The Green Crab Guide IN THE FIELD & IN THE KITCHEN

Gabriela Bradt, Ph.D. Marissa McMahan, Ph.D. Contributor Jessie Batchelder





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ABOUT THE AUTHORS





gabriela.bradt@unh.edu

GABRIELA BRADT, PH.D.

Gabriela is an Associate Fisheries State Specialist for New Hampshire Sea Grant and the University of New Hampshire Cooperative Extension. Her programming is mainly focused around seafood marketing, market creation, and consumer education and awareness about New Hampshire's fisheries and local seafood accessibility. Her research on invasive green crabs explores market development for a potential green crab fishery, as well as soft-shell crab production. Additionally, she leads citizen science programs looking at green crab population and distribution in coastal New Hampshire.

Gabriela received a Ph.D. in Zoology from The University of New Hampshire in 2005, and an M.A. in Biology from Bryn Mawr College in 2000. Since 2011 she has been involved in marine biology and fisheries research and outreach.



mmcmahan@manomet.org

MARISSA MCMAHAN, PH.D.

Marissa is the Director of Fisheries at Manomet, based in Brunswick, Maine. Her research addresses real-world problems and is applied to help create solutions to those problems. Much of her research focuses on strengthening and diversifying fisheries opportunities in the Gulf of Maine, in an effort to preserve fishing cultures and traditions, while also promoting a healthy and resilient marine ecosystem.

Marissa received a Ph.D. in Ecology, Evolution and Marine Biology from Northeastern University in 2017, and an M.Sc. in Marine Biology from the University of Maine in 2011. She has studied marine ecology and fisheries in the Gulf of Maine for over a decade. Much of her life has also revolved around working as a commercial fisher.



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Introduction



Green crabs are successful invaders because they possess many biological and physiological properties that allow them to exploit diverse habitats, withstand broad ranges in temperature and salinity, as well as the ability to to survive out of water without eating for extensive periods of time and have high fecundity.

In recent years, a confluence of many factors including warming ocean temperatures, the continued devastation of shellfish fisheries and estuarine and coastal habitats by green crabs and the simultaneous demand for fresh, local seafood have driven the need to both gain control of the invasion and to develop diverse uses and markets for this edible and abundant crab.

In New England, controlling green crab populations has the potential to create new economic opportunity for fishers (or others making a living off the water), bring a new, local and abundant seafood product to the region and restore biodiversity and critical estuarine, marsh and coastal ecosystems.

While the possible uses and products from green crabs that have high market potential are many, in New Hampshire and Maine we are focusing on establishing a viable, high-value soft-shell green crab fishery and market demand. To this end, New Hampshire Sea Grant and Manomet have worked together for years to create and compile educational resources for fishers and seafood connoisseurs/consumers to bring soft-shell green crab from 'boat to plate'.

This **Green Crab Guide** to "eating an invader" is meant for anyone interested in learning to produce and/or eat softshell green crabs. We include a field guide for fishers and foragers, how to process soft-shell and hard-shell green crabs for culinary purposes and recipes that were developed by our continued partnerships and outreach with chefs and teachers.



















WHAT IS A PRE-MOLT CRAB AND WHY DO WE NEED TO ID THEM?

All crustaceans must undergo the process of molting, or shedding their exoskeleton, as they grow. During the molting process, crustaceans are at their most vulnerable. as they are conserving energy to undergo a dramatic and physically demanding transformation. Once crustaceans have shed their exoskeleton, there is a period when they are 'soft', their new exoskeleton not having hardened yet. It is at this soft-shell stage, where some species of crabs, for example Blue Crabs (Callinectes *sapidus*), become a very valuable seafood product. In the southern United States, the soft-shell blue crab fishery is incredibly lucrative and in Venice, Italy, the artisanal 'Moeche', soft shell green crab fishery is also very valuable and popular. In fact, it is the existence of the Venetian soft-shell green crab fishery that inspired us to research and pursue the feasibility and viability of a soft-shell green crab fishery in New England as a possible mitigation/control strategy for



these invasive crustaceans, as well as, a fisheries diversification strategy.

