



Northeast Regional Cod Tagging Program Industry-Science Workshop 2

Gulf of Maine Research Institute, Portland, ME
6th June, 2007

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I. Overview

As part of its Year Four contract, the Gulf of Maine Research Institute (GMRI) has coordinated a two-part industry/science workshop for in depth presentation of contemporary cod tagging data from the Northeast Regional Cod Tagging Program (NRCTP). Individuals with a strong interest in both the fishery and the science addressing Atlantic cod in the Gulf of Maine were invited to participate. The aims of the two-part workshops were as follows:

Workshop 1 – Initial presentation of data and findings to date (March 2007)

- Present in detail the data, analyses and findings to date from the NRCTP.
- Invite comment and suggestion from both industry and scientific stakeholders on what additional analyses would benefit our understanding and management of the cod fishery.
- Identify a short-list of key analyses which will be undertaken for presentation at the 2nd workshop.

Workshop 2 – Delivery of follow-up analyses (June 2007)

- Present back to the group the identified short-list of key analyses proposed at the 1st workshop.
- Develop a list of recommendations for future research and analyses for cod stocks in the Gulf of Maine and neighboring waters
- Identify which findings will be of most interest for inclusion in the final dissemination of results for distribution to stakeholders throughout the region (~5000 individuals).

The workshop was attended by 28 individuals; the ratio of industry:science stakeholders was skewed towards scientists this time around, but this was in part due to the time of year being more conducive to fishing. The attendees of Workshop 2 are listed in Annex 1 and the agenda is presented in Annex 2.

Some attendees at this second workshop were again people who had not necessarily attended past cod tagging meetings, or the March 2007 workshop. As such, the day started with introductions and a brief overview of the Program with reminders of the NRCTP's objectives and the types of data collected to date. For the rest of the day, data analysis formed the focus of discussions with the first session being a presentation of new analyses on growth from this mark-recapture dataset. Thereafter, cod movements were re-presented and further in-depth discussions took place regarding the weighting models being used to incorporate biomass/abundance estimates, fishing effort and reporting rates into estimations of cod mixing between areas. The final session served to identify the key findings which should be included in the planned glossy results-oriented mass-mailing. Finally, a wrap-up period took place where major points and future tasks were re-iterated.

These minutes serve to summarize just the key points/questions put forward by workshop participants. The actual results presented will not be summarized in this document, however examples of analysis have been included when appropriate/necessary as a means of clarifying a comment/question.

Disclaimer: When dialogue or comments are included, these convey the general gist of what the individual said and not necessarily the exact words they used.

2. Review of Program history & deliverables from Workshop I

2.1 Program history

A program-wide update was given starting with a review of the Program's goals to provide context for the data collected to date and the analysis being undertaken. [Additional sources of program information are listed in Annex 3].

- 1) Identify the movement patterns of Atlantic cod throughout the Gulf of Maine and neighboring waters (Canadian Maritimes & southern New England)
 - Growth information
 - Spawning grounds
- 2) Develop a large-scale, collaborative cod tagging program;
 - Fishermen and scientists to tag ~100,000 Atlantic cod throughout the study area.
- 3) Make data available to the public:
 - Develop an online database with a GIS mapping interface for tracking tagged cod
 - Feedback of tagging information, e.g. recaptures
- 4) Identify future research questions

It was also pointed out that despite these being the original goals, the additional goal of utilizing this data as means of augmenting stock identification has been added. To this end, the data is being considered for both growth and mixing by region.

Data collection & analysis

Much detail on the data and preliminary analysis was presented in the NRCTP Final Report, and as such, was not presented here. This section essentially covered:

Tag releases: A total of 114,473 tagged cod were released. Of these, 18,300 were double-tagged fish, 2,679 were tagged with low-reward orange tags and 2,238 were tagged with high-reward blue tags. The two primary tag release gear types were hook and trawl.

Outreach and visibility of data: An overview of the methods used by GMRI and partner organizations to achieve the goal of making sure the Program was well known and visible, from outreach materials, incentives and the program website (www.codresearch.org) to the online mapping database (www.gmamapping.org/codmapping.htm).

Recapture data: Currently, >5% of the tags have been returned. All gear types have reported tags, in addition to a good number of tags being reported by processors and observers. Tag returns are classed as NPOs (non-participating organization tag returns, e.g. Joe goes fishing and catches a tagged cod) and TOs (tagging organization tag returns, e.g. DMR catches a tagged cod during a tagging trip).

Spatial analysis resolution: It was reiterated that depending on the question being asked, it will be necessary to undertake analysis at different resolutions (both temporal and spatial). For example, the spatial scales of key relevance to this dataset and anticipated analyses are: 1) stock management areas (MAs) (e.g. Gulf of Maine – 5Y, Georges Bank – 5Z and CA 4X); 2) general fishing areas (GAs) and 3) three-digit statistical squares and 4) Stock management areas including the transboundary management area, Eastern Georges Bank. All analysis models and tools being applied are being designed with the capacity for application to data at each of these resolutions. Examples of these polygons are presented in Annex 4.

