Struys*, (London: Princes Arms in S. Pauls Church-yard, 1683), 80.
[69] Davis, *Christian Slaves*, 76.

perished from combat, fatigue, or disease. With these harsh working conditions, it was necessary to constantly acquire more slaves to replace the dead ones. This is bad, of course, however, consider the age: African slaves were treated just the same by Europeans on plantations in Brazil and on Jamaica or on the journey across the Atlantic in this, the Era of the Transatlantic slave trade. Judicial torture was routine in most European criminal investigations before the eighteenth century.

Moreover, with the increased supply of more slaves, both the European powers and the Ottoman Empire were able to build up their fleets without fear of being undermanned in combat. Even though both sides were expanding their respective fleets, neither side engaged in major battles but instead each engaged in smaller skirmishes before 1571. These skirmishes between the Ottoman Empire and the Christian powers escalated to its apex during the engagement of their massive fleets at the Battle of Lepanto (1571). While they were still utilized in the Mediterranean Sea afterwards, war galleys gradually declined as sail ships became more prevalent competitively in both battle and trade.[70]

This is evident from the Venetians hiring many Dutch ships and crews to fight against the navies of the Ottoman Turks.[71]As battles are fought and won both sides take away prisoners of war from the conflict. Galleys, however, did not disappear at the frontlines from an insufficient number of rowers. Instead, the beginning of the Age of Sail and the emergence of sail ships rendered galleys obsolete in naval combat.

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[70] Boterbloem, *Fiction and Reality,* 22.
[71] Ibid., 22.

Sail ships also faced a similar problem to galley ships when using cannons. Moreover, their solution to this problem was similar to the solution used for the galley ships with one key difference. As sail ships increased in size (as specialized warships or east India men), they began to utilize more crew. The difference between these solutions was the type of crew members used by each ship. With sailing ships, the demands for crewmen were significantly less than the demands for galley ships. Larger sailing ships with three masts required fewer bases than galleys because of their reliance on wind.

This was one of the many advantages that sailing ships had over galleys. Because of this, sail ships were able to focus less on using enormous numbers of crewmen to power the oars of the ship, and put more emphasis on incorporating more soldiers onto their ships. These soldiers include specialized constables or gunners as well as more mariners to handle the larger number of sails on sail ships. The English utilized sailing ships equipped with a forward and a rear firing cannon to combat the galleys in the 1560s and 1570s.[72] Previously, before utilizing cannons, naval warfare mainly involved ramming or pulling alongside and boarding enemy ships.[73]

The cannon changed the revolutionized military tactics employed by maritime powers. But sturdier ships with advancements in hull and rigging construction were required for heavier guns. With the application of carvel building, shipbuilders were able to join the edge of hull planks over frames instead of build ships by overlapping planks as in the clinker shipbuilding

[72] Black, *European Warfare,* 169.
[73] Ibid., 173.

system.[74] This style of clinker shipbuilding originally came from the shipbuilding design of the cog, the standard northern European trading ship at the time.[75]

This shipbuilding style carried on many of the same features that the classic Viking ships had before becoming extinct.[76] The cog featured a single mast with a square shaped sail and a single rudder for mobility.[77] The larger hull from the cog design allowed for ships to carry more cargo as well as more troops.[78] Each oak plank is overlapped and fastened in a "lap-stratke" construction method.[79] Moreover, the development of the forecastle and sterncastle, which were platforms at the bow and stern, allowed the transported soldiers enough room to fight enemy combatants.[80] These replaced the flimsy structures at the bow and stern and were an integral part of the ship's hull.[81] With the addition of forecastles and stern castles, sailing ships of the future were much more capable of handling the harsh conditions in the seas of Northern Europe.

