Water and Beverages on DEIC Ships Between the Netherlands and the Cape: 1602-1795

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Introduction

The Dutch East India Company (DEIC) was a remarkable organisation, deeply ingrained in South African history due to its establishment of a permanent European presence at the Cape. Over a period of almost 200 years, from 1602 to 1795, it shipped close to a million people from the Netherlands to the Cape, with many continuing the voyage to Batavia and other locations in the East. The logistical challenges posed by this massive movement of people were daunting and provided the material for much historical and anecdotal narration – physical and emotional hardship, navigational difficulty, piracy, warfare, mutiny and disease.

Less dramatic, perhaps, but equally important, was the need to provide water and other beverages to the seafarers during the long periods at sea – literally a matter of life or death. The voyage from the Netherlands to the Cape was the longest leg that was sailed by the DEIC and therefore the most challenging from a provisioning standpoint (the return voyage had a much smaller complement of passengers which made the requirements for provisioning less stringent). The uses of water on board were manifold:

- An obvious user of fresh water was the ship's galley, with an essential water-need for food preparation. Pickling and salting were the only preservation methods of the time and the food supplies were therefore too heavily salted to be used directly. Salted meat, for example, had to be soaked in fresh water for 24 hours before it could be used, with the water changed every 4 hours. A staple supply such as *stokvis* (dried fish) had to be boiled in fresh water, but its use was completely abandoned in 1760 in order to save fresh water, against some medical objections.

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The complaint was that the total salt intake would therefore be even higher, to the detriment of the general health of the crew.[1]

- A second user was the ship's surgeon, who had a priority claim on the freshwater-supply and fortified beverages on behalf of the sick. The reasons for fatalities and death on DEIC ships have been meticulously studied and will not be re-examined here.[2] Suffice to say that a considerable number of an average crew were sick at any given time, as many as 40 to 60 out of a crew of 250 to 300. Very often there were not enough facilities for the sick in the sick-bay and they had to be confined to their own sleeping-quarters.[3] The dreaded disease of the time was scurvy, the symptoms of which include a severe thirst which had to be catered for. Scurvy, and the thirst caused by it, was not a problem for a healthy crew at first, but after the twelfth to fifteenth week of a voyage it struck quite severely, as evidenced by the clustering of fatalities thereafter.[4]
- A portion of the water was reserved for live animals, kept on board for periodic slaughtering. In 1731, for example, the DEIC quota for live hogs was set at 12, 16 and 18 hogs on ships with lengths of 130, 145 and 160 feet respectively.[5] A similar quota of 40 hens for a large ship was in force in 1724.[6] It is noteworthy that much later in 1869, when much more reliable sea-water distillation systems had been available, similar quotas of the British Navy continued to allow for horses, cows, sheep, pigs, fowls, geese and ducks to be kept on board.[7] Live animals were therefore probably provided to break the monotony of diet as much as for survival.
- The main water-requirement, however, was for direct human consumption. The human need for water was supplemented by other beverages, primarily by beer and, to a lesser extent, wine. The other minor beverages were brandy, gin, vinegar, and lemon

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1. J. de Hullu, "Voeding", *in* J.R. Bruijn en J. Lucassen (reds.), *Op de Schepen der Oost-Indische Compagnie* (Wolters-Noordhoff, Bouma's Boekhuis, Groningen, 1980), pp 116-118.
2. A good overview is provided by A.E. Leuftink, *Harde Heelmeesters Zeelieden en hun Dokters in de 18de Eeuw* (Walburg Pers, Zutphen, 1991).
3. A.E. Leuftink, *Chirurgijns Zee-Kompas De Medische Verzorging aan Boord van Nederlandse Zeeschepen gedurende de Goude Eeuw* (Uitgewer onbekend, Nederland, 1963), p 31.
4. Leuftink, *Harde Heelmeesters*, p 51.
5. De Hullu, "Voeding", p 119.
6. J.R. Bruijn, F.S. Gaastra and I. Schöffer, *Dutch Asiatic Shipping in the 17th and 18th Centuries* I (Martinus Nijhoff, The Hague, 1987), p 218.
7. R.W. Stevens, "On the Stowage of Ships and their Cargoes". A summary from this 1869 publication is published at http://www.bruzelius.info/Nautica/Provisions/Stevens(1869)_S1185.html, accessed on 12 August 2005.

juice, but these were mostly for medicinal use and consumed in negligible quantities.

The need for water on board was therefore absolutely imperative. Not having fresh water on board would lead to starvation by thirst within days. Although the distillation of sea-water offered much promise, it never developed beyond the experimental stages until about 1780, when it was turned into a robust technology by the British and the French navies – in the sunset of the DEIC era.[8] The only option was to ship enough fresh water at the start of the voyage and to manage the water-supply on board carefully to make it to the end. This article systematically explores the evolution of the water-management system of the DEIC on the critical voyage from the Netherlands to the Cape – from the development and improvement of the water-source at the island of Texel until the water-barrels were cleaned and refilled at the Cape.

Provisioning the Ships at the Reede of Texel

The DEIC was an umbrella body for six independent Dutch maritime chambers – those of Amsterdam, Enkhuizen, Hoorn, Delft, Rotterdam and Zeeland. The first three of these chambers were situated on the shore of the Zuiderzee, from where their ships had to depart. The ships of the chambers of Delft and Rotterdam left through a rather tortuous, variable path through the delta of the Maas, and the ships of the chamber of Zeeland from Middelburg, situated directly on the North Sea. The ships of the Zuiderzee chambers accounted for about two-thirds of all DEIC traffic and will be the focus of this section.[9]

The Zuiderzee was too shallow to allow for fully-laden ships to depart from their home ports. The ships therefore had to be taken without cargo to the Reede of Texel, often with the help of two "camel" or flat-bottomed boats on both sides, which would partially lift the ships out of the water. The Reede of Texel was a staging area just east off the island of Texel, which formed a natural breakwater between the North Sea and the Zuiderzee, immediately opposite the village of Oudeschild. There were a number of advantages to having the ships provisioned at this point. It provided relative seclusion from the bustling home ports, with better control over the provisioning and personnel. This became especially important in the period when the ships were ready to leave, but had to

8. J. Haarhoff, "The Distillation of Sea-Water on Ships in the 17th and 18th Centuries", *Heat Transfer Engineering*, 28, 7, July 2007.
9. Bruijn, Gaastra & Schöffer, *Dutch Asiatic Shipping in the 17th and 18th Centuries* I.

wait for the right combination of wind and tide to clear the *Marsdiep*, the shallow and tricky passage between the southernmost tip of Texel and the town of Den Helder on the mainland. The DEIC ruled that the soldiers and sailors only started to earn their salaries once the ships had sailed and long delays caused understandable impatience which was contained more easily in the remote region of Texel. The Reede of Texel was also within the protection offered by *De Schans*, a military fortification about 1 500 metres south of Oudeschild. During its heyday as a staging area, it is estimated that 2 000 to 3 000 ships were annually provisioned off the Reede of Texel.[10] Only a small fraction of these ships were DEIC ships, as the Dutch trade with the Mediterranean and Baltic countries was substantially more than that of the DEIC with the East.

With so many ships being provisioned at the Reede of Texel, a reliable source of good water needed to be developed as closely by as possible. The gradual increase in the volume of shipping turned the supply of water into a business proposition. In 1627 the entrepreneur Dirk Nannings requested permission to dig a well, with the express purpose of selling the water to the ships. This well was situated about 1 200 metres from the shore. At first, the water-barrels were filled at the well, sealed and rolled through the pastures to the shore. After only eight years of following this slow, tedious process, the Council of the Amsterdam Admiralty gave permission in 1635 for a further capital improvement, namely to construct a small channel which would permit a *praam* (flat-bottomed boat) to take the barrels from the well to the shore. After these changes had been made by 1637, the practice was to fill the barrels at the well, transport them by boat to the shore, where the barrels were first hauled with a winch to the top of the dike, and then lowered down the other side with a small crane onto the beach. The shoreline of Oudeschild at that time was protected by a low earthen dike buttressed by a vertical timber palisade on the seaward side. From the beach, the barrels were taken by large *sloep* (an open boat) to the ships where they were stowed below deck. Despite these improvements and investments, the provisioning of a ship with drinking-water remained a tedious task which took *eenige dagen* (some days).

