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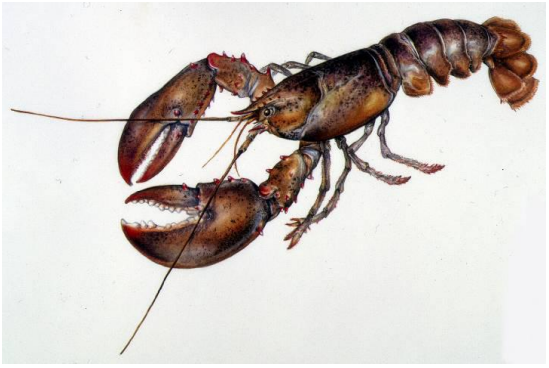
Seafood WATCH

American Lobster

Homarus americanus



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U.S. Northwest Atlantic

Trap/Pot

August 20, 2012

Gabriela Bradt, Ph.D., Consulting Researcher

Disclaimer

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Final Seafood Recommendation

The American lobster (*Homarus americanus*) is a large bodied crustacean that is found in the Northwest Atlantic region from Newfoundland, Canada to Cape Hatteras, North Carolina in the United States. This report covers the United States American lobster trap/pot fishery, which accounts for 98% of all US landings.

American lobster is ranked as a **Good Alternative** for both the Gulf of Maine and Georges Bank stocks (97% of landings) and as **Avoid** for the Southern New England stock (3% of landings).

Species/ Stock	**Gear/ Region**	**Impacts on the Stock** Rank Score	**Impacts on other Species** Lowest scoring species Rank*, Subscore, Score	**Manage -ment** Rank Score	**Habitat and Ecosystem** Rank Score	**Overall** Recommendation Score
GBK-American lobster	GBK	Green 3.83	North Atlantic Right Whale Red, 1,0.75	Green 3.46	Yellow 3.12	**GOOD ALTERNATIVE 2.54**
GOM-American lobster	GOM	Green 3.83	North Atlantic Right Whale Red, 1,0.75	Green 3.46	Yellow 3.12	**GOOD ALTERNATIVE 2.54**
SNE-American lobster	SNE	Red 2.16	North Atlantic Right Whale Red, 1,0.75	Red 1.73	Yellow 3.12	**AVOID 1.85**

Scoring note – scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact. * Rank and color in the 'Impacts on other Species' column is defined based on the Subscore rather than the Score. See scoring rules for more information.

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Executive Summary

This report provides analysis and recommendation for the American lobster (*Homarus americanus)* fishery in the Northwest Atlantic region of the United States. The American lobster is a large bodied, benthic crustacean that is found from Newfoundland, Canada to Cape Hatteras, North Carolina in the United States. The U.S. American Lobster fishery is composed of three main stocks identified by differences in life history parameters and biogeographic and biophysical differences. The three stocks are the Gulf of Maine (GOM), Georges Bank (GBK) and Southern New England (SNE) stocks. American lobsters are caught using primarily fixed gear (vented traps) that account for 98% of all lobster landings in the United States with the other 2% of landings from trawls.

American lobsters have a low resiliency to fishing pressure. They are long lived and with estimated ages up to 100 years. Stock assessments, regularly conducted by the Atlantic States Marine Fisheries Commission (ASMFC), in conjunction with the National Marine Fisheries Service (NMFS), indicate that overall lobster landings and abundance have been increasing steadily for the last twenty years. However, two of the three stocks- Gulf of Maine and Georges Bank stocks - are considered healthy while the Southern New England stock has been in a decline since the late 1990's and has remained at depleted levels ever since.

Retained and bycatch species analyzed in this assessment were selected based on either the percent of catch they comprise in the lobster fishery, the amount used as bait, or their conservation status (endangered, threatened, overfished, etc.). Traps used in the commercial lobster fishery are highly selective and as a result, bycatch is not considered a large issue. However, data are lacking on the nature and quantity of bycatch. The most common types of bycatch found in lobster traps are juvenile lobsters, ovigerous female lobsters, crabs and some finfish (e.g. flounders, scup, tautog). There is little information on discard and mortality rates for the lobster fishery and overall it appears that discard rates of lobster bycatch are low compared to other fisheries. Although bycatch species in lobster traps themselves are relatively few, the American lobster fishery is considered a Category I fishery by NMFS due to the frequency of marine mammal entanglements in lobster gear. Because of the interactions of North Atlantic right whales (*Eubaleana glacialis*) and Atlantic humpback whales (*Megaptera novaeangliae*) -- both considered endangered or threatened -- with lobster fishing gear, these species are also analyzed in this assessment.

In addition to North Atlantic right whales and humpback whale analysis, this report also evaluates the effects of the American lobster fishery on bait species, in particular, Atlantic herring (*Clupea harengus*). Atlantic herring is the main bait species used in lobster traps and approximately 70% (70 -75,000 mt) of all Atlantic herring landings are used directly by the lobster fishery.

The Atlantic States Marine Fisheries Commission oversees the management of the U.S. American lobster fishery. It is a relatively well-managed fishery, with regulations that protect ovigerous females by v-notching and prohibit the possession of v-notched females. Gear restrictions mandate the use of traps with bio-degradeable ghost panels and escape vents. Trap size limits as well as effort control measures such as trap limits and limited entry restrictions have also been implemented. In the Gulf of Maine and Georges Bank the American lobster stocks are well managed and lobster abundance remains at high levels. However, management efforts have been weak for the Southern New England stock where a proposed 5-year moratorium has morphed in recent years into only a 10% cut, Thus, the stock continues to be depleted with no evidence of recovery.

Though the American lobster fishery is well managed and lobstermen are cooperative in complying with the FMP and all of the management regulations mandated by the Atlantic Large Whale Take Reduction Plan (ALTWTRP), North Atlantic right whales and Humpback whales continue to interact with lobster fishing gear in large part because of the sheer volume of gear that is being fished.

American lobsters are almost exclusively fished with trap gear and, in general, it is accepted that traps have a moderate to low impact on benthic habitats. However, because of the intense fishing effort directed at lobsters and the amount of gear required -millions of traps being fished multiple times- the impact on benthic habitats may be underestimated. This "cumulative effect" could be more damaging to benthic ecosystems than previously thought; however, very little information is available regarding the effects of lobster trap gear on habitats. At this time, there are no extensive measures in place to manage the ecosystem and food web impacts of the fishery.

Introduction

Scope of the analysis and ensuing recommendation

This report provides analysis and recommendations for the American lobster (*Homarus americanus)* fishery in the US Northwest Atlantic from Maine to Cape Hatteras, North Carolina. The American Lobster fishery in the US is composed of three main stocks identified primarily by differences in life history parameters in each of these regions (ASMFC 2009). The three stocks are the Gulf of Maine (GOM), Georges Bank (GBK), and Southern New England (SNE) stocks (Figure 1). American lobster is caught using primarily fixed gear (vented traps) that account for 98% of all lobster landings; the other 2% are from trawls (NMFS 2011).

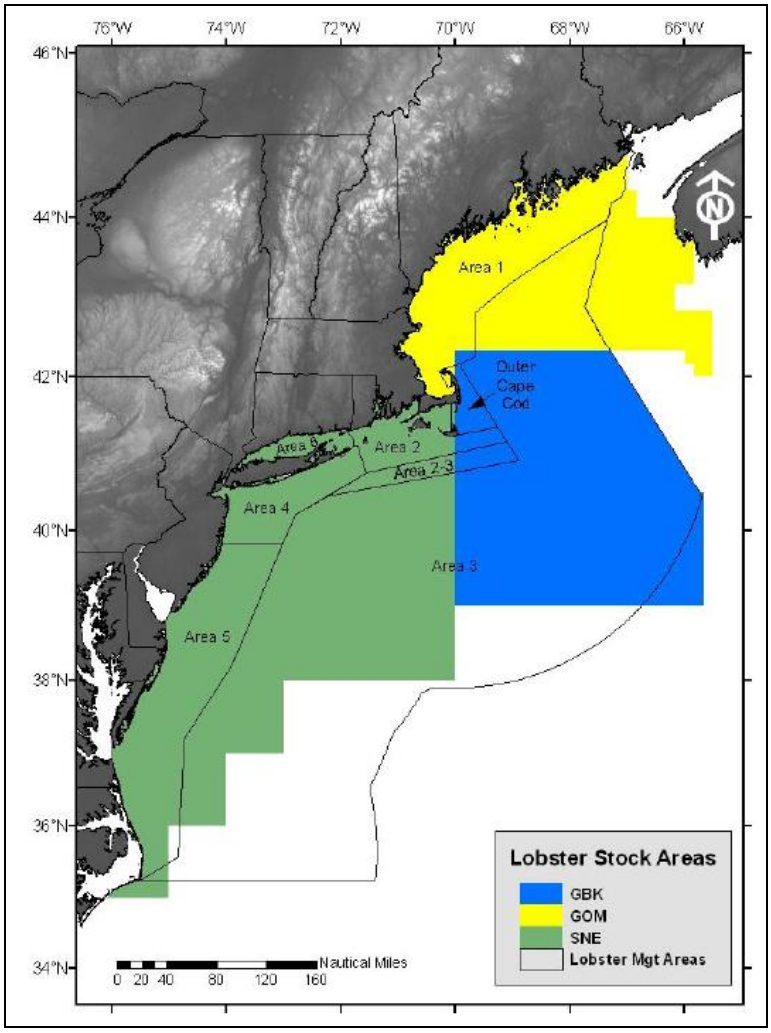

Figure 1. Lobster Stock Areas in the Northeastern US. Figure from NMFS 2011.

Species overview

American lobsters are large-bodied territorial crustaceans found from Maine to North Carolina with abundance declining from north to south (ASMFC 2009). The American lobster (*Homarus americanus*) is one of the most valuable commercial fisheries in the Northeastern region of the United States (NMFS 2011). This fishery brings in estimated annual revenues of nearly $400 million (NMFS 2012). The US resource of American lobster is found both inshore and offshore. Lobsters reside in a variety of benthic habitats, especially cobble and habitats that can provide shelter or possibilities for burrowing (ASMFC 2009). Adult and juvenile lobsters are found seasonally in water temperatures ranging from 0°–25°C (ASMFC 2009). American lobsters inhabit a range of depths from the intertidal to approximately 700 meters (ASMFC 2000; Lavalli and Cowan 2004); however, lobsters are most abundant in shallow coastal waters between 4 and 50 meters deep (ASMFC 2000, Lavalli and Cowan 2004).

Three primary stocks have been identified based on regional differences in their life history parameters as well as biophysical and biogeographical differences (ASMFC 2009; Wilson, pers. comm. 2012). These three stocks are the Gulf of Maine (GOM), Georges Bank (GBK), and Southern New England (SNE) stocks. Each of the three stocks supports both inshore (0–3 miles; state) and offshore (3–200 miles; federal) components (ASMFC 2009). The majority of lobster landings are within 12 nautical miles of shore (ASMFC 2009).

