

# Portuguese galleon's armament at the end of the sixteenth century

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## Introduction

As is known, when the Spanish Armada sailed from Lisbon, in 1588, it took with it nine Portuguese galleons, which were considered as the best armed units of the Armada.

But what was their armament? Most of the relations that have survived till today, only tell us the total number of guns that each ship carried, but not which kind of guns they carried.

In a long known document that exists in the "Biblioteca Nacional de Lisboa" (BNL), from the late sixteenth century, the *Livro Náutico*<sup>1</sup>, which is mentioned by several Portuguese authors and even by some foreigners, but unfortunately never fully published, there are several references to the armament of Portuguese men-of-war, of that period. There are even references to the warships that were in the Tejo<sup>2</sup>, possible in the end of 1589, which include one of the galleons ( the *São Luís* ) and the two *zavras* that went on the Armada campaign<sup>3</sup>. The other 9 ships which are referred to are ships that were away from the kingdom, or are newly built units. In the *Livro Náutico* there are also references to the armament of several galleons, of different displacements, from the same period, to be built in 1596.

Using these two documents from the BNL and the information from the Armada, I intend to show that: we can consider the armament from those documents as a good reference to study their armament; the Portuguese used two wheel carriages, had the same number of gunners, as their opponents; the Portuguese had the same rate of fire as their foes and finally, that the English galleons had a gun advantage, over the Portuguese galleons, during the 1588 Armada campaign.

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<sup>1</sup> The *Livro Náutico*, was divided in two códices in the "Biblioteca Nacional de Lisboa", the 2257 and the 637, in the past, for some unknown reason.

<sup>2</sup> Although some ships are designated as *nau*s, they are, in point of fact, galleons, as one, the *São João* is referred to either as a galleon or as a *nau*, and the one referred to as the *nau N. Sr. do Rosário*, has the same number and type of masts that it is usually believed only the galleons had.

<sup>3</sup> The other Portuguese galleons that sailed with the Armada, and had survived, possibly did not return to Lisbon until a much later date, as the *São Maninho*, the *São Cristóvão* and the *Santiago*, sailed with the Spanish armada that went to Ireland in 1590, and those three, together with the smaller *São Bernardo*, were present in the fight against the "Revenge", in 1591.

## 1. What armament

### 1.1. The Guns

Regarding the armament of the warships of this period, there will always be several difficulties, that I don't think will ever be solved. The first one is the fact that the guns were made one by one, which means that there are no two guns exactly alike. The second one is a problem of nomenclature of the guns, each country sometimes used their own names for their own guns<sup>4</sup>. The final difficulty is the lack of standardisation, between the countries, or even inside one country, in all kinds of measures, especially those ones relating to weight. All the reasons shown above, make comparisons between different countries, extremely difficult to do.

Another difficulty, will be to know what the lists represent, that is, if they are just intentions, or the armament referred to in the *Livro Náutico* was what the Portuguese galleons really used to sail with. If the list of armament necessary to arm the galleons that were to be built, presents no difficulties, as they show which guns should be given to them, it might not be so easy for the armament shown in the list of the ships that were in the Tejo.

First of all, I believe that the armament referred to in the "Tejo list", is the number of guns that the ships need to be fully operational again, and ready to sail. I think that the main armament of the ships after they arrived in Lisbon, was returned to the King's Warehouses, and used on other units, while the first ship was under repair<sup>5</sup>. This procedure, wasn't something new in Portugal, in what concerns the personal armament and other ships' equipments<sup>6</sup>, but I think that with the ships heavier guns, it only occurred after 1580<sup>7</sup>.

On the other hand, I also believe that the lists represent the total and the general type of guns the ships carried, but the usual shortage of guns in the Spanish Empire, together with the lack of standardisation already mentioned, didn't allow, in most cases, the high degree of uniformity that was desirable<sup>8</sup>. As an example, the Portuguese galleon *São João*, which was considered the bestarmed galleon of the Portuguese squadron, carried nine different types of iron throwing guns and seven different types of stone throwing guns which when compared with the biggest ships from the lists of the *Livro Náutico*, which had 3 and

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<sup>4</sup> In Portugal alone, there can be identified more than 50 different Portuguese names for Portuguese guns, although I believe that most of those names are just the "common" names, and that "officially", the guns were identified by the type (often with Portuguese names) and their weight, only. cf. João Manuel Cordeiro, *Apontamentos para a História da Artilharia Portuguesa*, vol. I, Lisboa, 1944, pp. 87-88 and the "Livro Náutico", Sousa Viterbo, "Armarias e arsenais portugueses no século XVI", *Revista Militar*, n.º 13, ano 39, Lisboa, Julho 1887, pp. 400-401.

<sup>5</sup> The document tells us that the rearmament of the *São Lucas*, as well as some caravelas, was going to be made using the guns that he still had on board, plus some of the guns of the Galleon *São Luís* - which, I believe, had just arrived from the north of Spain, after the Armada campaign and was surely needing some repairs. cf. Cod. 637, p. 48 v.

<sup>6</sup> During a normal voyage, there was several items that needed to be replaced, and both the king's ships and the private ones used the king's warehouses to do it, long before 1580. cf. A. Farinha de Carvalho, *Diogo do Couto. O soldado prático e a Índia*, Lisboa, imp. 1979, pp. 78-85 e Leonor Freire Costa, *Naus e Galeões na Ribeira de Lisboa. A construção naval no século XVI para a rota do Cabo*, Cascais, 1997, pp. 163-211.

