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Effects of Commercial Fishery on the Bream Population and Influence of Water Temperature

Wade Monteleone*

Department of Primary Industries, Sydney Institute of Marine Science, Mosman, Australia

***Corresponding author:** Wade Monteleone, Department of Primary Industries, Sydney Institute of Marine Science, Mosman, Australia, Email: Email wademonte@gmail.com

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Description

Despite documented negative effects on aquatic ecosystems, management agencies commonly receive requests to stock non-native rainbow trout Oncorhynchus mykiss (Walbaum). We used a multinomial N-mixture model and a suite of diet analyses to evaluate effects of large (265–530 mm) rainbow trout on reach-scale abundance and feeding ecology of an important endemic, keystone species, Neosho bass Micropterus velox (Hubbs and Bailey). We evaluated potential changes by seasonally sampling multiple reaches of an Ozark Highlands stream before and after the introduction of 10,800 rainbow trout. Results suggest that rainbow trout altered the distribution of Neosho bass, as indicated by a negative relationship between rainbow trout density and Neosho bass abundance. Trophically, rainbow trout and Neosho bass <101 mm were equivalent, but rainbow trout diets significantly overlapped with larger Neosho bass. High rainbow trout abundance in the spring post-stocking period changed Neosho bass diets by altering predator–prey dynamics with crayfish. Controlling for fish size revealed Neosho bass consumed larger crayfish than rainbow trout, although rainbow trout and Neosho bass between 200 and 299 mm consumed equal-sized crayfish. Outcomes of rainbow trout stockings are likely density- and size-dependent, but caution is warranted for introductions in warmwater streams. Fish otoliths encode information on surrounding environmental conditions. This study used otolith chemistry to investigate population structure and potential connectivity in stout whiting (Sillago robusta) along the east coast of Australia. Otoliths were analysed for both minor and trace elements, targeting the otolith core (location of birth) and otolith edge (location of capture), along with Ba:Ca transects to investigate life histories. Significant differences were found between core and edge signatures as well as among sample zones for select trace and minor elements. Otolith edge signatures showed evidence of some heterogeneity among zones, likely influenced by both environmental and physiological factors.

Catch Biomass

This combination of factors is reflected in poor separation of sample zones from the multielement analysis, suggesting that future research may benefit from incorporating additional natural markers. Transects reflected some degree of individuality in Ba:Ca profiles, with evidence for potential exposure to upwelling events, or movement from shallow, inshore habitats into deeper waters. The variation in Ba:Ca profiles among fish suggests that populations are comprised of both resident and migratory individuals. While analysis of otolith chemistry could not reliably separate capture locations, patterns in the data suggest that inshore juvenile habitats are likely to be important in supporting exploited populations. The growing human population and consumption rates of provisioning ecosystem services have many negative consequences on nature, including depletion of fish stocks in the ocean. The Mediterranean Sea has heavily exploited fishing grounds, which can be ascribed to poor legislation enforcement by responsible organisations and differences in multiple legislations implemented in the Mediterranean. Although the Aegean Sea particularly lacks fishery management plans, high fishing activity proliferates in the area due to a higher productivity than in the rest of the Eastern Mediterranean due to nutritional inflow from the Black Sea and rivers in the North of the Aegean. Consequently, fisheries and marine wildlife are highly abundant in this region, leading to frequent interactions. Cetaceans are one group most impacted by such interactions, with the common bottlenose dolphin (Tursiops truncatus, Montagu 1821) mainly being impacted due to its coastal distribution and high abundance. Fishing effort is also elevated in the Aegean Sea. High fishing boat density and high fishing effort, or amount of fishing, increase the frequency of interactions with marine mammals in the Aegean and makes the region particularly treacherous for T. truncatus. Interactions between fisheries and T. truncatus can have negative results such as conflicts and depredation events. Stealing or spoiling of fish from fishing nets by marine mammals can result in death of T. truncatus individuals by entanglement in fishing nets and culling by fishers. Fishers cull cetaceans primarily because of economic losses caused by damaging and stealing fish from fishing nets. Depredation behaviour increases when fish populations decline. Additionally, conflict frequency increases when the same fish species are targeted. Therefore, due to their diet, marine mammals share the same interest with fisheries and most likely catch their prey in the same places at the same time, thereby causing conflicts. Many fish families have been recognised as drivers of conflicts, which can be ascribed to uncertainty in the diet composition of T. truncatus, which is partially caused by differences in the diet in time and space. However, the families thought to be primarily involved in conflicts include Mullidae, Merlucciidae and Sparidae. The catch rate of certain fish species by fisheries can be heightened with the use of specific gear at a specific depth. Therefore, the type of gear used by fisheries can be a proxy for the frequency of expected conflicts between fisheries and T. truncatus . Depredation by T. truncatus is enhanced when nets such as bottom trawls and static nets, specifically trammel and gillnets, were used in shallow waters.

Spatial Distribution of Fisheries

The variables “gear that is operated by fisheries” and “fish families of common interest between fisheries and T. truncatus” have been used as proxies before to determine the frequency of depredation. However, geographical locations where conflicts occur more frequently have yet to be identified. Information on these areas might be used to mitigate and decrease the growing number of reported conflicts and ultimately avoid overexploitation of fish at certain places at certain times to maintain a sustainable environment for T. truncatus. Moreover, identifying potential conflict zones might help to visualise potential conflict zones for reducing the number of conflicts. The primary aim of this study was to identify areas and fish species of high conflict risk between commercial fisheries and T. truncatus in the Dodecanese region. High-risk areas were hypothesised to be located in the regions with the highest fishing effort in the Dodecanese; the area around Rhodes and between the islands of Kalymnos, Agathonisi and the southeastern coast of Turkey. According to previous research, Mullidae, Merlucciidae and Sparidae were hypothesised to be targeted fish families that lead to conflicts between fisheries and T. truncatus . We developed a method to identify high-conflict areas with information available to the public by focusing on the Dodecanese region located in the Aegean Sea, a region with a lack of knowledge on the topic compared to mainland coastland waters while having the largest and most active fleet in the Mediterranean. The method was developed by firstly gaining insight into activities of the Greek fishing fleet with global open-access data from Global Fishing Watch. Second, the public database of Hellenic Statistical on the fish families landed by commercial fisheries was accessed to identify the targeted species. Third, data were complemented with the probability that a certain geartype caught a certain fish family and the probability of occurrence of fish families in the area as found. Finally, this information was correlated with fish families in the diet of T. truncatus based on a literature review.