The key to success for both the blue crab fishery and the Venetian green crab fishery is being able to identify which crabs are about to molt. With blue crabs, 'buster' crabs are easily identified by harvesters because of a tell-tale red outline that appears on the back swimming legs of the crab. In the Venetian green crab (which is a similar species to the invasive green crab in the US), fishers use the emergence of a white/gray halo that is visible around the abdominal episternites of the male crab to identify crabs that are about to molt. Being able to readily pick out the 'pre-molt' crabs is critical because you do not want to waste time and space holding on to crabs that will not molt. Using the Venetian green crab fishery as a guide, we set out to research and identify morphological signs on crabs in the 'pre-molt' phase and discovered that while they exist, the signs are more subtle and require a trained eve to pick out. However, once familiar with these morphological signs, the sorting of a green crab harvest during the molting season becomes more efficient.

The purpose of this guide is to extend the results of our years of combined research and effort in identifying pre-molt morphological features in green crabs to facilitate the creation of a soft-shell green crab fishery and industry. We want to provide an easy user guide for everyone, whether it is a fisherman interested in producing soft-shell green crabs as an alternative revenue stream or a seafood consumer interested in trying a new seafood product that they can forage on the shoreline.



Purpose

The purpose of this field guide is to help identify pre-molt European green crabs (*Carcinus maenas*) in New England. The key to producing soft-shells is identifying pre-molt crabs and holding them until they molt.

Signs

Subtle changes in color along the margins of the abdonimal ventral episternites (platelets) indicate that the crab is likely to molt in the next several weeks (see page 8).

A good pair of strong reading glasses can help magnify the pre-molt signs. Males are more likely to molt in synchrony in the spring (April-May-June) and sometimes again in the fall (Sept.-Nov). Imminentmolt crabs (likely to molt within 1-3 days) lose the shadowy line on the margins of the ventral plates, become opaque and become lethargic. The abdomen becomes soft and squishy on the posterior end where it wraps around and meets the carapace.

Imminent-molt crabs must be checked daily for molting. Once a crab molts, it must be removed from the water and chilled within 12-18 hours, otherwise the new shell will begin to harden.

SIZE MATTERS

For soft-shell crabs, the target size is neither too large nor too small (30-50 mm). Large-old (often reddish) male crabs seldom molt and small crabs are difficult to hold in cages. Medium-small males are the best because they are still actively molting.

THE ITALIAN CONNECTION

The Venetian crab (*C. aestuarii*) sets the standard for molting signals in the European green crab (*C. maenas*) of New England.

Molting Sequence Terminology

Most trapped crabs are in the "intermolt" phase. They are not good for the soft-shell fishery and can be discarded. "Pre-molt" crabs are of interest for holding until they become "imminent" molts and then finally molted "soft-shell" crabs. The challenge is to figure out which of these 4 types you're holding in your hand.

halo around platelets



INTERMOLT

No signs of molting or has molted and the shell is hard. NOT OF INTEREST FOR HARVESTING.



Pre-molt

Signs of molting in 1-3 weeks (see circled area, inset and arrows). These should be kept and monitored for molting.



IMMINENT

Molting in 1-3 days (note the creamy, opaque/dull look of abdomen). These should be kept and monitored more often until they molt.



SOFT-SHELL - DESIRED PRODUCT!

The crab has molted within the last 12-24 hours and is the desired end product. The crab is shiny, green or lemon yellow often with very purple claws. The shell is soft to the touch, leathery. Crab must be removed from water immediately to keep the shell from hardening.



Preferred size: 30-55 mm

FAST ID FIELD GUIDE







MALE

Narrow, spear shaped abdomen (apron)- "Washington Monument"

FEMALE

Rounded and broad shaped abdomen (apron) "Capital Building"

MOLTED CRAB

Newly molted crabs are very soft, leathery and very shiny. The color will vary from lemon yellow to bright green. The claws will be bright blue/purple with very distinct spots.

Green Crabs aren't always green! Some are brown, dark green/brown, red or orange.



FAST ID FIELD GUIDE - ANATOMY



- ✓ Shell oval shaped
- ✓ 5 'spines' on either side of the eyes
- ✓ 3 rostral bumps between the eyes
- ✓ Claws not round
- ✓ Last pair of walking legs flattened
- Color: green, brown, reddish, typically red/ orange joints





HOW TO FORAGE FOR PRE-MOLT AND SOFT-SHELL GREEN CRABS

Because green crabs in the process of molting are at their most vulnerable to predators, they tend to seek refuge under rocks and seaweed primarily in the intertidal zone. At low tide, one can go to an easily accessible coastline that is sheltered from the open ocean (e.g., bays and estuaries) and that has the following characteristics:

- soft, muddy substrate
- boulders with ledges
- smaller moveable rocks
- rocks/boulders covered in seaweed (bladderwrack and knotted wrack)

The best times to forage for pre-molt or softshell green crabs in northern New England is during peak molting periods (late spring-early summer for males and late summer-early fall for females). During these times, green crabs that are approximately 30-55mm carapace width (CW) will be molting en masse and can be found at low tide buried under rocks with softmud under them or in the seaweed on bigger boulders with ledges.