<sup>7</sup> This practice, I believe, was only introduced after 1580, because when D. Pedro de Valdés writes to Felipe II about the ships that were in Lisbon, in 1581, he states that the two old galleons that were in Lisbon, only needed some minor repairs and personnel, but they had with them their main guns. cf. Avelino de Freitas Meneses, *Os Açores e o domínio Filipino (1580-1590)*, vol. II, Angra do Heroísmo, 1987, pp. 11-13. This action was common in Spain in the middle of the XVI century, and was also a monopoly of the king. cf. Carla Rahn Phillips, *Seis Galeones para el Rey de España. La defensa imperial a principios del siglo XVII*, Madrid, 1991, pp. 144-145.

<sup>8</sup> Especially, in the year of the Armada, when there was a global shortage of guns for almost all ships of the Armada, including the Portuguese Squadron, made it necessary to complement the ships' main armament, even with guns taken from Lisbon's area fortresses. Cf. Enrique Herrera Oria, *Felipe II y el Marqués de Santa Cruz en la empresa de Inglaterra. Según los documentos del Archivo de Simancas*, Madrid, 1946, p. 145.

4, respectively, can tell us something about what was theoretical and what was really used<sup>9</sup>. However, I believe the total weight would be approximately the same.

Not having a detailed list of the guns on board the Portuguese ships of the Spanish Armada, in order to compare with the lists from the "Livro Náutico", I can only make comparisons in broad numbers ( Graphic A ). From those graphics, we can see that there are only minor variations in the total numbers, which might allow us to say that there would be no great difference between the two.

## 1.2. The Carriages<sup>10</sup>

Which carriages the Portuguese used on board their ships, during the XVI and early XVII centuries, is a subject seldom referred by Portuguese authors, but usually it is accepted that Portugal used four-wheel carriages<sup>11</sup>. Some modern anglo-saxon authors say that only the English used the four-wheel carriages, and that, they say, gave them several advantages<sup>12</sup>, including greater firing rates<sup>13</sup>.

In my opinion, Portugal used two-wheel carriages, although neither the wheels nor the carriage itself were the same size as those used on land, and also it did not reduce their firing rate, as I will try to show later.

Regarding the carriages, and although is not much many evidence, I believe we can say that they were two-wheel carriages, because<sup>14</sup> :

a. In a representation of Lisbon<sup>15</sup> (c.1550), there is a caravel represented, among other ships, where we can see a heavy gun in the bow of the caravel, on a two-wheel carriage. But we can also see, at the extreme right of the drawing, several guns that are on a beach. Two of them are mounted on two-wheel carriages; on the other side of the drawing, on a pier, we can see several guns, of different calibre, that are ali lined up, near several other items, possibly for the ships.

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<sup>9</sup> In the document from Simancas, with references to the galleon *São João*, there are some guns, that can weigh almost 10 Quintais (± 580 Kg) more than lighter ones of the same calibre, cf. AGS GA Leg. 347 - foi. 218, *Livro Náutico* and *Memorial de Varias Couzas Importantes*.

<sup>10</sup> I am grateful to Eng. Richard Barker, for sharing his views and comments, especially on this subject.

<sup>11</sup> Cf. Nuno Varela Rubim, *Artilharia Histórica Portuguesa Fabricada em Portugal*, [s.l.], 1985, pp. 25-28.

<sup>12</sup> As for the disadvantages, Sir William Monson, only states that the main disadvantage of the two wheel carriages was the impossibility of transversing their guns, due to their big size, only allowing them to shoot straight. Portuguese writers of that time, state that it was impossible to transverse the guns, not due to carriages limitations, but due to the "... empacho da muita fazenda, com que as peças não podiam bornear senão direitas, de tal modo que para a pontaria da peça havia que fazer convinha virar tanto o galeão que a suprisse", cf. Sir William Monson, *The Naval Tracts of...*, vol. V, London, 1914, p. 147 & Melchior Estácio do Amaral, "Tratado das Batalhas e sucessos do Galeão Santiago com os holandeses na Ilha de Santa Helena e da Nau Chagas com os ingleses entre as ilhas dos Açores", in *História Trágico Marítima*, vol. III, Lisboa, 1956, p. 182. However in the "Diálogo anónimo entre un vizcaíno y un montañes sobre construcción de naves" (c. 1630), it is mentioned that the big difference between the two-wheel carriages and the four-wheel, is the number of personnel needed to operate the gun, 10 and 4, respectively. Cf. Cesáreo Fernandez Duro, *Disquisiciones Náuticas*, vol. VI, Madrid, 1881, pp. 152-153.

<sup>13</sup> It is yet to be proven which was the most effective to be used on board naval units, because we don't know how the guns were reloaded (was it done outside the hull or recoiling the gun to inside of the ship) or how they were fastened to the ship (there are several references to ships being damaged due to their own guns). Also the fact is, that the two-wheel carriages, might help when there was the need to take out the guns from the ships, moving them around the ship whenever there was the need to remove the guns.

<sup>14</sup> Apart from what will be presented below, there are no references whatsoever to that subject, in the several accounts of voyages on board Portuguese ships, that survived till today. Especially the ones made by foreigners, like Linschoten and Pyrad de Lavai, which may show us, that two-wheel carriages were a common thing, even for them. When Linschoten refers to what he considered the long time the Portuguese took to reload their guns. cf. Jan Huygen van Linschoten, *Itinerário, viagem ou navegação de Jan Huygen van Linschoten para as índias Orientais ou Portuguesas*, Lisboa, 1997, p. 333.

