Economic Implications of Possible Reductions in Boston Port Calls due to Ship Strike Management Measures

Report produced for NOAA National Marine Fisheries and MASSPORT

March 2005

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Executive Summary

We estimate the direct and indirect effects of commercial vessel port calls in the Port of Boston for the Massachusetts economy, using the US Maritime Administration's PortKit Model. The model results suggest that cruise ships using Boston as their home port, container ships, tankers, and dry bulkers each contribute around $1 million per port call to the gross state product; and that these port calls support between 10 and 30 full-time-equivalent jobs per port call (see Table 8 in the report).

We use these results to estimate the economic implications for Massachusetts of hypothetical lost future port calls that may result from costs/delays imposed by right whale ship strike management measures. We consider four specific scenarios:

- ***Scenario 1: MSC*** eliminates Boston from its sailing schedule; a loss of 104 container ship calls per year. Estimated economic implications: loss of $49 million in gross state product; loss of 920 full-time-equivalent jobs.
- ***Scenario 2: COSCO*** eliminates Boston from its sailing schedule; a loss of 52 container ship calls per year. Estimated economic implications: loss of $24 million in gross state product; loss of 460 full-time-equivalent jobs.
- ***Scenario 3: Norwegian Majesty*** no longer homeports in Boston, a loss of 27 embark/disembark cruise ship calls per year. Estimated economic implications: loss of $35 million in gross state product; loss of 783 full-time-equivalent jobs.
- ***Scenario 4: Royal Caribbean Cruise Lines*** eliminates its Boston port calls, a loss of 12 embark/disembark cruise ship calls and 15 port-of-call cruise ship calls per year. Estimated economic implications: loss of $22 million in gross state product; loss of 453 full-time-equivalent jobs.

Ship operators' decisions about port calls are complex and involve a large number of considerations. Although we can assume that a greater probability of unscheduled delays due to ship strike management measures would increase the likelihood that carriers might eliminate Boston port calls in the future, it is not possible to quantify this increase, or to say how likely the above scenarios are to occur, without significant additional analysis.

Introduction

As many as half of all human-caused mortalities of the northern right whale (*Eubalaena glacialis*) may result from collisions with large ships ("ship strikes") along the US and Canadian eastern seaboard. Although the number of documented ship strikes is small, the right whale is a highly endangered species, and losses of any individuals from the population are taken seriously. To address the issue of ship strikes, the NOAA published on June 1st 2004 an advance notice of proposed rulemaking for right whale ship strike reduction (Federal Register 69(105):30857-864). The proposed rules consist of a combination of routing restrictions, areas to be avoided, and speed restrictions for vessels along the US east coast, with a combination of seasonal (static) and dynamic management measures (dynamic measures are activated based on observed presence of whales).

Under a right whale ship strike management regime, vessels entering a management area would be required either to keep their speed below an established limit, or to reroute around the area. Traffic moving to or from the Port of Boston would be subject to seasonal route restrictions and/or speed restrictions in the Gulf of Maine, in Cape Cod Bay, off Race Point (Cape Cod), and in the Great South Channel area. These restrictions will result in increased operating cost for ships calling on the Port of Boston (see below). There is concern that they may also cause some ship operators to temporarily or permanently eliminate port calls in Boston altogether. The purpose of this report is to describe the direct and indirect economic effects of commercial port calls in Boston and to assess the economic harm to the region from the hypothetical elimination of such port calls. The rules now under consideration will govern shipping throughout the right whale range along the US east coast, and will affect many ports. While this study addresses the Port of Boston only, the approach applies similarly to other affected ports.

We use MARAD's Port Kit Model to estimate the economic effects to Massachusetts of commercial port calls in the Port of Boston, and use these results to estimate the economic loss to the Commonwealth of a "lost" port call.

Previous Work on Economic Effects

Kite-Powell and Hoagland (2002) have estimated the likely increase in operating cost due to ship strike management measures for shipping along the US east coast from the Penobscot River, Maine to Port Canaveral, Florida. The ship traffic management measures modeled for this purpose are based in part on recommendations made to NMFS by Russell and Knowlton (2001) and in part on conservative assumptions about how these recommendations might be implemented and how vessel operators might respond. Our base case assumes a 10 knot speed limit imposed on vessel traffic into and out of most ports over a distance of 25 nm during a predictable annual "season" lasting 60 days. Some ports face additional constraints: for example, Boston traffic faces additional speed restrictions in the Great South Channel, and ports within the Southeast Critical Habitat, in the mid-Atlantic migration corridor, and in southern New England face restrictions over 120 to 150 days/year.