Management bodies

Since December 1997, the US American lobster fishery has been under the management of the Atlantic States Marine Fisheries Commission (ASMFC) and the National Marine Fisheries Service (NMFS). The ASMFC is a regulatory body formed by the 15 Atlantic coast states. It is responsible for managing the American lobster fishery in state waters, up to three miles from shore (ASMFC 2009). NMFS is responsible for managing the lobster fishery in federal waters, 3–200 miles from shore. Both ASMFC and NMFS are under the authority of the Atlantic Coastal Fisheries Cooperative Management Act (ASMFC 2009). The US American lobster fishery is managed under Amendment 3 to the Interstate Fishery Management Plan (FMP) for American lobster as well as Addenda I–XVI. Amendment 3 delineates a plan for area management that includes the participation of the industry through seven Lobster Conservation Management Areas (LCMAs) (Figure 1) that can develop management programs to address the specific needs of each management area (ASMFC 2009).

Amendment 3 to the FMP was designed to minimize the potential of a population collapse due to recruitment failure. Ultimately, Amendment 3 was approved with the goal of maintaining a healthy American lobster resource by establishing and implementing a management framework that allows for a sustainable harvest, maintains opportunities for participation, and provides for cooperative development of conservation methods (ASMFC 2009). The main regulatory measures that have been implemented involve minimum and

maximum legal size limits, gear restrictions (minimum escape vent size in traps) and limits on number of traps being fished (effort control measures), state license moratoria and protection of ovigerous females by v-notching the tails and releasing them (ASMFC 2009). Since the adoption of Amendment 3, an additional 16 addenda to the amendment have been implemented.

Production statistics

American lobster is only found in the waters of the Northwest Atlantic from Newfoundland, Canada to Cape Hatteras, North Carolina and as such, the United States and Canada are the two major producers. To date, despite continuing research effort, there is no large-scale commercial farmed lobster production. In the Northeast United States, American lobster is one of the most successful and valuable commercial fisheries, bringing in an estimated $400 million dollars in 2010 (ASMFC 2009).

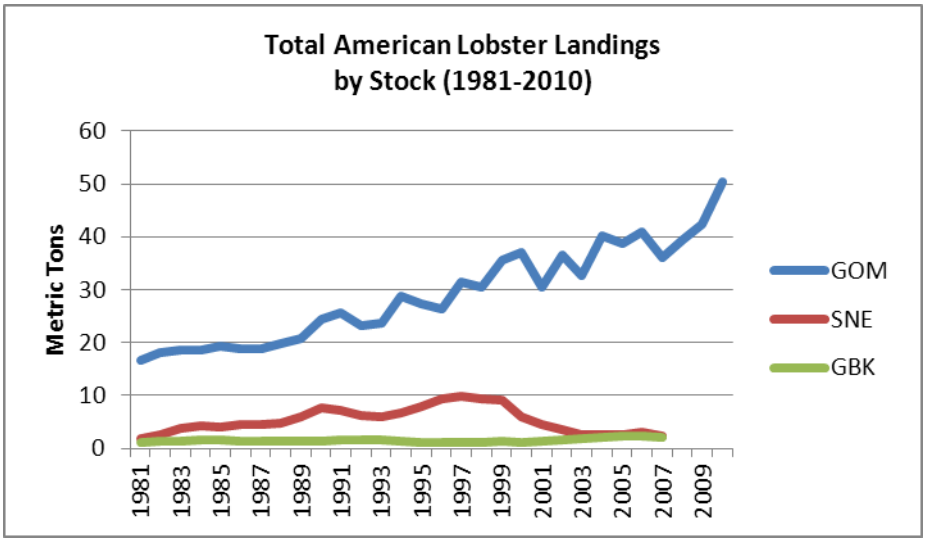

Figure 2. US Landings of American lobster by the three major stock fisheries 1981-2010, in metric tons
Figure compiled from data in NMFS 2012 and ASMFC 2009.

Landings from the US American Lobster fishery in the Gulf of Maine (GOM) have grown considerably since the 1980s when commercial landings for the GOM averaged 14,600 metric tons (ASMFC 2009). From 1990–2000, landings from the GOM increased from 19,200 to 37,727 metric tons (ASMFC 2009). Since 2000, landings in the GOM have remained fairly stable, averaging more than 35,000 metric tons per year (Figure 2; ASMFC 2009; NMFS 2012). However, since 2008, landings in the GOM have continued to increase; in 2010, total landings of American lobster from the GOM stock were 50,439 metric tons (data compiled from NMFS 2012). The GOM fishery is the largest lobster fishery in the United States, bringing in 85% of the total landings in 2010 alone (Figure 3). The Georges Bank fishery is the second largest fishery, currently comprising 12% of total US landings (2007) followed by

the Southern New England fishery with 3% (2007) (Figure 3).

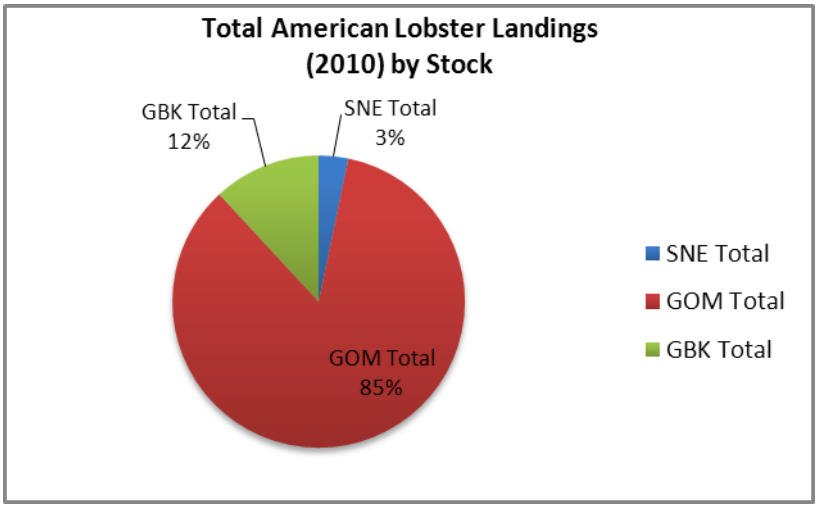

Figure 3.Percentage of US Landings of American lobster by the three major stock fisheries 2010. Figure compiled from data in NMFS 2012

Although landings data throughout this report will be presented by stock, the state of Maine dominates the US American Lobster fishery, accounting for more than 80% of the total annual landings in the United States over 2000–2010 (Figures 4a and 4b). The 2011 projection for total American lobster landings for the state of Maine is a record breaking 109 million pounds (DMR 2012).

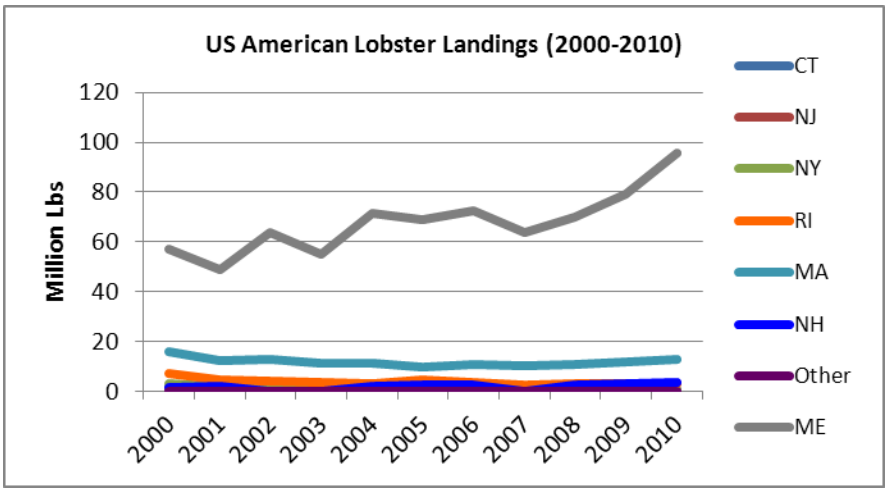

Figure 4a. US Landings of American lobster in million pounds by state 2000-2010. “Others" are Maryland, Delaware and Virginia. Figure compiled from data in NMFS 2012 and ASMFC 2009.

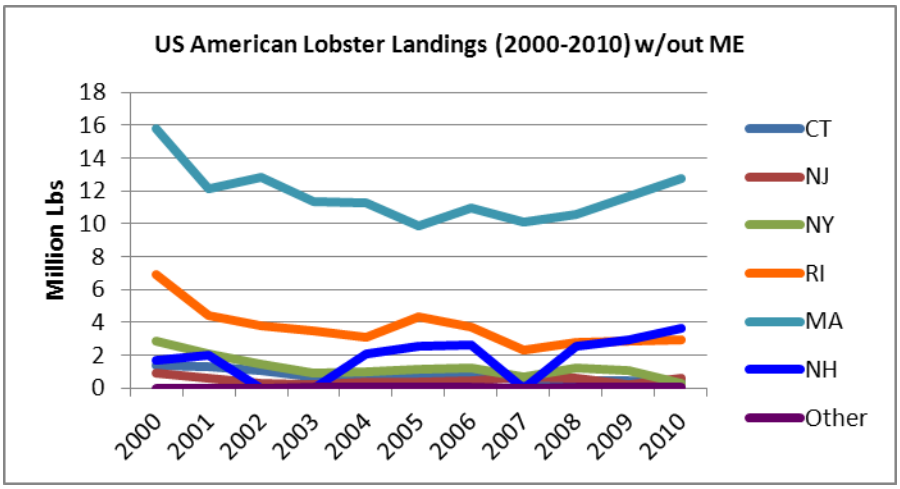

Figure 4b. US Landings of American lobster in million pounds by state 2000-2010 with Maine data excluded. "Others" are Maryland, Delaware and Virginia. Figure compiled from data in NMFS 2012 and ASMFC 2009.

Importance to the US/North American market

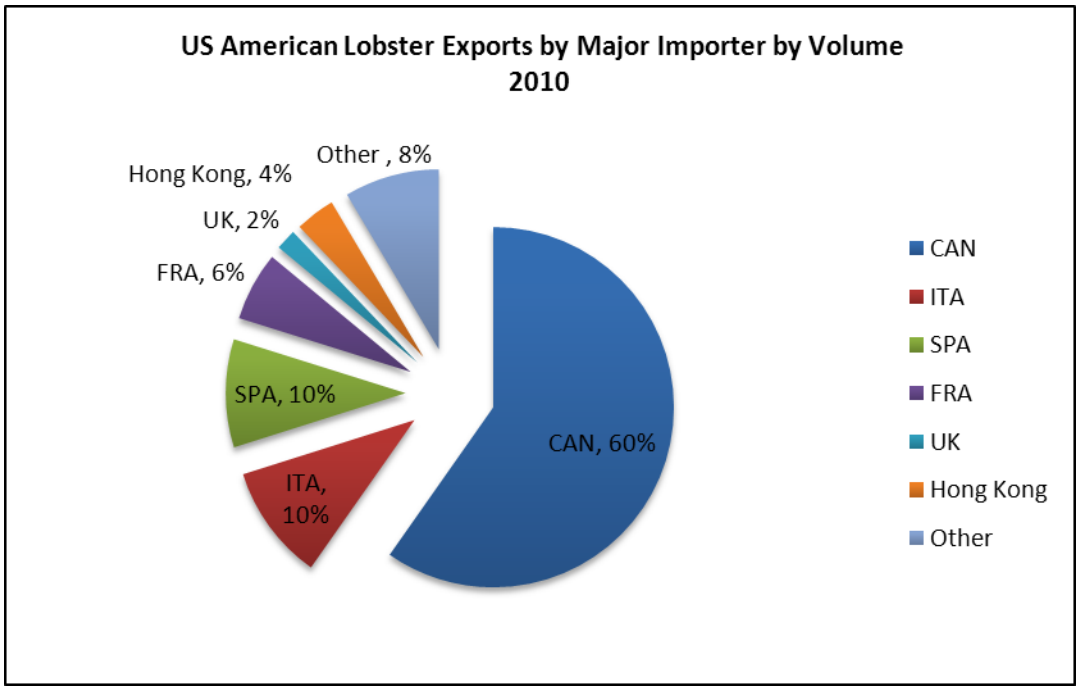

Figure 5. US Exports of American lobster by major importers in 2010 (NMFS 2010).