<sup>15</sup> It is a view of Lisbon, that is in the Library of Leiden, of which exists a copy in the "Museu da Cidade de Lisboa".

b. Almost thirty years later, in Linschoten's representation of a Portuguese oared vessel, used in the Far East, can be seen the upper part of two big wheels, of the guns that are mounted in the vessel's bow.

c. In an interesting manual of mathematics and artillery, from the middle of the XVII century, that exists in the "Arquivo Histórico Militar", in Lisbon, there are several references to carriages, but all of them two-wheel ones. For the naval carriages it says "[As rodas]... pêra os navios achão que seijão da altura das portinholas; e que os reparos pêra os navios seijão de comprido, os dous terços do comprimento da peça"<sup>16</sup>.

d. In a letter from 1627, to the King, Filipe III, we can read "Convém que V. Mag<sup>de</sup>. mande que nenhuma nau que se fabricar se lhe abra portinhola nenhuma no estaleiro, antes que vá fabricando como senão houvesse portinhola [...] e se abrirão todas de uma altura de modo que umas sós rodas sirvam todas as peças..."<sup>17</sup>.

All this makes me firmly believe that Portugal used two-wheel carriages for naval purposes<sup>18</sup>. But also the last examples, together with the references from both the *Livro Náutico* and the "Memorial de Varias Couzas Importantes", which have only references to one price for main gun carriages<sup>19</sup>, for each ship, with only two prices in all<sup>20</sup>. For the two heavier ships, the galleon *São Filipe* and the 630 ton galleon, there is reference to carriages to "peças grossas" (big guns). For the other ships that were in the Tejo in 1589, the carriages are referred to as "ferrados"<sup>21</sup>.

All this makes me believe that this is an early case of standardisation, because if the wheels were all of the same size, even though the carriage was of different length and possibly width, it would be possible to open the gun-ports all at the same height, with all the advantages that would bring.

But how can someone use the same carriage, on guns weighing 3000 Kg and guns weighing 700 Kg, and both costing the same<sup>22</sup>? Also the space available on the main deck, is different to the space available on the upper deck. But maybe it was simple for a XVI century gunner.

<sup>16</sup> "[The wheels]...for the ships should be of the same height of the gun ports; and the length of the ships' carriages should be two thirds the length of the gun.". There is a rule for each kind of gun, for land use, but this is the only rule for naval carriages. cf. *Tratado de Artilharia e Matemática*, Secção de Reservados do Arquivo Histórico Militar - Lisboa, c. 1640, p. 146 v.

<sup>17</sup> "It would be better if Your Majesty orders that no gun ports should be open on newly built ships [...] so that all can be open all at the same height, so that one kind of wheels fit all guns..." cf. Christiano José de Senna Barcellos, "Construções de naus em Lisboa e Goa para a carreira da Índia no começo do século XVII", *Boletim da Sociedade de Geografia de Lisboa*, 17<sup>o</sup> Sér., n<sup>o</sup> 1, 1898-1899, p. 68.

<sup>18</sup> Although not for Portuguese ships, specifically, there is a reference that the guns that went to the Armada ships in Lisbon, coming from the fortress near Lisbon, were placed in "...hazer caxas y ruedas por piezas de mar y de hazer ruedas grusas enterizadas y vaxas..." Apud I. A. A. Thompson, in *God's Obvious Design. Papers for the Spanish Armada Symposium*, Sligo, London, 1988, p. 80.

<sup>19</sup> Excluding the *Falcões e Berços*.

<sup>20</sup> There were 14.000 Reis carriages for ships above 400 tons and 13.000 Reis for lower tonnage. See end tables of this study.

<sup>21</sup> In the Artillery Manual already mentioned, there is also a reference to how to "ferrar" a carriage, that is how to apply some iron plates to the body of the carriage, in order to reinforce its structural strength.

<sup>22</sup> For example, in a relation of artillery for English ships, and although it referred to four-wheel carriages, each kind of gun, has its own carriage. cf. Julian S. Corbett, ed., *Papers relating to the Navy during the Spanish War. 1585-1587*, imp. Aldershot, 1987, p. 29.

### 1.3. *Bombardeiros*<sup>23</sup>

In Portugal, as in Spain, there was permanent shortage of *bombardeiros* for the ships, so foreign gunners were usually hired. But even with such shortage, the ships always carried their complement of *bombardeiros*, although, I believe, there were different complements for the different kind of ships and even duties.

In Table I, we can see that there is one gunner to each of the main guns<sup>24</sup>, which only occurred for the main fighting ships, the galleons, as for the others, the *Naus da Carreira da Índia*, there was only a gunner for half the guns, which could imply that they only fired the guns of one side of the ship, at each time<sup>25</sup>.

As for their expertise, I believe that in Portugal they were well trained, as they didn't do anything else, and also because of the chronic shortage already mentioned, many foreigners were employed by the Crown.

The *bombardeiros* needed help in their duties, but several auxiliaries, that even though they weren't permanently attached to each individual gun, on "battle stations", that was their only function and they were chosen for a particular action or campaign<sup>26</sup>.

Comparing Tables I and II, we can see that if we take out the number of light guns (anti-personnel guns), both countries had, more or less, the same number of gunners, on their fighting ships<sup>27</sup>.

### 1.4. Rate of Fire

There are several recent studies, that try to show that the Portuguese and the Spanish ships, had rates of fire of one round per hour, which they consider to be much slower than their foes, English and Dutch ships. One author, Nicholas Rodger, gives the only reference, that I was able to find, of how long English ships took to fire and reload. Surprisingly, or not, he says that they would take 40 minutes per round<sup>28</sup>.

But which sources are used to give the Portuguese ships' rate of fire? The sources that are more commonly used are:

a. The combat, described by Linschoten, between the ship where he was, and several English corsairs, where he says that the Portuguese took one hour to reload a gun, and did a great celebration, whenever it fired<sup>29</sup>.

<sup>23</sup> i.e. the gunners.

<sup>24</sup> As for the *Berços* and the *Falcões*, which were guns used mostly in short range battles, I believe that they were used by the normal soldiers or sailors.

