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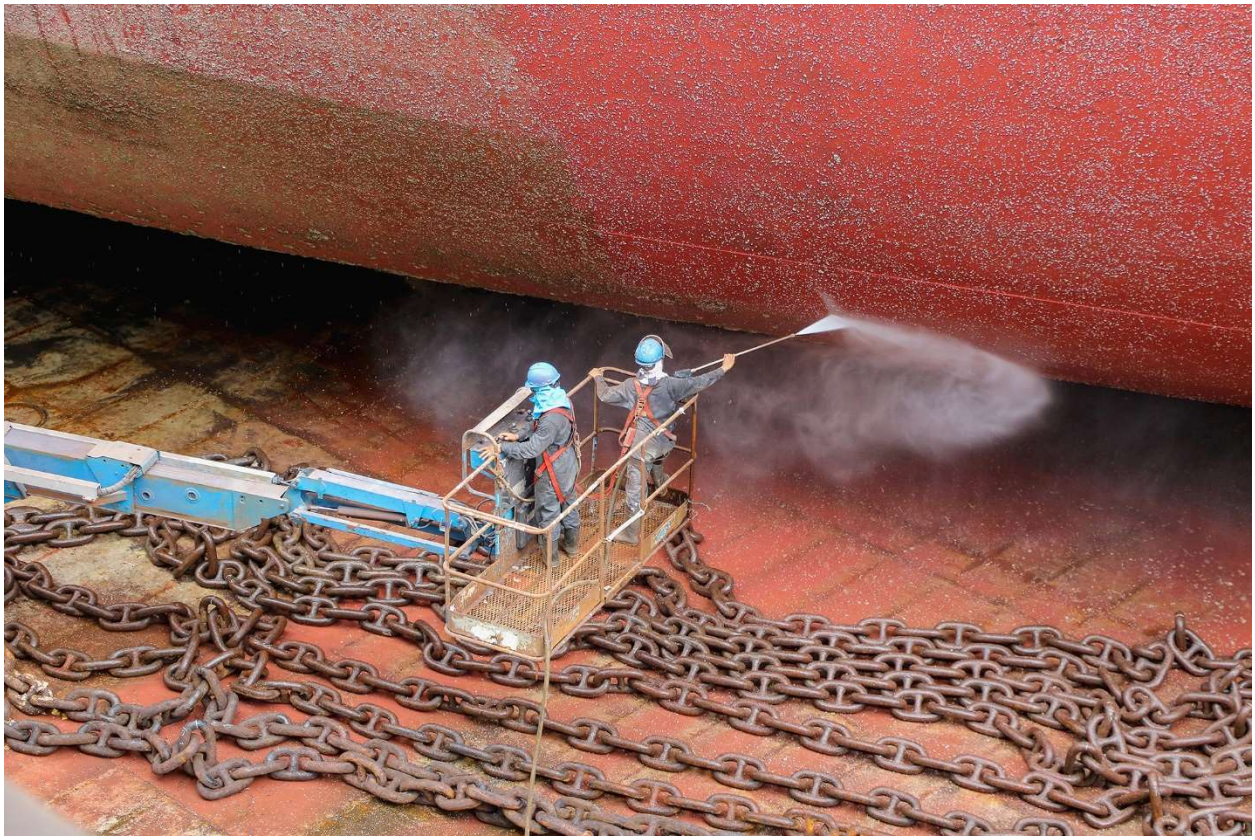


REPORT OF THE BIMCO BIOFOULING SURVEY 2021

Introduction

In autumn 2021, BIMCO conducted a survey on biofouling to gather information from the industry with regard to anti-fouling systems (AFS) and the factors that trigger an underwater inspection or in-water cleaning.

Fifty-seven companies, representing a total 5,668 ships, participated in the survey, which represents approximately 8% of the world fleet of 74,505 ocean going ships.

The results of the survey gave some good insights into the current biofouling management practices of shipowners and operators. However, owing to the different trade profiles of ships, it proved difficult to generalise for a large fleet of ships. For example, it is not easy to accurately estimate the effective lifetime of a particular AFS used on different ships operating on different trade routes and in different geographical conditions.

