

# Fatigue at Sea



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**For you who work onboard – here is  
some advice on how to avoid fatigue**

Every year a number of accidents take place because the watch keepers are tired or even fall asleep on the bridge. A study carried out by the Swedish Maritime Administration shows that between 15-20 percent of all accidents can be related to a lack of sleep. But sleepiness is not just a question of safety. It is also a question of working environment, personal health and how the body reacts to being active at night and sleeping at day. In the summer of 2007 a research report named "Fatigue at Sea" was published at VTI (the Swedish National Road and Transportation Research Institute). It shows that officers often are tired during the watch, sometimes to the extent that they must struggle not to nod off on the bridge. The problem is mostly noticeable on vessels with only two bridge officers. One purpose of the study was to compile a list of recommendations on how to reduce the problems of fatigue. In this brochure you can read some advice, all well founded in Swedish as well as international research. The advice is meant for you who work onboard, however, it does not imply that you are the only one responsible for your working situation – employers and authorities carry a large part of the responsibility.

The master is outermost responsible to see that the law concerning rest periods is followed. According to the ISM-code he/she is responsible for writing a deviation report every time the period of rest, regulated in the law, is violated.

## Diminish fatigue

### Undisturbed while off duty!

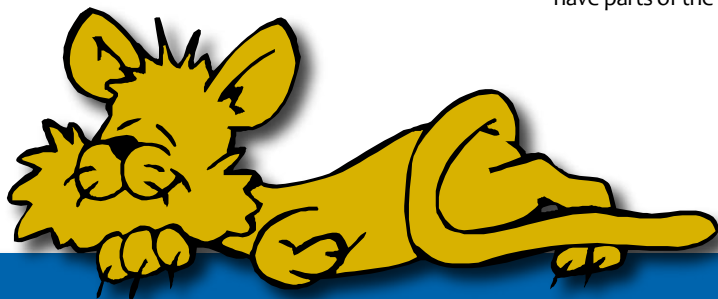
In order to avoid dangerously high levels of fatigue among officers on board vessels with a two-watch-system, the free watch has to remain undisturbed. Paperwork, exercises and other tasks should as far as possible be scheduled for regular work hours. Should the workload be too heavy to be able to keep the off duty time without disturbance, inform the shipping company. It may be that the manning level is insufficient to maintain safety.

### Calculate the level of sleepiness!

The computer program SWP (Sleep Wake Predictor) is based on a mathematical model and can be used to reduce the risk of fatigue. By feeding in information about how and when crew members shall work and sleep during a planned trip, the sleepiness can be predicted and assessed. SWP can also be used when planning different activities such as exercises, bunkering and provisioning. The program has been developed by sleep researchers at Karolinska Institutet in cooperation with the Swedish Navy and VTI.

### Adjust the time for watch changes!

The traditional watch shifts on a vessel with two nautical officers with shift changes at 00-06-12-18 are not ideal. Working 03-09-15-21 can be a better alternative. Then the demanding night shift is shared at the same time as you and your colleague can have parts of the important night sleep.



**Fatigue is a question about your health and safety!**



## Shorter voyages in wintertime!

Lack of sunlight and poor quality of sleep due to bad weather can make you more tired in wintertime. Therefore consider shorter voyages during the dark months of the year.

## Naps!

A scheduled nap can boost the level of feeling awake considerably. A 5 to 20 minutes nap can be the equivalent of 1.5 hours of sleep! Be aware, however, that if you sleep 30 minutes or longer it can take more than 15 minutes to be fully awake again.

## Prepare the watch shift!

Try to get two full nights of sleep before embarking. If you are scheduled for a night shift, sleep a while in the day before going onboard.

## Do not rotate the watch shifts!

Rotating the night shifts causes disturbance to the body rhythm and should be avoided as far as possible. Should it be necessary, however, rotate the watch forward in time which is somewhat better than backwards.