<sup>25</sup> Their numbers in the ships of the "Carreira da Índia", were subject to other factors, such as the number of *bombardeiros* available in the ports of departure, and also, the high rate of mortality, that occurred on their long voyages.

<sup>26</sup> In the conquest of the Azores, the Portuguese galleons, *São Mateus* e *São Maninho*, were helped by young sailors, while for the English campaign, the *São Maninho* used, this time, servants and soldiers to perform those duties. cf. Cesáreo Fernandez Duro, *La Conquista de los Azores*, Madrid, 1886, pp. 324-326 e 327-333 e *La Armada Invencible*, tomo 2, Madrid, 1885, pp. 41-55. Maybe they had to use these people, because of the bigger number of personnel that the two-wheel carriages needed.

<sup>27</sup> I specify on their fighting ships, because, as we have seen in Table I, the "Naus da Índia" had only half the gunners that the warships had, because I believe that their main objective was defence, and not attack, so they didn't need so many gunners. Also, it might be difficult to get gunners for that *Carreira*.

<sup>28</sup> This reference is for 1625. cf. Nicholas Rodger, "The development of the broadside gunnery, 1450-1650", *The Mariner's Mirror*, vol. 82, n° 3, London, August 1996, pp. 313-314. Richard Barker, however, gives, for a fight between Portuguese and English ships, in actions between 1612-1620, a rate of fire for the English ships of 4-5 shots per hour. Cf. Richard Barker, "Barrels at sea: water, stowage and guns on the Portuguese Ocean", / *Simpósio da História Marítima. Lisboa 1992*, Lisboa, 1994.

<sup>29</sup> Cf. Jan Huygen van Linschoten, *Itinerário, viagem ou navegação para as Índias Ponuguesas*, Lisboa, 1997, p. 333.

b. Several documents compiled by Cesáreo Duro, where there are references to the number of shots fired and received by several Portuguese ships<sup>30</sup>, during the Armada campaign.

Although I haven't been able to examine any reference at all, from those sources or other contemporary authors, confirming the Portuguese lower rate of fire, modern authors try to justify that opinion, pointing out several reasons, some already mentioned, as for example: Smaller number of gunners and auxiliaries, and of lower quality; and the two-wheel carriages. As we have seen above, there is no evidence that either of those two factors, were true, or responsible for that alleged lower rate of fire. Nevertheless, the use of always more and different auxiliaries, together with the somewhat complex procedure for reloading a sixteenth century gun, may lead to that slightly lower rate of fire, by the Portuguese warships<sup>31</sup>.

As for the two sources, above mentioned, I have the following comments:

- The time that the Linschoten crew took to reload and fire their gun, one hour, was the time for a *Nau da Carreira da Índia*, and not a "first line" galleon. Which, as we have seen, after a long trip around half the world, might not have all the gunners, and those might not be of the highest expertise<sup>32</sup>.

- During the Armada campaign, the average time the Portuguese ships took to fire and reload, was one hour, if we don't consider that the numbers include the lighter guns fired, but there were exceptions<sup>33</sup>. The *São Maninho*, in the combats of the 2nd of August, during the Armada campaign, was able to reach a rate of fire of one every 30 minutes, on average: «... "Ali the [English] fleet", passed the San Martin, "shot at her ship by ship, whilst she on her part, fired her ordnance very well and fast, so as half the enemy's fleet did not approach, but shot at her from a far."»<sup>34</sup>. The combat lasted close to one hour, where the *São Maninho* fired 120 shots and received around 50<sup>35</sup>.

## 1.5. Comparison with English Warships

A.A. Thompson<sup>36</sup>, although without much data for the Portuguese ships, reached the conclusion that the English had heavy guns. Using his values for the English ships, and comparing with the Portuguese warships<sup>37</sup> and, dividing the guns into three major types -

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<sup>30</sup> Cf. Cesáreo Fernandez Duro, *La Armada Invencible*, Tomo II, Madrid, 1884-1885, pp. 371-399.

<sup>31</sup> That may justify some references to some fears that the Iberian gunners allegedly had.

<sup>32</sup> Also, Linschoten's ship, was surrounded by several ships, and he might have been lead to believe that his ship had a lower rate of fire, than their foes, but the Portuguese ship was, almost for sure, under fire from several English ships, and not only from one. For someone under cover, it can be considered as perfectly normal. Cf. Jan Huygen van Linschoten, *Itinerário, viagem ou navegação para as Índias Portuguesas*, Lisboa, 1997, p. 333.

<sup>33</sup> This rate of fire can be reached, simply by dividing the time we know the combats took (but considering that the ship was always in the front line of the fight), by the total number of shots fired by the ship, and then dividing that number by the number of major guns, on both sides.

<sup>34</sup> Apud. D. W. Waters, *The Elizabethan Navy and the Armada Campaign*, Greenwich, 1975, p. 29.

<sup>35</sup> Cesáreo Fernandez Duro, *La Armada Invencible*, Tomo II, Madrid, 1885, p. 384.

<sup>36</sup> Cf. A. A. Thompson, "Spanish Armada guns", *The Mariner's Mirror*, vol. 61, n° 4, Greenwich, NOV 1975, pp. 355-374 and "Spanish Armada gun policy and procurement", in *God's Obvious Design. Papers for the Spanish Armada Symposium, Sligo, 1988*, London, 1990, pp. 69-84.

<sup>37</sup> The Portuguese warship tonnage's, were multiplied by 1.5, as given by Casado Soto.

"smashing guns", periers and anti-personnel guns, we can reach the following results, from Annex B :

- The Portuguese ships carried 50% more perier guns.
- The English ships had almost double on lower 1000 Kg guns, and on ships around 500 tons, had a great superiority on 1500 Kg guns.
- The percentage of total gun weight on board the English ships is higher, than on the Portuguese ones.
- The English heavier weight of artillery, is especially in guns of 1500 Kg and heavier<sup>38</sup>.