When foraging for green crabs please remember that you are in ecosystems that have other critters in them, not just invasive green crabs, and while you move rocks and seaweed around, you are causing a disturbance. That said, feel free to gently move rocks, look under them and if you find a 'keeper', take it, and then put the rock back where it was. The same strategy can be used when moving seaweed around, look through it, move it around gently being sure not to detach it from the rocks where it is growing and then put it back as you found it.



If you find a hard-shell crab, use our field guide to see if it is a pre-molt. If you don't think it is, that is ok, just put it in your bucket and you can still use it for bait or boil it with others to make a delicious stock for other dishes. If you identify the crabs as pre-molt, you can set up a fish tank with an air stone and some clean salt water and leave the crab in there and see if it will molt in a few days. If it doesn't, remove it, freeze it and you can either dispose of it in your garden (making sure you bury it well, or it will smell!) or throw it back in the ocean.

If you find a soft-shell crab and you want to bring it home to eat, make sure you put it gently in a cooler/ container with some moist seaweed covering it and keep cool if you can. If you aren't sure if you have a softshell crab, gently apply pressure to the body of the crab with your thumb and forefinger. If the shell easily gives under gentle finger pressure, or feels similar in texture to Jell-O[®], you've found a soft-shell crab! Make sure that you do not put it in a container with hard-shelled crabs or it will quickly become their dinner! At home, you may gently use cold water to wash the crab, especially if it was buried in mud. You want to make sure you wash the dirt and mud off completely, but be gentle when handling soft crabs. Once clean, you may pat the crab dry, and put it in a fresh, clean container, and put a damp paper towel or cloth over the crabs to keep them from drying out. You can then place it in your fridge until you are ready to use it- up to 3 days (sometimes more) if it is alive. Do not put the crabs in water or they will suffocate and die.



THINGS TO REMEMBER:

- Make sure you are allowed to sample at your chosen site. In ME and NH, you may not take anything from a state park- including invasive species.
- Check with your local marine resources department that there are no regulations regarding the taking of invasive green crabs for your own consumption.
- Try to disturb the environment as little as possible, return rocks and seaweed to the same position you found them.

- Pay attention to the tide, choose to go at very low tide so you have time to forage without worrying about the tide coming in.
- Check with marine resource or public health departments to see if there are any beach closures or other public health warnings at the location you want to forage- if there are ANY, do not forage there.
- Take only what you HONESTLY think that you will need. Even though these are invasive crabs, if you do not have a way to dispose of them properly, don't take them. If you do take them, do not return them to the coast alive.

What to bring when you forage:

- Boots
- Rubber gloves- for protection from barnacles and the crabsthey can pinch, and their shells can cause small lacerations.
- Clean buckets, Tupperware or a cooler (ice pack recommended)
- Our pre-molt and quick ID field guide





Culinary Preparation Guides

BACKGROUND ON GREEN CRAB CULINARY GUIDE

A question we always get when we talk about the invasive green crab is, if it's invasive, is it edible? Yes, green crabs are edible. Just because they are invasive does not mean they can't end up on your dinner plate. In fact, in Venice, soft-shell green crabs, also known as Moeche, are a delicacy, fetching up to 40 € euros/pound!

Part of our work has been to educate seafood consumers, harvesters, and chefs on different ways to use all the green crabs harvested, both hardshelled and soft-shelled. While the soft-shell crab is the more desirable and valuable product, the hard-shell crab can also be used, though not in the traditional sense. Green crabs do not have enough meat yield to make it a worthwhile picked crab meat market. So, if the hard-shell crabs aren't worth picking, what CAN they be used for? And how do you process and prepare green crab once you have harvested them?

This guide is meant to teach the user how to process both hard-shell and soft-shell green crabs for use in culinary applications. Together with our partner, Green Crab Cafe, we developed step by step "How To" guides for processing hard-shell and soft-shell green crabs, as well as, how to harvest internal roe from female green crabs for culinary purposes.



HOW TO PROCESS SOFT-SHELL GREEN CRABS





Cleaning and preparing live soft-shell green crabs for consumption is quick and simple!

