THE SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL

Life Stage Updates for EFH Definitions

Habitat and Ecosystem Advisory Panel
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Life Stage Information Background

- Subpart J of 50 CFR part 600 of the Magnuson-Stevens Act identifies the requirements of what the EFH definitions should entail. One of those requirements is that Councils must "identify in FMPs EFH for each life stage of each managed species in the fishery management unit".
- Life history is described in each FMP but it isn't integrated into the official designation and therefore not into the User Guide.

Life Stage Information Status

- Resilient Fisheries projects: CMP, Snapper grouper, and dolphin wahoo
- Spiny Lobster – Cameron Luck
- Shrimp – Matt Kenworthy
- Coral – Kathleen Howington
- Sargassum – Kathleen Howington
- Golden Crab – The AP may be willing to review, but we need a volunteer to do the initial write-up

Life Stage Information Questions

- We will review each description by FMP
- After each FMP, please answer the following questions:
  - Is this format appropriate?
  - Does this contain the needed information to meet the requirements?
  - What edits are recommended?
  - Any additions?

Spiny Lobster

- South Atlantic-specific life history information remains limited relative to Florida and the wider Caribbean, particularly for spawning locations, juvenile habitat use, and recruitment dynamics north of Florida (Marx and Herrnkind 1985; Acosta and Butler 1997; Farhadi et al. 2024).
- Recent research has refined understanding of regional larval connectivity and recruitment processes but has not substantially altered the established life history model for P. argus (Butler et al. 2010; Farhadi et al. 2024).
- Genetic and biophysical modeling studies continue to support strong connectivity between Caribbean source populations and the southeastern United States (Butler et al. 2010; Farhadi et al. 2024).
- Habitat degradation, including seagrass loss, coral decline, and reduced shelter availability, may negatively affect juvenile survival and long-term population resilience (Butler et al. 1995; Briones-Fourzán 2025).
- Artificial shelter structures (“casitas”) may locally increase juvenile abundance and carrying capacity where natural refuge habitat is limited (Briones-Fourzán 2025).
- Additional research is needed to better understand climate-driven changes in larval transport, settlement success, and future recruitment into South Atlantic waters (Farhadi et al. 2024; Briones-Fourzán 2025).

Spiny Lobster

Caribbean spiny lobster (*Panulirus argus*) reproductive adults primarily inhabit reef, hardbottom, and structurally complex benthic habitats throughout south Florida, the Caribbean, and adjacent western Atlantic waters as far north as North Carolina (Marx and Herrnkind 1985; Goldstein et al. 2008).

Spawning generally occurs during spring and summer months, after which fertilized eggs hatch into phyllosoma larvae that remain planktonic for approximately 5–7 months and are widely dispersed by regional current systems (Goldstein et al. 2008; Farhadi et al. 2024). Ocean temperature strongly influences larval development, dispersal, recruitment success, and the northern extent of the species' distribution, with warmer conditions generally supporting faster larval development and improved survival (Goldstein et al. 2008; Farhadi et al. 2024).

Following offshore metamorphosis into the puerulus stage, postlarvae recruit into shallow nearshore nursery habitats including seagrass beds, macroalgae, mangrove shorelines, and sponge-dominated hardbottom habitats where refuge availability is critical to survival and growth (Acosta and Butler 1997; Behringer et al. 2009).

Early juveniles remain closely associated with structurally complex shelter habitats before transitioning into larger reef and hardbottom habitats as subadults and adults (Childress and Herrnkind 2001; Goldstein et al. 2008). Throughout benthic life stages, habitat quality and shelter availability strongly influence distribution, survival, and recruitment success (Butler et al. 1995; Briones-Fourzán 2025).

Penaeid Shrimp

Penaeid shrimp along the U.S. South Atlantic coast, primarily white (*Penaeus setiferus*), brown (*Penaeus aztecus*), and pink shrimp (*Farfantepenaeus duorarum*), share a broadly similar life history pattern characterized by offshore spawning, planktonic larval development, estuarine-dependent juvenile phases, and size-dependent migration back to coastal waters as subadults and adults.

