Pacific-Atlantic Sea Turtle Assessment (PASTA) Working Group Meeting II

Report for PFRP Meeting
November 14 – 17, 2006
Honolulu, Hawaii

Selina Heppell
Molly Lutcavage
Purpose of PASTA

- Develop a framework for comparative analysis of loggerhead and leatherback populations in the North Atlantic and North Pacific.
- Involve modelers, oceanographers, fisheries scientists and sea turtle biologists.

New skills, new ideas, new synthesis!
PASTA II

PI’s: Molly Lutcavage, Selina Heppell

Steering committee: David Kirby, Rebecca Lewison, Yonat Swimmer, Melissa Snover, Tomo Eguchi

- Abby McCarthy, Jay Vaughn
- Funded by PFRP
- Inspiration John Sibert
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<tr>
<th>Name</th>
<th>Specialty/Field</th>
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<tr>
<td>David Kirby</td>
<td>Modeling</td>
<td>SPC Ocean Fisheries Program</td>
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<td>Rebecca Lewison</td>
<td>Bycatch</td>
<td>San Diego State University</td>
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<td>Melissa Snover</td>
<td>Modeler</td>
<td>Pacific Islands Fisheries Science Center</td>
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<td>Yonat Swimmer</td>
<td>Pelagic Fisheries</td>
<td>SW Fisheries Science Center</td>
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<td>Tomo Eguchi</td>
<td>Genetics</td>
<td>SW Fisheries Science Center</td>
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<td>Martin Hall</td>
<td>Fisheries</td>
<td>Inter-American Tropical Tuna Commission</td>
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<td>Jeanette Wyneken</td>
<td>Physiology</td>
<td>Florida Atlantic University</td>
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<td>Mark Maunder</td>
<td>Fisheries</td>
<td>Inter-American Tropical Tuna Commission</td>
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<td>Francois Royer</td>
<td>Fisheries Oceanogr.</td>
<td>UNH Large Pelagics Lab</td>
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<tr>
<td>Andy Myers</td>
<td>Ecology, Oceanogr.</td>
<td>UNH Large Pelagics Lab</td>
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<td>Jeffrey Seminoff</td>
<td>Coastal fisheries</td>
<td>SW Fisheries Science Center</td>
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<td>Francisco Chavez</td>
<td>Oceanography</td>
<td>Monterey Bay Aquarium Research Institute</td>
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<td>Vince Saba</td>
<td>Biol. Oceanogr.</td>
<td>Virginia Institute of Marine Science</td>
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<td>Kate Mansfield</td>
<td>Coastal fisheries</td>
<td>Virginia Institute of Marine Science</td>
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<td>Yoshi Matsuzawa</td>
<td>Biology</td>
<td>Sea Turtle Association of Japan</td>
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<td>Jay Vaughan</td>
<td>Biology</td>
<td>Oregon State University</td>
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<td>Bryan Wallace</td>
<td>Biology</td>
<td>Duke University</td>
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<td>Irene Kinan</td>
<td>Pelagic Fisheries</td>
<td>Western Pacific Regional Fishery Management Council</td>
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<td>Shaleyla Kelez</td>
<td>Coastal Fisheries</td>
<td>Duke University</td>
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<td>Jenny Purcell</td>
<td>Jellyfish Biology</td>
<td>Western Washington University</td>
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Project Goals

- Develop hypotheses to determine what drives sea turtle pop dynamics and role of human and environmental impacts, (ocean basin and species levels)

- Design assessment tools to test those hypotheses

- Provide guidance for research, management and mitigation
Arguably, we should promote all possible means to reduce human impacts on declining populations of sea turtles, *BUT*

- Elimination of impacts is not possible, nor likely necessary
- Limited time, money for research and monitoring
- Need to know “how much is enough?”
Meeting objectives

- Identify the likely impacts of human & natural stressors on abundance, vital rates, distribution and size structure.
  - Synthesize over broad spatial and temporal scales
- Compare impacts and expected population dynamics for loggerhead and leatherback turtles
- Develop testable hypotheses for identifying drivers of population change
- Fine tune assessment tools, fill data gaps required to test hypotheses, eliminate some!
Species life-history differences

**Loggerhead (Caretta caretta)**
- Primary habitat is life-stage specific
- Age at maturity: 25-30 years
- Smaller body size = susceptibility to cold shock, smaller niche size
- Slower early growth rate

