

LIGHTHOUSE

N 57° 42.4' E 011° 56.2'

LIGHTHOUSE MARITIME COMPETENCE CENTRE



- As the special events coordinator for the Newfoundland and Labrador Division of the Company of Master Mariners of Canada, 3rd annual seminar on '**Maritime Human Resource Solutions**' being held in St. John's, Newfoundland on Thursday, 1 October 2009. Of particular interest is your research on Fatigue at Sea.
<http://www.mastermariners.ca/newfoundland/presandvideo.php>

Been here, done that...

- CB
- Stephenville



Photos Hans & Simon Rosenkrantz, Ken Smith Shipspotting.

Ergoship

Human Factors in Shipping



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Shaping ships for people

3 studies of fatigue

- Fatigue at sea
 - VTI ++
- Hours of work and work conditions onboard two-navigator ships
 - KMA
- HORIZON
 - Warsash, Chalmers, SRI ++

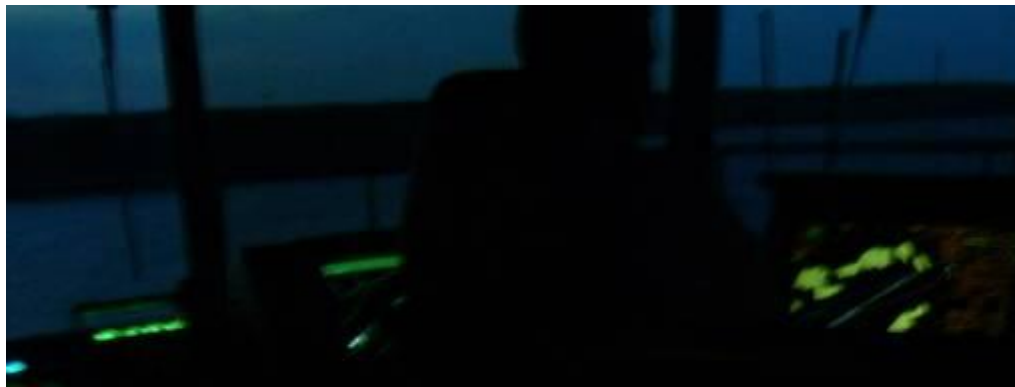


Fatigue definition

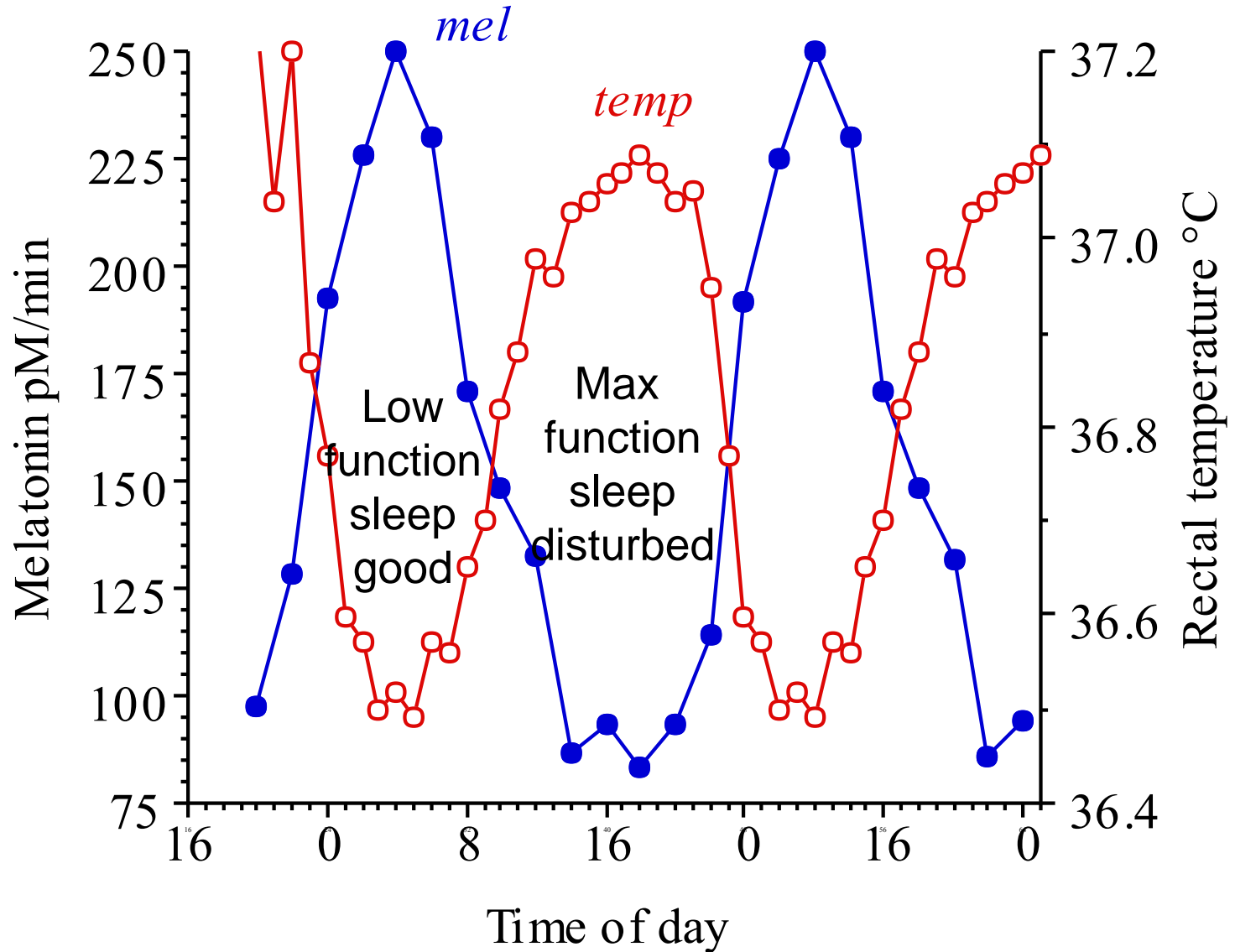
Sleepiness, a response to a lack of sleep