The continued increase in total landings of American lobster (all three stocks combined) over 2008–2010 has led to a 22% increase of US exports of American lobster from 26,387 metric tons in 2008 to 33,924 metric tons in 2010 (NMFS 2010). The largest markets in 2010

were Canada (60%) followed by Italy (10%) and Spain (10%) (Figure 5; NMFS 2011).

Common and market names
American lobster is also known as Maine lobster. It is a different species than rock lobster or spiny lobster.

Primary product forms
American lobster is available year-round in both retail and service markets and is commonly sold whole and live. Lobster is also marketed as fresh or frozen lobster meat (tail and claw meat), canned, as lobster roe (tomalley), or as value-added product (breaded and stuffed-tails).

Analysis

Scoring guide

- All scores result in a zero to five final score for the criterion and the overall final rank. A zero score indicates poor performance, while a score of five indicates high performance.
- The full Seafood Watch Fisheries Criteria that the following scores relate to are available on our website at www.seafoodwatch.org.

Criterion 1: Stock for which you want a recommendation

Guiding principles

- The stock is healthy and abundant. Abundance, size, sex, age and genetic structure should be maintained at levels that do not impair the long-term productivity of the stock or fulfillment of its role in the ecosystem and food web.
- Fishing mortality does not threaten populations or impede the ecological role of any marine life. Fishing mortality should be appropriate given current abundance and inherent resilience to fishing while accounting for scientific uncertainty, management uncertainty, and non-fishery impacts such as habitat degradation.

Stock	Inherent Vulnerability	Stock Status	Fishing Mortality	Criterion 1
Georges Bank-American lobster	High	Low Concern (4)	Low Concern (3.67)	Green 3.83
Gulf Of Maine-American lobster	Low	Low Concern (4)	Low Concern (3.67)	Green 3.83
Southern New England-American lobster	Low	High Concern (2)	Moderate Concern (2.33)	Red 2.16

Synthesis

In general, American lobsters have a high vulnerability to fishing pressure. Although it is relatively difficult to age lobsters, as they do not have otoliths or other features that facilitate accurate aging, it is believed that they reach maturity and market size in 5– 8 years. American lobsters are long lived and it is estimated that they can live for up to 100 years (Cooper and Uzmann 1980). American lobsters will extrude eggs from their abdomen and brood them for up to 9 months before the eggs hatch into planktonic larvae (ASMFC 2000). The larval phase lasts anywhere from 10 days to 2 months (depending on water temperature) and allows for some larval dispersal (ASMFC 2000). The stock assessments regularly conducted by ASFMC indicate that total American lobster landings and abundance have been increasing steadily for the past twenty years. Two of the three stocks—Gulf of Maine (GOM) and Georges Bank (GBK)—are considered healthy, while the Southern New England (SNE) stock has been in decline since the late 1990s and remained at low abundance levels. The SNE stock has also experienced record low recruitment years since the 1990s and is thus considered depleted (ASMFC 2009).

Justification of Ranking

Factor 1.1 Inherent Vulnerability: High vulnerability

Key relevant information:

American lobster in all regions is considered of high inherent vulnerability

Detailed rationale:

Factor	American Lobster	Score	Source
Average age at maturity	5-8 years	2	Rowe, 2001
Average maximum age	>50 years	1	Cooper and Uzmann, 1980;ASMFC 2009
Reproductive Strategy	egg brooder	2	ASMFC 2009
Density Dependence	No depensatory or compensatory dynamics demonstrated or likely	2	Wahle, 2012-pers.comm
Score (mean of factor scores)		1.75	

Factor 1.2 Stock Status

Gulf of Maine (GOM): Low concern

Key relevant information:

The GOM stock is considered healthy because the reference abundance is above the threshold (Figure 6) (ASMFC 2009). The reference abundance in the GOM increased steadily

from 1982 to 2000 then declined slightly followed by an increase to record levels in 2005. After 2005, reference abundance has declined but is still above the 1982–2003 median (threshold) (Table 1). However, some uncertainties do exist on appropriate biological reference points (Zhang *et al.* 2011).

Detailed rationale:
The most current American lobster stock assessment does not use BMSY to assess stock status. Using abundance and effective exploitation models as well as non-model based stock indicators, it was determined that stock abundance, spawning stock biomass and recruitment are high for GOM American lobster (ASMFC 2009)[1]. The GOM stock is considered healthy because the reference abundance is above the threshold (Figure 6) (ASMFC 2009). The reference abundance in the GOM increased steadily from 1982 to 2000 and then declined slightly followed by an increase to record levels in 2005. After 2005, reference abundance has declined but is still above the 1982–2003 median (Table 1).

Georges Bank (GBK): Low concern

Key relevant information:
The GBK stock is in favorable condition and based on the last ASMFC assessment, (ASMFC 2009) the abundance of the stock is at record highs. The reference abundance in Georges Bank remained relatively consistent at 1.5–2 million between 1982 and 1999. Total reference abundance began to increase in 2002 and reached a peak in 2004. Abundance began to decline in 2005 but remains high (Figure 7) and above the 2005–2007 mean (Table 2) (ASMFC 2009). However, some uncertainties do exist on appropriate biological reference points (Zhang *et al.* 2011).

Southern New England (SNE): High concern

Key relevant information:
The SNE stock is in poor condition. The reference abundance of the stock is below the 1984–2003 threshold. The SNE stock suffered severe and well-documented population declines beginning in 1997 (ASMFC 2009; ASMFC 2010) due in part to shell disease (ASMFC 2009; ASMFC 2010) (Figure 8; Table 3). Since 2004, abundance levels have stabilized but continue to be well below the 1984–2003 threshold (ASMFC 2009).

Because the Southern New England American lobster stock has been below threshold levels abundance for several years, the stock is considered 'depleted but not overfished' (ASMFC 2009).

[1] Though this is accurate according to the stock assessment released in 2009, reference points for all stocks changed with Addendum XVI, approved in May 2010. The updated reference points use the 25th percentile as a threshold for reference abundance for all three stocks. The new target for GOM and GBK was changed to 75% and to 50% for SNE. Effective exploitation changed as well. Although the reference points changed, the status for all of these stocks did not (Carloni, pers. comm.) (ASMFC 2010).

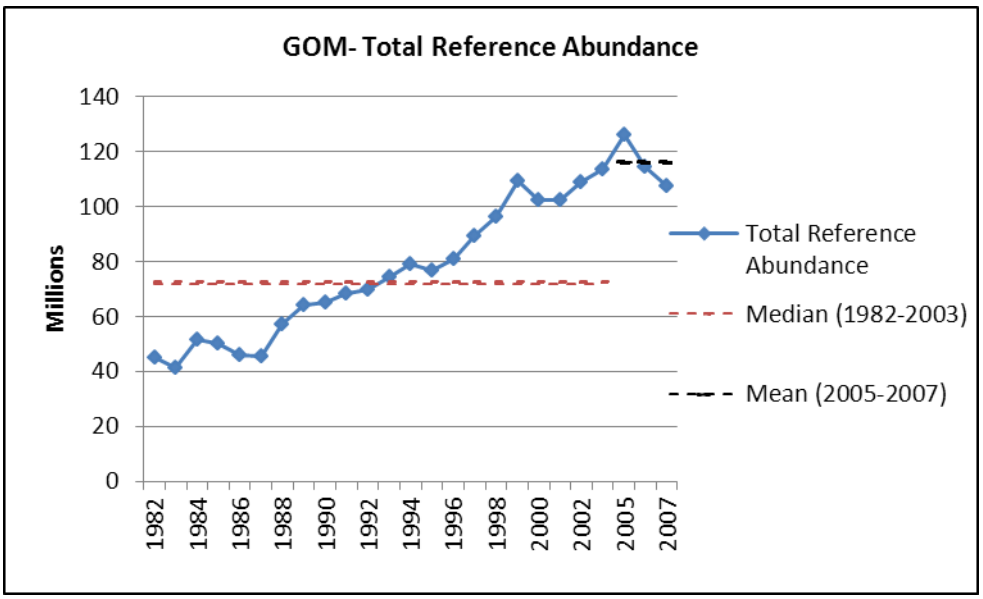

Figure 6. Total reference abundance in millions of American lobster in the Gulf of Maine (ASMFC 2009).

Table 1. Abundance threshold for Gulf of Maine American lobster stock (ASMFC 2009)

Variable	GOM
Abundance threshold	72,030,500
Recent abundance 2005-2007	116,077,000
Abundance above threshold	YES

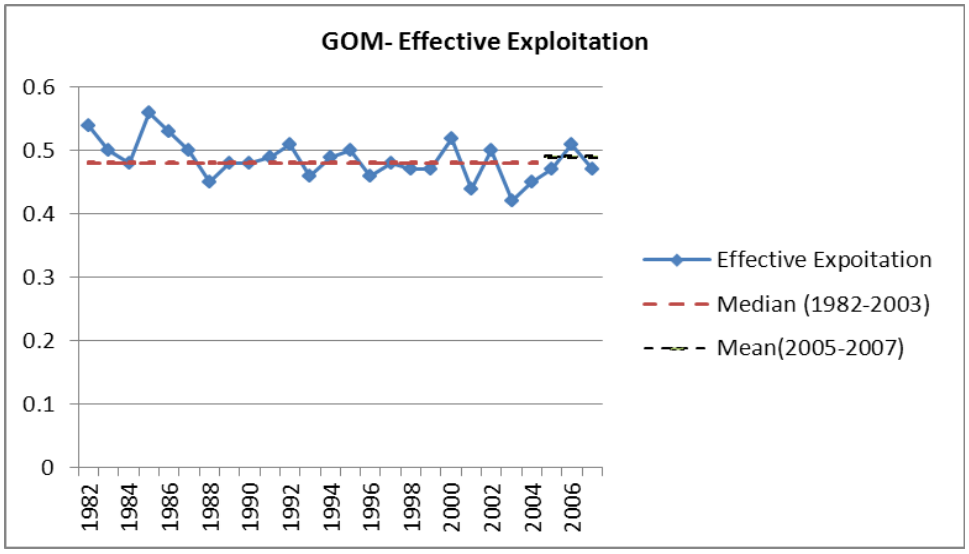

Figure 7.Annual effective exploitation of American lobster in the Gulf of Maine 1982-2007 (ASMFC 2009).