2.2 Deliverables from Workshop 1

Following is the list of seven deliverables agreed upon during the wrap-up session of Workshop 1. These were each addressed during Workshop 2.

General movement:

D1 - Refine 'General Area' polygons (based on Workshop 1 discussions).

Weighting related:

D2 - Refine estimates of reporting rate by gear & region (consider IBS data if possible)

D3 - Refine reporting rates from high-reward tags (May 2004+) & extrapolate backwards

D4 - Provide a rate of net movement

D5 - Look for inter-annual consistencies

D6 - Run analysis on legal & sub-legal fish separately

D7 - Look at 'hot spots' – present finer resolution analysis (e.g. statistical squares)

3. Growth

This is the first time any in depth growth analysis has been presented to the group. The value of using mark-recapture data for estimates of growth is that you have *in situ* data for individual fish's growth over a prolonged period of time.

Two different growth models were applied to the tagging dataset and the results were compared. Overall, it was decided that the Gulland-Holt method would be dropped and instead, GROTAG (and potentially other similar models) would be the primary analysis technique.

Discussion points:

- Haddock are not getting to marketable size, would cod growth decrease based on haddock and dogfish abundance? (Eric Hesse, FV Tenacious). We would need to look at growth rates of a number of species over time to detect any pattern like this (Shelly Tallack, GMRI). Seeing a decrease in mean length at age and mean growth at age is often seen for exploited species (Mark Terceiro, NEFSC).
- These growth estimates are in the right ballpark (Mark Terceiro, NEFSC).
- Growth data can be used to back-up decisions on stock boundaries (Steve Cadrin, CMAR/SMASST).
- What order of magnitude difference in K is needed to differentiate stocks? (Earl Meredith, NOAA/CRPP). You need a persistent K , or a significant difference in K over a period of time (Steve Cadrin, CMAR/SMASST).
- Limit growth curves to ~20 years, since reaching 60 years is unlikely (Steve Cadrin, CMAR/SMASST).
- Check the mean measurement errors – these seem dubious (Earl Meredith, NOAA/CRPP).
- Obtain comparative estimates of K from DFO And NMFS, based on otolith sampling.

4. Movement and migrations – descriptive analysis

DI - Refine 'General Area' polygons.

Since a number of people attending Workshop 2 had not been present at Workshop 1, this section focused on re-presenting the raw, descriptive movement data, but at the resolution of 'revised' General Areas (Figure 1).

It was reiterated that this section only presents raw, unweighted data and as such, depicts only actual movement observations. It was again noted that the seasonality of releases and recaptures can affect how this data is interpreted since if no fish are released in a given area at a given time of year, the movement of fish from that area at that time of year will not be evident. Similarly, fishing effort and management regulations (e.g. rolling closures) will also influence the data collected and thus, the cod movements observed. It remains undecided how to take these influences into account during analysis.

After considering the raw movements observed, the depiction of the proposed passages of travel (Figure 2, first unveiled during Workshop 1) was presented again.

Group fidelity in cod: Attention was also paid to the concept of 'group fidelity'; i.e. if large numbers of cod were tagged together, were they also recaptured together in subsequent season? This had been a discussion prior to and during Workshop 1 and was investigated in greater depth during Workshop 2. Three large tagging trips (by DMR, DFO & SMAST) were selected, in addition to batches of sequential single-day trips undertaken by CCCHFA when tagging rates were high. These release batches were plotted, showing dispersal and direction of travel by season. Overall, findings were varied: fish released during Spring 03 in the Bay of Fundy (DFO) did show some fidelity with some recaptures being close to others in subsequent season. The same was true for the DMR release in inshore GOM. However, fish released during one SMAST trip on Georges Bank in Spring 04 ($n > 5,000$) had scattered in multiple directions by Summer 04. A number of factors are likely to affect group fidelity, including fish size, release season and release location.

Figure 1: General Area polygons – original (A) and revised (B).