- 1. Wash the crabs in cold water to remove any sand or mud.
- 2. With scissors, trim off just enough of the face (a) (includes the spines between the eyes, eye stalks, antennae, and antennules). Trim off the ends (pointy parts) of the 4 pairs of the legs (b).



3. Flip the crab over and trim the apron (the V-shaped flap)(c) that opens up on the stomach and mouth parts (d).



PHOTOS BY THANH THAI



- 4. Gently lift each side of the carapace (top of the crab) and trim off the gills (e).
- 5. Finally, rub a little salt on the crabs, rinse with cold water, and place them in a strainer to be used.

*You may also choose to use the crab whole without trimming for example deep frying the whole crab!



HOW TO PROCESS HARD-SHELL GREEN CRABS

Cleaning and preparing live hard-shell green crabs for consumption is a bit more timeconsuming than it is for soft-shell crabs

- 1. Wash crabs in cold water to remove any sand or mud.
- 2. Remove carapace using your fingers (a). You need to apply pressure when removing the carapace because it is hard and the crabs are fast! With your thumb under one side of the carapace, lift up while holding onto the belly with your other thumb and push down. Separate the carapace from the rest of the body (b).
- 3. With your fingers or scissors, remove the mouth parts from the body, these are small, bony protrusions and remove the gills from either side of the body (the feathery looking tissue) (c).
- 4. Break or cut off the distal tips of the legs and discard (d).
- With scissors or a knife, lift up the apron (V-shaped flap on the abdomen) and pull off (e).
- 6. With a knife, remove the yellow/orange colored roe or 'crab mustard' from the middle of the body (f) and from the inside of the carapace and save.

Optional: You can clean the prepared crabs with a salt rub (2 tsp-1 Tbsp). Rinse with cold water several times to remove the salt. You can also use vinegar (2-3 Tbsp) to wash, then rinse with cold water immediately. Do not let the crabs soak in salt or vinegar as it will change their taste and texture.















PHOTOS BY THANH THAI



MEAT AND PICKING















Picking cooked green crabs for meat, roe and crab mustard is certainly more time-consuming but it is worth it for the sweet flavor!

- 1. Clean live crabs well in cold water. Boil crabs in water for 5-7 minutes. Crabs will turn red when cooked. Let cool.
- 2. Remove carapace (top shell) from cooled crabs (a).

b

d

- 3. Scoop the roe and crab mustard (yelloworange material) from the carapace (b). Keep roe and mustard if desired. Discard the carapace.
- 4. Gently pull the apron (V-shaped flap on abdomen) to remove the intestine and discard (c).
- 5. Remove the roe from the body, if any, and save (d).
- Use a knife to cut the body into 4 sections (e). Remove the meat between the cartilage and save (f). Discard the gills, cartilage, shell bits and any non-edible parts.
- Use a nut/lobster cracker to gently crack or break the shell of the claw and remove the meat (g). Remove and discard the cartilage located inside the middle of the claw.
- 8. Look through the meat, remove and discard any shell or cartilage.

Green Crab Recipes

A NOTE ABOUT HUMANE PREPARATION OF GREEN CRABS FOR COOKING

Most crustaceans are prepared for consumption while they are still alive. If this is of concern, there are a few methods one can utilize depending on your determination of what is considered humane. Removing the carapace and gills quickly while the crab is still alive kills them somewhat quickly (but not instantaneously) as does putting them in boiling water. Freezing crabs may also be an option, but it depends on how cold your home freezer is (ideal freezer temperature for all food storage is 0F°*) If you are unsure of how cold your freezer is, you can put the crabs in a bag and put them in the freezer. Check on the crabs after two hours to see if they are still moving. If they are, return them to the freezer. If they are not moving, you can proceed with processing and cooking the crabs.

Crabs will tend to drop legs when stressed and one way to prevent this, is to cool them in the freezer for 30 minutes and then cook them. This procedure tends to be the least stressful and thus (in our opinion) the most humane for the crabs. Furthermore, the whole crab remains intact with no loss of appendages.

* This note is based on anecdotal observations, not specific, controlled scientific experiments. We are including this here to acknowledge that some may not feel comfortable with the traditional methods of processing crustaceans and to offer an alternative process.



