

Conservation of marine biodiversity and artisanal fishing in Maltese waters

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for
ICCAT meeting 2015, MALTA

As the Maltese islands are right in the centre of the Mediterranean Sea and thus particularly well situated for the monitoring of both resident and migratory species, the Conservation Biology Research Group has been running long-term research efforts on both marine species but also on fisheries and their impact on these resources.

With regard to Bluefin tuna, molecular genetics using microsatellites (Vella *et al. in print*) has shown that this species still shows a healthy genetic diversity across the Mediterranean. Nonetheless, tuna penning has increased pressure on the distribution and migration patterns of this species and has increased the emphasis on the use of purse-seining to catch the Bluefin tuna. The latter being the most efficient at catching and exploiting this species. On the other hand long-line fishing by Maltese fishermen has not over-exploited this resource and has also allowed for sharing of this important resource among Maltese artisanal fishermen.

The same is valid for swordfish fishing which needs to be clearly distinguished between large commercial fishing and sustainable artisanal fishing for this species. The latter allowing for both preservation of the species and the preservation of equitable sharing of a resource in sustainable manner. In actual fact Maltese artisanal fishermen have never adopted large-scale swordfish fishing, such as drift nets which are well known as the walls of death and to have a devastating effect not only on swordfish stocks but many other species out at sea.

The effects of various anthropogenic impacts on marine biodiversity, including pollution (chemical, plastic, noise, etc), increasing transport and traffic, illegal activities out at sea (disposal of toxic substances to illegal fishing), climate change and alien species, etc will be affecting marine life and sustainable artisanal fishing. ICCAT should therefore consider suggestions for improvements from both independent conservation scientists and artisanal fishermen too. Financial or economic struggles for these resources need to be very carefully considered in the light of what is best for preserving marine life for generations to come. Conservation research and artisanal fishing needs to be encouraged to develop further hand in hand in order to achieve a more environmentally conscious ecosystem based management of natural resources from local to regional. Fishermen should be financially sustained to undertake conservation research during closed seasons thus allowing them to be more involved in the conservation process too.

Large-scale business and commercial exploitation of resources cannot be seen as the way forward as this excludes fundamental rights to equitable sharing and benefitting of natural resources while promoting the equitable sharing of the duties in safeguarding these same resources.

Various long-term studies on shark exploitation and by-catch by Maltese fishermen has shown that these fishermen have always worked in small-scale considering the immediate needs of locals and tourists on the Islands, rather than working on exports. It is clear that such focus has intrinsically controlled the exploitation rates and the landings.

Keeping these issues in mind it is clear that ICCAT needs to put more weight on promoting artisanal small-scale fishing, especially where this has been part of a tradition and has run through

many generations of experience in exploiting without destroying an ecosystem or impoverishing a stock. Maltese fishermen have proved to be able to do this and like them other small-scale artisanal fishermen across the Mediterranean. Conservation therefore may be achieved by incorporating traditional knowledge side by side by encouraging independent research to run alongside fisheries activities in the Mediterranean. While independent scientific research provides the knowledge to improve such activities, artisanal fishermen need to be recognised as exercising both their rights and their duties in protecting marine life and their futures.

At the same time biological studies that consider the various problems faced by exploited stocks from other anthropogenic pressures also need to be considered in annual assessments of stocks, as ecosystem based assessments should not just cater for the impact of fishing but also consider how changes in the ecosystem will affect fishing, fishermen and marine biodiversity. Future resilience of exploited species will require genetic diversity to be maintained high while reducing the various human pressures on their natural environment.

Closed seasons, quotas and increased enforcement may still not be effective if large-scale commercial fisheries are encouraged, as the latter may catch-up on their financial losses through efficient large-scale exploitation within the windows of opportunity supplied. This therefore may be cause for concern against the artisanal or small-scale fishermen that may not manage to sustain himself and his family during such closed seasons or if the quota is too low to allow him to live through closed seasons. For these reasons it is felt that small-scale fishermen's involvement in conservation research and management and research on improving gear to increase selectivity and reduce environmental impacts should be encouraged by all management bodies (national to regional). Such an effort should bring forward improved options for sustainable fisheries with equitable and fair management considering the particular needs of artisanal fishermen and the marine ecosystem in different parts of the Mediterranean.

Reference:

Vella Adriana, Noel Vella, Saadet Karakulak, Isik Oray, Susana Garcia-Tiscar and Renaud de Stephanis, 2016 (*in print*): **Population genetics of Atlantic Bluefin Tuna, *Thunnus thynnus*, in the Mediterranean: implications for its conservation management** in *J. Appl. Ichthyol.* Vol 32.

Summary

The movement of Atlantic Bluefin Tuna (ABFT) across international boundaries necessitates traceability strategies that may accurately provide information needed for its stock assessments. The Mediterranean Sea is a main contributor to ABFT's reproduction, global population's genetic diversity and fitness. In this study, the ABFT's genetic variability of this species was investigated through 193 samples of adult ABFT collected from Spain, Turkey and Malta – across a longitudinal distance of 3400 km. 13 microsatellite loci were analysed (8 of which newly tested) as genetic markers for this ABFT population study. Allele richness measured per locus and sampling location varied from 1.89 to 8.88, taking into account rarefaction. ABFT private alleles were detected in each of the three sampling sites. No significant spatial genetic divergence was found between pairs of the studied locations, (F_{ST} values < 0.0001 ; P -values > 0.05). Bayesian clustering analysis corroborated a single and panmictic ABFT population in the Mediterranean Sea. Statistical power analyses indicated that the probability of detecting genetic differentiation and population structure with the sample size and microsatellites used was high even at an F_{ST} value of 0.005. From the results, it may be postulated that migrating ABFT during the spawning season are allowing gene flow within the Mediterranean Sea. The complex interplay of ABFT's movements, including plasticity in the selection of spawning sites with increasing age and environmental conditions, require multiple and new fisheries monitoring and management techniques in order to target ABFT's long-term conservation effectively.