Table 2.Effective exploitation threshold for Gulf of Maine American lobster stock (ASMFC 2009)

Variable	GOM
Effective exploitation threshold	0.49
Recent effective exploitation 2005-2007	0.48
Effective exploitation below threshold?	YES

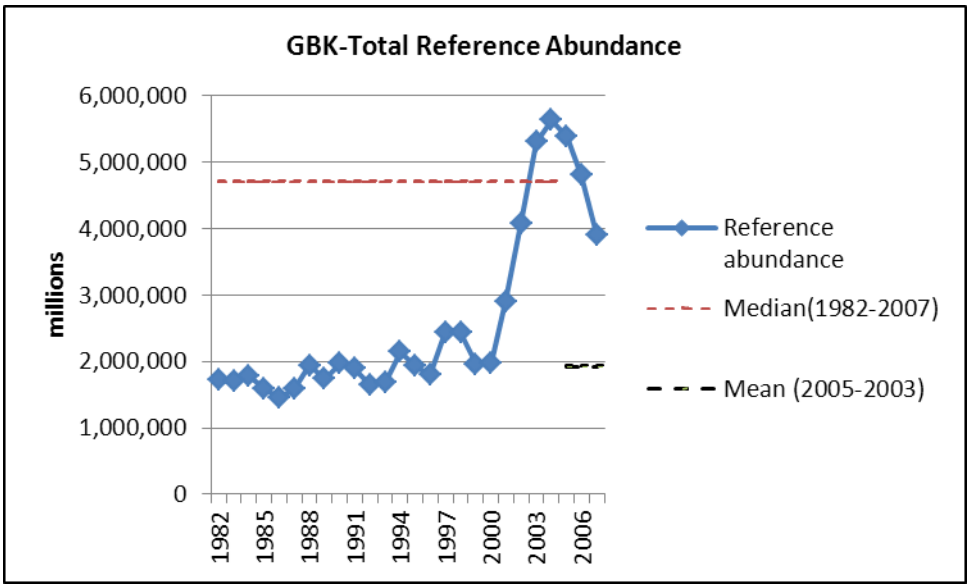

Figure 8. Total reference abundance of American lobster in Georges Bank 1982-2007 (ASMFC 2009).

Table 3. Total reference abundance threshold of American lobster stock in Georges Bank (ASMFC 2009)

Variable	GBK
Abundance threshold	1,912,355
Recent abundance 2005-2007	4,698,670
Abundance above threshold	YES

Factor 1.3 Fishing mortality

Key relevant information:

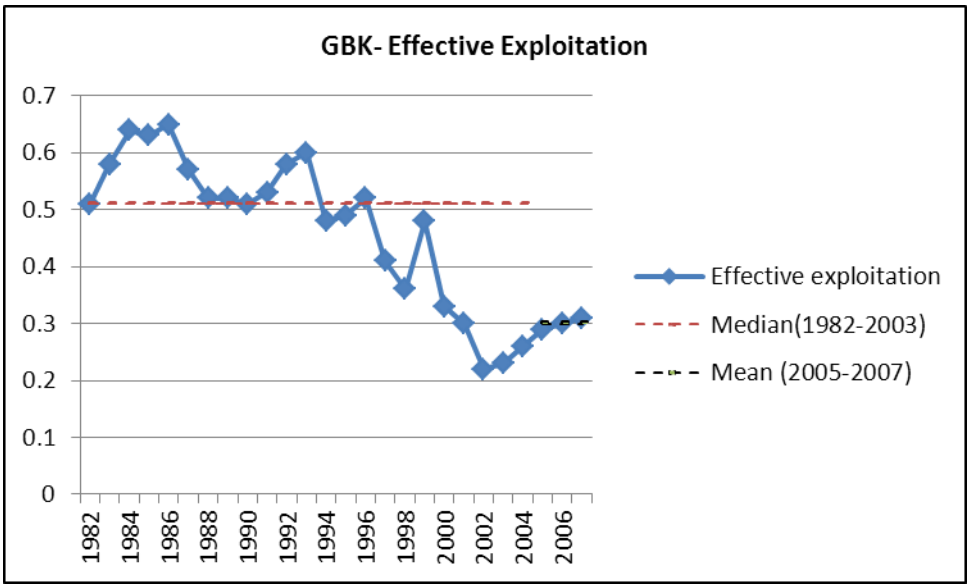

Figure 9. Annual effective exploitation rates of American lobster in Georges Bank 1982-2007 (ASMFC 2009).

Table 4. Effective exploitation threshold for American lobster in Georges Bank 1982-2007 (ASMFC 2009).

Variable	GBK
Effective exploitation threshold	0.51
Recent effective exploitation 2005-2007	0.3
Effective exploitation below threshold?	YES

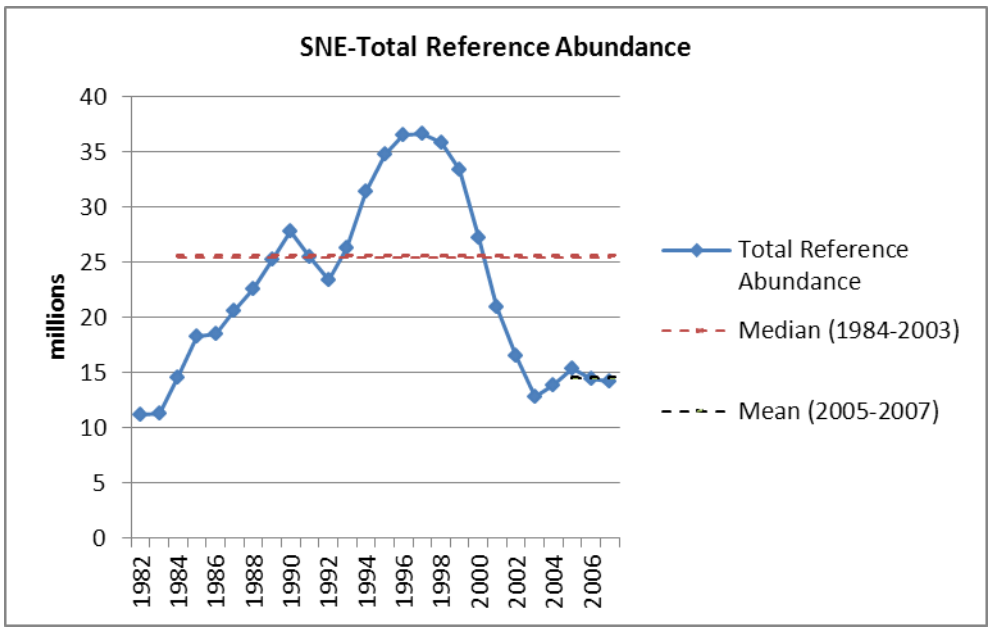

Figure 10. Total reference abundance of American lobster in Southern New England 1982-2007 (ASMFC 2009).

Table 5. Total reference abundance threshold of American lobster in Southern New England 1982-2007 (ASMFC 2009).

Variable	SNE
Abundance threshold	25,372,700
Recent abundance 2005-2007	14,676,700
Abundance above threshold	NO

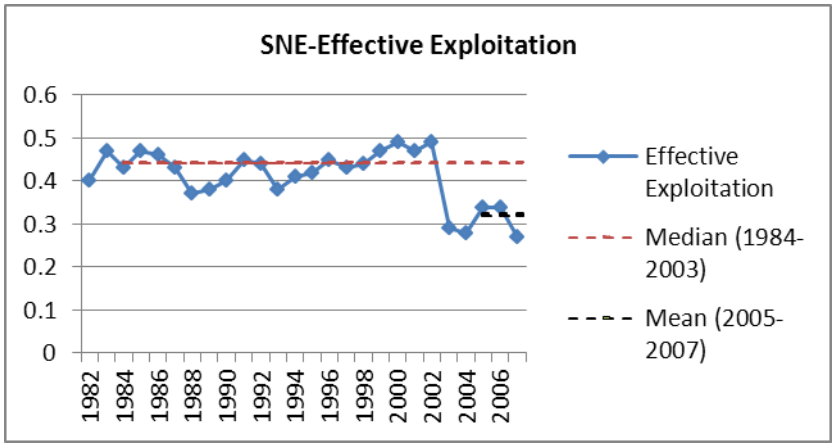

Figure 10.Effective Exploitation of American lobster in Southern New England 1982-2007 (ASMFC 2009).

Table 6. Effective exploitation threshold of American lobster in Southern New England 1982-2007 (ASMFC 2009).

Variable	SNE
Effective exploitation threshold	0.44
Recent effective exploitation 2005-2007	0.32
Effective exploitation below threshold?	YES

Detailed rationale:

Gulf of Maine (GOM): Low concern
Effective exploitation was used to determine fishing mortality estimates because of the variability in size selectivity (ASMFC 2009). In the Gulf of Maine, annual effective exploitation rates remained fairly constant between 1982 and 2007 (around 0.49), and were slightly below the threshold in 2007 (Figure 9) (ASMFC 2009). There are no fully established harvest control rules in place (Zhang *et al.* 2011).

Georges Bank (GBK): Low concern
Effective exploitation is at a rate of 0.51 and is below the threshold. However, there are no fully established harvest control rules in place (Zhang *et al.* 2011).

In Georges Bank, annual effective exploitation rates are at record lows. Since 1994, the annual effective exploitation rates have declined steadily and have remained below the 1982–2005 threshold ever since. The recent mean effective exploitation rate for 2005–2007 is 0.3 (Figure 10; Table 5) (ASMFC 2009).

Southern New England (SNE): Moderate concern
The Southern New England American lobster stock is depleted. However, conflicting models make it difficult to ascertain whether overfishing is occurring. Uncertainty remains around the fishery's contributions to continued stock declines and depleted status. However, based on the recently assessed (2005–2007) effective exploitation rate of 0.32 (Table 6), the stock is below the threshold and thus not considered overfished even though it is depleted (ASMFC 2009). From 1982–2002, the effective exploitation rate in SNE remained fairly constant, after which exploitation declined to record lows and remain low and well below the threshold (Figure 11). Therefore, as this is a depleted stock with conflicting models leading to uncertainty in the fishery's contribution to population declines, American lobster fishing mortality in Southern New England is deemed a moderate concern.

Criterion 2: Impacts on other retained and bycatch stocks

Guiding principles

- The fishery minimizes bycatch. Seafood Watch® defines bycatch as all fisheries-related mortality or injury other than the retained catch. Examples include discards, endangered or threatened species catch, pre-catch mortality and ghost fishing. All discards, including those released alive, are considered bycatch unless there is valid scientific evidence of high post-release survival and there is no documented evidence of negative impacts at the population level.
- Fishing mortality does not threaten populations or impede the ecological role of any marine life. Fishing mortality should be appropriate given each impacted species' abundance and productivity, accounting for scientific uncertainty, management uncertainty and non-fishery impacts such as habitat degradation.