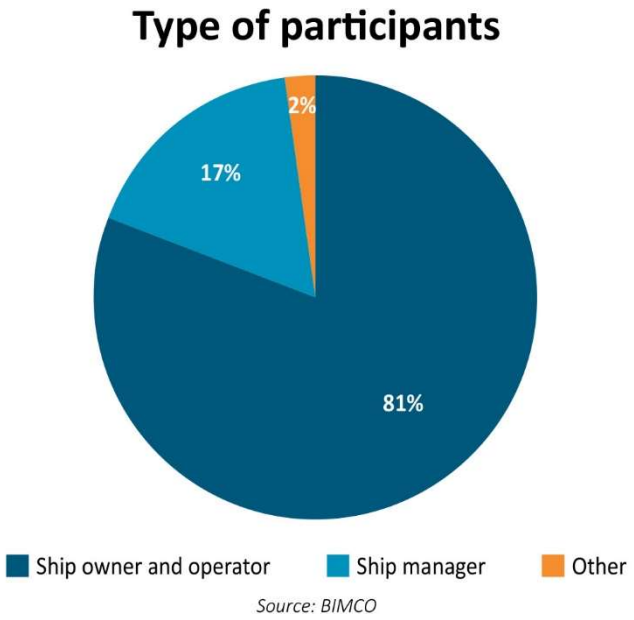
Furthermore, not every company follows the popular five-yearly dry dock cycle. Some companies dock their ships every 2.5 years. This adds another level of complexity when estimating the average lifetime or effective lifetime of an AFS. Despite the challenges in gathering and analysing the data, the survey provides some interesting insights into the current industry practices.

It is also interesting to note from the respondents that the recent improvement in the quality and effectiveness of AFS has resulted in a reduction in cleaning frequency.

Survey report

The biofouling survey was sent by BIMCO to shipping companies (both members and non-members). The 57 companies, which participated in the survey, included shipowners, ship operators and trading companies. After removing data from the four entities that did not have a direct experience with ships and AFS, the 53 remaining responses were analysed further.

43 responses were from shipowners and/or operators, nine from shipmanagers and one from a trading company, which is trading directly with ships.



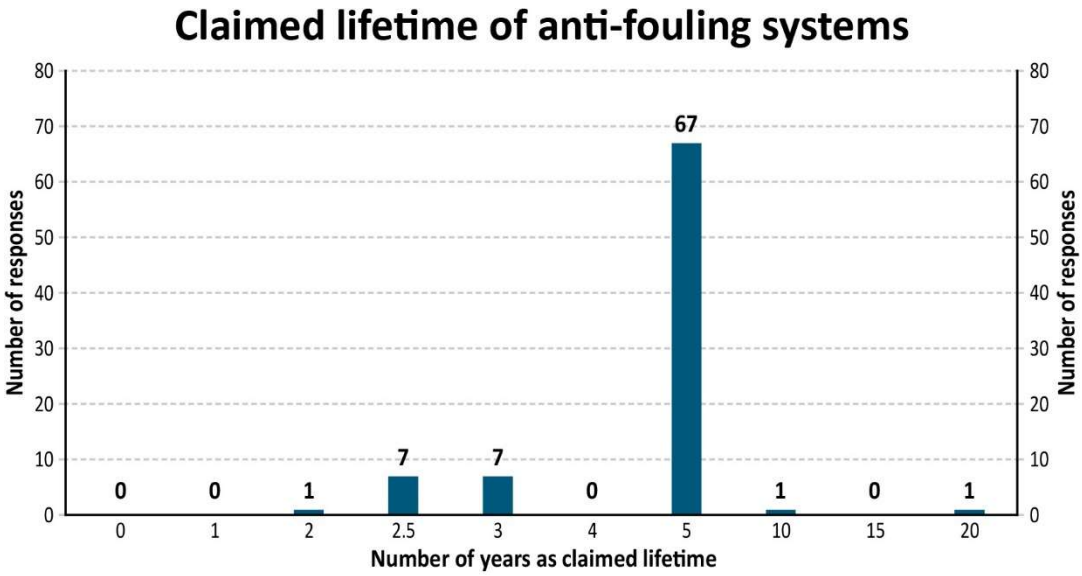
Source: BIMCO

As shown in the map below, there is a good geographical spread among the companies that participated in the survey.

A total of 5,668 ships were represented by the survey. Out of the 53 companies, 42 companies (79%) had implemented biofouling management. 10 of the 11 companies that did not have biofouling management implemented on their ships, were interested in seeing the results of this survey.

The participants were asked about their experience with biofouling management, especially with regard to the AFS used on their ships. Each of them was asked to give details of up to three of the most used AFSs applied to their ships. The survey received responses on 88 different AFSs. In the survey, these AFSs have not been grouped into specific brands or types as every AFS counts as a separate entry.