PREPARATION: 20 MINUTES | COOKING: 25 MINUTES | READY IN: 30-35 MINUTES

INGREDIENTS

- Green Crab roe
- ¹/₂ lb of diced monkfish
- 10-12 thin slices red onion
- Fresh lime juice-to taste
- 1 tsp chopped chili peppers (optional)
- 1 tsp chopped cilantro leaves 1 tsp chopped scallion (green parts only)
- Salt, to taste
- A generous pinch eachlime and lemon zest

- 1. Simmer the green crabs (use the amount depending on how much roe there is and your preference) for about 10 minutes. Drain and cool completely.
- 2. Remove roe and save.
- 3. Steam and dice monkfish until just cooked (if you can easily pierce with a fork-then it is done).
- 4. Thinly slice red onion and soak in cold water, squeeze out water before using.
- 5. Combine all ingredients in a bowl and gently mix.



GREEN CRAB FRIED RICE



PREPARATION: 10 MINUTES | COOKING: 20 MINUTES | READY IN: 30 MINUTES

INGREDIENTS

- Green crab stock amount needed to cook rice (may vary)
- 3 cups cooked rice
- 2-3 tablespoons vegetable oil
- 6 cloves chopped garlic
- 2 eggs, beaten
- 3 tablespoons fish sauce
- 4-6 chopped green onion
- Salt and pepper to taste

- 1. Cook the rice according to package instructions, substituting green crab stock for the water.
- 2. Heat oil in large skillet, sauté garlic 1-2 minutes.
- 3. Pour beaten eggs into pan and scramble using spatula.
- 4. Add cooked rice and fish sauce to skillet, stir well, season to taste.
- 5. Add chopped green onions, stir, and serve immediately

GREEN CRAB POZOLE



PREPARATION: 10 MINUTES | COOKING: 10 MINUTES | READY IN: 20 MINUTES

INGREDIENTS

- 1 small onion, diced
- 1 yellow and 1 red bell pepper, diced
- 4 oz hominy
- 1 ¹/₂ qts green crab stock
- $\frac{1}{2}$ tbs cumin
- ¹⁄₂ tbs smoked paprika
- Salt and pepper to taste
- ¹/₂ bushel cilantro
- 3 red radishes, shaved
- 4 oz Napa cabbage, shredded

- 1. Sweat onions and peppers over medium heat with a little canola oil until soft. Add hominy and spices and toast gently.
- 2. Add green crab broth and season to taste.
- 3. Split between bowls and garnish with cilantro, radish, and cabbage.

GREEN CRAB RAMEN SOUP



PREPARATION: 30 MINUTES | COOKING: 1-2 HOURS | READY IN: 1-2.5 HOURS

INGREDIENTS

The Ramen

- 1 tsp sesame oil
- 1 tsp vegetable oil
- 3 tsps grated ginger
- 4 tsps grated garlic
- ¹⁄₂ tsp Chinese All Spice Powder
- 4 cups green crab broth
- 1 cup of water
- 2 packages dried ramen noodles
- ¹/₂ cup chopped scallions
- ¹/₂ cup shredded carrots
- ¹/₂ cup thinly sliced red peppers
- ¹/₂ cup shredded kale
- 1 cup extra firm tofu, diced

The Ramen - continued

- 1 Lime, cut into wedges
- ¼ cup chopped cilantro

The Broth

- 2 lbs cleaned green crab bodies, unpicked
- Approximately 4¹/₂ cups water 1 onion, roughly chopped
- 2 celery stalks, roughly chopped
- 2 carrots, roughly chopped
- 3 garlic cloves, smashed
- Salt & Pepper

DIRECTIONS

- 1. Place the crabs, onion, celery, carrots & garlic into a large stockpot. Fill pot with cold water until all ingredients are covered. Bring to a boil, add a little salt & pepper then reduce broth to a simmer for 1 to 2 hours.
- 2. Carefully pour the broth through a mesh strainer into a large bowl & set aside.
- 3. Heat the oils in a large skillet over medium low heat. Add the garlic and ginger; stir fry for 2 minutes until soft and fragrant.
- 4. Add the broth and the water.
- Bring to a boil then simmer for 10 minutes. Add the Chinese All Spice Powder, tofu & instant noodles to the broth and simmer for an additional 5 minutes or until the noodles have softened.
- 6. Remove from heat, stir in the scallions, carrots, red peppers & kale. Add a squeeze of fresh lime juice & sprinkle w/ cilantro.

