

## **An analysis of vessel transits in the Hauraki Gulf and the potential industry impact of speed reduction measures for reducing Bryde's whale mortality from ship strike**

A report to the International Fund for Animal Welfare (4/8/2014) by:

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### **Introduction**

The Hauraki Gulf is home to a year-round resident population (<200 individuals) of Bryde's whales (*Balaenoptera brydei*) that has been listed in New Zealand as a nationally critical species (Baker et al. 2010). Since 1996, the carcasses of 43 Bryde's whales have been found, with vessel collision accounting for 84% (n = 16) of the events for which a mortality cause could be assigned. This high rate of ship-related mortality could pose a risk to the population (Constantine et al. 2012). As a result of this potentially high interaction between Brydes whales and the maritime industry, the Environmental Defence Society convened a workshop of interested parties under the auspices of the Hauraki Gulf Forum, with a goal of identifying measures to reduce fatal collisions between whales and ships. The workshop included shipping industry representatives, the Ports of Auckland, government departments and agencies, iwi and non-governmental organisations.

Constantine et al. (2012) identified reducing ship speed as the most feasible method for reducing vessel strikes to Bryde's whales. This finding is similar to other research suggesting that decreases in vessel speed could reduce the lethality of whale/ship collisions (e.g., Knowlton et al. 1995, Laist et al. 2001, Pace and Silber 2005; Vanderlaan and Taggart 2007, Silber et al. 2010) and that reduction to 10 kts is more effective than higher threshold speeds (NOAA 2008, Wiley et al. 2011a). Such findings led the US National Oceanic and Atmospheric Administration (NOAA) to promulgate vessel speed restrictions of =<10 kts to protect North Atlantic right whales (*Eubalaena glacialis*) along the eastern seaboard of the United States (NOAA, 2008), which have been shown to reduce right whale mortality (Laist et al. 2014). In September 2013, the Ports of Auckland introduced a voluntary protocol for vessels transiting the Hauraki Gulf. This protocol included encouraging ships to travel at speeds not greater than 10 knots. Concerns have been expressed by the maritime community with regards to the impact Hauraki Gulf speed reductions would have upon shipping transit times and industry viability.

Similar concerns were expressed before speed restrictions were introduced for vessels transiting in and out of Boston harbour, MA USA. To address mariner concerns, NOAA staff at the Stellwagen Bank National Marine Sanctuary (SBNMS) devised a method to analyse individual vessel transits to gain a detailed understanding of shipping behaviour and to calculate the additional time required to travel at lower speeds. This analysis showed that impacts were lower than anticipated. In 2012, the mean vessel time lost to be fully compliant was 4 minutes and 45 seconds (n = 1,028). However, this number is influenced by the US speed rule having been in place since 2009 and individualized education materials (Wiley et al. 2011b) having been sent to mariners transiting the area since that time.

To address mariner concerns relative to speed restrictions in the Hauraki Gulf, the International Fund for Animal Welfare (IFAW) commissioned SBNMS staff to undertake a similar analysis of individual vessel transits in the Hauraki Gulf. The goal of this work was two-fold: First, to provide data from a representative sample of vessel transits to identify the likely impact on vessel transit times from introducing speed restrictions. Second, to provide individualized education materials for

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vessels transiting the Hauraki Gulf to improve awareness and diffusion of the Ports of Auckland’s voluntary protocol. These latter materials will be sent out to individual vessels with letters co-signed by IFAW, the Hauraki Gulf Forum, the Department of Conservation, the Ports of Auckland and the Environmental Defence Society, emphasising the ongoing collaborative nature of the Bryde’s whale effort.

