

Minutes of the Joint Scientific Review Group Meeting
January 8-9, 2008
Embassy Suites Hotel
Monterey, CA

January 8

Welcome and Introductions

Cottingham and Eagle made brief welcoming remarks, including an expression of NMFS' appreciation to SRG members for their willingness to serve this advisory role. Many members have served continuously since the SRGs were first established in 1994. All participants introduced themselves, and a sign-up list was circulated to record attendance (see Appendices)

Forney provided logistical information. Scott noted the death of John Heyning of the Pacific SRG and invited all participants to join the PSRG later in the day for a toast to John's memory.

Eagle provided a brief overview history of SAR performance by enumerating the number of stocks (reports) and stocks with or without abundance estimates and PBR calculations from 1995, 2002, and (draft) 2007. In Alaska, numbers of stocks and reports have remained fairly constant. Abundance of all ice seal stocks has never been estimated, and several Category II fisheries have not had observer programs, which results in incomplete mortality estimates throughout the state for most stocks. In the Atlantic, the number of reports decreased after 1995 because several beaked whale stocks were combined in a single report due to difficulty in identifying species during abundance surveys and observer programs – only combined abundance and mortality estimates were available. In recent years, abundance estimates in the Gulf of Mexico have exceeded 8 years of age and are no longer reliable for use in PBR calculations; thus, several stocks have an “undetermined” PBR. In the Pacific, numbers of stocks increased because stock structure of harbor porpoise along the west coast has been examined and revised. In 2002, SWC conducted the first cetacean abundance survey in the Hawaii EEZ, which resulted in an increase in number of stocks with abundance estimates and PBR.

Issues Related to Abundance Estimation and PBR Calculation

Incomplete implementation of PBR: Lowry presented concerns from members of the Alaska SRG that the PBR system does not work because many stocks have not been assessed, and range-wide assessments would be difficult and expensive because ranges are large, populations are widely distributed, and funds are limited. Lowry stated that abundance and mortality have not been estimated for ice seals stocks, and these stocks are important to Alaska Natives for subsistence purposes. Where there was a conservation issue known or suspected in the mid-1990s, there has been funding and interest to collect necessary information. However, funding was not available to collect baseline data for other stocks; therefore, there is no baseline for comparison now that

there is concern for stocks such as ice seals. Thus, NMFS and the Alaska SRG are in a situation where the status of stocks must be assessed with lots of gaps in data.

Lowry also noted that it may be more efficient to collect trend information than to obtain range-wide abundance estimates to determine whether or not stocks are increasing as a mechanism to assess whether the stock should be strategic or non-strategic. Beluga whales, specifically the Bristol Bay stock, was used as an example. There is a long history of aerial surveys in summer along with consistent data collection related to human-caused mortality. The aerial surveys did not produce abundance estimates; however, the resulting counts provide a basis for trend analysis. The stock seems to be increasing at 4-5% per year over a long period based upon the counts (without correction factors for detection and availability). Lowry concluded that trend surveys rather than a PBR calculation may be a more effective tool for assessing status. Lowry asked if lack of information for PBR and mortality was an issue in other regions.

Eagle noted that lack of information is a national issue, particularly for mortality incidental to fisheries. For example, there are about 50 Category I or II fisheries identified on the List of Fisheries, with reasonable, recent observer coverage on 12-15 – and the fisheries with highest levels of coverage are not for MMPA purposes, rather are industry-funded groundfish fisheries in Alaska (primarily Category III).

Inconsistency in Reporting PBR: The topic then switched to apparent inconsistency in use of PBR for declining stocks of marine mammals. Hawaiian monk seals and Cook Inlet beluga whales are small, declining stocks, and the SARs of these stocks note the PBR is “undetermined”. For North Atlantic right whales, PBR is zero, and for two other stocks (northern fur seals in Alaska and Western US stock of Steller sea lions) a PBR is calculated using the formula specified in the MMPA.

Baker discussed Hawaiian monk seals, noting that the narrative and quantitative parts of the MMPA’s definition of PBR do not match. The narrative definition states that PBR is the maximum number of animals that may be removed from the population while allowing the population to recover to or be maintained within its OSP. Using the statutory formula, one can calculate a value for PBR. However, human-caused mortality and serious injury is less than PBR and cannot account for the observed rate of decline in the population. Therefore, the basic assumption of the PBR approach (that a population would grow if it is depleted and mortality is less than PBR) is invalid in this case, and, given the small population size and decline, it would be inappropriate to calculate a number that could be considered a “safe” level of human-caused mortality.

