

The Science & Politics of Reducing Vessel/Whale Collisions

Marine Shipping Working Group
Channel Islands National Marine Sanctuary
Oxnard, CA
29 June 2015

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Office of Protected Resources

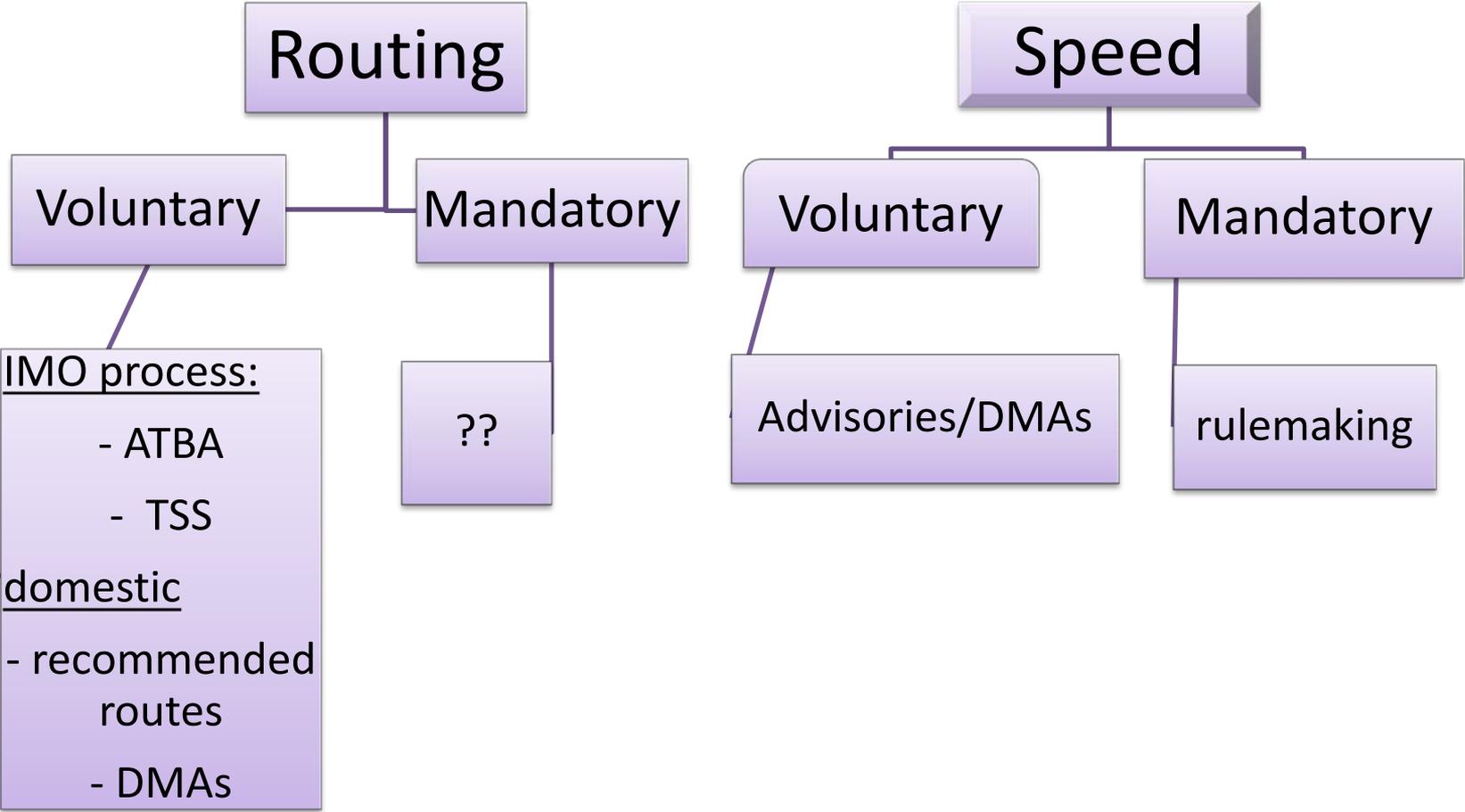


Ships & Whales

- Vessel collisions with whales involves *all* whale species, *all* vessel types/classes, in *all* oceans, and at nearly every major port
- A major threat for a some whale species, e.g., North Atlantic right whales, perhaps others
- Measures have been established in a number of locations to reduce the likelihood of collisions
- The approaches taken and justification for doing so may vary



Tools – Operational Measures --Processes



Ship Strike Reduction Planning

- Establish/justify the need – what is the threat, and why is it a biological threat?
- Establish impact to the shipping industry and others; and the impact to the economics of shipping
- Establish/justify why the measure(s) taken will alleviate the threat



Creating an Area To Be Avoided (ATBA)

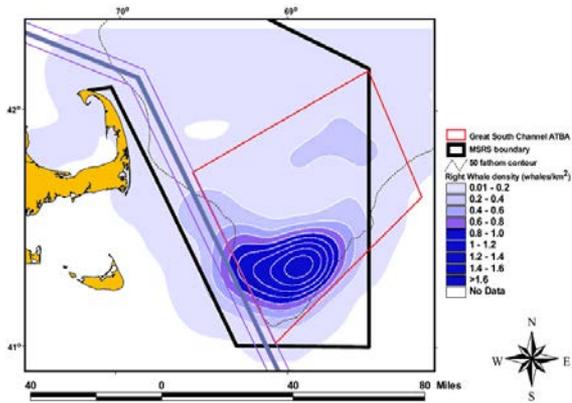


Figure 4. Northern right whale sighting densities (whales/km²) in the Great South Channel during April–July, 1999–2005 shown with the Great South Channel Area To Be Avoided (ATBA) and Mandatory Ship Reporting System (MSRS) boundary.

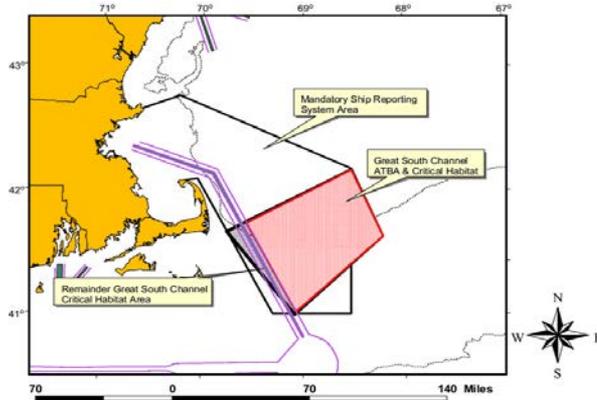


Figure 2. Mandatory Ship Reporting System, proposed Area To Be Avoided (ATBA) and Critical Habitat areas.

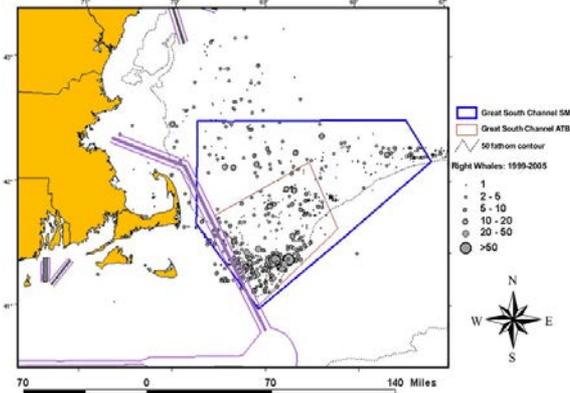
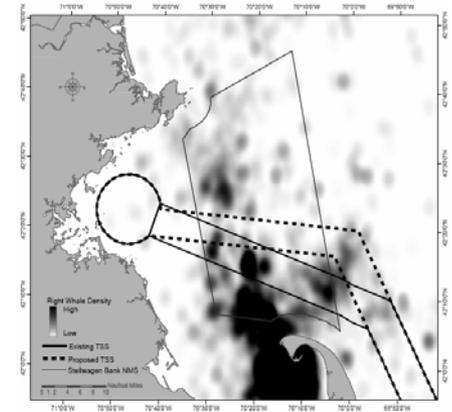


Figure 3. Northern right whale sightings during April–July, 1999–2005 shown with the Great South Channel Seasonal Management Area (SMA) and Area To Be Avoided (ATBA).

