Phase I Red Snapper Experimental Design Workshop Summary Report

January 10-12, 2017
New Orleans, Louisiana

Workshop Scope

A 2.5-day workshop (Appendix 1) was held in New Orleans, Louisiana, on January 10-12, 2017, to discuss six experimental designs developed through a competitive request for proposals (RFP) issued on May 16, 2016 (Appendix 2). During the workshop design recommendations were developed and will be used as a basis for a $12-million funding request to conduct a one-time estimate of age 2+ red snapper by habitat type in U.S. Gulf of Mexico waters (Appendix 1).

Figure 1. Workshop participants on January 10, 2017. The workshop was sponsored by the Mississippi-Alabama Sea Grant Consortium on behalf of the National Oceanic and Atmospheric Administration's (NOAA) National Sea Grant College Program and NOAA National Marine Fisheries Service.

The six experimental design reports were submitted to the Mississippi-Alabama Sea Grant Consortium (MASGC) on December 5, 2016. Four fishery stock assessment experts reviewed the experimental design reports using review criteria provided by the project steering committee. Each expert reviewer prepared a written assessment of each report. The steering committee also reviewed the six experimental design reports and the assessments of them prepared by the four expert reviewers. The final experimental design will be guided by the six experimental design reports, expert reviews of design reports, and the project steering committee.

This workshop summary includes recommendations for the final experimental design. This report and the six experimental deign reports are available at: http://masgc.org/red-snapper.

Workshop Participants

Workshop participants (Appendix 3) included 57 university scientists, state fisheries agency scientists and managers, Sea Grant and National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) employees, and fisheries consultants. Each of the five Gulf of Mexico states was represented.

Background

In FY 2016, Congress directed the National Sea Grant College Program to use $5 million of its budget to support Gulf of Mexico red snapper fisheries data collections, surveys and assessments, independent of NMFS stock assessment and related efforts. Congress also directed NMFS to use $5 million of its FY 2016 appropriation for complementary research on red snapper, including applications of advanced sampling technologies potentially useful in improving red snapper stock assessments. Sea Grant and NMFS are working together through a joint steering committee to design an effective research program and to ensure its results can be used to develop an independent estimate of Gulf of Mexico red snapper stock abundance.

In March 2015, more than 60 people from academia, state management agencies, commercial and recreational fishing sectors, NMFS and Sea Grant attended a workshop in New Orleans, Louisiana. Among them, they had more than 1,000 years of red snapper work experience. The purpose of the workshop was to identify and prioritize research and data collection efforts that would improve the accuracy of Gulf of Mexico red snapper stock assessments. Workshop recommendations focused on creating a Gulf of Mexico-wide tagging and advanced technology program capable of accurately sampling red snapper abundance across several different habitat types.

The recommendations from the March 2015 workshop formed the basis of an MASGC competitive RFP (Phase I) to describe alternative experimental designs for use in a large-scale study to determine red snapper abundance (Phase II). Six Phase I experimental design projects received funding totaling $543,763.

Workshop Content Summary

Day 1

Day 1 consisted of one-hour presentations from each of the six experimental design project teams. Key points from each team presentation are provided below.

<u>Red Snapper Data Collection Spatial Modeling and Population Assessment in Northern Gulf of Mexico. Principal Investigator: Peter Rubec, Florida Fish & Wildlife Conservation Commission.</u>

1. Collect catch, effort and size composition data for red snapper on commercial and recreational vessels from Florida to Texas and associated environmental data (temperature, depth, bottom type).
2. Map bottom circulation, bottom type and bathymetric habitats.
3. Develop Habitat Suitability Models (HSM) that relate catch rates to environmental conditions.
4. Link the HSM to the habitat maps and create maps of abundance (based on Catch Per Unit Effort-CPUE indices) using GIS.
5. Estimate seasonal population numbers for juvenile and adult red snapper from the abundance maps.

6. Apply operations management to plan, organize and coordinate estimation of the red snapper population in the U.S. Gulf of Mexico.

Change-in-Ratio Methods for Estimating Recreational Exploitation Rate and Absolute Abundance of Gulf of Mexico Red Snapper. Principal Investigator: Sean Powers, University of South Alabama.

The project team recommended dividing Gulf of Mexico red snapper habitats into three types:

1. Artificial reef structures, platforms and other known areas of high fish density
2. Known, natural, low relief reefs
3. Areas of featureless or unknown bottom type

Based on habitat type, the team proposed using change-in-ratio (CIR), index-removal (IR) and removal estimators to estimate red snapper abundance. The CIR and IR methods involve a survey, a partial depletion of the population or a component of the population (e.g., legal-size animals) and a post-depletion survey. The removal method includes a series of two or more fishing (e.g., longline) sets at each sampling location and noting the progressive decline in catch per set.

Design of a Multidisciplinary Study to Estimate Red Snapper Population Size, Population Connectivity, and Mortality Rates in the US Gulf of Mexico. Principal Investigator: James Cowan, Louisiana State University.

The project team undertook a simulation modelling exercise as the basis for its recommended sampling design. The team focused its effort on obtaining a Gulf-wide estimate of abundance while addressing the need to consider habitat stratification in its design.

The team identified the sample universe using generalized additive model (GAM) to calculate the sampling framework and set of sampling methodologies; and provided a discussion of the interaction between sample costs and levels of uncertainty. Team members proposed to estimate red snapper populations using tag-recapture and video/acoustic methods. They identified assumptions that could affect the uncertainty of the results and identified how their results could be transformed into an estimate of absolute abundance of red snapper.

A summary of key points from the presentation include:

1. Estimate the population size of age 2+ red snapper in the U.S. waters of the Gulf of Mexico using tagging and video-based counts.
2. Divide the northern Gulf into 3 arc-second squared sampling units (~35 million) between 10 and 160 m depths. These sampling units would then be partitioned into 15 strata representing broad boundaries from west to east and 3 depth zones (10-40 m, 40-100 m, 100-160 m). Plotted shipwrecks, obstructions, oil rigs.
3. Create density estimates of red snapper from ROV, acoustic, and catch surveys.
4. Use a delta log-normal generalized additive model (GAM) to estimate expected relative red snapper density based on physical characteristics. Used conventional and genetic mark recapture methods.
5. Discussed sampling design and evaluation.

A Stratified Random Survey, Tagging Study (Conventional and Telemetry), Fish Health Evaluation, and Genomics Study of Red Snapper, *Lutjanus campechanus*, in the Northern Gulf of Mexico. Principal Investigator: Stephen Szedlmayer, Auburn University.