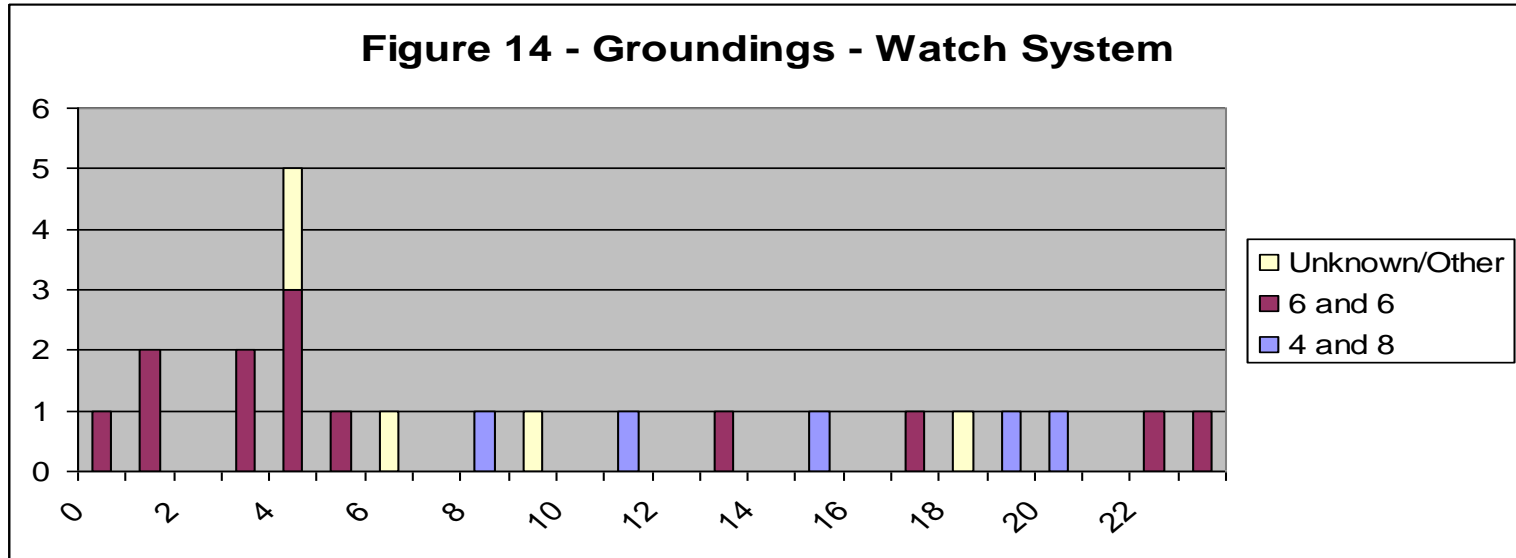
Shiftwork

- 4-8
 - Work 4 hours, free 8
 - 12-4, 4-8, 8-12
- 6-6
 - Work 6 hours, free 6
 - 6-12, 12-6
- Other combinations
 - Less common



The biological clock





11 of the 13 groundings with 6 and 6 watchkeeping occurred at night --- indicating fatigue?

Slide from MAIB 2004

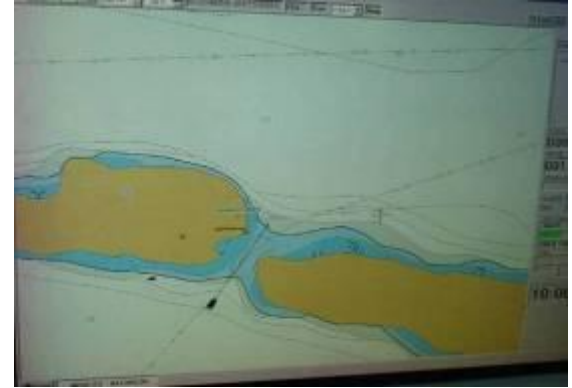
Fatigue and cognitive performance

- Periodically lower attention
- Reaction time increased
- Thoughts incoherent, speech may be slurred
- Communication decrements
- Memory is impaired, updating impaired
- More difficult to change train of thought, less creative – harder to change strategy