The average estimated cost of the base case management measures for larger ports is $1.3 million/year, and ranges from $4.8 million for the Port of New York and New Jersey to about $300,000 for Portland, ME and Wilmington, NC. In calculating the cost per ship call, it is useful to distinguish between ship calls that are affected by these measures and those that are not (for example, because they take place outside the season when measures are in effect). The average cost per ship call (including those not affected by these measures) for all east coast ports is $500, and ranges from $1,170 for the Port of Fernandina Beach to $210 for the Port of Philadelphia. The average cost per affected ship call for all east coast ports is $2,350, and ranges from $3,550 in Fernandina to about $1,100 in the Ports of Brunswick and Canaveral. The values for Boston are $500 and $3,000, respectively. The estimated cost increase due to base case management measures amounts to less than 0.5 percent of total annual operating cost for ship traffic calling on US east coast ports.

We consider these estimates to be approximate for several reasons, including: (1) in most cases, we assume a larger geographic extent for the speed restrictions than that suggested by Russell (2001); (2) our per-hour operating cost estimates and delay penalties are conservative (high); (3) our assumed normal operating speeds are high; (4) we generally assume larger, more expensive vessels than those actually trading along the US east coast; and (5) operator responses are likely to be more sophisticated than those we have assumed. We suggest, therefore, that our estimates (total cost of about $16 million) are likely to overstate the true cost of these measures. Based on these considerations, it is likely that the true cost of these ship strike management measures to operators along the US east coast would be on the order of $10 million per year.

This work is being updated in 2005 to reflect more recent and more detailed traffic data. Russell and Knowlton (p.c., 2003) have recently revised the assumptions behind proposed management measures in light of new information about ship operations and right whale population distribution. Additional revisions follow from the 2004 ANPR and the strategy it describes. In work scheduled for 2005, the author (Kite-Powell) will update the operating cost estimates to reflect likely measures based on the strategy outlined in the ANPR (this work has been proposed to NOAA NMFS). Specifically, the update will:

- Incorporate traffic management scenarios reflecting NOAA’s strategy
- Add additional ports to the analysis
- Incorporate new vessel traffic and operating data
- Add fishing vessels and large recreational boats to the model

These estimates of increased operating costs assume that the level and distribution of vessel traffic across ports along the US east coast will continue largely as at present, and that there will be no “dislocation” of port calls from one port to another as a result of these measures. Such dislocations may in fact take place, periodically or permanently, as a result of ship strike management measures. For example, a container ship en route to Boston is typically under a tight schedule with little room for delays; and many container vessels need to enter the port at high tide. If ship strike management measures cause a vessel to miss the tide, the operators may decide to bypass the port, particularly if the combined delays will affect their overall schedule. Each port bypass results in an economic loss to the port and the region. If delays frequently result in port bypasses, the shipping line may decide to eliminate the port from their schedule altogether, shifting port calls to Halifax or New York instead, and resulting in larger economic impact to the port and region. This study attempts to quantify that impact.

In addition, port industry representatives suggest that the initial estimates of the cost of ship strike management measures may understate the true costs because:

1. The analysis carried out to date only considers the cost to the ship, not the subsequent economic impacts down the logistics and customer chain.

2. The analysis carried out to date is based on existing data on whale sighting locations and frequency. As more whale surveillance is conducted, more whales may be found, and the extent and duration of the ship strike management measures may increase over time as the frequency and accuracy of whale detection/surveillance activities increase.

The primary purpose of this report is to estimate the economic effect to the Commonwealth of Massachusetts from possible port call dislocation from the Port of Boston. First, we will briefly address the two other issues listed above.

Economic Impacts of Higher Shipping Costs

An increase in the cost of providing shipping services to a particular port – whether it is due to a change in port charges, fuel or labor costs, or ship strike management measures – is either absorbed by the shipping service provider, or passed on to the shipping customer (shipper), or – most commonly – some combination of both. Increased cost absorbed by the shipping service provider translates into reduced profit; and unless the shipping service company is located in the port/region, this does not affect the local/regional economy. Since maritime shipping supply is usually provided in large increments (a ship call, with space for numerous containers, as opposed to discrete single-container increments), and since we assume here that port calls remain unchanged, costs absorbed by shipping service providers do not lead to a change in cargo volume.