The project team would carry out a Gulf-wide fishery independent survey of red snapper using a stratified random sampling of three depth strata. Two sampling approaches were recommended. The first would use hydroacoustics and remotely-operated vehicle camera surveys and side-scan sonar. Age and growth analyses would be included in this approach. The second approach would consist of a tagging study using telemetry, conventional tagging and environmental DNA (eDNA).

An Experimental Design to Estimate Absolute Abundance of Red Snapper in the U.S. Gulf of Mexico. Principal Investigator: Greg Stunz, Texas A&M University.

The project team included the following design recommendations:

1. A stratified random sampling framework using four ecological regions and two sub regions with three depth strata.
2. Abundance estimates – Advanced technologies:
    a. ROV paired with bioacoustics
    b. Camera-Based Assessment Survey System (C-BASS)
3. Directed Studies:
    a. High-reward tag-recapture
    b. Change-in-ratio
    c. Fixed cameras
    d. Vertical and bottom longline
    e. Catch-survey-catch methodology
4. Biological sample collection
5. Design optimization tool
    a. Coefficient of variation (CV) and cost estimates
    b. Scalable without sacrificing geographic coverage

Methods for the Determination of High Precision Estimates of Red Snapper Abundance in the Gulf of Mexico. Principal Investigator: Robert Leaf, the University of Southern Mississippi.

The Leaf team described the expected precision of a regional abundance estimate of age-2+ red snapper using a two-year conventional tagging and recapture study. The team constructed an individual-based simulation model parameterized using values derived from expert opinion and the literature. The team analyzed the binary-recapture probabilities in different experimental design scenarios and characterized the associated outputs.

Morning of Day 2

During the morning of Day 2, project teams, steering committee members and external report reviewers discussed the main points of each report. Several challenges were identified during the discussion in designing a protocol(s) to comprehensively and accurately sample red snapper in the Gulf of Mexico (Phase II). Five grand challenges were identified:

1. Funding: Cost estimates from the reports ranged from $6-30M.

2. Time frame: Completing the Phase II project within one year is extremely unlikely. **At least** two years would be needed for a comprehensive study, including adequate time for data analysis.
3. Habitat mapping: Identifying all red snapper habitat in the Gulf of Mexico will be costly. The use of existing red snapper habitat mapping data could reduce the cost.
4. Overall complexity of program: Managing a regional, multi-institutional consortium will be an important component of Phase II.
5. Stakeholder engagement: At least one team identified the need for better stakeholder engagement on red snapper stock assessments. One reviewer pointed out the need for adequate stakeholder engagement across all program aspects (e.g. design, implementation and analysis). Without adequate stakeholder engagement, the validity of the final survey results will be challenged. Over the long-term, increased stakeholder engagement, science synthesis and communication is needed.

Afternoon of Day 2 and Morning of Day 3

After lunch on Day 2, all project team participants departed. The steering committee and external report reviewers began the process of synthesizing the results from the six experimental design reports and recommending final design components for the Phase II study. The focus during the afternoon of Day 2 and morning of Day 3 was to critique design criteria identified during the workshop. By the end of the workshop, the steering committee and external report reviewers drafted recommendations based on the six experimental design reports, discussions among workshop participants, expert written reviews of each design and discussion between expert reviewers and the steering committee.

The recommendations are organized into five sections: general, geographic scale and sampling depths, habitat types, working with fishing industries and sampling methods. Key points under each section are provided below. NOTE: The final recommendations will be included in the Phase II RFP.

<u>General</u>

1. A single RFP for $12 million (including $2.5 million in required non-federal match) is recommended. The RFP should require a project design that includes mark-recapture tagging and advanced sampling technology.
2. Lead investigators must be from a university within the Gulf of Mexico region.
3. A Letter of Intent (LOI) will be required to submit a proposal. The LOI will allow MASGC the needed time to identify reviewers while full proposals are being developed.
4. A full proposal narrative of no more than 25 pages should be adequate to allow investigators to fully describe their approach.
5. In addition to the 25-page narrative, include:
    a. A two-page description of how the project consortium will be managed
    b. A two-page description of how an additional $10 million in funding would be used to increase the precision of the stock assessment. There is a possibility of an additional $10 million being made available to this effort under the FY 2017

appropriations to NOAA's NMFS and the National Sea Grant College Program. As of the writing of this summary report, these appropriations are not yet made.

6. Investigators will have three months to put together the Phase II proposal.
7. Project duration can be up to 2 years: 6 months to prepare and 18 months to implement. Additional time may be needed for complete data analysis.
8. A coefficient of variation (CV) of 0.3 for the abundance estimate is the planning target and the proposals should describe the expected precision of the proposed approach.
9. Any sampling method providing a relative abundance must be converted to absolute abundance of 2+ red snapper as both total numbers of fish at length and total biomass.
10. Proposals must include methods and approaches to account for fish growth, recruitment, movement and mortality over the survey period.
11. Proposals must include approaches for collecting biological samples during surveys (e.g., otoliths, tissues for genetics, reproductive tissues)
12. Proposals must include a data management plan to store, access and protect raw and processed data.
13. Fish health studies are a low priority because project funding is limited and disease work may not contribute directly to a stock assessment.
14. Future developments in genetic sequencing may mean genetic tagging will become a viable and cost effective individual marking option for red snapper.

<u>Geographic Areas and Sampling Depths</u>

15. Utilize 2-4 geographic areas (Appendix 4 provides an example from Stunz, et al.). At a minimum, the study should be divided into an Eastern and Western Gulf sub-regions with the division being made near the Mississippi River. Two additional strata per sub-region should be considered for the purposes of looking at spatial difference in age structure, growth and mortality. Rationale should be provided for proposed boundaries to be able to detect differences between strata.
16. Eastern boundary of the study areas should be the Dry Tortugas and the western boundary is Texas border with Mexico.
17. Sampling should be within the depth range of 10-150 meters.

<u>Habitat Types</u>

18. Habitat suitability maps (HSMs) are not sufficiently comprehensive to provide complete mapping of red snapper habitat. However, HSMs may be appropriate to inform targeted sampling.
19. At a minimum, there should be three habitat classifications:
    a. Known artificial reefs
    b. Known natural reefs
    c. Unknown bottom: unconsolidated uniform bottom, unknown natural reefs and unknown artificial structure.
20. Include sources of locations of known natural and artificial reefs and include a description of the process for identifying habitat types to be sampled.