Pace described the situation for North Atlantic right whales. From 1995 through 1999, there was a PBR of 0.4 reported in the SAR. It was changed to zero in 2000 based upon a recommendation from a working group at IWC that the stock appears to be decreasing, and there is an absolute urgency to reduce anthropogenic mortality, indicating that no lethal takes could be allowed if the stock was to recover. Barlow asked which element in the PBR was set to zero to achieve a PBR of zero. Kenney responded that the Atlantic

SRG did not recommend setting a single element within the PBR calculation as zero, rather the PBR should be zero without the element-by-element analysis.

Angliss reported there were three stocks of marine mammals in Alaska known to be declining. Cook Inlet beluga whales are a small ($n = \sim 350$) stock where there is a small removal for subsistence use. However, the number removed cannot account for the observed decline. Given the small population size and declining trend, there is a high risk of extinction, and the PBR was revised to “undetermined”. Western Steller sea lions and northern fur seals are also declining. The western stock of Stellers may now be stable or increasing with a population abundance greater than 30,000, and direct, human-caused mortality is low (slightly less than a PBR calculated with a recovery factor of 0.1). There are also many northern fur seals, and the resulting PBR is more than 14,000. Although the population is declining, human-caused mortality is very low and not likely to be a contributing factor to the decline, and the risk of extinction is considered low at this time. Therefore, NMFS uses default values and the current abundance estimates for Western Stellers and northern fur seals to calculate PBR levels.

In the discussion following these presentations, several participants asked about setting recovery factors (RF) and productivity (R_{max}) to zero to produce a zero PBR. The MMPA states that RF should be in the range 0.1 to 1.0; therefore, using zero would be inconsistent with terminology in the MMPA. R_{max} could be set at zero; however, the term, as it's defined in the MMPA, has been interpreted to be a theoretical maximum rate instead of an observed maximum rate. Young noted that the MMPA says that it could be “theoretical” or “estimated” rates. Eagle responded that it is still R_{max} that's being estimated not an observed or current rate of increase. He noted that Barlow and colleagues estimated R_{max} of harbor porpoise based on life history information and reported a range of values, depending upon which survivorship schedule one assumed for the species.

Barlow suggested that people are trying to force PBR to be the one and only tool for managing marine mammal stocks, but there are other tools available. Although calculating PBR is required by law, its use is limited to evaluating the impact of human-caused mortality. Therefore, in SARs, we could report PBR as required, but if another tool is more appropriate, the status of stock section could state that we are using another tool in assessing the status because... (and give the reason or reasons for the use of alternative tools).

A participant asked if managers are getting the information they need through the PBR system to adequately manage marine mammal stocks. In general the answer was affirmative; however, there are exceptions. As long as the major questions were related to human-caused mortality, the PBR approach generally works – except for the relatively few cases where no abundance estimate is available. The default values for R_{max} and RF are sufficiently conservative that in cases where mortality is below PBR, NMFS can conclude that human-caused mortality would not disadvantage the affected stock or stocks.

Discussion switched to observer programs, including comments related to focusing observer coverage in areas where there are hot spots and on shifting the effort from quantifying mortality (observers) to reducing mortality. NMFS participants responded that the agency has used stranding information to identify specific fisheries and target dates for observer coverage in the mid-Atlantic coastal areas. Also, AKC has offered to analyze available information and design a limited, local observer program in Southeast Alaska to estimate mortality of cetaceans in small areas rather than attempting a range-wide (or fishery-wide) mortality estimate.

Although the concept of reducing rather than quantifying mortality was suggested in the 1980s by the Harbor Porpoise Working Group, a group of scientists and representatives from the fishing industry and conservation organizations, more recent history through the Take Reduction Team process indicates much focus on the available data during team meetings. In general, the industry has been reluctant to agree to required measures to reduce mortality unless there was information showing such reductions were necessary and quantifying the extent to which mortality needed to be reduced.

Wynne noted that fishermen do not want to catch marine mammals because they do not want damaged gear or catch. They may be willing to work with the agency to reduce interactions. Forney responded that a fisherman may not see his catch of a single harbor porpoise as a conservation problem; however, 1,000 fishermen each catching a single harbor porpoise would be a problem. A value of PBR is that it is a tool to raise awareness of problems so they can be addressed.

Young added that such a use is one of the strengths of the PBR process, and where we have sufficient information to calculate PBR, NMFS should do so. She also noted other (other than direct mortality) anthropogenic factors may be a problem. Lowry reiterated that PBR does not work for these types of problems; therefore, NMFS should evaluate trends. Barlow responded that trends have not been useful historically due to lack of information. However, in more recent years, NMFS is accumulating 15-20 years of data on some stocks, and these could support trend analyses. He added that NMFS should be using trends not as a replacement for PBR but in addition to it. He noted that the Bristol Bay beluga stock is not a strategic stock, and it would be useful to evaluate the use of trend information as a management tool in cases involving strategic stocks.