Fatigue has the same effects as alcohol

- Test in a flight simulator in connection to night work: performance decreased to same level as if moderately intoxicated: 0.5 ‰ blood alcohol (Klein, 1970)
- Physicians tested after night shift 90-80 hour week + every 4/5 night on duty = 34-36 hour duty stretch
 - Test: attention, vigilance and driving simulator. Results similar to those of physicians with 0.5 ‰ (Arnedt mfl, 2005)
- Physicians who worked a 79-hour week made 36% more mistakes than those with a 63-hour week. (Bernstein & Etchells, 2005)

Fatigue, health and accidents



- Increased risk of heart and circulation problems
- Not enough sleep, serious tiredness levels
- Increased risk of accidents and mistakes
- Social disruptions (work schedule vs. private life)

“I did not know how tired I was until I changed from two-watch to three-watch”

How you can see fatigue in others

- Yawning – but not always
- Keep changing body posture
 - (body tries to stay awake)
- Unnecessary/repeated touching of face
- Less conversation (withdrawal)
- Speech is slightly blurred
- Half closed/lowering eyelids
- Tendencies of head nodding

Participants:



SWEDISH MARITIME
ADMINISTRATION



Finance by

VINNOVA



WALLENIUS  LINES



SWEDISH MARITIME
ADMINISTRATION



THE UNITED KINGDOM
HYDROGRAPHIC OFFICE

Endorsed by:



1. Fatigue at Sea 2005-2007

- Onboard (field) study
- Simulator study
- Shipping company interviews

Method field study

- Qualitative study with 32 participants, 2 female
- Two watch systems; 6 on/ 6 off, 4 on/ 8 off
- 13 cargo vessels; bulk and car carriers and tankers
 - Mainly Baltic sea traffic
- Equipment was as non-disturbing as possible
 - Pilot studies before start of the data acquisition
- Questionnaires and diaries, eye movement measurements, activity meters and reaction time tests

Measurement equipment



The KSS scale

KSS

- 1 extremely alert
- 2 very alert
- 3 alert
- 4 rather alert
- 5 neither alert nor sleepy
- 6 some signs of sleepiness
- 7 sleepy, no effort to stay awake
- 8 sleepy some effort to stay awake
- 9 very sleepy, great effort to stay awake, fighting sleep