## Methods

Automatic Identification System (AIS) data were supplied by Kordia Ltd (curators of the archive for Maritime NZ) for the periods 30 December 2012 – 16 January 2013 and 12 March 2013 - 7 April 2013. An AIS transmitter broadcasts a suite of data that includes time, vessel identification and speed over ground (SOG) as often as every 2 s. Our analysis focused on vessels of greater than 70m, transiting through the central part of the Hauraki Gulf where whales are most common (Riekkola 2013). AIS data identifies a ship’s activity type (e.g., cargo, tanker, passenger) allowing us to partition data by vessel type. Vessel speed was taken from the AIS SOG category. For more information on AIS data see <http://www.imo.org/OurWork/Safety/Navigation/Pages/AIS.aspx>

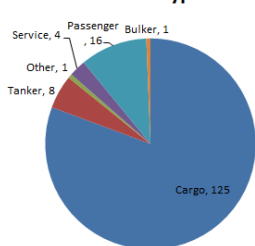
To examine risk to whales, we binned risk into four categories based on vessel speed: Low Risk; <10 kts, Medium Risk; 10.1 – 12 kts, High Risk; 12.1 – 14 kts, and Very High Risk > 14 kts and calculated the percentage of shipping in each category. These general categories are based on data showing that increasing vessel speed results in increased lethality to whales resulting from collision with ships (Pace and Silber 2005, Vanderlaan and Taggart 2007).

To examine transit times and the impact of speed reduction on shipping, we used ArcGIS (ESRI, 2006) to apply a 10 kt. speed reduction to observed ship traffic within the Hauraki Gulf. We then calculated how much time would be lost if the observed ship transited at 10 kts.

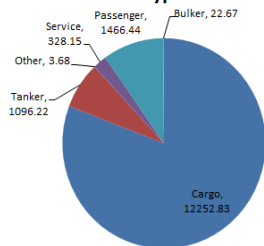
## Results

The analysis used 572 transits made by 155 vessels, travelling a combined total of 15,170 nautical miles. The majority of the ships (n=439) and total miles transited (n=12,253 nm) were cargo vessels (Figures 1 – 3).

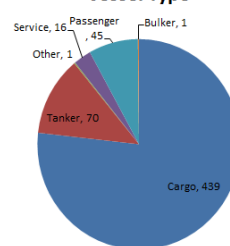
**Figure 1. Number of Vessels by Vessel Type**



**Figure 2. Total NM by Vessel Type**



**Figure 3. Number of Transits by Vessel Type**



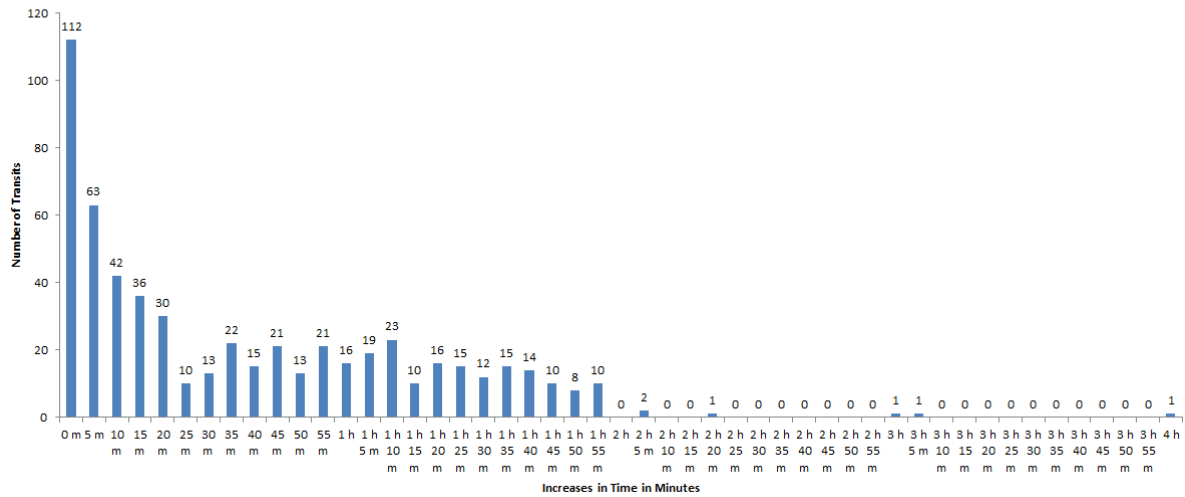
No single vessel transited the Hauraki Gulf at a speed of less than 10 kts for its entire voyage. However, there were a total of 77 transits where speeds did not exceed 10 kts. The greatest percentage of total nautical miles travelled were in the Very High Risk category (39%) followed by the High Risk category (25%). Seventeen percent of the trips were made in the Low Risk category (Table 1).