Citing North Atlantic right whales as an example, Nowacek recommended the use of alternative data sets (e.g., acoustics) in specific locations to inform management and that NMFS incorporate such alternative data into the SARs – although it may not be easy to do so. Eagle noted it would be useful to evaluate the SAR guidelines to see whether there is something that would prohibit use of alternative data or it's a matter of no apparent place to discuss alternative data in the traditional SAR format. He added that NMFS has historically resisted requests to expand SARs to include various types of information. If SARs were expanded to include ever-increasing requests for additional information, the SARs could lose their purpose of being concise compilations of information. Therefore, if there is a recommendation for additional information in SARs, consider what limits in additional information would be useful.

Comment [MSOffice1]: I don't understand this. . .help?

There was a comment that when a stock's abundance estimates suggest fluctuations in trend, the stock should be strategic. Forney noted that marine mammals are long-lived, and for such species, it would be normal for trends to show fluctuations. The guidelines are not "one size fits all" rather they were designed to fit most stocks, particularly if there is not a conservation problem. For stocks that are consistently declining and there is not a fishery problem, these are cases where the PBR approach fails.

Simpkins asked how we can get data where none (or insufficient quantity or quality) exists – establish priority to get these data. NMFS remains in a "status quo" situation where effort continues to be directed at the same stocks. Mullin added that priorities seem to be driven by dead body counts. In the Gulf of Mexico, MMS and ONR have supported data collection to address recent conservation issues. He asked how we can get past the dead body approach.

Eagle responded that NMFS allocated its marine mammal funding in the mid to late 1990s when its priorities focused on developing and implementing the regime to govern marine mammal/fishery interactions. In 1997, Bengtson led completion of a document describing NMFS' process and criteria for funding marine mammal research and management. Funding was insufficient to address all information and management needs at the time, and since then, other issues (e.g., non-lethal and lethal taking incidental to Navy or seismic acoustic activities) have become growing issues, and funding has not substantially increased. NMFS has not formally revised its guidance for priorities for marine mammal funding. In addition, the issues that were a problem in the mid-1990s (e.g., fishery mortality of harbor porpoise along the Atlantic coast) remain a problem; therefore, funding was not reallocated to new issues.

Taylor suggested that NMFS has a lot of data on various fisheries and that NMFS could focus more effort on areas where there are no data, but there are the same types of animals and similar gear types in the water. She also noted that marine mammals that are outside a certain distance from shore are less likely to end up on the beach. In Alaska where there has been little observer coverage, perhaps NMFS could use comparisons to areas where information is available. Wynne noted that such comparisons or extrapolations are useful if you know what you're extrapolating. However, gillnet fishing in Alaska is different from that in New England. Thus, you need to know the fisheries in the specific area of concern rather than assume they are similar.

Lessons Learned from Monitoring Trends

Taylor presented lessons learned from monitoring trends in abundance of marine mammals, based upon a publication in the Jan 2007 issue of Marine Mammal Science. Taylor noted that human-caused mortality is low for several declining stocks of marine mammals and discussed the need to be able to detect such trends in the absence of observed or reported high levels of human or human-caused mortality. The authors reviewed SARs and evaluated the ability to detect a precipitous decline in abundance (50% decline in a 15-year period) for groups of marine mammal stocks using reported

survey frequencies and effort and a 1-tailed test with $\alpha=0.05$. Their analysis resulted in a failure to detect declines in 70% or more cases for large whales (n=23); beaked whales (n=11); small whales/dolphins/porpoises (n=69); and pinnipeds on ice (n=5). Ability to detect such a decline was about 95% for pinnipeds surveyed on land (n=13), and slightly less than 50% for polar bears and sea otters (n=6). Taylor suggested two ways to increase the power to detect these declines: first, to increase survey precision or frequency – both of which would require substantial additional funding. Second, change the decision criterion from 0.05 to a higher probability. She noted that using the second approach would increase the ability to detect trends; however, it would also increase the frequency of false positives (detecting a decline when the population is stable or increasing slowly). Taylor concluded that the current PBR approach for the SARs worked well to detect excess human-caused mortality, but it was poor at detecting declines due to factors such as habitat change/degradation or disease. She added that the analysis was impeded by inconsistent documentation of pertinent information, a lack of survey intervals reported in SARs, and other factors. Taylor concluded by noting shortcomings of the SARs. There is no performance metric for the quality of the SARs, therefore, no way to assess whether performance is improving or worsening. Factors contributing to overall quality of the assessment are also lacking, such as adequacy of survey effort, basis for identifying stocks, or how many stocks are not assessed at all.