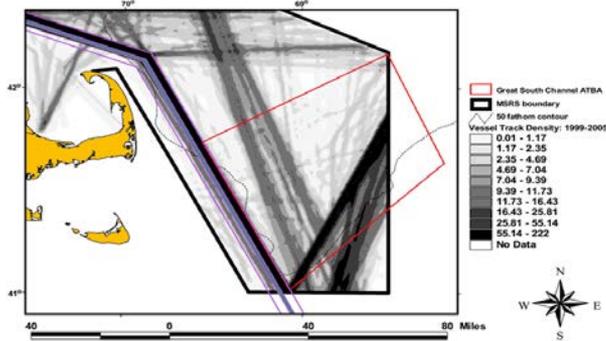


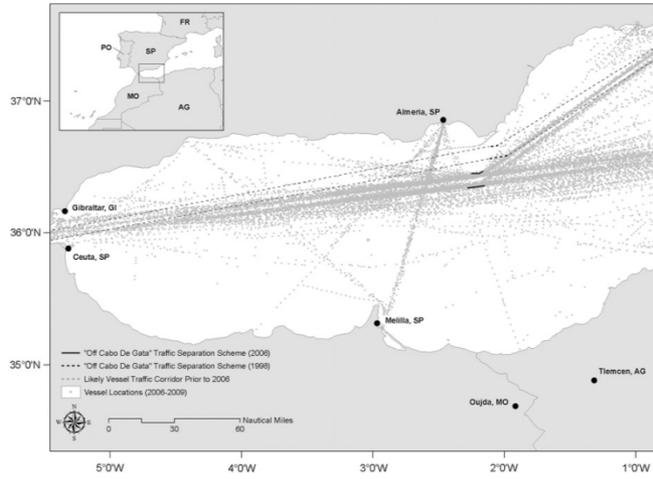
Figure 5. Mandatory ship reporting system (MSRS) boundaries and densities of ship track (km of ship track/km²) through the potential Great South Channel Area To Be Avoided (ATBA) for April–July, 1999–2005.

Large Whale Conservation through IMO Routing Measures

Proposals submitted/adopted by IMO	Member State	NAV	MSC	MEPC	Implemented
Report to MSC-IMO: vessels striking right whales	USA	-	-	June 1997	Information 1997
Mandatory Ship Reporting (MSR): east coast	USA	July 1998	December 1998	-	July 1999
Traffic Separation Scheme (TSS): Bay of Fundy	CANADA	April 2002	December 2002	-	July 2003
Traffic Separation Scheme (TSS): Cabo de Gata	SPAIN	June 2005	May 2006	-	December 2006
Traffic Separation Scheme (TSS) and Recommendatory Speed: Strait of Gibraltar	SPAIN	March 2006	December 2006	-	July 2007
Traffic Separation Scheme (TSS): Boston	USA	July 2006	December 2006	-	July 2007
Recommendatory Area To Be Avoided: Roseway Basin	CANADA	April 2007	October 2007	-	May 2008
Traffic Separation Scheme (TSS): Boston	USA	March 2008	July 2008	-	June 2009
Recommendatory Area To Be Avoided: Great South Channel	USA	March 2008	December 2008	-	June 2009
Guidance document: Measures to reduce ship strikes with cetaceans	USA			August 2008	Information July 2009

Silber, Vanderlaan, Tejedor Arceredillo, Johnson, Taggart, Brown, Bettridge, and Sagarminaga. 2012. **Role of the International Maritime Organization in large whale vessel strike reduction: processes, measures and effectiveness.** Marine Policy 36:1221-1233.

Large Whale Conservation through IMO Routing Measures



North Atlantic right whales are Endangered

Right Whales in Atlantic Canada
Right whales are found in the waters of Atlantic Canada from June through December. Their range extends from their calving habitat on the lower Bay of Fundy to the southern Bering Sea in the summer and the western coast, with occasional sightings in the Gulf of St. Lawrence.

Grand Marine Basin
Area and proposed other routes

NOVEMBER 2010
Basin Area to be avoided for ships of 100 gross tonnage and seaward during the period of low energy (1 December to 15th Dec 2010).

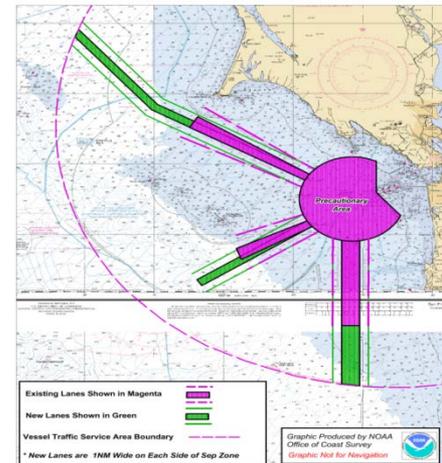
Basin Area
Area to be avoided

Map to be used for compliance for Canadian navigational service charts 4401 (200) (Atlantic), 4411 and 4412.

Right whales are injured or killed by collisions with vessels and entanglement in fishing gear.

If you see a right whale, be careful that there may be more in your vicinity and call 800-487-6267. The ship observing the whales will get help at your own expense (except if you are a reporter, photographer or media crew) contact the Canadian Coast Guard (1-800-461-1111) or VHF 16, Traffic VHF 14 or Environmental Emergencies 1-800-461-1111.

Your help is greatly needed and appreciated.



Reducing Ship Strikes of North Atlantic Right Whales

- At that time... population size of 300-350 right whales; 1-2 *known* ship strikes deaths per year



- The Need: therefore, quite strong justification for action
- Developed a long-term, range-wide strategy to reduce ship strikes of right whales, involving a number of approaches, while also minimizing adverse impacts to ports and shipping industry...
 - Evaluated 100s of options
e.g., post lookouts, daytime-only transits, guide boats, routing changes
 - Quantified right whale occurrence, distribution, seasonality – all of which were quite well known
 - Weighed conservation value
 - Weighed economic effects
 - focused on minimizing impact to industry in time and space
 - Recognized quickly: there are limited tools in the toolbox:
 - education/outreach – of course
 - Routing – the best; separate ships/whales
 - Speed – if need be; when other options limited

The plan:

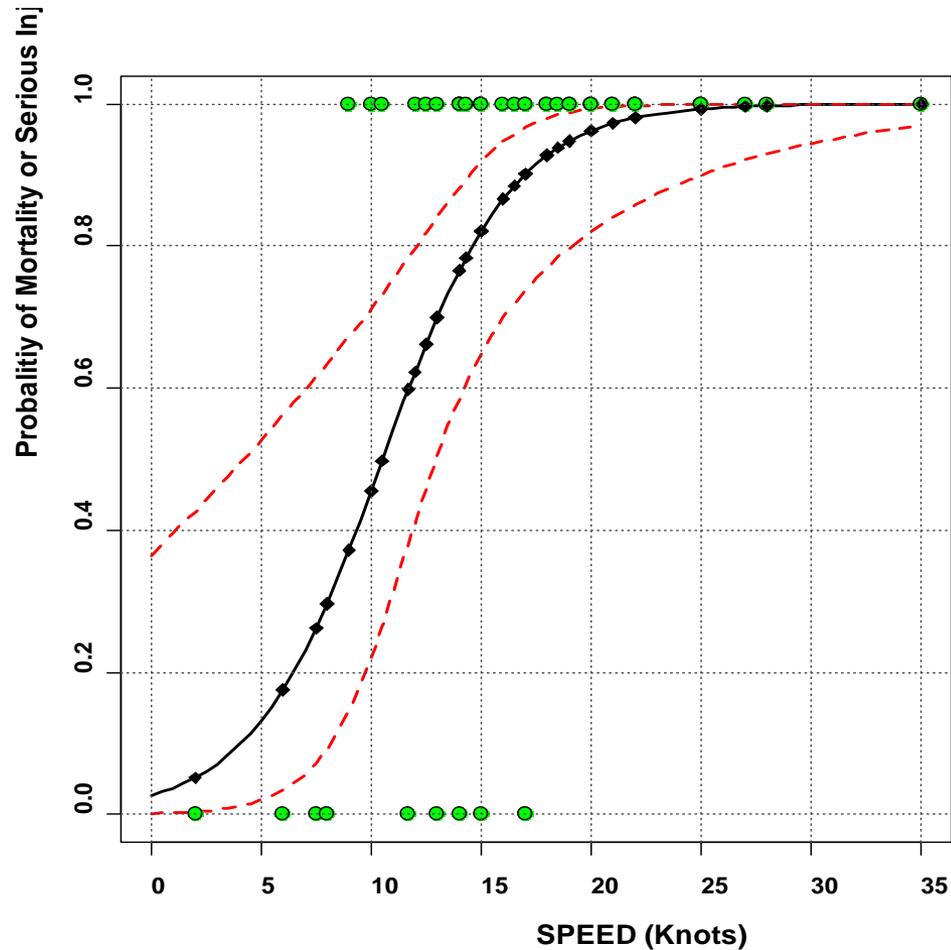
- Continue ongoing ship strike reduction measures, including research on technologies
- Develop/maintain mariner education & outreach programs
- Federal agency under Endangered Species Act Section 7 consultations
- New *vessel operational measures*, such as routing measures and speed restrictions

Reducing Ship Strikes of North Atlantic Right Whales



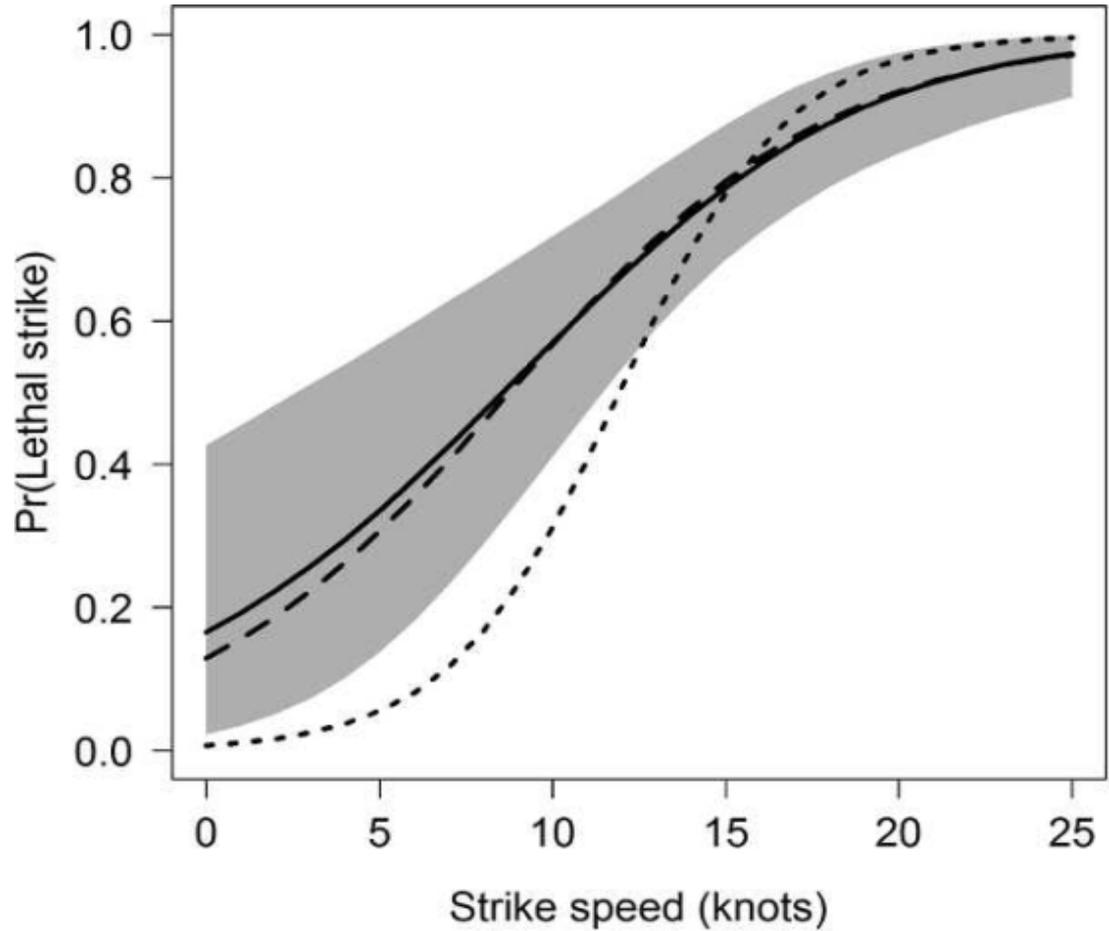
The Need for Speed...

Studies on vessel speed:
Laist et al.;
Pace & Silber; Vanderlaan
& Taggart



- All large whale species
- known (a) speed of vessel, (b) fate of whale
- sample = abt 50

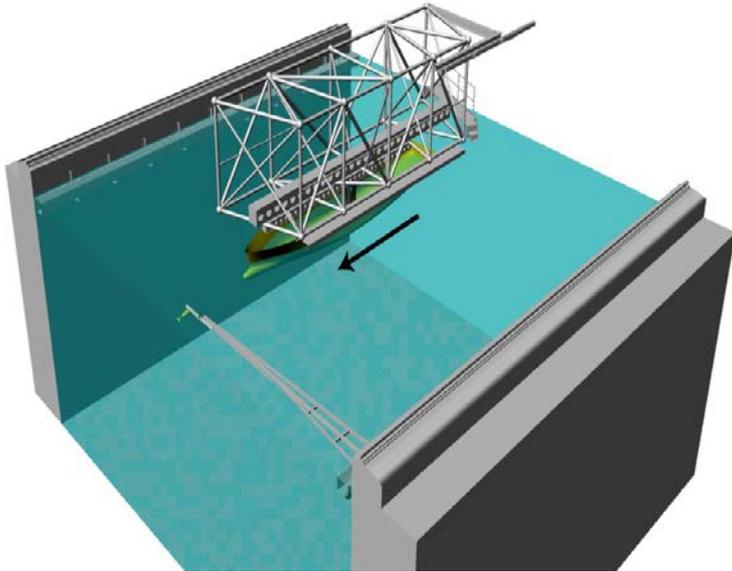
Relation between Ship Speed and Whale Fatalities



