

The influence of ship movements on the energy expenditure of fishermen

– A study during a North Sea voyage in calm weather

Tomas Breidahl MD, Michael Christensen, Jens-Peter Johansen MD, Øyvind Omland MD, PhD. Department of Occupational Medicine, Aalborg University Hospital, 9000 Aalborg, Denmark.
Jørgen Riis Jepsen MD. Centre of Maritime health and Society, University of Southern Denmark.

Background:

Previous studies of professional fishing activities has indicated that in addition to the work tasks onboard the ship's movements, in it self, increases the fishermen's energy expenditure.

We have studied the effects of exposure to the ship's movement during calm weather by examining the crude relation between the ship's movement and fishermen's energy expenditure, thus ignoring the various tasks undertaken on board.

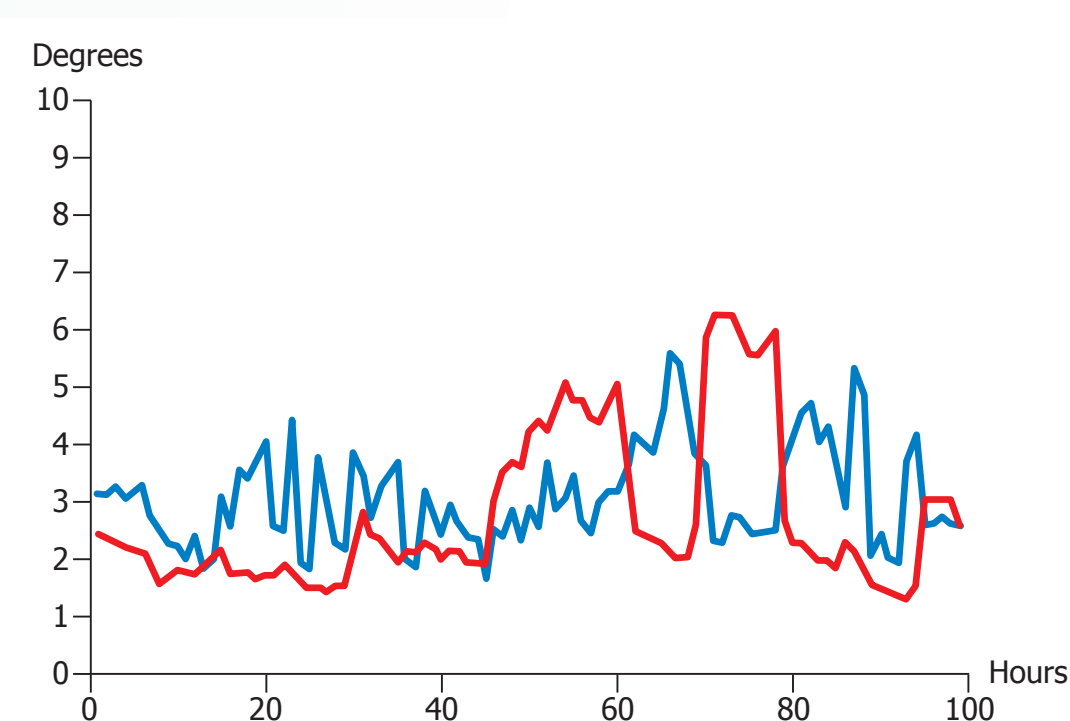
Methods:

- Four fishermen on two contemporary steel trawlers were recruited, with assistance from Hirtshals Fishermen's Association, and participated during fishing expeditions in the North Sea off the coast of Bergen
- The energy expenditure was estimated with a body monitoring system (SenseWear Pro 3 developed by BodyMedia) carried as an armband placed on the right upper arm.
- Measurements of the vessels' movements in the sea were obtained by a gyroscope from Foruna industries, Esbjerg, placed in the wheelhouse.
- Recordings were done continuously in 4 days periods (98 hours). Polaris (HG 352) from July 20th 2010 and on Luna (HG 350) from October 2nd 2010.
- Due to the anthropometric variations in between the participating fishermen, we have standardized the energy expenditure according to their body surface, thereby making the measurements comparable (Table 1)
- The data were analysed by linear regression.