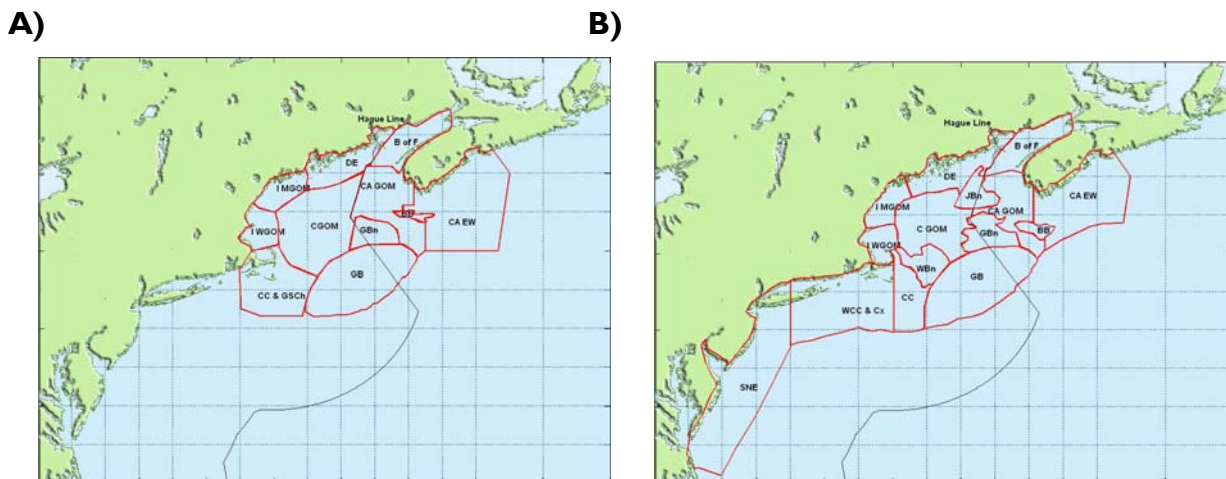
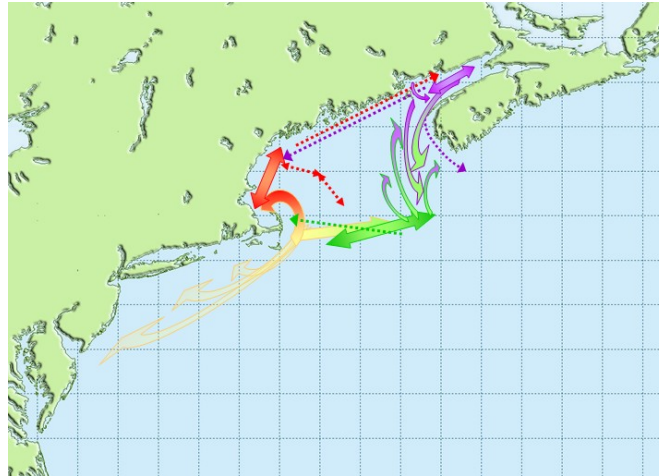


Figure 2: A preliminary depiction of “passages of travel” which summarizes the primary migration paths for cod tagged and recaptured in the Gulf of Maine region. NOTE: this is based on raw, un-weighted data and serves to indicate only the major paths of migration, not necessarily the magnitude of these migrations.



5. Quantification of mixing

This section began by reiterating how tagging data can be useful to stock assessments (Figure 3); specifically, tagging data can provide considerable information regarding population gains (i.e. growth and immigration) and losses (i.e. emigration and fishing mortality). With regard to fishing mortality, at least three years of tag release data are generally required, and as such, the NRCTP can only provide an estimate for the Bay of Fundy area where releases took place in Spring of 03, 04 and 05.

All deliverables from Workshop 1 were addressed during Workshop 2; the key points for each are presented following.

5.1 Weighting of releases and recaptures

Appropriate weighting of data is crucial for providing accurate estimates of movement and mixing between areas; this is particularly true for the NRCTP data since the experimental design did not plan for releasing tagged cod in numbers relative to biomass present. It had been decided previously, through a combination of meetings with NMFS and DFO that the weighting approach taken by Hunt *et al.* (1999) should be used as a starting point. The weighting currently being applied and refined is summarized in Figure 4.

Figure 3: The potential use of tagging data in a basic stock assessment model.

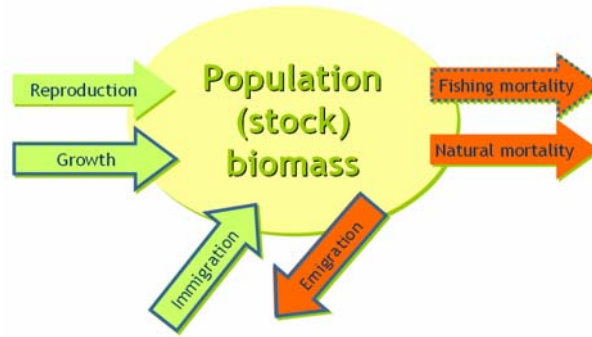
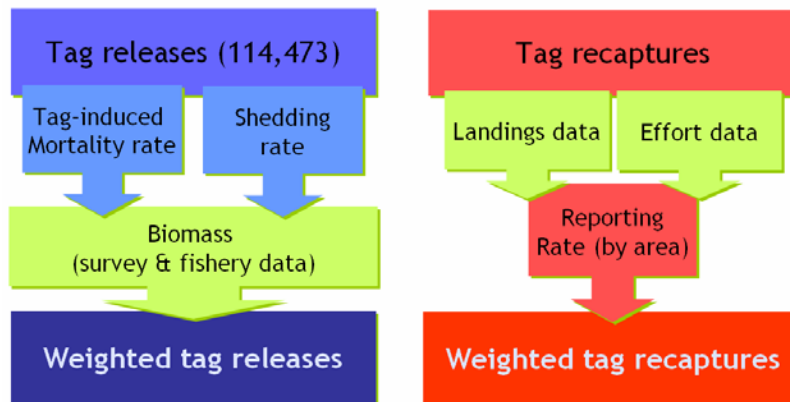


Figure 4: The components involved in weighting tag releases and tag recaptures, after Hunt et al. (1999), with modifications.