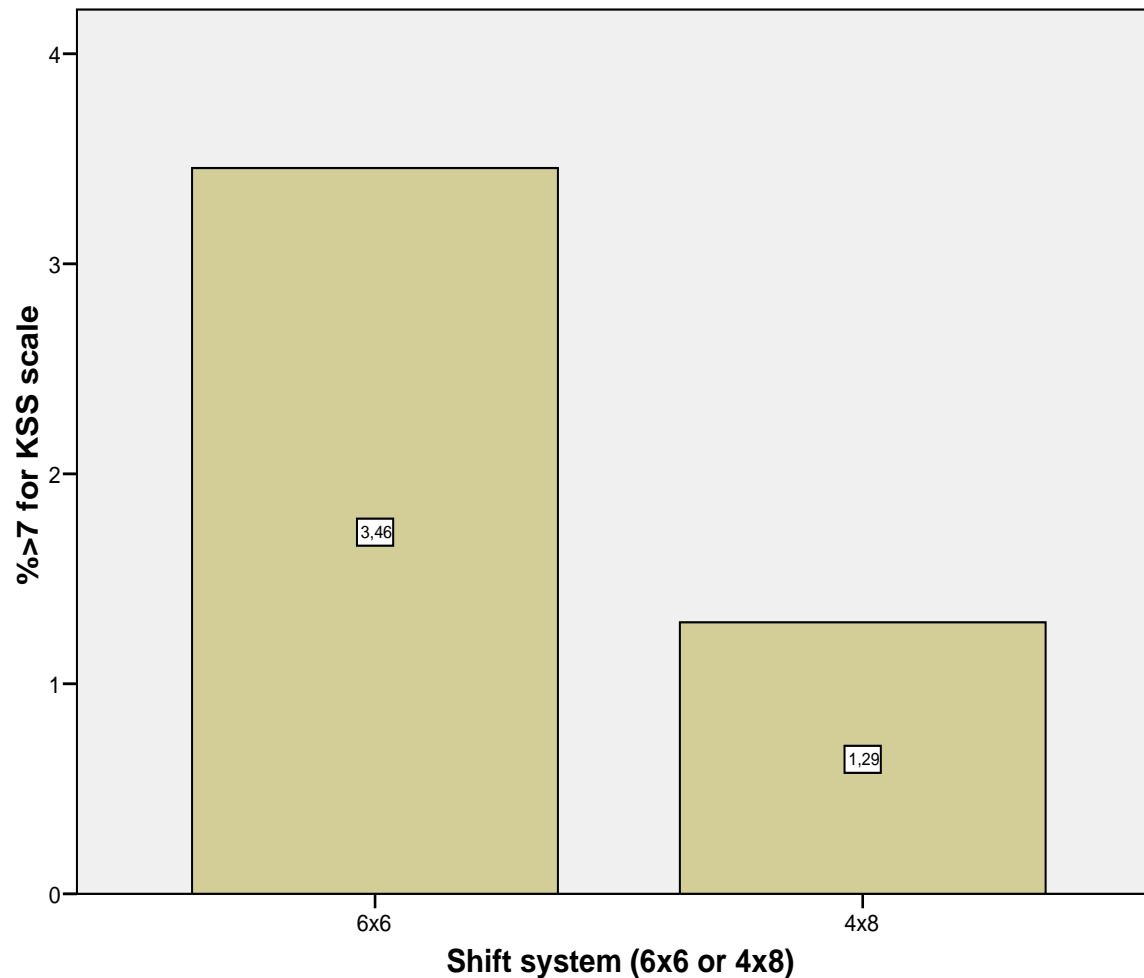


Example of sleep length

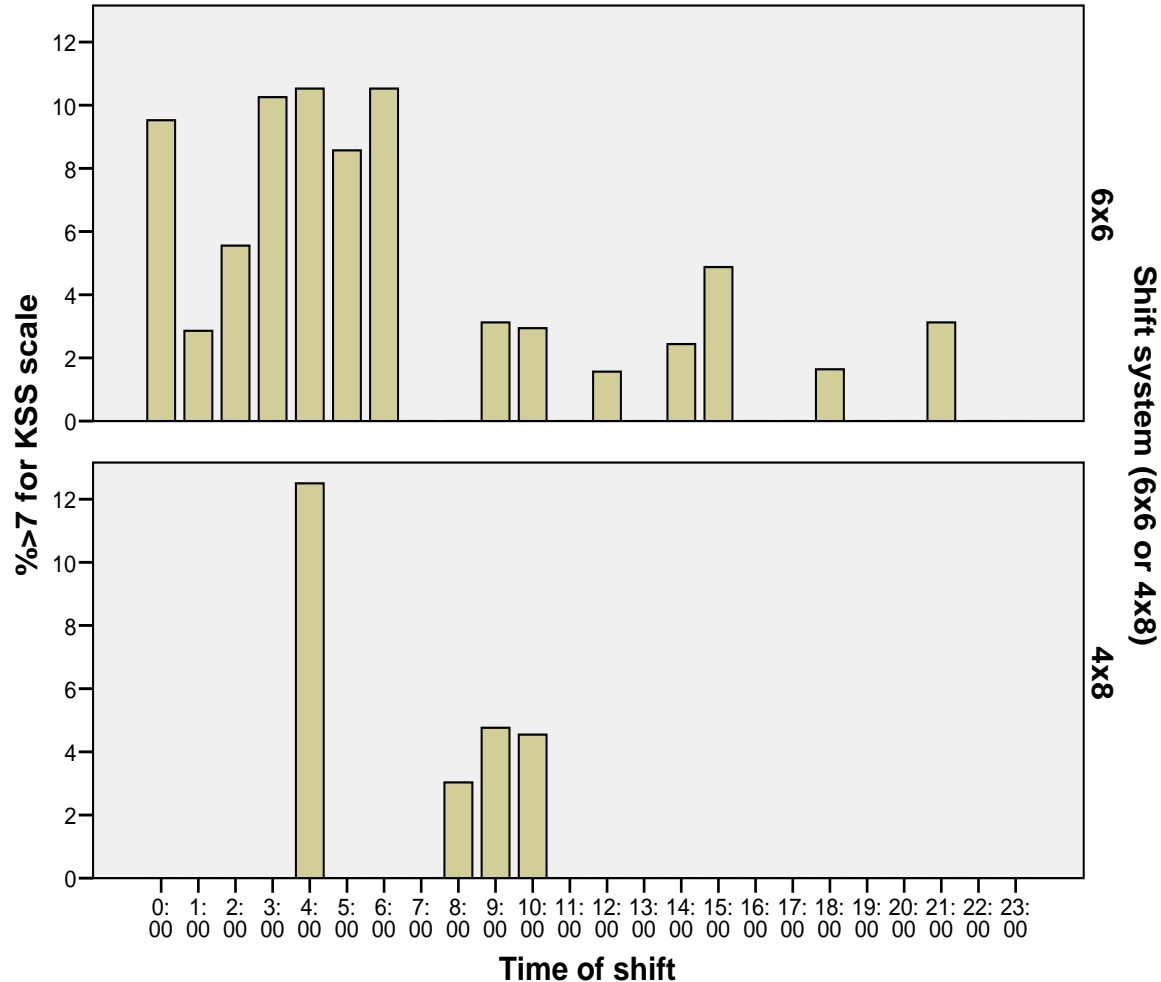
Watch	Sleep length /heavy eyelids
Free watch	4,17
06 - 12	30
Free watch	2,08
18 - 24	0
Free watch	3,66
06 - 12	60
Free watch	2,0
18 - 24	180
Free watch	4,42
06 - 12	360
Free watch	2,0
18 - 24	120
Free watch	3,0
06 - 12	120
Free watch	0
18 - 24	240
Free watch	4,42
06 - 12	360