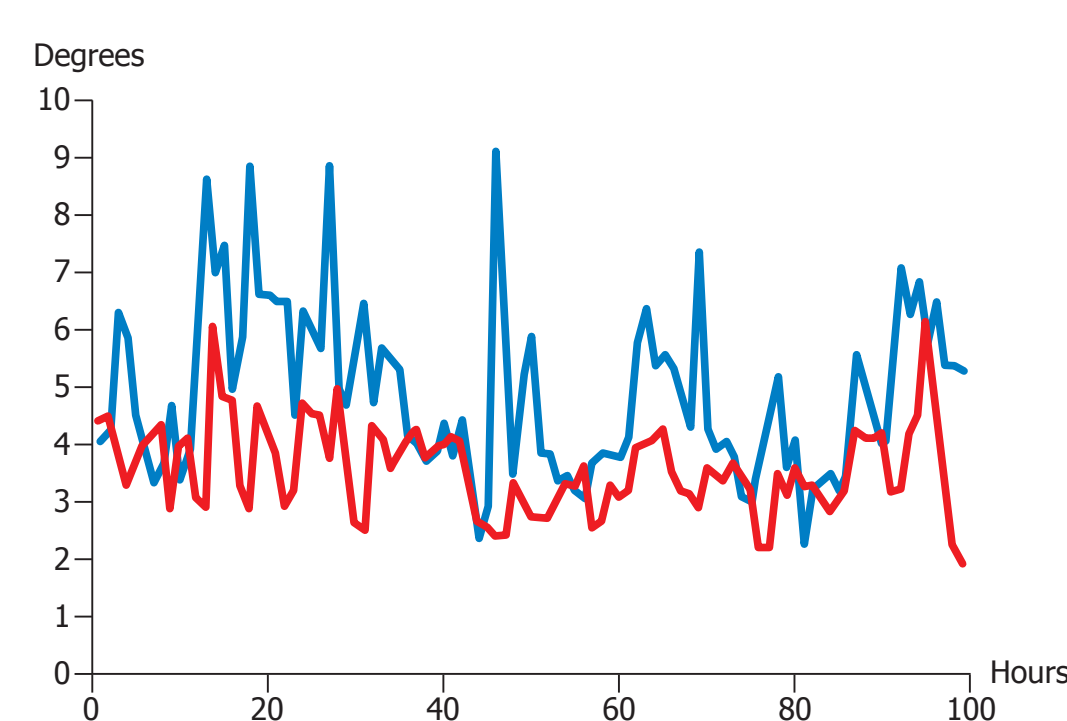
Table 1. Demographics of the studied subjects

Vessel	Position on board	Age (Years)	Height (cm)	Weight (Kg)	Body surface (m ²)*
Polaris	Skipper	53	196	126	2.58
	Apprentice	23	185	82	2.06
Luna	Fisherman	45	180	88	2.08
	Machinist	37	183	80	2.02

*The body surface (A) was estimated by the formula $A = W^{0.425} \times L^{0.725} \times 0,007184$, with W as the weight in kg and L as the height in cm.



