RoRoSeca

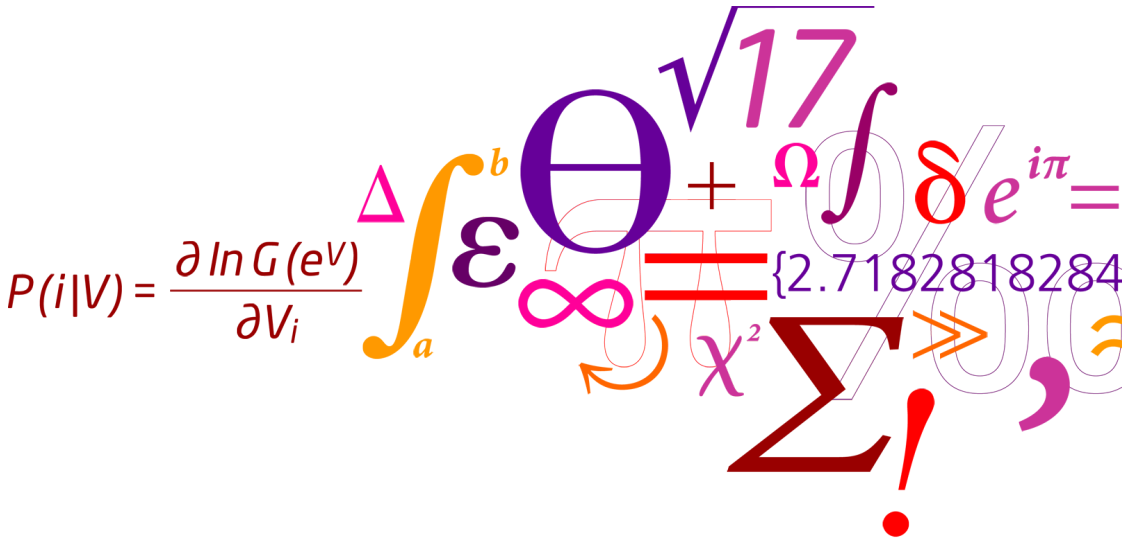
www.roroseca.transport.dtu.dk

DTU

Development of SHIP-DESMO Ro-Ro generic model for calculation of energy demand and emissions of Ro-Ro ships

Hans Otto Kristensen
Owner and director of HOK Marineconsult ApS

HOK Marineconsult ApS



Main principles of SHIP-DESMO model:

On basis of statistical data calculate the ship's dimensions as functions of ship capacity, C

Length = Lpp = $f_1(C)$
Breadth= B = $f_2(C)$
Draft = T = $f_3(C)$
Depth = D = $f_4(C)$
Light ship weight = M = $f_5(C)$
Service speed = V = $f_6(C)$
Auxiliary machinery power = Pa = f_7(propulsion power)

Propulsion power, Pf, is calculated on the basis of main dimensions, and utilization fraction, U (actual cargo/maximum cargo capacity)

Pf = f_7(L, B, T, D, M, V, C, U)

Energy consumption and emissions are calculated on the basis of the propulsion and auxiliary power Pf and Pa

Finally, main dimensions, speed and engine characteristics can be modified and the influence on propulsion power and energy consumption can be determined

Development of SHIP-DESMO model:

Data for the SHIP-MODEL

- Data from Significant Ships published by Royal Institution of Naval Architects, RINA (1990 – 2015)
- Data from ShipPax electronic database. ShipPax is a Swedish company specialised in collection of all kind of information about the Ro-Ro sector, including ship data and ferry route data
- Very detailed data supplied by DFDS
- Data collected during 35 years by Hans Otto Kristensen

Ro-Ro ship types

Ro-Ro cargo ships

Ships primary used for transport of rolling cargo (1000 – 7000 lanemeters) and maxium 12 passengers

Ro-Ro passenger ships

Ships for rolling cargo in combination with transport of passengers (13 – 3000 persons)