21. Proposals must include a sampling plan to support the spatial allocation of sampling and to estimate the expected precision of the results.
22. Proposals are not to include further habitat mapping. However, the successful project team will seek out high-resolution habitat maps to leverage the funds available for this program. A component of the proposal could include the synthesis of habitat maps from various sources.
23. Reserve around $200K to develop a model-based approach at the end of the project to identify future stock assessment strategies (multi-method/multi-area).

Working with the Fishing Industries

24. Strongest proposals will work directly with the commercial and recreational fishing industries. Fishermen should be included from the start of program. It is possible to hire commercial fishermen and allow them to catch fish and then sell them under the red snapper Individual Fishing Quota (IDQ) program. This approach could lower vessel use costs. It also is possible for charter boat captains to lease quota from commercial fishermen. This would require an exempted fishing permit from the NMFS Southeast Regional Office.
25. Strongest proposals will include a communication strategy to ensure the fishing community, resource managers and other stakeholders are regularly updated on the status of the project.

Sampling Methods

26. Sampling methods must involve the use of advanced technologies (acoustics and video), depletion ratio surveys, and mark-recapture.
27. Regardless of the technology used, validation and bias correction of the principal survey method will be essential using a combination of fish capture (hook-and-line) and video methods when acoustics is the primary method, and hook-and-line when video is the primary survey method.
28. For all methods, investigators will need to provide detailed steps for calibration and how to avoid biases and address uncertainties.
    a. A sample size to cost determination should be included using an approach like Cowan, et al. (Appendix 5).
    b. A simulation analysis must be conducted and results included in the proposal to understand the sensitivity of the estimates to some of the more obvious sources of bias associated with a mixed survey spatial allocation design.
29. The use of mark-recapture will be essential to:
    a. Determine local scale abundance estimate validation, accounting for selectivity bias
    b. Growth, movement and mortality estimation.
30. The steering committee does not recommend mark-recapture methods as the primary Gulf-wide method for two reasons:
    a. It is unlikely to be feasible to tag and release snapper over depth ranges greater than 75 meters with conventional tagging technologies due to high barotrauma mortality.

b. It is doubtful a Gulf-wide mark-recapture program could achieve a sufficiently random distribution of tags across the whole region.
    i. Random distribution would be necessary because red snapper do not move rapidly enough to mix throughout the Gulf,
    ii. Red snapper fishing is concentrated in localized areas of the Gulf.

29. Recommended sampling methodologies by habitat type. Regardless of survey method, all surveys should be completed within a few months to minimize possible bias from movement, mortality, recruitment and growth.
    a. Known natural and artificial reef habitats: Depletion and mark-recapture methods emerged as the most appropriate methods to implement on known artificial and known natural habitats. The depletion method is based on short-term depletion experiments on the selected habitats. The mark-recapture method would require the use acoustics as the primary source of quantitative abundance data. The depletion approach could be complemented by simultaneous mark-recapture methods. The acoustic method would need to be paired with another method like optical methods fish collection by hook-and-line.
        i. As a minimum mark-recapture designs will need to account for known sources of bias (e.g. tag-loss, release mortality, trap-shyness).
        ii. Where possible the fishing industry should be involved in tag recovery, in doing so investigators should consider high-dollar tag rewards ($25-50K) in their proposal budget.
        iii. Different sizes and types of natural and artificial reefs have different average numbers of red snapper. The proposal must address these differences in selecting habitats to sample.
    b. Unknown habitat: This strata is the large majority of the bottom area in the Gulf of Mexico and fish numbers per unit area are expected to be much lower than on the reefs. However, the large areas mean that total red snapper abundance will be significant. Survey methods used must be able to cover large areas, and must be able to accurately measure the number of fish per unit area. Towed video or towed acoustic technologies are recommended for unknown habitats
        i. Fish, including red snapper, react to observing platforms. Proposals must address the calibration of towed technology to calculate the number of red snapper per unit area sampled.
        ii. The unknown habitat areas will likely have large numbers of unknown high density reefs
        iii. Known natural and known artificial reefs and structures falling within the unknown habitat type will need to be excluded from the unknown habitat estimate. An alternate random survey position should be used when a random survey site falls on a known reef complex. Likewise, the physical area (and or number) of known reefs must be removed from the total unknown habitat area estimate prior to scaling up the survey estimates.

Phase II Project Timeline

- RFP released in late February or early March 2017
- Proposals due June 2017
- Proposal reviews July 2017
- Technical review panel meeting in mid-August 2017
- Project start October 2017
- Project end date September 2019

Next Steps

A RFP will be released to implement the stock assessment (Phase II). It is expected that this RFP will include both tagging and advanced technology components. Total funding for the stock assessment will be up to $9.5 million plus $2.5 million in non-federal match for the Sea Grant share. Selection of the successful Phase II proposal is expected by September 2017, and work on this project will begin in October 2017. This one-time estimate will be considered an independent Gulf-wide red snapper stock abundance estimate.

There were three short-term action items:

1. Deciding if the Sea Grant and NMFS funding can be combined into a single RFP.
2. Send the four written reviews conducted by the external review team to the principal investigators of each of the six experimental design reports.
3. Produce a workshop summary (this report). The report will be sent to workshop participants and published on MASGC's web and social media sites.
4. Draft Phase II RFP by end of January.

Conclusions

The workshop confirmed the complexity of a project of this scale. It is an ambitious undertaking. Although unprecedented and challenging, a one-time estimate of absolute abundance by habitat type can produce reliable and valid results. To succeed, a well-thought-out research program using appropriate tagging and advanced technology methods will require excellent science, multi-institutional collaboration and strong project management abilities.