**Demand understanding  
from your employer for the  
human need of sleep!**

# Enhance the quality of your sleep

## Sleeping environment!

The cabin should be quiet, dark and cool. Use dark curtains for the windows and keep the temperature between 17 and 21 degrees Celsius. Respect each other's rest and avoid as far as possible disturbing activities close to the

cabins. If necessary, use a sleep mask to get darkness and request good quality, possibly personal, sleeping equipment e.g., pillow and mattress. There also might be a need of improved noise insulation in the cabin. Discuss your requests with the company and/or the company health service.



## Relax!

There are different types of relaxing techniques. For instance you can find a variety of tapes with soothing sounds at the pharmacy. Be aware, however, that it can take some time before you manage to use methods effectively and get optimal results. Reading relaxes you better than watching TV, but choose the method that works best for you.

## The coffee clock!

Avoid coffee before going to bed. The wakening effect of caffeine remains for 3 to 4 hours.

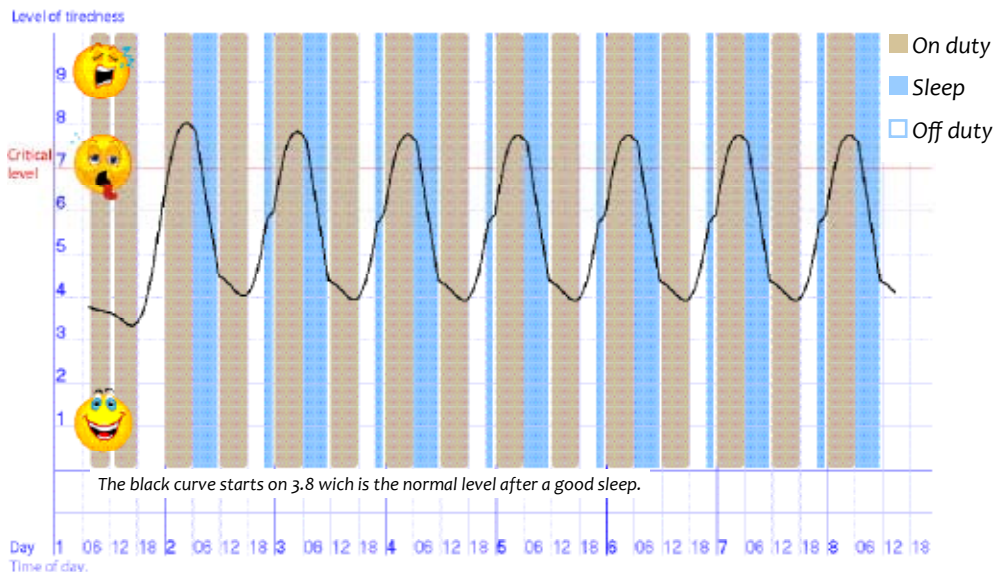


## Avoid strong light!

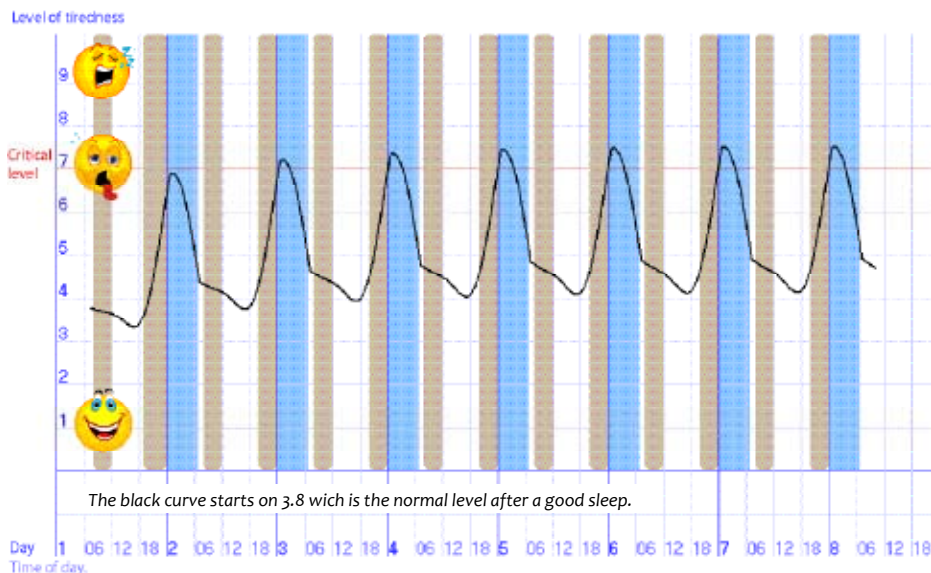
Light will trigger a number of processes in the body reducing sleepiness, and making you feel more awake. If you expose yourself to sunlight before going to bed it might make it more difficult for you to fall a sleep.

