

2.0 Background and Purpose

2.1 Background

On and off since the early 1970's, there has been a small directed fishery off the coast of New England and the Mid-Atlantic for the deep-sea red crab (*Chaceon quinquedens*¹). The size and intensity of this fishery has varied somewhat over the years, but the fishery has always been small relative to the more prominent New England fisheries for groundfish, sea scallops, and lobster. Prior to the emergency regulations implemented in May 2001, this fishery had never been regulated, either under federal or state jurisdiction. No management plan existed for the red crab fishery prior to this one.

Prior to 1970, there was no known fishery for deep-sea red crab, although there was some incidental catch of red crab in other fisheries. In the early 1970's small markets opened up for the species, spurring one or two vessels to attempt to fish for red crab directly. Markets for this species fluctuated over the next decade or so, as did attempts at new techniques to improve the harvest, preservation, and processing of the crabs.

Throughout the 1980's there appears to have been a fairly consistent fishery for red crab, with known landings averaging over 5.5 million pounds. In the early 1990's landings appear to have fluctuated somewhat, but have been steadily increasing since about 1995. Reported landings were nearly 7 million pounds in 2000.

Faced with increasing landings and increased interest in the fishery from potential new entrants around the country, a group of fishermen approached the New England Fishery Management Council (Council) in late 1999 with a request that the Council develop a fishery management plan (FMP) for red crab. They also asked the Council to consider taking steps to control access to the fishery to help maintain it at sustainable levels. The Council considered the testimony of the red crab fishermen, as well as information on estimates of maximum sustainable yield (MSY) and current capacity in the fishery. In November 1999, the Council agreed to begin development of a new FMP for the deep-sea red crab fishery.

In January of 2000, the Council's Red Crab Committee met to consider available information, to prepare for scoping the proposed Red Crab FMP, and to consider whether to recommend the Council establish a control date for the red crab fishery. The Council considered the recommendations of the committee at its January 2000 meeting and voted to establish a control date for the red crab fishery and to begin the scoping process for the Red Crab FMP. It was the intention of the Council that the control date, once established, would serve as a placeholder in the event the Council wanted the option of differentiating historic participants in the red crab fishery from new speculative entrants.

¹ The deep-sea red crab, now known as *Chaceon quinquedens*, was previously known as *Geryon quinquedens*. In 1989, Manning and Holthius revised the Geryonidae family to include two new genera and nine new species. The majority of geryonid species were renamed as *Chaceon* spp. Only two species remained in the *Geryon* genus, *G. longipes* and *G. trispinosus*, both from the northeastern Atlantic Ocean.

The Council also hoped that the setting of a control date would serve as a disincentive to any new vessels considering moving to New England to begin fishing for red crab.

In February 2000, the Council's Notice of Intent to Prepare an Environmental Impact Statement (EIS) was published in the *Federal Register*, officially beginning the Council's FMP scoping process (65 FR 4941). The Council hosted two scoping meetings, well attended by the red crab industry and other interested parties. At the scoping meetings, there was general support for the development of a Red Crab FMP, including the consideration of management measures such as a limited entry program, setting a minimum allowable size, restricting the fishery to male crabs only, prohibiting the processing of red crabs at sea, and some type of reasonable trap limits. There was less support at the scoping meetings for measures such as closed areas, closed seasons, and quotas (either trip limits or individual fishing quotas).

A control date was established for the red crab fishery by publication of the official notice in the *Federal Register* on March 1, 2000 (65 FR 11029). The control date allows the Council and NMFS to implement a controlled or limited entry system or some other program to differentiate historic participants from new entrants. The publication of the control date notice did not obligate the Council or NMFS to establish a limited entry system or to constrain access to this fishery in any way.

In November 2000, the Council was notified that at least two new vessels had announced their intention to relocate to New England from other parts of the country and begin fishing for red crab. The existing members of the fishery and the Council became concerned that the additional fishing power and effort represented by these new entrants could jeopardize the sustainability and condition of the resource before an FMP could be developed and implemented.