## 1.6. Conclusions

First, we can conclude that the gun lists given by the *Livro Náutico*, are what was supposed to be used on board the Portuguese ships, even if the shortage of guns, didn't allow it to be always exactly true.

Second, the Portuguese ships used two wheel carriages, not of the same size as those used on land, and I believe there was a degree of standardisation on board the Portuguese ships.

Third, although there was a difference in the number of gunners on board the Portuguese ships, depending on they were "fighting" galleons, or "Naus da Carreira da Índia", the galleons had the same number of gunners as the English galleons.

Fourth, the firing rate of the Portuguese galleons was the same, or even faster, than the English rate.

Fifth, using the lists from the *Livro Náutico*, and comparing them with the English lists available, for the 1588 Armada campaign, we clearly see that the English galleons were better armed than the Portuguese ones, which considering that they were the best armed ships on the Spanish side, might confirm that the English did enjoy a vast advantage in heavier guns.

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<sup>38</sup> According to Geoffrey Parker, those were the guns capable of penetrating the hulls of the adversary (although he doesn't say where in the ship). Cf. Geoffrey Parker, "The *Dreadnought* revolution of the Tudor England", *The Mariner's Mirror*, vol. 82, n° 3, London, August 1996.

## TABLES

TABLE I — Gunnery Personnel in Portuguese Warships

Year	CONDESTÁVEIS (Master Gunners)	BOMBARDEIROS	Number of Guns	References
1582		1 + 6 Aux. (p/gun)	>34	Duro (1)
	1	8 + 12 Sailors (Lower Deck) 8 + 8 Sailors (UpperDeck)	26 a 30	Duro (1)
1583	1	8	—	Linschoten (2)
1590	1	29	37	Livro
	1	19	32	Náutico
	1	19	24	
	1	14	20	
	1	6	12	
1593	1	14	S.Filipe	Matos (3)
1607(?)	1	11	—	Carvalho (4)
1610	1	25	—	Lavai (5)

(1) DURO, *Conquista Açores*, pp. 325 e 327

(2) LINSCHOTEN, *Itinerário ....* p. 75

(3) MATOS, *Na rota da Índia ....*, p. 144.

(4) CARVALHO, *Diogo do Couto ....*, p. 74.

(5) LAVAL, *Viagem de....*, p. 142.

TABLE II — Gunnery Personnel in English Ship (1585)\*

TONNAGE	Number of Guns**	Number of Gun- ners
1000	55	50
900	64	50
900	70	50
800	52	40
650	37	30
500	36	30
500	38	30
500	40	30
360	34	24
330	34	20
300	28	20
300	26	20
260	28	20
160	31	12
160	21	12
120	24	10

\* Julian S. Corbett, ed., *Papers relating to the Navy during the Spanish War. 1585-1587*, imp. Aldershot, 1987, pp. 276-277 ( except \*\*)

\*\* Frank Howard, *Sailing ships of war. 1400 - 1860*, Greenwich, © 1979, p.74.