The French King Louis IX (1226-1270) used Venetian and Genoa developed cogs, which utilized double masted lateen sails instead, to transport his armies for crusades.[82] Italian shipbuilders would later build carvel type ships by increasing the hull size of the cog. By the late 15th century, the cog's hull size became large enough to efficiently carry two or three masts

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[74] Ibid., 170.
[75] Angus Konstam, *The History of Shipwrecks*, (New York: Lyons Press, 2002), 76.
[76] D.H. Keith and T.L. Carrell, *International Handbook of Historical Archaeology*, ed. Teresita Majewski and David Gaimster, (New York: Springer, 2009), 118.
[77] Konstam, *History of Shipwrecks*, 76.
[78] Ibid., 76.
[79] Keith and Carrell, *International Handbook*, 118.
[80] Konstam, *History of Shipwrecks*, 76.
[81] Ibid., 77.
[82] Ibid., 76.

with lateen sails.[83] As the ship hulls of these vessels became more streamlined, the ship became less resistant to the flow of air and water on the seas allowing for the ship's speed and ease of movement to increase.

Meanwhile, after north-western Europeans developed the cog, Iberian shipbuilders developed the caravel from the cog designs of northern Europe. Specifically, these shipbuilders incorporated the stern rudder and flat stern of the cog with a carvel built hull large enough to hold two or three masts and carry lateen sails into their caravel design.[84] Caravels had many varieties: fishing caravel, lateen lateen twomaster, lateen threemaster, and the caravel redonda.[85] Despite the many varieties of caravels, the basic design consisted of a broad-bowed vessel with a high, narrow poop that usually carried three masts with lateen or both square and lateen sails".[86]

It was once understood that caravels were only built by the Portuguese on the order of Henry the Navigator (1394-1460). However, Duarte Leite questioned this assertion because there has been no evidence proving that Henry the navigator truly invented the caravel.[87] Moreover, historians such as Azurara and Cadamosto have do not go into detail about the ships in Henry's time according to Diffie and Winius.[88]

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[83] Martin M. Elbl, *The Portuguese Caravel and European Shipbuilding: Phases of Development and Diversity* (Coimbra: UC Biblioteca Geral 1, 1985), 543-544.
[84] Konstam, *History of Shipwrecks*, 77.
[85] Elbl, *Portuguese Caravel*, 544.
[86] Ibid., 546.
[87] Bailey Wallys Diffie and George Davison Winius, *Foundations of the Portuguese Empire, 1415-1580* (Minneapolis: University of Minnesota Press, 1977), 181-182.
[88] Diffie and Winius, *Foundations,* 119.

Nonetheless, Spanish and Portuguese shipbuilders innovatively added a square mainsail to their caravel ships.[89] Because of this small change, Spanish and Portuguese vessels became much faster and easier to control when sailing with the wind.[90] With this upgrade in speed and maneuverability, the use of caravel ships shifted away from fishing vessels towards extended use as exploration vessels and warships.[91] *Caravel redonda* were popularly used by the Portuguese when they explored the African coast and Indian Ocean for riches.[92] It also turned into becoming the ship of choice for explorers, most notably Christopher Columbus, who brought the Nina and the Pinta on his voyage into the Americas.[93]

At the end of the fifteenth century, caravel design allowed for stern castles to extend "as far forward as the mainmast", and allowed for an extra deck.[94] Note: Caravel-designed ships began to outpace the clinker-built hulls as ship borne artillery began to develop.[95] "The integrity of clinker-built hulls would be compromised by cutting holes in them to accommodate for the artillery, so strongly armed ships needed to be caravel built".[96] The use of caravels peaked at

[89] Konstam, *History of Shipwrecks,* 77.
[90] Ibid., 77.
[91] Richard W. Unger, *Cogs, Caravels and Galleons*, (London: Conway Maritime Press, 1994), 9, 91-93.
[92] Konstam, *History of Shipwrecks,* 77.
[93] Ibid., 77.
[94] Diffie and Winius, *Foundations,* 181-2.
[95] Konstam, *History of Shipwrecks*, 77.
[96] Elbl, *Portuguese Caravel*, 544..