How much do you need?
6 hours minimum

KSS analysis – Shift system



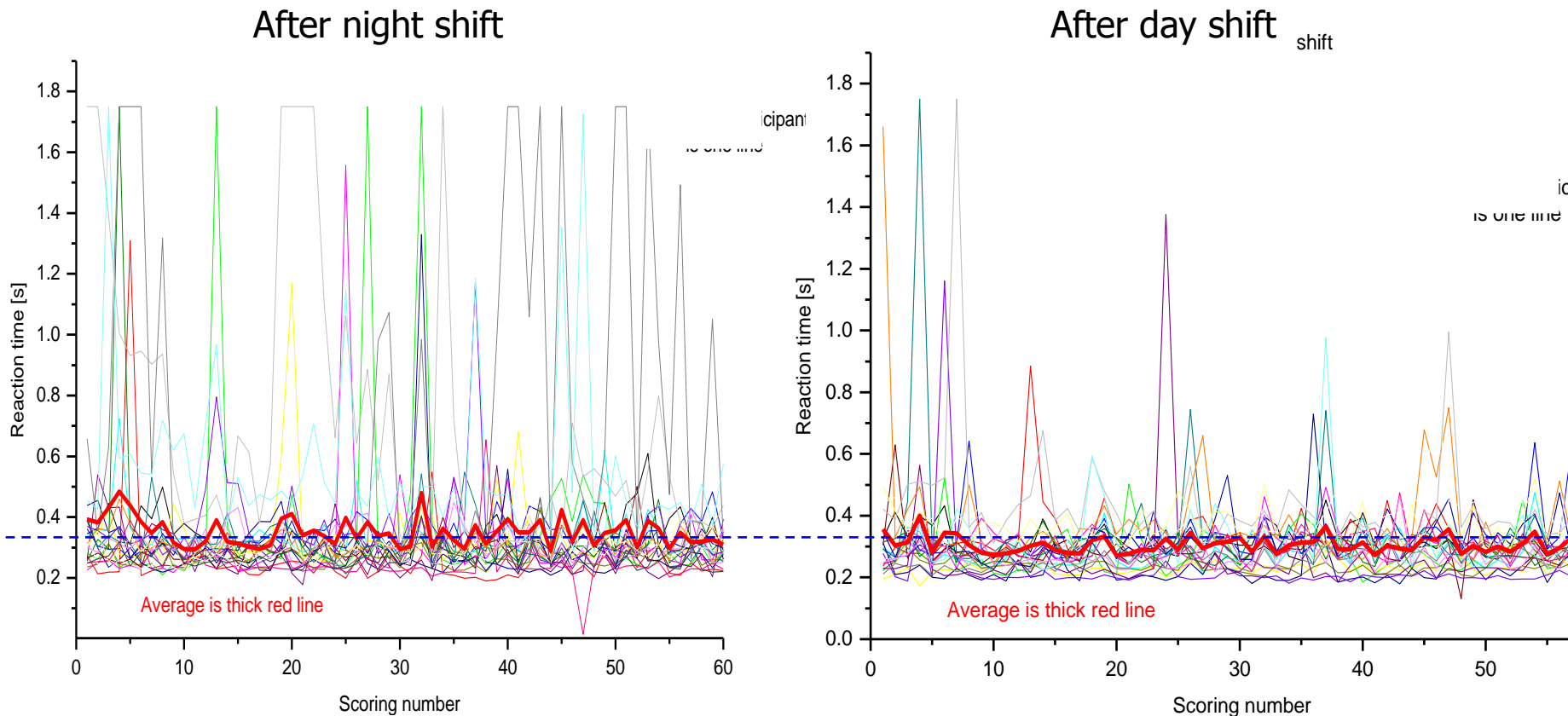
KSS and time of day



“Most tiresome is when we are in port,
then all have to work no matter what shift.
When we have a few days at sea we can
rest”

Reaction time tests 1

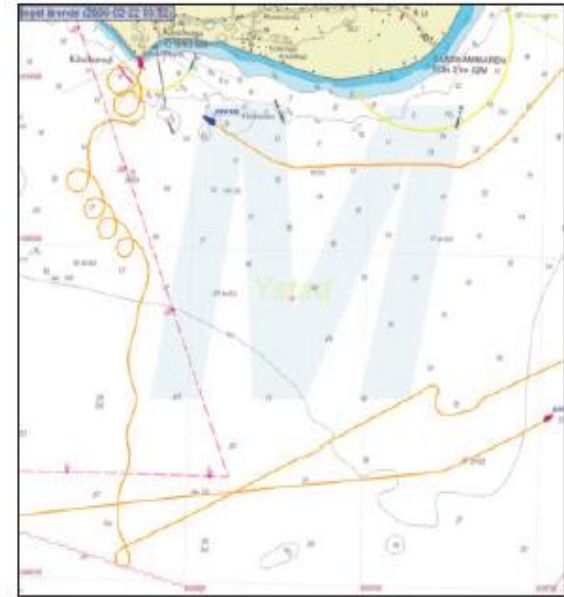
For each participant: one six-minute test after day shift, and one after night shift.