Weighting of tag releases

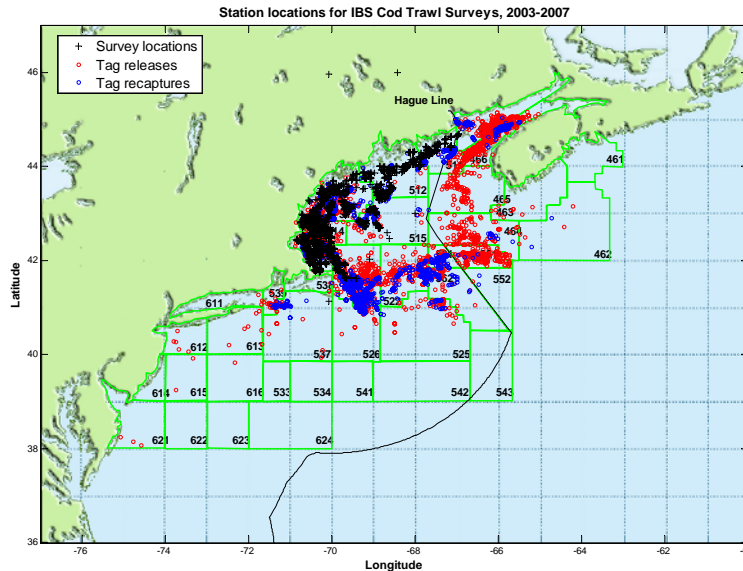
Considerable attention was paid during Workshop 1 on all the factors which must be taken into account for weighting releases. During Workshop 2, the only component re-visited was that of how to weight by biomass.

Biomass weighting: A total of four different tag release weighting scenarios are currently being run: 1) raw, un-weighted data, 2) weighted by biomass (NMFS/DFO survey data) (i.e. fishery independent index), 3) weighted by catch per unit of effort (CPUE) data (i.e. fishery-dependent index), and 4) weighted by Virtual Population Analysis (VPA) data. It was again shown that each method ‘distributes’ the number of tag releases (after accounting for tag shedding and tag-induced mortality) slightly differently between tagging areas while keeping the overall number of tagged cod released constant.

Action: It was agreed to continue with all biomass weighting methods, rather than selecting just one, since no method is perfect and it remains unclear which is the most appropriate at this point in time. Shelly will present all varieties at the pre-GARM stock assessment workshops during the Fall 07. Future analysis (post-weighting) will include stepwise multivariate GLM (General Linear Model) analysis to determine the relative sensitivity of reporting rates to fish size at initial release.

Use of IBS Trawl survey data for weighting tag releases: Also considered during Workshop 2 was whether or not data from the parallel collaborative study, the Industry-Based Trawl Survey (funded by NOAA, CRPP) could be used as a means of weighting the biomass. Shows, however, that the survey stations of this study do not fully represent the tag releases areas in the NRCTP. Specific gaps include the Cape Cod region (Nantucket Shoals) and the Georges Bank region. As such, it may not be appropriate to invest too much time investigating weighting by this data further for tag releases.

Figure 5: The spatial coverage of the IBS trawl survey data (black), relative to tagged cod releases (blue) and recaptures (red).



Weighting of recaptures

Two deliverables for Workshop 2 were in reference to the weighting of recaptures, in particular improving estimates of reporting rates.

D2 - Refine estimates of reporting rate by gear & region (consider IBS data if possible)

Reporting rates by gear: Reporting rates have now been calculated by gear type. It was reiterated that this becomes harder to do at more fine-scale spatial or temporal scales since the number of same polygon recaptures (required to determine a reporting rate) reduces as the number of polygons increases, or as the time frame decreases.

It was discussed whether to treat fish reported by processing plants separately, whether these fish caused a problem for the data. It was decided that no extra steps need to be taken for processor-reported fish, that they could still be classified by recapture gear and that that is sufficient.

Action: It was suggested that a figure be made which presents the % landings by gear type compared with the reporting rate by gear type, for the region (Eric Hesse, FV Tenacious). This could also be broken down by region.

IBS data: Along with considering the IBS trawl survey data as a means of weighing tags by biomass, it had also been suggested that recaptures from IBS trips might serve as a means of calibrating reporting rates. However, on close attention, it was discovered that IBS recaptures

amounted to only ~30 fish. This sample size was considered too small but it was agreed that using tag returns from vessels on which observers had worked might still be an option; these recaptures total ~200 fish.

Action: In order to take this further, additional information is needed from the observer program (via Mark Terceiro at NEFSC) since this is data not accessible to GMRI.