Larval development is strongly influenced by temperature, food availability, and habitat conditions, and postlarvae are transported shoreward by a combination of tidal currents and regional circulation patterns. Although all three species follow this overarching framework, each exhibits distinct ecological patterns.

White shrimp, which spawn closest to shore, are the most tolerant of low-salinity conditions and routinely migrate far into oligohaline to mesohaline upper-estuary creeks, thriving in turbid, nutrient-rich marsh systems.

Brown shrimp, spawn farther offshore and recruit primarily into brackish marsh-edge and seagrass habitats, showing broad flexibility but centering their distribution in mesohaline to polyhaline zones while largely avoiding fresher headwaters.

In contrast, pink shrimp, whose major spawning grounds occur on the outer continental shelf and in deeper offshore regions, are tightly constrained to polyhaline–euhaline nursery habitats, with strong dependence on seagrass-dominated shallow flats. These differences in salinity tolerance and habitat use shape each species' estuarine distribution, growth opportunities, overwintering strategies, and sensitivity to environmental change, ultimately defining their distinct ecological roles and fishery dynamics.

Rock Shrimp

- Information on habitat use and distribution remains limited.
- The majority of information on distribution and habitat use is derived from studies from the 70's (Kennedy et al. 1977 and Cobb et al. 1973)
- The fishery primarily operates off Florida's central east coast
- A 2008 study from the northern GOM (offshore Alabama) found that rock shrimp were more abundant over the structurally complex, non-trawled areas.

Rock shrimp (*Sicyonia brevirostris*) spawn offshore throughout the year, with peak activity in late fall to winter, releasing fertilized eggs into the water column where early development occurs. The larvae remain planktonic and widely dispersed across the shelf, their distribution shaped largely by prevailing currents rather than specific habitat features. After completing planktonic development, postlarvae settle to the seafloor and transition to a benthic lifestyle, with early juveniles first appearing most often in shallower offshore habitats around 26 m where recruitment is highest. As juveniles grow, they expand across a broader depth range but continue to favor fine to medium sand and shell-sand substrates, avoiding muddier bottoms. Subadults and adults utilize mid-shelf terrigenous and biogenic sand bottom habitats from 18 to 182 meters in depth with highest concentrations occurring between 35 and 35 meters where stable salinity and suitable sediment structure support the highest densities. Throughout adulthood, rock shrimp remain strictly offshore, often burying in the substrate during the day.

Coral: Stony corals

- Gamete / Spawning Stage : Stony Corals use water column habitats that support broadcast spawning and fertilization. This includes nearshore hardbottom, shelf-edge reefs , and bank and ridge systems.
- Larval Stage (Planula): Stony Corals use pelagic habitats supporting dispersal of coral larvae. This is defined as the water column across the Inner shelf to outer shelf and gulf stream-influenced regions
- Settlement & Juvenile Stage: Stony Corals use benthic habitats providing suitable substrate for larval settlement and early colony growth. This includes hardbottom and reef substrate, including limestone outcrops, reef framework, and consolidated sediments.
- Adult Stage (Reef Formation): Stony Corals use structured reef habitats supporting mature stony coral colonies. This includes coral reefs and live/hardbottom systems across the shelf.

Coral: Octocorals

- Gamete / Spawning Stage: Octocoral use water column habitats supporting both broadcast spawning and brooding reproductive strategies. Specifically water column over hardbottom and reef habitats
- Larval Stage: Octocorals use pelagic habitats supporting dispersal of larvae, which are often short-lived relative to stony corals. This includes near-bottom and mid-water column over reefs and hardbottom
- Settlement & Juvenile Stage: Octocorals use benthic habitats suitable for attachment and early colony development, including hardbottom, ledges, and vertical relief features
- Adult Stage (Habitat Provision): Mature octocoral communities form structurally complex benthic habitat utilizing live/hardbottom and reef ecosystems, including ledges, rocky outcrops, and deep shelf areas.