Each participant is one line. Red thick line is average.

Reaction time tests 2

- The reaction time after a night shift was significantly longer than after a day shift.
- Varying by nationality



Bilden visar AIS-spåret efter lastfartyget VITA innan hon går på grund utanför Kåseberga



Lastfartyget VITA på grund utanför Kåseberga

Extreme findings

- During 38 (450) occurrences the participants had difficulties in staying awake
- In 84% of the cases when KSS was 8 or 9, this came from a participant in the 6x6 shift system.



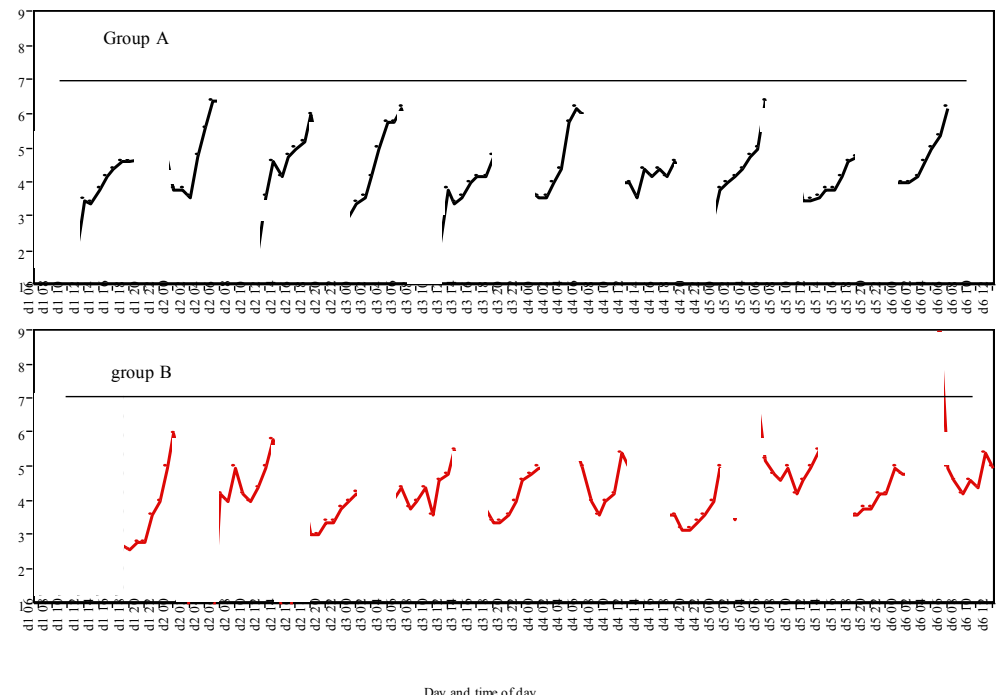
Sleep length and quality

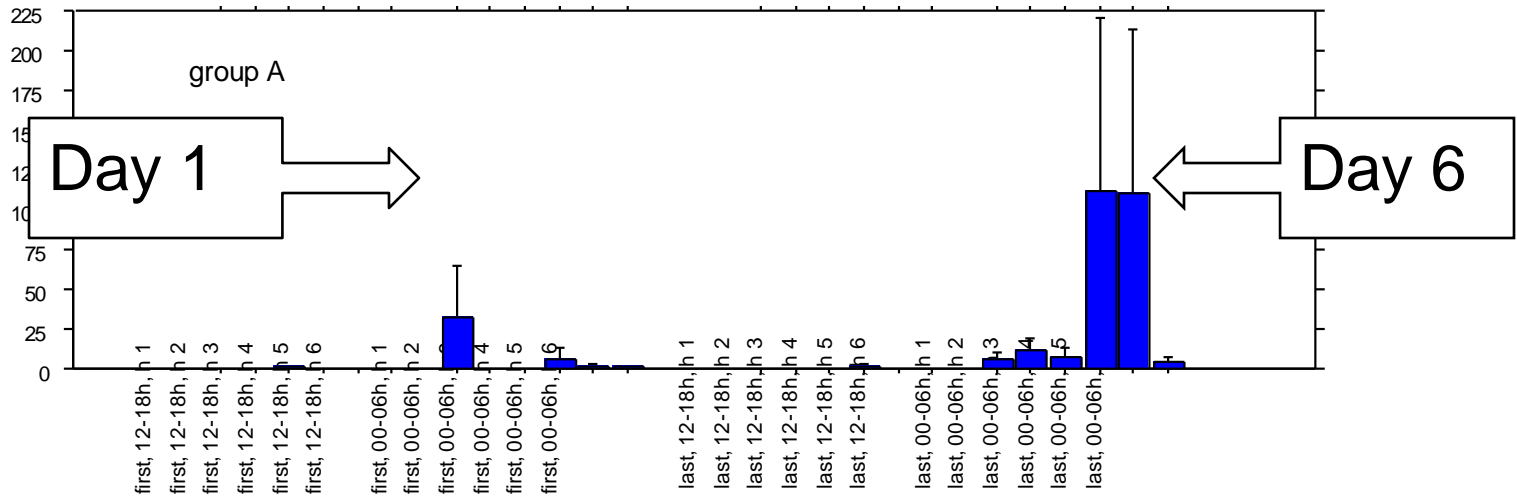
	<u>6 h Shift</u> (7 subjects)	<u>4 h Shift</u> (6 subjects)
Mean values of:		
Actual sleep time (24 h total)	< 7 h	< 7 h
Sleep efficiency	75.2 %	78.8 %