Summary

All regions:

Stock	**Inherent Vulnerability** Rank	**Stock Status** Rank (Score)	**Fishing Mortality** Rank (Score)	**Subscore**	**Score** (subscore*discard modifier)	**Rank** (based on subscore)
North Atlantic Right Whale	High	Very High Concern (1)	High Concern (1)	1.00	0.75	Red
Atlantic Humpback Whale	High	Very High Concern (1)	High Concern (1)	1.00	0.75	Red
Atlantic Herring	Medium	Low Concern (4)	Low Concern (3.67)	3.83	2.87	Green

Synthesis

Retained and bycatch species analyzed in this assessment have been chosen based on either the percent of catch they make up in the American lobster fishery, the amount of the species used as bait, or their conservation status (endangered, threatened, overfished, etc.). In general, the traps used in the commercial lobster fishery are considered highly selective gear compared to other types, and as a result, overall levels of bycatch are relatively low compared to other marine fisheries. Because bycatch in the lobster fishery is not considered a large problem, there is insufficient documented information about the nature and quantity of bycatch. The most common types of bycatch found in lobster traps are juvenile lobsters, ovigerous female lobsters, crabs and some finfish (e.g., flounder, scup, tautog). In addition, there is little information on discard and mortality rates for the lobster fishery and

overall it appears that discard rates of lobster bycatch are low compared to other fisheries. Although bycatch in lobster traps involves relatively few species, the American lobster fishery is considered a Category I fishery by NMFS (NMFS, 2012) due to the frequency of marine mammal entanglements in lobster gear. Because of the interactions of North Atlantic right whales (*Eubaleana glacialis*) and humpback whales (*Megaptera novaeangliae*) (both considered endangered or threatened species) with lobster fishing gear, these species are also analyzed here.

In addition to North Atlantic Right whales and Humpback whale analysis, this report is also evaluating the effects of the American lobster fishery on bait species, in particular, Atlantic herring (*Clupea harengus*). Atlantic herring is the main bait species used in lobster traps and approximately 70% (70-75,000 mt) of all Atlantic herring landings are used directly by the lobster fishery (Grabowski et al.; ASMFC 2010).

Justification of Ranking

Factor 2.1 Inherent Vulnerability

North Atlantic Right Whale
Key relevant information:
High vulnerability (Criteria document p.9)

Humpback Whale
Key relevant information:
High vulnerability (Criteria document p.9)

Atlantic Herring
Key relevant information:
Medium vulnerability (FishBase score: 40-60) (Froese and Pauly 2010)

Factor 2.2 Stock status

North Atlantic Right Whales: Very high concern

Key relevant information:
Listed as Endangered (NOAA 2012)

Detailed rationale:
The North Atlantic right whale is considered one of the most critically endangered large whale species in the world. It constitutes a strategic stock because the level annual fishery related mortality and serious injury continues to exceed its Potential Biological Removal

(PBR) (NOAA 2012). According to the latest stock assessment (2010), there are between 350–400 North Atlantic right whales in existence (NOAA 2012). In 2005, 361 individuals were known to be alive. The population of North Atlantic right whales declined in the 1990s; increases in mortality rates in 2004 and 2005 were cause for serious concern (Kraus 2005). It was predicted that these mortality rate increases would likely reduce the right whale population by 10% per year (Kraus *et al.*; 2005). However, despite these predictions, examination of the minimum number as it existed between 1990 and 2005 suggests that the right whale population is experiencing a positive trend in size with a mean growth rate of 2.1% in that time period (Waring *et al.* 2010; ASMFC 2010).

North Atlantic Humpback Whales: Very high concern

Key relevant information:
Listed as Endangered (NOAA 2012)

Detailed rationale:
The North Atlantic right whale is considered one of the most critically endangered large whale species in the world. It constitutes a strategic stock because the level annual fishery related mortality and serious injury continues to exceed its Potential Biological Removal (PBR) (NOAA 2012). According to the latest stock assessment (2010), there are between 350–400 North Atlantic right whales in existence (NOAA 2012). In 2005, 361 individuals were known to be alive. The population of North Atlantic right whales declined in the 1990s; increases in mortality rates in 2004 and 2005 were cause for serious concern (Kraus 2005). It was predicted that these mortality rate increases would likely reduce the right whale population by 10% per year (Kraus *et al.*; 2005). However, despite these predictions, examination of the minimum number as it existed between 1990 and 2005 suggests that the right whale population is experiencing a positive trend in size with a mean growth rate of 2.1% in that time period (Waring *et al.* 2010; ASMFC 2010).

Atlantic Herring: Low concern

Key relevant information:
Since a severe population crash in the 1970s, subsequent management regulations on harvest levels were imposed in order to rebuild the herring stock (TRAC 2009; ASMFC 2010). Since then, the biomass of Atlantic herring has been increasing and current estimates of biomass of Atlantic herring are at 652,000 mt, slightly under BMSY of 670,600 (TRAC 2009; ASMFC 2010). Current estimates indicate that about 10% of the stock is being exploited (TRAC 2009).

Factor 2.3 Fishing mortality

North Atlantic Right Whale: High concern

Key relevant information:
The North Atlantic right whale is one of the few species that is considered bycatch in the American lobster trap fishery (Johnson *et al.* 2005). It is one of the most threatened and endangered species in the world, and the North Atlantic population is estimated to be at most 400 individuals (Waring *et al.* 2010). From 2004–2008, the minimum annual rate of mortality and serious injury to right whales due to anthropogenic effects was an average of 2.8 per year (U.S. waters, 2.2; Canadian waters, 0.6) (Waring *et al.* 2010). The two main causes responsible were: 1) incidental entanglements in fishing gear at 0.8 per year (U.S. waters, 0.6; Canadian waters, 0.2), and 2) ship strikes at 2.0 per year (U.S. waters, 1.6; Canadian waters 0.4) (Waring *et al.* 2010). During this same time period (2004–2008), out of 14 records of mortality or serious injury, four were attributed to entanglement or fishery interactions (Waring *et al.* 2010). The average mortality rate due to fishery entanglement was 0.8 whales per year (U.S. Waters, 0.6; Canadian waters, 0.2) (Waring *et al.* 2010). In the latest Large Whale Entanglement and Ship Strike Report (NMFS 2009), of the 31 reports of whale entanglements, two of them were right whales entangled in lobster gear (NMFS 2009). Although lobster gear is not entirely responsible for all whale entanglements, it is considered the largest single source of right whale entanglements due to the sheer volume of gear (Waring and Pace *et al.* 2004; Johnson *et al.* 2005; Brilliant and Tripple 2010). It is the consensus that with a PBR of 0.5 (ALWTRP, 2011) even a single right whale entangled in lobster pots per year is too many.

Detailed rationale:
There are three identified stocks of right whales (*Eubalaena glacialis*), North Atlantic, North Pacific and Southern Hemisphere. The North Atlantic Stock has two sub stocks: Eastern North Atlantic and the Western North Atlantic (WNA). The WNA stock of right whales has a range from North Florida to the Bay of Fundy (Fujiwara and Caswell, 2001) as well as six major aggregations: 1) Georges Bank / Gulf of Maine, 2) Cape Cod and Massachusetts Bay, 3) Bay of Fundy, 4) Scotian shelf, 5) coastal waters of the southern United States, and 6) Great South Channel. All of these except the southeast support an active lobster fishery (Waring and Pace *et al.* 2004). Right whales are the most endangered of all the great whales in the world and their effective population size is between 350-400 individuals. Due to the limited size of the population, the species may already be functionally extinct because of demographic stochasticity (Fujiwara and Caswell, 2001).

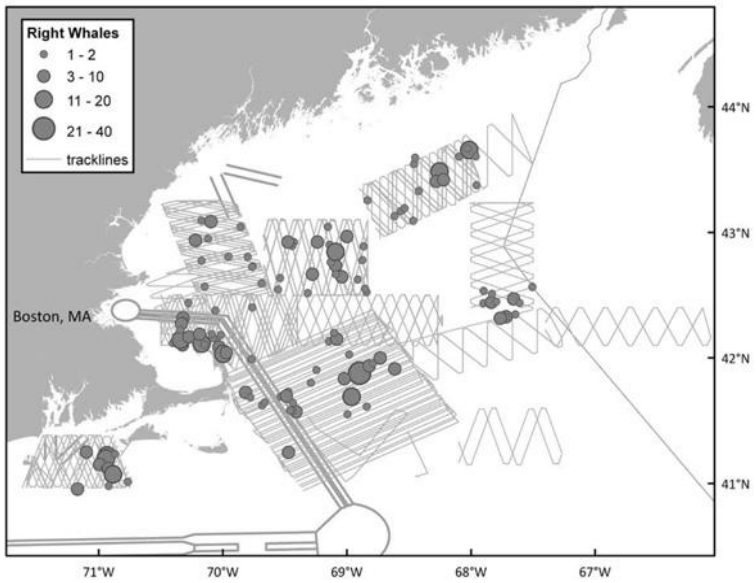

Figure 11.North Atlantic Right Whale Aerial Survey sightings off of the Northeastern Coast of the U.S. from October 2010-September 2011 (NEFSC 2011).

Despite active protection of the species, North Atlantic right whales do not appear to be recovering (NMFS 2005). The NMFS 2005 Recovery Plan stated that there had been no recovery of the population in the last 15 years and suggested that North Atlantic right whales were actually much rarer and more endangered than previously believed (NMFS, 2005). The reasons for lack of recovery were probably due to decreased birth rates and increased mortality rates. Juvenile right whales appear to be particularly vulnerable to mortality from ship strikes, interaction with fishing gear and natural causes (NMFS 2005)**.** In a study by Kraus (1990), it was estimated that in the first four years of life, North Atlantic right whale mortality rates ranged from 2%–17% with approximately a third of those mortalities attributed to anthropogenic factors (Kraus 1990).

Entanglement records from 1990–2008 show 47 confirmed right whale entanglements in a variety of fishing gear (e.g., weirs, gillnets, trailing lines and buoys) (Waring *et al.* 2010). From 1997–2001, documented mortality and serious injury were at 2.0 whales per year with 0.8 attributed to ship strikes and 1.2 attributed to gear entanglements **(**ALWTRP, 2004). In 2002 and 2003, there was a substantial increase in the number of entanglements reported: 8 entanglements in 2002 and 9 in 2003 (ALWTRP 2004). Entanglements can result in the long-term deterioration of the animal if it does not lead to death immediately, and therefore it is thought that the actual mortality of right whales is higher than estimated (Knowlton and Kraus, 2004). Large whales are susceptible to floating ground lines attached to lobster pots that are oriented horizontally to the sea floor (ALWTRP 2004) as well as the vertical lines that attach lobster gear to surface buoys (Johnson and Salvador 2005). Gear gets caught in the mouth and lines can get wrapped around tails and flippers while whales are feeding.