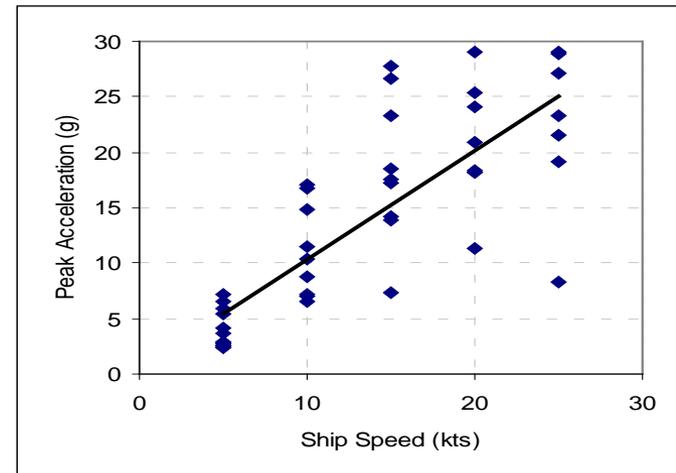
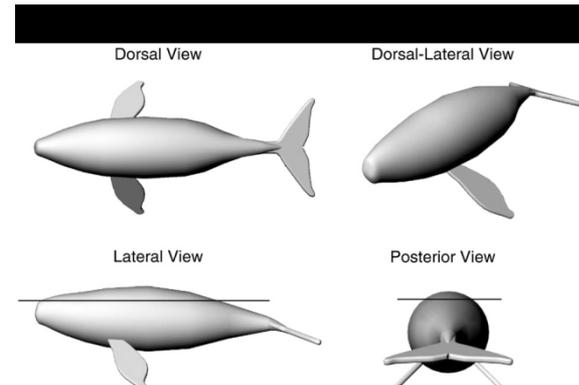
Updated curves:
sample now abt 90+
cases

Conn, & Silber. 2013. Vessel speed restrictions reduce risk of collision-related mortality for North Atlantic right whales. *Ecosphere*

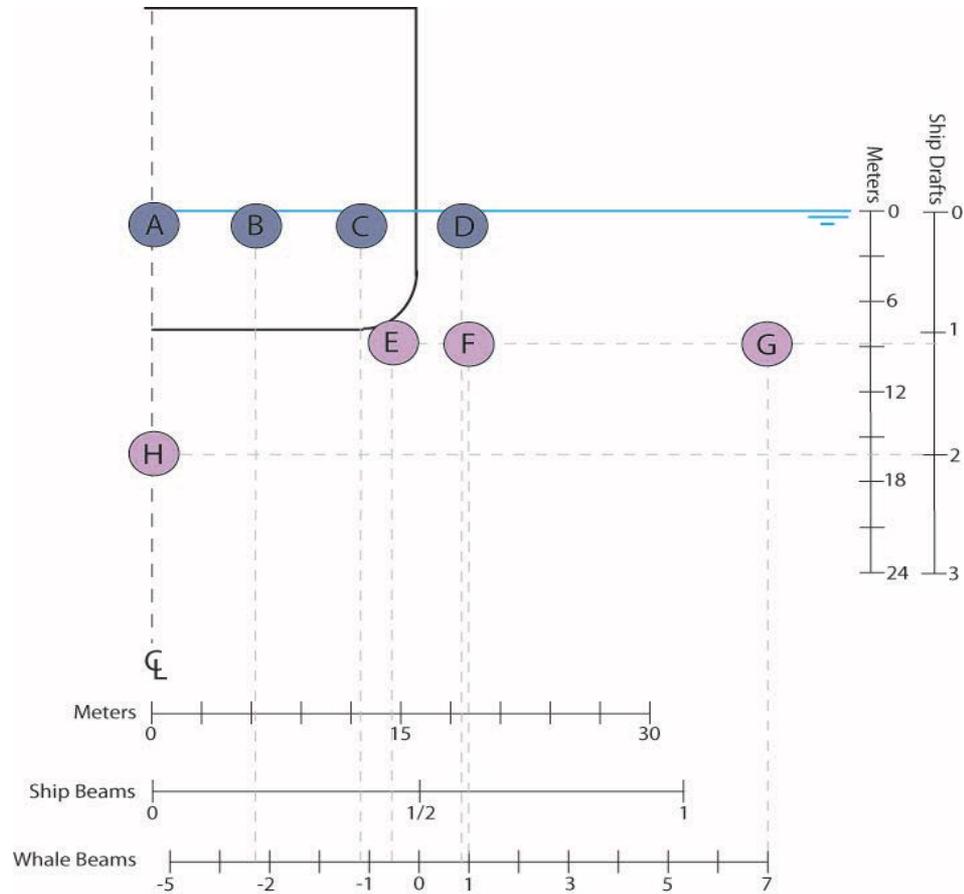
Experimental studies of vessel hydrodynamics



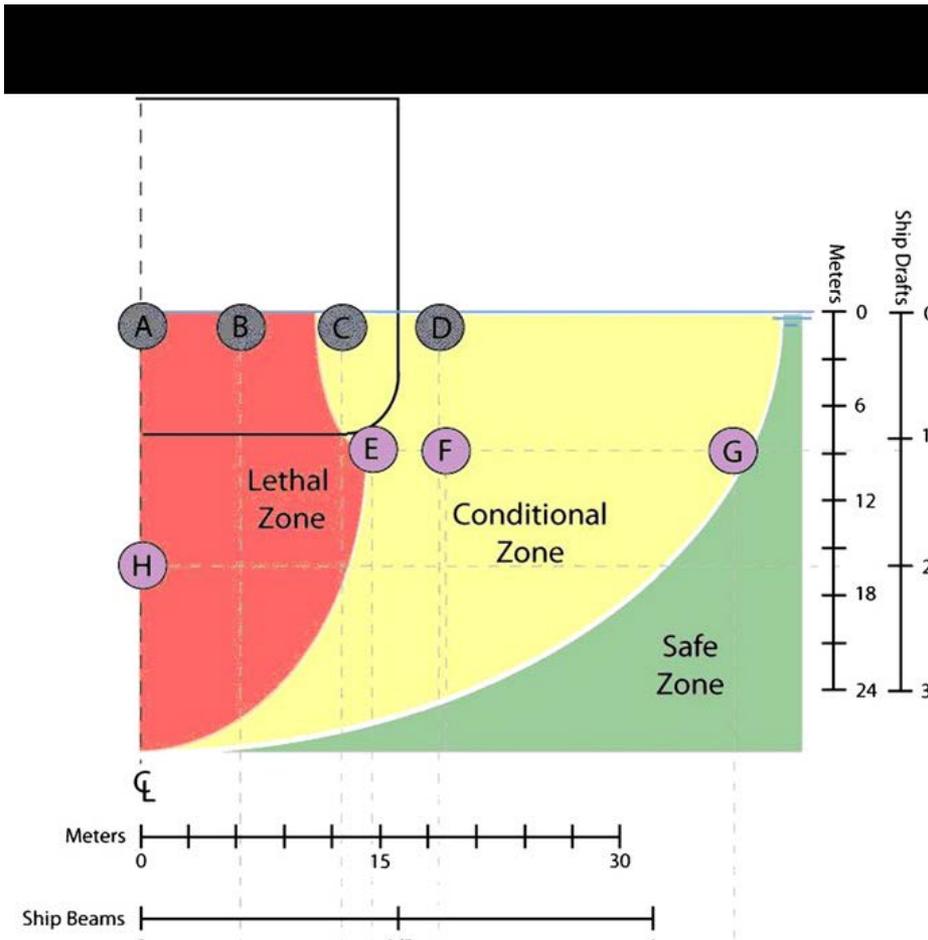
Silber, Slutsky & Bettridge. 2010. Hydrodynamics of a ship/whale collision. *Journal of Experimental Marine Biology and Ecology* 391:10-19.



Experimental studies of vessel hydrodynamics



Experimental studies of vessel hydrodynamics



Baleen whale biology

bowhead & right whales

vs.