At about this time, the rights to the well water were transferred to the regents of the orphanage in Den Burg. Thus the term *Wezenputten* (orphan wells) was coined, used to this day. From 1648, the regents

10. According to a display at the *Maritiem en Jutters Museum* in Oudeschild. A new maquette of 18 metres by 4 metres of the Reede of Texel was unveiled in May 2005, based on years of meticulous research, which provides a striking idea of the extent of the activity at around 1700.

contracted *pachtmeesters* (well managers) on an annual basis to maintain the well pump and the water-chute, the boats and the cranes. Through the ever increasing volumes of water being transported along the system, the channel steadily deteriorated as the orphanage did not have the means to reconstruct the channel and the adjoining path. By 1662, the condition of the channel deteriorated to the extent that the boats could not be used and the barrels had to be rolled through the pastures once more. The orphanage had to seek financial assistance from the Admiralty of Amsterdam, then one of the large consumers, which committed itself to financial support of 25 florins per year. The orphanage also approached the DEIC, which committed itself to 10 florins per year. The level of financial support suggests that the DEIC was not such a large user of water at the time. The DEIC claimed that it used the wells *noijt of seer selden* (never or very rarely), which was probably a deliberate understatement, as there were no other significant water-wells at Oudeschild at the time. Despite the DEIC's denial of the importance of the *Wezenputten*, they nevertheless tied their financial support to four conditions, namely that the depth of the channel had to be maintained at a level convenient for the boats, that two boats had to be available for use in the channel, that two cranes had to be available at the dike, and that the DEIC had to have the priority use at all times. The conclusion is inescapable that the DEIC used its contribution to put its water provisioning on a more solid footing. This was further borne out when the DEIC appointed a permanent commissioner at Texel soon thereafter in 1666. With a reconstructed channel and road, freely available boats and cranes, priority rights and direct contact with the regents and well managers, the wells became a convenient water-provisioning point for the DEIC.[11]

The exact volumes of water supplied to the DEIC from the well are not known. If it is assumed that the DEIC took all its water from 1665 onwards from the well, then a reasonable estimate of the water volumes can be made from the number of DEIC ships and their cargoes. In 1756, for example, 22 DEIC ships left Texel with 5 900 men, for whom about 1,8 million litres of water had to be taken in. In 1756, the price of water at the well was *3 stuivers en 6 penningen per okshoofd*, which works out to a unit cost of 0,523 florins per 1 000 litres.[12] The unit cost of brandy,

11. Display notice at the well, erected for the 2002 celebration of the founding of the DEIC in 1602; V. Roeper, "Het Weesewater: Texels Drinkwater op de Schepen van de VOC", *in* V. Roeper and I. Vonk-Uitgeest (reds.), *Texel en de VOC Schepen op de Rede*, *Texelaars in de Oost* (Maritiem en Jutters Museum / Stichting VOC 2002, Texel, 2002), pp 46-47.
12. 16 penningen = 1 stuiver; 28 stuivers = 1 florijn; 1 okshoofd = 230,4 litres.

by comparison, was 198 florins per 1 000 litres and the monthly salary of a military recruit was 9 florins. The DEIC had to spend 21 times more on brandy than on water, despite providing 18 times more water than brandy per ship! [13] Although the water-cost was a mere pittance for the DEIC, it meant much to the orphanage and the well manager. Using 1756 as an example again, the well manager had to pay 800 florins to the orphanage, while the water-sales to the DEIC alone amounted to 1 327 florins.

The brisk business at the well allowed it to be upgraded. In 1750 Isaac Tirion noted that the path next to the channel had been paved shortly before. During the Fourth English War (1780-1784), a second well was dug only 15 metres north of the first, due to the many naval vessels requiring water. The yield of the well was remarkable. An eye-witness reported in 1781 that the well yielded 1 800 litres per hour on a continuous basis without evidence of the water-table having dropped at all. Another report from 1800 (after the second well had been dug) estimated the yield of the oldest well at between 1 550 and 2 100 litres per hour, essentially unchanged from the estimate of 1781.[14]

The Fourth English War accelerated the decline of the DEIC, whose era ended in 1795. With the cessation of DEIC activities and the end of the Dutch "Golden Century", the income from water-sales dropped precipitously and came to a complete halt when the North Holland canal (providing direct access from Amsterdam to the North Sea) was commissioned in 1824.

How Much Water and Beverages were Required?

When the DEIC was formed in 1602, the Dutch had limited experience of the long and difficult sea-voyage to the East. They also did not have established settlements at the Cape or in the East where the ships could be provisioned for their onward or return journeys. During these beginning years, the six chambers followed their own guidelines. In general the ships were provisioned for 30 months, which included the time between Europe and the East, as well as the time required to sail amongst the different trading posts. In February 1603, soon after its establishment, the DEIC took a first decision towards standardisation (an objective which would tax the DEIC for the rest of its existence) by adopting a uniform provisioning period of 27 months. By 1614, a pattern had been established to send a consignment of soldiers on each east-bound voyage

13. Roeper, "Het Weesewater: Texels Drinkwater", pp 49-50.
14. Roeper, "Het Weesewater: Texels Drinkwater", p 46.

for semi-permanent occupation in the newly established forts and settlements of the DEIC, which resulted in a revised decision to provision the ships for 30 months for the sailors and 15 months for the soldiers.[15]

An early obstacle for the DEIC was the lack of uniform weights and measures. Not only were the systems amongst the different chambers incompatible, but the DEIC's trading partners in the East also used indigenous systems of their own. In order to get a standardised DEIC system, a series of resolutions were adopted between 1630 and 1633 to use a consistent system of weights and measures.[16] Each effort towards standardisation seemed to be followed by a period during which the different chambers tended to drift towards their own preferences for provisioning. In 1649 new uniform rules were approved which required provisioning for 18 months for return ships. For smaller ships, 12 months were called for as they presumably were meant to stay in Batavia as part of the Eastern fleet. In 1656 (after the establishment of the Cape as a provisioning station in 1652) these periods were shortened to 15 months and 9 months respectively. The provision specifically for bread was always for a slightly longer period than the other supplies to allow for its drying and shrinking.[17]

For the next forty years the DEIC focused on three key provisioning problems:

- The first problem was to enforce a uniform provisioning policy amongst the different chambers. In 1661 more detailed provisioning lists were drawn up and from 1669, as verification, the chambers had to report in detail on what was actually supplied.
- The second problem was to exercise adequate discipline over the senior officers. Between 1689 and 1691, elaborate controls were introduced to prevent the captains of ships from assuming too much discretion regarding the provisions. Five copies of the extensively detailed instructions had to be on board each ship at all times – one copy for each senior officer.
- The third problem was to find an equitable provisioning system that would suit both small and large ships. The difference between small and large ships, introduced in 1649, was abolished in 1673 when it was decided that all ships had to be provisioned for

15. P. van Dam, *Beschryvinge van de Oostindische Compagnie*, *Eerste Boek* I (Martinus Nijhoff, Den Haag, 1927), pp 512, 516-518.
16. P. van Dam, *Beschryvinge van de Oostindische Compagnie*, *Eerste Boek* II (Martinus Nijhoff, Den Haag, 1927), p 53.
17. Van Dam, *Beschryvinge van de Oostindische Compagnie* I, p 513.