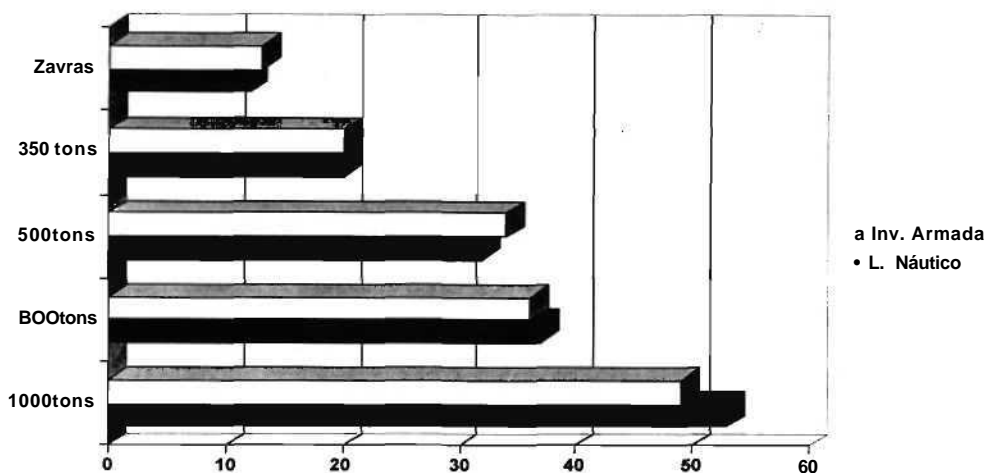


ANNEX B

COMPARISONS BETWEEN SHIPS OF THE SPANISH ARMADA AND THE LIVRO NÁUTICO

GRAPHICS A — Number of Guns per Ship

(1) By tonnage



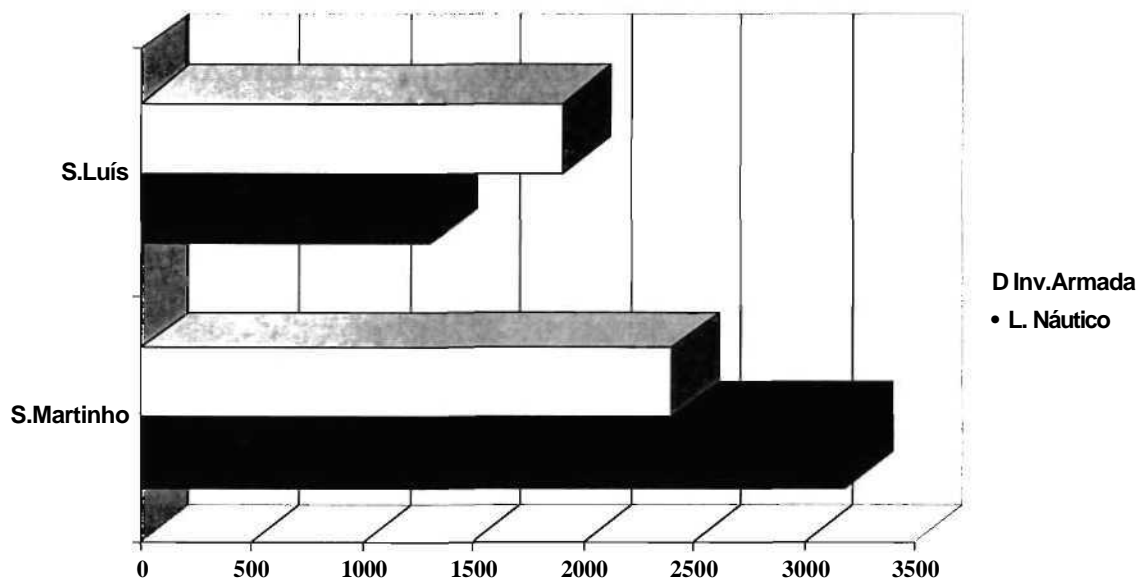
(2) Ships from the Armada and the ones that returned to Lisbon

GRAPHICS B — Number of Shot Carried

(1) By tonnage



(2) Ships from the Armada and the ones that returned to Lisbon



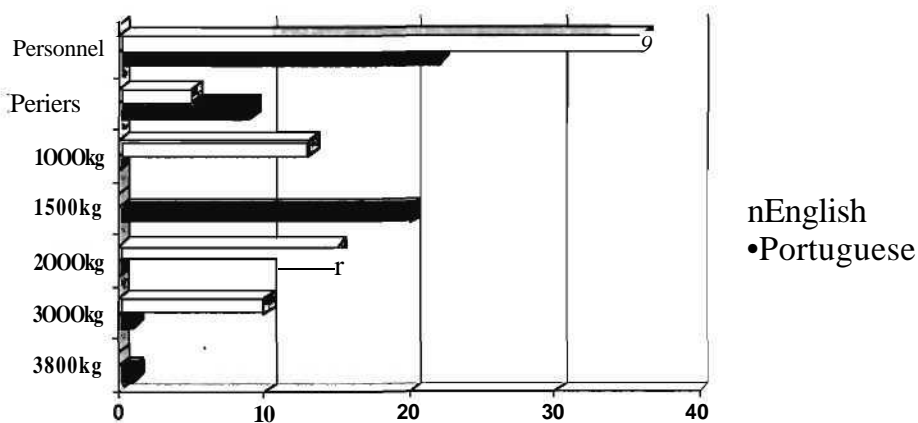
ANNEX B

COMPARISONS BETWEEN PORTUGUESE AND ENGLISH WAR-SHIPS

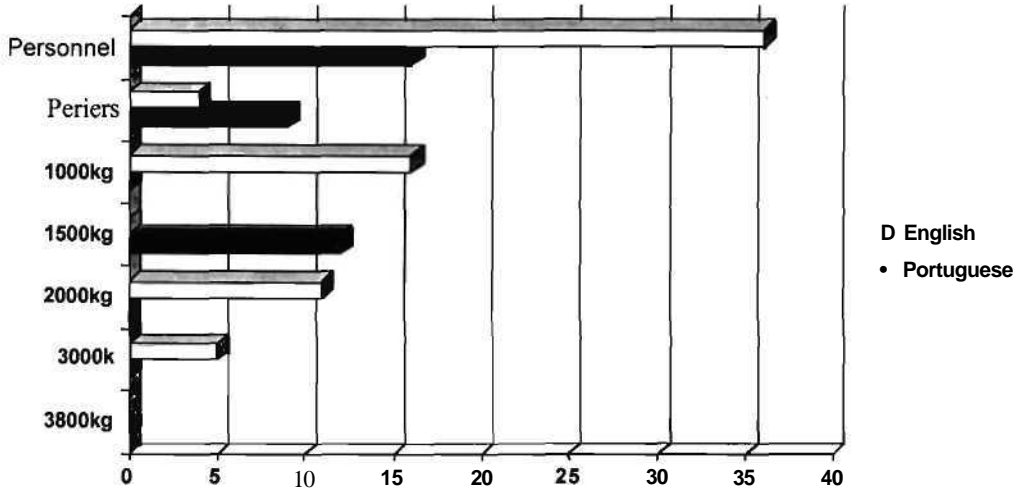
Portuguese galleons data - *Livro Náutico e Memorial ... I* English galleons data - Frank Howard, J. S. Corbett and Monson