Faced with an increase in the number of vessels targeting the red crab resource, in January 2001, the Council requested that the Secretary of Commerce take emergency action to prevent overfishing in the red crab fishery while the Council continued to develop an FMP. The Secretary reviewed the available information on the resource and its fishery and determined that the current exploitation and the likelihood of substantive increases in total exploitation, in the area north of Cape Hatteras, North Carolina, constituted an emergency situation presenting serious conservation problems and that emergency action was indeed necessary to prevent overfishing. On May 8, 2001, NMFS announced a set of emergency regulations designed to prevent overfishing, for a 180-day period effective May 18 - November 14, 2001 (66 FR 23182).

The emergency regulations were not intended to limit access to the red crab fishery, but rather to control the overall fishing pressure and prevent or eliminate overfishing while the Council developed the FMP. After analyzing several alternatives to address the emergency and to prevent overfishing, NMFS implemented a set of measures that included: (1) the establishment of a total allowable catch (TAC) of 2.5 million pounds; (2) a trip limit of 65,000 pounds of whole weight red crab or its equivalent; (3) a trap limit of 600 pots; and (4) an incidental catch limit of 100 pounds of red crab per fishing trip (NMFS 2001a). The regulations also established a requirement for any vessel that

wished to fish for red crab at more than the incidental catch level to obtain a letter of authorization (LOA). Vessels with an LOA were required to report their landings for each trip via an interactive voice response (IVR) system and to submit vessel trip reports (VTR) documenting each red crab fishing trip. On July 23, 2001, NMFS amended the emergency regulations to revise the conversion factor used to determine the whole weight equivalent of partially-processed or butchered crabs (66 FR 38165).

The emergency regulations included a provision that gave the NMFS Regional Administrator the authority to close the directed red crab fishery if, at any time during the 180-day effectiveness period, she projected that the 2.5 million pound TAC would be harvested. On August 8, NMFS announced that the directed red crab fishery would be closed down on August 17, 2001 (66 FR 41454). Effective August 17 through November 14, 2001, no vessel was allowed to fish for, or possess, red crab harvested from the exclusive economic zone (EEZ) in excess of 100 pounds per trip. There were a total of 52 trips made by 7 vessels during the emergency period and a total of 2,839,931 pounds of red crab landed. This amount is equivalent to 113.6% of the TAC established for the 180-day period. Landings of red crab by vessels without LOAs (these vessels would have been limited to 100 pounds of red crab per trip) were not tracked and were not counted against the TAC.

The emergency regulations were extended for a second 180-day period, effective November 15, 2001 - May 14, 2002. The extension included the same measures as the first emergency period, but reduced the overall TAC to 2.16 million pounds to account for the overage from the first emergency period. On January 15, 2002, NMFS announced that the directed red crab fishery would again be shut down, effective January 18 through May 14, 2002 (67 FR 1908). During the second emergency period, 6 vessels made a total of 36 trips and landed a total of 2,075,457 pounds. This amount is equivalent to 96.1% of the TAC established for the second 180-day emergency period. The combined landings during the two emergency periods equal 4,915,388 pounds, or 98.3% of the total TAC.

2.2 Statement of the Problem

This FMP is being developed in an attempt to address one primary problem and one secondary problem. All actions considered and proposed in this FMP are intended to be directly or indirectly related to solving one or both of these problems.

Overfishing the Red Crab Resource. The threat of overfishing the red crab resource is the primary problem needing management attention. Based on a comprehensive survey conducted when the fishable stock of this resource was considered to be in virgin condition, maximum sustainable yield (MSY) was estimated at 5.5 million pounds of exploitable males (Serchuk 1977). Commercial landings of red crab have exceeded this level several times since the development of the fishery. In 1982, NMFS characterized this resource as “becoming fully exploited” after landings increased from nearly 2.7 million pounds in 1979 (there had been a fairly steady increase in landings since 1974) to just over 5.6 million pounds in 1980 (NMFS 1982). The following year NMFS revised this status to “fully exploited” after landings increased to 6.8 million pounds in 1981 (NMFS 1983).