Appendix 1: Workshop Agenda

Phase I Red Snapper Workshop Agenda

January 10-12, 2017

Hilton New Orleans Riverside
Two Poydras Street
New Orleans, LA 70130

Tuesday, January 10		
9:00 a.m.	Registration	Kay Bruening
9:30	Introductions, Workshop Goals, Agenda Overview	LaDon Swann
	Presentations by Project Teams	Jim Berkson
10:00	Red Snapper Data Collection Spatial Modeling and Population Assessment in Northern Gulf of Mexico	Peter Rubec
11:00	Change-in-Ratio Methods for Estimating Recreational Exploitation Rate and Absolute Abundance of Gulf of Mexico Red Snapper	Sean Powers
Noon	Lunch	
1:00 p.m.	Design of a Multidisciplinary Study to Estimate Red Snapper Population Size, Population Connectivity, and Mortality Rates in the US Gulf of Mexico	Rob Ahrens
2:00	A Stratified Random Survey, Tagging Study (Conventional and Telemetry), Fish Health Evaluation, and Genomics Study of Red Snapper, Lutjanus campechanus, in the Northern Gulf of Mexico.	Steve Szedlmayer
3:00	Break	
3:30	An Experimental Design to Estimate Absolute Abundance of Red Snapper in the U.S. Gulf of Mexico	Greg Stunz
4:30	Methods for the Determination of High Precision Estimates of Red Snapper Abundance in the Gulf of Mexico	Robert Leaf
5:30	Closing comments	Jim Berkson and others

Wednesday, January 11		
8:00 a.m.	Welcome and recap	LaDon Swann
8:15	Group Discussion • Common ground among designs • Identify essential design elements • Discuss implementation challenges	
10:15	Break	
10:30	Group Discussion (continued)	
Noon	Lunch with everyone	
1:30 p.m.	Reviewers and project steering committee reconvenes	
	Discussion with report reviewers and steering committee	LaDon Swann
3:00	Break	
3:30	Develop initial draft of Phase II design	
5:00	Discuss framework for Thursday morning	LaDon Swann
5:15	Adjourn for the day	
Thursday, January 12, 2017		
8:30 a.m.	Report reviewers and steering committee reconvenes to discuss Phase II design	LaDon Swann
10:00	Break	
10:15	Finalize Phase II design	
Noon	Lunch and Adjourn	

Appendix 2: Experimental Design Request for Proposals

Request for Proposals: Red Snapper (*Lutjanus campechanus*) Experimental Design for Population Estimates in the Gulf of Mexico Region

Funding Opportunity Title: Fiscal Year (FY) 2016 Red Snapper (*Lutjanus campechanus*) Experimental Design for Population Estimates in the Gulf of Mexico Region

Funding Source: The National Oceanic and Atmospheric Administration's (NOAA) National Sea Grant College Program and NOAA Fisheries. The research competition will be managed by the Sea Grant Programs in the Gulf of Mexico region.

Announcement Type: Notice of request for proposals (RFP)

Release Date: May 16, 2016

Funding Opportunity Summary: This notice advises the public that the Mississippi-Alabama Sea Grant Consortium (MASGC), on behalf of the four Sea Grant Programs in the Gulf of Mexico region and NOAA Fisheries, is accepting proposals to develop an experimental design(s) that will be incorporated into larger advanced technology and mark-recapture requests for proposals planned for Fiscal Year 2017 (Federal). The design will be used to assess the population of red snapper on artificial reefs and other structures and as the basis for a Gulf-wide estimate (with estimates also produced for natural habitats) of absolute abundance. The design may include traditional tagging methods and/or advanced technology for large-scale field projects to be used in red snapper stock assessments. Project initiation is scheduled for September 2, 2016. Award period is September 2, 2016, through December 5, 2016, no extensions.

Eligibility: MASGC welcomes proposals from individuals, institutions of higher education, nonprofit organizations, businesses, and tribal, state and local governments. The proposal principal investigator (PI) must be located within a U.S. Gulf of Mexico state. Co-investigators may be located in other U.S. regions. Federal partners may participate as uncompensated collaborators. No person shall be excluded on grounds of race, color, age, sex, national origin or disability from participation in, denied benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from MASGC.

Funding Levels: MASGC anticipates funding approximately five proposals from the $500,000 available to support the design phase.

Deadlines: A Letter of Intent (LOI) is required in order to submit a full proposal and is due by 5 p.m. CST on Friday, June 3, 2016. Full proposals are due by 5 p.m. CST on Friday, July 15, 2016. Submissions after the deadline will not be reviewed or considered for funding.

Funding Priorities

MASGC invites proposal submissions that will recommend an experimental design for estimating the abundance of red snapper (*Lutjanus campechanus*) in the U.S. portion of the Gulf of Mexico. The red snapper is a popular target of sportfishers and the commercial fishing industry throughout the Gulf of Mexico. Historical overharvesting resulted in a depleted population, but under current management measures the population is recovering, with full recovery expected by 2032. Some controversy surrounds the current stock assessment for red snapper, particularly with regard to accuracy of population estimates on artificial reefs and other structures considered to be difficult to sample using trawl surveys. Given this, interest exists in the development of an independent estimate of red snapper abundance in the U.S. portion of the Gulf of Mexico.

Input leading to this funding request was obtained at a workshop held March 2-3, 2016, in New Orleans, Louisiana. The guidance received at the workshop was useful in understanding how a U.S. Gulf-wide mark-recapture tagging program or synoptic survey might take advantage of large-scale traditional tagging and advanced technology by habitat type (including artificial reefs and other structures) to provide an independent estimate of the red snapper population. The independent estimate from the tagging/survey program will be compared to the estimate obtained from NOAA's current stock assessment approach to evaluate its accuracy.

Only the primary and secondary objectives will be considered for this competition.

1. **The primary objective** is to assess the population of red snapper on artificial reefs and other structures, and to provide a Gulf-wide estimate (with estimates also produced for natural habitats) of absolute abundance of fish Age-2 and older in the U.S. Gulf of Mexico (by age or age-groups).
2. **The secondary objective** is to estimate biological parameters, such as growth and natural mortality rates (by age or age-groups).

To accomplish this, a multi-step process will be followed, beginning with experimental design planning (Phase I supported by this request for proposals) and followed by implementation (Phase II and the subject of request(s) for proposals in FY 2017). A valid and reliable experimental design will be critical due to the unprecedented scale and complexity of any tagging/survey study designed to estimate fish abundance Gulf-wide. The Phase I experimental design will engage the Gulf scientific community and other Gulf stakeholders before proceeding with Phase II. The Phase I experimental design will also ensure results obtained from Phase II can be used for comparison and possible integration with NOAA's stock assessment.

In Phase I, funding will be provided for designs of studies that will provide preliminary estimates of absolute abundance Gulf-wide and by habitat type (artificial/natural) within two years of the

commencement of the Phase II study. Precise estimates of abundance with a coefficient of variation of approximately 30% are desired. The design should consider that significant funding will be available, but the design should be scalable in terms of sampling intensity (not geographic scale) if the original design exceeds the available funds.

Study designs developed through this competition will be reviewed at a workshop to be held in December 2016, and a final study design will be selected. Members of funded project teams will also participate in the workshop. The final experimental design used for the Phase II RFP may result from a combination of the designs. The final design will then provide the basis for Phase II (design implementation) that will be funded through request for proposals in FY 2017. Success in receiving Phase I funding does not guarantee or obligate funds in Phase II to the PI(s), even if a portion of or the entire experimental design that a PI(s) develops in Phase I is identified for implementation in Phase II.