**A dark room and a good pillow  
can improve your quality of  
sleep considerably!**

The examples below are extracts from the computer based program SWP (Sleep Wake Predictor), developed by Karolinska Institutet, Swedish Navy and VTI. SWP is a mathematic model for calculations that can be used for planing watch keeping, drills and other activities on board. The program is available at the Swedish Maritime Administration's web page [www.sjofartsverket.se/forskningsdb/SearchSWP](http://www.sjofartsverket.se/forskningsdb/SearchSWP)

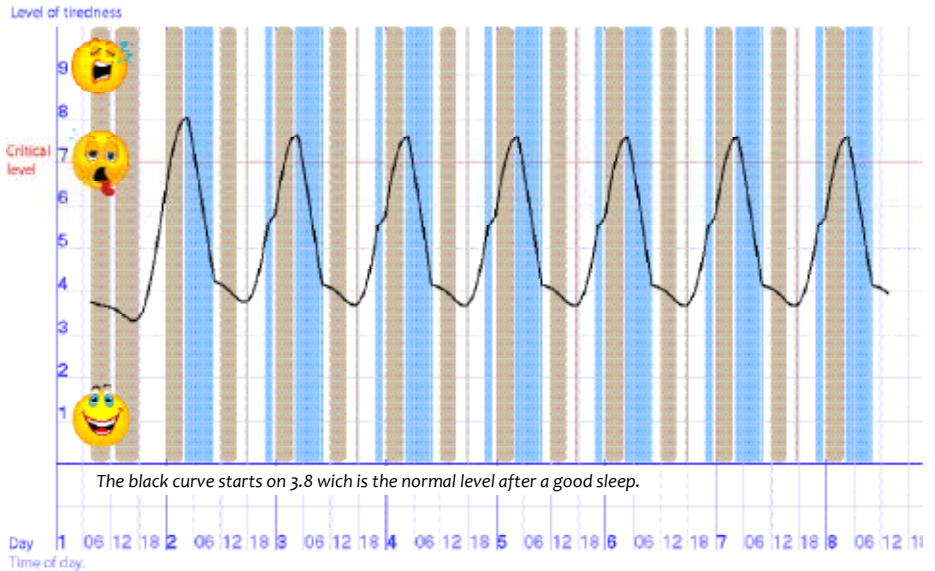


**Two-watch, 00-06 o'clock.** The officer embarks on day 1, works all day and doesn't sleep before going on watch at midnight. Shortly after the starting the watch tiredness level 7 is surpassed, reaching its peak around 4-5 am.