GRAPHICS A — Number of guns, by tonnage

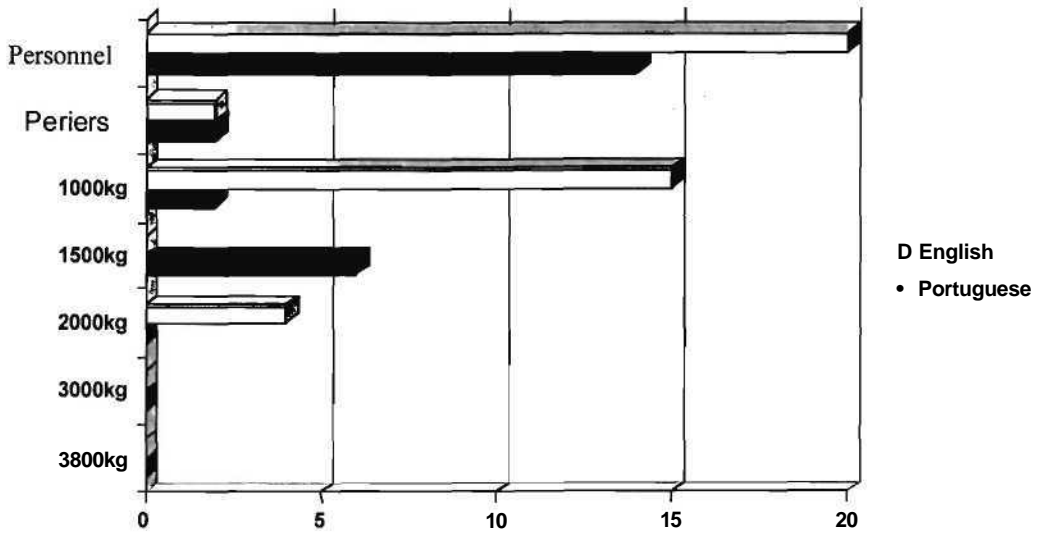
1000 tons Galleons



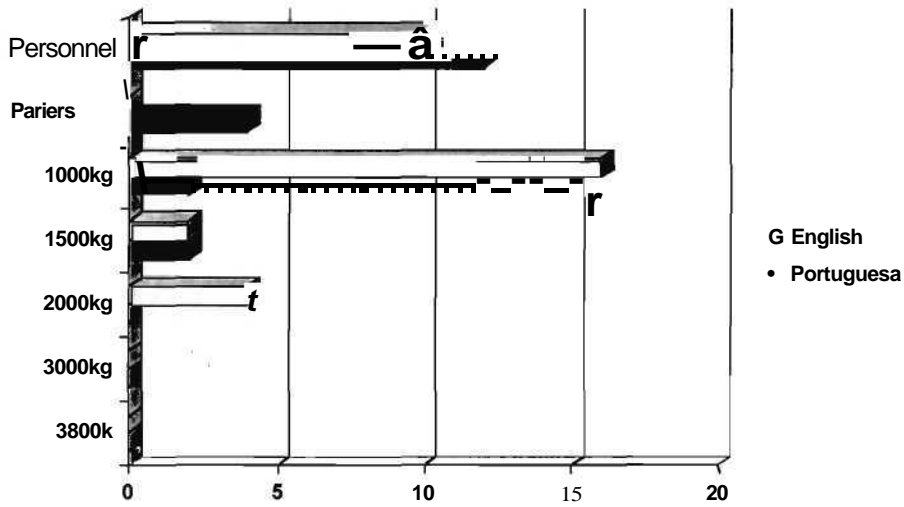
800 tons Galleons



Galleons 500 tons

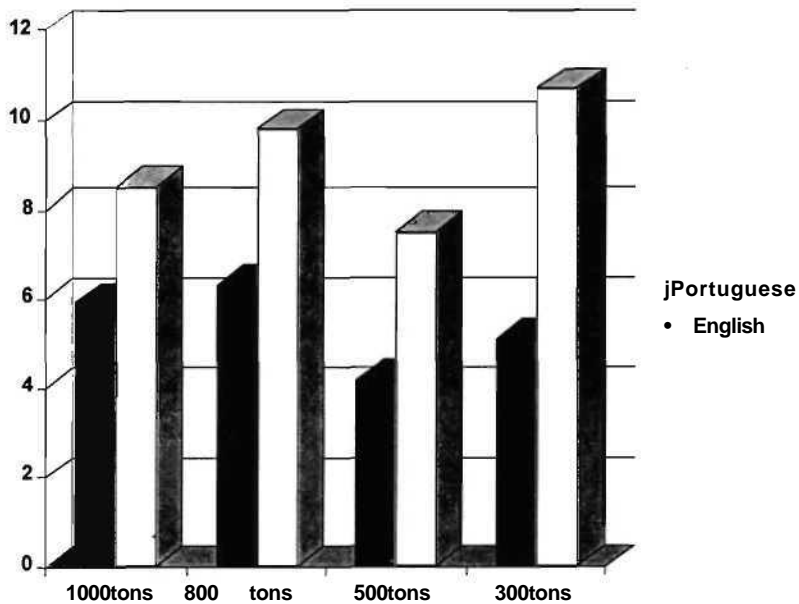


300 tons Galleons



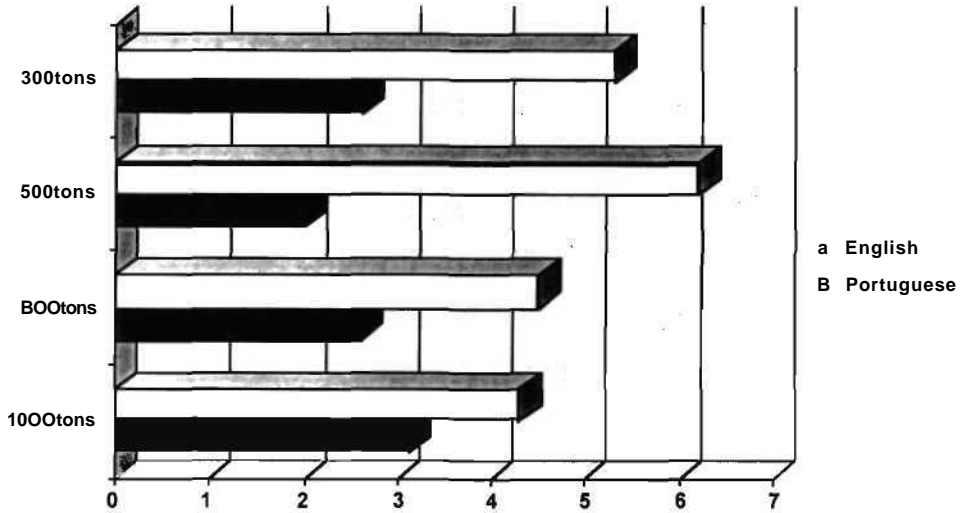
GRAPHICS B — Total Artillery Weight Comparison