Considerations in the Ultimate Design

It is recognized that obtaining a U.S. Gulf-wide or habitat-specific estimate of absolute abundance for red snapper will prove challenging. All of the approaches proposed to date, whether based on tag recaptures, cameras or acoustics, have technical challenges to overcome. Optical platforms (fixed cameras, ROVs, towed arrays) are routinely used to produce indices of local density, but estimation of local absolute abundance requires knowing the fraction of the population that is detected by the camera and how it changes with fish behavior (avoidance/attraction), habitat type and water clarity. Acoustic methods can provide biomass estimates if red snapper can be distinguished from other species, but they are complicated by features that block backscatter (e.g., the dead zone near the seabed and obstructions around platforms) or side lobes that can "create fish" on steep slopes. A significant amount of ground-truth measurements on known fish may be needed, and research is required to develop classification algorithms. Tagging approaches are challenged by the high rate of release mortality associated with fish caught at depth or hooking-related injuries, tag shedding and non-reporting of recaptured tags. Genetic methods (individual genetic tag-recapture or parental recaptures) may also prove to be an approach for monitoring red snapper and samples should be taken during the study, but further research may be required to identify genetic markers before the samples can be analyzed. In order to meet these challenges, a successful study design will likely need to employ a combination of approaches and take advantage of existing resources in the Gulf of Mexico.

Proposals selected for development should, therefore, address the following:

<u>If tagging is included then provide:</u>

1. Recommended types of tags and corresponding field tagging protocols
2. Sampling plan that ensures the tagged population will be representative of the untagged population at large, specifically accounting for
    a. the Gulf-wide geographic range of red snapper
    b. stratification by different habitat types (recognizing that different age classes occupy natural reefs, artificial structures and low-relief bottom)

    c. high site fidelity of red snapper
    d. mechanisms to mitigate or account for post-release mortality (e.g., depth-related barotrauma)
3. Systematically designed scientific release and scientific recovery effort structured in a way to maximize potential for obtaining robust estimates of abundance
4. Recreational and/or commercial fishery-based recoveries to augment information from the scientific release/recovery program
5. Estimation of biological parameters, such as growth, natural mortality rates and release mortality rates of red snapper (by age or age-groups)
6. Identify challenges with using the approach(es) to estimate red snapper populations and present alternative approaches to overcome the challenges

<u>If advanced technology surveys are included then provide:</u>

1. Recommended technology (e.g., cameras, acoustic profilers) and field implementation protocols
2. Sampling plan that ensures the surveyed population will be representative of the un-surveyed population at large, specifically accounting for
    a. the Gulf-wide geographic range of red snapper
    b. artificial and natural habitat types (recognizing that different age classes occupy natural reefs, artificial structures and low-relief bottom)
    c. high site fidelity of red snapper
3. Approaches to dealing with fish attraction/avoidance
4. Identify challenges with using the approach(es) to estimate red snapper populations and present approaches to overcome the challenges

<u>In all cases provide:</u>

1. Description of how areas of different habitat types (e.g., natural reefs, artificial structures and low-relief bottom) will be estimated
2. Description of how the data in the study will be transformed into an estimate of absolute abundance of red snapper throughout the U.S. Gulf of Mexico region, and on areas of natural reefs, artificial structures and low-relief bottom, and what the expected precision would be for these estimates
3. Description of the logistical challenges to implementing large-scale surveys and tagging studies in the Gulf of Mexico, including the varying environmental conditions in different regions of the Gulf and how those challenges can be met, including possible contingency plans
4. Approaches for collecting biological samples during surveys (where appropriate), scientific tagging studies and from the commercial/recreational fisheries (e.g., otoliths, tissues for genetics, reproductive tissues)
5. Possible ways to allow citizens or regional consortia to provide regional support without compromising the ability to obtain Gulf-wide red snapper population estimates
6. Schedule of work from initial fieldwork through analysis and report preparation
7. Cost estimate for a full study and how this cost could be scaled to lower levels (and the impacts on precision)

8. How the design could be adapted to become part of a regular process for estimation of red snapper abundance in the U.S. Gulf of Mexico by resource managers
9. Description of a multidisciplinary, integrated approach for conducting the research across a broad geographic scale. Multi-state, multi-institutional/agency and interdisciplinary projects are strongly encouraged, but not required

2016 Timeline

- May 16 (Monday) – Request for proposals released
- June 3 (Friday) – Letters of intent due
- July 15 (Friday) – Full proposals due
- August 12 (Friday) – Notification of funding
- September 2 (Friday) – Project initiation
- December 5 (Monday) – Project ends and final report due

Contacts for Additional Information

For additional information, contact LaDon Swann (swanndl@auburn.edu or 251-648-5877). Contact Loretta Leist (loretta.leist@usm.edu) for proposal guidance or Devaney Cheramie (devaney.cheramie@usm.edu) on fiscal matters.

Proposal Development Instructions

Letter of Intent

A Letter of Intent (LOI) is required to be eligible to submit a full proposal to MASGC. The LOI should be submitted to MASGC as a PDF file attached to an email message to Research Coordinator, at rc@masgc.org. The LOI should include a project title, names and work affiliation of investigators and a short description of the proposed approach. The LOI must be no more than 2 pages. There will be no formal review of LOIs. The LOI will help expedite the review process and is due on Friday, June 3, 2016, by 5 p.m. CST.

Full Proposal

The full proposal must be submitted to MASGC as a PDF attached to an email message to Research Coordinator, at rc@masgc.org. The proposal submission deadline is 5 p.m. CST on Friday, July 15, 2016. Proposal guidelines, required forms and other information can be found at the following website: http://masgc.org/funding/red-snapper.

Required Proposal Elements

Each of the following sections and sub-sections are required proposal elements. Omission of any element from I-V will result in the proposal being disqualified.