During discussion, it was noted that NMFS prepared a stock assessment improvement plan, which was completed in 2004 (and is available on the Office of Protected Resources website). The plan describes specific criteria for evaluating the adequacy of a stock assessment and categorizes assessment of marine mammal stocks into one of three tiers of adequacy. It was suggested that availability of the plan was not widely known.

Fairfield asked about frequency for updating information and noted that peer review is an important part of making information available for management use and that unpublished information was incorporated into SARs. Taylor noted that new abundance information may not be accepted for publication in peer-reviewed journals but was important for stock assessment. There is also a trade-off between peer review and timeliness because it may take years for information to be published after the data are collected.

Pace noted that within the NEFSC, there is a peer-review process for the SARs. It was added, however, that SARs do not contain descriptions of the methods used for many estimates – rather the SARs presented brief summaries of the results of pertinent analyses.

Eagle stated that at the last joint SRG meeting, Phil Clapham proposed a mechanism to classifying levels of review for information used in management (available as an appendix to the report of the 1999 meeting). At that meeting, there seemed to be an agreement about the need for a document fully describing various estimates used in the SARs, and these documents would be discussed with and reviewed by SRGs as part of the SAR process. Such a requirement for source documents has not been incorporated into guidelines for preparing SARs.

Palka added that documentation was a potential recommendation. Reports for analyses could be prepared and subjected to peer-review, perhaps among centers or other scientists, but not as formal as that of a journal article. Such an approach would provide necessary review but would address the time element as well. Forney and Garrison responded that the NOAA Technical Memorandum series are subjected to review by peers within NMFS and may be published in a timely manner.

Lowry noted that SARs do not have to include everything about a stock but should be brief documents that focused on critical elements. SARs then could be a tool for determining what really needs to be done and achieving the resources to do these tasks. Simpkins asked if the SARs let us know where we are doing OK and where we are not. Taylor noted that trends can be used to identify where attention needs to be focused. Among other things trends help you interpret other available data. She noted that we could do a similar assessment with PBR or other parameters that she and her colleagues did with trends.

Kelly acknowledged the value of the paper and noted that we could look at both types of data (PBR and trends). He added that there is another point of view for status of stocks in Alaska because Alaska Natives used marine mammals as consumptive resources. Over-protection and under-protection have different consequences.

Mathews asked if Taylor had plans to do additional analyses to evaluate trends in fishery mortality. Taylor responded that she had no such plans and noted that someone could review mortality and quantify progress in particular areas.

Ralls asked about the process for SRGs making joint recommendations, and the group discussed options for compiling and making recommendations. It was decided that the organizers would compile a list of potential recommendations, and the SRGs would reserve a period of time at the end of presentations and open discussion to evaluate potential recommendations.

There was a brief discussion on the process for SRGs making joint recommendations.

Current Guidelines for Use of Old Abundance Estimates

Taylor noted that current guidelines state that we should not use abundance estimates to calculate PBR after the supporting survey information is more than 8 years old. She added that there may be other mechanisms to account for lack of reliability of old abundance estimates, such as ramping down the PBR over time, and that PBR should not be the sole impetus for collecting abundance data. She suggested it would be helpful to re-open discussion of this issue when the guidelines are next revised. The original guidelines had recommended a reduction in PBR over time by reducing the recovery factor progressively until it reached 0.1; however, at the GAMMS workshop in 1996 (and reported in Wade and Angliss, 1997), participants recommended the current approach of PBR being undetermined after 8 years.

Simpkins suggested that the CV of the estimate should be increased over time to reflect the decreasing confidence in the accuracy of the estimate; increasing the CV would reduce PBR in a logical and appropriate manner as abundance data age. Garrison added that for beaked whales, estimates are not reliable after 6 years and suggested that reliability of PBR based upon old abundance be evaluated on a case- or stock-specific basis. Barlow added that the MMPA defines Nmin to provide a level of assurance of the data, and Nmin could be reduced over time as the confidence limit widens over time.

Kelly asked if that meant there could be no subsistence taking of ice seals because we had no abundance data. It was noted that subsistence use of marine mammals is not governed by the PBR approach and that there is a complex, formal process for regulating subsistence take of marine mammals by Alaska Natives. Another participant added that designating stocks as strategic could help focus resources on needed information, noting that ice seals are not designated as strategic. Eagle responded that strategic status, for species other than depleted, threatened or endangered stocks, was a function of direct human-caused mortality and is not affected by threats or declines from indirect human activity or natural factors. Lowry stated that when stocks are not designated as strategic, the inference is “no problem”. He expressed concern that there should be guidelines to assess stocks if something is going on.