Increased cost passed on in the form of higher freight charges to shippers may result in a contraction in the cargo volume. How much cargo volume contracts, and how much of the cost increase is absorbed by shipping companies as opposed to shippers, depends on the price elasticity of shipping service supply and the price elasticity of shipping demand in the port region. This price elasticity is an economic concept that describes, based on the nature of the supply of and demand for shipping services, how the quantity of goods shipped and the market price for this service will change in response to a change in cost of providing the service. A full price elasticity analysis is beyond the scope of this report. However, it is reasonable to assume that at the level of cost change likely to result from ship strike management measures – on the order of $1/TEU or $1/cruise passenger – the effect on cargo volume will be minimal, and that most of the cost increase will be absorbed by shippers (and likely passed on to their customers).

Survey Effort and Duration of Management Measures

Right whales are already surveyed extensively in approaches to Boston during the season of heavy right whale activity in New England. In theory it is possible that additional survey effort (if it is funded) might identify whales that are not presently known to exist, or locate them more often in shipping lanes than the historical data suggest. However, the North Atlantic right whale population is thought to be fairly well known; and organized survey effort combined with whale watch activity and sighting reports by mariners provide significant coverage today of right whale habitat in southern New England. These questions, including the likely number of days on which detection of clusters of whales will trigger dynamic management measures, will be revisited in the new economic analysis discussed above.

What is perhaps more likely is that as efforts to help the right whale population recover bear fruit, the number of right whales in the waters off Boston (and along the US east coast) will indeed increase, and possibly increase the economic burden associated with ship strike management measures.

Regional Economic Effects: the MARAD Port Kit Model

To estimate the economic losses that may be suffered by the Commonwealth of Massachusetts because a shipping company temporarily or permanently reduces or cancels scheduled calls at the Port of Boston, we have customized and applied the MARAD Port Economic Impact (Port Kit) Model. Economic effects estimated by the MARAD model include direct effects of port operations (defined as the expenditures of businesses directly associated with the movement of waterborne cargo and passengers through the terminals, including vessels, terminals, cargo and passenger transactions, and inland transport) as well as indirect effects (expenditures of the port industries buying goods and services from other industries in the region) and induced effects (spending by employees of the port industries and their suppliers).

The Port Kit Model is based on an input–output (I-O) model of the US economy. I-O models are commonly used to estimate the direct and indirect/induced economic effects of specific events, such as port activity. An I-O model describes interrelationships (sales and purchases) between sectors of an economy. For example, the model may include information about how much a sector such as road transportation purchases from a sector such as vehicle repair and maintenance for every dollar of transportation activity.

The MARAD Port Kit Model is based the US I-O model produced by the US Bureau of Economic Analysis. This model describes interactions among more than 500 economic sectors and reflects 1998 economic data from the US Bureau of Labor Statistics. It has been augmented with specialized port sectors by a team from the Center for Urban Policy Research at Rutgers University. Regional purchase coefficients based on the Census of Transportation's Commodity Flow Survey provide information about the fraction of such purchases that will come from suppliers in a particular geographic region, such as

Massachusetts. For more details on the model, see the MARAD Port Economic Impact Kit User's Guide.[1]

Model Inputs for Port of Boston Traffic

To estimate the economic effect of port call dislocation scenarios, the MARAD Port Kit Model is first "customized" to conditions in the Port of Boston with information specific to the costs associated with moving cargo through the port. The model comes with "default" values representative of ports around the United States. These default values can be used where specific data for the Port of Boston are not available. However, to obtain good estimates for Boston and its surrounding region, it will be best to have specific information.

The information required for the MARAD model is described in detail in the *User's Guide* for the Port Kit Model. For container and bulk cargo movements, it includes data on the cost per container in categories such as:

- Port services (tugs, pilots, dockage, etc.)
- Bunkers
- Loading/discharging
- Expendable supplies
- Inland movement
- Government requirements (customs, taxes, etc.)
- In-transit storage
- Cargo packing

For passenger traffic, the data required includes (cost per ship call):

- Port services (tugs, pilots, dockage, etc.)
- Loading/discharging
- Supplies and services
- Inland transportation
- Bunkers
- Government requirements (customs, immigration, etc.)

as well as the spending per night per person of cruise ship passengers.

Tables 1 through 6 show input parameters for the MARAD Port Kit model for cruise ship, container ship, tanker, dry bulk, and car carrier port calls in the Port of Boston. The Port Kit supplies default values based on national averages. Tables 1 through 6 show values specific to the Port of Boston where these are known. In this analysis, we use the Port Kit default values only where input data specific to the Port of Boston are not available.

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[1] A. Strauss-Wieder, Inc. and Rutgers Center for Urban Policy Research. *MARAD Port Economic Impact Kit, Volume II: A User's Guide*. Prepared for the US Department of Transportation, Maritime Administration.