% Total Ordnance by weight / Type of Ship (tonnage)



Graphics C — ( smashing guns 1500Kg ) / Tonnage

("Smashing-Guns" / Tonnage X 100)



ANNEX C

Ships in the *Livro Náutico* and in the *Memorial de Varias Couzas Importantes*

	Galleon 630 Tone). ⋄	Galleon 500 Tonel.	Galleon 500- 600 Toneis	Galleon 300- 400 Toneis	Galleon 300- 350 Toneis ®	Galleon 200- 220 Toneis	Zavras 80 Toneis
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ARTILLERY

Ship	Galleon 630 Tone). ⋄	Galleon 500 Tonel.	Galleon 500- 600 Toneis	Galleon 300- 400 Toneis	Galleon 300- 350 Toneis ®	Galleon 200- 220 Toneis	Zavras 80 Toneis
LEÃO	1	—	—	—	—	—	—
SERPE	1	—	—	—	—	—	—
ESPERA (250)	20	12	12	—	—	—	—
ESPERA (220)	—	—	—	6	6	2	—
ESPERA (180)	—	—	—	—	2	2	2
CAMELO	3	1	1	—	—	—	—
PEDREIRO (230)	6	—	—	—	—	—	—
PEDREIRO (130)	—	8	8	6	2	4	—
FALCÃO	12	10	10	8	8	6	4
BERÇO	10	6	6	12	6	6	6

## IX REUNIÃO INTERNACIONAL DE HISTÓRIA DA NÁUTICA E DA HIDROGRAFIA

	<b>Galleon 630 Tonel.</b>	<b>Galleon 500 Tonel.</b>	<b>Galleon 500- 600 Toneis</b>	<b>Galleon 300- 400 Toneis</b>	<b>Galleon 300- 350 Toneis</b>	<b>Galleon 200- 220 Toneis</b>	<b>Zavras 80 Toneis</b>
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**ROUNDS**

<b>FERRO COADO</b>	1200	600	600	300	300	<b>240</b>	80
<b>PEDRA</b>	1000	<b>640</b>	<b>640</b>	<b>640</b>	400	<b>480</b>	(...)
<b>DADO</b>	—	<b>60</b>	—	<b>120</b>	—	<b>80</b>	60
<b>BERÇO</b>	300	<b>180</b>	<b>180</b>	<b>320</b>	<b>180</b>	<b>240</b>	180
<b>FALCÃO</b>	600	—	—	—	—	—	—
<b>COBRE CADEIA</b>	40	—	<b>50</b>	<b>50</b>	100	<b>40</b>	—
<b>FERRO CADEIA</b>	40	—	<b>50</b>	<b>50</b>	100	<b>40</b>	—

**SMALLITEMS**

<b>COLHER CARRE- GAMENTO</b>	29	<b>20</b>	<b>20</b>	<b>10</b>	<b>10</b>	<b>6</b>	—
<b>LIMPADO- RES</b>	29	<b>21</b>	—	<b>21</b>	—	—	—
<b>CÂMARAS BERÇO</b>	36	<b>30</b>	<b>30</b>	<b>24</b>	<b>24</b>	<b>18</b>	12
<b>CÂMARAS FALCÃO</b>	36	<b>18</b>	<b>18</b>	<b>36</b>	<b>18</b>	<b>18</b>	18
<b>BANCOS FALCÃO</b>	—	<b>12</b>	<b>12</b>	<b>6</b>	<b>8</b>	<b>6</b>	4
<b>CHAVES FALCÃO e BERÇO</b>	20	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>4</b>	2
<b>REPAROS</b>	31 (14) Peças Grossas	<b>21 (14)</b>	<b>21 (14)</b>	<b>12(14)</b>	<b>10(13)</b>	<b>8(13)</b>	2(13)

**PERSONNEL**

<b>CONDES- TÁVEIS</b>	1	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	1
<b>BOMBAR- DEIROS</b>	—	—	<b>29</b>	<b>19</b>	<b>19</b>	<b>14</b>	6
<b>SOLDADOS</b>	—	—	<b>260</b>	<b>190</b>	200	100	—

Portuguese Ships in the Tejo (late of 1589)®

	Galeão São Filipe (D)	Nau São João	Nau N <sup>a</sup> Sr <sup>''</sup> Rosário	Galeão Santo António ©	Galeão São Pedro	Galeão São Paulo	Galeão São Luís	Galeão São Bartolo- meu	Galeão São Pantaleã o
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ARTILLERY

LEÃO	1	—	—	—	—	—	—	—	—
SERPE	1	—	—	—	—	—	—	—	—
ESPERA (250)	20	12	12	12	12	12	12	12	12
ESPERA (220)	—	—	—	—	—	—	—	—	—
ESPERA (180)	—	—	—	—	—	—	—	—	—
CAMELO	7	1	1	1	1	1	1	1	1
PEDREIRO (230)	6	—	—	—	—	—	—	—	—
PEDREIRO (130)	—	8	8	8	8	8	8	8	8
FALCAO	7	10	10	10	10	10	10	10	10
BERÇO	10	6	6	6	6	6	6	6	6

SHOTS

FERRO COADO	1620	600	600	600	600	600	600	600	600
PEDRA	1000	640	640	640	640	640	640	640	640
DADO	—	30	30	30	30	30	30	30	30
BERÇO-	300	20	20	20	20	20	20	20	20
FALCÃO	60	20	20	20	20	20	20	20	20
COBRE CADEIA	40	—	—	—	—	—	—	—	—
FERRO CADEIA	40	—	—	—	—	—	—	—	—

