

Project Title: Providing Data on Discards and Fishery Dynamics to Inform Management Policy of the Recreational Summer Flounder Fishery in Raritan Bay

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Summer flounder (*Paralichthys dentatus*) is a key species for New Jersey's fisheries, including being the most commonly captured species by recreational anglers and the most valuable finfish species for the commercial fishing industry (NMFS, 2017). Increasingly strict fisheries management measures have been implemented in recent years due in part to the results from the most recent stock assessment which indicated that the summer flounder stock is experiencing declines in spawning stock biomass, low recruitment, and overfishing (Terceiro, 2016). For the recreational fishery in New Jersey, including anglers fishing in Raritan Bay, these fisheries management measures have included shorter fishing seasons, larger minimum sizes for harvesting, and lower possession limits. These management measures lead to a great deal of discarding when fish do not meet the criteria for harvest (e.g., too small, out-of-season) or due to personal conservation ethics of the anglers. In fact, it is estimated that 5-10 million summer flounder are discarded annually by New Jersey's anglers (NMFS, 2017). As a result, additional information on fishery dynamics and discards were needed to inform fishery management policy and decision-making for the recreational summer flounder fishery in Raritan Bay and throughout New Jersey. This mini-grant project brought together a team of scientists from Rutgers University, the University of Massachusetts Dartmouth, the New England Aquarium, and the New Jersey Department of Environmental Protection (NJDEP), multiple stakeholders of New Jersey's recreational and commercial fisheries, and a full-time undergraduate intern to address some of these data gaps.

Fisheries management plans and stock assessments currently assume a 10% discard mortality rate for summer flounder that are caught and released by recreational anglers (Terceiro, 2016). Many factors can influence the discard mortality rate of summer flounder, including fishing tackle choices, potential injury upon capture or handling, or environmental conditions. Additional information regarding anglers' fishing practices would be valuable for evaluating the impacts of discards in the summer flounder recreational fishery, informing fishery management policy, and for educating anglers on recommended best practices for reducing discard mortality. Therefore, an online survey of anglers who target summer flounder was conducted during the summer of 2018 to describe the fishing practices of anglers targeting summer flounder. A total of 339 anglers who target summer flounder in Raritan Bay, or other regions in New Jersey, completed the survey, including many who primarily fish on private boats, which is a sector of the fishery that is typically not well understood. Results from the survey provided valuable information regarding the tackle types most commonly used by anglers (e.g., bucktail jigs, bait rigs) and capture and handling practices of summer flounder (e.g., use of landing nets, hook removal methods). These results will be used to develop educational materials through Rutgers Cooperative Extension to educate anglers on recommended best practices for reducing discard mortality. Also, survey results will be shared with fishery managers at the NJDEP's Division of Fish and Wildlife and other fisheries management councils for consideration in their decision-making, and for use in future discard mortality studies.

Summer flounder exhibit sexually dimorphic growth, whereas, females grow faster and mature at a larger size than males (Terceiro, 2016). Fisheries management policy has increased the minimum landing size for summer flounder by recreational anglers, which has contributed to the situation where approximately 90% of the recent summer flounder landings by recreational anglers are female (Morson et al., 2012, 2015, 2017). Furthermore, summer flounder beneath the minimum landing size that are discarded by recreational anglers have a higher proportion of females than fish of the same length that are caught by commercial fishermen, suggesting differences in behavior among the sexes or different fishery dynamics (Morson et al., 2015). Therefore, the sex ratio of the recreational landings and discards is a major concern given the potential impacts on population dynamics from female-biased harvest. Despite the sexual dimorphism in growth and maturation, there are no known methods for externally identifying the sex of summer flounder so they currently have to be sacrificed and dissected to determine their sex. This project evaluated multiple potential methods for externally identifying the sex of summer flounder, which would be useful for identifying the sex of tagged fish and investigating potential behavior differences, and for having a non-lethal method for monitoring the sex ratio of both recreational and commercial catch. Summer flounder were sampled at commercial fishing docks or processors, including the Belford Seafood Co-Op (Belford, NJ), Sally's Seafood (Waretown, NJ), Trinity Seafood (Lakewood, NJ), and Fishermen's Dock Co-Op (Point Pleasant Beach, NJ). Methods for externally identifying the sex of summer flounder that were tested included visually examining the location of the genital pore, using a cannula to extract gametes, and morphometrics to investigate body shape (e.g., Cadrin and Silva, 2005). Despite evidence from other flounder species, the location of the genital pore had no noticeable difference between male and female summer flounder. Cannulation to extract gametes was not successful for summer flounder during the summer but might be more effective when summer flounder are spawning during the fall and winter and will be tested further in the future. Using photographs of the summer flounder for morphometrics analysis showed some promise in being able to identify male and female summer flounder based on differences in their body shape. However, additional sampling and image analysis will be