Although NMFS did not report the status of the red crab resource after 1983², available landings data illustrate a continuing increase in landings through 1984 when reported landings peaked at over 8.5 million pounds. Thereafter, reported landings fluctuated around an average of 5.8 million pounds for the 1980's. Landings declined in the 1990's until about 1995. Landings reported in the NMFS vessel logbook and dealer weighout databases are summarized in Table 1 for 1991 - 2001. There were no reporting requirements for red crab prior to 2001, so the landings presented in the table should be considered the minimum estimates of total landings. After May 18, 2001, all vessels landings more than 100 pounds of red crab were required to report their landings, so this may explain the apparent significant increase for 2001. The very low landings reported in 1994 may be a result of less effort, less reporting, an aberration in the NMFS landings database system, or a combination of all three factors.

Overfishing this resource is of particular concern due to the nature of the species. As reported in Steimle et al. (2001), Hastie (1995), and elsewhere, geryonid crabs are typically slow-growing and major recruitment events are believed to occur rarely. Hastie (1995) makes a strong case that deep-water benthic crustacean communities, geryonids especially, are particularly vulnerable to overfishing and the protection of these resources by strict management is important. It is interesting to note that all of the reviewed literature that discusses fishing potential for red crabs and other geryonid crabs are unanimous in their assessment that this resource cannot sustain significant fishing pressure, that this resource is particularly vulnerable to overfishing, and that strict management controls are needed to protect the sustainability of the fishery (Armstrong 1990; Duggan and Lawton 1998; Hastie 1995; Holmsen 1978; Holmsen and McAllister 1974; Meade and Gray 1973; Serchuk 1977).

Year	Reported Landings (in pounds)
1991	3,948,903
1992	2,340,103
1993	3,172,858
1994	2,681
1995	1,655,734
1996	2,283,998
1997	4,487,192
1998	3,891,386
1999	4,019,243
2000	6,956,613
2001	8,798,959

Table 1: Reported landings of red crab by year, 1991 - 2001. Because there were no requirements to report landings of red crab prior to May 2001, the numbers presented here are very likely minimum estimates of actual landings in these years. One explanation for the significant increase in 2001 is that after May 18, 2001, all vessels landing more than 100 pounds of red crab were required to report their landings.

² In fact, after 1985 red crab was no longer included in the annual "Status of the Fishery Resources Off the Northeastern U.S." reports developed by NMFS (NMFS 1986).

Overcapitalization of the Red Crab Fishery. The directed red crab fishery is overcapitalized and needs management attention. Determining the appropriate number and fishing power of the vessels in the directed red crab fishery is a problem that must take into account biological, economic, and social concerns. The directed commercial fishery for red crab began in 1973 in response to declines in the offshore lobster fishery and fishery development efforts improved the harvesting, processing, and marketing of the resource (NMFS 1982). When the fishery was initiated, there were only one or two vessels participating (Ganz and Herrmann 1974). Between 1973 and 1981, the number of red crab fishing vessels fluctuated between one and four (Lux et al. 1982), as several vessels attempted the fishery but failed (Holmsen 1978). By 1986, the number of vessels appears to have stabilized at two (Elner 1986). It is not clear how many vessels fished for red crab between 1986 and the early-1990's, but NMFS landings and dealer reporting data only indicate two vessels with significant landings (more than 15,000 pounds annually) between 1991 and 1994. Between 1995 and 2000, there were as many as five vessels apparently directing on red crab.

The number of vessels actively prosecuting this fishery is an important consideration because historically a small number of vessels has been able to fish at or above MSY levels.³ In fact, in an attempt to frame the ideal capacity of this fishery, Holmsen and McAllister (1974) suggested that “if the NMFS assessment of the size of the resource is correct [MSY of five to six million pounds], there would not be room for more than seven to eight efficient vessels . . . in the red crab fishery.” It is important to understand, however, that this estimate of the number of vessels is based upon their description of an “average” crab vessel (for 1974). They describe the average vessel as 85 feet in length, fishing 250 pots, and landing approximately 40,000 pounds of whole crabs per trip. Holmsen and McAllister’s estimate of seven to eight efficient vessels supported in the fishery should be revised downward to represent the fact that the vessels in the fishery since 1995 have greater fishing capacity than what they presumed in 1974.