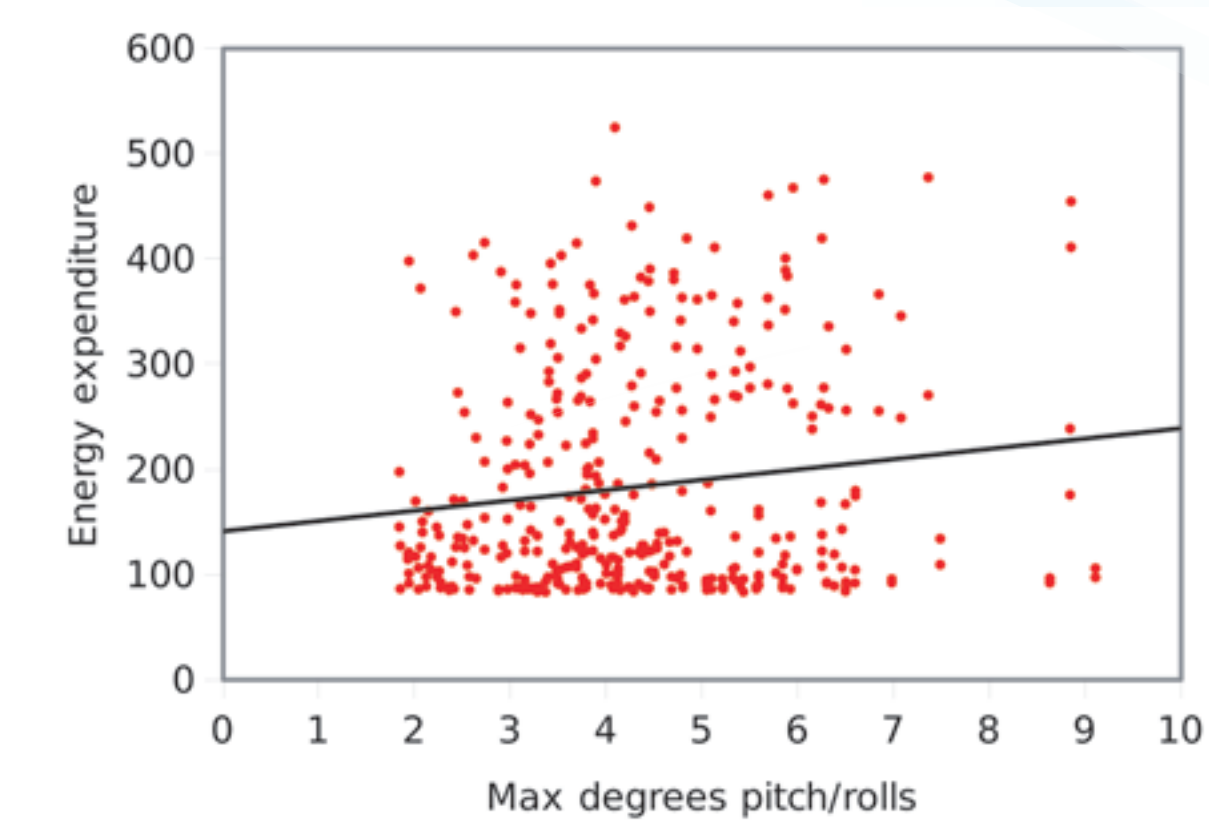
Movements Polaris



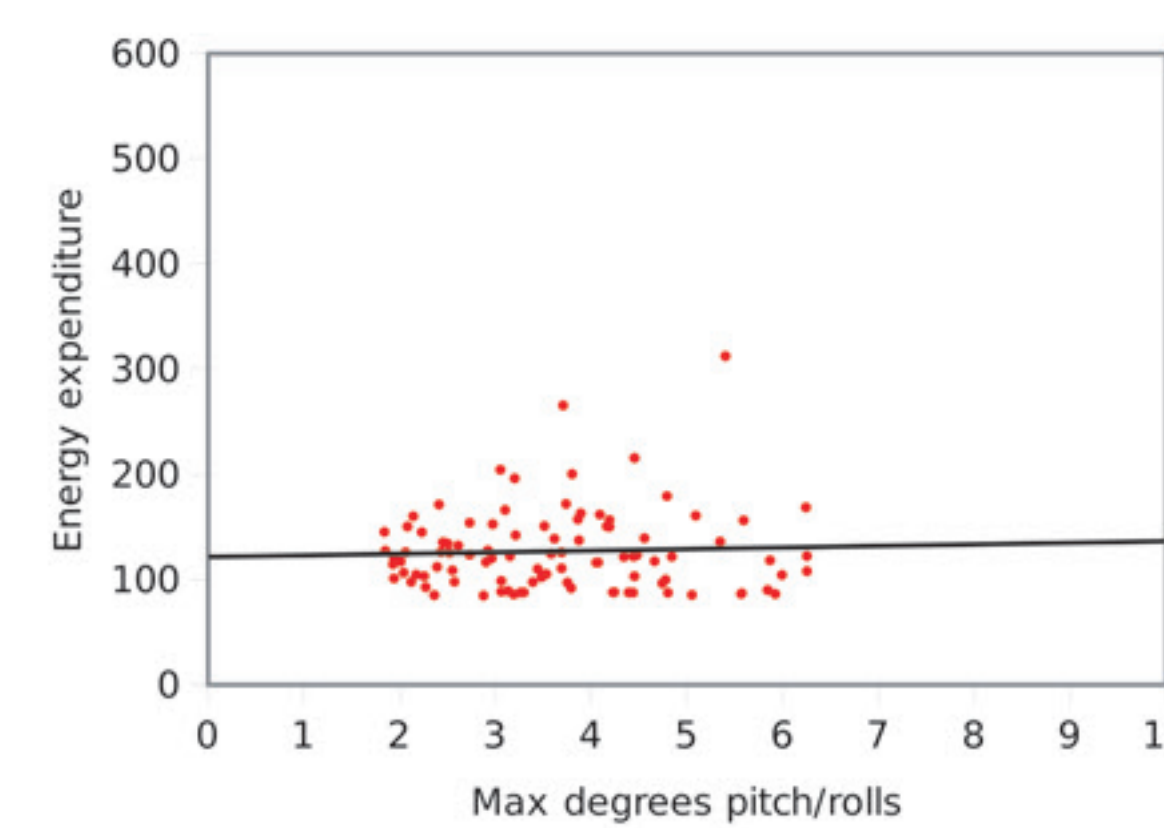
Movements Luna

Results:

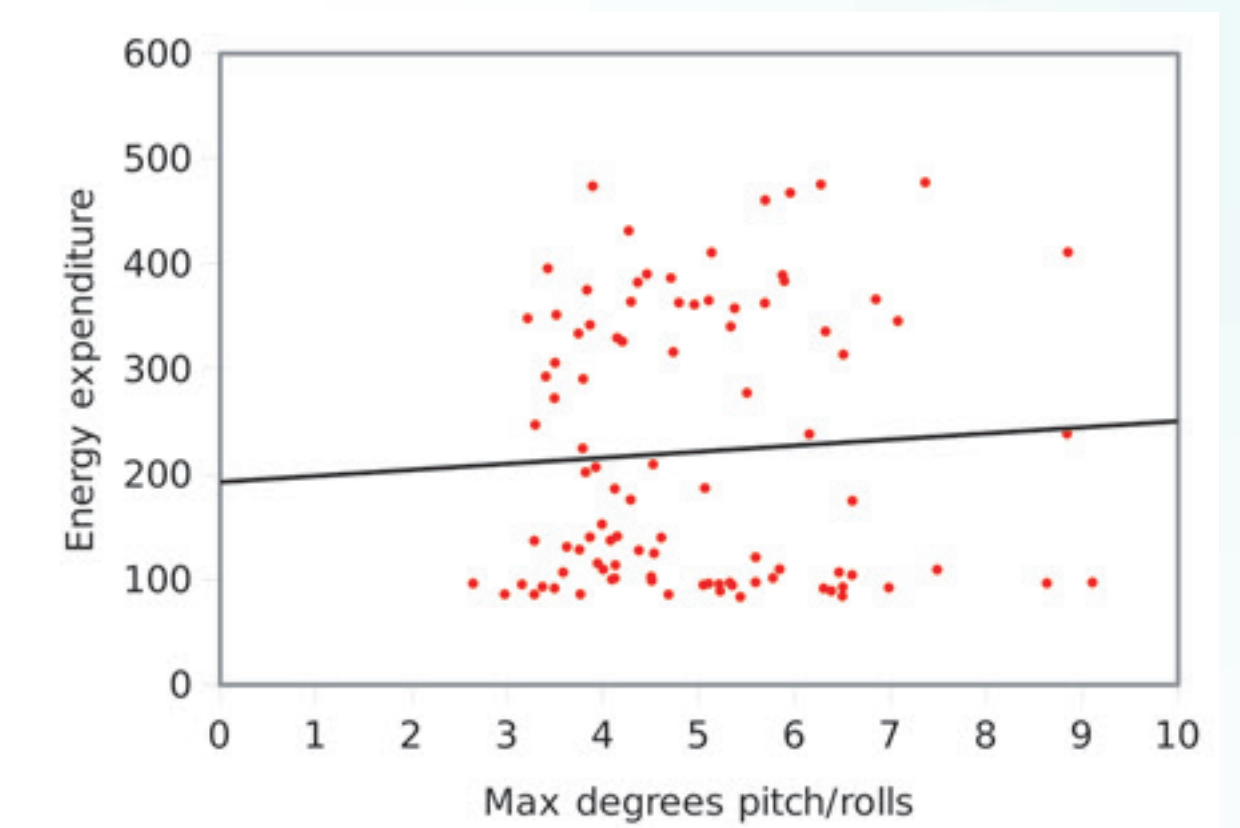
- The actually measured energy expenditure (calories/hour) at sleep, and the estimated basal metabolic ratio (brackets) for each fisherman, were close to each other: Skipper: 99.8 (100.7), apprentice: 80.1 (81.0), fisherman: 79.3 (78.2), machinist: 76.9 (76.2).
- This shows the validity of the measurements.
- The exposure monitored in calm weather conditions was small for all measurements with heeling and pitch being less than 10° for both vessels. The weather conditions at both voyages were relatively calm.
- However, the fishermen's energy expenditure was significantly influenced by these minor motions of the vessels in the sea.
- Trends of increasing energy expenditure at higher exposure levels were seen for each individual fisherman.