Whales will often free themselves of gear following an encounter with fishing gear and thus, it seems, a better way to estimate entanglement events may be to analyze scarification of right whales. A study of 447 right whales looking at scarification found that 338 of the whales (75.6%) examined during 1980–2002 had been scarred at least once by fishing gear (Knowlton *et al.* 2005). In fact, other research using the North Atlantic Right Whale Catalogue suggests that between 14% and 51% of right whales are involved in entanglement interactions every year (Knowlton *et al.* 2005). Based on this information it would seem that the NMFS estimate of 1.2 serious injuries or deaths per year is a large underestimate. With the PBR of right whales is 0.5, no anthropogenic mortality can be tolerated (Waring and Pace *et al.* 2004).

North Atlantic Humpback Whales: High concern

Key relevant information:
Like the right whales, the North Atlantic Humpback whales are one of the few species that are considered bycatch in the American lobster fishery. Humpback whales are also endangered; however, the status of the population seems to be healthier than the right whale population. Despite positive recovery trends humpback whales are still experiencing mortality rates due to entanglement in fishing gear that may impair the population's recovery.

Detailed rationale:
There are five identified stocks of Humpback whales *(Megaptera novaeangliae)* in U.S. waters: 1) Gulf of Maine, 2) Western North Pacific, 3) Central North Pacific, 4) California/Oregon/Washington, and 5) American Samoa (NMFS, 2012). This report only deals with the Gulf of Maine North Atlantic humpback whale stock.

The best available estimate for the current North Atlantic Humpback whale population is approximately 11,750 (Stevick *et al.* 2003), and the Gulf of Maine stock has approximately 550 individuals (NOAA, 2012). The latest Humpback whale assessment puts the PBR for the Gulf of Maine stock at 1.1 whales (Waring *et al.* 2010).

The main threats to the Humpback whale population are entanglements in fishing gear and ship strikes (NMFS, 2012). Between 2004 and 2008, the minimum annual mortality and serious injury rate due to human causes was 4.6 individuals per year (U.S.=4.4; Canada=0.2). This included mortalities and serious injury rates due to fishery related entanglements (U.S.= 2.8; Canada=0.2) (Waring *et al.* 2010; Glass *et al.* 2010).

Similar to right whales, ship strikes and fishery related entanglements could be significantly impairing the rate of recovery for humpback whales. A 1995 study (Wiley 1995) looked at 20 dead humpback whales and determined that 30% (6 individuals) had major injuries that were consistent with ship strikes and 25% (5 individuals) had injuries that were attributed to

fishing gear entanglement. This study indicated that at least 60% of the whales analyzed showed signs that human factors contributed to mortality of the whales (Wiley, 1995). In addition, there is scarring evidence that male humpback whales are more likely to get entangled compared to females (Robbins and Mattila 2001) and that yearling humpback whales have higher incidence of entanglement than any other age class. There was also indication that entanglement events had significant effects on reproductive success (Robbins and Mattila 2001).

Atlantic Herring: Low concern

Key relevant information:

The status of the Atlantic herring stock based on fishing mortality is 'not being overfished' and 'no overfishing occurring', but there are concerns that the potential for overfishing exists, especially in the Gulf of Maine inshore fishery (NEFSC 2005)[2]. In 2009, the Scientific and Statistical Committee (SSC) recommended that the Allowable Biological Catch (ABC) for herring not be increased based on substantial uncertainty from the last stock assessment (2006) (NEFMC 2009). The SSC recommended that the annual catch for 2010–2012 should be limited to recent catch levels of about 90,000 mt. The rationale behind this recommendation was that exploitable biomass for 2010–2012 was projected to decline due to poor recruitment (NEFMC 2009).

The last update to the 2006 ASMFC stock assessment states that the Gulf of Maine/ Georges Bank Atlantic herring stock is not overfished and that overfishing is not occurring (ASMFC 2008); this is confirmed by the latest TRAC report (2009). Fishing mortality rates have remained well below Fmsy (0.27), with a high of 0.20 in 2001 and a low of 0.14 in 2008 (ASMFC2008; TRAC 2009).

[2] It is worth noting that the majority of all American lobster landings come from inshore in the Gulf of Maine so it is logical that concerns of overfishing of the herring stock could occur in this region.

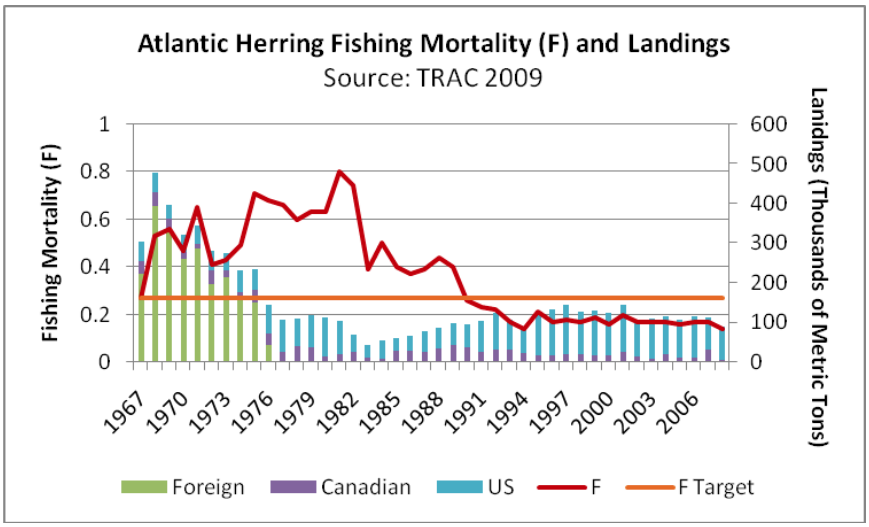

Figure 11. Fishing Mortality for the Atlantic Herring Stock Complex (1967-2008).

Factor 2.4 Overall discard rate/ Bait Use

Atlantic Herring: >100%
Key relevant information:
Ratio of herring bait inputs to lobster landings is >100% (data from Grabowski et al 2010).

Detailed rationale:
The use of Atlantic herring as bait for the American lobster fishery is important to address because herring removal from the marine ecosystem may have significant impacts. Herring is a vital forage species for other fish, marine mammals and seabirds and if the herring stocks were to crash again there could be severe ecosystem wide consequences. However, the more pressing issue is not that the Atlantic herring stock is being depleted but that both the American lobster fishery and the Atlantic herring fishery are becoming co-dependent on one another; ecological and commercial changes that affect one fishery will also affect the other (Ryan *et al.* 2010; Grabowski *et al.* 2010). Additionally, the American lobster and Atlantic herring relationship seems to be having a positive effect on the biological productivity of American lobster through its large consumption of herring bait (Ryan *et al.* 2010). This is believed to be one of the main reasons for the surge in the lobster population despite intensive fishing pressure (Saila *et al.* 2002; Drinkwater *et al.* 1996).

The American lobster industry and the Atlantic herring fishery have a long history of being artificially linked. Since the 19th century, Atlantic herring has been used as the primary source of bait for lobster traps (ASMFC 2010). The dependence on Atlantic herring as bait for the lobster fishery is the main driver of the herring fishery. Herring accounts for nearly 90% of the bait used in lobster traps (Driscoll 2008) while the lobster fishery is the predominant market for herring (Brandt and McEvoy 2006). Every year, an average of 100,000 mt of herring are landed in the Gulf of Maine and about 70% (70,000 mt) of the

total landings go directly to the lobster fishery (ASMFC 2010; Grabowski *et al.* 2010). There are a few hypotheses about why the lobster populations in the GOM and Georges Bank are experiencing growth. One of them, the predator reduction hypothesis, suggests that the lobster populations are thriving because of the overexploitation of other groundfish stocks—such as cod—that are natural predators of lobster. With the disappearance of natural predators, there is little predation pressure on juvenile lobsters (Saila *et al.* 2002; Grabowski *et al.* 2010), which ultimately resulted in increasing the adult stock.

Climate change has been another explanation for the increase in lobster abundance in the GOM and Georges Bank. Increasing ocean temperatures could lead to favorable conditions for lobster growth and recruitment. Lastly, and the explanation that has gained the most traction, herring bait may actually be subsidizing lobster populations by increasing growth rates, survivorship and fecundity (Grabowski *et al.* 2010; Saila *et al.* 2002). Lobster traps are heavily baited, providing extra nutrients that otherwise would not be available for lobsters. Additionally, bait thrown overboard will also be available for consumption by lobsters not in traps. Jury *et al.* (2001) demonstrated that sub-legal sized lobsters enter and exit lobster traps at will and can consume vast amounts of bait with little competition (Saila *et al.* 2002). A mark and recapture study of lobsters in areas with traps show that these lobsters outgrow those in areas without traps by 15% (Grabowski *et al.* 2009). Their findings support the hypothesis that herring bait is in fact augmenting lobster diets and, as a consequence, lobster growth rates and abundance are increasing. This, in turn, enhances the overall economic value of the lobster fishery (Grabowski *et al.* 2010).

The problem with a bait-constrained fishery such as American lobster is that if something happens to the bait stock (herring) it will likely have negative consequences both economically and ecologically. When fishing effort for lobster increases, so does the demand for herring; in turn, this can potentially drive the bait stock below its MSY. An overexploited herring stock would mean less abundant, more expensive bait, which could ultimately limit lobster landings and lead to a smaller growth subsidy (Ryan *et al.* 2010). The codependency of these two fisheries could lead to the collapse of one or both if not properly managed. Indeed, herring landings declined by 20% in 2007 while lobster effort did not. Though officially not overfished and with no overfishing occurring, the GOM lobster stock is being closely watched and managed in order to prevent overexploitation (ASMFC 2010).

Criterion 3: Management effectiveness

Guiding principle

- The fishery is managed to sustain the long-term productivity of all impacted species. Management should be appropriate for the inherent resilience of affected marine life and should incorporate data sufficient to assess the affected species and manage fishing mortality to ensure little risk of depletion. Measures should be implemented and enforced to ensure that fishery mortality does not threaten the long-term productivity or ecological role of any species in the future.

Fishery	**Management: Harvest Strategy** Rank (Score)	**Management: Bycatch** Rank (Score)	**Criterion 3** Rank Score
GOM	Low Concern (4)	Moderate Concern (3)	Green 3.46
GBK	Low Concern (4)	Moderate Concern (3)	Green 3.46
SNE	Very High Concern (1)	Moderate Concern (3)	Red 1.73

Synthesis

The Atlantic States Marine Fisheries Commission (ASMFC) oversees the management of the US American lobster fishery. It is a relatively well-managed fishery under the Fisheries Management Plan along with Amendment 3 and its subsequent addenda (I–XVI). The Southern New England stock provides an exception, however: it is depleted and management has not been able to effectively recover the stock from its depleted state. The ultimate goal of the FMP and Amendment 3 is to maintain a healthy lobster resource by protecting and restoring egg production. To this end, regulations have been drafted that protect immature animals, those over maximum size, and ovigerous females (via v-notching). Possession of v-notched females is also prohibited. To reduce bycatch, gear restrictions mandate the use of traps with biodegradable ghost panels and escape vents. Trap size limits, as well as effort control measures such as trap limits and limited entry restrictions, have also been implemented. In the Gulf of Maine and Georges Bank, American lobster stocks are well managed, and lobster abundance remains at high levels. However, despite some management efforts, the Southern New England stock continues to be depleted with no evidence of recovery.