Proposals must include:

I. 2016 Red Snapper Phase 1-Experimental Design Project Summary Form 90-2

II. Completed and unsigned copy of the cumulative 2016 Red Snapper Phase 1-Experimental Design Title/Cover Form (MS Word)
III. In a single file
    A. Signed 2016 Red Snapper Phase 1-Experimental Design Title/Cover form (signed by institutional authority)
    B. Project Narrative (maximum of 10 pages)
        1. Rationale
        2. Scientific and Professional Merit
            a. Hypotheses
            b. Objectives
            c. Approach
                i. A sampling plan
                ii. A plan for data analysis
                iii. A detailed funding estimate to implement experimental design
            d. Links to Other Projects
        3. Expected Benefits
        4. End-users, Partners and Co-Sponsors
    C. Literature Cited (no page limit)
    D. Curriculum Vitae (2 pages per investigator)
    E. Current and Pending Support for Each Investigator (NSF, NIH or USDA formats are acceptable)
    F. Project Schedule
IV. MASGC Budget Form 90-4 (MS Excel)
V. MASGC Budget Justification (MS Excel)
VI. (Optional) List of people who should not review the proposal (MS Word)

Description of Each Proposal Element

I. 2016 Red Snapper Phase 1-Experimental Design Project Summary Form 90-2

MASGC suggests completing this form as the final step in writing the proposal to concisely summarize what is stated in the project narrative.

II. 2016 Red Snapper Phase 1-Experimental Design Title/Cover Form

Submit signed 2016 Red Snapper Phase 1-Experimental Design Title/Cover Form

III.C. Project Narrative (Maximum length, 10 pages)

Maximum length is 10 pages and single-spaced on 8.5” x 11” paper with one-inch margins. Times New Roman or an equivalent serif typeface with a 12-point or larger font should be used. Tables and figures are included in the page limit. Paginate the narrative with page numbers right-justified in the footer. Literature citations and CVs are not included in the 12-page limit. No appendices are permitted. Citations in the narrative should follow your disciplinary literature format.

1. Rationale

Use the research literature and/or preliminary research to describe the problem or opportunity at hand. Document the magnitude of the situation and the relevance of the issue or problem in the Gulf of Mexico region. Describe how this work would add to the body of knowledge in the research area.

The rationale section needs to address both the scientific rationale for the project and quantify from a practical standpoint why the issue is a high priority. Describe what makes this project innovative and why this topic is important. The goal of the proposal should flow logically from this discussion. The overarching approach (e.g., tagging, advanced technologies, combination) should be included under the rationale.

2. Scientific and Professional Merit

Describe in detail the overall project design and include enough detail to demonstrate the technical qualities of the proposed approach so that the salient features can be quantitatively assessed by those who review the proposal. This section must include sub-sections for hypotheses; objectives; approach; and links to other projects. In the proposal provide a subheading for each of the following:

a. Hypotheses: Include all hypotheses related to the proposed work. These must be presented in bulleted format.

b. Objectives: The objectives should be a numbered list and each objective should begin with the word "To" followed by a verb. Be specific and brief. Proposals that state objectives in a way that is specific, measurable, attainable, realistic and time-bound will fare best during the review process. Be realistic and do not list more objectives than can be accomplished.

c. Approach: Provide specific details on how the proposal will develop a sampling plan and a plan for data analysis. Include proposed methods, approaches and techniques that will be used to meet the stated objectives. Proposals should describe major aspects of the project, such as controls, replication, sampling, surveys, etc. Include information about facilities, equipment, personnel, management and interactions with other institutions or other resources that are directly applicable to the proposed project. A budget estimate to implement the proposed experimental design is also requested.

d. Links to Other Projects: Describe how this project could interface with other related research or similar projects that you or others are leading. The links to other projects may be local, statewide, regional or national in scope. Please be specific in identifying and explaining these links. Clearly distinguish how the proposed work relates to or is associated with any current or pending funding.

3. Expected Benefits

Describe the overall impacts of the completed project and how results can be immediately applied to inform Phase II (implementation) of the regional red snapper estimate of absolute abundance. Describe how the results of the project can be applied to improve governmental and other management decisions, improve technological or economic efficiency and/or benefit community members, industry or others. Be as specific as possible.

4. End-users, Partners and Co-Sponsors

Successful application of the research results will depend on the inclusion of end-users, partners and, in many cases, co-sponsors. This section should identify approaches to involve the recreational and commercial fishing industries. Also, describe their role and how they will be part of the planning and implementation of Phase II (design implementation) of the project, how they will be brought into the execution of the project, and/or how they will use the results.

III.D. Literature Cited (no page limit)

Provide complete reference information, per your disciplinary literature format. Citations should include author, date, title, source and page number. Up-to-date citations are expected.

III.E. Curriculum Vitae

Up to a two-page CV that includes evidence of each investigator's position, education, qualifications and experience in the field.

III.F. Current and Pending Support for Each Investigator

For all investigators on the project, include current and pending extramural sponsored research projects using NSF, NIH or USDA formats that include the title, sponsor, total budget, FTE devoted to the project and duration for each entry.

III.G. Project Schedule Form

Milestones are specific actions that will be undertaken to accomplish the objectives whereby progress toward the goals and/or outcomes is realized. Examples of milestones are data collection, analyzing samples, engagement with end-users and presentation/publication of results. Mark with an "X" the appropriate year(s) and month(s) expected for individual milestones identified for the proposed work.

IV. MASGC Budget Form 90-4

Complete one budget form for the project. Sub-award recipients must complete a budget form for their portion of the project. Label each budget form where indicated to appropriately describe the budget year and sub-award recipient.

V. MASGC Budget Justification Form

Investigators must use the MASGC Budget Justification Form. Complete one overall MASGC Budget Justification form. Sub-award recipients will be requesting funds must complete a

budget justification form. Label each budget justification form with the budget year and sub-award recipient.

VI. (Optional) List of people who should not review the proposal
Although not required, investigators are welcome to submit a list of people who should not review their proposal for any reason. This list will be kept confidential. Also consider including scientists and other people with whom you would have a conflict of interest in reviewing the proposal.

Proposal Submission Information

Electronic mail submissions of the proposal in a PDF format are preferred and should be addressed to "Research Coordinator" (rc@masgc.org). If an electronic mail submission is not possible, please contact Loretta Leist at loretta.leist@usm.edu for instructions for submitting a hard-copy.

Evaluation of Proposals

Proposals are expected to be highly integrated, multidisciplinary projects that address the research need identified in this request. Multi-state, multi-institutional/agency and interdisciplinary projects are strongly encouraged, but not required.

Proposals will be evaluated using merit reviews from national experts, followed by a review by a Technical Review Panel (TRP). The TRP includes scientists from universities around the U.S. and federal employees who have the necessary technical expertise. The TRP will recommend placement of each proposal into one of three categories ("fundable," "maybe fundable" and "not fundable") based on their reviews and the merit reviews. The funding request will be closed in the event no proposals are identified as "fundable" by the TRP.