The five vessels participating in the directed red crab fishery prior to 2000 average 96 feet in length, fish an average of 544 pots, and have the capacity to land the equivalent of an average of approximately 78,000 pounds of red crab per trip. The figures suggest that these five vessels alone can exceed the total fishing power suggested by Holmsen and McAllister as an upper bound on this fishery.⁴ The problem for the Council to

³ Consider that in the early to mid-1980's there were no more than four vessels directing on red crab in any one year (Lux et al. 1982), but reported landings between 1980 and 1982 averaged 5.8 million pounds. It was only two years later, in 1984, that reported landings peaked at 8.5 million pounds.

⁴ If we assume the maximum number of vessels suggested by Holmsen and McAllister (1974) and multiply that number of vessels times the estimated number of traps fished and the per trip landings, we get:

$$8 \text{ vessels} \times 250 \text{ pots per vessel} = 2,000 \text{ pots, and}$$
$$8 \text{ vessels} \times 40,000 \text{ pounds per vessel per trip} = 320,000 \text{ pounds.}$$

We can then compare these estimates of “fleet fishing power” to those derived for the five vessels in the fishery prior to 2000:

$$5 \text{ vessels} \times 540 \text{ pots per vessel} = 2,700 \text{ pots, and}$$
$$5 \text{ vessels} \times 78,000 \text{ pounds per vessel per trip} = 390,000 \text{ pounds.}$$

address is the desire of additional fishing vessels to enter the directed red crab fishery and the increased fishing power they would add to the fleet.

In early 2001, two additional vessels entered the red crab fishery. One vessel relocated from the North Pacific and the other vessel relocated from the Gulf of Mexico. Both are catcher-processor vessels over 150 feet in overall length. Although they may be fishing with fewer pots, both reportedly have the capacity to fish approximately 1,000 crab pots. Vessel hold capacity may be a more important indicator of overall fishing power than either vessel size or the number of pots fished. The hold capacities of the two additional vessels are reported to be in the range of 185,000 to 300,000 pounds of red crab product. The equivalent amount of red crab in whole weight depends on the degree of processing that occurs on-board the vessel. If the crabs are simply butchered (split into half sections with the carapace removed), the whole weight equivalent is approximately 1.56 - 1.72 times the butchered weight (66 FR 23182 and 66 FR 38165). This indicates that the two additional vessels may be able to land the equivalent of 288,000 to 516,000 pounds of red crab per trip, depending on the exact butchering process used by the vessel. Even if we assume the lower bound of this range, each of these new vessels individually possesses the capacity to harvest more per trip than the entire fleet suggested by Holmsen and McAllister (1974).

Given the concerns about overfishing and the vulnerability of the resource identified above, it seems unlikely that such a fleet (the five vessels fishing prior to 2000 and the two additional vessels that entered the fishery in 2001) can be sustained. Even with this concern, there are reports of even more vessels interested in entering the directed red crab fishery.

2.3 Purpose and Need for the Action

All the information available on the deep-sea red crab and its fishery indicates that there is a limited MSY of 6.24 million pounds and that four to six vessels fishing at existing levels of capacity represent the maximum amount of harvesting effort that can be sustained by the resource. The addition of new vessels, especially catcher-processor vessels with increased capacity, threatens not only the resource, but the viability of the existing fishery. Even without any new entrants, overfishing is a potential threat. Anecdotal reports from the industry suggest that the existing five vessels harvested more than seven million pounds of red crab in 2000, roughly 112% of MSY (J. Williams, personal communication).

There has been both an increase in reported landings of red crab over the past few years and an increase in interest among fishing vessels to enter and participate in this fishery. Some of this interest has no doubt been related to the fact that the red crab fishery is one of the few remaining unregulated crab fisheries in the country. Nationally, crab fisheries rank sixth in terms of quantity landed and second in terms of value (NMFS 2000). Crab fisheries such as those for the blue crab, Dungeness crab, king crab, and snow crab are all aggressively managed. Interest in fishing for deep-sea crabs in other regions has been increasing (Waller et al. 1995).

Active management of this fishery is now needed to prevent overfishing and maintain a fishing fleet that is of an appropriate size and capacity for the resource. The New England Council has primary responsibility for managing this resource (NEFMC 1986). An FMP designed to address overfishing and fleet capacity will provide the Council and NMFS with the opportunity to manage this fishery in a sustainable manner that ensures a continuing and productive fishery for this unique resource.

