Constituent based tagging of cobia in the Atlantic and Gulf of Mexico waters

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Abstract
Data used in this analysis were derived from the Southeast Fisheries Science Center's Cooperative Tagging Center conventional tagging program. The data set contains 1510 cobia tag releases and 148 recaptures over 58 years of data collection. Exchange and mixing were examined between six geographical regions.

Methods

Data used in the analysis were obtained from the Southeast Fisheries Science Center's (SEFSC) Cooperative Tagging Center (CTC). The CTC (known as the Cooperative Game Fish Tagging program prior to 1995) is a constituent based tagging program which contains a historical database spanning 58 years. While the CTC's current focus is on tagging highly migratory species, there was an expansion in the late 80's through mid 90's to include coastal species (Figure 1). Since the program's inception, tagging kits have been distributed to constituents free of charge. Over the years a variety of tag types have been used. The stainless steel dart tag (model FH69; Floy Tag Manufacturing Company) was used as the primary tag from 1954 to 1980; followed by the modified stainless steel dart tag through 1995, when the program switched over to the double-barb nylon anchor tag (Ortiz et al., 2003). In addition to tags, constituents were supplied with tag release cards to record information on date, size, species, fish condition, and location of the tagging event. In the event only a geographic description was provided for the tagging location (off Key Largo), an estimated latitude and longitude were assigned based on the general area of release.
Data were plotted using ArcGIS 9 (ArcGIS v. 9.2; ESRI, Inc., Redlands, CA, USA) software and any erroneous data points were eliminated from any subsequent analysis. Release and recapture points were assigned to one of 6 areas based on geographic location and are defined as follows:

GAN: From the Georgia/Florida line north along the Atlantic Coast.
N-BR: From the Brevard/Volusia County line to the Florida/Georgia line.
BR: Brevard County from Brevard/Volusia County line to the Brevard/Indian River County line.
S-BR: From waters offshore of Biscayne Bay to South Brevard County line.
Keys: From Biscayne Bay around the tip of Florida to First Bay on the Gulf side, encompassing all of the Florida Keys.
Gulf: From First Bay through the Gulf States, to the Texas/Mexico Line.

Results

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A total of 1510 cobia were tagged in U.S. coastal waters (Figure 2). The majority of the tagging effort occurred in the Gulf followed by the BR and Keys (Table 1). Although tagging occurred during all months, peak tagging occurred in February (Keys), March (BR), May (N-BR), July (GAN), August (Gulf), and October (S-BR) (Figure 3). Of the 1510 cobia tagged, 148 were subsequently recaptured representing an overall recapture rate of 9.8%. When examining area specific releases, GAN exhibited the greatest recapture rate (17%) while N-BR had the smallest recapture rate (4%)(Table 1). With the exception of S-BR and N-BR, which each had only one recapture, all regions had the highest recapture rate occurring in the same region as release (Table 2). While there appears to be some mixing between individuals in all 6 regions (Figure 4), the greatest exchange is between the Keys and Gulf (14), followed by the BR and Gulf (12). This suggests a great deal of mixing is occurring between individuals in the Gulf, Keys, S-BR, and BR regions (Table 3). When examining a plot of distance traveled vs. time at large there appears to be some clustering of data points around year zero and one suggesting an annual return to the general area of release (Figure 5).

References

Ortiz, M., E. D. Prince, et al. 2003. Global overview of the major constituent-based billfish tagging programs and their results since 1954. Marine and Freshwater Research **54**(4): 489-507.

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Tables

Table 1. Summary of the number of releases and subsequent recapture rates for Cobia tagged in 6 geographic regions.

Area	releases	recapture rate
GAN	126	17% (22)
N-BR	26	4% (1)
BR	293	12% (34)
S-BR	16	6% (1)
Keys	275	13% (35)
Gulf	774	7% (55)

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Table 2. Percentage of recaptures per region based on region of tagging.

	Region Recap	GAN	N-BR	BR	S-BR	Keys	Gulf
Region Tagged	N						
GAN	22	82%	9%	0%	0%	0%	9%
N-BR	1	100%	0%	0%	0%	0%	0%
BR	34	9%	9%	35%	6%	9%	32%
S-BR	1	100%	0%	0%	0%	0%	0%
Keys	35	0%	0%	0%	3%	69%	29%
Gulf	55	0%	2%	2%	2%	7%	87%

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Table 3. Summary of Cobia mark-recapture movements between 6 regions. Percentages represent fraction of total reported recaptures.