Though the American lobster fishery is well managed and lobstermen are cooperative in complying with the FMP and all of the management regulations mandated by the Atlantic Large Whale Take Reduction Plan (ALTWTRP), North Atlantic right whales and humpback whales continue to interact with lobster fishing gear, in large part because of the sheer volume of gear that is being deployed.

Justification of Ranking

Factor 3.1 Management of fishing impacts on retained species
GOM and GBK – Low concern
SNE – Very high concern

Fishery	**Critical?**	Mgmt strategy and implement.	Recovery of stocks of concern	Scientific research and monitoring	Scientific advice	Enforce.	Track record	Stakeholder inclusion
GOM	No	Highly Effective	Highly Effective	Moderately Effective	Highly Effective	Highly Effective	Highly Effective	Highly Effective
GBK	No	Highly Effective	Highly Effective	Moderately Effective	Highly Effective	Highly Effective	Highly Effective	Highly Effective
SNE	No	Highly Effective	Ineffective	Moderately Effective	Moderately Effective	Highly Effective	Ineffective	Highly Effective

Key relevant information:
Management of the US American lobster fishery has been effective at protecting ovigerous females and regulating the stock through lobster size, trap size, number of traps, effort limitations, and gear restrictions. Bycatch of undersized and ovigerous females is effectively controlled though minimum size requirements and escape vents.

Management Strategy and Implementation:
All regions – Highly effective
The United States American lobster fishery has been under the management of the Atlantic States Marine Fisheries Commission (ASMFC) in state waters (0–3 miles) and the National Marine Fisheries Service (NMFS) in federal waters (3–200 miles) since December 1997. In 1997, the American Lobster Board approved Amendment 3 to the Fisheries Management Program (FMP). The FMP was designed to minimize population collapse as a result of recruitment failures (ASMFC 2009).

The goal of Amendment 3 is to sustain a healthy American lobster resource and a management framework that provides for sustainable long-term harvest, provides opportunities for participation, and allows the cooperative development of conservation measures (ASMFC 2009). The American lobster is under the management of both state and federal (NMFS) authorities as mandated by the Atlantic Coastal Fisheries Cooperative

Management Act. The main management unit for American lobster is all of the Northwest Atlantic Ocean and adjacent inshore waters from Maine to North Carolina (ASMFC 2009). For management purposes, this main unit has been divided in to seven Lobster Conservation Management areas (LCMAs) that cut across stock boundaries.

Three discrete stocks have been identified based on regional differences in life history parameters (ASMFC 2009). The three stocks—Gulf of Maine (GOM), Georges Bank (GBK) and Southern New England (SNE)—all have an inshore and offshore component (ASMFC 2009). The GOM and SNE areas are mainly inshore while GBK is an offshore fishery (ASMFC 2009). Although there are no restrictions on the total allowable catch for American lobster, landings are limited by size limits and protection of ovigerous females by v-notching berried females. V-notching berried females is only mandatory in Area 1 (GOM) and Area 3 (above 42° 30') (ASMFC 2009) but is a widespread practice through voluntary industry action. Additionally, the management of the lobster fishery requires all lobster fishers to have permits, and all traps must be tagged for identification purposes. Limits also exist on the number and size of traps. All traps are required to have biodegradable escape panels. Lobster management strategy and implementation in all regions is considered 'highly effective'.

Recovery of stocks of concern
GOM and GBK – Highly effective
SNE -- Ineffective
American lobster stocks in the GOM and GBK are considered abundant and healthy and therefore ranked as 'highly effective', while the SNE stock is considered depleted and well below the minimum threshold abundance (ASMFC 2009, 2010). Abundance indices have persisted at time series lows since the 2006 stock assessment (ASMFC 2010). In August 2009, the Technical Committee recommended that drastic management measures be taken to aid in the recovery/rebuilding effort of the SNE stock using existing parent stock by significantly reducing landings (ASMFC 2010). Following further evidence of significant recruitment failure and other impediments to stock recovery, in 2010, the Technical Committee recommended a moratorium on harvest in the SNE stock area for five years (ASMFC 2010). In February 2012, the American Lobster Board approved Addendum XVII to Amendment 3, which establishes area-specific management measures (for LCMAs 2, 3, 4, 5, and 6) to reduce fishing exploitation on the SNE stock by 10% beginning in July 2013 (ASMFC 2012). This is insufficient given the initial five-year moratorium recommendation. Therefore, this sub-factor is ranked as 'ineffective'.

Scientific Research and Monitoring:
GOM and GBK – Highly effective
SNE – Moderately effective
American lobster stocks are assessed using both fishery dependent data (landings, CPUE) and fishery independent data (NEFSC, NMFS and regional trawl surveys and measurements of recruitment and larval settlement and at sea sampling by observers). These methods all

contribute to the determination of biomass, target fishing levels, stock abundance and stock health. Stock assessment reports are issued every five years (the next assessment is due in 2014). Due to highly variable recruitment rates, leading to uncertainties in population size from year-to-year, there is need for greater research and monitoring and therefore, this sub-factor is ranked as **moderately effective**

Scientific Advice:
Management of American lobster relies heavily on scientific research and monitoring. The Lobster Technical committee, made up of scientists (e.g.,technical staff from member states, NFMS, USFWS and academia), determines appropriate harvest levels and reviews the health of the fishery based on current scientific data and provides scientific advice for state managers to follow. In 2010 the Lobster Technical Committee (TC) recommended a 5 year moratorium on harvesting in the SNE region and acknowledged the severity of the measure as well as the catastrophic economic impacts it would have on fishery participants. However, the TC believed that this was the best chance at stock rebuilding. The recommendation was not accepted and in February 2012, the American Lobster Board approved area-specific measures to reduce fishing exploitation in SNE by 10%, however despite this action, management has generally followed scientific advice and is therefore ranked as **moderately effective** for the SNE stock, while the GBK and GOM stocks closely follow scientific advice and are therefore ranked as **highly effective**.

Enforcement:
All regions – Highly effective
There is some rigorous enforcement in the American lobster industry - both federally and by each state and voluntary actions by the industry. Each state monitors lobster landings and patrols for illegal activities and then reports annually on the status of lobster fishery enforcement. In general, the effectiveness and extent of enforcement varies by state and level of voluntary compliance by the industry. In addition, all states have some at-sea observation of catch, therefore enforcement effectiveness is ranked as **highly effective**.

Track Record:
GOM and GBK – Highly effective
SNE – Ineffective
Currently, the American lobster status of the stocks presents a somewhat mixed picture. The Gulf of Maine stock as well as the Georges Bank stock appear to be relatively healthy and are experiencing continued record high abundance. The GOM and GBK stocks have been experiencing increases in abundance since the 1970's (ASMFC 2009) and this can be attributed to management efforts but also to other environmental factors that have been favorable for successful recruitment (e.g. water temperature increases, loss of main predators and abundance of fish bait). Though both the GOM and GBK American lobster resources are currently stable and abundant the intense fishing effort may not be sustainable if the stocks were to experience poor recruitment in the future (NMFS 2011) unless management measures were strict enough to enforce limiting landings, fishing effort,

sizes and trap allocations. However, management of the fishery is flexible. It is not predicated upon a single management measure but rather it is adaptive and changes when necessary (NMFS 2011) and is therefore ranked as **highly effective**.

In sharp contrast to GOM and GBK lobster stocks, the Southern New England stock is critically depleted with no evidence of recovery. Abundance of lobsters has been decreasing steadily since its peak 1997. Evidence has shown that several factors were involved that contributed to the collapse including overfishing, climate change, shell disease and extremely poor recruitment (NMFS 2011). Since the collapse of the fishery management measures (effort reductions) have been taken in an effort to allow the fishery to recover. Presently, the SNE stock abundance continues to be at record lows with no improvement. Overwhelming environmental and biological changes coupled with continued fishing greatly reduce the likelihood of SNE stock rebuilding (ASMFC 2010) and therefore the SNE track record is deemed to be **ineffective.**

Stakeholder inclusion:
All regions – Highly effective
Management of the American lobster fishery is community based and addresses needs of local areas while meeting the conservation and fishery targets set forth by the FMP. Public and industry stakeholders input on management measures is solicited through open meetings and through the website and is therefore **highly effective.**

Factor 3.2 Management of fishing impacts on bycatch species: Moderate concern

Fishery	**All Species Retained?**	**Critical?**	Mgmt strategy and implement.	Scientific research and monitoring	Scientific advice	Enforcement
GOM	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
GBK	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
SNE	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective

Key relevant information:
As a result of continued right and humpback whale entanglements leading to serious injury or even mortality, the American lobster fishery has been classified as Category I and compelled to comply with the gear modification mandates put forth by the ALWTRP. Some of these mandates include the elimination of floating lines at the surface, using weak links and breakaway lines (600 lbs inshore; 1500–2000 lbs offshore), and adopting neutrally buoyant and sinking groundlines (ALWTRP 2011). Management is ranked as a 'moderate

concern' due to the uncertain effectiveness of the bycatch reduction techniques being used.

Detailed rationale:
There is little to no quantitative information available regarding composition and management of bycatch in the US lobster fishery. Lobster trap gear is highly selective and incidental bycatch is considered low. The species most commonly caught as bycatch in lobster traps is American lobster for which there are management measures in place. Regulations prohibit lobstermen from landing small, juvenile, and ovigerous females, as well as V-notched females and lobsters above maximum size limits.

Of more pressing concern regarding bycatch is the role lobster gear has in large whale entanglement, specifically the North Atlantic right and humpback whales. Lobster gear is officially determined to be of great entanglement risk to right and humpback whales. As such, NMFS classified the American lobster fishery as a Category I fishery. Though it is difficult to determine exactly the involved fishery and geographic source of the entanglements, the high volume of lobster gear in the water suggests that the American lobster fishery is perhaps the largest single source of entanglements (NMFS 2005).

Management strategy and implementation: Moderately effective
North Atlantic right and humpback whales are endangered species that are protected under the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA) and as such, management measures must be in place to achieve compliance. As mandated by the 1994 amendments to the ESA and MMPA, NMFS developed the Atlantic Large Whale Take Reduction Plan (ALWTRP) in order to reduce mortality and serious injury to right, humpback and fin whales in US commercial fisheries (especially gillnet and trap fisheries) (ALWTRP 2011). The initial goals of the ALWTRP were to reduce serious injuries and mortality among right whales in US commercial fisheries to below 0.4 animals per year by January, 1998 (six months after implementation) as well as to reduce entanglement related serious injuries and mortality of right, humpback and fin whales to zero (10% of PBR) within five years of implementation. The methods outlined by the ALWTRP consist of a combination of gear modifications and area closures (ALWTRP 2011).