9 months. Bread had to be supplied for 10 months, but in 1680 this period was increased to 12 months. In 1684 a distinction was once again made between small and large ships – not in terms of the periods for which they had to be provisioned, but in terms of the amount of supplies which had to be carried for each crew member. More attention was paid to compensate for the problems of drying out (solid supplies) and leakage (liquid supplies).[18]

The year 1695 marked a turning-point in the provisioning policy of the DEIC. The distinction between small and large ships was finally abolished (again), the list of provisions was standardised (to be used in the same format, with revisions, for the next 100 years), and the quantities were increased. The increase of provisions was ostensibly aimed at the better health of the crew, but it was pointed out that this increase came at a time when DEIC ships were prohibited from sailing through the English Channel and had to follow the longer route around Scotland. This increased the length of the voyage from about four to five months. As scurvy only became a problem after about three months, the increase in the provision for water, beer, wine and round plums was actually to compensate for the longer voyage.[19] The provisioning list of 1695 became the benchmark for all future revisions. In all subsequent revisions, credit was given to their 1695 origin. During the next 95 years (the last published version available is dated 1790), a total of 22 revisions were approved. It is noteworthy that the revisions were not evenly spread, but clustered around 1705, 1712, 1731, 1742, 1752, 1761, 1776, and 1789.

The DEIC used a wide range of weights and measures, understandable at a time when each guild or industry adopted an own system based on tradition and convenience. The basis for mass measurement was the Amsterdam pound. Likewise, the basis for volumetric measurement was the *mingelen* (an old word for jar). For meaningful comparison and analysis, Tables 1 and 2 were compiled to relate the historical units to their current metric equivalents.[20]

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18. Van Dam, *Beschryvinge van de Oostindische Compagnie* I, pp 512-513.
19. Van Dam, *Beschryvinge van de Oostindische Compagnie* I, pp 514-515.
20. Compiled from Bruijn, Gaastra & Schöffer, *Dutch Asiatic Shipping in the 17th and 18th Centuries* I, pp 114-118; Anonymous, "Woordenlijst – Personeel en Organisatie", published at http://www.vocsite.nl, accessed on 14 August 2005; J. Gawronski, *De Equipagie van de Hollandia en de Amsterdam VOC-bedrijvigheid in 18de-eeuws Amsterdam* (De Bataafsche Leeuw, Amsterdam, 1996), p 232.

Table 1: Mass units used by the DEIC

UNIT	RELATIONSHIP	EQUIVALENT
1 loot	1 /16 pond	30,9 gram
1 once	1 / 8 pond	61,8 gram
1 pond	-	0,4941 kilogram
1 vierendeel	8 pond	39,5 kilogram
1 ton	2000 pond	988,2 kilogram
1 last	4000 pond	1976,4 kilogram

Table 2: Volumetric units used by the DEIC

UNIT	RELATIONSHIP	EQUIVALENT
1 pimpeltje	1 / 64 mingelen	18,75 millilitre
1 mutsken	1 / 8 mingelen	150 millilitre
1 pint	1 / 2 mingelen	600 millilitre
1 mingelen	-	1,2 liter
1 flapkan	10 / 8 mingelen	1,5 litre
1 stoop	2 mingelen	2,4 litre
1 anker	32 mingelen	38,4 litre
1 halfaam	64 mingelen	76,8 litre
1 aam	128 mingelen	153,6 litre
1 tonnen	-	155,4 litre
1 okshoofd	192 mingelen	230,4 litre
1 halflegger	256 mingelen	307,2 litre
1 pijp	-	435,0 litre
1 toelast	512 mingelen	614,4 litre
ALTERNATIVE	RELATIONSHIP	EQUIVALENT
1 vat (brandy)	1 halfaam	76,8 litre
1 vat (beer)	1 aam	153,6 litre
1 vat (wine)	1 halflegger	307,2 litre
1 varken (wine or water)	1 halflegger	307,2 litre

With these conversions known, it is a simple matter to express the provisioning lists in metric equivalents. Six such provisioning lists were available for this analysis, starting just after the beginning of the DEIC in 1603, and continuing up to 1790, in its closing years.[21] Table 3 shows a compilation of the prescribed provisions for the major beverages (water, beer and wine). The seasonal distinction was made to compensate for the warmer weather encountered when ships stayed in a summer zone for almost the whole voyage.

21. Dutch National Archive, The Hague (hereafter DNATH): VOC Collection 1.04.02, File 4967, Lyste van de Victualien, en ordre op de Rantsoenen, published in 1786; DNATH: VOC Collection 1.04.02, File 4968, Lyste van de Victualien, en ordre op de Rantsoenen, approved 1 November 1684, 10 December 1695, 19 June 1702, 8 December 1790.

Table 3: Total provision of water, beer and wine (litres per 100 crew)

YEAR	DECEMBER TO MARCH				APRIL TO NOVEMBER			
	Water	Beer	Wine	Total	Water	Beer	Wine	Total
1603	31 334	15 540	25 903	72 778	31 334	15 540	25 903	72 778
1680	21 042	15 540	3 686	40 268	30 258	7 770	3 686	41 714
1684	21 042	15 540	3 786	40 268	21 042	15 540	3 686	40 268
1695	21 042	15 540	3 686	40 268	30 258	7 770	3 686	41 714
1702	21 042	15 540	3 686	40 268	35 173	7 770	3 686	46 630
1724	31 487	7 770	4 301	43 558	35 173	3 885	4 301	43 359
1786	42 394	1 943	1 843	46 179	42 394	1 943	1 843	46 179
1790	42 394	1 865	1 229	45 487	42 394	1 865	1 229	45 487

Table 4: Daily per capita allowance of water, beer and wine (millilitres per day)

YEAR	DECEMBER TO MARCH				APRIL TO NOVEMBER			
	Water	Beer	Wine	Total	Water	Beer	Wine	Total
1603	387	192	320	898	387	192	320	898
1680	779	576	137	1 491	1 121	288	137	1 545
1684	779	576	137	1 491	779	576	137	1 491
1695	779	576	137	1 491	1 121	288	137	1 545
1702	779	576	137	1 491	1 303	288	137	1 727
1724	1 166	288	159	1 613	1 303	144	159	1 606
1786	1 570	72	68	1 710	1 570	72	68	1 710
1790	1 570	69	46	1 685	1 570	69	46	1 685

The total quantities in Table 3 can now be converted to a daily per capita allowance of each of the beverages shown in Table 4. The same data are also shown in Figure 1.

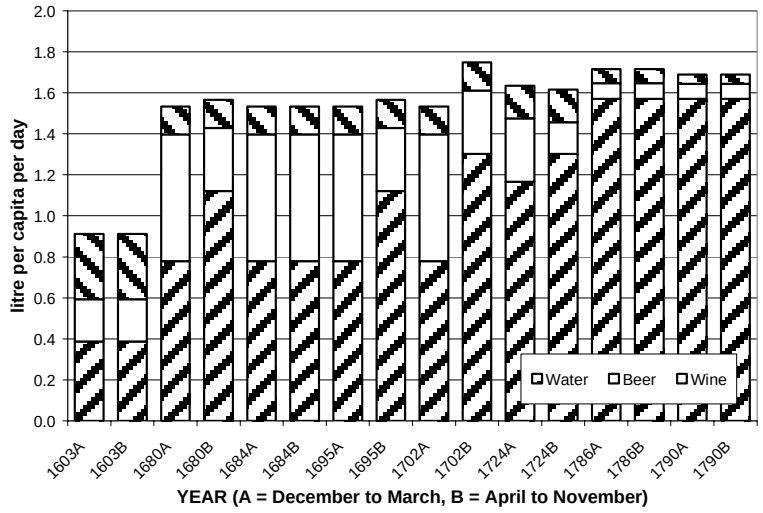

Figure 1: Daily per capita allowance of water, beer & wine at different times per season.