The top ranked "fundable" proposal(s) will be recommended for funding and will be funded as resources permit. The final funding decision will be made in consultation with the four Gulf of Mexico Sea Grant Programs and with concurrence from the NOAA National Sea Grant Office and NOAA Fisheries.

Evaluation Criteria
All proposals will be evaluated by external reviewers and the TRP based on the following criteria:

1. **Rationale (10%)** – Evaluates how well the proposed project addresses this RFP.

2. **Scientific and Professional Merit (30%)** – Assesses whether there is a clearly stated testable hypothesis, if the approach is technically sound and/or innovative, whether there are clear objectives, if methods are appropriate, and whether the research will advance the state of the science or discipline. Determines the degree to which

approaches are used to solve problems or focus on new resources, timely issues or opportunities. Proposed budgets will also be evaluated under this criterion.

3. **Expected Benefits (30%)** – Evaluates the overall impacts of the completed project and whether results can be immediately applied to inform Phase II (implementation) of the regional red snapper estimate of absolute abundance.

4. **End-users, Participants and Co-Sponsors (10%)** – Assesses the degree to which users or potential users of the results of the proposed project can be brought into the planning and implementation of Phase II.

5. **Investigator Qualifications (20%)** – The degree to which the applicant and identified collaborators possess the necessary education, training and/or experience to execute the proposed activity. This assessment will be primarily based on the investigator(s) CV(s). This criterion will also assess the stage of career development and record of productivity with previous funding.

Post-Project Selection Requirements

PIs of selected project(s) will be required to submit additional materials prior to project initiation. These include:

1. Applicant response to any significant review comments.
2. Letter of commitment from the institutions involved in the project. Letters of commitment will also be required for each sub-award recipient, co-sponsor and unfunded collaborator identified within the proposal. Letters of commitment from sub-award recipients must be signed by the appropriate institutional authority.
3. Consent Form – Intellectual Property.
4. Form CD-512 or CD-511 (Certification Regarding Lobbying).
5. Standard Form 424B (Assurances – Non-Construction Programs).
6. Participate in a workshop with investigators from other funded projects. Please include travel costs estimates for a two-day meeting in a city with a major airport in the Gulf of Mexico region (i.e. Tampa, New Orleans or Galveston)
7. Additional materials may be requested as needed.

NOAA Data Sharing Plan

Environmental data and information collected and/or created under NOAA grants/cooperative agreements must be made visible, accessible and independently understandable to general users, free of charge or at minimal cost, in a timely manner except where limited by law, regulation, policy or security requirements. PIs of selected project(s) will be required to submit an acceptable Data Sharing Plan prior to funding.

Appendix 3: Participant List

Name	Affiliation	Email address
Investigators (26)		
Greg Stunz	Harte Research Institute, Texas A&M University – Corpus Christi	greg.stunz@tamucc.edu
Robert Leaf	University of Southern Mississippi	robert.leaf@usm.edu
Steve Szedlmayer	Auburn University	szedlst@auburn.edu
Sean Powers	Dauphin Island Sea Lab	spowers@disl.org
Peter Rubec	FWC/Florida Fish & Wildlife Research Institute	Peter.Rubec@myfwc.com
Rob Ahrens	University of Florida	rahrens@ufl.edu
Marcus Drymon	Dauphin Island Sea Lab	mdrymon@disl.org
John Hoenig	Virginia Institute of Marine Science	hoenig@vims.edu
Liese Carleton	Virginia Institute of Marine Science	lcarleton@vims.edu
John Walter	NOAA Fisheries	John.F.Walter@noaa.gov
Matthew Lauretta	NOAA Fisheries	Matthew.Lauretta@noaa.gov
William Patterson	University of Florida	wpatterson@disl.org
Frank Hernandez	University of Southern Mississippi	frank.hernandez@usm.edu
Stephen Bullard	Auburn University	ash.bullard@auburn.edu
Jay Rooker	Texas A&M University at Galveston	rookerj@tamug.edu
Mike Dance	Texas A&M University at Galveston	dancem@tamug.edu
Lynne Stokes	Southern Methodist University	slstokes@mail.smu.edu
Dave Wells	Texas A&M University at Galveston	wellsd@tamug.edu
Judd Curtis	Harte Research Institute, Texas A&M University – Corpus Christi	judd.curtis@tamucc.edu
Richard Flamm	FWC/Florida Fish & Wildlife Research Institute	Richard.Flamm@myfwc.com
John Liu	Auburn University	liuzhan@auburn.edu
Eric Saillant	University of Southern Mississippi	eric.saillant@usm.edu
Benny Gallaway	LGL Ecological Research Associates	bjg@lgltex.com
Matt Catalano	Auburn University	mjc0028@auburn.edu
Ed Chesney	Louisiana Universities Marine Consortium (LUMCON)	echesney@lumcon.edu
Kevin Boswell	Florida International University	kevin.boswell@fiu.edu
Reviewers (4)		
Steven Cadrin (By conference line)	UMASS	scadrin@umassd.edu
Jeremy McKenzie	National Institute of Water and Atmospheric Research, New Zealand	Jeremy.McKenzie@niwa.co.nz
Richard Starr	Cal State	starr@mlml.calstate.edu
Patrick Sullivan	Cornell	pjs31@cornell.edu
Steering Committee (10)		
Kelly Samek	National Sea Grant	kelly.samek@noaa.gov
Jon Pennock	National Sea Grant	jonathan.pennock@noaa.gov
Roy Crabtree	NOAA Fisheries Southeast Regional Office	roy.crabtree@noaa.gov
Clay Porch	Southeast Fisheries Science Center	clay.porch@noaa.gov