a. Low cargo density Ro-Ro passenger ships

b. High cargo density Ro-Ro passenger ships

Ro-Ro ship types

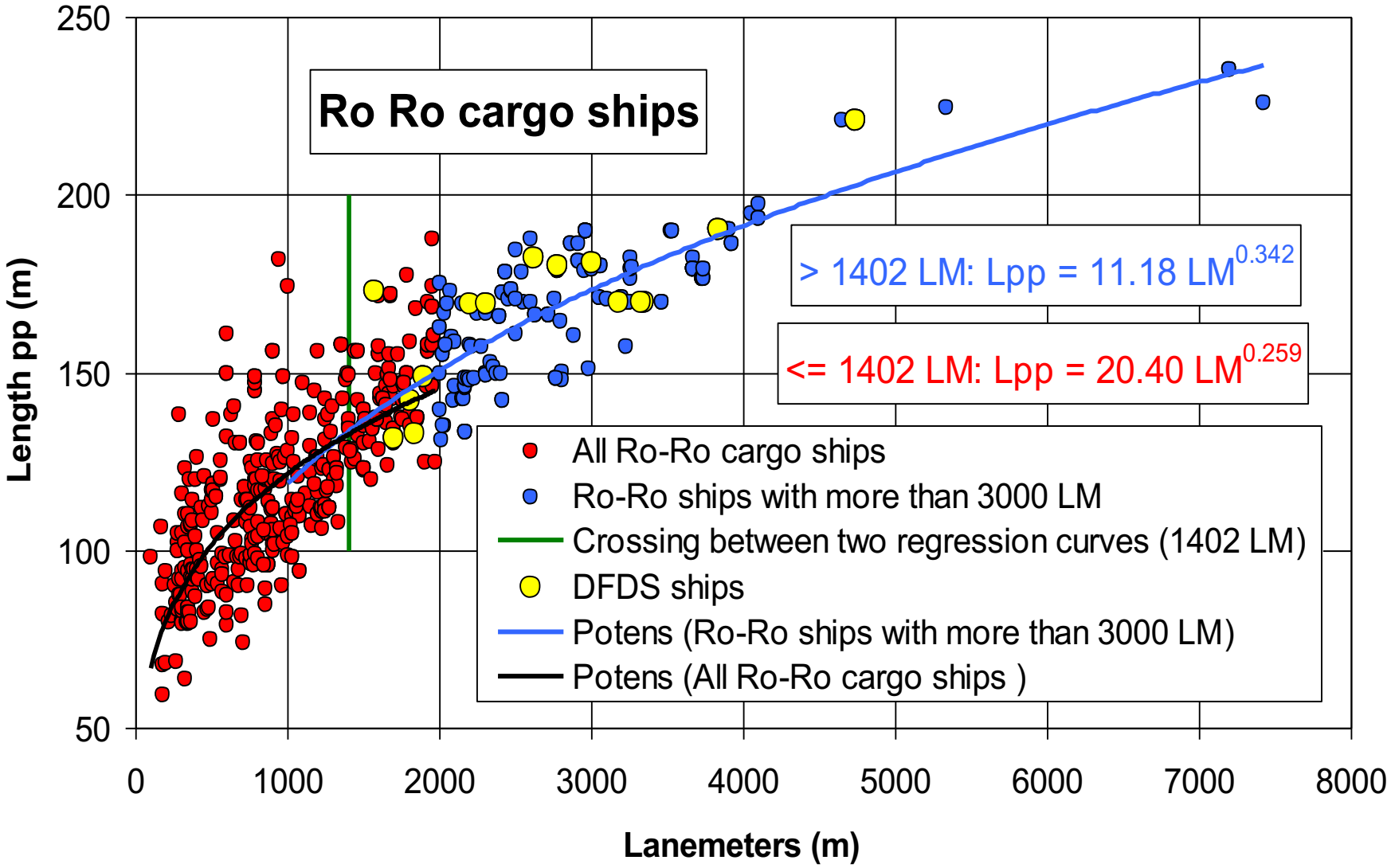
Ro-Ro cargo ships

Ro-Ro passenger ships

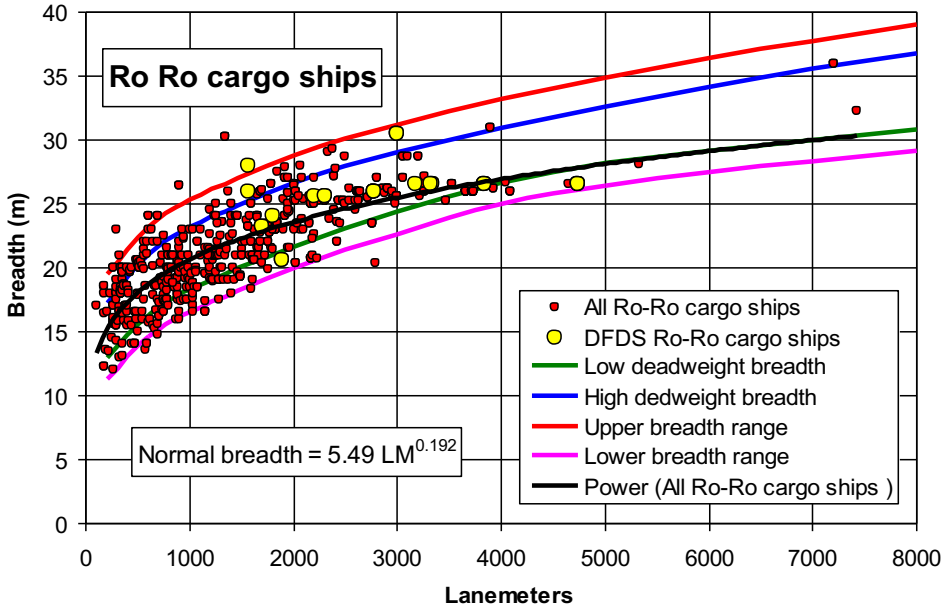
Low cargo density Ro-Ro passenger ships

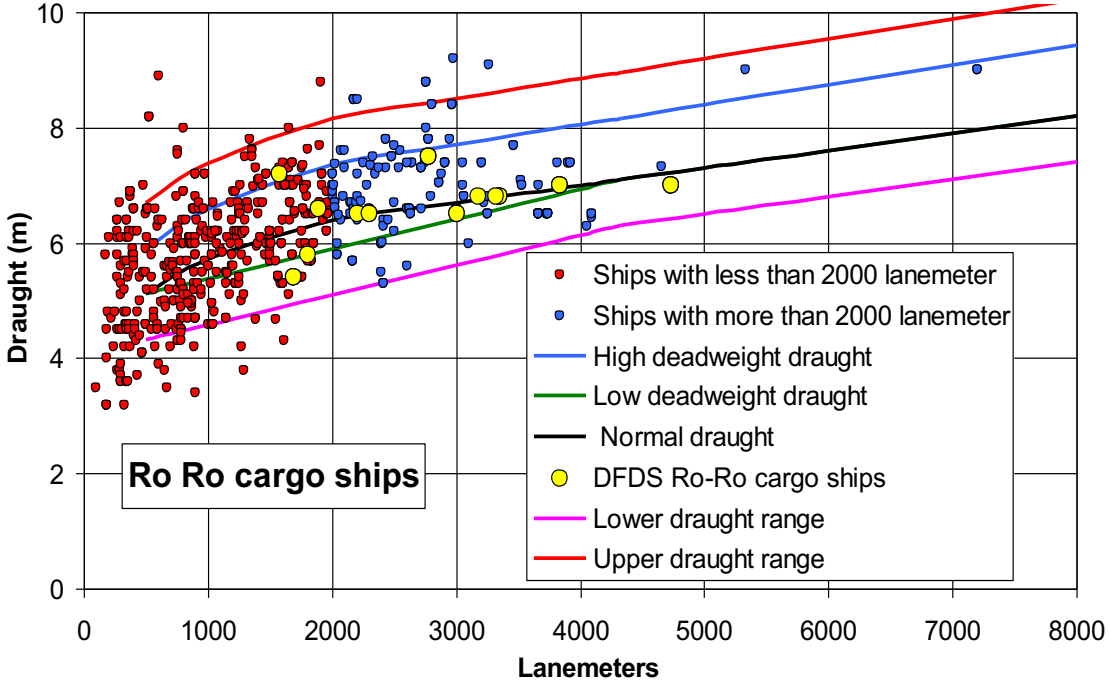
High cargo density Ro-Ro passenger ships

Development of SHIP-DESMO model:

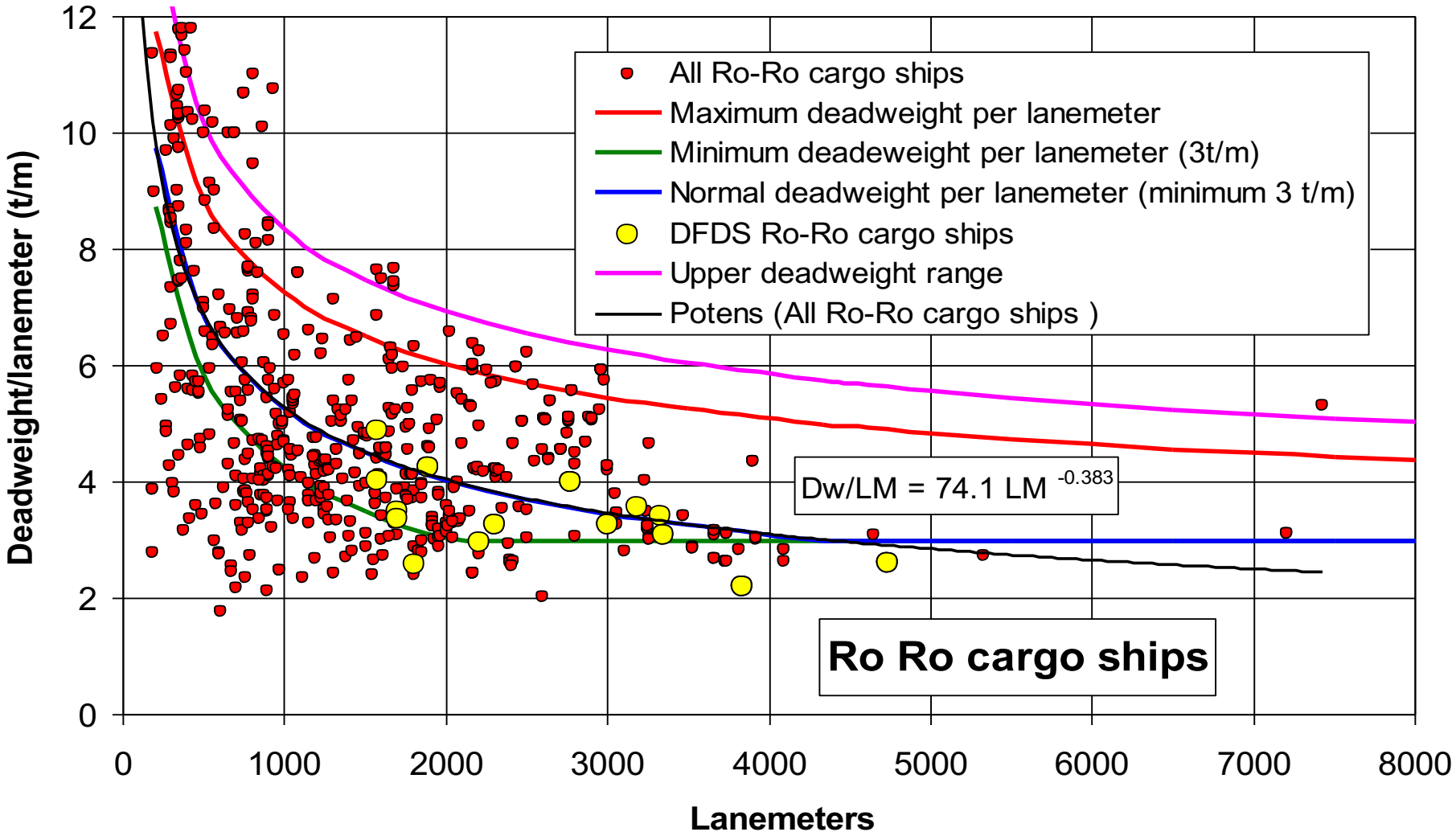


Development of SHIP-DESMO model

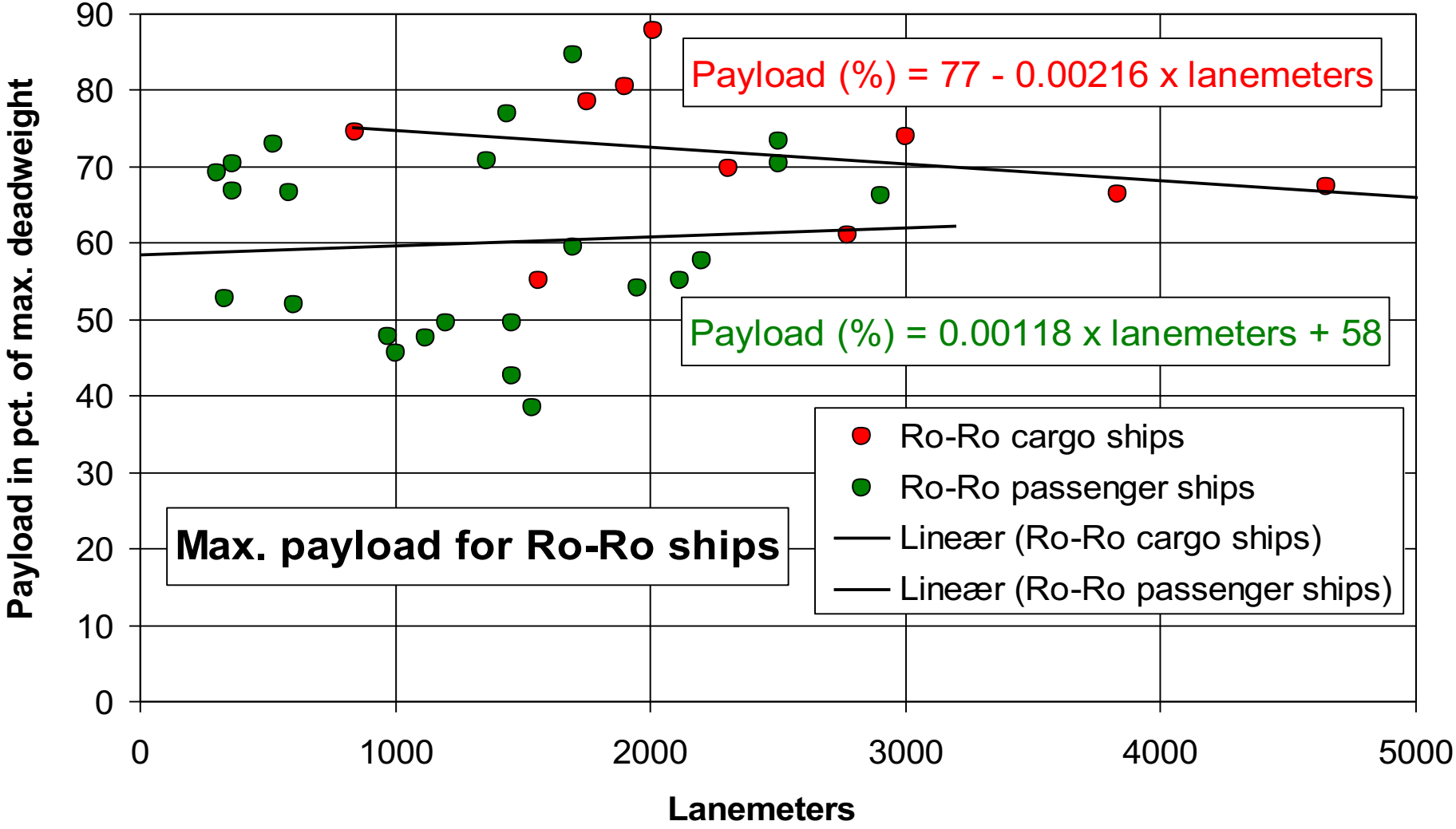




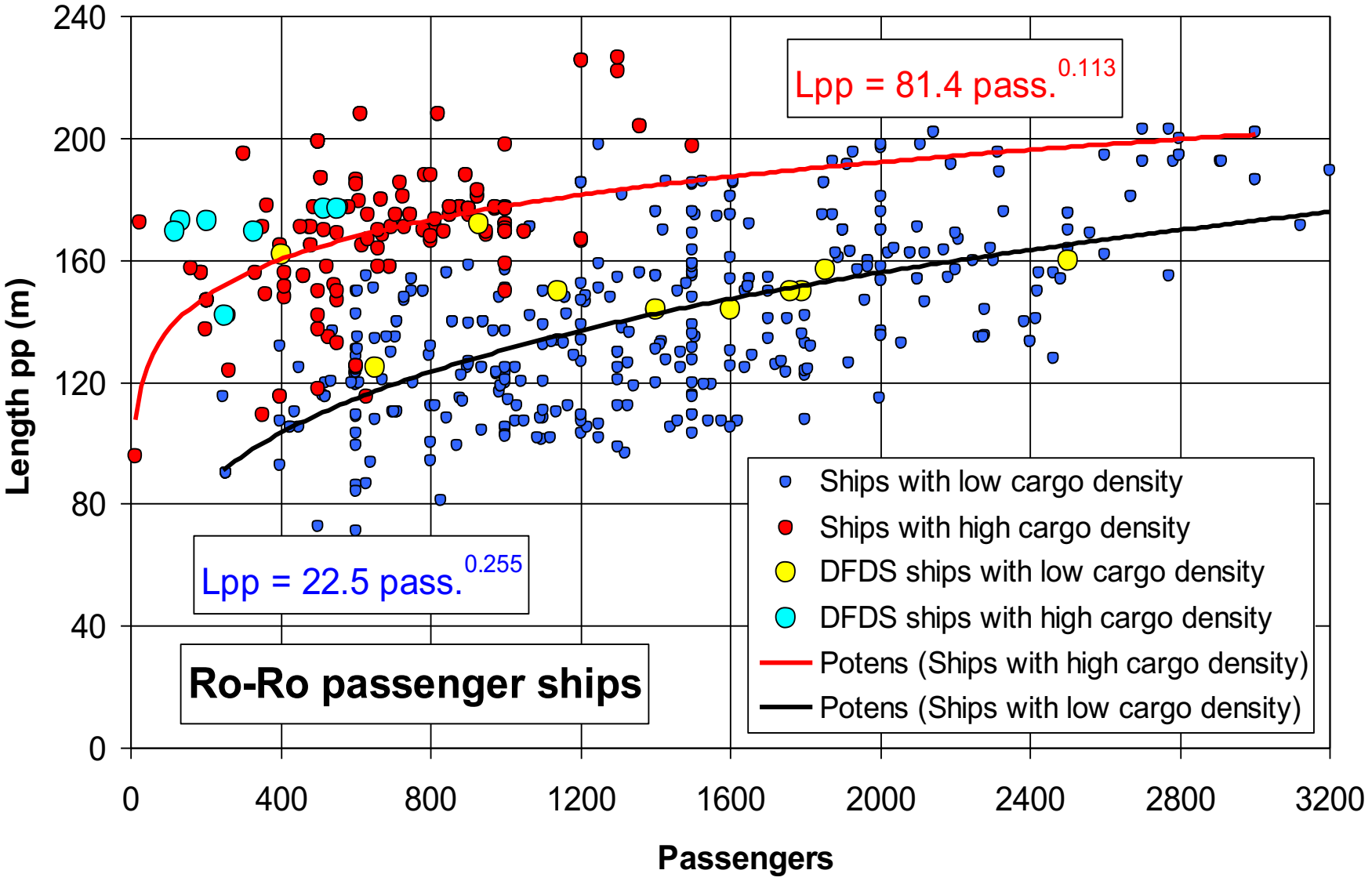
Development of SHIP-DESMO model:



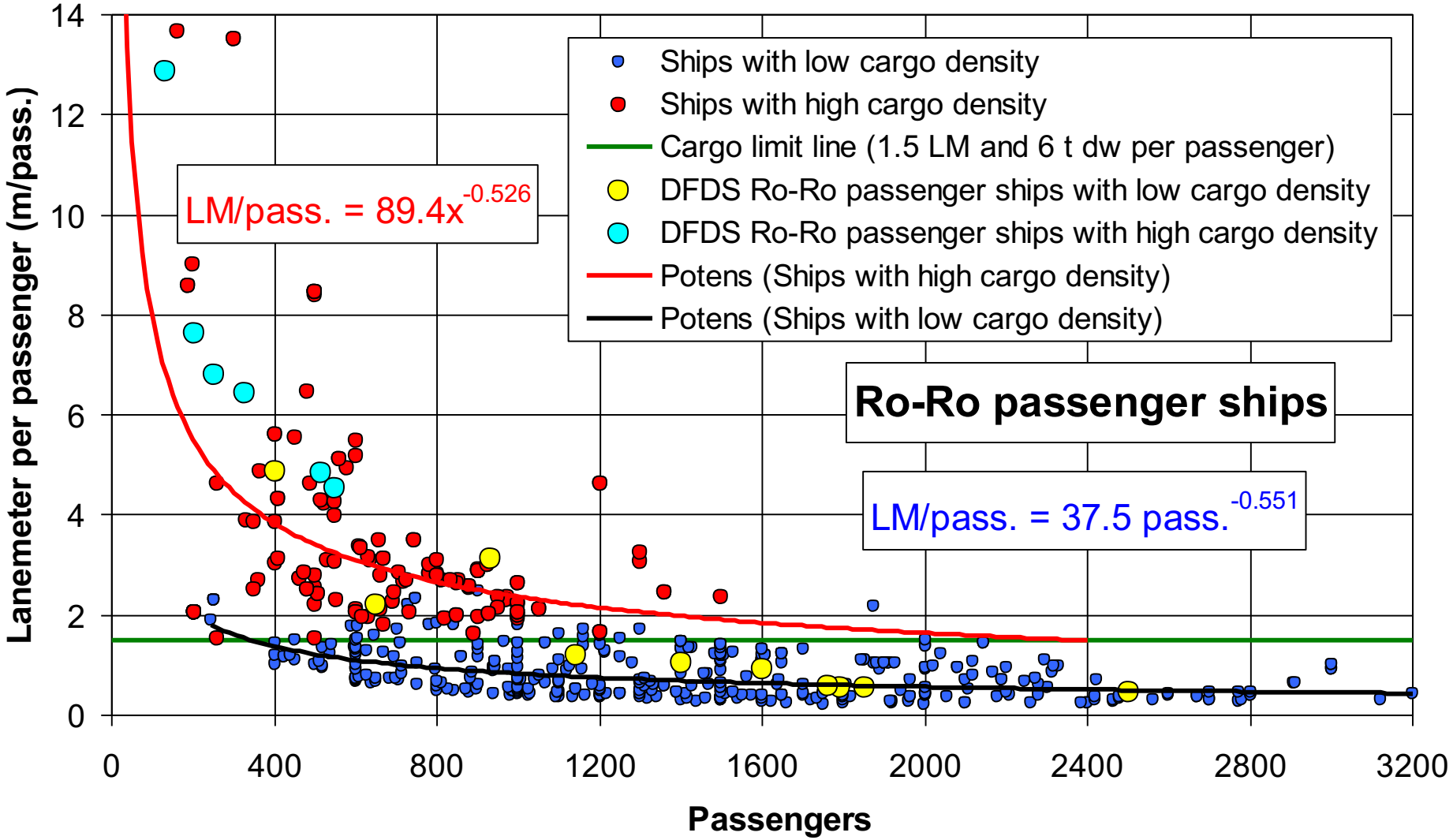
Development of SHIP-DESMO model



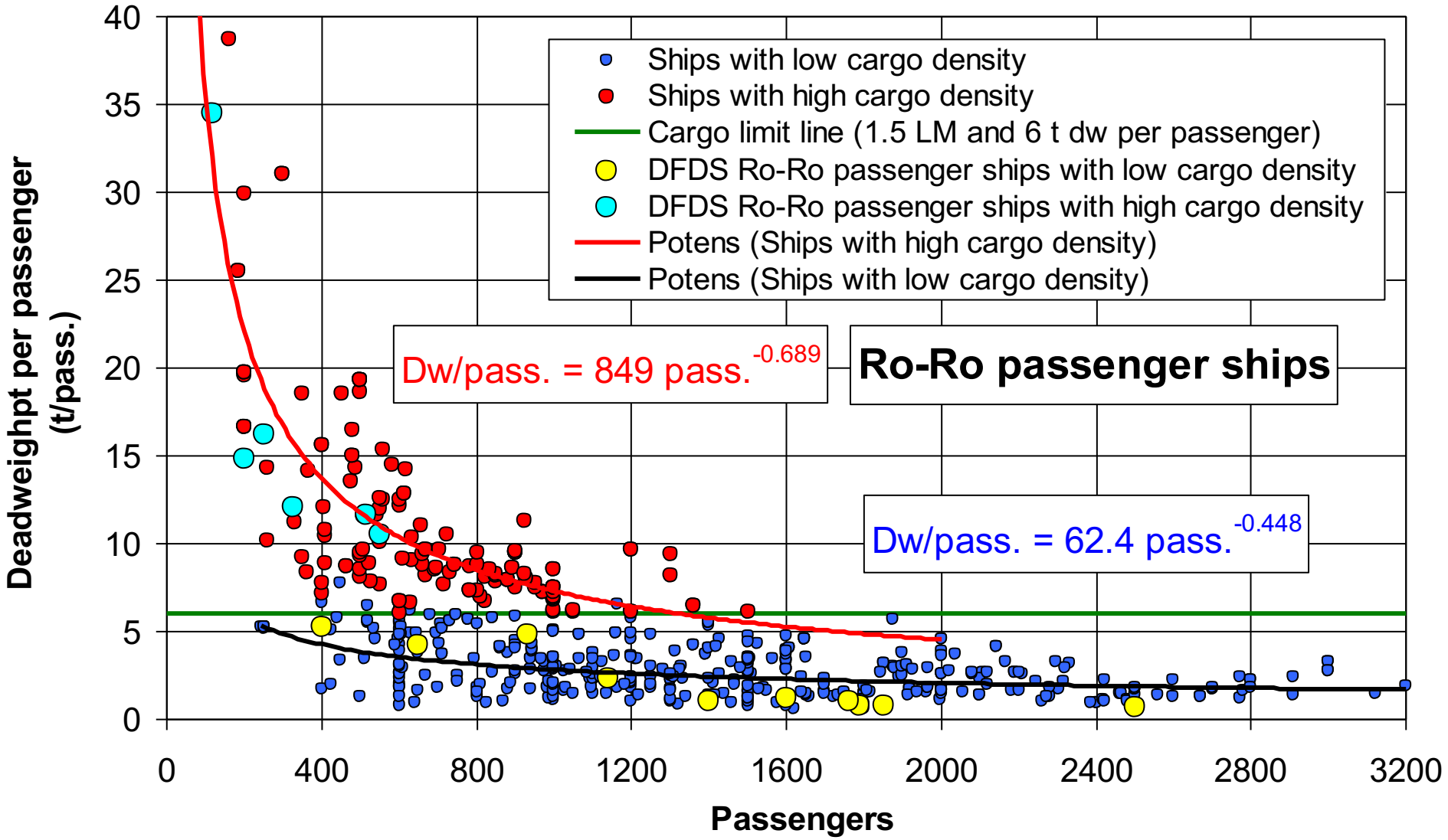
Development of SHIP-DESMO model



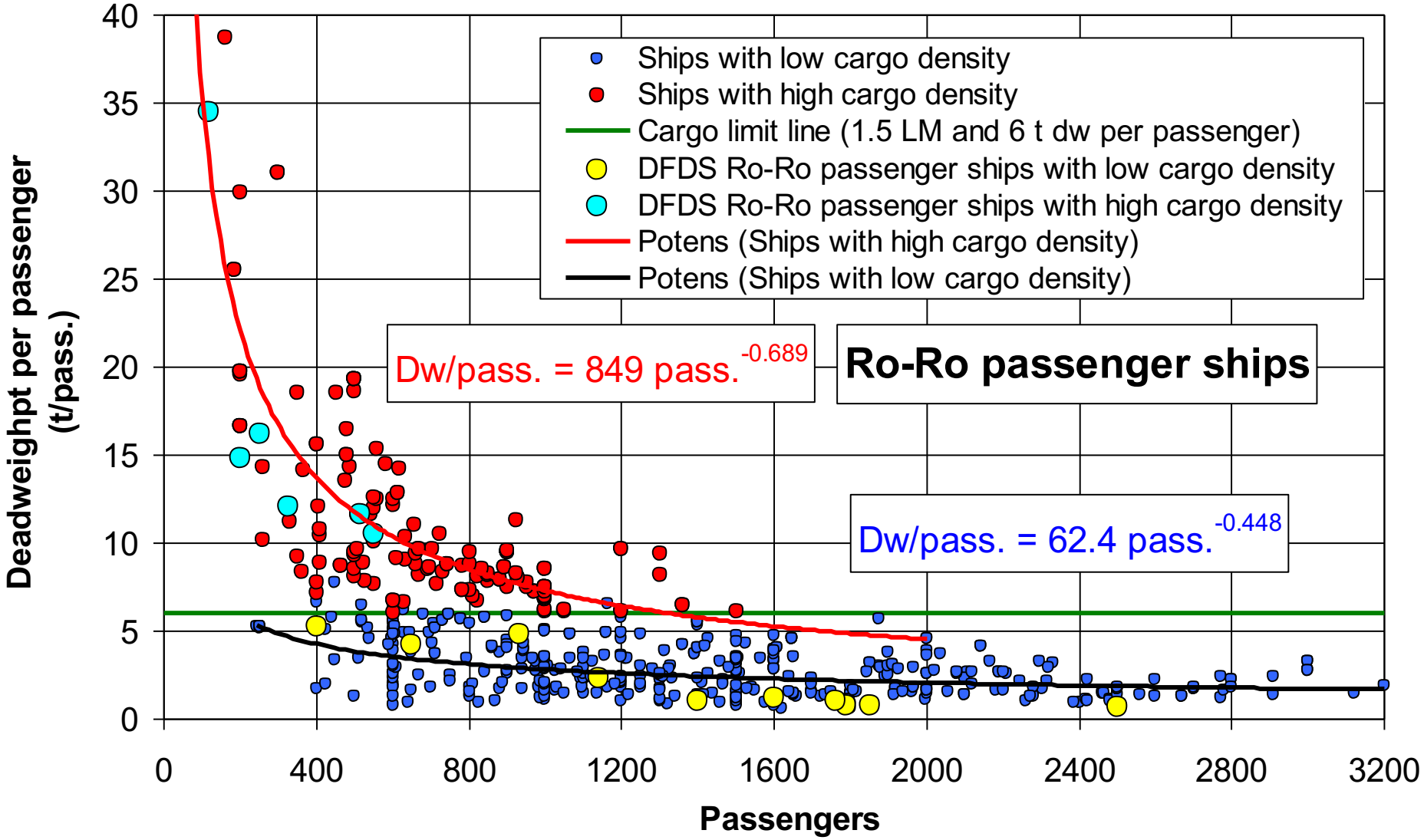
Development of SHIP-DESMO model



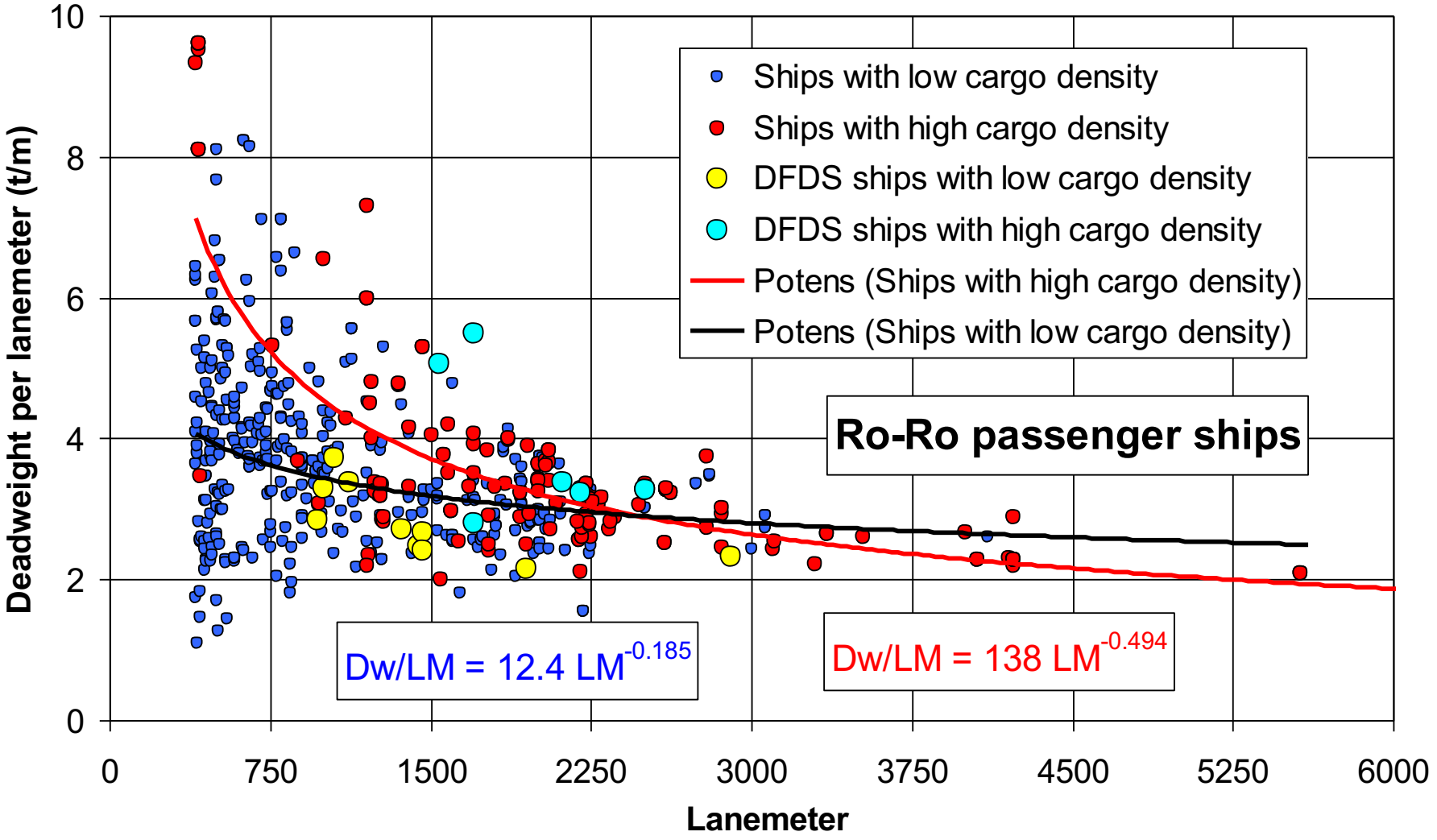
Development of SHIP-DESMO model



Development of SHIP-DESMO model



