RH Parrish - Final Report – Dec. 19, 2009

Review of

CENTRAL COAST TRAWL IMPACT AND RECOVERY STUDY

Study Design for External Science Review
November 25, 2008

Overview:

This report consists of a review of the assumptions and methodology of a trawl impact study to be carried out off of Morro Bay during 2009-2013. The study is to be carried out by The Nature Conservancy and associated researchers from several institutions. The basis of the review was to focus on their Study Design for External Science Review (November 25, 2008).

On reading the draft Study Design it was clear that plans for the benthic surveys were well developed, however, the plans for the trawling 'treatment' was very preliminary and it was obvious that there was not enough information presented to determine how the investigators intended to carry out the trawling portion of the study or to assess how they were going to sample the fishes and invertebrates taken during the trawling portion of the study.

I therefore contacted one of the principal investigators (Mary Gleason) and asked about getting the final study plan. Mary informed me that the survey plan was not yet finalized and that they would be interested in my comments as they wanted to make the trawl impact study as good as possible. I therefore made the decision that instead of a traditional external review of the study plan I would place my principal effort on trying to provide input that would improve the study plan and ensure that the final results of the study would be of interest to as wide an audience as possible. The bulk of my input to the principal investigators is contained in the series of emails written to Mary Gleason discussing the study plan and the talking points outline for my meeting with Mary Gleason and James Lindholm. (see Appendix)

A principal difficulty in the present trawl impacts and recovery study, and any other similar study, concerns the interpretation and application of the results obtained in the study. Given that some pattern of faunal and physical alteration will be observed the problems are: How do you interpret the ecological importance of this alteration? How do you determine if the alteration allows or precludes a sustainable fishery? and, How do you determine how much alteration must occur before significant ecosystem effects are seen? These problems are not addressed in the Study Design and little information concerning the future assessment of the implications of results from the study are presented. The Study Design section titled Analytical Methods primarily consists of a description of sampling methods rather than a description of the analyses that will be carried out at the completion of the field work. However; the authors did mention the species richness, diversity and community comparison methods that they will employ.

Summary of Trawl Study Plan, Critique and Suggestions Made

In my opinion, the Trawl Survey has the potential to be the best trawl impacts study yet made on the West Coast. The survey has a unique, near port, study area that has not been trawled in at least a decade. It has a dedicated trawl vessel with an experienced captain, excellent replicates in very similar habitat (3-4 treatment sites and 3-4 control sites) and the several benthic surveys are well designed. It is a multiyear study (5 years) that will be able to assess both the effects of trawling and interyear climatic variability.

To achieve the above characteristics the original survey plan was limited to a single depth and habitat (the habitat was necessarily in poor fishing grounds; otherwise, it would have been trawled during the previous decade) and it originally had a single trawl treatment. This treatment entailed trawling the treatment sites multiple times during a short period in the first and second years of the study and then using the three following years to assess the recovery of the fauna. The original design was to have a full benthic survey just prior to trawling and a full benthic survey just after trawling to assess the immediate physical and biological affects of trawling. Work in years 3-5 would consist of a single full benthic survey each year. The original trawl treatment was to trawl the entire area of each of the treatment sites 5 or 10 times (it had not yet been decided which) in a short time period.

Prior to meeting with the principal investigators I tried to estimate the trawling pattern that might be expected and I met several times with Janet Mason (NMFS Monterey) to assess the trawling pattern that has occurred in Central California during the last decade. The object of these activities was to determine how often local areas are trawled. This determination required an assessment of the width of the swept area of a typical central California trawler (i.e. the door to door distance).

The net to be used in the trawl effect survey is shown below. The fishing width of the trawl was given as 33’ and the head rope is 61’. Figure 1 presented in the study plan does not do a good job of showing the actual dimensions as the bridles of the survey gear are 7 fathoms long and the sweeps (mudline) are given as 70-75 fathoms. The actual perspective is shown in figure 2.