	Region Recap	GAN	N-BR	BR	S-BR	Keys	Gulf
Region Tagged	N						
GAN	22	12% (18)	1% (2)	0% (0)	0% (0)	0% (0)	1% (2)
N-BR	1	1% (1)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)
BR	34	2% (3)	2% (3)	8% (12)	1% (2)	2% (3)	7% (11)
S-BR	1	1% (1)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)
Keys	35	0% (0)	0% (0)	0% (0)	1% (1)	16% (24)	7% (10)
Gulf	55	0% (0)	1% (1)	1% (1)	1% (1)	3% (4)	32% (48)

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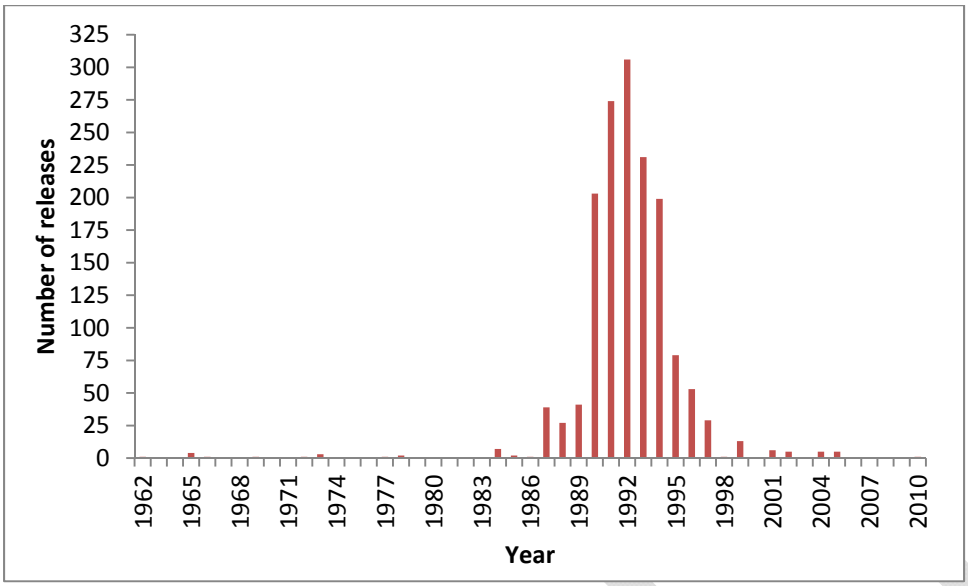

Figure 1. Number of cobia tagged annually by constituents of the Cooperative Tagging Center.

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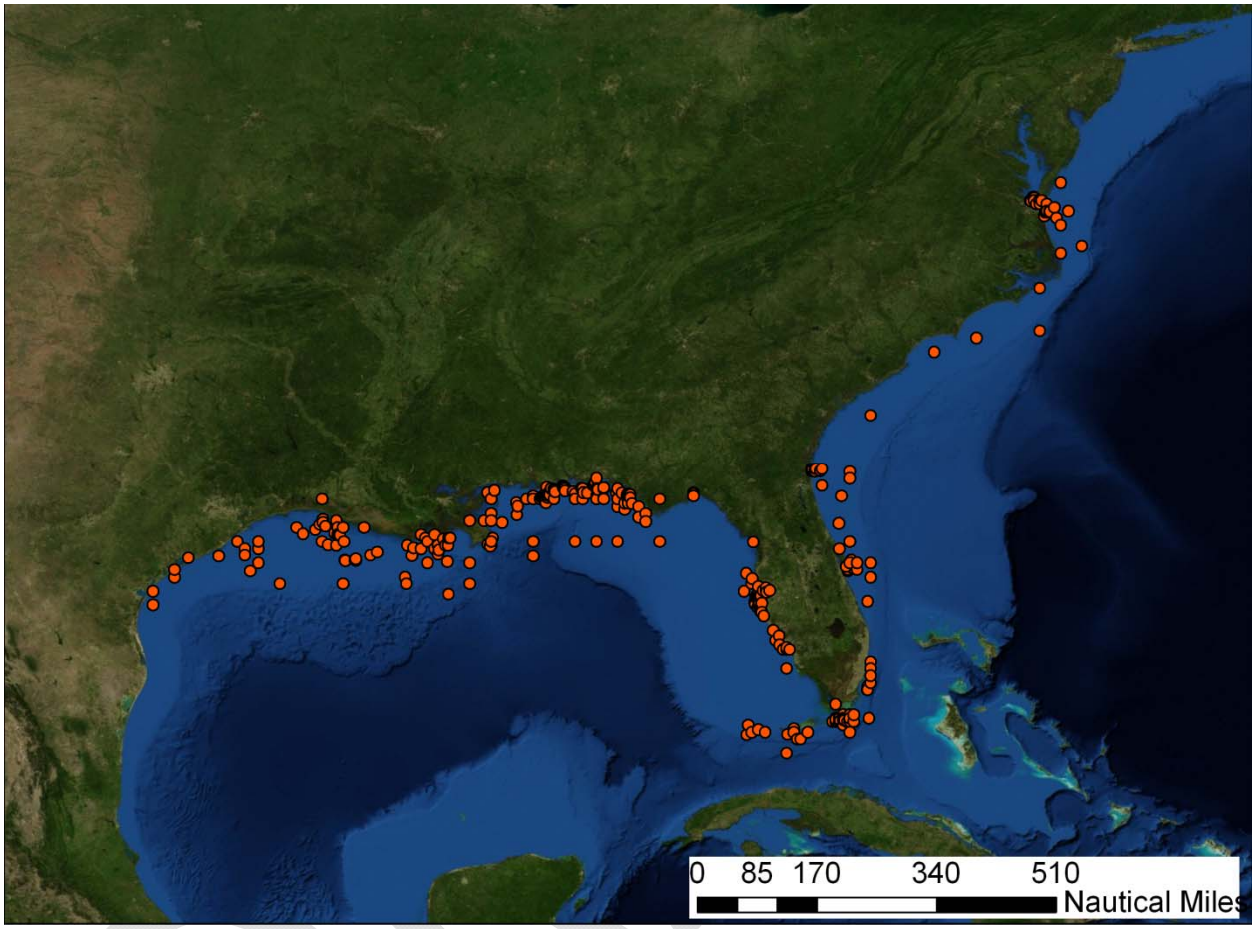