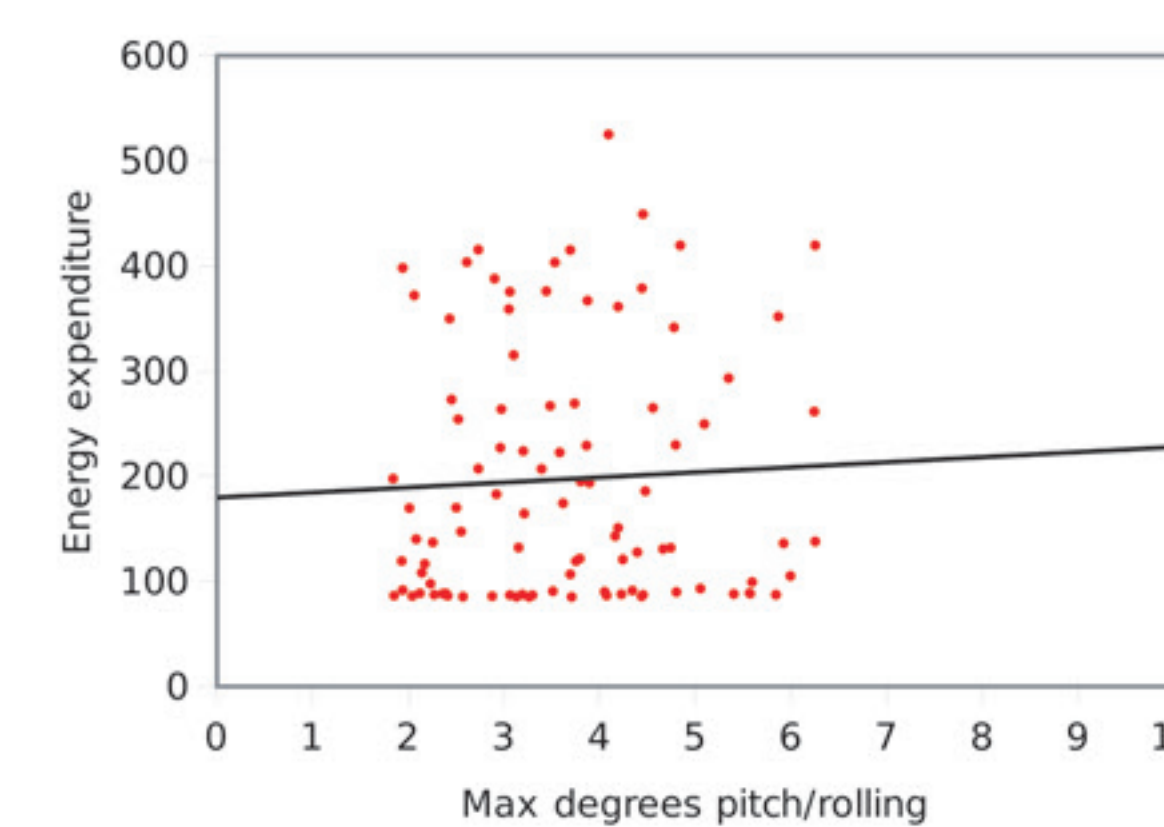
All participants together



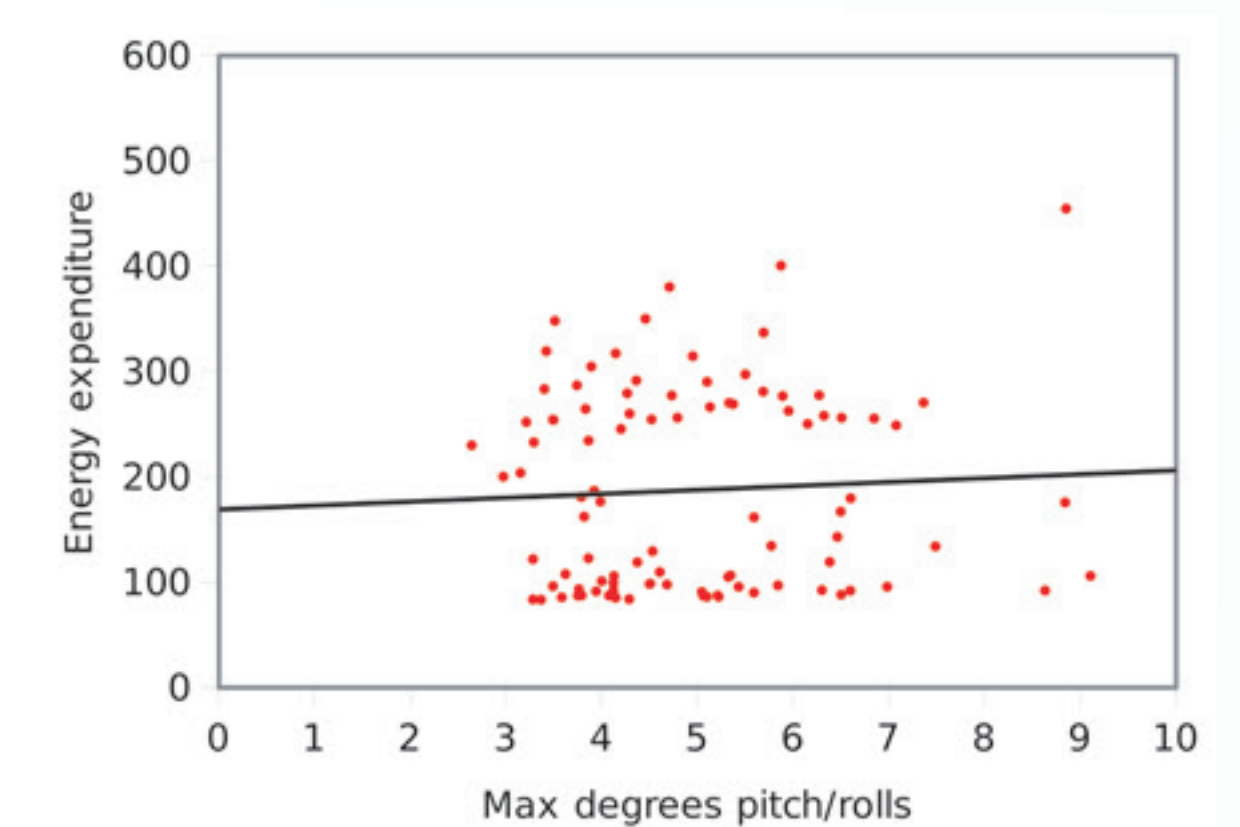
Skipper Polaris



Fisherman Luna



Apprentice Polaris



Machinist Luna

Conclusion:

Our data suggests that the heel and pitch even in calm weather have an impact on the fishermen by increasing their energy consumption. This study has demonstrated the feasibility of the applied methods. Studies should be performed with larger samples and in rough weather.

REF: Breidahl T, Christensen M, Jepsen JR, Johansen JP, Omland Ø. Int Marit Health. 2013;64(3):114-20.



Contact:
Tomas Breidahl
E-mail: tomas.breidahl@rn.dk