D3 - Refine reporting rates from high-reward tags (May 2004+) & extrapolate backwards

It is not possible to calculate reporting rates for years when no high-reward tags were released (i.e. Year 1 of the program (Mar 03-Apr 04). In addition, since no tags of any kind were released beyond July 2005, reporting rates cannot be calculated for tags returned in 2006 or 2007. Accordingly, attempts were made to extrapolate a reporting rate from 2004 and 2005.

Reporting rates from high-reward tags were calculated for three temporal scales: May 2004+, 2004 only and 2005 only. Considerable inter-annual variation was found with low-reward tag returns exceeding high-reward returns in 2004, but then by 2005 the more expected trend is seen of more plentiful high-reward returns than low-reward returns in 2005.

It was agreed that the best estimate would be an averaged value, i.e. the reporting rate calculated from May 2004 onwards, rather than 2004 alone or 2005 alone. All future weighting will use this averaged reporting rate for all recapture years (2003, 2004, 2005, 2006 and 2007).

Reporting rates by fish size (legal (> 63 cm) VS sublegal (< 53 cm) were also presented.

Action: Re-calculate annual return rate table for legal fish only. It is legitimate to exclude fish released <53 cm for certain movement analysis.

5.2 Mixing rates

D4 - Provide a rate of net movement

An estimate of net movement was added to movement rate calculations. An example of a typical movement matrix is presented (Table 1) and these data show the % of fish recaptured in the original release area (blue, diagonal cells) compared with %s which move to other areas. The rate of net movement is calculated by subtracting the % loss (emigration) from the % gain (immigration) for each polygon. Such matrixes are generated for each release-weighting scenario (i.e. raw, biomass, CPUE and VPA). They can also be generated by tagging year, and on different spatial scales.

It was suggested that these estimates of net movement be refined by calculating only on the absolute values (Merrie Cartwright, NOAA Fisheries Service).

Table 1: An example matrix showing presentation of movements between polygons for raw, unweighted data (red) and data weighted by e.g. biomass (orange).

% Residency	5Y-GOM	5Z-GB	4X	% Immigration (gain)	Ave mixing
5Y-GOM	92.6%	11.6%	2.0%	13.61%	10.65%
5Z-GB	4.9%	82.2%	4.7%	9.59%	
4X	2.5%	6.2%	93.3%	8.75%	
% Emigration (Loss)	7.41%	17.79%	6.75%	89.35%	
Net movement	6.20%	-8.20%	2.00%	Average residency	
Status (% of population remaining)	98.79%	74.01%	95.25%		

% Residency	5Y-GOM	5Z-GB	4X	% Immigration (gain)	Ave mixing
5Y-GOM	84.7%	4.4%	1.7%	6.16%	10.95%
5Z-GB	12.6%	89.2%	4.9%	17.55%	
4X	2.7%	6.4%	93.3%	9.13%	
% Emigration (Loss)	15.35%	10.83%	6.67%	89.05%	
Net movement	-9.19%	6.72%	2.47%	Average residency	
Status (% of population remaining)	75.46%	95.89%	95.80%		

D5 - Look for inter-annual consistencies

The release/recapture data has been filtered and worked with on more refined time periods. A number of examples were presented during the course of the workshop. By way of example, Table 2 shows the relative mixing rates calculated for 2003, 2004 and 2005, using the relevant reporting rates for each year, and weighted in this example using the biomass method. As is evident, there are inter-annual differences in the relative movements between areas. It was also demonstrated that this can be applied to data filtered by release season also. It was noted that such filtering works best for larger polygons (e.g. Management Areas) since as the polygon sizes get smaller (e.g. General Areas or Statistical Squares) it becomes harder to find sufficient numbers of same-polygon recaptures to enable the calculation of reporting rates.

Action: Additional biomass and total catch information (by gear type, including discards) is needed for 2006 to complete weighting for 2006 recaptures.

Table 2: An example of looking for inter-annual consistencies in mixing rates. Biomass-weighted data are presented here, for 2003, 2004 and 2005.

	% Residency	5Y-GOM	5Z-GB	4X	% Immigration (gain)	Net mixing
2003	5Y-GOM	84.5%	2.9%	0.5%	3.33%	10.00%
	5Z-GB	9.2%	89.4%	3.4%	12.65%	
	4X	6.3%	7.8%	96.1%	14.01%	
	% Emigration (Loss)	15.46%	10.63%	3.89%	90.00%	
	Net movement	-12.13%	2.02%	10.11%		
	Status (% of population remaining)	72.41%	91.39%	106.22%		
2004	5Y-GOM	87.9%	1.8%	0.2%	1.94%	8.22%
	5Z-GB	9.8%	95.2%	7.6%	17.43%	
	4X	2.3%	3.0%	92.2%	5.28%	
	% Emigration (Loss)	12.12%	4.76%	7.76%	91.78%	
	Net movement	-10.18%	12.67%	-2.48%		
	Status (% of population remaining)	77.70%	107.90%	89.75%		
2005	5Y-GOM	97.3%	0.0%	0.0%	0.00%	34.25%
	5Z-GB	2.7%	100.0%	100.0%	102.74%	
	4X	0.0%	0.0%	0.0%	0.00%	
	% Emigration (Loss)	2.74%	0.00%	100.00%	65.75%	
	Net movement	-2.74%	102.74%	-100.00%		
	Status (% of population remaining)	94.52%	202.74%	-100.00%		