Additional input values for the Port Kit Model are as follows (unless otherwise noted, these data are based on information provided by Massport officials):

In 2003, there were 43 embark/disembark cruise ship calls in the Port of Boston, with a total of 137,155 passengers. Of these, 40% traveled to the port by private auto, 45% traveled by taxi, and 15% traveled by air.

In 2003, there were 57 port-of-call cruise ship calls in the Port of Boston, with a total of 63,197 passengers. Of these, an estimated 47% traveled from the port by taxi, 1% traveled on foot, 1% by private auto, and 1% by public transit. The remaining 50% made use of organized bus service.

In 2003, 155,273 TEUs of container cargo moved through the Port of Boston. 71% of this cargo moved in container ships (draft greater than 35 ft), which made about 100 port calls in Boston during the year. The remainder of the container cargo moved in feeder ships (9%) and barges (20%). An estimated 90% of container cargo moves to/from the port by short-distance truck, 8% by long-distance truck, and 2% by rail.

For 2003, the US Army Corps of Engineers reported 18,762,000 short tons of petroleum and petroleum products moving through the Port of Boston. Some 400 tanker and 650 tank barge port calls accounted for this cargo (US ACE). An estimated 50% of this cargo left the port by short distance truck, and 50% by long-distance truck. (LNG cargos are included in these liquid bulk totals. Assuming 50 LNG cargos/year at an average volume of 70,000 tons/cargo, LNG accounts for about 3.5 million of the 18.8 million total liquid bulk volume.)

For 2003, the US Army Corps of Engineers reported about 4.8 million short tons of cargo other than petroleum, petroleum products, and manufactures (assumed to move in containers) moving through the Port of Boston. We assume that all of this represents dry bulk cargo, and that 50% of it moves from the port in short distance truck and 50% in long distance truck. An estimated 150 dry cargo vessel calls accounted for Boston’s dry cargo movements in 2003 (US ACE).

For 2002, the US Army Corps of Engineers reported some 135,000 short tons of automobiles moving through the Port of Boston. At 1.5 tons/automobile, this represents about 90,000 vehicles. About 100 car carrier vessels called on the port during that year (Massport). We assume that 50% of these leave the port by long distance truck, and 50% by short distance truck.

		$ per ship call	
		values used in Boston analysis	Port Kit default
Service			
	Tugs	0	0
	Pilots	5,000	6,500
	Line Handling	3,200	1,000
	Launch	0	0
	Radio/Radar	500	500
	Surveyors	5,000	0
	Dockage	1,500	6,500
	Tenders	0	5,000
	other (docking master)	0	0
Bunkers			
	oil	180,000	180,000
	water	2,500	500
	other	0	0
Loading/Discharging			
	stevedoring	40,000	20,000
	clerking and checking	6,000	3,520
	watching	6,000	3,000
	cleaning/fitting	0	0
	equipment rental	5,000	2,000
	agency fee	3,000	0
	other	0	0
supplies			
	chandler	500,000	400,000
	laundry	3,000	3,000
	medical	5,000	160
	waste	5,000	1,500
	provisions	5,000	5,000
	entertainment	2,500	2,500
	other	0	0
inland transportation			
(per passenger)	private auto	40	20
	transit	5	10
	air	510	10
	taxi	10	300
	bicycle/walking	0	0
	other	0	0
gov't requirement			
	customs	415	0
	entrance/clearance	3,000	3,000
	immigration	0	0
	quarantine	1,040	1,040
	fumigation	80	80
	other	370	0
spending per person night in port city		181	40
head tax per ship call		27,115	0
federal cruise tax per ship call		0	0
other federal taxes per ship call		3975	0
number of ship calls per year		43	
number of passengers per ship call		3190	
average predeparture/postdeparture nights		2	

Table 1: Port Kit Model inputs for embark/disembark cruise ship calls.
All values are per ship call, except inland transportation, which is per passenger.

		$ per ship call	
		values used in Boston analysis	Port Kit default
Service			
	Tugs	0	0
	Pilots	5,000	6,500
	Line Handling	3,200	1,000
	Launch	0	0
	Radio/Radar	500	500
	Surveyors	5,000	0
	Dockage	1,500	6,500
	Tenders	0	5,000
	other	0	0
Bunkers			
	oil	180,000	180,000
	water	2,500	500
	other	0	0
Loading/Discharging			
	stevedoring	40,000	20,000
	clerking and checking	6,000	3,520
	watching	6,000	3,000
	cleaning/fitting	0	0
	equipment rental	5,000	2,000
	agency fee	2,000	0
	other	0	0
supplies			
	chandler	500,000	400,000
	laundry	3,000	3,000
	medical	5,000	160
	waste	5,000	1,500
	provisions	5,000	5,000
	entertainment	2,500	2,500
	other	0	0
inland transportation			
(per passenger)	private auto	20	20
	transit	5	10
	air	0	10
	taxi	10	300
	bicycle/walking	0	0
	other (tour bus)	40	0
gov't requirement			
	customs	415	0
	entrance/clearance	3,000	3,000
	immigration	0	0
	quarantine	1,040	1,040
	fumigation	80	80
	other	370	0
spending per person night in port city		82	40
head tax per ship call		9,427	0
federal cruise tax per ship call		0	0
other federal taxes per ship call		3975	0
number of ship calls per year		57	
number of passengers per ship call		1109	
average predeparture/postdeparture nights		1	