**Table 1. Percentage of nautical miles travelled and risk posed to whales**

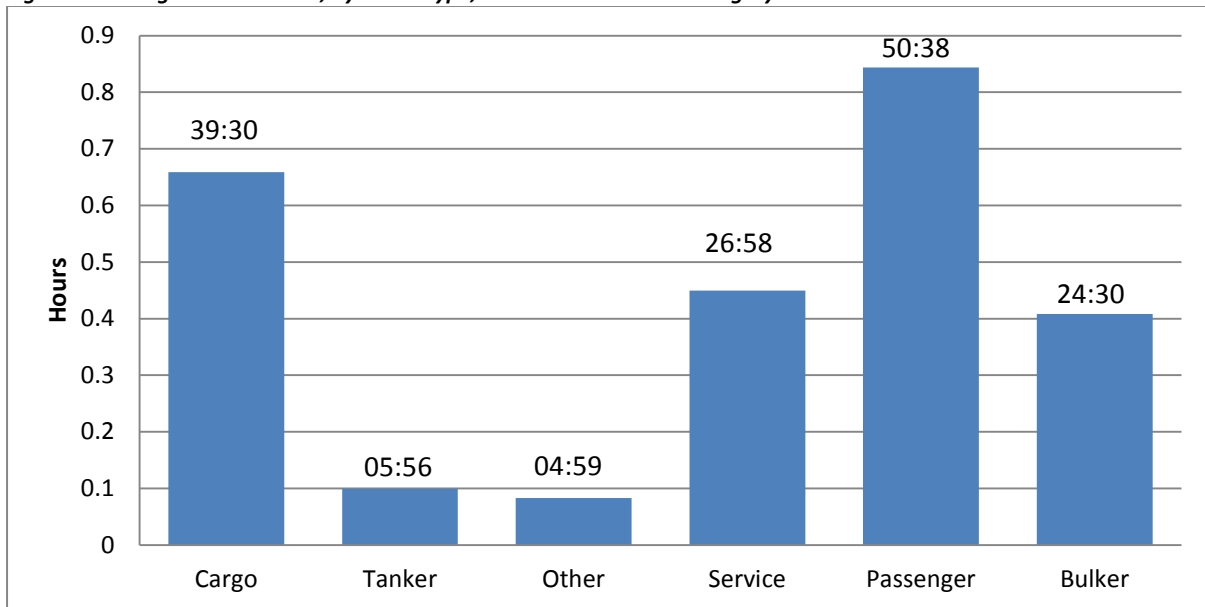
Speed	Risk	Distance (nm)	Percentage of total nm travelled
< 10 kts	Low	2,621.1	17.3 %
10.1 – 12 kts	Medium	2,790.7	18.4 %
12.1 – 14kts	High	3,822.3	25.2 %
> 14 kts	Very high	5,935.9	39.1 %

Reduction to a 10 kt. transit speed (Low Risk) would not equally impact all vessels (Figure 4). Forty-four percent (n=253) of the transits would be increased by 15 minutes or less and 64% (n=365) would increase by less than 1-hour. Transit times for 28% (n= 158) of the trips would be increased by over 1-hour and 1% (n=6) would have transit times increase by over 2-hours. Transit times would be increased most for ships in the passenger and cargo categories (mean increase = ~50 and 40 minutes, respectively) and least for ships in the “other” and tanker categories (mean increases of ~ 5 and 6 minutes, respectively) (Figure 5).

**Figure 4. Increases in Transit Time for Vessels to be Considered Low Risk (Transiting at Less Than 10 Knots Speed) in the Hauraki Gulf**



**Figure 5. Average time increase, by vessel type, to be in the Low risk category**



The analysis also indicated a high proportion of vessels made repeat visits to the Hauraki Gulf, with 43% of vessels making more than two trips. This suggests outreach efforts to individual vessels and notification of measures through the International Maritime Organization could have a high chance of success in raising awareness of voluntary speed restrictions in the Gulf.

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