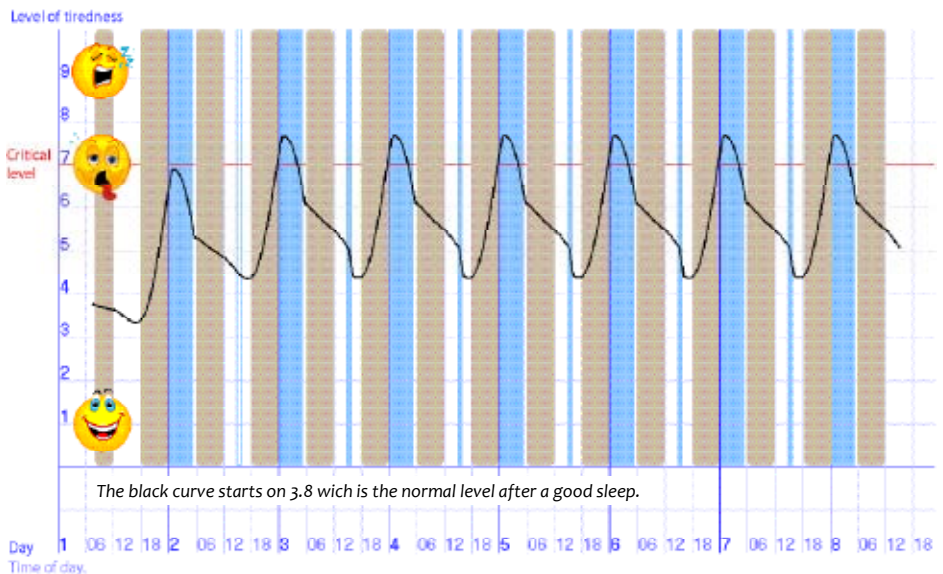


**Three-watch, 8-12 o'clock.** The officer gets about 6-7 hours of uninterrupted sleep every night. He is most tired right before midnight and then reaches level 7.

The graphs show eight days of watch keeping without overtime. The sleep is free from noise, high sea and disturbing activities. The 9-degree scale shows the level of fatigue where 1 = very alert, 7 = tired, 9 = extremely tired.



**Three-watch, 00-04 o'clock.** On the day of embarkation the officer takes no nap before the night watch. The rest of the week, however, he or she takes naps, but still level 7 is surpassed several times. The officer relieves the senior officer every afternoon for a meal break.



**Two-watch, 06-12 o'clock.** The master takes a long nap every afternoon. All the same, he reaches level 7, or slightly above, daily.



# Stay awake

## Two on the bridge!

Being two means that you and your colleague can give each other both physical and psychological support during your work shift. It is important to follow the instructions regarding lookout.

## Interesting tasks!

Being passive will make you more tired than if you are busy. Try to find motivating tasks for yourself as well as for anyone else on duty on the bridge during the watch. These tasks might include more active navigation and look-out techniques.

## Food and drinks!

The good news is that a small sandwich before going to bed is recommended. Nuts and raisins make good snacks for the night watch, too. Eat food rich in protein, fruit and vegetables but reduce the intake of fats and sugar since they in larger quantities can influence your level of alertness. The largest meal should be taken after the longest period of sleep.

# Sleep

Sleep is as important to our body as food and water. When we sleep our body repairs itself. The energy lost during the day is refilled, the functions of the brain recover and the long term memory is stored. The secretion of different hormones is dependent on sleep as well as the immune system and the solidity of the skeleton. You need at least 6 hours of sleep per day, preferably in one stretch and at night. The recommended amount of sleep per day is 7.5 hours. A person getting too little night sleep can to a certain extent compensate this with naps in the day. Sleep progresses in cycles of 90 minutes consisting of 5 different phases. The important deep sleep takes place during the first 4 hours, a time when it is of particular importance not to be disturbed. Without deep sleep stress on the body increases. Stress often entails poorer sleep, therefore avoid this vicious cycle!



**Even if you manage to stay awake, it does not mean the problem of fatigue is solved!**

# Effects of fatigue

If you are forced to stay awake despite being tired, you can experience difficulties in functioning normally. Research shows that fatigue is comparable to being intoxicated – your reaction time slows down, you lose concentration and may experience difficulties in making rational decisions and correct judgements. In the long term, fatigue can have implications on your health. The immune system gets weaker and the risk of infections increases. You also run a higher risk of heart and coronary diseases, diabetes type II, and depression. There is also a connection between fatigue and obesity as well as getting burnt out. No harmful effects have been established from sleeping too little for only a limited period of time.

that the body is used to sleeping at night and being awake during the day, a biological fact that a watch rota can not change. The officers in the study were also shown to have low-quality sleep. Good quality sleep is characterized by few awakenings and has an efficiency of 90 percent – the efficiency among the participants was about 75 percent. Weather, noise, vibrations and different activities disturb the sleep onboard. Several factors are difficult or even impossible to influence, however, poor sleep nevertheless leads to increased fatigue risk. The study made use of four different measuring methods: EOG (eye movements), activity meters, reaction time tests as well as questionnaires and personal assessments. 30 officers from 13 different vessels took part in the study and the measurements were performed onboard during regular working hours. The study was initiated during the fall in 2005 and ended in the summer 2007.