Table 2: Port Kit Model inputs for port-of-call cruise ship calls.
All values are per ship call, except inland transportation, which is per passenger.

		$ per TEU (TEU = 8.5 short tons) values used in Boston analysis	Port Kit default
Service			
	Tugs	3.00	2.85
	Pilots	11.32	3.74
	Line Handling	2.71	1.47
	Launch	0.00	0.64
	Radio/Radar	0.00	0.04
	Surveyors	0.13	0.13
	Dockage	1.84	2.46
	Lighterage	0.00	0.00
	other	0.58	0.00
Bunkers			
	oil	0.00	20.00
	water	0.09	0.09
	other	0.00	0.00
Loading/Discharging			
	stevedoring	136.00	93.68
	clerking and checking	0.88	0.88
	watching	4.92	0.11
	cleaning/fitting	0.00	0.00
	equipment rental	1.10	1.10
	agency fee	0.38	0.26
	other	0.00	0.00
supplies			
	chandler/provisions	0.92	0.92
	laundry	0.04	0.04
	medical	0.24	0.24
	waste	0.02	0.02
	security	0.00	0.00
	other	0.00	0.00
inland movement			
	long distance truck	500.00	500.00
	short distance truck	250.00	250.00
	barge	0.00	0.00
	air	0.00	0.00
	rail	275.00	275.00
	pipeline	0.00	0.00
	other	0.00	0.00
gov't requirement			
	customs	0.99	1.10
	entrance/clearance	0.05	0.50
	immigration	0.08	0.08
	quarantine	0.04	0.04
	fumigation	0.14	0.14
	federal harbor tax	7.57	0.00
	other	0.92	0.00
In-Transit Storage			
	wharfage	31.00	17.00
	yard handling	0.77	0.77
	demurrage	0.07	0.07
	warehousing	0.02	0.02
	auto and truck storage	0.00	0.00
	grain storage	0.00	0.00
	refrigerated storage	0.04	0.04
	wholesale: durable	0.00	0.00
	wholesale: nondurable	0.00	0.00
	other	0.00	0.00
Cargo Packing			
	export packing	0.13	0.13
	container stuffing/stripping	5.32	5.32
	cargo manipulation	0.15	0.15
	other	0.00	0.00

Table 3: Port Kit Model inputs for container ship calls

		$ per short ton	
		values used in Boston analysis	Port Kit default
Service			
	Tugs	0.40	0.29
	Pilots	0.23	0.31
	Line Handling	0.10	0.01
	Launch	0.03	0.02
	Radio/Radar	0.02	0.00
	Surveyors	0.08	0.01
	Dockage	0.01	0.01
	Lighterage	0.00	0.01
	other	0.00	0.00
Bunkers			
	oil	0.00	2.50
	water	0.03	0.00
	other	0.00	0.00
Loading/Discharging			
	stevedoring	0.00	0.00
	clerking and checking	0.00	0.00
	watching	0.00	0.00
	cleaning/fitting	0.00	0.00
	equipment rental	0.00	0.00
	agency fee	0.07	0.03
	other	0.00	0.00
supplies			
	chandler/provisions	0.07	0.04
	laundry	0.02	0.00
	medical	0.03	0.00
	waste	0.00	0.00
	security	0.03	0.00
	other	0.00	0.00
inland movement			
	long distance truck	47.00	47.00
	short distance truck	20.00	20.00
	barge	0.75	0.75
	air	0.00	0.00
	rail	5.60	5.60
	pipeline	0.00	0.00
	other	0.00	0.00
gov't requirement			
	customs	0.10	0.10
	entrance/clearance	0.03	0.00
	immigration	0.00	0.00
	quarantine	0.00	0.00
	fumigation	0.00	0.00
	federal harbor tax	0.00	0.00
	other	0.00	0.00
In-Transit Storage			
	wharfage	0.12	0.12
	yard handling	0.00	0.00
	demurrage	0.00	0.00
	warehousing	0.00	0.00
	auto and truck storage	0.00	0.00
	grain storage	0.00	0.00
	refrigerated storage	0.00	0.00
	wholesale: durable	0.00	0.00
	wholesale: nondurable	0.00	0.00
	other	0.00	0.00
Cargo Packing			
	export packing	0.00	0.00
	container stuffing/stripping	0.00	0.00
	cargo manipulation	0.00	0.00
	other	0.00	0.00
crew-leave spending		0.08	0.08