By Jenny Devivo, West Tisbury School, Martha's Vineyard

GREEN CRAB STOCK

PREPARATION: 20 MINUTES | COOKING: 1 HOUR | READY IN: 1 HOUR 20 MINUTES

INGREDIENTS

Makes 6 quarts

- 4 tablespoons olive oil
- 2 bunches celery, with the leaves, about 1 pound, roughly chopped
- 1 large red onion, roughly chopped
- 1 small head fennel, cut into ¹/₂" slices
- 12 corn cobs (optional)
- Salt
- 2 bay leaves
- 1 tablespoon Old Bay seasoning
- Approx. 3 quarts water
- 2 cups white wine
- 2 dozen green crabs

- Rinse crabs well in cold water. I recommend doing this outside in a large bucket; just fill the bucket with water and throw your crabs in. Stir well, and leave them in the bucket until your stock is boiling.
- 2. In a large stock pot or lobster pot heat the olive oil to medium. Add the celery, onion, and fennel. Lower heat, and cook until vegetables are soft, about 15 minutes. Add the corn cobs if using, the salt, bay leaves and Old Bay and stir well, tossing the vegetables well with the seasoning. Allow to cook for 5 more minutes, or until the onions just begin to darken.
- 3. Add the water and wine, and bring to a boil. Let simmer for 10-15 minutes to integrate the flavors, particularly the corn cobs.
- 4. Bring stock back to a hard boil. Bring the crabs into the kitchen, and scoop them into the boiling stock. Allow to cook at a strong simmer/low boil for 45 minutes. Let cool, and spoon out the cooked crabs and as much of the vegetables as you can. Strain the remaining cooled broth through cheesecloth. Pour into jars or plastic containers for storing or freezing.

GREEN CRAB RANGOON

INGREDIENTS

- 5 oz green crab meat or roe
- ¹/₂ cup diced scallion
- 3 tbs diced shallot
- 1 tbs minced fresh ginger
- 1 tbs Worcestershire sauce
- 1 tbs fish sauce
- 1 tbs lemon juice
- 8 oz whipped cream cheese at room temperature
- Salt and pepper to taste
- 1 package wonton wrappers
- 1 egg, beaten
- Vegetable oil for frying or spray oil for baking

- 1. Mix first 7 ingredients together
- 2. Gently fold in cream cheese
- 3. Add salt and pepper to taste
- 4. Lay wonton wrappers on clean surface, about 10 at a time
- 5. Spoon 1 tsp of mixture on to center of each wrapper
- 6. Lightly brush inside edges of wrapper with egg
- 7. Fold, bringing the opposite corners together and press tightly to seal (can also just fold wrappers in half to make a triangle)
- 8. Keep folded rangoons on a cookie sheet under a clean towel until ready to cook (can freeze at this point also)
- 9. If frying, heat oil to 250°F and fry until golden on both sides. Drain on paper bag or towels.
- 10. If baking, spray cookie sheet with spray oil, lay rangoons on sheet and spray each side with oil
- 11. Bake at 375°F for 12 minutes or until golden brown

GREEN CRAB RISOTTO



Preparation: 10 minutes | Cooking: 30-35 minutes | Ready in: 40-45 Minutes

INGREDIENTS

- 6 cups green crab stock
- 1 tbs butter
- 1 tbs olive oil
- ¹/₂ red onion, chopped
- 1 ½ cups or 12 oz Arborio rice
- Red pepper flakes
- Salt and pepper
- 1 pound crab meat (½ ¾ cup reserved for garnish if you like)
- Juice from 1-2 lemons to taste

- 1. In a medium saucepan, bring the stock to a simmer
- 2. In a large sauté pan heat butter and olive oil together on medium heat. When butter is melted and bubbling, add onion. Let cook for 8-10 minutes over medium heat until softened. Add rice, and stir well, cooking until the rice begins to crackle and just begins to turn light brown. Season with salt and pepper and red pepper flakes.
- 3. Ladle 1 cup of the hot broth onto the rice and stir until it is all absorbed. Continue to ladle in the stock, stirring each addition until it is absorbed. This usually takes 20-25 minutes
- 4. Taste the rice to make sure there is no "crunchiness." You want it to be creamy, but not mushy.
- 5. Remove rice from heat, stir in crab meat and drizzle with lemon juice to taste



OTHER GREEN CRAB CULINARY RESOURCES AND COOK BOOKS

- Green Crab Cafe a blog about harvesting, cooking and eating invasive green crabs by Thanh Thai <u>greencrabcafe.com</u>
- The Green Crab Cookbook by Thanh Thai and Mary Parks
- NH Sea Grant Green Crab Recipes
- <u>Manomet</u>
- Greencrab.org

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