“84 hours of work every week, plus
overtime!”

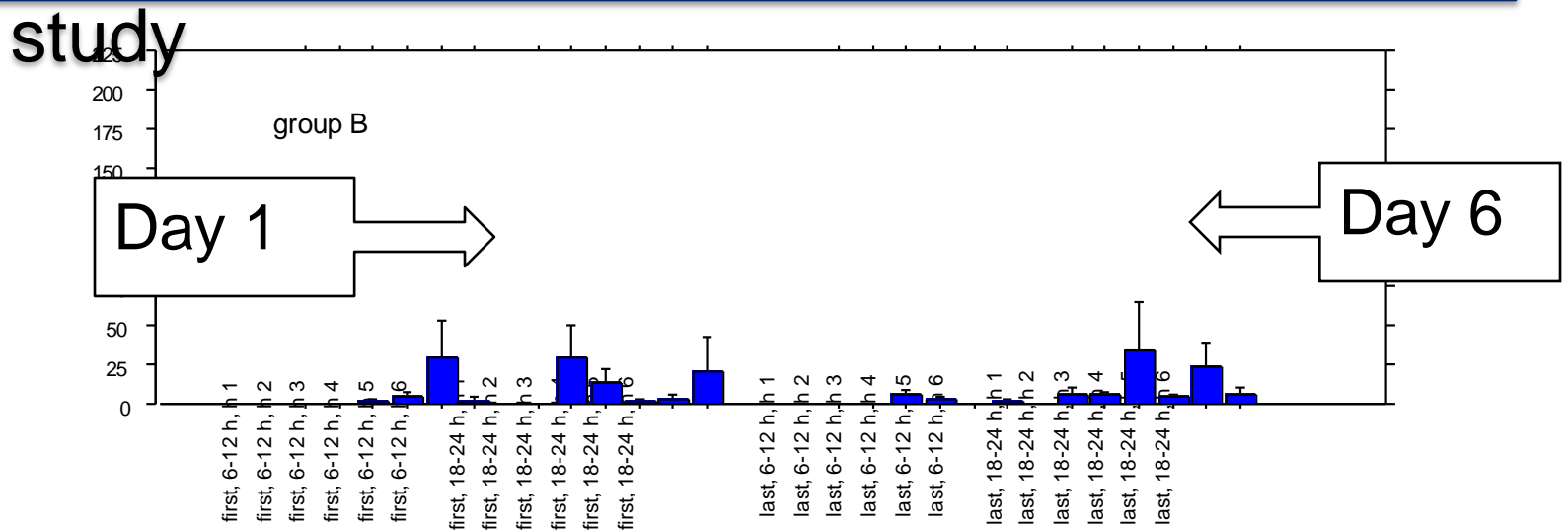
Simulator study at Kalmar Maritime Academy

- Sleep per 24 hours = 6-7 hrs
- Group 00-06, 12-18, longest sleep 3,5 h
- Sleep efficiency 80-90%
- KSS not critical during week but rises per watch and per day