2.4 Issues to be Resolved

In addition to the two main problems of overfishing and overcapitalization identified above, there are several other issues which must be addressed, if not resolved, in this FMP. This section attempts only to identify the issues and offers a brief summary. Each issue is fully explained and addressed later in the FMP, in the appropriate sections.

- a. *Status of the stock.* Although survey data exist from the mid-1970's and these data provide a good overview of the size and composition of the resource under virgin stock conditions, no comprehensive recent or current survey data exist with which to facilitate a comparison. This prevents NMFS and the Council from making a determination of the current status of the stock (is it overfished? has the size or sex composition changed? etc.). The FMP must, therefore, develop a management program for this fishery in the absence of a current stock assessment.

The lack of fishery-independent survey data on the red crab resource presents a real challenge to the Council, as we have no current estimates of red crab biomass. The NMFS bottom trawl survey only occasionally captures any red crabs (Steimle et al. 2001) and only at the shallowest fringe of their habitat. Red crabs are known to occupy depths from 274 - 1800 meters with highest densities and biomass occurring between 320 - 910 meters (Wigley et al. 1975 and Steimle et al. 2001). The NMFS otter trawl survey does not tow deeper than 366 meters (Reid et al. 1999).

There are plans for a proposed survey to be conducted sometime in the next two to three years. The survey would be conducted independently of NMFS in a joint venture by several area scientists and one or two red crab fishing vessels.

Depending on how the survey is designed and implemented, the resulting data may be comparable with the prior survey and therefore useful in developing an index of biomass. Because we have little information on the population dynamics that have taken place between the 1970's and the present, as new information about this fishery is obtained, the management plan could change.

- b. *Availability of data.* As noted above, comprehensive recent or current survey data are not available for this resource. Fishery data, including data on landings and effort, are available in some cases but not necessarily for the entire fishery. Until the implementation of the emergency regulations (66 FR 23182), there were no requirements for vessels fishing for red crab to report their landings or their fishing effort unless the vessel also carried a permit for a fishery that required data reporting (such as groundfish).

The nature of this directed fishery -- deep-water, traps only -- led many in the fishery to fish only for red crab. Thus, the majority of participants in the directed fishery were under no obligation to provide any landings information to NMFS or any other government agency. Prior to 2000 most red crab product landed in the U.S. was reportedly sold to a processor based in Canada and therefore exempt from U.S.-based processor dealer reporting requirements. In late 2000 and 2001, a U.S. processor began purchasing and processing red crab products.

- c. *Incidental catch and discards.* In addition to the fleet of vessels that target red crab in the directed fishery, there are many vessels which occasionally land varying but much lower amounts of red crab. For all years 1991 through 2000, there were a total of 83 vessels that reported landings of at least one pound of red crab in at least one year. Of these, there were only 7 vessels that reported landings that averaged over 100,000 pounds of red crab per year in the years they fished for red crab.⁵ For the vessels with less than 100,000 pounds of red crab landings, the yearly average of landings drops off quickly, with only 7 of the remaining 76 vessels averaging more than 10,000 pounds per year. This analysis indicates that, on average, 92% of the vessels that land red crab only fish occasionally or at what we will call “incidental catch” levels (less than 10,000 pounds per year). Further analysis of these data indicate that although there were a total of 83 vessels that reported some landings of red crab during this ten-year period, the number of vessels reporting landings in any one year averaged only 15 vessels and in no year did the number of vessels reporting landings of red crab exceed 25. Table 2 summarizes the numbers of vessels in each year, 1991 - 2000, within a category of red crab landings.

Landings (pounds)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Mean
< 10,000	7	10	9	6	19	18	15	11	6	6	11
10,000 > 100,000	1	0	0	0	4	4	0	1	2	1	1
> 100,000	2	2	2	0	2	2	7	4	4	5	3

Table 2: Numbers of vessels with landings of red crab, 1991-2000. This table provides a summary of the numbers of vessels in each year with reported landings of red crab within one of three categories.