The following picture emerges from the data presented and the literature consulted:

- For the 1603 list, the liquid provision was not enough to sustain the crew for 27 months. The assumption was obviously made that it would be always possible to obtain fresh water for the return voyage once the ships had arrived at the trading posts. The remainder of the lists show a consistent total allowance of between 1,5 and 1,7 litres per capita per day.
- A separate allowance for wine and beer (not shown in the tables) was made for an average of 9 persons in the captain's cabin, where the officers and the passengers dined. These daily per capita allowances in 1724 were 411 millilitres of wine (compared to 159 millilitres for the crew) and 253 millilitres of beer (compared to 154 millilitres for the crew).
- On British ships of that time, the water-allowance was usually not above 1,6 litres per capita per day, and in cases of water-shortages this quota was reduced.[22]
- There had been a steady shift from the fortified beverages to water. In 1603, water made up less than 50 per cent of the total allowance, while it was more than 90 per cent in 1790.
- For those lists where differences were made according to the departing season, the differences in beer and water-allowances almost exactly balanced each other. When ships left during the European summer, the beer had a shorter life, which prompted a lower beer and higher water-allowance.
- For the ships leaving in the European winter, a small extra amount of Spanish wine was included to compensate for the cold, but this wine was reserved for use in the baking of bread, and therefore not included in the tables.

The provision of the minor beverages, which were used mainly for medicinal purposes, is shown in Table 5. No brandy was provided at first, but then kept at a steady level until it was partially replaced by gin. The increase in the provision of vinegar in 1790 was probably the result of a favourable report in 1786 on the general use of vinegar on board.[23]

22. L.H. Roddis, *James Lind, founder of nautical medicine* (WM Heinemann, London, 1950), p 93.
23. DNATH: VOC Collection 1.04.02, File 4973, Stukken betreffende het gebruik van "anti-pestilentiele" of luchtverversende azijn.

Table 5: Provision of brandy, gin, vinegar and lemon juice (litres per 100 crew)

YEAR	TOTAL PROVISION (litres)				DAILY PER CAPITA (millilitres)			
	Brandy	Gin	Vinegar	Lemon	Brandy	Gin	Vinegar	Lemon
1603	0	0	3686	154	0	0	46	1,9
1684	1843	0	1229	38	68	0	46	1,4
1695	1843	0	1229	38	68	0	46	1,4
1702	1843	0	1229	38	68	0	46	1,4
1724	1843	0	1229	38	68	0	46	1,4
1786	230	1382	1229	38	9	51	46	1,4
1790	230	1382	1843	38	9	51	68	1,4

The Management of the Liquid Supplies on Board

The per capita allowances presented in the previous section are averages, based on the full crew complement at the beginning of the voyage, over the maximum period allowed for the voyage. In principle, the allowances could be more generous for a number of reasons:

- Mortality rates at sea were high during the seventeenth and eighteenth century. Water-supplies reserved for the deceased thus became available to the remaining crew. Was this significant? For the period 1650 to 1780, a total of 774 900 people left the Netherlands for the Cape. Some ships perished underway, which accounted for 27 800 people. Of the remaining 747 100 people, a total of 54 300, or 7,3 per cent died.[24] However, quite a number of ships made the voyage to the Cape without any deaths at all. Moreover, most deaths, if there were any, occurred towards the end of the voyage. The deaths at sea could therefore not have had a significant impact on the per capita water availability.
- A much more significant but unpredictable augmentation of the water-supply was due to periods of rain, when sails were hung out and the water collected.[25] More generous rations could obviously only follow after such rainfall events.
- Undoubtedly, the single most important determinant of the water availability was the duration of the voyage. The DEIC had to be over-cautious in estimating the duration of the voyage, as a lack of drinking-water at sea meant death. From 1673 onwards, the DEIC based the provisioning on a maximum duration of 9 months, or

24. Calculated from Bruijn, Gaastra & Schöffer, *Dutch Asiatic Shipping in the 17th and 18th Centuries* I.
25. J. de Hullu, "Ziekten en Dokters", *in* J.R. Bruijn en J. Lucassen (reds.), *Op de Schepen der Oost-Indische Compagnie* (Wolters-Noordhoff, Bouma's Boekhuis, Groningen, 1980), p 85.

roughly 270 days. On average, however, the duration of the voyages from the Netherlands to the Cape was 134 days, less than half of what was budgeted for.[26] This was, however, a bonus which was not apparent until very close to the end of the voyage. There can be no question that the feared doldrums of the tropical regions were the worst nightmare for the early mariners. Voyages of 210 days or longer between the Netherlands and the Cape were commonly recorded, regardless of the sailing season, justifying the conservative position of the DEIC.[27]

How did the ship authorities manage the water-supply from day to day? Beer and water were distributed directly to every crew member, at the standard rate of one *flapkan* (a beaker with a lid, holding 1,5 litres) of either beer or water per day.[28] The beer was to be distributed from the start of the voyage. Only after the beer supply had been depleted, could the distribution of water begin. This was a practical measure prompted by the fact that the cheaper beer reserved for the crew did not keep well and had to be drunk while possible.

Was one *flapkan* per day an adequate liquid provision? Apparently it did not satisfy all, as a saying from that time went that the ration was *te veel om van te sterven en te min om van te leven* (too much for death and too little for life).[29] Others considered the water-supply to be generously adequate to reach the Cape and even enough to reach Batavia directly.[30] The current medical wisdom suggests a minimum daily liquid intake of 1,5 litres per capita under average conditions, but there were a number of reasons why a typical crew member on a DEIC ship would require more. The diet was salty to the extreme. A quote from that time goes: *De zeeman krijgt zelden zijn maag vol, en dan nog met zulk zout eten, dat menig bedelaar het zou laten staan* (The seaman rarely has enough to eat, en then it is so salty that it would be left by many a beggar).[31] A significant part of the crew would be struck at any time with dysentery, fever and scurvy after three months – diseases which brought on extreme thirst. The sailors, which made out more than half of the crew, had to do hard physical labour almost every day. Finally, a large part of the voyage

26. Bruijn, Gaastra & Schöffer, *Dutch Asiatic Shipping in the 17th and 18th Centuries* I.
27. Leuftink, *Harde Heelmeesters*, p 55.
28. Bruijn, Gaastra & Schöffer, *Dutch Asiatic Shipping in the 17th and 18th Centuries* I, pp 114-118.
29. De Hullu, "Voeding", p 122.
30. Roeper, "Het Weesewater", p 45.
31. Leuftink, *Chirurgijns Zee-Kompas*, p 29.

was spent crossing the tropics, being exposed to sweltering heat both on and below deck.

When the ship slowed down, or stopped during periods of calm, the already meagre water-rations were further curtailed. The one *flapkan* (10 *mutskens*) was then reduced to 8 or 6 *mutskens* or even less.[32] During prolonged calm, the ships hardly moved for days and cases were reported where the daily ration was cut down to as little as 3 *mutsken* (450 millilitres).[33] The unbearable thirst between the tropics had been vividly described in numerous journals of the time, aggravated by the salty food. The desperate crew chewed on bullets and small chunks of lead to combat the thirst, with the drinking of own urine in extreme cases.[34] A dramatic account by the ship surgeon of the *Goes* describes an event in 1629 when the ration was cut to 4 *mutskens* during an unusually long crossing of the equator. An anonymous note on a door threatened death to all unless the ration was increased. The culprit confessed after two more days, preferring death by execution to the slow torture by thirst. After a hearing by an admiral, he was summarily dumped overboard with a cannonball tied to his feet.[35] Diseases were aggravated by the shortage of water in the tropical heat. Towards the end of the eighteenth century, the position was somewhat relieved when ships were allowed to stop at the Cape Verde islands, where the water-supply could be replenished.[36] This may be the reason for a surprisingly generous resolution in 1793 (two years before the DEIC came to an end) that water was to be scrapped as a "controlled" supply and that an open barrel of water should be permanently available for the use of the crew, under the permanent watchful eye of the officer on duty, unless unusual problems warranted rationing.[37]

Besides the personal rationing to the crew, the cook had a separate allowance for the galley. In the very first provisioning list of 1603, the galley's allocation was a meagre 3,9 per cent of the total daily water-ration. By 1680, the galley's share had risen to about 7 per cent of the