Figure 2. Historical cobia tag release locations (red dots) by participants of the Cooperative Tagging Center (CTC).

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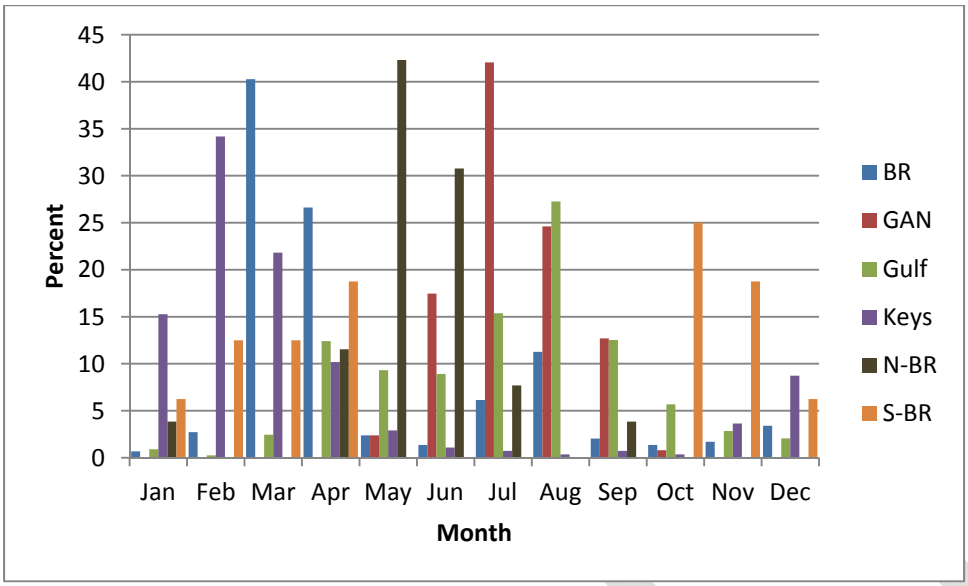

Figure 3. Occurrence (%) of tag released Cobia by month and geographic area.