Micro sleep during night watch, simulator study

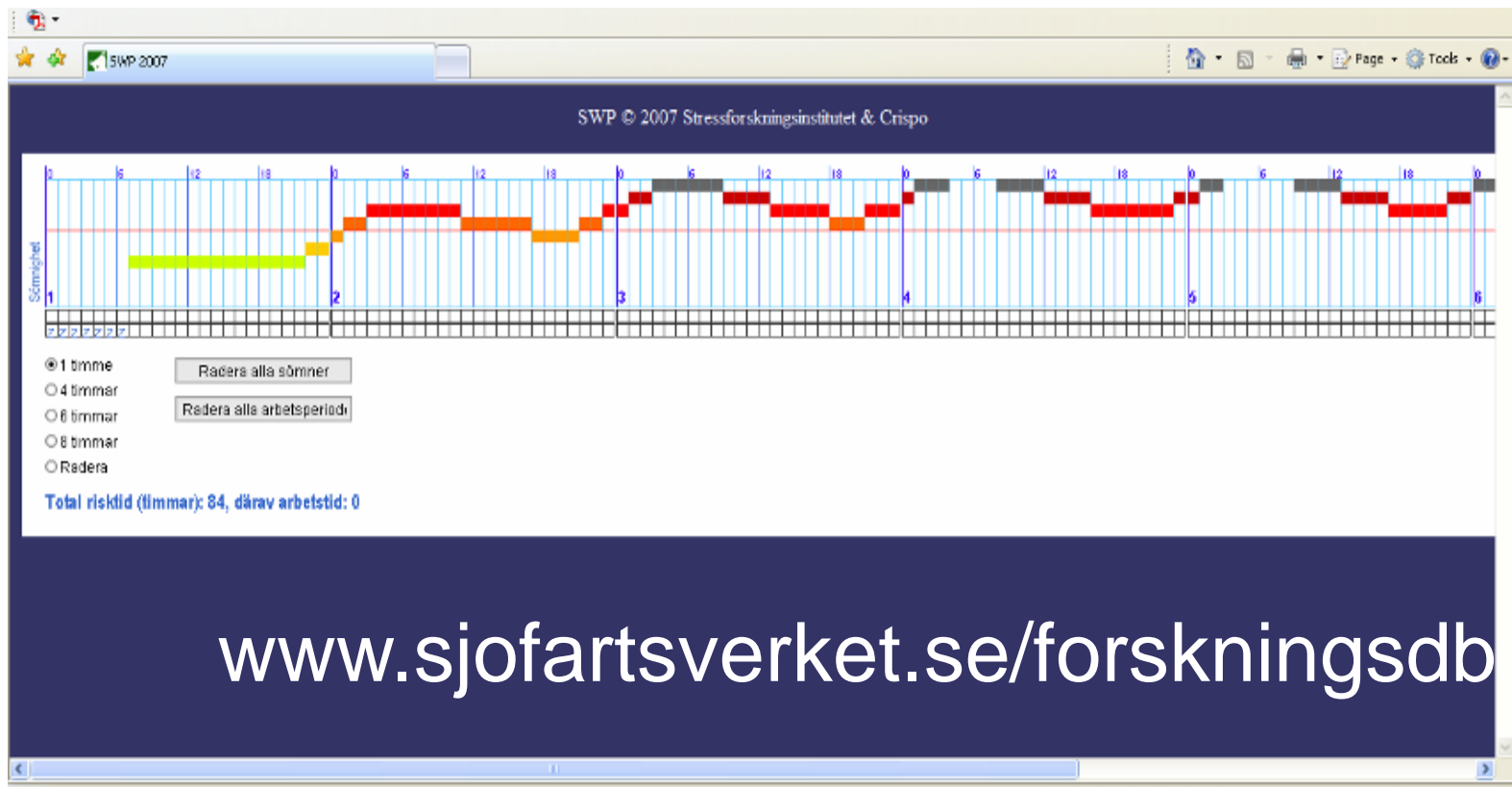


Shipping company interviews

- Most Swedish shipping companies do not think fatigue is a problem (during normal conditions) – but would address it if they found it necessary.
- Most would consider fatigue monitoring equipment, and believe the crew would accept it.
- All would install equipment if insurance premiums were lowered (say 30%).

Recommendations

- Use SWP: Sleep Wake Predictor.



Recommendations, selection

- Free watch on 6-6 must be free for sleep and rest.
- Education on all levels in shipping.
- Design of sleeping environment.
- Better to change watch
 - At 03-09-15-21, than at 00-06-12-18.
 - US version: better 3 am, 9 am, 3 pm, 9 pm

Dissemination

- SWP on web
- Information brochure swe/eng
- Large no of publications, press & radio
- Talk at IMO, STW Copenhagen 2007
- Final report at www.vti.se/fatigueatsea

2. KMA study

General conclusions

- The studies indicate difficulties with a continued use of the two-watch system on ships with only two nautical officers.
 - Working more than 2x6 hours per 24 hours should be avoided.
 - There should always be two persons on the bridge during watch keeping.
- A mutual effort with commitment on all levels is needed to accomplish improvement.
 - Existing recommendations are often directed to the ship and those onboard. Only seldom do they address shipping companies, land-based organisations or authorities.



EU project

Warsash lead partner

12 partners

- The project will define and undertake scientific methods for measurement of fatigue in various realistic seagoing scenarios using bridge, engine-room and cargo simulators;
- will assess the impact of fatigue on decision-making performance and
- will determine optimal settings for minimising those risks to both ship and seafarer.

HORIZON

- 60+ officers, Swe, UK + EU
 - 7-day simulations
 - North sea
 - Navigation, cargo handling
 - Machinery/engineering tasks
 - Interrupted/uninterrupted weeks
- Your input wanted!
 - Watchkeeping ER?
 - Disturbances?
 - Common tasks?
 - Events?

Lighthouse
partner



LIGHTHOUSE

N 57° 42.4' E 011° 56.2'

LIGHTHOUSE MARITIME COMPETENCE CENTRE



LIGHTHOUSE
Founder

CHALMERS



UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