32. Leuftink, *Harde Heelmeesters*, p 18.
33. Bruijn, Gaastra & Schöffer, *Dutch Asiatic Shipping in the 17th and 18th Centuries* I, p 166.
34. De Hullu, "Ziekten en Dokters", p 85.
35. V. Roeper en R. van Gelder, *In Dienst van de Compagnie Leven bij die VOC in honderd getuigenissen (1602-1799)* (Athenaeum – Polak & Van Gennep, Amsterdam, 2002), pp 73-74.
36. Leuftink, *Harde Heelmeesters*, p 18.
37. DNATH: VOC Collection 1.04.02, File 4967, Extract uit die Resolutien, 5 December 1793.

total (compare this to the British Passenger Act of 1855 which reserved about 15 per cent of the total for the galley).[38] The separate provisioning for the galley came to an end with a resolution in 1777 which abandoned the separate budgeting for water for the kitchen and the crew.[39] Instead, a single budget item was introduced for all water and the competing water-demands for drinking, the galley, the sick and the animals were left to be reconciled by the authorities on each ship. The total allowance for water and other beverages, however, stayed almost unchanged as evidenced by Figure 1. Although the allocation of the water was now discretionary, more stringent accounting of the water was simultaneously introduced. A register had to be filled in every two weeks of how the water had been allocated, and reconciled with an independent, weekly inventory of the remaining water-supply.

The meticulous bookkeeping requirements which characterised much of the operations of the DEIC were symptomatic of a problem which plagued the DEIC throughout its history. The supplies on the ships were valuable, even more so in the East, where high prices could be negotiated for rare European goods. Many a crew member and officer traded on a limited scale for their own account and many took private goods on board for this express purpose. What bothered the DEIC, was that unscrupulous officers would illicitly sell surplus provisions, left on the ships at the end of the voyage, for their own account, instead of returning them to the warehouses of the DEIC. Even worse, some inevitably followed a deliberate practice of unnecessary rationing to leave a larger surplus at the end.[40] While this argument does not hold for water (which had no residual value once the ship arrived at its destination), it certainly held for the other beverages and almost all the other supplies.

There were thus two reasons for tight security and control of the water and other beverages – the maddening thirst of the crew, and the greed of the officers. This explains the elaborate controls that were prescribed. A *bottelier* (bottle master) was in charge of all the liquid supplies. The daily rations could only be distributed by the bottle master in the presence of the senior boatman, a second officer and the constable. After every daily distribution, a written record had to be produced on exactly how much of what had been distributed, with the quantities not expressed in numerals, but written out in full words. At the end of the

38. Stevens, "On the Stowage of Ships and their Cargoes".
39. DNATH: VOC Collection 1.04.02, file 4967, Extract uit die Resolutien, April 1777.
40. De Hullu, "Voeding", pp 114-115.

voyage, each of the supervising officials had to confirm the truthfulness of the records by oath.[41]

How were the liquids distributed? According to one report, the provision of drink "produced even more problems than solid food".[42] The *flapkan* was offered once a day to each crew member, and most of them drank all of it in one go.[43] The wine and brandy were distributed early in the morning, before the morning meal, *om beter door de leden te trekken* (to flow better through the limbs) as it was specifically meant to offer some relief during cold and wet conditions.[44] With the stronger drinks, a fine balance had to be struck between attaining a degree of anaesthesia against the extreme conditions imposed by heat, cold, thirst, disease and filth, and avoiding drunken scenes. Wine had to be distributed every third day (150 millilitres at a time) and brandy every second day (150 millilitres at a time). It was specifically prohibited to split the brandy ration into smaller morning and evening portions, served on the same day.[45]

Vinegar was generously allowed for in the provisioning, but it is not clear whether it was rationed for direct human consumption. Dutch ships were credited with maintaining a high degree of cleanliness at the time. Detailed procedures were drawn up to guarantee the cleanliness of the ships and their supplies, but despite these efforts, conditions on board were appallingly crowded and unhygienic.[46] To suppress the resulting stench, vinegar was sprinkled or gunpowder was burned with juniper berries.[47] In a report from 1786, the usages and benefits of vinegar were described in some more detail.[48] For the suppression of stench, the vinegar had to be diluted with an equal volume of fresh water. For sprinkling, the mixture had to be poured from a small metal watering-can with a sponge on the inside. The can had to be held high and the mixture had to be sprayed, falling like rain. It had to be done along the sides as well as the middle of the areas below deck, in the morning and evening.

41. DNATH: VOC Collection 1.04.02, File 4967, Extract uit die Instructie voor Kooplieden en Schippers.
42. Bruijn, Gaastra & Schöffer, *Dutch Asiatic Shipping in the 17th and 18th Centuries* I, p 160.
43. De Hullu, "Ziekten en Dokters", p 85.
44. De Hullu, "Ziekten en Dokters", p 89.
45. Bruijn, Gaastra & Schöffer, *Dutch Asiatic Shipping in the 17th and 18th Centuries* I, p 160.
46. De Hullu, "Ziekten en Dokters", p 86.
47. Leuftink, *Chirurgijns Zee-Kompas*, p 31.
48. DNATH: VOC Collection 1.04.02, File 4973, Stukken betreffende het gebruik van "anti-pestilentiele" of luchtverversende azijn.

The other method was to place the mixture on a warming plate to slowly release its fumes to spread through the room. This was to be done twice a day, or even continuously when necessary. It was cautioned that the vinegar had to be prevented from spilling directly onto the surface of the warming plate or the fire itself, as the pungent fumes that then suddenly flared up, were considered to be very detrimental to the throat and chest. Vinegar was also to be splashed onto the hands of those who worked with the sick and the dead, or onto the hands of the sick in the sick-bay. This report was distributed as a directive to all ships after 1786, which probably explained the 50 per cent increase in the vinegar ration soon thereafter.

How did the rationing of the beverages on board match up to the volumes supplied in terms of the provisioning lists? A convenient way to approach this question is to express the total supply in terms of the number of days it would take to exhaust the supply at the normal rationing rate. Such an analysis is provided in Table 6.

Table 6: Total supply, in terms of the number of days at the normal ration

	Water + Beer*	Wine	Brandy + Gin
Ration	1,5 litres / day	50 ml / day	75 ml / day
1684	226	737	246
1695 (Dec – Mar)	226	737	246
1695 (Apr – Nov)	236	737	246
1702 (Dec – Mar)	226	737	246
1702 (Apr – Nov)	269	737	246
1724 (Dec – Mar)	244	860	246
1724 (Apr – Nov)	243	860	246
1786**	296	369	215
1790	295	246	215

* Water or beer after subtraction of the volume reserved for the galley

** No separate water allowance for the galley from 1786

Assuming that there was no leakage of water and beer from the barrels (probably an unrealistic assumption, but no estimates could be obtained from the sources consulted), the values for water and beer in Table 5 are somewhat surprising. Considering that an average voyage had a duration of 19 weeks, it would have been only necessary to introduce rationing in the extreme cases where the duration exceeded 32 or more weeks. From the literature, however, one gleans the impression that rationing of water between the tropics was the rule rather than the exception. It either indicated a highly cautionary approach by the ship authorities (who could obviously not forecast the duration until it was

almost over), or unscrupulous stashing of beer in view of later illicit trade, thereby placing greater pressure on the water-supply. Given that the cheaper "crew" beer did not keep well after the first few months, the latter option seems less likely.

The entries for brandy/gin indicated that almost all was destined for rationed distribution to the crew, with little room for discretionary use, even more so as of 1786. This is understandable, as the sick-bay had a separate, small allowance of strong liquor for medicinal purposes. The rations for wine left the most room for discretionary use, indicating that about two-thirds of the supply was for discretionary use and one-third for rationing. In 1786, the discretionary use was sharply curtailed, and the last list of 1790 practically brought an end to the discretionary use of wine.