**Leatherback (Dermochelys coriacea)**
- Primary habitat is pelagic
- Age at maturity: 10-15 yrs
- Large body size = greater physiological tolerance, larger niche size, warm-bodied
- Fast early growth rate

http://tofino.ex.ac.uk/euroturtler.htm
Leatherbacks in the Pacific

**Mexico (Pacific)**

- **Equation**: $y = 8961.2e^{0.279x}$
- **$R^2$**: 0.7292

- **Equation**: $y = 1487.5e^{0.2552x}$
- **$R^2$**: 0.6179

**Malaysia**

- **Equation**: $y = 9297.9e^{0.1511x}$
- **$R^2$**: 0.922

**Leatherback females**

- **Location**: Playa Grande, Costa Rica
- **Equation**: $y = 1542.7e^{0.187x}$
- **$R^2$**: 0.8627
Leatherbacks in the Atlantic / Caribbean

French Guiana

\[ y = 13625e^{0.0359x} \]
\[ R^2 = 0.1509 \]

St. Croix

\[ y = 17.79e^{0.0869x} \]
\[ R^2 = 0.7087 \]

Florida

\[ y = 87.691e^{0.1376x} \]
\[ R^2 = 0.8793 \]
Stressors

To nesting beaches:
- Egg/female harvest
- Coastal development, human population growth
- Nest predation by native & introduced predators
- Catastrophic natural events, e.g. hurricanes

To pelagic habitat:
- Large-scale shifts in current/ wind patterns, temperature that may affect forage quality
- Marine debris aggregations, both direct and indirect
- Fishing, shifting gear types and location of effort

To coastal habitat:
- Fishing: gillnet, trawl, longline, others
- Entanglement
- Boat strikes
- Marine debris
- Pollution
Pacific Basin

- Higher density of pelagic hooks (4.4 hooks/km²), more hooks (718 million) but lower turtle CPUE
- Higher concentration of fishing near beaches
- Less bycatch management/monitoring
- Larger basin, longer migration lengths
- More variation in nesting beach productivity
- Lower adult female recapture rate
- More nesting beach development
- Greater climate change impacts, leads to:
  - Higher variability in availability of prey?
  - Longer re-migration interval for leatherbacks?
Atlantic Basin
Fisheries in Atlantic

- Lower density of pelagic hooks than Pacific (3.4 hooks/ km²), fewer hooks (316 million hooks), but higher turtle CPUE
- More bycatch management and monitoring than Pacific
- More nests and higher number of eggs per nest
- Larger female body size
- More variable migration patterns for leatherbacks
- More nests per season for leatherbacks
- Better nesting beach data
Mapping Products

- GIS maps nesting beach locations, trends > 3 decades for leatherbacks and loggerheads.

- GIS maps of fishing effort (# of boats)
  - by country
  - by size of boat (grt)
    - small = coastal?
    - large = pelagic?
Assessment of fishing intensity

In collaboration with Project GLOBAL, Duke Univ, we’ve collated data on major fisheries in each basin:

Maps showing distribution of gear types.

Bycatch rates for each fishery have been calculated.

Estimate of post encounter mortality from bycatch events examined.

Next steps: examine differences in fishing pressure, bycatch mortality rates, overlap of turtles and fisheries between basins.
Satellite Tracking Synthesis

- Available satellite tracking data compiled from published literature, Seaturtle.org, OBIS-SEAMAP, TOPP websites.

- Tracks revealed some patterns of movement from specific nesting locations, but no obvious differences in patterns between basins.

- More detailed analysis necessary to determine if migration distance, availability of suitable habitat are potential drivers between the two populations.
Modeling Products

- Age-structured population model to examine impacts of past perturbations on both species.
  - Ability to input 5 different sets of life history parameters
  - Explore effects of time lags on population response
    - e.g., Loggerhead response in Japan (recent increase) could be a rebound following cessation of driftnets
  - Examine responses in nesting female counts that may be due to changes in nesting frequency rather than population size
    - e.g., Atlantic leatherback increase (in part) due to large number of annual nesters
Modeling Products

- Simulation of hatchling drift trajectories for the Pacific and Atlantic basin
  - “hatchlings” are released from nesting beach locations during peak time of emergence
  - Model disperses passive drifting hatchlings based on basin wide currents, behavior, physiology
Future work

- Participants will acknowledge PASTA meetings (and PFRP) on manuscripts as appropriate
- Collaboration across disciplines fostered!
- Possible future PASTA meetings
- Synthesis symposia at sea turtle and/or fisheries meetings, Cliotop?