Pacific Cod Tagging group (PACT) Research Plan

This outline describes PACT research goals and the way past, current, and future research projects address those goals. The intent of this document is to guide future research projects, assist with proposal writing, and educate people about our tagging work and its importance for fisheries management.

**Goals:**

1. Assist stock assessment
   1. Movement across management boundaries: connectivity
      1. NBS/EBS
      2. WGOA/CGOA
      3. AI/Bering Sea/GOAHow to account for effects of climate change/temperature regime
   2. Movement into and out of managed areas
      1. Russia/arctic
      2. How to account for effects of climate change/temperature regime
   3. Seasonal change in distribution
      1. AI distribution of tagged fish summer vs winter
         1. proportion of time in surveyed strata
      2. Survey and fishery mismatch in size distribution
      3. Overlap of fish locations with summer survey grid
   4. Activity/catchability
      1. Distance off-bottom, depth trends during summer foraging
      2. Behavior prior to capture in trawl
      3. Light-based activity (night, day, dawn/dusk)
      4. How does this change in space and time?
         1. Aleutians vs. Bering Sea vs. GOA
   5. Incorporate tagging data into Pacific cod distribution models (Jim Thorson) that can predict Pacific cod distribution based on environmental variables
2. Understand Pacific cod life history
   1. Conceptual model of cod distribution and movement in Alaska
      1. Migration timing
         1. Is there an external trigger for migration in either direction
      2. Migration extent
      3. Site fidelity: seasonal and annual
      4. Partial migration
      5. Behavior during spawning, migrating, foraging
      6. How these differ by region
   2. Definition of ideal spawning habitat
      1. Bathymetry, substrate, slope, etc.
      2. Environmental conditions (Temp, current, light, etc.)
      3. Utilization distribution
   3. Relating summer foraging distribution to diet/substrate/prey distributions
      1. Look for possible links to habitat, etc.
   4. Relationships with temperature
      1. Foraging vs. spawning
   5. Bio-energetics
      1. Time spent in various environmental conditions
      2. Can feeding events be identified?
3. Predict effects of climate change
   1. How is seasonal movement affected by environmental conditions
      1. Migration timing/extent in cold vs warm years
      2. Can distribution of stock be predicted?
         1. For stock assessment, indicators of likely movement outside of survey boundaries?
      3. How are migration timing and extent expected to change with predicted climate change scenarios?

**Fieldwork/analyses:**

Completed

1. Aleutian Islands post-spawning migration
   1. Fieldwork winter 2019
   2. Management objectives 1A, 1C, 1D, 2A, 2D
   3. Manuscripts:
      1. Bryan et al.
      2. Rand et al.
      3. Nielsen et al.
      4. NPRB final report (framework for conceptual model of cod movement in Alaska)

In progress

1. Bering Sea – seasonal movement from NBS
   1. Fieldwork summer 2019, tag release in NBS
   2. Management objectives 1A, 1B, 1D, 2A, 2B, 2D
   3. Manuscripts
      1. High abundance in NBS is due to shift in summer foraging locations
      2. Depth/diet trends during summer foraging NBS
2. Gulf – connectivity with EBS following spawning
   1. Fieldwork winter 2021, tag release in WGOA
   2. Management objectives 1A, 1B, 1C, all of 2
   3. Manuscripts
      1. Connectivity: Gulf, EBS, NBS, Russia, Chukchi
3. Bering Sea – activity and seasonal movement
   1. Fieldwork summer 2021, tag release EBS and NBS
   2. Management objectives 1A, 1B, 1D, all of 2
   3. Manuscripts
      1. Activity during foraging, insights into survey availability
      2. Bolster sample size for connectivity, seasonal movement

Future

1. How does migration timing/extent vary with environmental conditions?
2. Diet/bioenergetics – why do they go to NBS/arctic?
   1. Effects on crab?
3. How to predict future distribution?

**Collaborators and complementary work:**

1. Spawning behavior – Charlotte, AEB
2. NSEDC, Native Village of Savoonga
3. Industry – behavior and activity
4. Life history - Ben Laurel, Alissa Abookire
   1. YOY in NBS?
   2. Use our information on spawn locations and timing in models
   3. Bioenergetics
   4. Spawning habitat – groundtruth temps during spawning
5. Survey availability/catchability
   1. Kim/Sean Rohan(?)
6. Genetics
   1. Connectivity match patterns in Ingrid’s genetics map?