The Quality of Water and Other Beverages

The poor quality of the drinking-water was one of the many problems the seamen had to contend with.[49] Was this due to bad water-quality being shipped in the first place? To a certain extent, the water-source was implicated. It was well known that the drinking-water brought from shore onto the ships might have been infected with typhoid, cholera, dysentery or other germs of water-borne diseases. Outbreaks of diarrhoea were frequent and ascribed to the water brought from ashore.[50] The British Navy of the eighteenth century cautioned its masters to pay special attention to water-sources and their purity. An example was presented where water taken directly from the river in Calcutta seriously afflicted the crew, "with disease clearly traceable to the consumption of unwholesome water.[51] In the British Navy of the eighteenth century, it was customary to send watering parties ashore with water-barrels to be filled from the wells, streams, or pools. Water, if clear, was usually transferred directly into the cask without any filtration. Where the water was obtained from a pool of stagnant water, and there was scum on it or it was otherwise grossly contaminated, it was strained through a blanket. Where the water was particularly suspect, or where the ship's surgeon insisted upon it, some form of filtration through gravel, sand, or charcoal was sometimes used.[52] In the case of the DEIC, the water from

49. Leuftink, *Harde Heelmeesters*, p 16.
50. Roddis, *James Lind, founder of nautical medicine*, p 91.
51. Stevens, "On the Stowage of Ships and their Cargoes".
52. Roddis, *James Lind, founder of nautical medicine*, p 92.

Amsterdam or the River Vecht to its east was not considered to be the best, but the well at Texel was highly regarded.[53]

While some water-sources may have been worse than others, all the contemporary accounts concur that there was significant water-quality deterioration during the voyage. As the water was kept in large wooden barrels, special attention was paid to the cleanliness and quality of the barrels. The staves of the water-barrels were not to be made of fir, pine or soft wood – oak was preferred. Moreover, the wood had to be properly charred on the inside.[54] Some went as far as fuming the barrels with burning brimstone to keep the water from putrefying or breeding insects (a similar practice was used to preserve wine and cider in barrels).[55]

After the barrels had been brought into use, further care was taken to keep them clean. Before barrels could be reused, they had to be thoroughly rinsed with fresh water.[56] Once wine or beer had been put into a barrel, it could never be used for water again, as the water would "never come sweet again, while in the cask".[57] Despite all of these precautions, the barrels were definitely contributing to the deterioration in quality. When oak barrels were later replaced (after the time of the DEIC) by steel tanks, the water-quality problem seemed to disappear.[58] The use of steel tanks, incidentally, brought problems of its own when the interior of the tanks corroded. The water, by the motion of the ship, became discoloured and termed "ship's port wine" by the seamen. This problem could be avoided by vigorous scraping, washing and whitewashing before re-filling.[59]

Water was considered to deteriorate "within the standard time of four months due to pollution and heat".[60] Other sources suggest that a marked odour and taste usually developed in the water after a short time, ranging from a few days to two weeks.[61] A British source cautions that

53. Leuftink, *Harde Heelmeesters*, p 16.
54. Roddis, *James Lind, founder of nautical medicine*, p 92.
55. S. Hales, *Philosophical experiments Showing how sea-water may be made fresh and wholesome and how fresh-water may be preserved sweet* (W Innys & R Manby, London, 1739).
56. DNATH: VOC Collection 1.04.02, File 4969, Informatie oor hoe men de mede gegeevene lepelbladen gebruiken zal.
57. Hales, *Philosophical experiments*.
58. Leuftink, *Harde Heelmeesters*, p 16.
59. Stevens, "On the Stowage of Ships and their Cargoes".
60. Bruijn, Gaastra & Schöffer, *Dutch Asiatic Shipping in the 17th and 18th Centuries* I, p 160.
61. Roddis, *James Lind, founder of nautical medicine*, p 92.

water from the Thames and several other waters will stink in seven or eight days, especially in unseasoned barrels. The quality problem was perceived in two ways:

- There was an offensive odour and an unpleasant taste which obliged the drinkers to hold their noses while they drunk it. It was ascribed to "a thin, clammy, slimy substance" which formed on the inside of the barrel.[62]
- In hot climates or the tropics, worms or larvae were found in the water.[63] A witness from 1705 describes how he had to keep his teeth clenched together as a strainer to prevent the passage of crawling worms ("*… tanden dicht op malkanderen moesten houden en het water daardoor zuigen, ten einde de daarin gegroeide en krielende wormen den doorgang te beletten …*").[64]

Understandably, some "preservatives" were added to the water to prevent its quality from deteriorating. By 1739, the Dutch added a small quantity of "spirit of vitriol" to prevent the water from stinking, while a leading British scientist at that time similarly advocated the addition of three drops of "oil of sulphur" to a quart to prevent the water from stinking "for many months".[65] Both are older terms for sulphuric acid. In 1755, a British inventor mentioned that the "usual" method was to add lime, which was very "fiery and pungent to the taste, and consequently very disagreeable, and rather apt to increase and inflame a man's thirst, than to quench and allay it". He advocated the addition of 250 milligrams per litre of "fine clear white pearl ashes", which would "purge and purify the water from all slime and filth".[66]

What to do with the water once its quality had deteriorated in the barrels? The larvae and worms could readily be removed by pouring the water through a piece of cloth before drinking.[67] Another method, advocated as early as 1767 by a British captain, was to boil the water to be used – a method which was not practical for an operation as large as that of the DEIC.[68] The most common approach, however, was to add

62. Hales, *Philosophical experiments*.
63. Roeper, "Het Weesewater", p 47.
64. De Hullu, "Ziekten en Dokters", p 86.
65. Hales, *Philosophical experiments*, p 59.
66. T. Butler, *A Safe, Easy and Expeditious Method of Procuring Any Quantity of Fresh Water at Sea* (Alexander Strakan, Cornhill, 1755), pp 39-40.
67. Roeper, "Het Weesewater", p 47.
68. Roddis, *James Lind, founder of nautical medicine*, p 93.

something before the water was distributed, which would render the odour and taste less offensive. The literature abounds with suggestions:

- A small quantity of vinegar (10 to 12 drops per beaker of water).[69]
- A pound of charcoal to about 300 litres of water, 12 hours before use.[70]
- Lemon juice.[71]
- About 4 pounds of burnt biscuits to a hogshead of water, or powdered ginger, or a small quantity of cream of tartar.[72]
- The insertion of a glowing hot metal rod. The water captured during rainstorms derived a bitter taste from the pitch on the sails and ropework of the ship and this particular taste could be successfully reduced by this method.[73]

If nothing was added to the water, a particular pattern was observed. When the barrels were opened, the water was turbid and stank. After a while of being exposed to the atmosphere, the water cleared, the stench diminished, eventually rendering the water quite drinkable, provided that there were not too many worms and larvae at the start.[74] This process would have been completed within "a few days or even hours". Naturally, this phenomenon was exploited to try to improve the water-quality. The simplest way was to open the barrel (by removing the plug from the bung-hole) some 12 to 24 hours before use.[75] The improvement could be sped up by shaking or decanting the water from one barrel to the other.[76]

In modern terminology, the bad water-quality can clearly be traced to anaerobicity, or a lack of oxygen. When pure surface water is placed in a barrel, some oxygen is already dissolved in the water. On the rough oak surface on the inside of the barrel, a bacterial biofilm (the "thin, clammy, slimy layer" referred to earlier) rapidly forms which steadily consumes the oxygen. With the barrel carefully sealed to eliminate spillage and evaporation, no more oxygen from the atmosphere can reach

69. DNATH: VOC Collection 1.04.02, File 4973, Stukken betreffende het gebruik van "anti-pestilentiele" of luchtverversende azijn.
70. Stevens, "On the Stowage of Ships and their Cargoes".
71. De Hullu, "Ziekten en Dokters", p 89.
72. J. Lind, *An essay on the most effectual means of preserving the health of seamen in the Royal Navy* (D Wilson & G Nicol, London, 1774), p 96.
73. De Hullu, "Ziekten en Dokters", p 85.
74. Leuftink, *Harde Heelmeesters*, p 16.
75. Stevens, "On the Stowage of Ships and their Cargoes".
76. De Hullu, "Ziekten en Dokters", p 89.

the water. Once the oxygen in the water is depleted, the water-chemistry changes from an oxidative to a reducing state. Hydrogen sulphide and methane are produced, and iron and manganese become soluble. When the barrel is opened, the first thing to be noticed is the smell of rotten eggs, or hydrogen sulphide. As soon as the water is exposed to the oxygen in the atmosphere, the dissolved iron and manganese precipitate in the water (making it turbid), followed by settling, which drags down bacterial and other debris in the water (making it clear again). The speed of the process depends on how quickly the oxygen is dissolved into the water. By stirring, or pouring the water from the one to the other barrel, the oxygenation rate is dramatically increased.