the end of the sixteenth century as a swift escort ship to cargo ships as well as an effective reconnaissance ship for warship fleets.[97]

This shift in shipbuilding resulted in the birth of the carrack as stated by northern Europeans or *nao* by the Spanish and the Portuguese.[98] Carracks were very similar to caravels in that they both use various combinations of square and lateen sails depending on the weather conditions.[99] Vasco Da Gama's fleet of 1502 predominantly used square sails throughout its explorations in Africa while switching to lateen sails in the Indian Ocean.[100] Normally, the square sail is on the mainmast, "flanked by a square sail on the foremast and a lateen sail on the mizzen mast if a third mast was available."[101] When using this combination of wind with the tacking technique, vessels are capable of sailing through a variety of sea conditions.[102] Tacking involves turning from one side of the wind to the other by turning to the side where the wind is blowing from. However, tacking with lateen sails required a larger crew to effectively utilize this technique.[103] At the end of the 15th century, a bowspirit added a spirit sail and the fore and main masts added topsails.[104]

At this time, the Portuguese fleets were able to defeat the Muslims in the Indian Ocean. While the battles in which they fought weren't as large as the Battle of Lepanto, these battles in

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[97] Roger C. Smith, *Vanguard of empire: ships of exploration in the age of Coumbus*, (New York: Oxford University Press, 1993), 30-37; John Horace Parry, *The Age of Reconaissance*, (London: Weidenfeld and Nicolson, 1963), 65-66.
[98] Konstam, *History of Shipwrecks,* 77.
[99] Ibid., 77.
[100] Unger, *Cogs, caravels, and galleons,* 92-93.
[101] Konstam, *History of Shipwrecks*, 77-78.
[102] Ibid., 78.
[103] Unger, *Cogs, caravels, and galleons,* 93.
[104] Konstam, *History of Shipwrecks*, 78.

the Indian Ocean truly amounted to the first step towards pushing back the Ottoman Empire. Despite the Ottoman Empire's repeated efforts to stop them, the Christian powers took control of the Indian Ocean and, consequently, caused a growing fear among the crews of the Ottoman fleet to engage Portuguese or Spanish vessels.[105]

One view suggests that the Ottoman Empire lost control of the Indian Ocean is from a lack of timber, but, while it is true that timber was absent from areas around the Red Sea and the Persian Gulf, the Ottoman Empire was capable of overcoming this obstacle.[106] In fact, the Ottoman Empire was able to mobilize multiple fleets in the Red Sea to combat the European threat.[107] Instead, the main reason for the Ottoman Empire's defeats in the Indian Ocean stemmed from their dependence on galley ships.[108]

What the Ottoman Empire failed to realize was that its own naval tactics and weapons were becoming obsolete. Instead of incorporating more modern sailing ships like the Christian powers, the Ottoman Empire decided to remain "medieval" from a military sense because their navies remained exclusively galley ships.[109] Even though the Ottoman Empire's navy included some sailing ships, its fleets were more dependent on using oar-driven galley ships.[110] Likewise,

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[105] Moryson, *Shakespeare's Europe*, 34.
[106] C.R. Boxer, *Portuguese in the East, in Portugal and Brazil*, ed. H.V. Livermore (Oxford: Clarendon Press, 1953), 197.
[107] R.B. Serjeant, *The Portuguese off the South Arabian Coast* (Oxford: Clarendon Press, 1963), 15.
[108] Cipolla, *Guns*, 101.
[109] Ibid., 102.
[110] Ibid., 102.

Turkish galley ships incorporated guns onto their large galley ships known as the qadyrgas to bear the brunt of the damage in battle.[111]

However, these galley ships were not suited to sailing in the Indian Ocean. If these galley ships weren't sunk by the guns of enemy sail ships, the seas of the Indian Ocean would surely have sunk them.[112] Thus, galley ships were never truly discarded from use in the calm Mediterranean before 1800. Nonetheless, the technological advantage that the European powers had over the Ottoman Empire continued to grow over the centuries.[113] As these navies were developed, more merchant ships were replaced at the frontlines as more specialized warships took their place. These warships were able to effectively protect the merchant ships from pirates and rival navies so that the cargo carried by the merchant ships did not get stolen.