Table 4: Port Kit Model inputs for liquid bulk ship calls

		$ per short ton	
		values used in Boston analysis	Port Kit default
Service			
	Tugs	0.29	0.29
	Pilots	0.38	0.38
	Line Handling	0.02	0.02
	Launch	0.03	0.03
	Radio/Radar	0.05	0.05
	Surveyors	0.06	0.06
	Dockage	0.75	0.75
	Lighterage	0.00	0.00
	other	0.00	0.00
Bunkers			
	oil	2.33	2.33
	water	0.01	0.01
	other	0.00	0.00
Loading/Discharging			
	stevedoring	0.34	0.34
	clerking and checking	0.00	0.00
	watching	0.00	0.00
	cleaning/fitting	0.00	0.00
	equipment rental	0.00	0.00
	agency fee	0.03	0.03
	other	0.00	0.00
supplies			
	chandler/provisions	0.03	0.03
	laundry	0.00	0.00
	medical	0.01	0.01
	waste	0.00	0.00
	security	0.00	0.00
	other	0.00	0.00
inland movement			
	long distance truck	25.00	25.00
	short distance truck	10.00	10.00
	barge	0.75	0.75
	air	0.00	0.00
	rail	3.25	3.25
	pipeline	0.00	0.00
	other	0.00	0.00
gov't requirement			
	customs	0.27	0.27
	entrance/clearance	0.39	0.39
	immigration	0.00	0.00
	quarantine	0.00	0.00
	fumigation	0.00	0.00
	federal harbor tax	0.00	0.00
	other	0.00	0.00
In-Transit Storage			
	wharfage	0.00	0.00
	yard handling	0.00	0.00
	demurrage	0.00	0.00
	warehousing	0.00	0.00
	auto and truck storage	0.00	0.00
	grain storage	0.00	0.00
	refrigerated storage	0.00	0.00
	wholesale: durable	0.00	0.00
	wholesale: nondurable	0.00	0.00
	other	0.00	0.00
Cargo Packing			
	export packing	0.00	0.00
	container stuffing/stripping	0.00	0.00
	cargo manipulation	0.00	0.00
	other	0.00	0.00
crew-leave spending		0.08	0.08

Table 5: Port Kit Model inputs for dry bulk ship calls

		$ per auto (auto = 1.5 short tons)	
		values used in Boston analysis	Port Kit default
Service			
	Tugs	6.67	2.50
	Pilots	6.67	12.00
	Line Handling	2.67	1.10
	Launch	0.20	0.20
	Radio/Radar	0.00	0.00
	Surveyors	0.00	0.00
	Dockage	4.67	1.60
	Lighterage	0.00	0.00
	other	5.33	0.00
Bunkers			
	oil	4.00	4.00
	water	0.00	0.00
	other	0.00	0.00
Loading/Discharging			
	stevedoring	40.00	20.00
	clerking and checking	0.00	0.00
	watching	0.00	0.00
	cleaning/fitting	0.00	0.00
	equipment rental	0.00	0.00
	agency fee	0.05	0.05
	other	0.00	0.00
supplies			
	chandler/provisions	0.75	0.75
	laundry	0.00	0.00
	medical	0.07	0.07
	waste	0.00	0.00
	security	0.11	0.11
	other	0.00	0.00
inland movement			
	long distance truck	50.00	50.00
	short distance truck	35.00	35.00
	barge	0.00	0.00
	air	0.00	0.00
	rail	33.00	33.00
	pipeline	0.00	0.00
	other	0.00	0.00
gov't requirement			
	customs	6.50	6.50
	entrance/clearance	1.33	0.30
	immigration	0.10	0.10
	quarantine	0.00	0.00
	fumigation	0.00	0.00
	federal harbor tax	0.00	0.00
	other	0.00	0.00
In-Transit Storage			
	wharfage	0.00	0.00
	yard handling	0.00	0.00
	demurrage	7.50	7.50
	warehousing	20.00	20.00
	auto and truck storage	20.00	20.00
	grain storage	0.00	0.00
	refrigerated storage	0.00	0.00
	wholesale: durable	0.00	0.00
	wholesale: nondurable	0.00	0.00
	other	0.00	0.00
Cargo Packing			
	export packing	0.00	0.00
	container stuffing/stripping	0.00	0.00
	cargo manipulation	0.00	0.00
	other	0.00	0.00
crew-leave spending		0.12	0.12