Development of SHIP-DESMO model



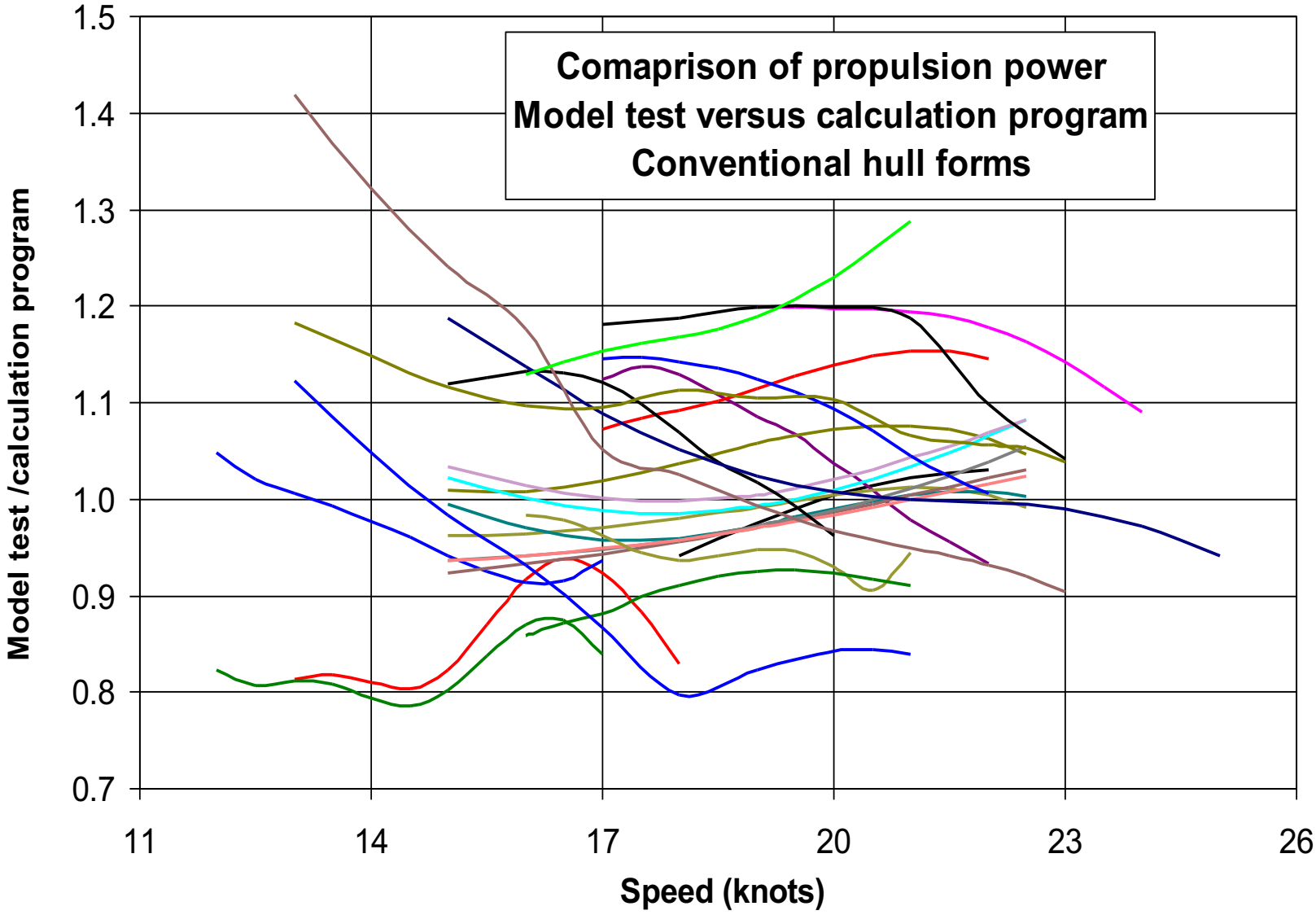
Development of SHIP-DESMO model

The power prediction of SHIP-DESMO is based on:

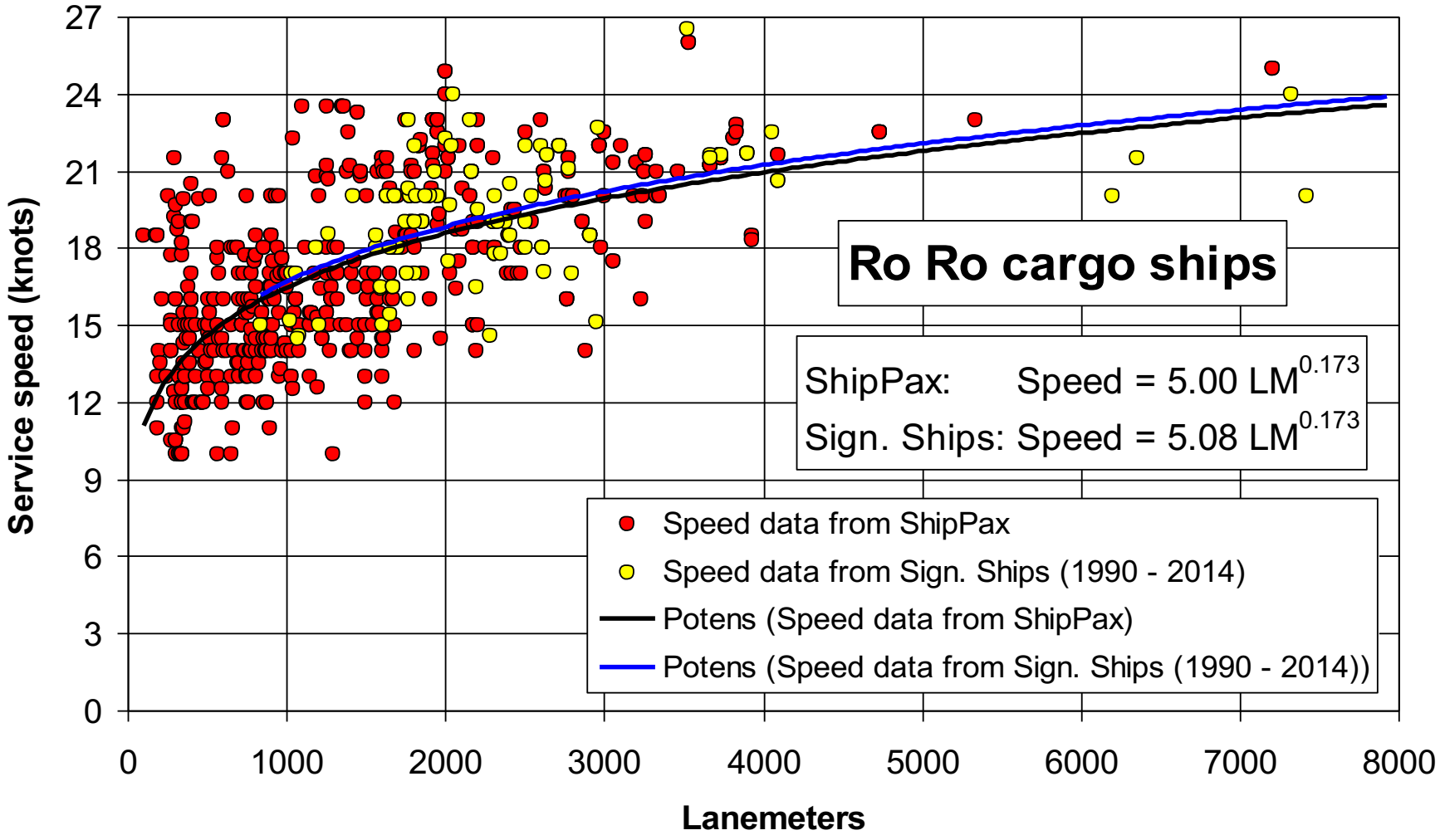
Guldhammer and Harvald´s method for prediction of the resistance. The method has been updated based on an analysis of 34 modern Ro-Ro ships