Young cautioned that nuances regarding mechanisms for showing inadequate information (e.g., Nmin going down due to age) would not be noticed by important constituencies, and those providing resources may not pay attention. She noted the need for a rationale for labeling stocks as strategic and that strategic status is an important tool for establishing priorities. She also asked when a stock would become strategic if information to assess the impact of human-caused mortality (abundance and mortality estimates or trends) is not available. After additional comments about labeling stocks as strategic when information is not available for long periods, Eagle noted that the report of the first GAMMS workshop (Wade and Angliss, 1997) contained an explanation why abundance estimates more than 8 years old should not be used to calculate PBR unless there was additional information indicating the trend is stable or increasing.

Estimating and Reporting Mortality

After a break for lunch, the meeting resumed with a presentation and discussion on mortality estimates. Scheduled discussion topics for which there was no formal presentation included low levels of observer coverage (with no observed take), no observer program (stranding and fisher self-reports for data), and distinguishing fishery mortality from other human-caused mortality in the SARs. Palka noted that our goal in estimating mortality is to calculate an accurate estimate with reasonable precision. Estimates are used, in turn, to evaluate the status of stocks relative to human-caused mortality. The goal is hampered by several challenges, including takes being rare events, small population sizes (and PBR) of many stocks, low levels of observer coverage in many fisheries – especially those where numerous small boats comprise the fleet, and changes in fishery practices. Palka described a sequence of events for Atlantic coastal

bottlenose dolphins and the use of mortality estimates in developing and assessing a take reduction plan. Palka suggested several model approaches to combine estimates obtained under the dynamics and constraints of commercial fisheries.

Garrison suggested that we could use a more sophisticated comparison of take to PBR, including the use of confidence intervals for mortality estimates. Palka noted that such approaches had been suggested in the past and rejected. Part of the problem is that for many fisheries, mortality is not estimated from an observer program producing information for an estimate; rather, mortality estimates consist of a minimum number derived from reports of stranded or entangled mammals (counts). Some fisheries are classified by comparison to other fisheries for which there are mortality estimates. Palka noted that NEC had tried to incorporate stranding data in the past when supporting information came from a reliable source with multiple people contributing to determining the cause of death.

Barlow noted that in many cases, strategic stocks were not necessarily those stocks with large numbers of mortalities; rather, we see a few mortalities from rare species or those with little information (e.g., beaked whales). Forney asked Palka if they could characterize bycatch with models if there was a short-term program to obtain sufficient data. Palka responded that high levels of observer coverage for short period could allow the center to model bycatch.

Simpkins suggested that observer coverage could be reallocated to focus on hotspots, which would help reduce uncertainties in some fisheries. It was noted that AKC had offered to help identify hotspots in SE Alaska fisheries for such purposes. Palka also noted that NEC had investigated such approaches; however, many observer programs have multiple species to consider (e.g., bottlenose dolphins and harbor porpoise along the east coast), and hotspots may be different for each species.

Inconsistency in Strategic Determinations

The discussion of apparent inconsistencies in labeling beaked whales as strategic stocks was moved from the second to the first day of the agenda. The issue was added to the agenda because it had been pointed out that beaked whales in the Atlantic were considered strategic, but those in the Pacific and Alaska were non-strategic – yet there was no direct evidence of mortality in either case. Waring noted that there used to be mortality of beaked whales in the Atlantic drift gillnet fishery exceeding PBR of the combined stocks. After the fishery was closed, NEC considered changing the status back to non-strategic. When the Center was discussing this change with the Atlantic SRG, there was agreement that the beaked whale stocks should remain strategic because the population sizes were generally small, there was little information upon which to base a decision, and beaked whales were vulnerable to acoustic activities in the ocean.

Angliss noted that beaked whales SARs in the Alaska region have not been updated since 2006 acoustic activities in the Gulf of Alaska; thus, these SARs do not consider potential mortality due to acoustic activities. Forney added that SARs for beaked whales in the

Pacific region acknowledge acoustic activities as a potential threat, but the stocks are not considered strategic.

Discussion following the brief statements about the approaches used for strategic determinations in the three regions was focused on uncertainty because many sources of human-caused mortality have no observer programs; therefore, resulting mortality or serious injury may not be documented. Forney added that such sources are comparable to unobserved fisheries where we suspect there is incidental mortality, but it is not documented. It was noted that for stocks other than Atlantic beaked whales, there are few, if any, cases where minimum mortality estimates below PBR have resulted in a strategic determination because we suspected that actual mortality levels were higher than documented and may exceed PBR. Palka stated that NEC has maintained stocks (e.g., harbor porpoise) as strategic although current mortality was below PBR because the trend in mortality was starting to increase. Forney and Fairfield noted that some stocks in the Pacific and Atlantic have switched between strategic and non-strategic status because abundance or mortality estimates fluctuate. Grampus was noted in particular because they are rarely seen, but occasionally there is a fairly large mortality estimate.