Lifetime of AFS



Source: BIMCO

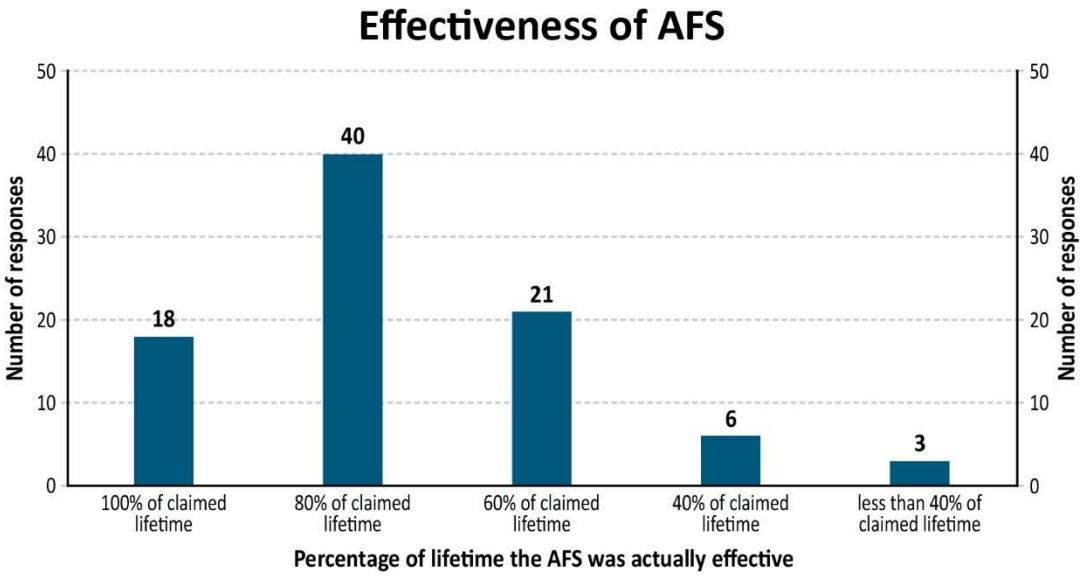
The average lifetime of the AFS was 4.92 years. 67 of the 88 submissions claimed a lifetime of five years. Seven responses claimed two and half and three years but this is mainly because these companies did not follow the popular five-year dry dock cycle.

Effectiveness of AFS

This part of the survey focussed on the AFS effectiveness, which is described as its ability to prevent or control the attachment of unwanted organisms. The aim was to establish if the effectiveness of the AFS lasted as long as promised and if not how big was the difference.

The table and graph below give the details:

Effectiveness of AFS	Number of AFS
100% of claimed lifetime	18
80% of claimed lifetime	40
60% of claimed lifetime	21
40% of claimed lifetime	6
less than 40% of the claimed lifetime	3



Source: BIMCO

As can be seen from the table/graph above, 90% (79 out of 88) reported that the AFS lasted 60% or more of their claimed lifetime and 66% (58 out of 88) stated that the AFS lasted more than the 80% of the claimed lifetime.

From the survey results, three AFSs appear to have failed for unknown reasons as they were effective for less than 40% of the claimed lifetime. The reason for the failure of an AFS can be anything from:

- low quality of the product itself
- bad application in shipyard
- the ship having prolonged idle periods
- the surface being damaged during cleaning
- cleaning too frequently.

However, it would appear that the AFSs in question did not fail owing to poor quality of the product because other respondents had reported good performance from the same AFS. For an AFS to last for a long time, several factors must be in place:

- The AFS manufacturer's required conditions of application of the AFS in the shipyard should be optimal including the temperature, humidity, weather conditions and workmanship
- The ship should be operating continuously in its planned profile, which includes the geographical area, the water salinity, speed and idle period amongst other factors
- Avoiding physical damage of the AFS by tugs, fenders etc during a port stay
- The cleaning method must be in accordance with the AFS manufacturer's instructions including the frequency and the quality of cleaning.

Therefore, any failure of an AFS needs to be carefully assessed to establish the cause and if necessary procedures corrected to avoid future failures.

Methods used to assess biofouling growth

The participants were asked about the different methods used to check the condition of biofouling growth.

If a respondent had replied "No" to using biofouling management, this part of the questionnaire was not be visible. The 44 replies give a good picture of how biofouling growth is monitored.