The propeller efficiency is based on Wageningen B-series propeller data combined with an analysis of model test results of Ro-Ro ships

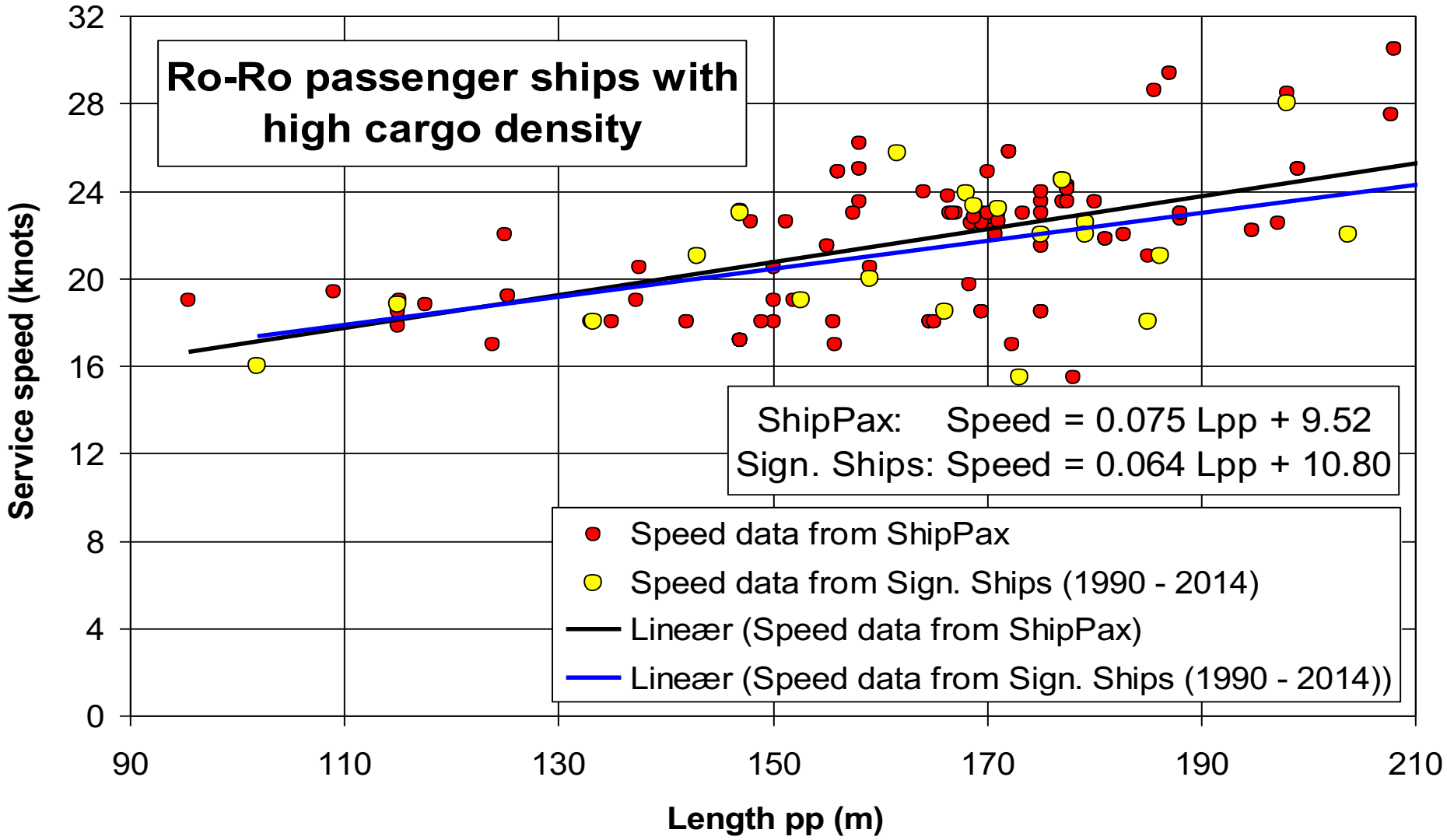
Development of SHIP-DESMO model



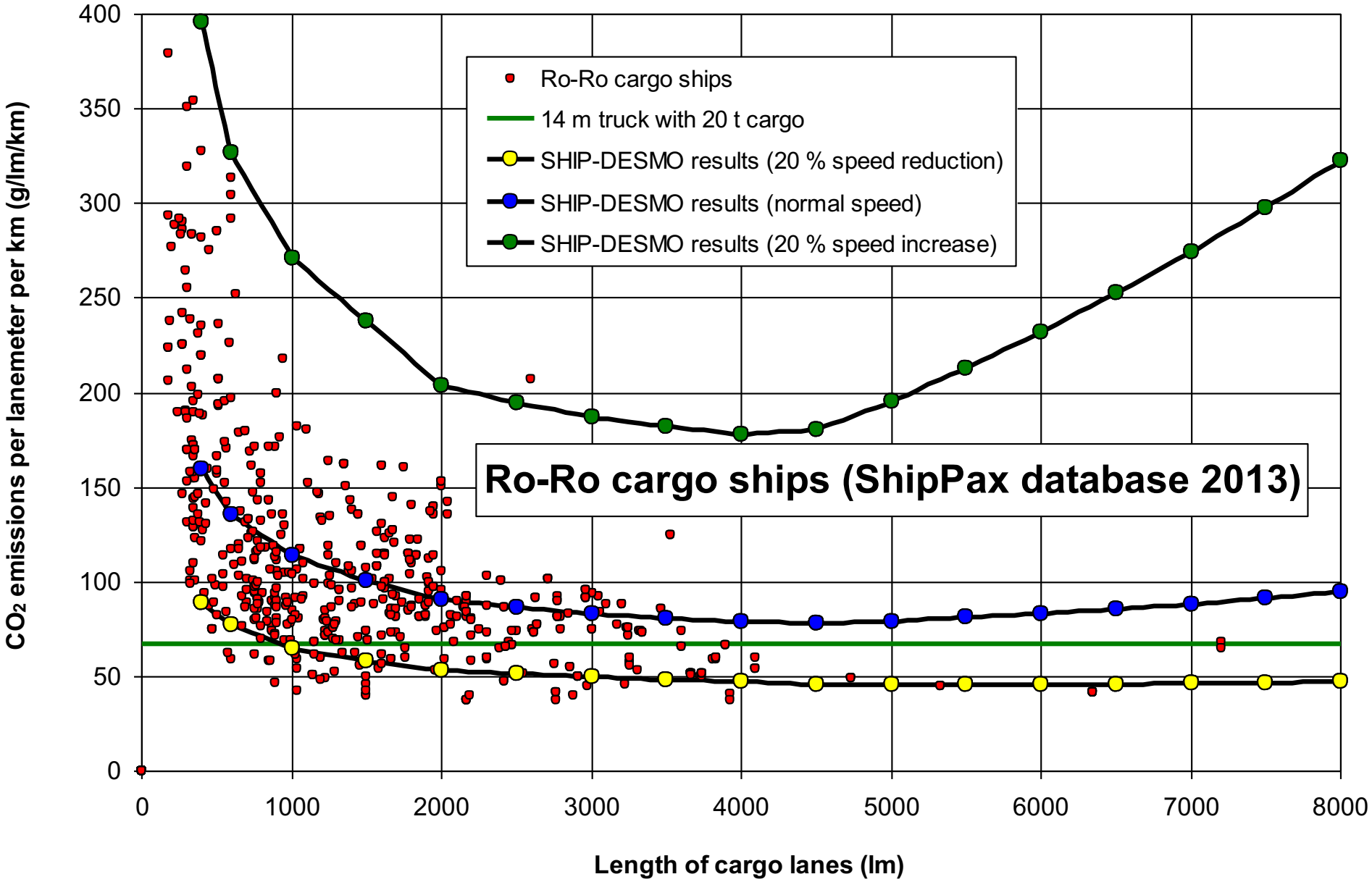
Development of SHIP-DESMO model



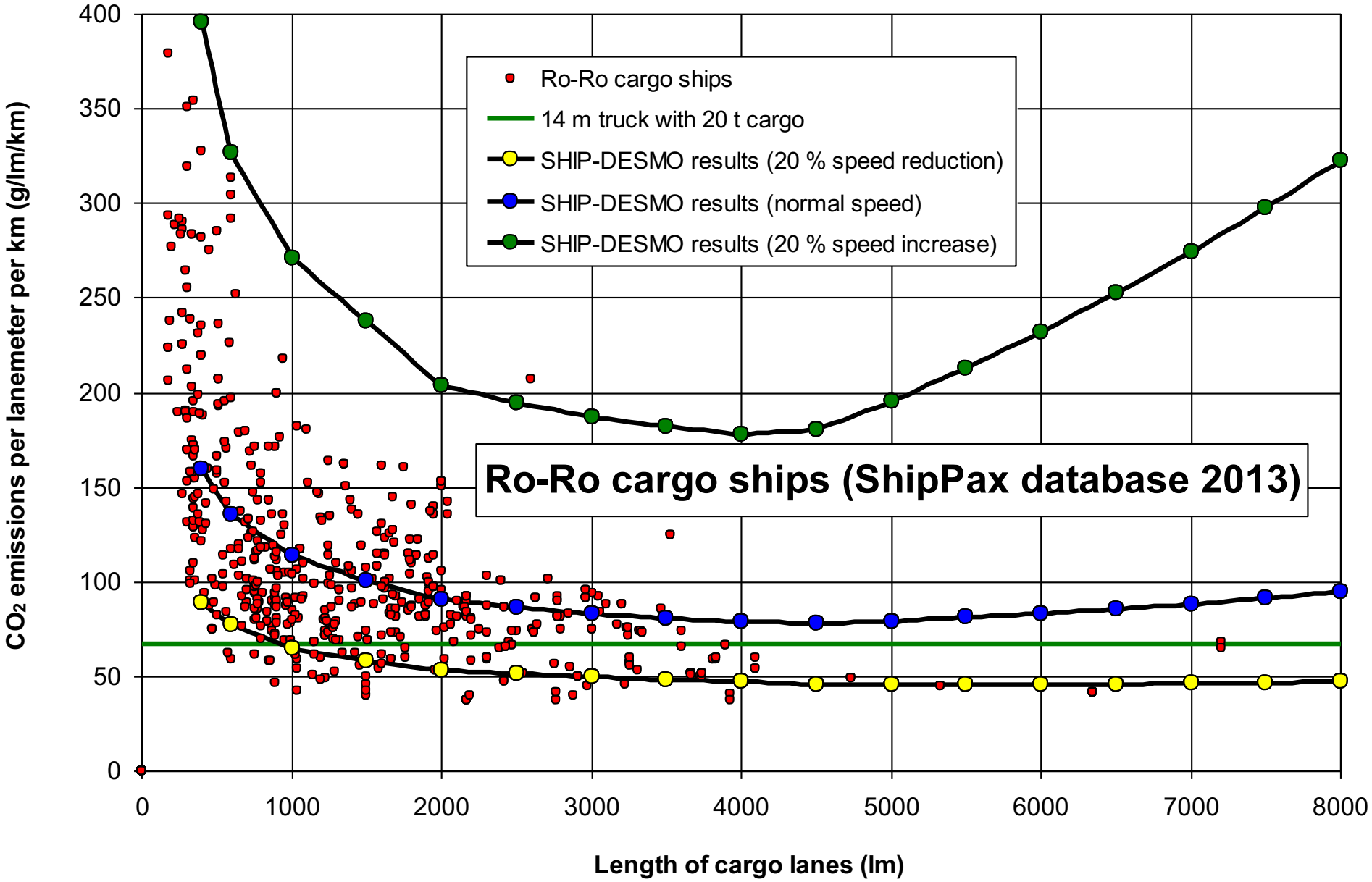
Development of SHIP-DESMO model



Development of SHIP-DESMO model



Development of SHIP-DESMO model



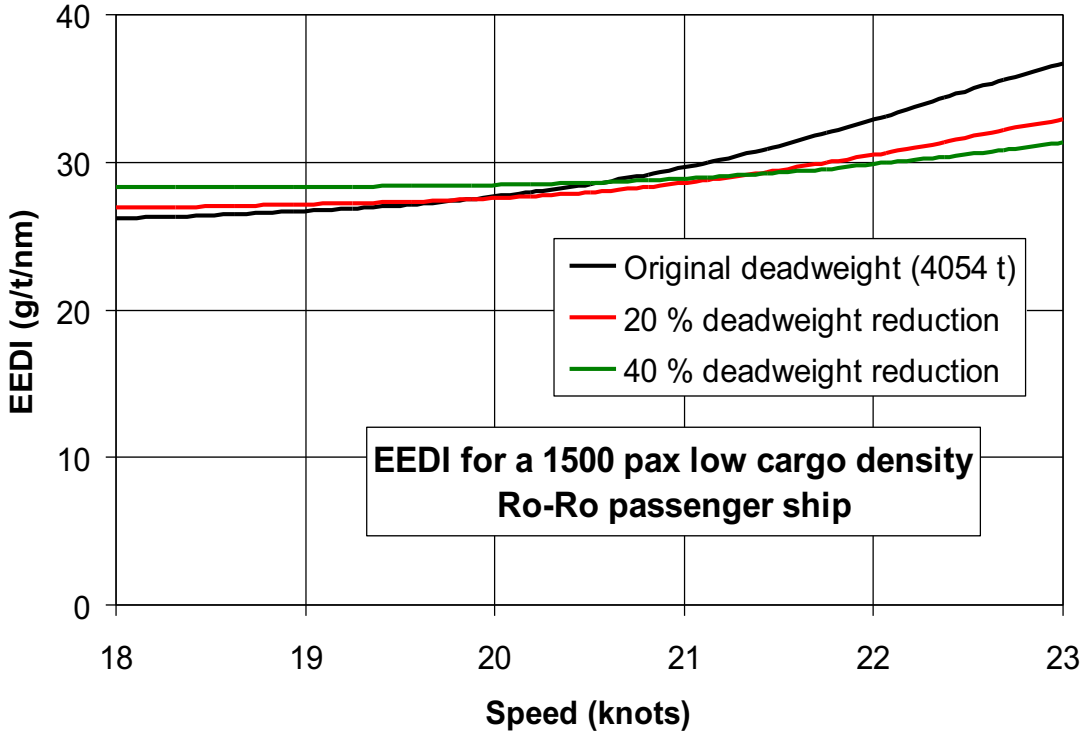
EEDI for Ro-Ro ships MEPC Res. 245(66)

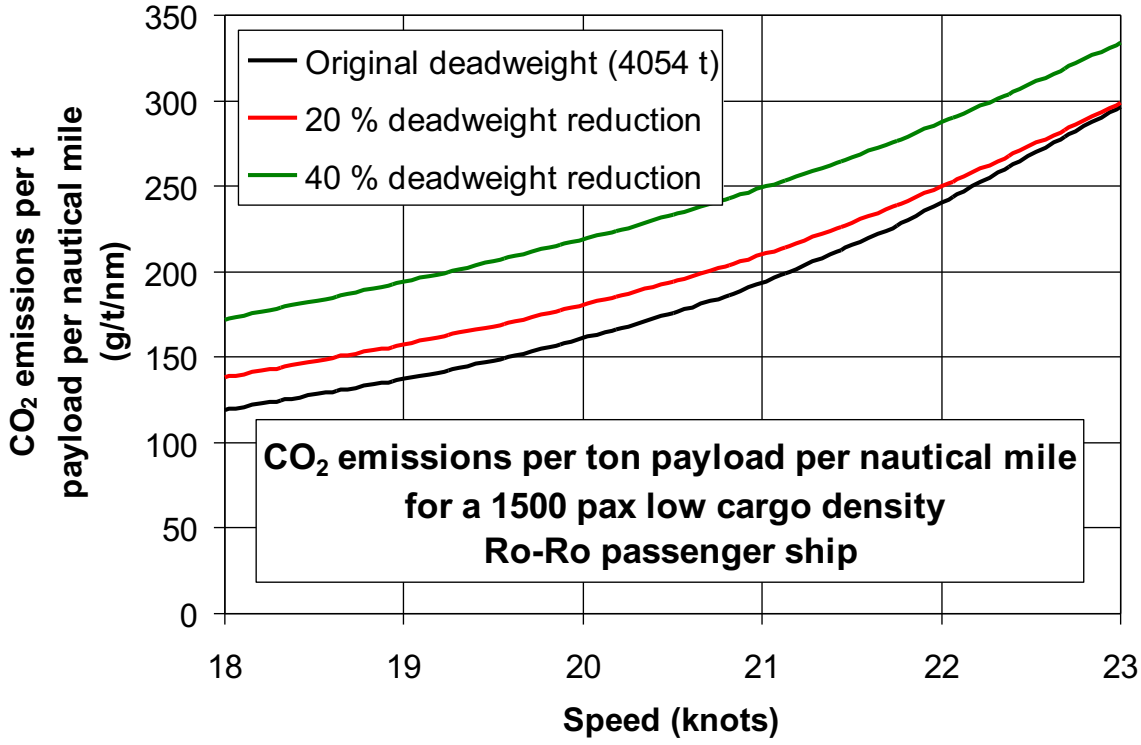
$$\frac{\left(\prod_{j=1}^{n} f_j\right)\left(\sum_{i=1}^{nME} P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)}\right) + \left(P_{AE} \cdot C_{FAE} \cdot SFC_{AE}\ *\right) + \left(\left(\prod_{j=1}^{n} f_j \cdot \sum_{i=1}^{nPTI} P_{PTI(i)} - \sum_{i=1}^{neff} f_{eff(i)} \cdot P_{AEeff(i)}\right) C_{FAE} \cdot SFC_{AE}\right)}{f_i \cdot f_c \cdot f_l \cdot Capacity \cdot f_w \cdot V_{ref}}$$

$$f_{jRoRo} = \frac{1}{F_{n_L}^{\alpha} \cdot \left(\frac{L_{pp}}{B_s}\right)^{\beta} \cdot \left(\frac{B_s}{d_s}\right)^{\gamma} \cdot \left(\frac{L_{pp}}{\nabla^{1/3}}\right)^{\delta}} \quad ; \quad \text{If } f_{jRoRo} > 1 \text{ then } f_j = 1$$