Scott reviewed the definition of strategic and suggested the need for a category such as “potentially strategic”. He asked how we deal with uncertainty in evaluating status. Eagle responded that in the past, we have considered mortality not to have occurred unless it is documented. An alternative to that history would be to switch to a precautionary approach. Barlow confirmed that we have consistently used an evidentiary approach in the Pacific region to report mortality and determine status.

When discussion returned to beaked whales and acoustic activities, Forney asked if there were documented deaths of beaked whales to indicate a minimum mortality level, and Waring responded that there were none. It was pointed out that cause of death could not definitely be determined as due to acoustic sources in the few animals discovered. Garrison added that the only documented case of mortality attributed to acoustic sources was the 2001 event involving beaked whales in the Bahamas and that virtually all stocks would become strategic if NMFS used a precautionary approach in evaluating uncertainty abundance and mortality with respect to the status of the stock.

In discussing the use of stranding information in SARs, Garrison noted that there were high levels of strandings in the SE; however, evidence on stranded animals rarely allows assigning cause of death to a specific fishery even when there are signs of fishery interactions. Forney added that there are few nearshore fisheries along the Pacific coast; therefore, stranded animals with distinct line marks usually are assigned to a specific fishery; however, in cases where evidence is less precise, the mortality is included in fishery mortality but not assigned to a specific fishery. Rowles added that the current stranding database has a field to indicate whether the mortality was attributable to “human interaction” but does not contain a field for “cause of death”. A future revision to the database will provide such a field. Entries would be subjected to a review process and will be determined by a pathologist. She noted that the program is cautious in assigning cause of death, and many cases will be labeled “cannot be determined”. She

also added that even when fishery interaction is determined as the cause of death, assignment to a specific fishery will be rare.

Serious Injury Technical Workshop

Andersen presented information regarding a workshop NMFS convened in September 2007 to provide guidance on distinguishing serious from non-serious injuries of marine mammals. Serious injuries are included in SARs, where human-caused mortality and serious injury must be summarized by source, and in classifying fisheries under MMPA section 118. If total human-caused mortality and serious injury of a stock of marine mammals exceeds the stock's PBR level, then the stock is labeled "strategic" even if the stock is not designated as depleted, threatened, or endangered. Andersen noted the objectives of the workshop were to review the recommendations of a workshop held in 1997, review information obtained since that workshop, and discuss use of and needed modifications to the guidance NMFS currently uses to distinguish serious from non-serious injury.

The workshop consisted of two sessions: (1) a 3-day open session that included Federal and state participants as well as invited experts in pertinent fields, and (2) a 1-day closed session that included only government officials. The open session was designed to exchange information related to injuries to marine mammals, the likelihood that marine mammals would die from those injuries, and factors that may affected a marine mammals probability of death from an injury. In the closed session, officials recommended that NMFS retain the current regulatory definition of serious injury (an injury that is likely to result in the death of the marine mammal), revise the existing guidance, and prepare a formal policy statement on distinguishing serious from non-serious injury, which would include clarification about "likely to result in death". The closed session resulted in a matrix of injury types by taxonomic grouping (large whales, small cetaceans, and pinnipeds) to serve as an initial guideline to evaluate injuries. The matrix provides guidance to categorize injuries as not likely to cause death, likely to cause death, or gray area (in which case-specific factors must be examined or the outcome is unknown).

Wells then repeated for the SRGs his presentation at the serious injury workshop, summarizing his findings related to human-caused injuries obtained during his long-term (>30 years) study of bottlenose dolphins in Sarasota Bay, FL. Wells reported that individual bottlenose dolphins were long-term residents of the bay, about 150 dolphins used the bay on a regular basis, the oldest known-age individual is 57 years old, and there was a spike in mortality from fisheries in 2006. Records of injuries came from stranding information, photo id, rescue and rehabilitation, and captures and release for health assessments.

Major types of injuries were ingestion of gear, entanglements in fishing gear and debris, and vessel collisions. Individuals may die from or survive injuries in all types. Wells also noted that tourist interactions (e.g., feeding dolphins) is increasing and that such human behavior may have a role in the dolphins' susceptibility to injury and other conflict due to depredation of bait or catch. Wells also reported that females with

entanglement scars have survived entanglement and successfully reproduced. He noted that dolphins may survive amputation of flukes; however, it was not clear how such damage may affect thermoregulation.

Mathews commented on the scope of the dataset and asked if Wells could assess life-time reproductive success of females with injured dorsal fins. Wells said that he could compare those females with uninjured females but did not know the reproductive histories of injured females before their injury.