The most popular method was physical inspection. The questionnaire did not ask for details about the inspections.

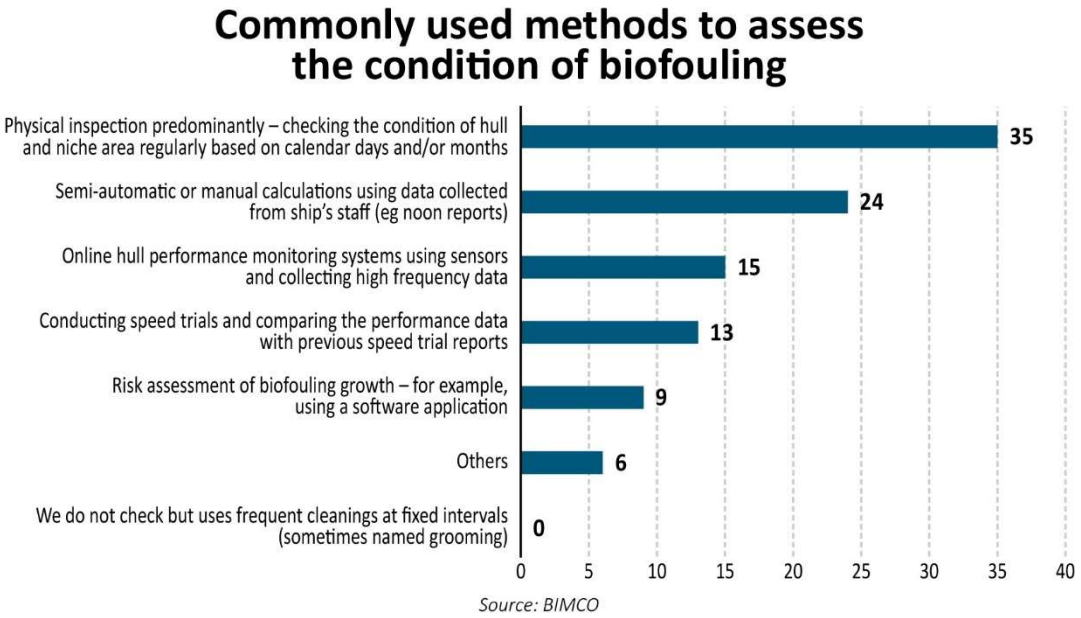
The next three were based on methods measuring the energy consumption. These methods mainly calculate the fuel consumption and compare it with the speed of the ship under given conditions, including cargo quantity, trim etc and then make allowances for the prevailing weather and sea conditions including currents. The difference in the result compared to a previous calculation will give an indication of an estimated amount of biofouling growth on the ship's hull.

Type of biofouling assessment	Number of responses
Physical inspection predominantly – checking the condition of hull and niche areas regularly based on calendar days and/or months	35
Risk assessment of biofouling growth – for example, using a software application	9
Online hull performance monitoring systems using sensors and collecting high frequency data	15
Semi-automatic or manual calculations using data collected from ship's staff (eg noon reports)	24
Conducting speed trials and comparing the performance data with previous speed trial reports	13
We do not check but uses frequent cleanings at fixed intervals (sometimes named grooming)	0
Others	6

Some of the answers in the "others" category were:

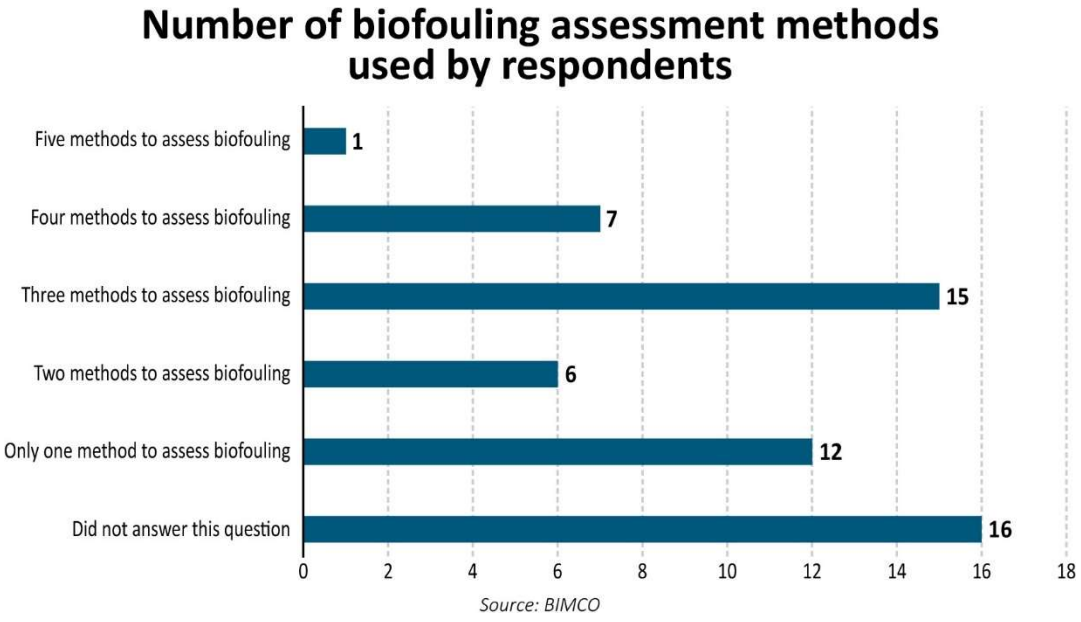
- "Some ships have been at anchorage for long time, waiting to load or discharge cargo (>30 days) that's why it has been necessary to carry out under water cleaning and propeller polishing"

- “Port requirements”
- “Depends on idle days, and trading patterns internationally”
- “Under water inspection based on earliest indication of rising fuel oil consumption in main engine”



Continual monitoring of changes in hull performance and biofouling condition by one or more methods by the respondents are as shown above.

Several respondents use more than just one method to assess the growth of biofouling. The following graph illustrates this:



Cleaning of ship's hull

In an effort to learn more about the effectiveness of the AFS, the survey asked for information on the cleaning of ships.

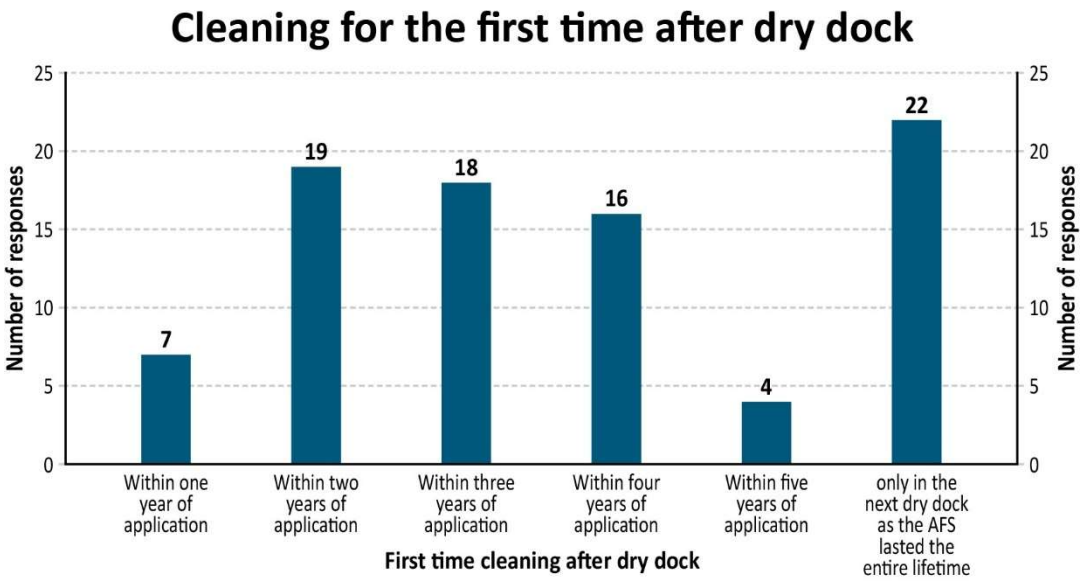
When there is biofouling build up on a ship's hull, it results in hull drag, which has a direct and negative impact on the performance of the ship in terms of loss of speed. To compensate for this loss of speed, the ship has to increase its power and therefore fuel consumption, which in turn results in higher fuel bills for either the charterer or the shipowner. The only way to reduce this financial impact is to remove the biofouling by cleaning the ship's hull.

There is a direct financial incentive to ensure that biofouling is removed from the ship's hull before the growth becomes significant. This is illustrated by the table and graph below. The majority of 22 AFSs were effective to the extent that no biofouling growth was found before the ships entered the dry dock after at least five years of service.