When well water was directly used to fill the barrels, the process described would have been exactly the same, except that well water typically has much less dissolved oxygen than surface water, meaning that the time to reach the anaerobic stage in the barrels would have been shorter. Moreover, because well water is mostly anaerobic and has intimate contact with the rock strata through which it percolates, it is often enriched in iron and manganese. The water from the well at Texel was known to be rich in iron, and the clear-turbid-clear cycle of the water upon exposure to the atmosphere can be observed to this day. When the water is taken from the well, it is clear. Upon being deposited in the channel draining the water away, oxygen from the atmosphere is taken up, the iron precipitates as red flakes, forming a scum on the surface near the well. As the water flows away from the well, it becomes clearer as the iron particles settle out.

Texel water was widely considered to deteriorate less than the water from other sources. It was this property, rather than its convenient availability, that earned praise from afar.[77] How can this be explained? One reason may be that the Texel water simply formed *more* precipitates once the barrels were opened, thereby "sweeping" more impurities from the water as the precipitates settled. Another reason may be that the high concentration of dissolved iron in the barrel had bactericidal properties.

What about the other beverages? The quality of the beer supplied to the DEIC varied greatly. According to a detailed analysis of the conditions during 1742 to 1743, there were six types of beer supplied to the DEIC by a single brewer. The price varied remarkably, with the most expensive beer almost five times more expensive than the cheapest; the cheaper beer being the "thinnest" or "lightest". The bulk of the beer was

77. Roeper, "Het Weesewater", p 47.

of the cheapest variety, which was distributed to the crew. The cheapest beer was also the beer that deteriorated the quickest. Even without deterioration, the quality was suspect. In 1749, the Amsterdam Carpenter Guild, which was supplied with the same beer as that loaded into the DEIC ships, lodged a complaint that the beer was undrinkable, caused *veele ziekten en ongemakken* (many diseases and discomforts) and was *mistroostig weggewerpt* (ruefully thrown away). The specifications for the cheapest beer were vague, while the better qualities, destined for the officers and passengers, were specified in much more detail. The beer destined for the captain's cabin, for example, was required to be "good" beer, while *jopenbier* was specified for the sick-bay. The most expensive beer had a much longer life and was despatched for the use of the senior DEIC officials in the East.[78]

Little information is available about the quality of the wine supplied by the DEIC. However, differences in quality can be inferred from the wine categories used. Ever since the DEIC had been established, the categories of "French" and "Spanish" wine were used. Spanish wine was used for rationing to the crew, while the better French wine was reserved for discretionary use. About five times more Spanish wine than French wine was supplied. For the captain's cabin, in contrast, Spanish wine made up only a third of the wine supply. In 1742 to 1743, large quantities of "Spanish" wine were imported from Germany.[79] Towards the end of the DEIC, "Cape" wine was also entered in the provisioning list. Table 7 summarises the composition of the wine supply.

Table 7: Categories of wine provided (litres per 100 crew)

YEAR	FRENCH	SPANISH	CAPE	TOTAL
1603	8 700	17 203	0	25 903
1680	614	3 072	0	3 686
1684	614	3 072	0	3 686
1695	614	3 072	0	3 686
1702	614	3 072	0	3 686
1724	1 229	3 072	0	4 301
1786	614	0	1 229	1 843
1790	0	0	1 229	1 229

The Water-supply Facilities in Table Bay at the Cape

During the first 50 years of the DEIC, an average of about 10 DEIC ships annually stopped at the Cape to use the opportunity to take in fresh water.

78. Gawronski, *De Equipagie van de Hollandia en de Amsterdam,* p 232.
79. Gawronski, *De Equipagie van de Hollandia en de Amsterdam,* p 232.

During this time, parties were sent to refill the water-barrels on land, which was described as a slow, arduous process. From 1616 onwards, Table Bay was a compulsory stop for DEIC ships to ensure better continuity of communication with the authorities in the Netherlands. An early investigation into the possibility of establishing a permanent provisioning station at the Cape (undertaken jointly by the DEIC and the British EIC) singled out Table Bay as the best spot due to its *soet rivierke* (sweet rivulet). A later report by Leendert Jantz (after staying at the Cape for a year following the wrecking of the *Haarlem* in 1648) suggested the construction of a jetty and a wooden gutter, which would make the refilling of the water-barrels with fresh water much easier and faster.[80] For the first years after the station had been established in 1652, DEIC ships were not keen to stop at the Cape for a number of reasons; the ships' crews were obliged to help with construction of the new facilities, the ships had to forfeit part of their beans, rice and other supplies to the Cape, and the ships complained that the meat was only skin and bones and the drinking-water muddy.[81] The latter excuse has to be taken with a pinch of salt, as numerous reports from travellers consistently praised the good quality of the drinking-water obtained in Table Bay. Despite these complaints, the average numbers of DEIC ships stopping in Table Bay quickly increased to about 40 per year after the station's establishment.

Upon arrival in Table Bay, the water-barrels had to be brought ashore by boat to be "thoroughly cleaned and rinsed in a brook", then filled with fresh water and returned to the ship for the next leg of its voyage. Before 1652, the only means of getting ashore was landing the boats on the beach and manhandling the barrels in the direction of Lion's Head for washing and filling. Soon after the establishment of the station in 1652, a wooden jetty was constructed to ease the access to the shore. This jetty was constructed with heavy beams resting on timber piles, with wooden board nailed across the top to create a smooth platform of 1,5 to 1,8 metres wide. The jetty, also described as a "bridge on beams", extended about 50 metres into the bay.[82]

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80. Bruijn, Gaastra & Schöffer, *Dutch Asiatic Shipping in the 17th and 18th Centuries* I, pp 107-109.
81. Bruijn, Gaastra and Schöffer, *Dutch Asiatic Shipping in the 17th and 18th Centuries* I, p 113.
82. O.F. Menzel, *A Topographical and Geographical Description of the Cape of Good Hope* I (Van Riebeeck Society, Cape Town, 1921), p 118; F. Valentyn, *Oud en Nieuw Oost-Indiën – Boek Tien Beschryvinge van de Kaap der Goede Hoope* (Joannes van Braam, Dordrecht, 1724), p 30.