Coral: Deepwater Corals

- Gamete / Spawning Stage: Deep water Corals use water column habitats supporting reproduction of deepwater corals including the continental slope and deep reef mounds and banks
- Larval Stage: Deep water corals use pelagic habitats supporting larval dispersal in deep-sea systems including deep water column along slope and bank features
- Settlement & Juvenile Stage: Deep water corals use hard substrate habitats suitable for settlement and early growth. This includes hard bottom on the continental slope, including carbonate mounds, lithified structures, and Coral rubble areas
- Adult Stage (Biogenic Reef Formation): Deepwater coral reefs and thickets forming complex three-dimensional habitat exist in deepwater coral ecosystems (slope, bank, and mound features), including Oculina Bank and the Blake Plateau.

Coral: Integrated EFH Statement

- Coral EFH in the South Atlantic includes taxa-specific habitat requirements across all life stages:
  - Stony corals depend on lighted, hardbottom reef habitats for settlement and reef formation
  - Octocorals depend on current-swept hardbottom and vertical relief features for suspension feeding and habitat structure
  - Deepwater corals depend on cold, food-rich slope habitats with strong currents and hard substrate
- Across all taxa, EFH includes:
  - Water column habitats (spawning and larval dispersal)
  - Benthic hard substrates (settlement and growth)
  - Biogenic reef structures (adult habitat and ecosystem function)
- These habitats are essential because they provide substrate, food availability, hydrodynamic conditions, and structural complexity necessary for spawning, breeding, feeding, and growth to maturity, and are often designated as Habitat Areas of Particular Concern (HAPCs) due to their ecological importance and vulnerability.

Coral: Integrated EFH Statement Paragraph

Coral habitats in the South Atlantic include shallow-water reef-building stony corals, octocorals, and deepwater azooxanthellate coral communities associated with reef, hardbottom, shelf-edge, and continental slope habitats. Although life-history strategies differ among taxa, most corals exhibit a general pattern involving broadcast spawning or brooding reproduction, pelagic larval dispersal, settlement onto hard substrate, juvenile colony development, and long-lived adult reef or biogenic habitat formation.

Spawning and fertilization typically occur within the water column above reef and hardbottom habitats and are influenced by temperature, photoperiod, lunar cycles, and hydrodynamic conditions. Coral larvae disperse through the pelagic environment via regional circulation patterns including the Gulf Stream and associated eddies, facilitating connectivity among reef systems throughout the South Atlantic and wider Caribbean region.

Successful settlement and recruitment require hard, stable substrate with low sedimentation and adequate water quality. Larval settlement frequently occurs on consolidated hardbottom, reef framework, limestone outcrops, and carbonate substrates where crustose coralline algae and suitable microhabitat conditions promote attachment and early survival.

Coral: Integrated EFH Statement Paragraph

Juvenile and adult coral colonies occur across a broad depth range from nearshore hardbottom habitats to deep continental slope coral ecosystems. Shallow stony corals generally require sufficient light to support symbiotic zooxanthellae, whereas deepwater corals rely on suspension feeding in cold, current-swept environments. Octocorals and gorgonians are commonly associated with moderate to strong current flow and structurally complex hardbottom habitats that support suspension feeding and vertical habitat development.

As colonies mature, corals create structurally complex biogenic habitat that supports diverse fish and invertebrate assemblages. Coral reefs, live/hardbottom systems, and deepwater coral habitats provide spawning habitat, nursery areas, feeding grounds, and refuge for numerous federally managed species including members of the snapper-grouper complex. Habitat quality, sedimentation, water quality, temperature variability, physical disturbance, and ocean acidification strongly influence coral recruitment, growth, survival, and long-term ecosystem resilience.