Wells then responded to several questions from the audience, noting the following. One female had been hooked in the mouth, but her death was attributed to a sting ray barb. Most hookings involved “J” hooks, but some circle hooks have been found in dolphins. He could not comment on the speed of vessels injuring dolphins because the interactions were not observed; however, most injuries appeared attributable to small vessels operating at high speeds. Most injuries occurred in shallow waters during the breeding season, and there were spikes of injuries near holidays, such as July 4. His study knows the fate of about one half of the dolphins that are no longer seen in the bay.

General discussion on serious injury continued on topics such as the likelihood that revised guidelines would result in more or fewer serious injuries – thus, changing the status (strategic/not strategic) of some stocks; accounting for injuries that are not documented; and the outcomes of injuries resulting from hooks embedded in the mouth. Forney noted that one apparent change from the previous guidance is that the amount of trailing gear involved in a hooking or entanglement may be less than previously considered to cause a serious injury, and future cases of trailing gear could result in more cases called “serious injuries”.

There was considerable discussion about resolving cases that fell into the “gray area” category. One approach to resolve these cases involved formal risk assessment procedures by personnel trained in risk assessment. Fairfield noted there had been much discussion at the workshop of capture myopathy following disentanglement of marine mammals from gear.

Simpkins asked whether FWS staff were likely to use the guidelines resulting from NMFS’ workshop. Valade noted that lots of manatees were injured due to interactions with humans and that he would be interested in the results of the workshop. Andersen noted that there was a presentation on manatees at the workshop, but the manatee expert noted there were features of manatee anatomy and physiology that would prevent manatee use as a model for survival of injury to other marine mammals. Carswell noted that observed injuries of sea otters were rare, but additional guidance may be helpful.

Making Recommendations

Discussion at the joint SRG meeting then turned to potential recommendations to NMFS and FWS. After several potential recommendations had been identified, Eagle agreed to record these, duplicate them, and distribute them to SRG members during the following

day's session so that the SRGs could discuss which recommendations they may want to make on a joint basis. The list of potential recommendations is attached as an appendix to this report.

January 9

Transboundary Stocks

Simpkins introduced the topic of transboundary issues by describing the types of issues encountered when stocks cross boundaries, summarizing NMFS' SAR guidance for addressing transboundary stocks, and introducing other speakers who described the application of NMFS' guidance in specific examples. When stocks cross US boundaries (e.g., between the US EEZ and international waters; between the US EEZ and Canadian or Mexican EEZ), these stocks encounter activities under different regulatory regimes, their movements may be predictable or unpredictable, and often the structure of the populations are not adequately understood.

Of particular concern is that the MMPA governs the interactions of marine mammals and human activity within the US EEZ and of marine mammals and US citizens in international waters. Furthermore, the MMPA contains no specific requirement to identify and assess the status of marine mammals stocks in international waters; therefore, stock structure, abundance and mortality are often unknown or only partially understood (e.g., US fisheries in international waters are subject to observer coverage and reporting under the MMPA, potentially resulting in sources of information to assess direct human-caused mortality). In international waters, US fisheries may be only a small part of the total fishing effort – and, consequently, may account for only a small part of the incidental mortality.

NMFS' guidelines state that the ideal way to govern interactions with transboundary stocks is through international agreement, with bycatch or other human-caused mortality and abundance (thus, PBR) based upon information collected throughout the range of the affected stock or stocks. For less than ideal cases, the guidelines state that PBR of transboundary stock should be based on the proportion of the stock within the US EEZ (non-migratory stocks) or reduced by the proportion of the year that the stock is outside the US EEZ (migratory stocks).

Simpkins ended his talk with questions to guide discussion or recommendations from the session: (1) How (or how well) is NMFS implementing its current guidelines, and (2) Are any adjustments needed in the guidelines? NMFS scientists then described specific case studies involved in apparent inconsistencies to explain why each case is handled as it is..

Palka reported on two transboundary stocks in the Northeast Region: harbor porpoise, Gulf of Maine/Bay of Fundy stock and Atlantic white-sided dolphins, Western North Atlantic stock. In the recent past, harbor porpoise information on abundance and mortality have been available throughout the stock's range in the US and Canada.

Accordingly, this PBR and status of this stock is based upon range-wide information and approaches the “ideal” situation in the SAR guidelines. Since 2002, however, mortality estimates in Canada have not been available. NMFS continues to use the last available year of mortality as the best estimate of mortality in Canada; therefore, the abundance, PBR and mortality estimates remain range-wide. Palka noted that there is a mixing of stocks of harbor porpoise in the mid-Atlantic area seasonally, and all harbor porpoise mortality in the mid-Atlantic area is assumed to be of the Gulf of Maine/Bay of Fundy stock.