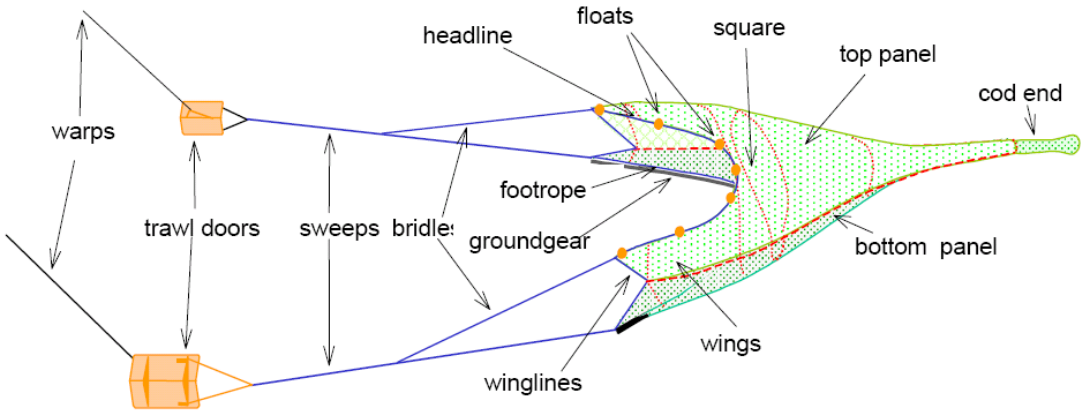

Figure 1. Diagram showing the basic design of bottom trawl gear.
(Source: http://www.seafish.org/upload/b2b/file/r__d/BOTTOM%20TRAWL_5a.pdf**)**

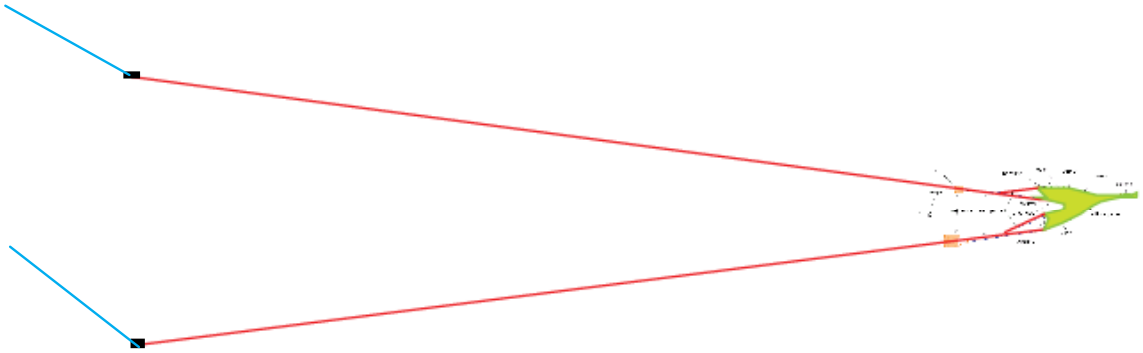

Figure 2 Actual perspective of trawl rig to be used in survey

The door to door distance, that extablishes the width of the trawls swept area, is not given in the survey plan, so I used the bridle and mudline lengths and information from trawl research sites available on the internet to estimate a door to door distance of about 95 meters for the gear to be used in the study. Before I met with the principal investigators they were using the 33 feet (i.e. 10 meter) fishing width of the trawl net to establish the swept area of the trawl gear. The treatment sites are 1000 meters by 200 meters in size and with a 95 meter sweep width it would take 3 trawl sets to sweep the entire area once. With a 10 meter sweep this would require 20 trawl sets to sweep the entire area once. Trawling each of the four treatment sites 5 times with a 10 meter sweep would have required 400 trawl sets. I convinced the principal investigators that the swept area should include the mudlines and suggested that they get a better estimate of the actual door to door distance for their fishing gear from their fishing captain.

My meetings with Janet Mason (NMFS Monterey) were to assess the number of times per year that central California trawling grounds are trawled. Her information on hours trawled per year per micro-block (i.e. 1 second of latitude by 1 second of longitude) when combined with a 95 meter swept area and an average trawl speed of 2.5 knots showed that the majority of the habitat in Central California are trawled less than one time per year, the halibut trawl grounds near the study area off Morro Bay were trawled about 1 time per year and that the most heavily trawled areas were in the area North of Monterey Bay (i.e where prior to the RCA closure some micro-blocks were trawled 10–30 times per year). Note that this assumes that the micro-bloc is trawled uniformly; actual trawling patterns may result in some areas being trawled at rates larger than the micro-block averages. It should be noted that the peak trawling effort occured before the RCA was closed (2003) and the majority of local trawlers were bought out. Presently there is only one boat trawling in Morro Bay and only 2 in Monterey Bay.