Despite the major improvement brought about by the jetty, it remained an arduous task to roll the barrels on land, especially after they had been filled (similarly to the early problems encountered at the well at Texel). As at Texel, the DEIC made continuous investments to develop a system which could fill the barrels easily and quickly. In the late seventeenth century, the barrels were still rolled in the direction of Lion's Head, but they could be filled more easily by means of pumps. [83] To eliminate the transportation of the barrels, an attempt was made to lead the water directly to the jetty with the construction of a stone gutter in 1670. This was not a success. It could neither be used at low tide (the jetty being too high above the water-surface), nor at high tide because of the interference of the surf during stormy weather.[84] Early in the eighteenth century a second, successful attempt was made with two lead pipes leading to the jetty. On the jetty, the pipes were encased by a wooden chute to protect them from damage. One pipe ran along each side of the jetty, each ending in three brass taps. Six barrels could therefore be filled simultaneously, each "in a few minutes" using a rolled piece of sailcloth as a funnel.[85]

Where did the pipes draw their water from? It is relevant to note that the DEIC had made major investments to procure a reliable water-supply. Water was collected at the natural springs at the base of Table Mountain. By 1767 the water was led into a covered stone reservoir close to the mountain, holding "several thousand cubic feet".[86] From here, the water was led with a wooden pipe to a lower reservoir near the Castle, built very close to the shoreline. The second reservoir was the main water-distribution point, feeding the lead pipes leading to the jetty. Other pipes from this point led to the Castle, the open square between the Castle and the settlement, and the market square in the centre of town. [87] There was no shortage of water at the time. The water-supply points at the open square and the town square (there were four at the open square) were all continuously running, as was the supply point in the Castle. The water-supply point, presumably at the town square, was an *altyd springende fontein ten dienst der borgers* (continuously running spring serving the citizens) provided by Willem Adriaan van der Stel during his tenure as governor from 1699 to 1707.[88]

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83. Valentyn, *Oud en Nieuw Oost-Indiën*, p 30.
84. Bruijn, Gaastra & Schöffer, *Dutch Asiatic Shipping in the 17th and 18th Centuries* I, p 114.
85. Menzel, *A Topographical and Geographical Description* I, p 118.
86. 5000 cubic feet = 140 000 litres.
87. Menzel, *A Topographical and Geographical Description* I, p 118.
88. Valentyn, *Oud en Nieuw Oost-Indiën*, p 30.

The stay in Table Bay had a number of purposes, of which the replenishment of the water-supply was only one. A primary concern was to allow the crew and especially the sick to recuperate before taking on the last leg of the voyage to Batavia. The average stay of DEIC ships at the Cape was 27 days, much longer than required to wash and refill the water-barrels. The next leg of the voyage to the East was less arduous and somewhat shorter, with the supply of good quality drinking-water much less of a problem than the voyage between the Netherlands and the Cape.

Summary and Conclusion

The DEIC was, for its time, an unprecedented commercial concern in terms of its size, its complexity and the global extent of its assets. The supply of water to their large shipping fleet operating between the Netherlands and the Cape may have been a relatively minor part of this large undertaking, but adequately illustrates a range of typical problems that had to be overcome.

The first and foremost problem was striking a balance between the security and comfort of the DEIC employees on the ships and the drive to maximize shareholder profit. Stowage space devoted to the bulky water-barrels translated into less room for other, much more valuable goods. At the same time, a lack of fresh water at sea would lead to death within days. It comes as no surprise that the provisioning was hardly adequate to please all on board but, to their credit, no DEIC ships appeared to have perished due to a complete lack of fresh water. As the years progressed, the total volume of liquids provided stayed about the same and even increased towards the end, but in the interests of cost, wine was gradually replaced with water, brandy was eventually replaced by gin and the lower ranks on board had to survive on cheaper beer and wine of lower quality.

The DEIC strived for the consistent application of uniform policies. This turned out to be easier said than done. On a higher level, the six independent chambers making up the DEIC tended to drift towards their own preferred practices and the rationing policies had to be continuously revised and issued for application by all, with feedback procedures to verify that the policies were followed. The rationing policies were reissued no less than 22 times between 1696 and 1790. On a lower level, ever more stringent anti-corruption controls had to be devised to ensure that the senior officers did not hoard the more expensive foodstuffs during the voyage at the expense of those on board – these could then be clandestinely sold for their illicit gain at ports of arrival.

The quality of the drinking-water was poor. Having an inadequate understanding of water-chemistry and microbiology at that time, the problem could only be dealt with empirically through experimentation. The DEIC took this problem seriously and many potential remedies were tried. Barrels of only the best quality were used, they were scrupulously cleaned after each use, the barrels used for water were kept separately from those used for beer, wine and brandy, and water-sources were carefully selected. Numerous additives were experimented with to prevent water-quality deterioration and additional measures were taken to improve the quality when the water was issued. Despite all of these efforts, the lack of proper scientific understanding and adequate technology hindered progress and the water-quality remained poor.

The water-supply on DEIC ships had to be supported by substantial capital works on land. In this article, where the voyage between the Netherlands and the Cape is examined, evidence of these investments is evident both at Texel, where the ships were provisioned for the voyage to the East, as well as in Table Bay, where the barrels had to be cleaned and refilled for the onward voyage. In the case of Texel, the DEIC negotiated an opportunistic deal with the orphanage at Texel to build and maintain a reliable supply and transportation system for the water-barrels to the ships anchored at the Reede of Texel. At Table Bay, in the absence of third parties, an elaborate system was eventually developed at the direct expense of the DEIC to convey fresh water up to a jetty, where the water-barrels could be conveniently and rapidly cleaned and filled.

Taken together, the DEIC experience with water-supply to its ships illustrates the very concerns which are now universally considered to be the cornerstones of water-supply – sufficient quantity, acceptable quality and convenient proximity.

Abstract

This article deals with the water-supply to ships of the Dutch East India Company (DEIC) on the voyage between Texel in the Netherlands and the Cape, the longest and most perilous leg of the DEIC sailing schedule. Although water-supply was a small, albeit vital part of the logistical management of the DEIC, it serves to illustrate the problems that this first global enterprise faced in its 193 years of existence. It had to provide for the water-security of its employees in the face of six independent chambers which incessantly pushed for higher profits, and did so by arduously establishing and enforcing a set of uniform policies applicable to all. It had to devise controls to prevent its senior seafaring personnel from illegally filling their pockets by depriving the ordinary seamen of

their liquid rations and selling the surplus. It faced the troublesome problem of maintaining acceptable water-quality in the light of insufficient scientific understanding of the problem and inadequate technology to counter water-quality deterioration. Finally, they reluctantly had to invest in substantial capital works on land to sustain the provisioning of water to their ships.

Opsomming

Water en Drinkgoed op HOIK-Skepe Tussen Nederland en die Kaap: 1602-1795

Die klem val hier op watervoorsiening op skepe van die Hollandse Oos-Indiese Kompanjie (HOIK) wat tussen Texel in Nederland en die Kaap gevaar het – die langste en gevaarlikse been van die HOIK se vaartskedule. Alhoewel watervoorsiening slegs 'n klein, hoewel belangrike onderdeel van die HOIK se bedrywighede was, is dit 'n goeie voorbeeld van die logistiese probleme waarmee die wêreld se eerste globale handelspeler in sy 193-jaarlange bestaan te doene gekry het. Watersekuriteit moes met behulp van 'n eenvormige beleid op die skepe gewaarborg word ondanks die sterk winsgedrewenheid en uiteenlopende praktyke van die ses dikwels eiesinnige kamers waaruit die HOIK bestaan het. Daarby moes teenvoeters vir die korrupsie van seevarende amptenary wat rantsoene van hulle bemanning weerhou het om dit later vir persoonlike gewin te verkoop, gevind word. Ondanks verskeie praktyke om die agteruitgang van waterkwaliteit op lang reise in tropiese gebiede hok te slaan, was dit onsuksesvol as gevolg van gebrekkige kennis en tegnologie wat toe nog nie genoegsaam ontwikkel het nie. Die stelsels wat vir die bestuur van drinkwater op die skepe ontwikkel is, moes deur aansienlike kapitaalbestedings aan die landkant aangevul word om goeie en genoegsame bronne te verseker waarmee die voorrade vinnig en maklik aangevul kon word.

Key words

Barrels; beer; beverages; brandy; Cape; Dutch East India Company (DEIC); gin; jetty; rationing; shipping; Texel; vinegar; water-quality; water; wells; wine.

Sleutelwoorde

Asyn; bier; brandewyn; Hollandse Oos-Indiese Kompanjie (HOIK); jenewer; Kaap; landhoof; putte; rantsoenering; skeepvaart; Texel; vaatjies, water; waterkwaliteit; wyn.