Fin, blue, minke, humpback
etc. whales

- the former float; the latter
sink at rest



Vessel Speed Restrictions to Protect Right Whales

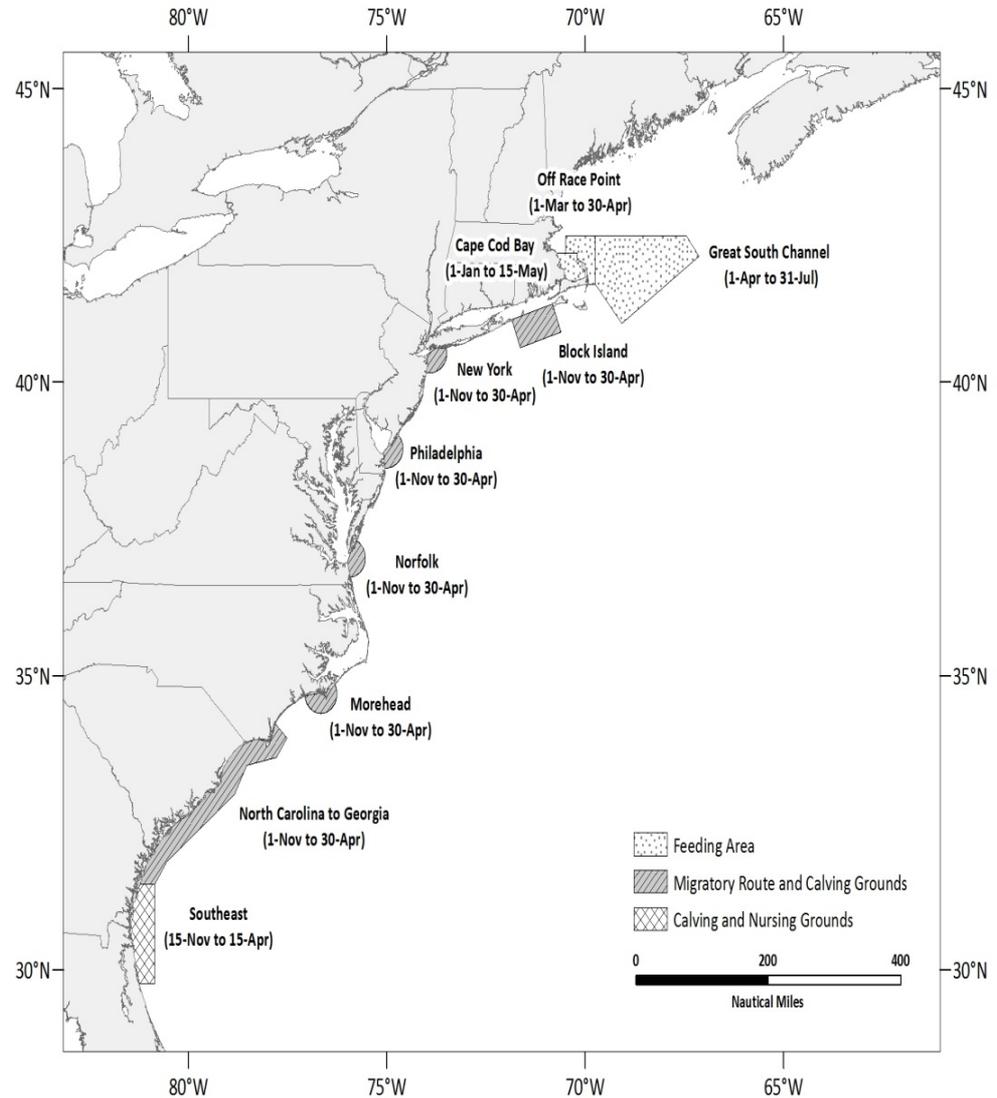
all vessels >65 feet in length

required to travel 10 knots or less in Seasonal Management Areas (SMA)

SMA = areas where co-occurrence of vessels-whales would be the highest

promulgated *domestically*, under the ESA/MMPA as a matter of *port entry*

note: 300 gt; 65 feet



Vessel Speed Restrictions: Process

- 1 June 2004: NMFS published an *Advanced Notice of Proposed Rulemaking* (69 FR 30857) regarding vessel speed restrictions and other measures to reduce the likelihood of deaths and serious injuries to endangered North Atlantic right whales from collisions with vessels.
- 26 June 2006: NMFS published *proposed rule* (71 FR 36299) to establish vessel speed restrictions to protect right whales.
- 10 October 2008: NMFS published a *final rule* ([73 FR 60173](#)) that established a ten-knot vessel speed restriction for vessels 65 feet or greater in length in certain locations and at certain times of the year along the east coast of the United States.
 - The rule included a navigational safety exception to account for severe wind and sea conditions; and
 - a December 2013 “sunset” provision.
- 6 June 2013: NMFS published a proposed rule (78 FR 34024) to eliminate the 2008 regulation’s sunset provision.
- 9 December 2013: NMFS published a final rule ([78 FR 73726](#)) that removed the sunset provision.

Are they working?

Right Whale Vessel Speed Restrictions: *Effectiveness*

- **No** vessel strike-related right whale deaths reported in or near active SMAs since the rule went into effect
 - The current period (5-6 yrs) without strikes is nearly twice the longest interval between subsequent known vessel collision fatalities in these same areas in an 18-year period prior to adoption of the rule

Laist, et al. 2014. Effectiveness of mandatory vessel speed limits for protecting North Atlantic right whales. *Endangered Species Research*

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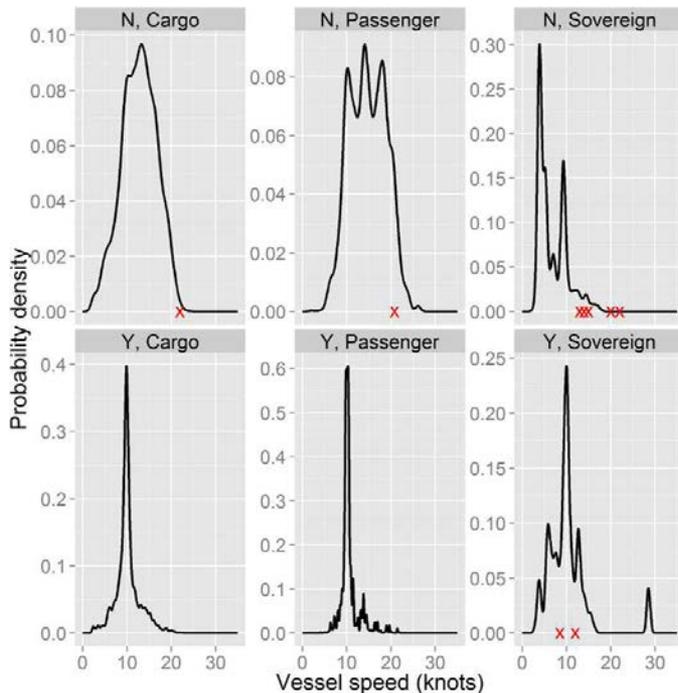
- Estimated ship strike risk was 86% lower in periods when speed limits were in effect vs. when they were not

Conn, & Silber. 2013. Vessel speed restrictions reduce risk of collision-related mortality for North Atlantic right whales. *Ecosphere*



Vessel Speed and Risk Reduction

Vessel AIS data were used to track vessel operations from 9 December 2008 to 31 July 2012, using *actual* speeds

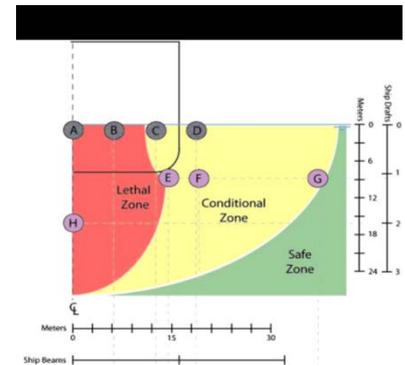


- Concluded that risk reduction was 80% for the first 2 years of vessel speed restrictions, and closer to 90% for the final 2 years of regulation.
- Over all years and comparing risk between periods when regulations were in effect versus periods when they were not, there was an 86% reduction in risk of fatal strike.