Discussions during the meeting with the principal investigators were heavily centered on the trawling aspects of the study and I pointed out that the planed treatment (either 5 or 10 trawl passes per treatment) would not result in replicate information for trawling in year one vs trawling in year 2. This was because in year one their survey would be trawling an area that had not been trawled in 10 years and year two the survey would be trawling an area that had been trawled heavily in the previous year. I suggested that in the first year the treatment should be only one pass per year and that the second year should have the higher treatment (i.e. 5 or 10 passes per year). This would allow them to assess the immediate affects of two trawling rates, low intensity and high intensity. It would allow annual assessment of the two intensities and also the multi-year recovery from a high intensity treatment.

My second major suggestion was that they should try to get at least one survey at 6 months from the trawl treatment so that they could assess the recovery rate at a period of less than one year.

Although the bulk of my comments during the review concerned the trawling aspects of the survey I would point out that I found the benthic survey portions of the survey to be very well thoughout. However, there were a few minor points brought up in the email portion of this report (see Appendix).

As mentioned above, the Design Plan has little mention of the analytical framework the authors intend to employ. The large scope of the trawl impacts study (i.e. 5 year duration, replicates for trawled and untrawled treatments, and sampling of multiple biotic and abiotic features) when coupled with the unique untrawled study site will allow a much wider range of analyses than any other such study published for the California Current area. If the authors expand the work to include the suggested inclusion of a 6 months sampling and differing trawl treatments in the first and second years of the study the range of analyses will be even larger. I therefore suggest that the analyses carried out at the end of the study should include the following :

1. Few previous studies have been able to assess the total change in species diversity as they usually do not have a picture of the original diversity before the onset of trawling. Therefore the authors should analyse the total change in diversity associated with trawling. The species diversity of the combined treatment and control sites will give a comparable assessment of the changes in diversity that occurs when only a portion of the habitat is trawled. In the case of this

study 50% of the habitat will be trawled ; as a comparison the percentage of the habitat that is open to trawling in the Monterey Bay National Marine Sanctuary's MPA study area is 36%. The expected result is that trawling will alter the species diversity in the areas trawled and that trawling will increase the species diversity in the total area due to the different arrays of species in the two components of the habitat.

2. This study has the potential to measure the relative changes in diversity, species richness and community structure associated with inter-year environmental changes and those associated with trawling. If a 6 month sampling period is included in the study it will also be possible to detect any major seasonal affects. Those carrying out the study should attempt to present their results in a way that will allow impartial evaluation of the full range of alterations in the habitat and biota. The presence of replicates and multiple years of data will allow comparison the magnitude of changes associated with temporal variability, trawling, and unknown variance.

Appendix:

A Correspondence Between Richard Parrish and Mary Gleason
B Talking points for Meeting with Principal Investigators

Appendix A Correspondence in Chronological Order

From: Richard Parrish [mailto:clupeid@sbcglobal.net]
Sent: Tuesday, September 08, 2009 12:43 PM
To: Mary Gleason
Subject: Trawl Survey Review

Hi Mary

As you probably know I have been asked to review the "Central Coast Trawl Impact and Recovery Study" and Steve Scheiblauer has sent me a copy of the Study Design for External Science Review dated November 25, 2008.

I have just made my first read-through and it is obvious that this version was a preliminary version with several important decisions on sampling methodology being put off until information from preliminary work was completed. Rather than review the preliminary version I think it would be better if I reviewed the final plan for the study as most of the questions that arose from my first reading concerned specifics that had not been decided in 2008.

In reading the timeline it is clear that I am catching you at a very busy time. I would appreciate it if you could either send me the updated plan, arrange a time when we could get together, OR let me know when your busy field schedule will allow us to get together.

I do not know where you are located now; if you are not in the Monterey Area perhaps a phone call would suffice as I principally need to know the decisions that were not made in the 2008 Study Design and that were made before the field study started.

The other alternative would be for me to email you specific questions.

What do you suggest?

From: Mary Gleason <mgleason@tnc.org>
To: Richard Parrish <clupeid@sbcglobal.net>
Sent: Tuesday, September 8, 2009 12:55:16 PM
Subject: RE: Trawl Survey Review

Hi Richard,

Nice to hear from you. I'm based here in Monterey.. ..but traveling a lot lately and am just heading off to LA.
We are just finalizing the sampling plan details now (# of transects, grabs, etc) and getting ready to do the pre-trawling surveys later this month. So sending some email questions now would be the best way to go.
Thanks,
Mary

From: Richard Parrish [mailto:clupeid@sbcglobal.net]
Sent: Tuesday, September 08, 2009 2:10 PM
To: Mary Gleason
Subject: Re: Trawl Survey Review

Thanks Mary

I will send a copy of the 2008 Design tomorrow; with questions embedded where they occurred to me.