Sargassum

- Vegetative Growth Stage: Occurs within offshore epipelagic surface waters throughout the tropical and subtropical Atlantic.
  - Associated with warm, saline, well-lit oceanic waters.
  - Growth is enhanced by nutrient availability associated with upwelling, riverine influence, frontal systems, and mesoscale eddies.
  - Floating thalli provide primary production and structural habitat within pelagic systems.
- Fragmentation and Propagation Stage: Reproduction occurs primarily through vegetative fragmentation.
  - Fragments are generated through wave action, grazing, turbulence, and physical disturbance.
  - Fragmentation commonly occurs in convergence zones, frontal regions, and storm-influenced waters.
  - Detached fragments remain buoyant and continue vegetative growth.
- Aggregation and Rafting Stage: Ocean currents and Langmuir circulation aggregate Sargassum into mats and windrows.
  - Associated with convergence zones, current boundaries, and frontal systems.
  - Floating mats create structurally complex pelagic habitat.
  - Rafting habitats concentrate prey resources and increase habitat complexity.
- Nursery and Ecological Maturation Stage: Persistent Sargassum mats provide nursery habitat for juvenile fishes and invertebrates.
  - Associated fauna utilize mats for feeding, refuge, and predator avoidance.
  - Habitat supports epibiotic communities and trophic connectivity within pelagic food webs.
  - Frequently utilized by highly migratory species, sea turtles, and reef-associated juveniles.
- Senescent and Sinking Stage: Aging Sargassum gradually loses buoyancy and sinks into the water column.
  - Organic material contributes to benthic-pelagic coupling and nutrient transfer.
  - Sinking biomass supports detrital pathways and deepwater food webs.
- Coastal Deposition (Wrack) Stage: Sargassum transported shoreward accumulates along beaches, barrier islands, and estuarine margins.
  - Wrack deposits provide habitat and food resources for shoreline invertebrates and shorebirds.
  - Large accumulations may influence nearshore water quality and dissolved oxygen conditions.

Sargassum

Pelagic Sargassum in the South Atlantic exhibits a holopelagic life history in which all life stages occur within the pelagic environment without attachment to benthic substrate. Unlike benthic macroalgae, reproduction occurs primarily through vegetative fragmentation rather than through an alternation of attached and free-living stages.

Floating Sargassum thalli occur primarily within the epipelagic zone where adequate light and warm oceanic temperatures support photosynthesis and vegetative growth. Growth is enhanced by nutrient enrichment associated with upwelling, riverine inputs, frontal systems, and mesoscale eddies. Fragmentation resulting from turbulence, grazing, and physical disturbance serves as the primary mechanism for propagation and expansion. Individual fragments remain buoyant through gas-filled vesicles and can continue growth following separation from parent mats.

Surface currents and convergence zones aggregate individual thalli into persistent mats and windrows that may extend across large spatial scales, including portions of the Great Atlantic Sargassum Belt. These rafting habitats provide important structural complexity within otherwise low-relief pelagic systems and support diverse assemblages of fishes, crustaceans, sea turtles, and invertebrates. Juvenile fishes and invertebrates frequently utilize Sargassum mats as nursery habitat, refuge from predation, and foraging grounds.

As Sargassum ages, buoyancy declines and senescent material either sinks into the water column or is transported into coastal environments where it accumulates along shorelines and estuarine margins as wrack. Sinking material contributes to vertical carbon and nutrient flux between pelagic and benthic ecosystems, while coastal wrack deposits support detrital food webs and shoreline invertebrate communities.

How do we Integrate this Information into the User Guide?

- The HEAP can’t do large updates for the EFH definitions via the User Guide
- The update needs to be through each FMP via various channels (exps: full amendment, abbreviated, or framework)
  - Planned for the next 5-year update
- Staff proposes adding an appendix to the User Guide with this information to be eventually integrated into each FMP

AP Actions

Decide how to integrate this information into the User Guide temporarily.

Decide whether to recommend the proposed life stage information for the EFH definitions for Sargassum, Coral, Shrimp and Spiny Lobster.

Determine a volunteer to update the Golden Crab EFH habitat use language.

Timeline

In the next 6 months to a year:

- Summarize life history information
- Identify important habitats separated by life stages

In the next three years:

- Identify pathways to update all FMP's EFH definitions with important habitats by life stage

By December 2029

- Integrate EFH habitat separated by life stage into the User Guide

Work Completion Goal: December 2029

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