Table 6: Port Kit Inputs for car carrier port calls

Model Output

Table 7 summarizes the output of the MARAD Port Kit Model for the vessel traffic described in the input section above. (For complete model output, see Appendix.) In the Port Kit Model results, "output" refers to the value of industry production exchanged between organizations as a result of the port activity (equivalent to "sales"). "Income" includes wages, salaries, and proprietors' income. "Gross state product" is the contribution to the state's "GDP" (gross domestic product), or value added, by the port activity. It includes wages and state, local, and federal taxes.

		$millions/year			
		output	income	gross state product	employment
Cruise – embark/disembark	direct	84.5	20.3	33.0	898
	indirect/induced	16.5	13.0	22.3	365
	total	**101.0**	**33.3**	**55.3**	**1,263**
Cruise – port of call	direct	50.5	8.5	14.9	196
	indirect/induced	0.0	6.7	10.7	175
	total	**50.5**	**15.2**	**25.6**	**371**
Container	direct	71.3	24.8	35.1	666
	indirect/induced	54.2	20.2	33.8	581
	total	**125.5**	**45.0**	**69.0**	**1,247**
Liquid bulk	direct	654.9	194.7	249.0	5,368
	indirect/induced	514.8	186.1	309.3	5.320
	total	**1,169.7**	**380.8**	**558.3**	**10,688**
Dry bulk	direct	123.5	36.2	48.6	972
	indirect/induced	90.2	32.7	54.7	935
	total	**213.7**	**68.9**	**103.3**	**1,907**
Automobiles	direct	15.2	5.2	7.5	140
	indirect/induced	11.3	4.2	7.1	119
	total	**26.5**	**9.4**	**14.6**	**258**

Table 7: Port Kit Model output summary: Economic effects within the Commonwealth of Massachusetts due to Port of Boston ship calls.

Assuming that economic effects, including employment, are (at the margin) related linearly to cargo and passenger movements, and therefore to port calls, we can estimate the marginal effect on the Massachusetts state economy of each port call, as shown in Table 8.

	port calls	$ millions/port call			employment
		output	income	gross state product	
Cruise – embark/disembark	43	2.3	0.8	1.3	29
Cruise – port of call	57	0.9	0.3	0.4	7
Container*	100	0.9	0.3	0.5	9
Liquid bulk**	400	2.2	0.7	1.0	20
Dry bulk***	150	1.4	0.5	0.7	13
Automobiles	100	0.3	0.1	0.1	3

Table 8: Estimated economic effect per ship call
*assuming 70% of cargo/effects accounted for by ships >35' draft
**assuming tanker ships account for 75% of petroleum movements
***assuming self-propelled ships account for all dry bulk cargo movements

Economic Implications of Lost Port Calls

The numbers in Table 8 reflect an estimate of the economic impacts of one (temporarily) diverted port call for the Commonwealth of Massachusetts. To illustrate the economic implications for the Commonwealth of more significant permanent reductions in port calls due to shipping companies' scheduling and service decisions, we consider four hypothetical future scenarios:

- ***Scenario 1: MSC*** eliminates Boston from its sailing schedule. Since MSC's schedule presently calls for two Boston port calls per week, this represents a potential loss of 104 container ship calls per year. (MSC had 87 port calls in Boston during 2004.)
- ***Scenario 2: COSCO*** eliminates Boston from its sailing schedule. Since COSCO's schedule presently calls for one Boston port call per week, this represents a potential loss of 52 container ship calls per year. (COSCO had 43 port calls in Boston during 2004.)
- ***Scenario 3: Norwegian Majesty*** no longer homeports in Boston. Based on the 2005 cruise ship schedule, this represents a potential loss of 27 embark/disembark cruise ship calls per year in Boston.
- ***Scenario 4: Royal Caribbean Cruise Lines*** eliminates its Boston port calls. Based on the 2005 cruise ship schedule, this represents a potential loss of 12 embark/disembark cruise ship calls and 15 port-of-call cruise ship calls per year in Boston.