The design strategy looks pretty good; with the usual lack of multi-year data, to assess both inter-year variation and longer term effects well taken care of.

Most of my questions deal with the things you are now finalizing and a couple of things probably where I am either misreading the report or where things are not firmly stated.

Richard

From: Mary Gleason <mgleason@TNC.ORG>
To: Richard Parrish <clupeid@sbcglobal.net>
Sent: Tuesday, September 8, 2009 2:14:25 PM
Subject: RE: Trawl Survey Review

great - it will be good to get your input and timely. we are trying to make it the best study possible given the usual constraints....so appreciate your thoughts. Mary

From: Richard Parrish [mailto:clupeid@sbcglobal.net]
Sent: Wednesday, September 09, 2009 1:21 PM
To: Mary Gleason
Subject: Re: Trawl Survey Review

Hi Mary

In writing this up I realized that most of "my problem" was that I just did not understand your trawling strategy. This was partially because much of the details were not yet

decided in the November 2008 Study Design for External Review; but also due to the fact that your description of your trawl "sampling" was not very detailed. So essentially today I understand your study much better than I did after reading it.

This is my interpretation of the terms used in the Study Design and I note that there is some confusion in the use of these and similar terms in the Study Design. I would suggest that you stick to a term and not substitute other similar terms.

Site: Is the study area just off of Morro Bay.

Plot (also called 'treatment block): There are 3 (or 4) trawl plots and the same number
of control plots?

Transect: This really only applies to the video/benthic sampling lines occupied in each
Plot. Multiple transects will be made in each plot and they will be selected "randomly
for each monitoring effort"

Trawling effort: Trawling effort is not well described in the Study Design. What is needed is a short overview of you strategy of achieving the historical trawling effort and you should note that your trawling effort is concentrated in a short time period whereas the historical effort was spread throughout a year.

Monitoring effort: Sampling period, one per year.

Obviously the timing will determine the ability to assess recovery times. If there is only one cruise per year 'recovery times' will be only at the annual, or greater, time scale.

Much of my original confusion concerned the statement below. This was because I assumed that both trawl and bethic sampling were considered to be transects which were selected randomly for each monitoring effort.

"Multiple transects will be identified in each control or treatment plot and randomly selected from for each monitoring effort. The number of transects will be determined after the baseline survey data from 2008 is analyzed to assess variability in parameters to be measured. "

Trawl transects are really a misnomer and it appears that you actually intend to make multiple trawl hauls to ensure that each entire trawl plot (200m by 1000m) is trawled one or more times in each monitoring period, or to approximate the historical trawling effort. Correct? Will you be using the 'lighter' gear being used on the TNC vessel or will another trawl design be used?
What was the historical level and/or what level will you be trying to achieve on the trawl

plots? I suggest that you reword the description of trawling effort to better describe how you actually intend to 'treat' the trawling plots. I would guess that several passes will be made over the plot in a practical attempt to spread the trawling effort over the plot

I assume that the same analysis methods used for the epifauna will also be used for the infauna; it is not stated. Will any biomass-based methods be used on the infauna?

It appears to me that some of the physical aspects of the benthic surveys, especially the micro-habitat portion, are likely to respond at much shorter time intervals than a year and I therefore have difficulty in seeing how they will contribute much to this trawl assessment. For example, if a benthic fish is taken how long will it take for it's 'home' depression to disappear, how is the persistence of micro-habitat structure associated with seasonal or transitory currents and how can the biological significance of an empty depression be assessed? However, I realize that this study will have much wider application than simply assessment of trawling as both the trawled and control plots will allow extensive inter-year assessment of a very poorly understood habitat and for this purpose the micro-habitat surveys will be quite valuable.

When do you expect to finalize the sampling design? I think that much of the strength of this study is dependent upon your final design and at this late date I would prefer to assess the actual study design rather than the preliminary version.

Richard

From: Mary Gleason <mgleason@TNC.ORG>
To: Richard Parrish <clupeid@sbcglobal.net>
Sent: Friday, September 11, 2009 11:52:17 AM
Subject: RE: Trawl Survey Review

Richard-
All good comments. I will get back to you on Monday or Tuesday...just getting back from LA.
Thanks much,
Mary

From: Richard Parrish [mailto:clupeid@sbcglobal.net]
Sent: Friday, September 11, 2009 4:31 PM
To: Mary Gleason
Subject: Re: Trawl Survey Review

I just received your email below as I was about to send off the following.