In addition to consideration for vessels to land incidental catch levels of red crab, the Council must also address the potential discards of red crabs that may occur in other fisheries. The monkfish trawl fishery, for example, has been

⁵ Data from the NMFS dealer weighout and VTR databases were analyzed to identify all vessels reporting at least one pound of red crab landings. Average landings were calculated for each vessel, but only considered the years in which they actually reported positive landings of red crab. For example, a vessel that reported landings of red crab only in 1991 and 1992 had their average calculated by dividing their total landings by 2 years rather than the full 10 years. This is intended to be a better indication of the number of vessels that landed significant amounts of red crab, *while they were fishing for red crab.*

- identified as one in which there may be the potential for bycatch and discarding of red crabs, with high attendant discard mortality. The FMP will address this issue to the extent possible.
- d. *Appropriate levels of fishing power.* As discussed above in the problem associated with the potential for overcapitalization in the red crab fishery, the Council must address the issue of identifying the appropriate level of fishing power for this fishery. There are several factors related to fishing power that need to be considered: size of vessels; hold capacity of vessels; number of traps used; number of crew; and on-board processing capability. These factors all combine and interrelate to determine the overall fishing power of the individual vessels and of the fleet.
 - e. *Maintenance of consistent supply.* Current fishermen and processors have requested that the Council try, to the extent possible, to allow for the maintenance of a consistent supply of red crab product all year long. The Council will attempt to address this issue by selecting management measures more likely to promote and maintain a twelve month fishery.
 - f. *Compliance with marine mammal protection requirements.* The red crab fishery, as described, falls under the Marine Mammal Protection Act Category I Lobster Trap/Pot Fishery and therefore is required to comply with the applicable gear restrictions for that fishery that are intended to reduce the potential for the entanglement of marine mammals in the gear. The Council must address this potential in the FMP and address any measures which may be required to bring this fishery and the gear they use into compliance with the marine mammal protection requirements.
 - g. *Council area of jurisdiction.* Historically, most commercial fishing for red crab has occurred off southern New England (Lux et al. 1982; Elner 1986), but commercial fishing operations are also known to target the southern flank of Georges Bank and the Mid-Atlantic as far south as the area off Cape Hatteras, North Carolina. The FMP must specify the management unit for the management program, including the area of jurisdiction. Typically, each FMP manages the fishery for each species throughout the entire range of the species. Red crab, however, occur off the coast of the south Atlantic states, including Florida, occur in the Gulf of Mexico, and may range as far south as northern Brazil (Elner 1986). It would not be practical nor prudent for the New England Council to attempt to manage this resource in the Gulf of Mexico or even as far south as Florida. Instead, the Council must identify a geographic point at which our jurisdiction over the management of the resource will end.
 - h. *Handling mortality.* “Handling mortality” is the rate of mortality to red crabs that results from being brought to the surface, handled, and returned to the seafloor. In the directed red crab fishery, this is associated with the sorting of the crabs harvested in the traps and the return of females and undersized males. Handling mortality may result from injury to the crabs during handling, being out of the

water too long, being subjected to temperature stress from high water temperatures at the surface or rapid temperature changes, predation while in the water column, or settlement to different areas of the bottom where survival is lower. There are no precise estimates of the magnitude of handling mortality, but high handling mortality would indicate that a large percentage of the discarded females and small males would die even though they are returned to the sea and not landed.

Even though the magnitude of handling mortality is unknown, there is evidence to suggest at least some crabs survive being returned to the ocean. Lux et al. (1982) conducted a tagging study of red crabs beginning in 1974. To complete this study, they tagged crabs brought up in commercial pots and simply released them back into the water, similarly to the sorting and discard process employed by the fishermen. If handling mortality was very high, then very few returns would be expected. Tagged crabs were collected for several years, even seven years after the tagging study. In the laboratory, Ganz and Herrmann (1974) subjected red crabs to changes in water temperature to see how they respond to this stress. One test involved subjecting crabs to increasing temperatures to simulate being hauled up through the water column in a trap. All crabs survived all the temperature changes, although while held at temperatures greater than 50°F the crabs appeared to suffer increasing degrees of sluggishness. The results suggest that crabs subjected to temperature stress as a result of being brought to the surface and returned to the ocean can survive (i.e., there is probably low to zero discard mortality due to temperature change stress).