**Forcing a person to stay awake is a well known method of torture!**

## Facts about fatigue

Lately, Sweden and the United Kingdom are the countries that have spent most resources on mapping and studying the problems of fatigue at sea. One of the most inclusive research reports is "Fatigue at Sea", upon which this brochure is based. In the report the levels of fatigue among nautical officers are being studied and two different watch systems are compared – 6 on/ 6 off, and 4 on/ 8 off. The results show that those working two-shift are more tired than those working three-shift. In 2.5 percent of the assessments critical levels of fatigue were recorded to the extent that the participants had difficulties staying awake. The officers in the two-watch-system rarely got more than 4.5 hours of sleep during evenings and nights, and even less in daytime. The short span of sleep in the daytime is primarily due to the fact



## Fatigue at Sea – report

The report "Fatigue at Sea" was published by VTI and project leader for the study was the researcher and master mariner Margareta Lützhöft. The studies of fatigue now continue at Chalmers University of Technology. For instance, a further study of the issues of fatigue amongst engine room personnel is being worked on and is expected to be published in the end of 2008.

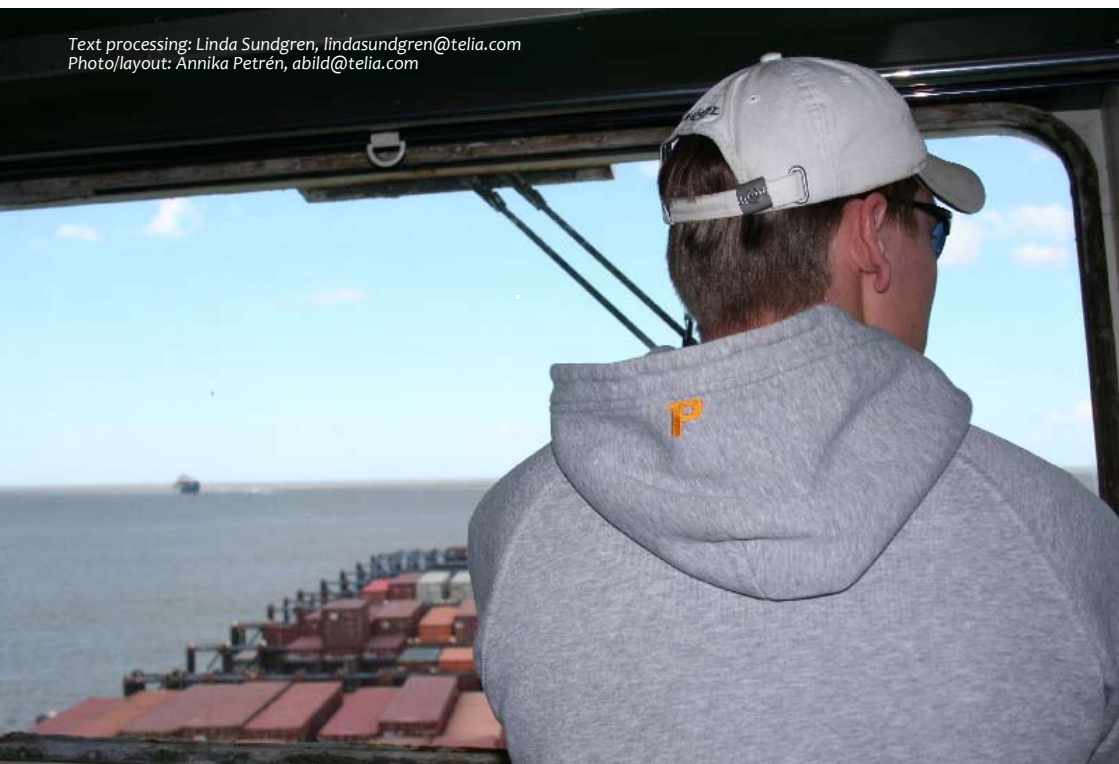
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See also: [www.sjofartsverket.se/forskningsdb/](http://www.sjofartsverket.se/forskningsdb/)

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