Hi Mary

After finally realizing the approach you seem to be using for the trawling portion of the study, and having slept on it, several things occur to me.

Overall the benthic survey portion of the study seems very well thought out and described; in contrast the fishing, or treatment, portion of the study is essentially un-described in the November 2008 Preliminary Study Plan. From your recent emails it appears that many decisions still have not been finalized. This seems to be true for both the treatment strategy and the details of the trawling portion of the study.

Treatment Strategy:

It appears that there will be only one treatment (i.e. trawling intensity) rather than a range of treatments. According to what I have heard this was decided due to lots of informed 'keep it simple' arguments that I have a great deal of sympathy with. A definitive simple study is certainly preferable to a more complex study with insufficient sampling intensity.

This means that you are limited to a single treatment strategy and there appears to be three logical approaches (i.e. approximate the historical maximum, approximate the expected future level and one trawl pass per year. Presently it appears that the ranking of the intensity of these three has not been described. Is the historical maximum greater than one trawl pass per year and is the expected future level less than one pass per year? Certainly these calculations need to be made before deciding on the study treatment. I note that Jan Mason at the NMFS Pacific Grove office has been working on the trawl log data for several years and she has the raw date necessary to calculate the historical and recent trawling activity in the study area. She would need the door-to-door distance mentioned below to accomplish this.

From my perspective the environmental community will be most interested in the historical maximum (i.e. the worse case senario). The fishermen, fishery managers and supposedly the Nature Conserancy will be most interested in the expected future level. Scientists not involved in the local area may be most interested in the standardized, one trawl per year treatment.

In my opinion the expected future level would be the single most useful treatment level to assess. Certainly this is the most important treatment for both the Nature Conservancy (i.e. it will probably be their fishing boats that trawl this area in the future) and the Pacific Fishery Management Council (i.e. the agency that is responsible for management of the trawl fishery). It is possible that two of the above treatment levels are similar and this might influence your choice. For example, if either the historical maximum or expected future level is close to one trawl pass per year I would recommend going with one trawl pass per year. Unfortunately it appears that this information is not yet available.

Trawl Treatment Details:

The preliminary study design provides little information on how the study plot will be trawled or upon how the trawl catches will be standardized or sampled. Based more on intuition, than information in the study design, it appears that you intend to trawl the 200 by 1000m treatment plots at a reasonably homogeneous level. For example if the treatment was one trawl pass per year you might simply start at the offshore side and make parallel trawl passes ensuring that the entire study area is trawled. It is less obvious how you would approximate a 0.4 or 2.3 per year treatment; although leaving gaps for the 0.4 level and overlapping trawl passes for the 2.3 level could be used. However, in the case for the 2.3 level multiple passes over the same area in a short time period is a poor substitute for the time spacing that probably occurred in the historical fishery.

The fishing width of the net is given as 33 feet and the doors are 77 to 82 fathoms from the net. I assume that the width of the trawl pass is defined as the door-to-door distance and I was unable to find this critical piece of information in the study design. It will, of course, be a principal factor determining how many passes you will have to make to cover the treatment plots. I can only grin at the usual unit-of-measure difference between the scientists and practical types.

From a trawl fisher's viewpoint you could simply start trawling well ahead of the treatment plot and trawl well past it to ensure that the entire plot is trawled. However, this brings up the problem of sampling the trawl catches. I see no practical way that you can ensure complete treatment of the plot without trawling a larger area than the 200 by 1000m plot. The trawling time over 1000m at 2.1 knots is just over 15 minutes and even if you are lucky and the trawl reels stop feeding and start retrieving cable exactly at the ends of the 1000m pass there will probably be several additional minutes that the trawl is on the bottom due to the scope of the cable. Thus trawl catches will be considerably larger than that taken within the trawl plot. What methods are you going to use to assess the actual area trawled so that you can correct the catches to the standardized 200 by 1000m plot?

I note that standardizing the catches to the plot area is highly desirable for future analyses as it will allow better comparison between the several data sources.

Discussing the trawl catches brings up the difficulty inherent in comparing trawl catches with ROV sightings. Having been involved in the two person submersible work that Mary Yoklavich organized I am well aware of the species differences between what you see under the submersible, what you see moving away from the submersible and what trawl nets catch from similar habitat. I note that in my very limited submersible experience flatfish appear to be more infauna than epifauna and I do not know the species bias of flatfishes that are inherent in sampling by ROV and there may be unknown bias in the trawl samples as well. The different bias in the ROV and trawl sampling is a problem and the probable lack of similarity between the species composition of the two sampling methods will heavily influence the interpretation of the results from the study. Hence the next thought.