Table 9 shows the economic implications, based on PortKit model results, of each of these scenarios for the Commonwealth of Massachusetts. These results are the product of the per-port-call effects (Table 8) and the number of lost port calls suggested by each scenario.

scenario	lost port calls	$ million/year			employment
		output	income	gross state product	
1. MSC	104 container	**92**	**30**	**49**	**920**
2. COSCO	52 container	**46**	**15**	**24**	**460**
3. *Norwegian Majesty*	27 embark/disembark	**62**	**22**	**35**	**783**
4. Royal Caribbean Cruise Lines	12 embark/disembark	28	10	16	348
	15 port-of-call	14	5	6	105
	subtotal, RC	**42**	**15**	**22**	**453**

Table 9: Estimated annual economic effect of lost port call scenarios

Notes on the Likelihood of Port Call Displacement

As discussed above, shipping companies' decisions about dropping port calls from their sailing schedules are complicated, often involve many interrelated factors, and are therefore difficult to model and predict. We describe here some anecdotal evidence about approximate cost differentials associated with three historical decisions by shipping companies to eliminate port calls, or move them from one port to another. By comparing these to the predicted cost increases associated with right whale ship strike management measures, we can gain some insight into the likelihood of permanent port call displacement due to such measures.

The first example deals with container shipping. In 2001, Maersk SeaLand eliminated Boston port calls from its Mediterranean-North America service. Maersk ships coming from the Mediterranean called first at Halifax, Nova Scotia, and then proceeded to Boston, New York, and ports south. According to MassPort officials, Maersk eliminated the Boston port calls because its transits into both Boston and New York were constrained by tide windows, and two tide-constrained port calls in a row represented too much potential for schedule delays.

MSC provides container ship service to Boston on both its North Atlantic (from northern Europe) and Mediterranean service routes. On both routes, MSC vessels call on Boston as their first North American destination, and then proceed to New York and ports south. Thus, they operate under much the same conditions as Maersk SeaLand did, apparently without undue difficulties associated with tide constraints. The other company now serving Boston, COSCO, operates on a route from Asia via the Panama Canal, and calls on a series of US east coast ports culminating in New York and Boston. These vessels are generally not draft constrained in New York or Boston because they must maintain draft limitations associated with the Panama Canal. On the other hand, unscheduled delays departing from Boston are problematic for this operation because of the costs associated with missing their schedule time for transiting the Panama Canal.

The second example concerns car carriers. In 2002-03, VW switched its import operations from Boston to Davisville, RI. According to MassPort officials, the cost of bringing cars ashore at Davisville is $35/car lower than in Boston, because port calls at Davisville are not subject to the Harbor Maintenance Tax. This suggests that a cost differential of about $50,000 per port call led to the elimination of Boston port calls in this instance. In a similar move, Volvo decided in 2002 to switch its imports from Jacksonville, FL to Brunswick, GA, for a reported cost differential of $10/car, or $15,000 per port call.

The implications of these anecdotal examples for potential future port call decisions are unclear. On the one hand, the kind of tide delays that reportedly caused Maersk SeaLand to eliminate Boston port calls are comparable to the most severe delays that might be imposed on fast vessels by unexpected dynamic management decisions in a right whale ship strike management regime (see Kite-Powell and Hoagland 2002). On the other hand, MSC is presently operating with the same tide restriction delay potential on its Boston port calls today. The cost differentials that have led to car carrier port call dislocation – in excess of $10,000 per port call – are significantly larger than those estimated for right whale ship strike management measures (Kite-Powell and Hoagland 2002) for the Port of Boston ($500 across all ship calls; $3,000 for calls affected by dynamic management measures). Given this information, we can assume that a greater probability of unscheduled delays due to ship strike management measures increases the likelihood that such carriers might eliminate Boston port calls in the future; but it is not possible to quantify this increase, or to estimate how likely permanent elimination of port calls will be, without significant additional data and analysis.

Acknowledgements

I received assistance from many in and around the Boston shipping community in assembling the information for this report. Among these, Deb Hadden and Capt. Brad Wellock of MassPort, and Pat Gerrior (NOAA NMFS, now retired), deserve special thanks. Lynn Vikesland provided valuable assistance with computer issues. Funding for this report was provided by NOAA NMFS and by MassPort.

References

Kite-Powell, H.L. and P. Hoagland. 2002. Economic aspects of right whale ship strike management measures. Report to NOAA/NMFS.

Russell, B.A. and A.R. Knowlton. 2001. Discussion draft: Right whales and ship management options. Final report to the Ship Strike Committee of the Northeast and Southeast Right Whale Implementation Team.

Appendix – Full MARAD Port Kit Model Output

- Cruise Industry – embark/disembark port calls (EDT)
- Cruise Industry – port of call port calls (POC)
- Container Ship port calls
- Liquid Bulk port calls
- Dry Bulk port calls
- Automobile Carrier port calls