Conn & Silber. 2013. Vessel speed restrictions reduce risk of collision-related mortality for North Atlantic right whales. *Ecosphere* 4:43.

Vessel Speed and Risk Reduction

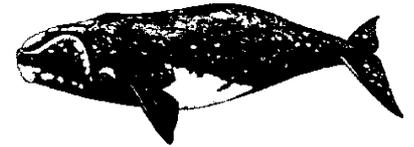
- **Why** do reduced speeds reduce the probability of a fatal strike – dunno
 - But, data certainly support that it is an effective measure
 - Impact (g-force) probably differs little at various speeds
 - “allows whales to get out of the way” – no evidence for this
 - Whales are likely oblivious when in engaged in certain behavior
 - Ships are not a known predator
 - Whales respond to ship noise – perhaps not likely
 - Like crossing a busy highway, at night



Compliance with (& monitoring & enforcement of) Vessel Speed Restrictions

- We assessed **four** notification/enforcement programs:
 - 1 program by the USCG;
 - 2 by NMFS enforcement;
 - 1 by NMFS Protected Resources

 - 3 programs involved notification;
 - 1 involved fines/citations
-
- Using AIS we: tracked operations of >200,000 *trips* by >8,000 *individual ships* in vessel speed Seasonal Management Areas, November 2008 and August 2013 to assess:
 - compliance; and
 - the influence of notification & enforcement programs in improving compliance



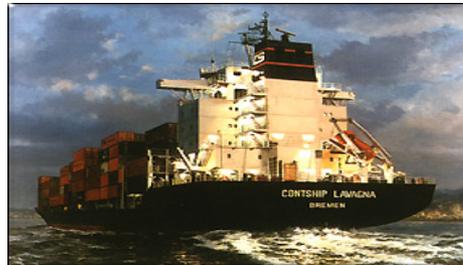
Systems used to notify mariners of the December 2008 vessel speed restrictions

**** these are required for sailing in U.S. waters**

- **** U.S. Coast Pilot.** Issued by NOAA in nine regional volumes and updated and published annually, the *Coast Pilot* is a key navigational aid that contains precautionary notices, information on navigational hazards, voyage planning, and related data that are vital to safe navigation. Carrying the U.S. *Coast Pilot* and knowledge of the information contained therein is mandatory for all vessels traveling in U.S. waters.
- **** Maritime Broadcasts.** USCG Broadcast Notice to Mariners (marine radio broadcasts), Local Notice to Mariners (updated weekly and distributed electronically), NOAA maritime weather broadcasts, and notifications on NOAA Weather Buoy websites. These are key sources of information frequently consulted by prudent mariners sailing in U.S. waters
- **International Sailing Publications.** The National Geospatial Intelligence Agency's *Notice to Mariners* and *Sailing Directions*, and to the United Kingdom's *Admiralty Publications*. Updated and published annually, these international guidance documents are distributed broadly and are considered essential guides for mariners on international voyages.
- **** Nautical Charts.** The management zones, their timing, and applicable restrictions were noted on printed nautical charts, a mainstay for navigational safety.
- **** Mandatory Ship Reporting systems.** Under these systems, mariners are required, as a matter of port entry into U.S. ports, to report to a USCG shore-station when entering two key right whale aggregation areas (see Ward et al. 2005 for a description). Ships are then sent an automated message with whale locations and ways to reduce vessel strikes, including information about speed restrictions.
- **Informational Brochures.** Laminated two-page compliance guides distributed and posted on web sites. An estimated 3,000 guides were distributed by the USCG, port authorities, pilots, shipping industry liaisons, and others. http://www.nmfs.noaa.gov/pr/pdfs/shipstrike/compliance_guide.pdf
- **Captain and Crew Training Material.** A merchant mariner training curriculum designed primarily for maritime academies. Training through these academies is essential for those seeking captain's licenses or upgrades to their license and the ship strike reduction curriculum is required in most U.S. academies. *Interactive CD-ROMs.* Captain and crew interactive training compact discs and "Right Whale Protection Program" notebooks were also developed. An estimated 2,500+ CDs and over 550 notebooks were distributed at no cost to the user.
- **Electronic Distribution Lists.** NMFS maintained electronic mail distribution lists for the shipping industry (containing several hundred recipients). Similar distributions were made via electronic mail lists (also containing owners and operators of several hundred vessels) maintained by industry associations, whereby their member companies were notified.
- **Agency and Company Information Dissemination.** Electronic mail notices were periodically and routinely distributed by the U.S. Maritime Administration (MARAD) to its entire fleet of 5,000+ domestically-flagged vessels. MARAD maintains or has jurisdiction over these commercially-operated material transport and cargo vessels that are pressed into service in time of war or national emergency as naval auxiliaries. A similar number of vessels were routinely notified about the requirements by Lloyds Registry.
- **Popular Press.** Press releases issued and numerous stories appeared in industry trade journals, local and national newspapers, and in radio spots.

Monthly Summaries of Vessel Operations

- ❖ in collaboration with the World Shipping Council, Chamber of Shipping of America association members we developed a voluntary program whereby ship operations summaries were sent *directly to shipping company officials*
- ❖ AIS-data derived information
- ❖ spreadsheets sent monthly that contained information on *every* vessel transit within active SMAs (regardless of whether the trip was compliant)
- ❖ 17 shipping companies ~ 400 ships
- ❖ began in December 2010 -- once per month to present



Monthly Summaries of Vessel Operations in Speed Zones

Association	Company	MMSI	Vessel Name	SMA	Entry Time	Exit Time	Distance(nm) in SMA	Avg Speed(kts)	Min Speed(kts)	Max Speed(kts)	Distance(nm) > 10 kts	Distance(nm) > 12 kts
WSC	CMA-CGM	212865000	Cma Cgm Matisse	North Carolina to Georgia (Migratory Route and Calving Grounds)	12/26/2014 17:15	12/26/2014 22:09	24.5	5.1	0.7	10	0	0
WSC	CMA-CGM	212865000	Cma Cgm Matisse	North Carolina to Georgia (Migratory Route and Calving Grounds)	12/27/2014 14:03	12/27/2014 16:38	25	9.7	8.8	10.2	1.1	0
WSC	CMA-CGM	212865000	Cma Cgm Matisse	Philadelphia (Migratory Route and Calving Grounds)	12/28/2014 20:01	12/28/2014 22:07	19.5	9.4	4.3	10.1	0.4	0
WSC	CMA-CGM	228313800	Cma Cgm Figaro	Norfolk (Migratory Route and Calving Grounds)	12/14/2014 16:05	12/14/2014 18:02	18.8	9.7	8.9	9.9	0	0
WSC	CMA-CGM	228313800	Cma Cgm Figaro	North Carolina to Georgia (Migratory Route and Calving Grounds)	12/15/2014 15:18	12/15/2014 18:05	25.6	9.1	7.9	9.8	0	0
WSC	CMA-CGM	228313800	Cma Cgm Figaro	North Carolina to Georgia (Migratory Route and Calving Grounds)	12/17/2014 9:10	12/17/2014 11:32	25.1	10.6	8.8	14.1	8.6	6.7
WSC	CMA-CGM	235052035	Cma Cgm White Shark	Southeast (Calving and Nursing Grounds)	12/17/2014 6:11	12/17/2014 9:40	33.2	9.9	7.6	12.5	4.4	4.4
WSC	CMA-CGM	235052035	Cma Cgm White Shark	Southeast (Calving and Nursing Grounds)	12/18/2014 7:23	12/18/2014 10:43	29.9	9.1	8.3	12.8	2.5	0.2
WSC	CMA-CGM	235052035	Cma Cgm White Shark	North Carolina to Georgia (Migratory Route and Calving Grounds)	12/19/2014 0:53	12/19/2014 3:17	18.9	11.6	7	16.5	11.6	11.3