With the present design the longer-term recovery of the epifauna will only be assessed with the ROV. In other words, only the species well sampled by the ROV will be assessed. Therefore I would suggest that you consider adding a full trawl sampling at the end of the study to better assess the longer-term recovery of the full range of species sampled. Of course if the species composition of the ROV and trawl samples prove to be fairly similar in the first two years of sampling this may not be necessary. In addition, it may not be necessary if there is little variance between the trawl sampling in year 1 and year 2. I note that it is possible, due to natural variability, that the trawl survey in year 2 will have larger catches or higher diversity than in year 1.

Therefore, at a minimum, I think you should raise the possibility of the need for a final, fifth year, sampling that duplicates the full range of sampling carried out in the first and second years of the study.

One final thought. The only time interval used is one year. If I were designing the study I would consider adding at least one benthic survey at a 6 month interval to assess shorter term responses and to get some feel for seasonal differences. For example, doing benthic surveys at year 1, 2, 2 1/2, 3, 4 and 5. If pressed for funding I would even drop the 4th year of the study to acquire some seasonal and shorter-term information. I realize that this complicates the whole study; but it might be very cost effective. Since it appears that the treatment will probably be equal or greater to one trawl pass per year it could be argued that the multiple year recover trajectory is unlikely to be achieved at high trawling rates and it would therefore be important to determine how much change occurs in less than a year. In addition, trawl fishers constantly tell me that animals move inshore and offshore seasonally and this would allow assessment of this potentially important factor.

Richard

Hi Richard-
Great points and yes you are right we have not articulated the trawl treatment intensity very well at all - though we have thought about it and have a plan in mind.

Rather than trying to respond to all your points via email, I'm wondering if you are around tomorrow morning (Wed) anytime between 9-12 to meet with me and James Lindholm (CSUMB) to discuss the details and your comments? We could meet here in my office at Heritage Harbor or come out to your house if that's best for you.
Let me know,
Mary
From: Richard Parrish [mailto:clupeid@sbcglobal.net]
Sent: Wednesday, September 16, 2009 3:32 PM
To: Mary Gleason
Cc: James_Lindholm@csumb.edu
Subject: Re: Trawl Survey Review

Hi Mary and Jim

I have attached the written comments I brought with me to the meeting this morning.

The last major point that we talked about was my suggestion of going for a lower level trawl density in the first year of the study and a considerably higher trawl density in the second year. Obviously with the same trawl density in the first and second years of the study you would not really have a temporal replicate because the first year would be on a near pristine habitat and the second year would be on an area that was completely trawled the previous year. A couple of hours after the meeting I realized that going with specific treatments in year one and year two gives you a couple of chances that no one that I am aware of has been capable of testing.

One of the unique things of your study is that circumstances have provided you with a study site that has not been trawled for a fair number of years and it probably has been at least 20 years since it was trawled at a moderate rate. This gives you the chance of seeing what a single trawl pass does to a near pristine habitat. So I hope that you will think about using a single trawl treatment the first year and say a 5x, or even higher, trawl treatment the second year.

This would allow you to determine the minimum effects of trawling on near pristine habitat (you cannot get less disturbance than a single trawl pass). Trawling at a much higher rate the second year would allow assessment of the effects of extensive trawling on habitat that had previously been lightly trawled; and of course the following years benthic surveys will allow assessment of the longer-term recovery.

That would be a really useful combination of trawl treatments that should be of interest to the widest possible audience.

I think you are now going to include one 6 month post-trawling benthic survey. I would suggest that, if possible, you should wait until you see the effects of the first round of trawling before you decide when to do the 6 month survey. It might be desirable to have the 6 month benthic survey after the higher density trawl treatment; rather than after the lower density trawl treatment particularly if you decide to use a 1x treatment the first year.

Richard

From: Richard Parrish [mailto:clupeid@sbcglobal.net]
Sent: Wednesday, September 16, 2009 3:32 PM
To: Mary Gleason
Cc: James_Lindholm@csumb.edu
Subject: Re: Trawl Survey Review

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The last major point that we talked about was my suggestion of going for a lower level trawl density in the first year of the study and a considerably higher trawl density in the second year. Obviously with the same trawl density in the first and second years of the study you would not really have a temporal replicate because the first year would be on a near pristine habitat and the second year would be on an area that was completely trawled the previous year. A couple of hours after the meeting I realized that going with specific treatments in year one and year two gives you a couple of chances that no one that I am aware of has been capable of testing.