With these advancements, sailing warships not only gained distinct advantage in speed and maneuverability but also were better able to take advantage of the winds. This fact was made known

Portugal was the first of the naval powers to apply these technological advancements to its own vessels. Originally dependent on the caravel, the Portuguese later developed the galleon during the Age of Sail.[114] The galleon was similar to carracks in design. However, it was not only longer and narrower than the carracks but also they were capable of equipping cannons to the sides of the vessel.[115] Because of this, galleons are recognized as somewhat of a

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[111] R.B. Serjeant, *The Portuguese*, 179.
[112] Cipolla, *Guns*, 103.
[113] Ibid., 103.
[114] Black, *European Warfare,* 170.
[115] Ibid., 171

hybrid ship which focuses on fighting capability as well as cargo capacity.[116] Because of these advancements, Portugal's ships were able to equalize the numerical advantage in warships of the other naval powers and took control of the seas during the beginning of the Age of Sail.[117]

Despite its superior firepower and sturdier hull, sailing ships were obviously not completely invulnerable. In places of where variables such as the weather, tides, and currents were a major factor, sail ships were handicapped when compared to galleys. Galleys were able to turn precisely and head towards an enemy by using their oarsmen while sail ships are completely dependent on utilizing wind, which did not always blow from advantageous directions during battle.[118]

Moreover, galleys had smaller draughts than sail ships and were less hindered in shallower waters.[119] In fact, galleys were "particularly favored by Mediterranean princes for inshore and amphibious operations in the narrow, rocky and island-strewn, or shallow waters of the Aegean, Adriatic, and Tyrrhenian seas."[120] This was a big reason as to why the use of galleys continued in the Mediterranean long after both the European powers and the Ottoman Empire had predominantly transitioned to sail ships.

The transition from galley ships to sail ships by the major naval powers was the one of the most significant changes in the history of warships. With the addition of new weapons such as the cannon and new building techniques, the sail ship began to surpass the galley ship, its

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[116] Konstam, *History of Shipwrecks*, 79.
[117] Black, *European Warfare,* 170.
[118] Bamford, *Fighting Ships,* 14.
[119] Black, *European Warfare,* 171.
[120] Bamford, *Fighting Ships,* 15.

predecessor, in every facet of military warfare from mobility to sheer firepower. Moreover, the sail ship not only expanded in size but also became much more efficient. This is evident where sail ship crews consisted more of marines while galley ship crews contained more oarsmen than fighting men. Because of these facts, use of galley ships in battle declined outside the Mediterranean Sea in favor of prototype sail ships such as the carrack and galleon after the Battle of Lepanto before eventually disappearing entirely from the front lines as the ship of the line emerged as the predominant warship in the Age of Sail. From evidence of many naval historians, it appears that this transition towards sail ships from galley ships was indeed a gradual change.

Bibliography

Anderson, Roger Charles. *Oared fighting ships: From classical times to the coming of steam*. London: P. Marshal, 1962.

Bamford, Paul W. *Fighting Ships and Prisons*. St. Paul: North Central Publishing Co., 1973.

Black, Jeremy. *European Warfare.* London: Routledge, 2002.

Boterbloem, Kees. *The Fiction and Reality of Jan Struys A Seventeenth-Century Dutch Globetrotter*. New York: Palgrave MacMillan, 2008.

Boxer, C.R. *Portuguese in the East, in Portugal and Brazil*. Edited by H.V. Livermore. Oxford: Clarendon Press, 1953.

Braudel, Fernand. *The Mediterranean and the Mediterranean World in the Age of Philip II*. Berkeley and Los Angeles: University of California Press, 1995.

