Conserving Atlantic Bluefin Tuna with Spawning Sanctuaries

THE PEW ENVIRONMENT GROUP

SCIENCE BRIEF

Atlantic bluefin tuna populations in both the western and eastern Atlantic Ocean are currently at very low levels (ICCAT 2010a; 2010b), and additional management measures are needed to rebuild their populations (Armsworth *et al*. 2010; Block *et al*. 2005; Druon 2010; Hurry *et al*. 2008; ICCAT 2007; MacKenzie *et al*. 2009; Safina and Klinger 2008; Teo *et al*. 2007a; Teo and Block 2010). The prohibition of certain fishing activities at specific times or in specific areas, known as "time and area closures" in fisheries management parlance, are tools commonly used to protect crucial genetic and biological diversity, restore population structure (e.g., age and sex distribution) and spawning stocks, and reduce bycatch (Pelletier *et al*. 2008).

Globally, pelagic fishes (Goodyear 1999), mollusks (Dredge 1992) and reef fishes (Galal *et al*. 2002) have been managed with closures because they protect specific size classes, sexes or individual species from excessive fishing mortality. For example, North Atlantic swordfish have been successfully protected by time and area closures and have recently been declared rebuilt by the U.S. National Marine Fisheries Service (NMFS 2009a), see box below. Recent research suggests that closure of spawning areas for Atlantic bluefin tuna, used specifically to protect spawning fish (Beets and Friedlander 1998; Heyman *et al*. 2005; Nemeth 2005; Sala *et al*. 2001), may be a viable tool to help rebuild their depleted populations (Armsworth *et al*. 2010; Block *et al*. 2005; Druon 2010; ICCAT 2007; Teo *et al*. 2007a; Teo and Block 2010).

The importance of genetic diversity

Genetic diversity is important for species survival because those species that have little genetic diversity may be more susceptible to disease or the effects of changes in the environment. Increased genetic diversity improves the chance of offspring with a variety of characteristics that could allow some of them to withstand changes in the environment and decreases the chance that deleterious genes (such as those linked to disease) show up in the population.

SPAWNING GROUND SANCTUARIES FOR ATLANTIC BLUEFIN TUNA

For spawning area closures to be implemented successfully, fisheries managers must have information on specific spawning times and locations, migration routes and habitat use behavior surrounding the spawning event (Nemeth *et al*. 2007). Atlantic bluefin tuna's two known spawning locations are in the Mediterranean Sea (Fromentin and Powers 2005; ICCAT 2008b; Karakulak *et al*. 2004; Mather *et al*. 1995; Neilson and Campana 2008; Nishida *et al*. 1998; Rooker *et al*. 2007) and in the Gulf of Mexico (Mather *et al*. 1995). Within the Mediterranean Sea, scientists have identified six major regions of spawning activity, some of which may constitute genetically isolated populations (ICCAT 2010c).

Area closures rebuild swordfish populations

North Atlantic swordfish became overfished in the early 1990s, and by 1999 it had been determined that despite the implementation of a minimum size limit, juvenile swordfish were still suffering from a high fishing mortality rate, and this was likely prohibiting the population from recovering. Subsequently, the U.S. National Marine Fisheries Service instituted two permanent area closures to protect juvenile swordfish in U.S. waters. These closures prohibited pelagic longline fishing in areas in the Gulf of Mexico and off the east coast of Florida. By 2002, the population was considered to be in recovery and by 2009 was considered rebuilt, suggesting the use of area closures aided in the timely recovery of North Atlantic swordfish.

OCEAN SCIENCE SERIES

OCTOBER 2010

In 2006, the Standing Committee on Research and Statistics (SCRS) of the International Commission for the Conservation of Atlantic Tunas (ICCAT), the intergovernmental organization charged with the management of tunas and tunalike species in the Atlantic Ocean and adjacent seas, recommended that the Mediterranean Sea be closed to fishing for Atlantic bluefin tuna during their spawning season. However, this scientific recommendation was not adopted by ICCAT itself (ICCAT 2006).

In 2008, ICCAT agreed to establish a multiyear recovery plan for Atlantic bluefin tuna in the eastern Atlantic Ocean and Mediterranean Sea, and the Commission requested that the SCRS identify possible spawning grounds in Mediterranean waters for the creation of sanctuaries that would aid in bluefin recovery (ICCAT 2008a). The Commission also upheld a recommendation to prohibit a directed bluefin tuna fishery in the Gulf of Mexico, where spawning areas are comparatively well known but not protected (ICCAT 2008a).

In addition, an independent review of ICCAT in 2008 recommended an immediate closure of all Atlantic bluefin tuna spawning grounds during their spawning seasons (Hurry *et al*. 2008). Despite these calls for action, spawning area sanctuaries have not been put into place.