Name	Affiliation	Email address
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Jim Berkson	NOAA Fisheries Office of Science and Technology	jim.berkson@noaa.gov
Ned Cyr	NOAA Fisheries Office of Science and Technology	ned.cyr@noaa.gov
Shelby Walker	Oregon Sea Grant	shelby.walker@oregonstate.edu
William Wise	New York Sea Grant	william.wise@stonybrook.edu
LaDon Swann	Mississippi-Alabama Sea Grant Consortium	swanndl@auburn.edu
State Agencies (11)		
Chris Blankenship	Alabama Marine Resources Division	chris.blankenship@dcnr.alabama.gov
Kevin Anson	Alabama Marine Resources Division	Kevin.Anson@dcnr.alabama.gov
Mark Lingo	TX Parks & Wildlife	Mark.lingo@tpwd.texas.gov
Joe West	Louisiana Department of Wildlife and Fisheries	jwest@wlf.la.gov
Jason Adriance	Louisiana Department of Wildlife and Fisheries	jadriance@wlf.la.gov
Mariana Steen	Louisiana Department of Wildlife and Fisheries	msteen@wlf.la.gov
Brett Falterman	Louisiana Department of Wildlife and Fisheries	bfalterman@wlf.la.gov
Andy Fischer	Louisiana Department of Wildlife and Fisheries	afischer@wlf.la.gov
Erik Lang	Louisiana Department of Wildlife and Fisheries	elang@wlf.la.gov
Xinan Zhang	Louisiana Department of Wildlife and Fisheries	xzhang@wlf.la.gov
Taylor Allgood	Louisiana Department of Wildlife and Fisheries	tallgood@wlf.la.gov
Other (6)		
Jim Hurley	Wisconsin Sea Grant and Sea Grant Association President	hurley@aqua.wisc.edu
Robert Shipp	University of South Alabama	rshipp@southalabama.edu
Robert Twilley	Louisiana Sea Grant	rtwilley@lsu.edu
Marc Santora	NOAA/NMFS	marc.santora@noaa.gov
Loretta Leist	Mississippi-Alabama Sea Grant Consortium	loretta.leist@usm.edu
Kay Bruening	Mississippi-Alabama Sea Grant Consortium	kay.bruening@usm.edu

Appendix 4

A reviewer suggested geographic groupings similar to Stunz, et al. (page 11). At least two Gulf of Mexico sub-regions should be used (East and West). The figure divides the Gulf into four sub-regions.

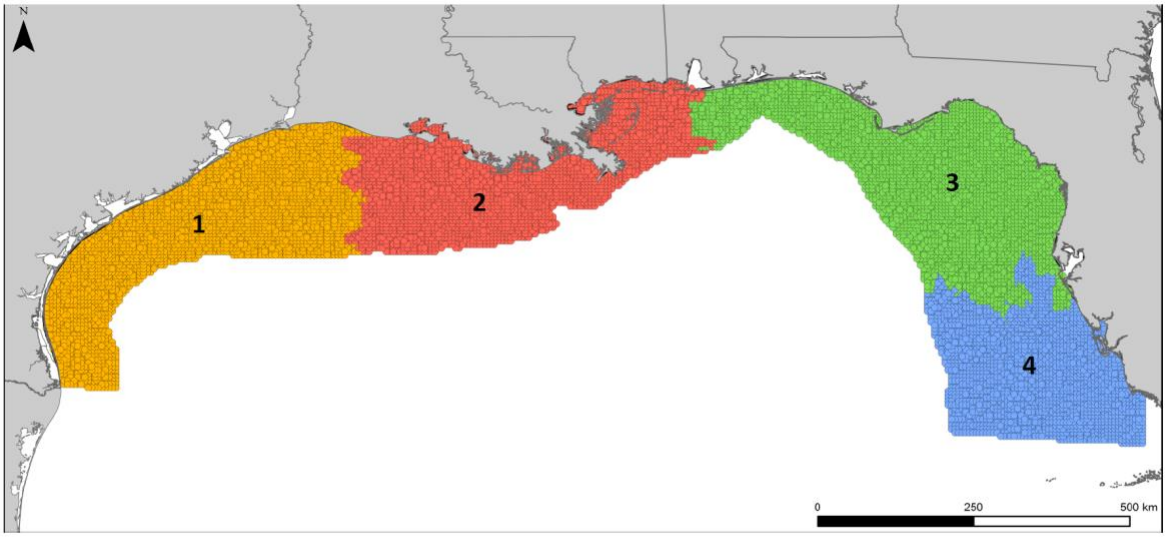

Fig 1. The four major groupings or regions identified in the northern Gulf of Mexico, with the specific location of geographic boundaries influenced by explanatory variables included in the grouping models.

Appendix 5

One reviewer suggested a sample size determination like the one from Cowan et al. (page 21). It would be helpful for determining the feasibility of achieving a 30% coefficient of variation when accounting for available funding.

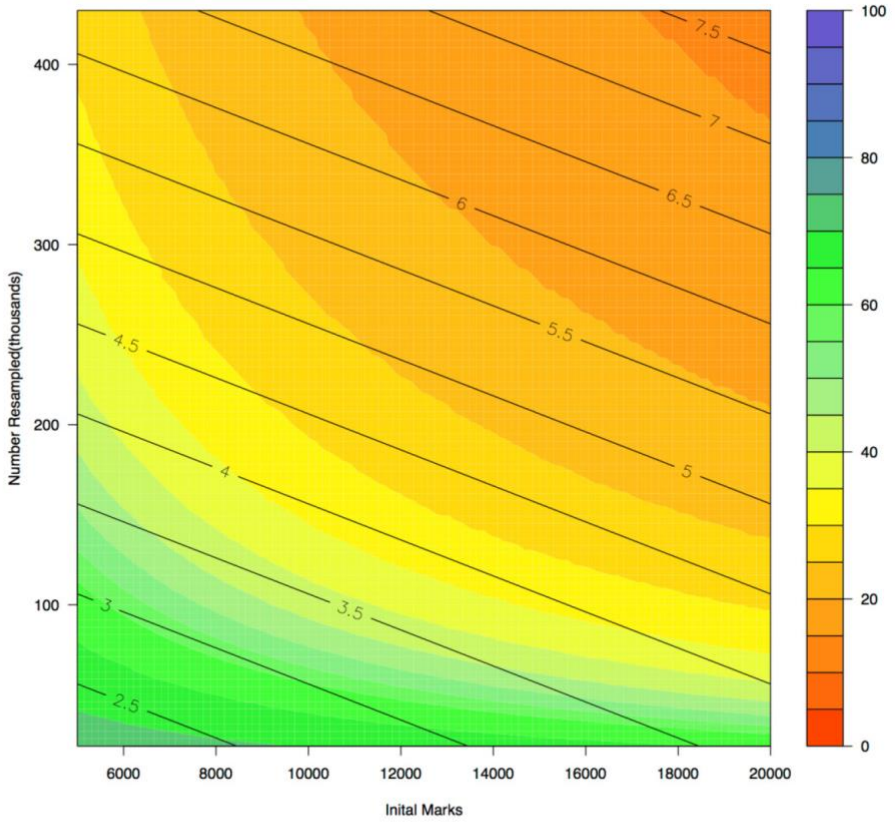

Figure 6. Estimated precision and costs for mark recapture sampling. Colored bands indicate precision (CV) in percentage and black contours indicate cost in millions of dollars.