Since the implementation of the ALWTRP in 1997, it has undergone several modifications in order to meet both short-term and long-term goals. These modifications have included gear restrictions and area closures. In 2007, NMFS approved a final rule implementing a broad-based gear modification strategy that included expanded weak link and sinking ground line requirements, changes in management boundaries, seasonal restrictions for gear modifications, expanded exempted areas, and changes in regulatory language for clarification and consistency (ALWTRP 2011). Despite best efforts from ALWTRP and the cooperation and compliance of the lobster fishermen, the main threats to both right and humpback whales continue to be entanglements in fishing gear and ship strikes (NMFS 2012). Between 1990 and 2001, minimum annual mortality of right whales was 1.2 per year. Between 2004 and 2008, the minimum annual mortality and serious injury rates for

humpback whales were 2.8 per year (Waring *et al.* 2010; Glass *et al.* 2010). Thus, 15 years after the implementation of ALWTRP, the mortality and serious injury rates have been reduced by management measures but have not reach zero mortality, and (at least for right whales) recovery is negligent. Therefore, this sub-factor ranked as 'moderately effective'.

Scientific Research and Monitoring: Moderately effective
Due to the lack of comprehensive and reliable data regarding large whale/fishery interactions, monitoring the ALWTRP is challenging and has been **moderately effective**. Three of the bigger challenges are; 1) large whale entanglements are often not witnessed or documented by observers or fishermen (ALWTRP 2011) and 2) even if fishing gear is recovered from an entanglement incident it is often difficult to identify or attribute to a particular gear type, gear component, fishery or geographic region (ALWTRP 2011) and 3) typically, the data that are necessary for effective monitoring of the ALWTRP encompasses many regulated fisheries spanning a large geographic range along the US east coast (ALWTRP 2011).

Despite the above challenges, the ALWTRP continues to develop and modify their monitoring strategies in the hopes that both the short and long term goals set forth by the MMPA can be met. One of the ways to measure how effective the ALWTRP is involves comparing the most recent estimated annual serious injury and mortality of right, humpback and fin whales to their respective PBR and Zero Mortality Rate Goal (ZMRG) levels (ALWTRP 2011). This comparison, on an annual basis, is important because it can determine effectiveness of ALWTRP regulations, enforcement and education/ outreach efforts and it also serves as an indicator of compliance levels (NOAA 2011). The most recent PBR estimates (December, 2011) for the North Atlantic right whale is 0.5 whales and for the Gulf of Main humpback whale is 1.1 whales. These estimates indicate that conservation of these species continues to be a priority (ALWTRP 2011).

In order to monitor the efficacy of the ALWTRP regulations currently in place, the two best available indicators are serious injury and mortality as well as the frequency of large whale entanglements that are either observed or reported (ALWTRP 2011).

Scientific Advice: Highly effective
There is no indication that scientific advice is not being followed or incorporated in any region as management has worked to reduce entanglements. Therefore, this sub-factor is ranked as 'highly effective'.

Enforcement: Moderately effective
Enforcement of ALWTRP regulations by the American lobster fishery is carried out by the NMFS office of Protected Resources (PRD), NOAA's Office of Law Enforcement (OLE), and by the marine patrols of each state. The level of enforcement varies by individual state, but the states do monitor and enforce fisheries' activities both dockside and within state waters. Additionally, state law enforcement agencies work with the United States Coast Guard

(USCG) and NMFS in federal waters (NOAA 2011). However, due to the importance of protecting right whale populations, there is need for greater enforcement and this sub-factor is therefore ranked as ‘moderately effective’.

Criterion 4: Impacts on the habitat and ecosystem

Guiding principles

- The fishery is conducted such that impacts on the seafloor are minimized and the ecological and functional roles of seafloor habitats are maintained.
- Fishing activities should not seriously reduce ecosystem services provided by any fished species or result in harmful changes such as trophic cascades, phase shifts or reduction of genetic diversity.

Fishery	Impact of gear on the substrate Rank (Score)	Mitigation of gear impacts Rank (Score)	EBFM Rank (Score)	Criterion 4 Rank Score
GOM	Low Concern (3)	Minimal mitigation (0.25)	Moderate Concern (3)	Yellow 3.12
GBK	Low Concern (3)	Minimal mitigation (0.25)	Moderate Concern (3)	Yellow 3.12
SNE	Low Concern (3)	Minimal mitigation (0.25)	Moderate Concern (3)	Yellow 3.12

Synthesis

American lobsters are almost exclusively fished with trap gear and in general it is accepted that traps have a moderate to low impact on benthic habitats (NMFS, 2011; Eno et al, 2001). However, because of the intense fishing effort of lobsters and the amount of gear that this requires -millions of traps being used multiple times- the impact on benthic habitats may be underestimated. This "cumulative effect" could be more damaging to benthic ecosystems than previously thought (Smolowitz,1998). However, very little information is available regarding the effects of lobster trap gear on benthic habitats.

Justification

Factor 4.1 Impact of the fishing gear on the substrate: Low concern

Key relevant information:

The American lobster trap/pot fishery is carried out on a variety of different benthic habitats including complex, hard rocky bottoms and mud, sand and gravel bottoms. Traps are generally accepted as low impact gear, although the sheer volume of lobster traps being

fished can have cumulative effects on bottom habitats (Smolowitz 1998).

Detailed rationale:
It is generally accepted that lobster traps have relatively little impact on benthic habitats and communities where they are fished (NMFS 2011). Lobster traps are also deployed on a variety of different substrates depending on whether the area is inshore or offshore. The inshore substrate is a rougher, rockier substrate than the offshore bottom substrate, which is generally smoother (mud, sand or cobble). Inshore lobster fisheries tend to deploy single traps because the risk of lines and traps snagging on the bottom is high. Offshore, 3–40 pot trawls are often fished because of the smoother, flatter substrate. Lobster traps are normally dropped onto the ocean floor and allowed to "soak" for a day or so before being hauled to the surface. Though single traps are considered fairly innocuous, the extremely high number of traps being fished, being dropped and hauled back to the surface multiple times, have a scour effect on the benthic habitat (Smolowitz 1998) that results in the scraping of epifaunal organisms (Smolowitz 1998). The effect on the benthic habitat of thousands of traps being fished every year is referred to as "cumulative effect" (Smolowitz 1998).

Factor 4.2 Modifying factor: Mitigation of fishing gear impacts: Minimal mitigation

Key relevant information:
While both NMFS and ASMFC have measures in place to control fishing effort (especially in SNE) there is no specific mitigation of gear impacts on benthic habitats for the American lobster fishery (Wilson, pers. comm. 2012).

Detailed rationale:
N/A

Factor 4.3 Ecosystem and Food Web Considerations: Moderate concern

Key relevant information:
Although North Atlantic right and humpback whales are technically not caught in lobster traps as part of the overall catch, they have enough encounters with lobster gear entanglements to be deemed a Category I fishery by NMFS. The ALWTRP is in effect and has resulted in significant gear modifications in order to reduce large whale entanglements in lobster gear and other fishing gear. However, in terms of fully assessing the ecological impacts of the fishery, there are no extensive measures in place other than fishing effort reduction via trap limits and limited access programs for a number of the LCMAs.

Overall Recommendation

The overall recommendation for the fishery is as follows:

- **Best Choice** = Final score ≥ 3.2 **and** scores for Criteria 1, 3 and 4 are all ≥ 2.2 **and** Criterion 2 *subscore* ≥ 2.2

- **Some Concerns** = Final score ≥ 2.2 **and** Criterion 3 ≥ 2.2 **and** **(**Final score ≤ 3.2 **or** scores for Criteria 1 &4 ≤ 2.2 **or** Criterion 2 *subscore* ≤ 2.2)

- **Red**= Final score < 2.2 **or** score for Criterion 3 < 2.2 **or** any one criterion has a critical score **or** two or more of the following are < 2.2: Criterion 1 score, Criterion 2 *subscore*, Criterion 4 score

Species/ Stock	**Gear/ Region**	**Impacts on the Stock** Rank Score	**Impacts on other Species** Lowest scoring species Rank*, Subscore, Score	**Manage -ment** Rank Score	**Habitat and Ecosystem** Rank Score	**Overall** Recommendation Score
GBK-American lobster	GBK	Green 3.83	North Atlantic Right Whale Red, 1,0.75	Green 3.46	Yellow 3.12	**GOOD ALTERNATIVE 2.54**
GOM-American lobster	GOM	Green 3.83	North Atlantic Right Whale Red, 1,0.75	Green 3.46	Yellow 3.12	**GOOD ALTERNATIVE 2.54**
SNE-American lobster	SNE	Red 2.16	North Atlantic Right Whale Red, 1,0.75	Red 1.73	Yellow 3.12	**AVOID 1.85**

Acknowledgements

Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

Seafood Watch® would like to thank Joshua T. Carloni of the New Hampshire Department of Fish and Game, Penny Howell of the Connecticut Department of Energy and Environmental Protection, and two anonymous reviewers for graciously reviewing this report for scientific accuracy.

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Appendix A*:* Review Schedule

Next stock assessment is due out in 2014. Maine lobster is under MSC assessment.

About Seafood Watch®

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch® defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch® makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from www.seafoodwatch.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices", "Good Alternatives" or "Avoid". The detailed evaluation methodology is available upon request. In producing the Seafood Reports, Seafood Watch® seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch® Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch®'s sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch® and Seafood Reports, please contact the Seafood Watch® program at Monterey Bay Aquarium by calling 1-877-229-9990.

Disclaimer

Seafood Watch® strives to have all Seafood Reports reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science and aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch® program or its recommendations on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

Seafood Watch® and Seafood Reports are made possible through a grant from the David and Lucile Packard Foundation.

Guiding Principles

Seafood Watch™ defines sustainable seafood as originating from sources, whether fished3 or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

The following **guiding principles** illustrate the qualities that capture fisheries must possess to be considered sustainable by the Seafood Watch program:

- *Stocks are healthy and abundant.*
- *Fishing mortality does not threaten populations or impede the ecological role of any marine life.*
- *The fishery minimizes bycatch.*
- *The fishery is managed to sustain long-term productivity of all impacted species.*
- *The fishery is conducted such that impacts on the seafloor are minimized and the ecological and functional roles of seafloor habitats are maintained.*
- *Fishing activities should not seriously reduce ecosystem services provided by any fished species or result in harmful changes such as trophic cascades, phase shifts, or reduction of genetic diversity.*

Based on these guiding principles, Seafood Watch has developed a set of four sustainability **criteria** to evaluate capture fisheries for the purpose of developing a seafood recommendation for consumers and businesses. These criteria are:

1. Impacts on the species/stock for which you want a recommendation
2. Impacts on other species
3. Effectiveness of management
4. Habitat and ecosystem impacts

Each criterion includes:

- Factors to evaluate and rank
- Evaluation guidelines to synthesize these factors and to produce a numerical score
- A resulting numerical score and **rank** for that criterion

Once a score and rank has been assigned to each criterion, an overall seafood recommendation is developed on additional evaluation guidelines. Criteria ranks and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide:

3 "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates.

Best Choices/Green:Are well managed and caught or farmed in environmentally friendly ways.

Good Alternatives/Yellow: Buy, but be aware there are concerns with how they're caught or farmed.

Avoid/Red: Take a pass on these. These items are overfished or caught or farmed in ways that harm other marine life or the environment.