Recent genetic, tracking and other studies (Block *et al*. 2005; Boustany *et al*. 2008; Carlsson *et al*. 2004, 2007; Nemerson *et al*. 2000; Rooker *et al*. 2008a, 2008b) have added support to the idea that Atlantic bluefin tuna return to their birth locations to spawn and thus have genetically distinct populations. Research by Block *et al*. (2005) revealed two populations of Atlantic bluefin tuna that overlap on feeding grounds in the North Atlantic and subsequently migrate to separate spawning locations in the Gulf of Mexico and Mediterranean. Similarly, genetic analysis shows that populations from the Gulf of Mexico and eastern and western Mediterranean Sea (Carlsson *et al*. 2004) are genetically distinct (Boustany *et al*. 2008; Carlsson *et al*. 2007). These results indicate that establishing sanctuaries in both the Gulf of Mexico and the Mediterranean is crucial to ensuring that the genetic diversity of the species is preserved.

Gulf of Mexico

The U.S. National Marine Fisheries Service recently designated an area of the Gulf of Mexico as a Habitat of Particular Concern (HAPC) for spawning Atlantic bluefin tuna (NMFS 2009b), see Figure 1. However, the agency has not implemented time and area closures in this region that would protect spawning Atlantic bluefin tuna (NMFS 2006). While directed fishing of Atlantic bluefin tuna is not allowed in the Gulf (NMFS 2006), they are still incidentally caught (and large proportions subsequently die) by longlines targeting yellowfin tuna and swordfish (Armsworth *et al*. 2010; Teo and Block 2010).

Teo and Block (2010) suggested that spatial and temporal management in the Gulf will become important in rebuilding the western Atlantic bluefin tuna populations. Their research showed that catch rates of Atlantic bluefin tuna in the Gulf increase dramatically during the breeding season (March to June) with peaks occurring in April and May. Block *et al*. (2005) suggested that considerable bycatch of Atlantic bluefin tuna in the Gulf of Mexico occurs during the spawning season and that this mortality could be substantially reduced by instituting time and area closures for longliners in the Gulf (Block *et al*. 2005).

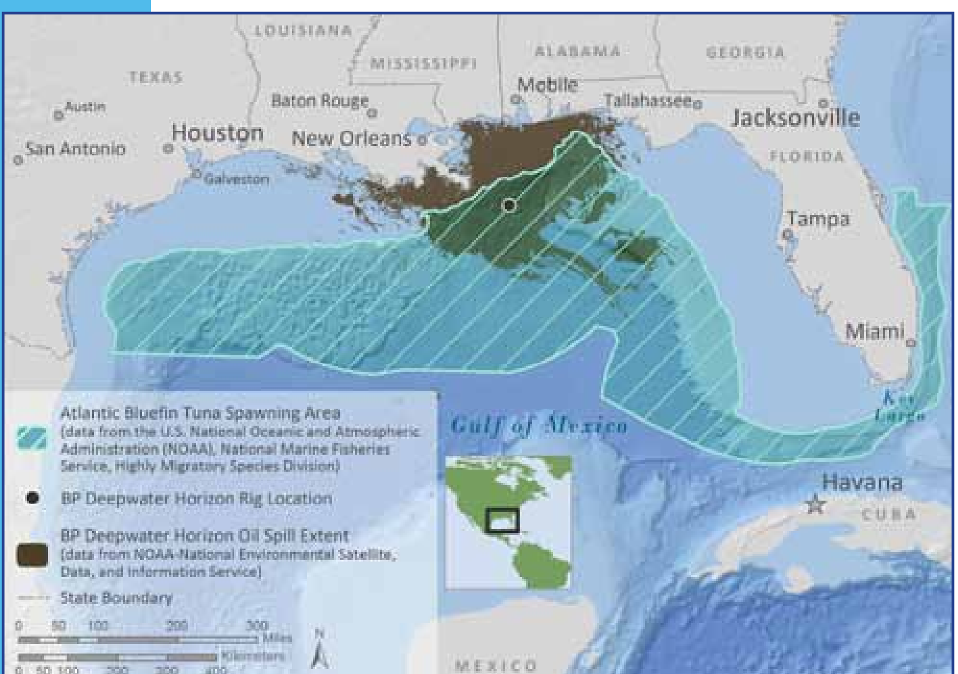

Fig. 1 Distribution of known spawning areas for Atlantic bluefin tuna in the Gulf of Mexico

Teo and Block (2010) provided additional information showing that targeted yellowfin tuna catch rates in the Gulf remain fairly constant throughout the year. Therefore, bycatch of bluefin tuna in this region can be substantially reduced by implementing time and area closures with only minimal impact on catch rates for target species (Teo and Block 2010). In addition, economic modeling has shown that time and area closures in the Gulf, combined with a coordinated effort among countries to rebuild bluefin tuna, would be economically beneficial over the long term, with an increase in profits of up to $9 million a year (Armsworth *et al*. 2010).

