# Document 3b: Key Characteristics of Ecosystem Models and Supporting Analyses Applied to Northeast Region Marine Species

| Model/Presenter [1] | Key characteristics | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Model type | EPU | Species included in model | Ecosystem reference points ? | Catch advice and scientific uncertainty ? | Spatial scales and demographics ? | Data needed and assumptions ? | MSE and backtesting or verification ? |
| End to end modeling using Atlantis (Gamble) | Food web dynamics; strategic advice | Georges Bank | 45 functional species groups; 18 fishing fleets | Maybe | No/no | No | Lots | Yes |

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| Technical summary of multispecies statistical catch at age models and their application on the NEUS continental shelf (Curti) | Multispecies VPA & statistical catch at age; strategic and tactical | Georges Bank | (9) White hake, spiny dogfish, winter skate, goosefish, cod, silver hake, pollock, Atlantic herring, Atlantic mackerel; 27 predator/prey interactions | Partial | YES | NO | Considerable | No |
| Application of a multispecies statistical catch at age model assess the productivity and ecosystem reference points for Atlantic menhaden (McNamee) | Multispecies VPA & statistical catch at age; strategic and tactical | Mid-Atlantic | Atlantic menhaden, striped bass, scup, shrimp, crustaceans, spot, croaker, butterfish, bluefish, other alosids | Partial | YES | NO | Considerable | No |

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| A habitat model-based method to estimate stock availability to surveys that can be incorporated in stock assessments (Manderson) | Thermal habitat | Mid-Atlantic & Georges Bank | Butterfish | NO | NO | YES | Moderate | YES |
| Indicator Approaches for EBFM on the Northeast Shelf (Smith) | Not presented to PDT | | | | | | | |
| Spatial Processes in the EcoPath with Ecosim Modeling Framework (Lucey) | Mass balance biomass/energetics based model | Coastwide; 4 regions | Highly aggregated groups | NOT YET | NO | NO | Lots | NO |

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| Application of Ecopath and Ecosim models to the Gulf of Maine American lobster ecosystem (Zhang) | Mass balance biomass/energetics based model | Gulf of Maine | Lobster, cod, Atlantic herring, Wolfish, Skates, shrimp, squid, silver hake, red hake, cunner, cusk, tautog, other fish, crustaceans | NO | YES | YES | Lots; mostly from literature | NO |
| Modeling and Analysis of Lower Trophic Level Dynamics (Friedland) | Not presented to PDT | | | | | | | |
| Ecosystem production potential of the Northeast U.S. Continental Shelf | Energy transfer model | Mid-Atlantic to Gulf of Maine and Georges Bank | Large functional groups | YES | YES | NO | Broad scale | NO |

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| Application of portfolio analysis for EBFM (DePiper) | Portfolio theory; minimize risk and variance; NEUS Altantis | Georges Bank | Goosefish, cod, winter flounder, yellowtail flounder, haddock, Atlantic herring, Atlantic Mackerel, winter skate, silver hake, spiny dogfis | YES, risk based | YES | YES | Complex | Not yet |
| Management Strategy Evaluation (Gaichas) "Hydra"/"Kraken" | Production model | Georges Bank | Spiny dogfish, winter skate, Atlantic herring, cod, haddock, yellowtail flounder, winter flounder, Atlantic mackerel, silver hake, goosefish | YES | YES | YES | Considerable | YES |

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| Empirical dynamical modeling for EBFM (Perretti) | Non-parametric stepwise time-series analysis | Georges Bank | All with catch data | MAYBE | MAYBE | YES | Less | YES |
| The following models focus on predicting effects of climate change on the physical oceanography and/or the biology or population dynamics of marine species.  By themselves, they do not provide sufficient advice for managing total removals of marine species to achieve optimum yield.  They are however supportive of such models that do so and provide advice about how marine systems are likely to respond to increasing water temperatures, declining pH, and/or changes in circulation or seasonality.  As such, they are important model components in any EBFM framework and toolkit. | | | | | | | | |
| High resolution climate modeling for EBFM (Saba) | Climate change forecasting – model designed to forecast climate changes which may be applied to ecosystem predictions | NW Atlantic | None | NA | NA | YES | Considerable | YES |
| Modeling climate-mediated distributional shifts (Kleisner) | GAMS habitat suitability; temperature, depth | Gulf of Maine/Georges Bank and Mid-Atlantic bight | Large fish by species | NA | NA | Spatial scales | Survey catches | YES, training and test set |
| Regime shifts on the Northeast U.S. Continental Shelf (Morse) | Bloom analysis and zooplankton distribution | Gulf of Maine to Mid-Atlantic bight | Zooplankton | NA | NA | Spatial scales | Zooplankton survey catches | NO |