Compliance with Vessel Speed Restrictions

Notice of Violation and Assessment of Civil Penalties (NOVA) and fines – GCEL

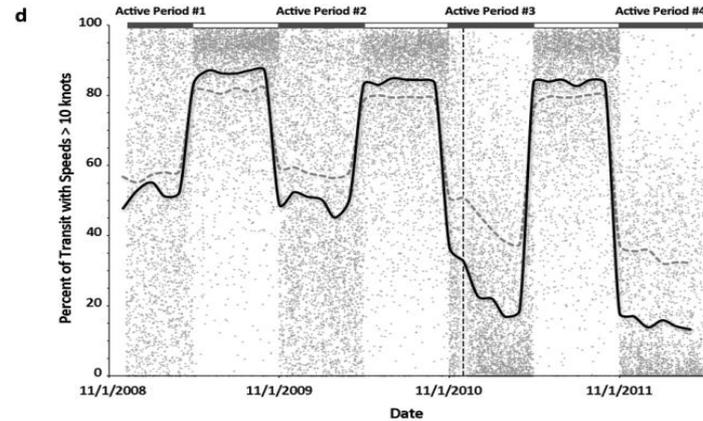
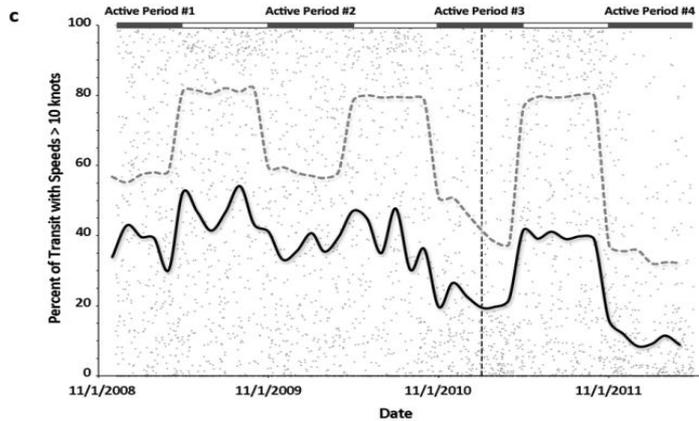
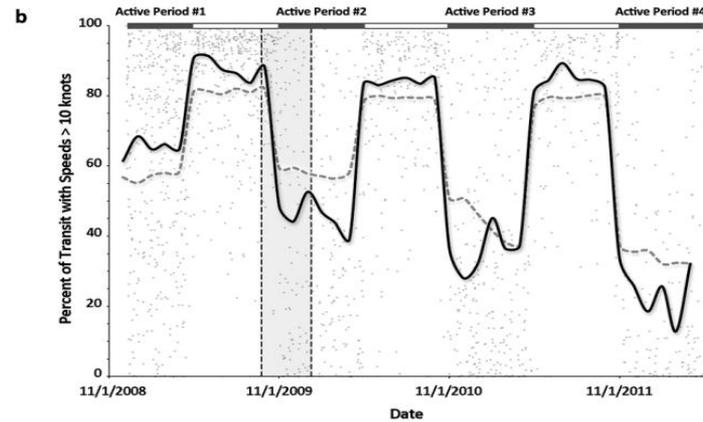
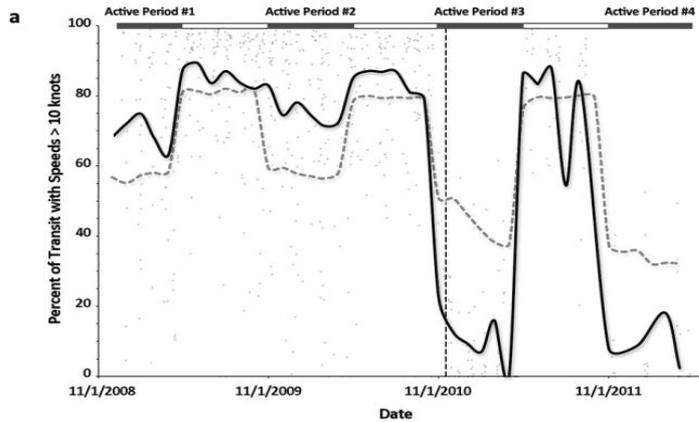
- total of **28** NOVAs issued between Nov 2010 and Sept 2012, in **6** batches:
- **November 2010 (n=7)** (*the onset of season 3*); December 2010 (n=2); in November 2011 (n=8); July 2012 (n=1); August 2012 (n=3); September 2012 (n=7)



We quantified compliance using two metrics:

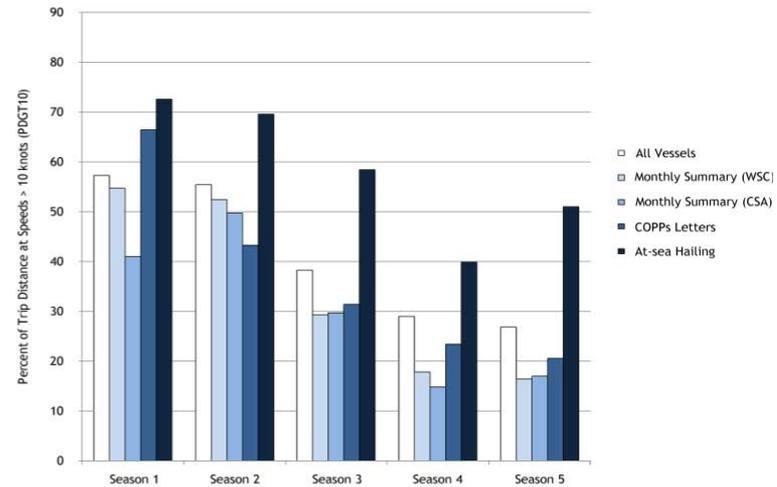
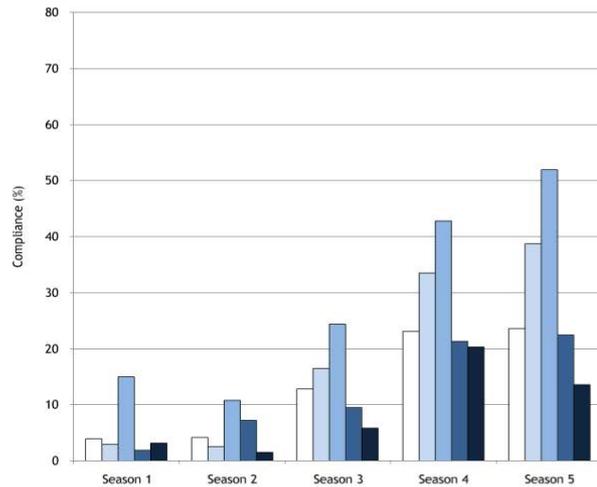
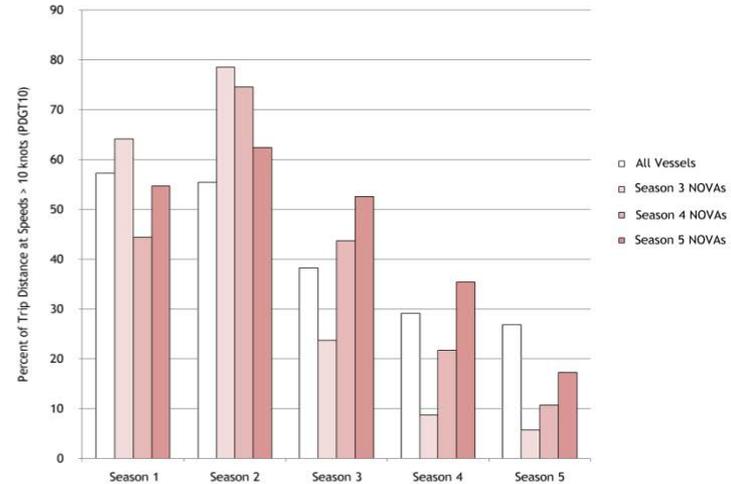
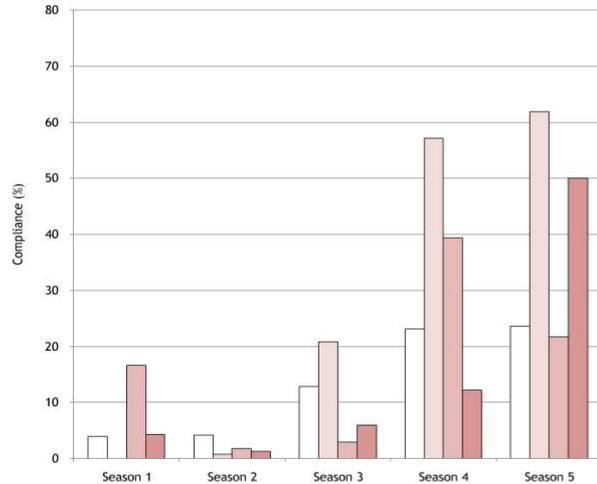
1. “*strict compliance*” = ≤ 10.0 knots
2. *PDGT10* = percentage (distance) of a given trip over 10 knots
 - more descriptive than a *mean* speed
 - not influenced by changes in speed or slow portions of trips (*i.e.*, more data points fast portions of trips)

