Exploration and documentation of the spawning grounds of oceanic top predators

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Willing to Attend Workshop?
Yes

Target Name(s)
Open Ocean-General

Geographic Area(s) of Interest within the North Atlantic Ocean (Indicate all that apply)
All Areas within North Atlantic Ocean

Relevant Subject Area(s) (Indicate all that apply)
Biology

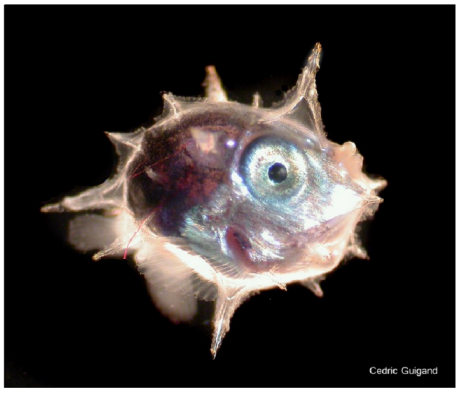
Description of Topic or Region Recommended for Exploration

In 1920 Johannes Schmidt undertook his famous expedition to determine the spawning grounds of European eels. The discovery that this species spawn in the Sargasso Sea, thousands of miles from their adult habitat, was remarkable in its own right and continues to have practical implications for how to manage this vulnerable species. Importantly, the approach used in making this discovery, plankton tows in an oceanic environment to collect eggs and early stage larvae, still has relevance today.

Atlantic spawning grounds for numerous high-profile migratory species still have yet to be determined, as is the case for giant squid, or are incompletely known as is the case for many economically valuable species of tunas and billfish. As an example, in 2013 opportunistic plankton collections made during a marine mammal cruise into the Slope Sea, between the Gulf Stream and Northeast U.S. continental shelf, revealed the presence of early stage Atlantic bluefin tuna larvae. These collections overturned the long-standing paradigm that Atlantic bluefin tuna only spawn in the Mediterranean Sea and Gulf of Mexico. As with the exploratory work with eels, the discovery of an additional bluefin tuna spawning ground has practical implications for how to manage this iconic and economically valuable species. Notably, the discovery also highlighted how little plankton sampling has occurred in the open Atlantic Ocean, and of this sampling, how little has been analyzed with the taxonomic expertise or genetic techniques necessary to resolve spawning by these highly migratory top predators. In other words, aside from a number of well sampled areas on the U.S. continental shelfs and in the Gulf of Mexico, we lack even the most basic understanding of which top predators are spawning in different locations within the Atlantic Ocean.

Exploratory work focused on resolving open-ocean spawning grounds of highly migratory species can occur through directed sampling guided by additional information that suggests the presence of spawning in a place and time (e.g. electronic tagging data, habitat modelling, reports from the fishing industry) or by opportunistic sampling done on cruises with alternate primary objectives. The latter approach is particularly suitable to adding onto to established exploratory cruises in the open ocean environment. Individual plankton stations can be sampled quite rapidly (about 15 minutes), with limited personnel requirements, and during weather and sea state conditions that may not be suitable for other types of operations. The early life stages of most pelagic teleost and squid species co-occur in the upper water columns and can be simultaneously sampled using the same gear. During most dedicated plankton cruises, a large portion of the ship time is spent in transit between stations, an issue that is magnified when sampling the vast expanses of the open ocean. Piggy-backing plankton sampling on already scheduled ship transits is thus a highly efficient approach to evaluating the spawning of highly migratory top predators in space and time.

Larval slender sunfish (*Razania laevis*), Atlantic sailfish (*Istiophorus albicans*) and Atlantic bluefin tuna (*Thunnus thynnus*) collected during plankton sampling operations. Photos by C. Guigand and K. Marancik



Plankton sampling and processing procedures are well established and have been standardized across the two National Marine Fisheries Service Science Centers that operate in the Atlantic. Advances in genetic techniques over the past decade have also allowed for the species-level identification of larvae and eggs that in the past could only be identified at higher taxonomic levels. The technical know-how and the capacity to process samples are both available if plankton sampling were to be integrated into the Atlantic exploratory cruises.

Relevant Partnerships (If Applicable)

National Marine Fisheries Service