Casson, Lionel. *The Ancient Mariners: Seafarers and Sea Fighters of the Mediterranean in Ancient Times*. Princeton, NJ: Princeton University Press, 1991.

Cipolla, Carlo M. *Guns, Sails, and Empire*. New York: Pantheon Books, 1965.

Crowley, Roger. *Empires of the Sea: The Siege of Malta, the Battle of Lepanto, and the Contest for the Center of the World*. New York: Random House Bertelsmann, 1996.

Davis, Robert C. *Christian Slaves, Muslim Masters*. New York: Palgrave MacMillan, 2004.

Diffie, Bailey Wallys, and George Davison Winius. *Foundations of the Portuguese Empire, 1415-1580*. Minneapolis: University of Minnesota Press, 1977.

Du Quet, Monsieur. "A method for rowing Men of War in a calm. Communicated by Monsieur Du Quet", *Philosophical Transactions* 31 (1720-1721): 239-250.

Froissart, Jean. *Sir John Froissart's chronicles of England, France, Spain, and the adjoining countries: from the latter part of the reign of Edward II to the coronation of Henry IV*, edited by Thomas Johnes. London: W. Smith, 1803-05.

Keith, D.H. and T.L. Carrell. *International Handbook of Historical Archaeology*, ed. Teresita Majewski and David Gaimster. New York: Springer, 2009.

Martin M. Elbl. *The Portuguese Caravel and European Shipbuilding: Phases of Development and Diversity*. Coimbra: UC Biblioteca Geral 1, 1985.

Grant, R.G. *Battle at Sea: 3,000 Years of Naval Warfare*, London: DK Publishing, Inc., 2011.

Glete, Jan. *Navies and nations: Warships, navies and state building in Europe and America, 1500-1860.* Stocholm: Almqvist & Wiksell International, 1993.

Guglielmotti, Alberto. *Storia della marina pontificia nel medio evo*. Vatican: Rome Printing Office, 1871.

Guilmartin, John Francis. *Gunpowder and Galleys: Changing Technology and Mediterranean Warfare at Sea in the Sixteenth Century.* London: Cambridge University Press, 1974.

Konstam, Angus. *The History of Shipwrecks*. New York: Lyons Press, 2002.

Konstam, Angus. *Renaissance War Galley 1470-1590*. Oxford: Osprey Publishing, 2002.

Moryson, Fynes *Shakespeare's Europe: Unpublished Chapters of Fynes Moryson's Itinerary*. Edited by Charles Hughes. London: London Sherratt & Hughes, 1903.

Sir Nicholas Harris Nicolas, *A History of the Royal Navy*. Charleston: Nabu Press, 2011.

Parker, Geoffrey. *Military Revolution*. Cambridge: Cambridge University Press, 1996.

Parry, John Horace. *The Age of Reconaissance*. London: Weidenfeld and Nicolson, 1963.

Patrick, James. *Renaissance and Reformation*. New York: Marshall Cavendish, 2007.

Roberts, Michael. *Essays on Swedish History*/ Minneapolis: University of Minnesota Press, 1968.

Rodger, Nicholas A.M. *The Safeguard of the Sea: A Naval History of Britain 660–1649.* New York: W.W. Norton & Company, 1997.

Serjeant, R.B. *The Portuguese off the South Arabian Coast*, Oxford: Clarendon Press, 1963.

Smith, Roger C. *Vanguard of empire: ships of exploration in the age of Coumbus*. New York: Oxford University Press, 1993.

Struys, Jan Janszoon. *The perilous and most unhappy voyages of John Struys*. London: Princes Arms in S. Pauls Church-yard, 1683.

Tout, Thomas Frederick. *Firearms in England in the fourteenth century*. Oxford: University of Oxford Press, 1911.

Tracy, James D. *The Political Economy of Merchant Empires*. Cambridge: Cambridge University Press, 1991.

Unger, Richard W. *Cogs, Caravels and Galleons*. London: Conway Maritime Press, 1994.