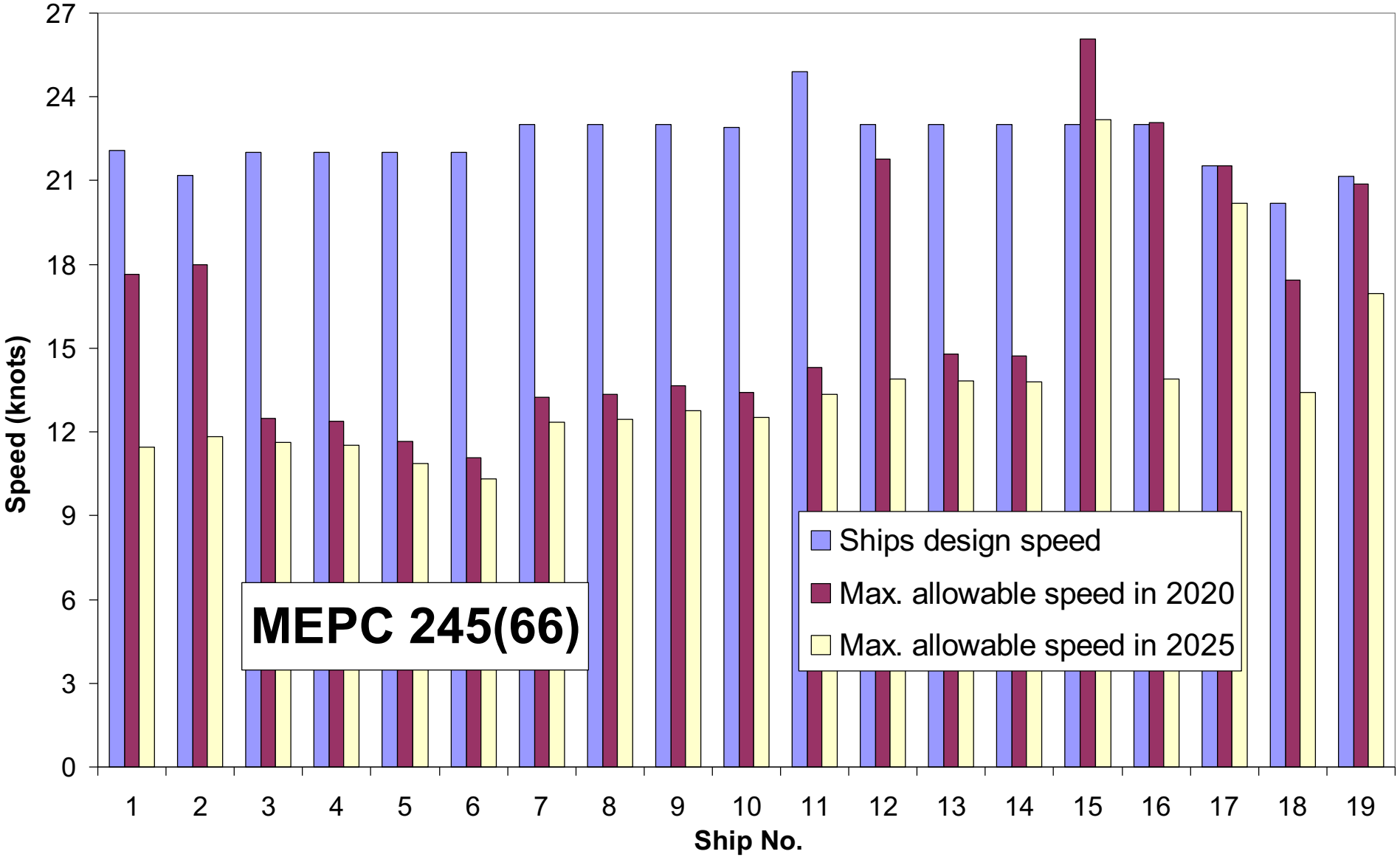
$$f_{cRoPax} = \left(\frac{\left(DWT/_{GT}\right)}{0.25}\right)^{-0.8}$$

Environmental paradoxes of the new EEDI regulation

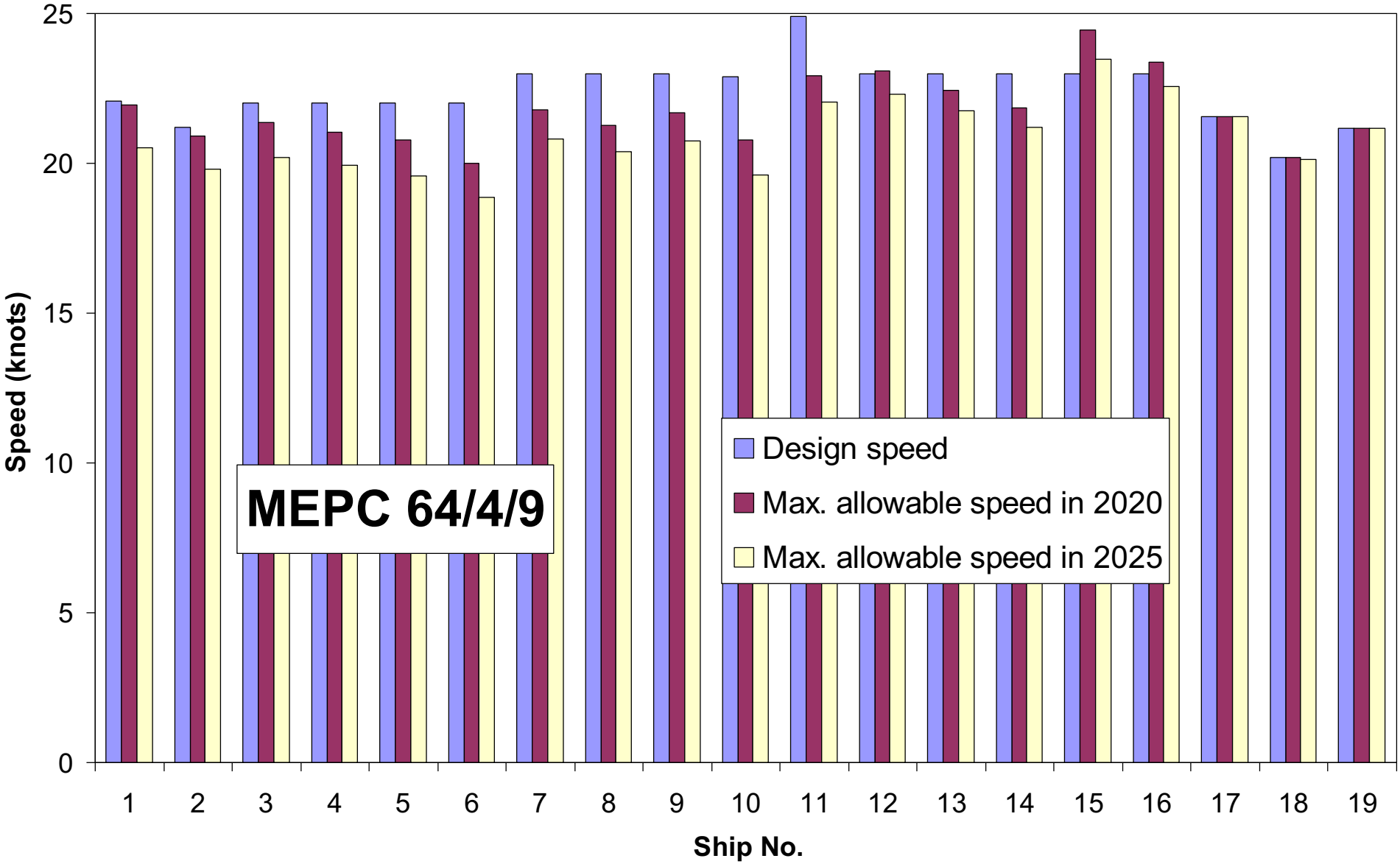




Necessary speed reductions to fulfill the new EEDI demands



Necessary speed reductions to fulfill the new EEDI demands



Thank you

www.roroseca.transport.dtu.dk

hokmarine@mail.dk