D6 - Run analysis on legal & sub-legal fish separately

The release/recapture data was filtered down by fish size at release. The two size groups addressed were <53cm and >63cm (allowing for a 10 cm buffer). These sizes represent sub-legal and legal fish. It had been decided to analyze these two groups separately in order to minimize the influence of catchability on reporting rates. Overall, it was summarized that:

- >63cm fish showed highest residency for 5Y (GOM) (~90-98%) and then 4X (~83-95%), but considerable emigration for fish released in 5Z (GB) (~18%-65% emigration).
- <53cm fish showed more consistency between management areas, with higher average residency %s for all weighting methods (~85%-92%).

Action: In order to more accurately carry out this analysis, biomass data by fish size category is needed.

It was decided that it is justifiable to assess movement of sub-legal fish separately from legal fish, and that sub-legal fish may not require weighting at all, since the vast majority of fish released <53cm were released in one primary area (i.e. in the vicinity of Cape Cod) and thus, may in effect be self-weighted according to the abundance of small fish in that area (Done Clark, DFO & Shelly Tallack, GMRI).

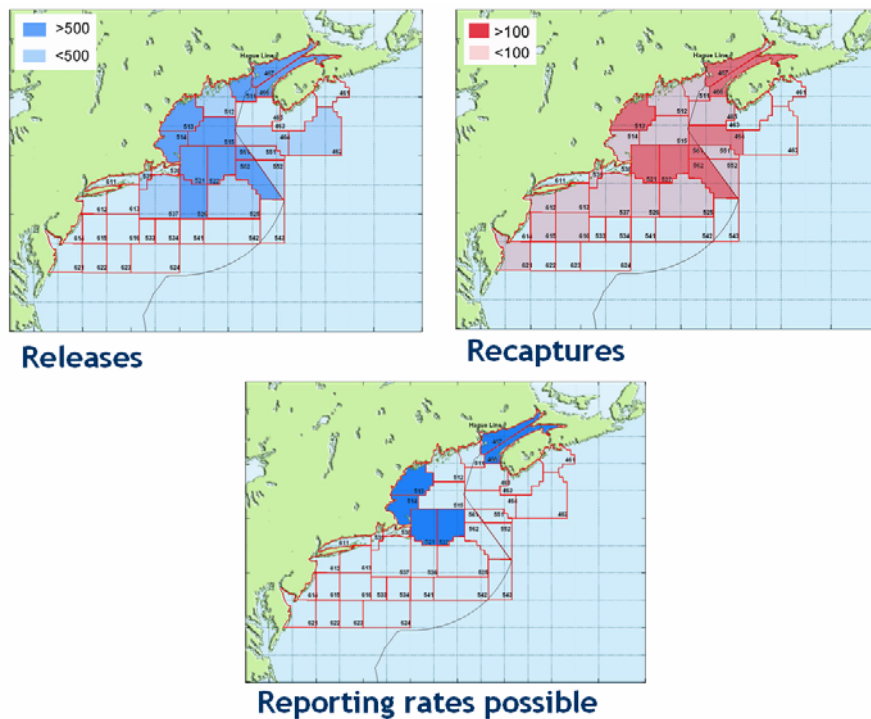
D7 - Look at ‘hot spots’ – present finer resolution analysis (e.g. statistical squares)

During Workshop 1 it was agreed that in order to really address the split in movements seen by fish released in the Cape Cod area (some moving northwards into the inshore WGOM and some moving eastwards and offshore to Georges Bank), that the more fine-scale resolution of analysis was needed (i.e. statistical square resolution) to estimate the relative movement between statistical areas. Mixing analysis on ‘hot-spot’ areas was presented during Workshop 2.

Certain problems associated with finer-scale analysis were identified, namely:

- Analysis is limited by the spatial distribution of tag releases and tag returns and can only be completed for polygons with ‘same polygon’ recaptures (from which reporting rates can be applied) (Figure 6).
- An alternative approach may be to look by ‘General Areas’? Since with fewer polygons, these tend to be larger and thus, may increase the likelihood of ensuring sufficient numbers of same-polygon recaptures.
- It is harder to also break fine scale analysis down by year since the likelihood of getting a same-polygon recapture is further reduced.

Figure 6: The number of finer-scale polygons in which tagged cod were released and recaptured, relative to the number of polygons in which same-polygon recaptures were recorded, and thus for which reporting rates are possible.