Ship Speed Rule Compliance



Silber, Adams, & Fannesbeck. 2014. Compliance with vessel speed restrictions to protect North Atlantic right whales. PeerJ 2:e399 <http://dx.doi.org/10.7717/peerj.399>

Compliance and PDGT10 rates, years 1 thru 5

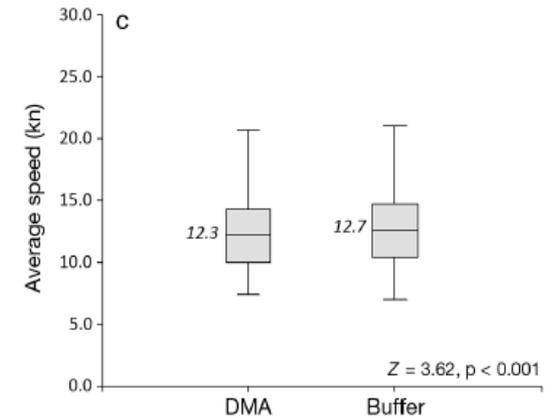
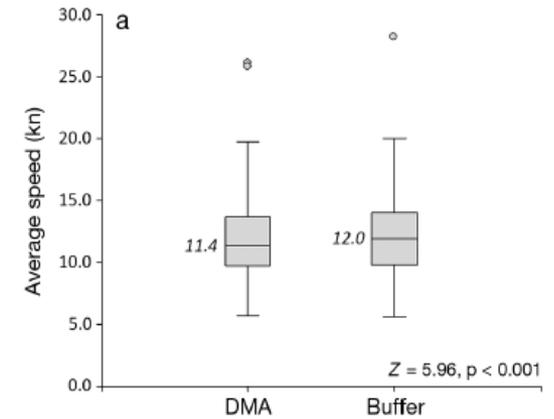
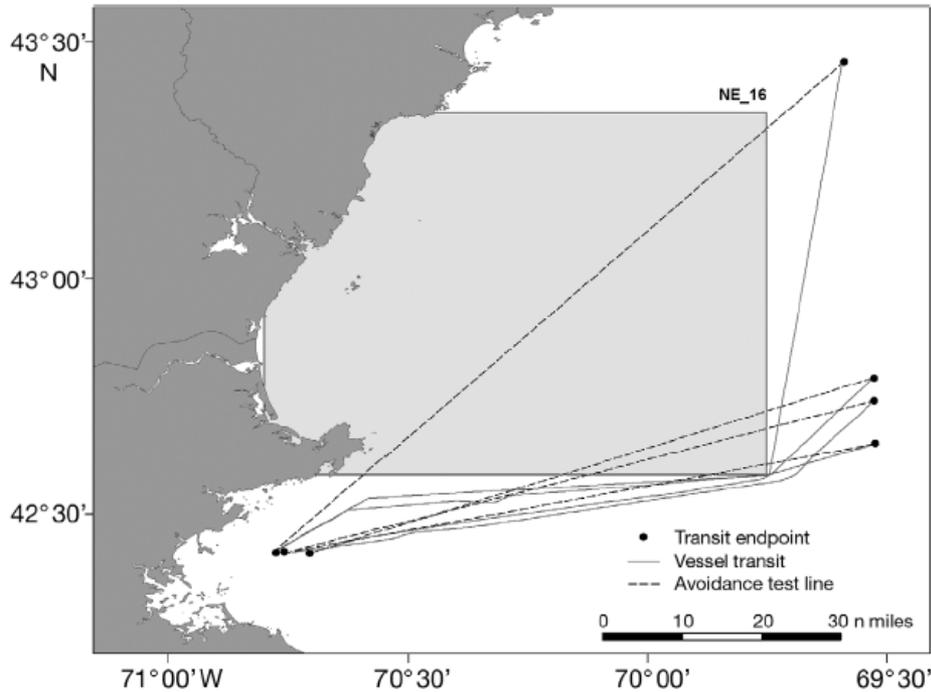


Let's rule out...
(or, at least discuss the limitations of...)

- Responses to ship noise (??)
- *Technologies* – detection, relaying of information only; then what??
- Some actions, like posting lookouts, Apps (?), may be of limited value. Better to have clear guidance, expectations
- some voluntary measures may be ineffective; here's why...



Assessing voluntary vessel speed – no go dynamically managed zones



Silber, Adams, & Bettridge. 2012. **Vessel operator response to a voluntary vessel/whale collision reduction measure.** *Endangered Species Research* 17: 245–254.

Tools -- Technologies

1. Moving Whales
 - alarm devices
2. Detecting Whales (*and moving ships*)
 - Observers
 - Tagging
 - Active acoustics (e.g., Sonar)
 - Enhanced optics
 - ++ passive acoustics
 - ++ predictive modeling

** *then what? “evasive action”*
(??) **



Report of a Workshop to Identify and Assess
Technologies to Reduce Ship Strikes of Large Whales

Providence, Rhode Island
8-10 July 2008

Gregory K. Silber, Shannon Bettridge, and David Cottingham
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910

In sum...



- ❑ US east coast situation is likely quite different from S. CA; right whale distribution is rather predictable; less predictable whale occurrence/distribution off CA presents challenges
- ❑ justify the need for actions; Good logic & clear to all involved
- ❑ Limited tools in a tool box; carefully weigh options
 - ❑ Consider mandatory vs. voluntary (may be of limited value)
 - ❑ education and awareness-raising is essential, of course, but likely not enough (like an App) unless there is some “carrot” or a “stick”
 - ❑ vessel speed probably best implemented through domestic laws; speed “advisories” enacted through the IMO have not been particularly successful
- ❑ Consider...
 - ❑ how measure will be *implemented*; and understand difficulties/hurdles/time involved in implementation processes
 - ❑ how *adherence* will be assured (*e.g.*, enforcement)
 - ❑ how *effectiveness* of the measure will be monitored; including how biological value is monitored/assured

Questions...?