Following this, majority of cleaning is conducted between the second to fourth year of the ship being in service.

Only 7 (8%) out of 86 responses, claimed that the hull had to be cleaned within the first year of application of AFS.

When was the first time the ship's hull needed to be cleaned?	Number of AFS
Within one year of application	7
Within two years of application	19
Within three years of application	18
Within four years of application	16
Within five years of application	4
only in the next dry dock as the AFS lasted the entire lifetime.	22

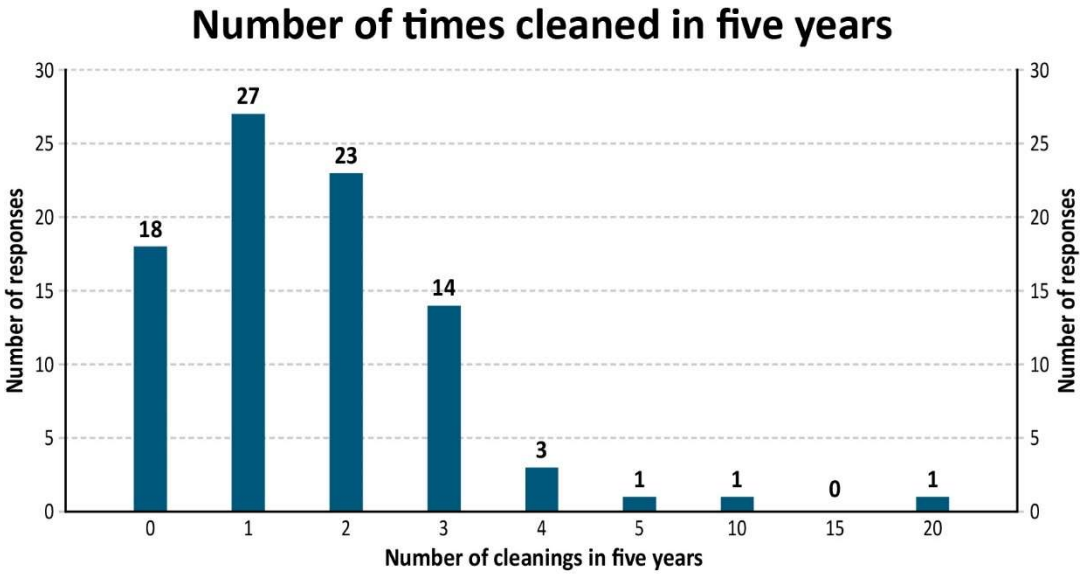


Source: BIMCO

The 3 abovementioned AFSs that seemed to have failed on application are among the eight that needed to be cleaned within one year. Further, at least two coatings were non-toxic coatings, which by design require more frequent cleaning during their lifetime. These non-toxic hard coatings do not avoid the settlement of biofouling, and therefore, need cleaning on a regular basis.

Continual monitoring of ship's hull for growth of biofouling by using one of more of the methods mentioned above enables the shipowner or operator to initiate in-water cleaning with due diligence before the biofouling growth becomes significant.

On average the AFSs were cleaned **less than twice (1.84 times)** over a period of five years. The table below gives details of cleaning over this period:



Source: BIMCO

As, can be seen, most of AFSs needed either no cleaning or ranged between one to three cleanings during a five year period. One AFS needed to be cleaned five times in five years, while one more AFS needed to be cleaned 10 times. These seem to be caused by an AFS failure. The AFS, which was cleaned 20 times in five years, was a non-toxic hard coating, which, as mention earlier, needs to be cleaned more frequently.

Furthermore, in most trades involving time charter, ships are often cleaned when the handover of the ship takes place between the charterer and the owner. A peculiarity of offshore trade is that ships (offshore boats) work in the same area and have long idle periods, which leads to the growth of biofouling. In most cases, these ships are cleaned every time there is a change of charterer, even if the charter party has lasted only for a few months. Only in a few exceptional cases is this practice not followed.

Conclusion

It is clear that the commercial entities such as shipowners, operators and managers involved with a ship have a keen interest to keep ships free of biofouling. This entails choosing the most appropriate AFS, continuously assessing the growth of biofouling and cleaning the ships as soon as the need arises and at times, before the need arises.

Furthermore, AFS manufacturers are continuously improving their range of products to cater for the demand and to get ahead of the competition. As a result there are improved products on the market that last their lifetime and work effectively throughout this period.