5.3 Future research needs

The primary future research/analysis needs identified at this point include:

- Continue with growth analysis, using GROTAG and possibly other more recently developed growth models. Focus on seasonal growth and stock identification through growth rates by region.
- Undertake sensitivity analysis on release weighting methods, but continue with all for the pre-GARM meetings.
- Refine the current weighting model to better incorporate catch by gear into the weighting of movements.
- Incorporate 2006 biomass & landings data.
- Incorporate 2006 & 2007 recaptures by using the averaged reporting rates applied throughout.
- Incorporate biomass estimates by fish size (e.g. 63cm+).
- Incorporate observer-reported fish into reporting rates calibration.
- Work with Tim Miller (NEFSC) to apply alternative modeling on movement estimates.

Data needs from NMFS/DFO:

- 2006 biomass & landings data
- Biomass data by fish size category (<53cm and >63cm)
- Data from observer trips to facilitate calibration of reporting rates by observer tag returns.

5.4 Future outreach needs

This discussion centered around the upcoming, final mass-mailing which will be a glossy, 8-10-page results oriented mailing to ~5,000 individual multi-species permit holders. This group brainstormed about what will create for the most interesting read for recipients of this mass-mailing.

- This mailing should be distributed after the pre-GARM meetings this fall, not before (Earl Meredith, NOAA/CRPP), so probably in December 2007.
- Present some of the hypotheses from both fishermen and scientists (e.g. warm-up exercise from last workshop) – see how they compared and how each are bearing up in light of findings (Earl Meredith, NOAA/CRPP).
- I'm impressed with how these results are complimenting historic assumptions; that we're not just chasing one big school of fish around the GOM, but that we've been exploiting different, smaller sub-stocks and units, and that we've beaten them down (Ted Ames, PERC).
- Show the passages of fish travel – these are interesting and are most consistent with the original Program objectives in terms of looking for broad scale movements of cod around the GOM; they seem like an accurate summary of Program Goal #3 (Steve Cadrin, CMAR/SMASST).
- The pre-GARM is focused on how to use this data for stock assessments, and the upcoming tagging symposium (planned for Spring 2008) is focused on showing how management can use data to educate their decisions, beyond what a stock assessment delivers, e.g. for evaluating closed areas or conservation zones. Maybe discussing the use of data in management could be discussed (Steve Cadrin, CMAR/SMASST).

- Identify the findings, but also the gaps in our knowledge – how do we tackle those now, what new research is needed to help fill these gaps? (Carolyn Woodhead, NOAA/CRPP).
- Growth – present this with comparisons to estimates from NMFS (Eric Hesse, FV Tenacious & Steve Cadrin, CMAR/SMASST).
- What from this study is new and useful for incurring changes in management and assessments? (Eric Hesse, FV Tenacious)
- Passages of travel – these are interesting and will fuel controversial discussions (Eric Hesse, FV Tenacious).
- Passages of travel, but with double-headed arrows incorporated to indicate the backwards and forwards between areas, since we don't know if the fish necessarily started in one area or the other (Merrie Cartwright, NOAA Fisheries Service).
- It is probably better not to try to quantify these movements between areas in this mailing (Steve Cadrin, CMAR/SMASST).
- Point out the huge variability in the findings (be season/year/decade) (Don Clark, DFO).
- Show how this work has answered some questions, but how it is also very normal for those answers to lead to more questions. For example, what drives the movements? Temperature? Spawning? Predator-prey interactions? (Earl Meredith, NOAA/CRPP). This would reassure industry that we're not looking at just fishing as being the problem for cod, but that other environmental influences (like climate change and ecosystem effects) are also considered factors (Carolyn Woodhead, NOAA/CRPP).
- Show some interesting factoids on things like the 'super-fish', i.e. which fish moved the furthest or had the most extreme/strange/interesting information (Merrie Cartwright, NOAA Fisheries Service).
- Acknowledgement page – for all participants, but particularly for key collaborators and those individuals who have gone above and beyond in terms of tagging or returning tags (Shelly).

6. References

Hunt, J.J., Stobo, W.T. & Almeida, F., (1999). Movement of Atlantic cod, *Gadus morhua*, tagged in the Gulf of Maine area. *Fishery Bulletin*, **97**: 842-860.

7. Acknowledgements

GMRI would like to thank NOAA Fisheries (NEFSC) for supporting the 4th year of this Program and as such, for facilitating this second workshop. The feedback GMRI received after both workshops confirms that these were very appreciated by the individuals who attended and this transparent, detailed forum has proven beneficial for re-involving and re-engaging collaborators from both industry and science backgrounds.

Sarah Whitford is thanked for her role as logistics coordinator for the day. And all workshop attendees are thanked for taking the time to spend a day reviewing the cod tagging analyses to date.

Annex I: Attendees of the NRCTP Industry-Science Workshop I.