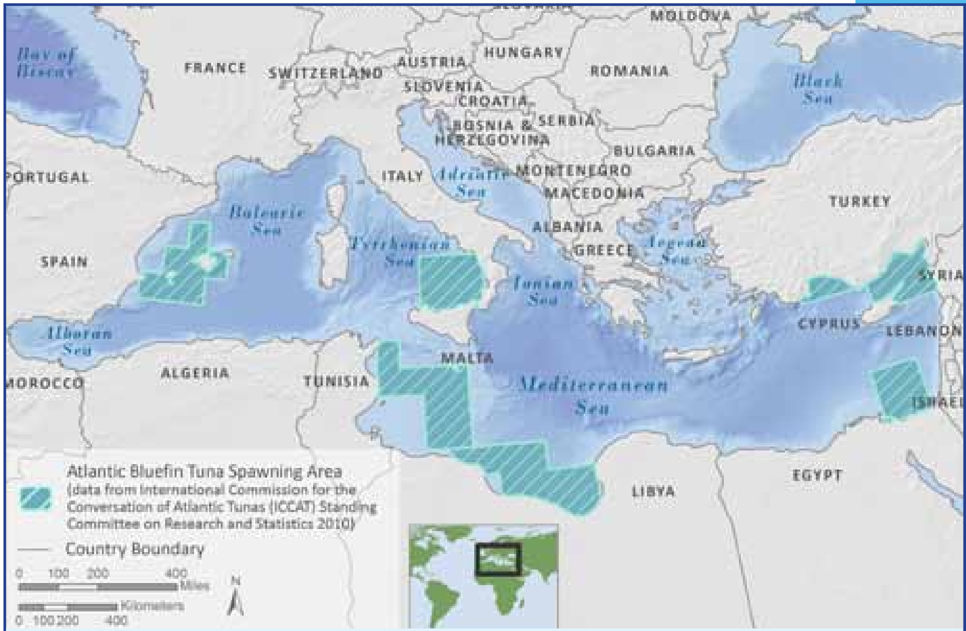

Fig. 2 Distribution of known spawning areas for Atlantic bluefin tuna in the Mediterranean Sea

Mediterranean Sea

Atlantic bluefin tuna are found in the Mediterranean Sea throughout the year (Nemerson *et al*. 2000). Spawning begins in the eastern Mediterranean in May and moves west, ending in the Balearic Islands off the coast of Spain in July (Druon 2010; Heinisch *et al*. 2008; Karakulak *et al*. 2004). Spawning occurs offshore in the Balearic Sea and peak spawning densities occur around the Balearic Islands from the Mallorca Channel and south of Menorca (Alemany *et al*. 2010; Garcia *et al*. 2003, 2005), see Figure 2. A genetic and demographic analysis suggests that multiple distinct populations of Atlantic bluefin tuna may occur in the Mediterranean (Riccioni *et al*. 2010).

In the eastern Atlantic and Mediterranean Sea there are closures for large longliners and purse seine vessels, but there are no closures in effect that specifically address Atlantic bluefin tuna spawning grounds (Fromentin 2008). Druon (2010) suggested closing spawning areas in the Mediterranean during the spawning season while allowing fishing in restricted feeding grounds (areas where Atlantic bluefin tuna gather to feed) before and after the spawning closure. Additionally, Druon (2010) provided evidence that utilizing habitat mapping to determine open fishing areas might reduce the number of days at sea—and therefore fishing costs—used by fishermen to target and capture Atlantic bluefin tuna in this region.

SUMMARY

Time and area closures to protect spawning fish aggregations are a common management tool for protecting and restoring overexploited populations (Beets and Friedlander 1998; Heyman *et al*. 2005; Sala *et al*. 2001), and they have proved to be successful in rebuilding such overfished populations when their designations are based on scientifically accurate information (Nemeth 2005; Nemeth *et al*. 2007). Atlantic bluefin tuna spawning locations, spawning and habitat utilization behaviors, migration patterns and movement during spawning events are known (Block *et al*. 2005; Fromentin and Powers 2005; ICCAT 2008b; Nemerson *et al*. 2000; Nishida *et al*. 1998; Rooker *et al*. 2007; Teo *et al*. 2007a, 2007b), making them a viable candidate for spawning area closures.

Recent population assessments (ICCAT 2008b, 2010a, 2010b) indicate that Atlantic bluefin tuna populations in both the western and eastern Atlantic need increased protection to rebuild their depleted populations, yet current management measures are not working. According to this review and a number of experts (Armsworth *et al*. 2010; Block *et al*. 2005; Druon 2010; Hurry *et al*. 2008; ICCAT 2007; Teo *et al*. 2007a; Teo and Block 2010), spawning area closures could be an important option for restoring bluefin tuna populations.

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