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Richard

Appendix B

Talking points for Meeting with Principal Investigators
Mary Gleason and James Lindholm (9-15-09)

Trawl treatment

What net is going to be used? What is the boat's horsepower? Note that trawling speed (2.1 knots) is barely above the speed where the net tends to mud-up (2.0 knots). What are you going to do if you get a trawl haul that does mud-up; and how will this affect your results? Is trawling at this rather slow speed due to vessel horsepower? or due to fuel/fish catching tradeoffs? Is the trawl fisher using this small flatfish trawl with quite long sweeps based on optimum flatfish catch with a small horsepower trawler (i.e. good flatfish/fuel ratio)?

What is the expected door-to-door distance? My guess is that the width of the swept area may be 8-10 times the width of the net spread (11m)

Treatment Intensity (expected future rate, 1 pass per year or maximum observed rate)

Trawl passes per year. (i.e. say 0.5, 1, 2 passes/year)
Non-overlapping passes at the 0.5 pass/yr level may have little effect on CPUE
Adjacent passes at the 1 pass/yr level may have minor effect on CPUE
Expected minor decrease of closely spaced passes should be looked for in data.
Suggest start at outside edge then inside edge then move towards the middle.
Repeated passes at the 2 passes/yr level will seriously decrease the CPUE of the second round due to close temporal spacing. The expected decrease will allow some assessment of the catch efficiency of the trawl gear, but the second round should not be used to assess original density.

Qualitative and quantitative sampling of trawl catches:

Sampling is not described: Will animals only be counted or will weights be taken?
I assume the same numerical analysis methods, any biomass based methods planned?

Area or density-based analyses; you will have area measurements on benthic surveys so I assume that it would be preferable to be able to compare area-based or density-based data from each sampling method. So the trawl sampling should allow density (per unit area or per plot) assessment of the catches. Will this be numerical or biomass?

I see no practical way that you can ensure complete treatment of the plot without trawling a larger area than the 200 by 1000m plots. The trawling time over 1000m at 2.1 knots is just over 15 minutes and even if you are lucky and the trawl reels stop feeding and start retrieving cable exactly at the ends of the 1000m pass there will probably be several additional minutes that the trawl is on the bottom due to the scope of the cable. Thus trawl catches will be considerably larger than that taken within the trawl plot. What methods are you going to use to assess the actual area trawled so that you can correct the catches to the standardized 200 by 1000m plot, or to a per-unit area basis.

Time interval between treatments and sampling for recovery:

Planned trawl sampling will only allow a single estimate of a one-year recovery with the trawl catch data.

Suggest trawl sampling on 5th year which will allow an additional single estimate of a 3 year recovery of an area sampled for at least 2 years with the selected trawl intensity. Planned sampling for the ROV, grab samples and micro-habitat surveys will include a single estimate of a one year recovery from trawling on an unfished habitat, and one estimate each of a one year, two year and three year recovery from trawling on a habitat that has been trawled for some number of times in the last 2 years.

Suggest adding at least one benthic survey at a 6-month interval to assess shorter-term responses and to get some feel for seasonal differences. Trawl fishers suggest that animals move inshore and offshore seasonally and this would allow assessment of this potentially important factor. If it is known that the fauna or micro-habitat have considerable seasonal variability the differences between the fall sampling periods may be interpreted differently than the case where seasonal variability is assumed to not occur. In addition, if the trawl treatment used is greater than one trawl pass per year it could be argued that a multiple year recover trajectory is unlikely to be achieved at such high trawling rates and it would therefore be important to determine how much change occurs in less than a year.