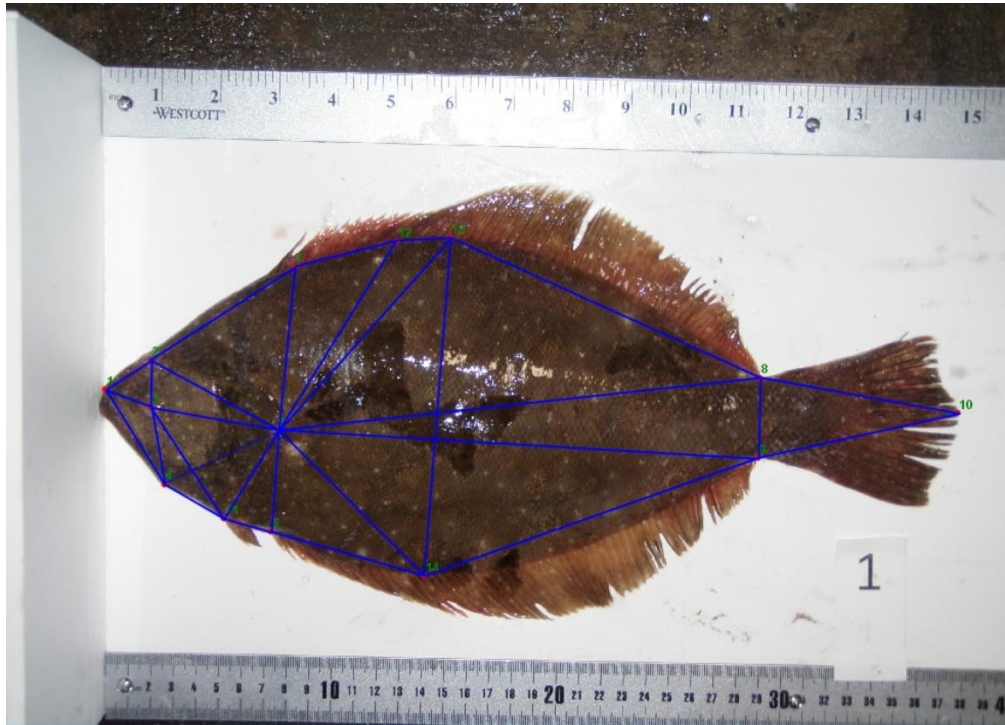
conducted to determine the efficacy of morphometrics for predicting the sex of summer flounder. This project also pilot tested the collaboration with two captains (Captain Paul Haertel, Captain Paul Eidman) who voluntarily photographed their summer flounder and shared the photos with our research team as a potential program by which to monitor the sex ratio of recreational landings and discards.

The research completed as a part of this mini-grant provided valuable information about the fishing practices of recreational anglers targeting summer flounder and insights into fishery dynamics in Raritan Bay and other regions of New Jersey, which will help to inform fishery management decision-making focused on this key species for New Jersey's recreational and commercial fishing industries. Furthermore, the activities as a part of this project also served as great educational experiences for an undergraduate researcher and all of the fishing industry stakeholders who were involved and educated on these issues impacting the sustainability and management of New Jersey's summer flounder fisheries. Therefore, this project has utilized the fisheries of Raritan Bay to inform university-based research and education, and brought together a diversity of scientists and stakeholders to provide data needed to inform fishery management decision-making to positively impact the sustainability of our marine fisheries.

For more information, please contact Dr. Douglas Zemeckis (zemeckis@njaes.rutgers.edu, 732-349-1152).



Massimo DiSanto (Rutgers University Undergraduate Student) sampling a summer flounder at Trinity Seafood (Lakewood, NJ). Photo Credit: Douglas Zemeckis



Mapped photograph of a male summer flounder showing the landmark points and distances connecting these landmarks that were used in the morphometrics analysis of summer flounder to determine if body shape differs between males and females. Photo Credit: Massimo DiSanto

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