	Industry/ Science	First	Last	Affiliation	Work	Email
1	I/S	Ted	Ames	Penobscot East Resource Center		amest@verizon.net
2	S	John	Annala	GMRI	(207) 228-1621	jannala@gmri.org
3	S	Crista	Bank	SMAST	(508) 910-6380	cbank@umassd.edu
4	S	Briana	Brown	BU - Les Kaufman's grad student	(401) 617-1151	bkbrown@bu.edu
5	S	Steve	Cadrin	School for Marine Science & Technology	(508) 910-6358	steven.cadrin@noaa.gov
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7	S	Donald	Clark	Canada Dept of Fisheries & Oceans	(506) 529-5908	ClarkD@dfo-mpo.gc.ca
8	I	Peter	Cura	FV Fisherman	(508) 997-1023	
9	I	Tom	DePersia	Stellwagen Bank Charter Boat Association	(781) 834-7504	hugetuna@aol.com
10	S	Steve	Eayrs	GMRI		seayrs@gmri.org
11	S	Pat	Foote	Independent		dfoote01@maine.rr.com
12	I	Eric	Hesse	FV Tenacious	(508) 364-5015	e.hesse@comcast.net
13	S	Hunt	Howell	Univ. of New Hampshire	(603) 862-4153	whh@cisunix.unh.edu
14	S	Kevin	Kelly	Maine Department of Marine Resources	(207) 633-9543	Kevin.Kelly@maine.gov
15	S	Ken	LaValley	UNH	(603) 862-4343	ken.lavalley@unh.edu
16	S	David	Martins	School for Marine Science & Technology	(508) 910-6392	dmartins@umassd.edu
17	S	Casey	Macisso	NOAA/NMFS	(207) 780-3322	Casey.Macisso@noaa.gov
18	I	Cameron	McLellan			m.cameron_mclellan@yahoo.com
19	S	Earl	Meredith	NOAA/CRPP	(978) 281-9276	earl.meredith@noaa.gov
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22	I	Mike	Sosik	FV Bigger n Better	(508) 347-7495	mfsosik@nemerchant.com
23	S	Shelly	Tallack	GMRI	(207) 228-1639	stallack@gmri.org
24	S	Laura	Taylor Sing	GMRI	(207) 228-1637	lsinger@gmri.org
25	S	Mark	Terceiro	NEFSC	(508) 495-2203	Mark.Terceiro@noaa.gov
26	I	Manuel	Vinagre	FV Sea Siren	(508) 992-9015	
27	S	Sarah	Whitford	GMRI	(207) 228-1646	swhitford@gmri.org
28	S	Carolyn	Woodhead	NOAA/CRPP	(978) 281-9197	Carolyn.Woodhead@noaa.gov

Annex 2: Agenda for the Northeast Regional Cod Tagging Program, Industry-Science Two-part Workshop – Workshop 2.

Wednesday, June 6th 2007
Gulf of Maine Research Institute, Portland, ME

8.30	Breakfast (coffee & pastries)
9.00	Introductions & overview of workshop goals
9.15	Review of Workshop I & Program history: <ul style="list-style-type: none">- Mini overview of Program's history, goals and data- Highlights & deliverables from Workshop I
9.45	Growth <ul style="list-style-type: none">- Growth analysis to date- Suggestions from participants
10.30	Break - refreshments
10.45	Re-visit movement & migration <ul style="list-style-type: none">- Overview of WSI discussion points<ul style="list-style-type: none">→ Descriptive analysis of movement patterns→ Impacts of season, region, fish size, etc.- Responses to WSI suggestions (General areas)
12.15	Working lunch – Buffet lunch provided
1.15	Re-visit quantification of mixing <ul style="list-style-type: none">- Overview of WSI discussion points<ul style="list-style-type: none">→ Data requirements – weighting releases & recaptures→ Reporting rates→ Movement and migration after weighting analysis- Response to WSI suggestions<ul style="list-style-type: none">→ Refinement of reporting rates→ Re-analysis of 'hot spots'→ Re-analysis by fish size→ Net movement/mixing
3.00	Break - refreshments
3.15	Future outreach & research needs <ul style="list-style-type: none">- Recommendations for future research & analysis- Identify key points of interest for inclusion in final results-oriented glossy mass-mailing (~5,000 recipients).
4.15	Wrap-up End

Annex 3: A list of relevant web pages associated with key documents or components of the Northeast Regional Cod Tagging Program.

Program website - <http://www.codresearch.org>

Database mapping website - <http://www.gmamapping/codmapping.htm>

Industry-Science workshops: Information about the two industry-science workshops (i.e. today's and the next one), in addition to summary materials produced from this workshop, will be downloadable from:

<http://www.codresearch.org/IndustryScienceWorkshop.htm>

Final Report from this Program's first 3.5 years is available at:

http://www.codresearch.org/GMRI_Final_Report_2003-2006.htm

Proceedings from the Mark-Recapture workshop (October 2004):

http://www.codresearch.org/WS/PROCEEDINGS_Fish_M-R_Workshop_Oct_2004.pdf

All past and current Program posters are viewable at:

http://www.codresearch.org/Program_posters.htm

Analysis to date – this page is likely to be the page receiving most updates in future months as we begin posting more of our findings online.

http://www.codresearch.org/Analysis_to_date.htm

Annex 4: The spatial polygons created for analysis at different resolutions; most analytical programs being developed will have the capacity for application at each resolution.