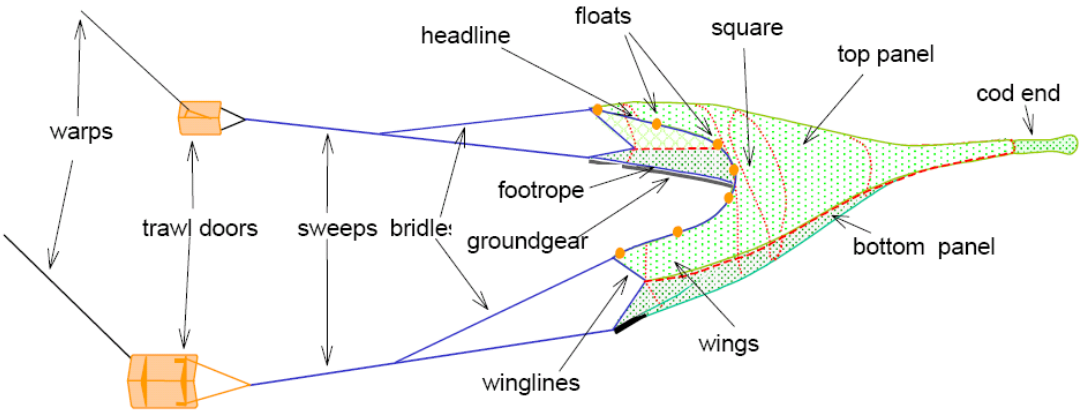
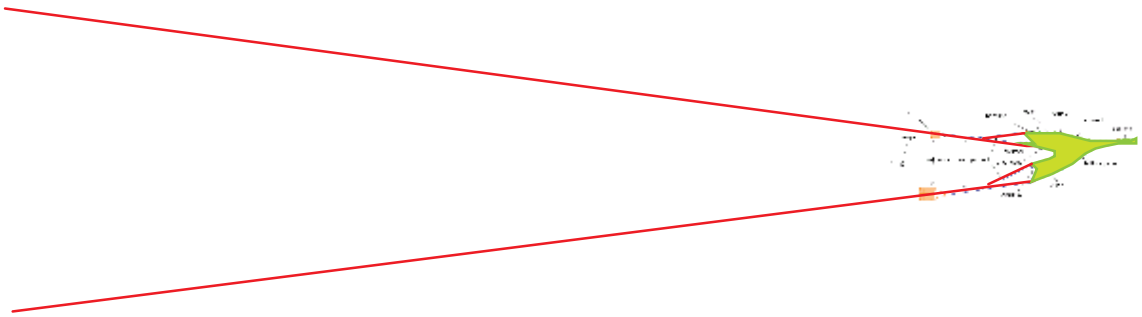


Figure 2. Diagram showing the basic design of bottom trawl gear.
(**Source:** http://www.seafish.org/upload/b2b/file/r__d/BOTTOM%20TRAWL_5a.pdf)

	Fms	M
Headrope (61')	10.2	18.6
Fishes (33')	5.5	10
Bridle	7	13
Sweep	75	137
B&S	80	146
Sweep width (15^{o})	52	95

Site depth	90	160-70	3.0 scope	270	490	2.5 scope	225	411

Trawl and mudlines as described in the text of the Survey Plan



According to Jan Mason the micro-blocks off of Avila where C. Halibut are fished received 4-12 hrs trawling per year. Area off of Morro Bay had no recent trawling and very little historical trawling.

The highly trawled area off of Santa Cruz received 10 to 100 hours of trawling per year.

A micro block is about 2.7 sq km
At 2.1 knots per hour your net, with an assumed door spread of 90 meters, one pass of the treatment plots would cover .09 sq km and take 15 minutes (i.e. 0.36 sq km per hour of trawling). A high-rise rockfish trawl with a 50m door spread at 3 knots would cover 0.28 sq km per hour and one trawl haul per year would be a rate of 9.6 hours of trawling per year.

Therefore if an entire micro-block had one trawl haul per year this would be a rate of 7.5 hours of trawling per year. (i.e. 2.7/0.36)

So one pass per year is much higher than the study area had historically,

One pass per year is about the rate ongoing in the Avila halibut trawling grounds

Using the above estimates of trawl door spread the historical trawling rates in the highest micro-blocks in the heavily fished grounds off of Santa Cruz would have been quite high. However, accurate estimation would require valid estimates of the trawl door spread of the historical rockfish nets and the trawling speed used. Probably the door spread was considerable smaller than the present flatfish gear; however the trawl speeds were probably higher.

Suggest that Mary get together with Jan Mason and some fishermen to more accurately estimate the trawling frequency in shelf, shelf break and slope habitats.

From:
Mary Gleason <mgleason@TNC.ORG>
View Contact
To:
Richard Parrish <clupeid@sbcglobal.net>

Cc:
James_Lindholm@csumb.edu

Richard-
Thanks again for your good comments. We are working on incorporating them. We like the idea of better justifying the directed trawl intensity and using two different intensities (lower then higher). We'll be looking for funding to try to do more sampling at 6months or something less than a year.
We'll keep in touch!
Mary