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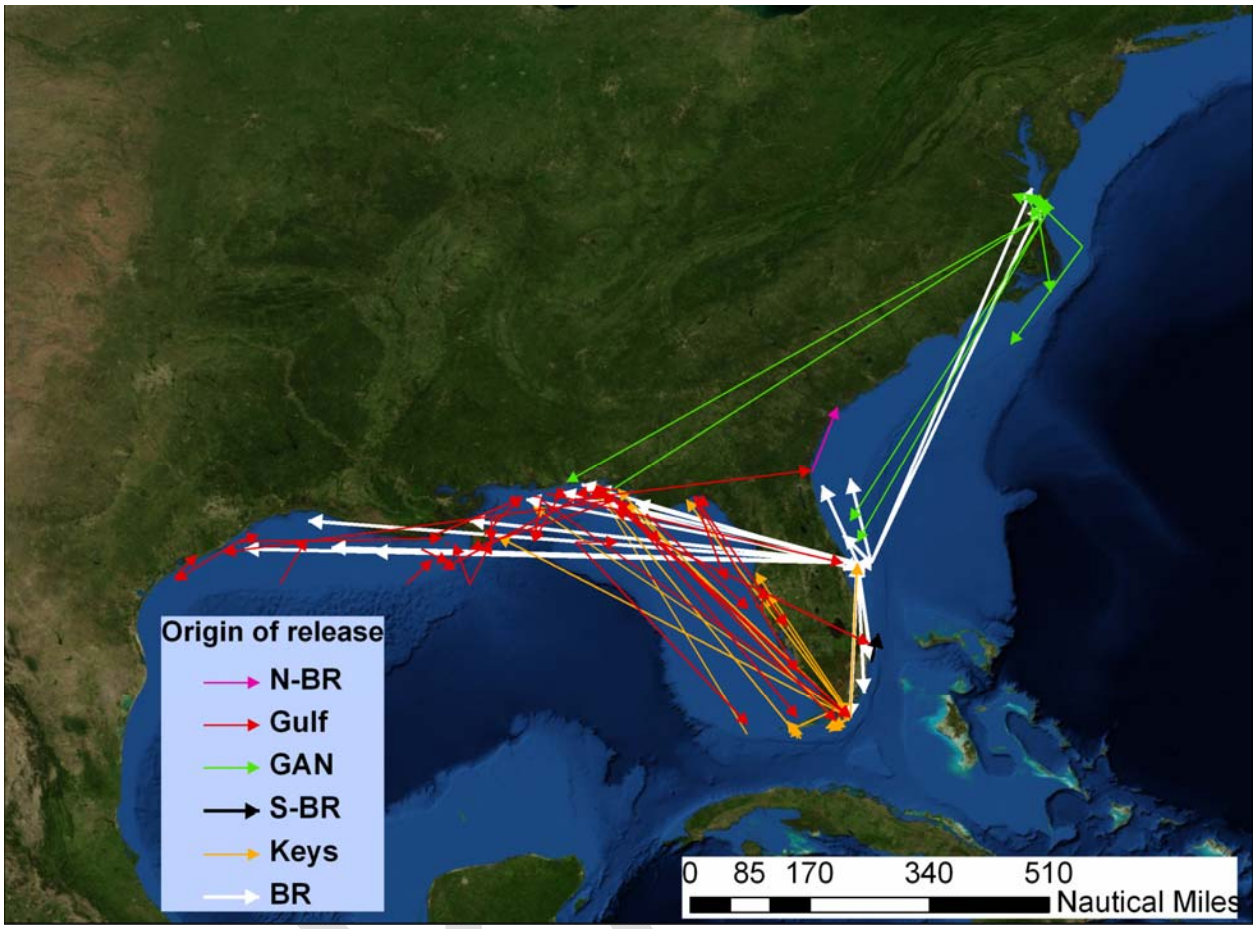

Figure 4. Straight line movement vectors for Cobia tagged by constituents of the Cooperative Tagging Center.

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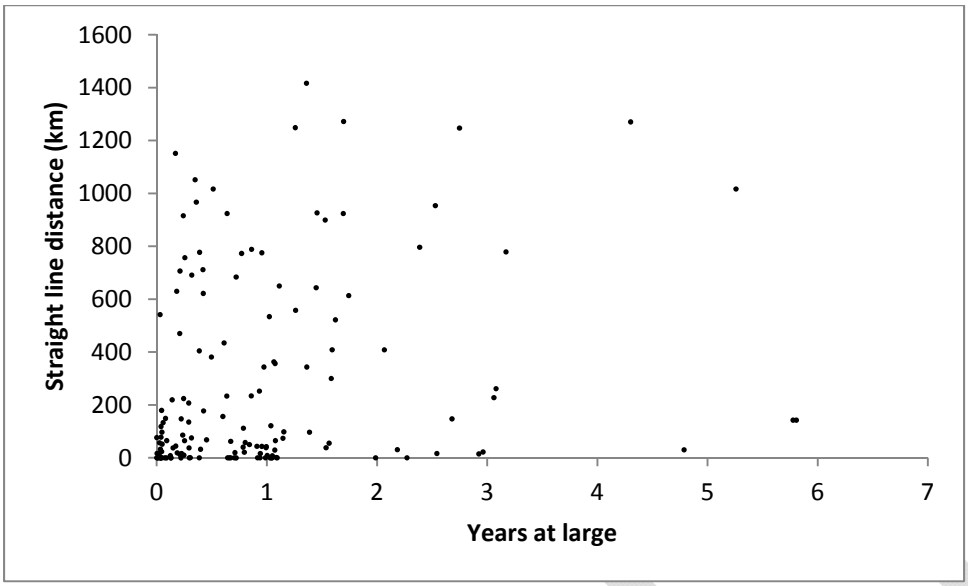

Figure 5. Distance traveled, in relation to time at large for mark-recaptured Cobia. Distances were calculated as great-circle arc vectors between release and recapture locations.