Atlantic white-sided dolphins occur in waters off the US and Canadian coasts. In some years they are concentrated within the EEZ boundaries and are sighted frequently during surveys. In other years, oceanographic conditions are such that these dolphins are outside the survey area, and abundance estimates are lower; thus, annual variability in abundance is highly variable. NMFS uses a mean abundance estimate to account for this inter-annual variability, and fluctuations in PBR are dampened somewhat in this approach.

Mortality estimates are available from major US fisheries in US waters and from one fishery in Canada. These are all included in the total mortality estimate. These mortality estimates are compared to a PBR computed from the mean abundance estimates to determine status of the stock.

Forney described the situation for two transboundary stocks of cetaceans along the US west coast. Distribution of short-finned pilot whales (CA/OR/WA stock) and long-beaked common dolphins (CA stock) are influenced by water temperature within the US EEZ. They are generally found within warmer tropical waters, and the US EEZ off the coast of California is a mixing area for temperate and tropical waters. When warm waters extend into the US EEZ, the distribution is more concentrated there, and abundance estimates during these years may be much higher than years when waters are cooler. Thus, there is a large degree of inter-annual variability in the abundance and, thus, PBR estimates.

Both stocks are taken in relatively low levels in US fisheries and are taken in Mexican waters. As PBR levels fluctuate from year to year, the status of the stock changes from non-strategic to strategic as variable abundance levels influence PBR.

Forney also discussed issues related to stock structure and estimating abundance, PBR and mortality of false killer whales in the North Pacific. The complete stock structure (range-wide) is unknown. Genetics information shows there is a stock in the near-shore waters around the main Hawaiian Islands. Within the Hawaiian EEZ there is another (pelagic) stock that ranges from about 50 nm from the main islands to an unknown extent that crosses the EEZ boundary into international waters. There is another stock that has been identified within the EEZ surrounding Palmyra; however, the range boundaries of this stock are also unknown.

The Hawaii based-longline fishery operates within the EEZs surrounding Palmyra and the Hawaiian Islands and in international waters outside both of these EEZs. The US

fishery is the only one operating within the EEZs; however, foreign fisheries operate in international waters – where US effort is only a small part of the total effort.

For managing the Hawaii-based longline fishery, NMFS estimated the abundance of false killer whales in the EEZs surrounding Palmyra and Hawaii and calculated PBR in these areas. Mortality and serious injury of false killer whales incidental to longline fishing within the Hawaiian EEZ exceeds the PBR based on surveys in this area. Accordingly, the Hawaiian stock of false killer whales is a strategic stock, and the longline fishery is a Category I fishery. There are two components to the fishery, shallow-set effort targeting swordfish and deep-set effort targeting tuna. Most marine mammal takes are in the deep-set component; however, sea turtle takes are concentrated in the shallow-set fishery. Observer effort is supported through funds appropriated for sea turtle conservation, and 100% of the shallow-set component is observed. There is a high level of observer coverage in the deep-set component as well.

Incidental mortality and serious injury within the Palmyra EEZ is less than the PBR for false killer whales estimated for that area; therefore, the Palmyra stock is considered not strategic. Stock structure, abundance, and mortality of false killer whales (incidental to foreign fisheries) in international waters are unknown.

Barlow then described the approach used for PBR calculations and status (strategic vs non-strategic) assessment of blue and humpback whales off the US west coast. Both stocks of whales are migratory and found seasonally within the US EEZ. Although the ideal approach would be to manage interactions through international agreement with Mexico, such agreements are not in place. Therefore, we estimate abundances within the EEZ, from which preliminary PBR levels are calculated. Then the PBRs are reduced by 50% in accordance with SAR guidelines for migratory transboundary stocks that spend half of their time within the US EEZ. If other countries followed the same approach for these and other migratory stocks of marine mammals, conservation/protection would be equivalent to US mortality from a stock that resides entirely within in US waters.

Simpkins then posed several questions to the SRGs to help guide discussion for developing recommendations to NMFS related to the various approaches used to govern interactions with transboundary stocks.

In response to questions related to international agreements or organizations (e.g., International Whaling Commission) as mechanisms for international cooperation in marine mammal conservation, Barlow noted that IWC does not consider small cetaceans in their efforts to govern whaling. He also stated that US/Mexican agreements related to the tuna/dolphin conflict had a negative history and that he did not consider additional agreements likely in the near future.

Scott initiated discussion about mortality estimation by asking whether NMFS scientists could match mortality estimates and abundance during years when data for both estimates were available or whether NMFS must use averages. Forney noted the potential for mismatch; that is, calculating PBR for a year when transboundary stocks were not

concentrated in US waters when multi-year average mortality rates indicated mortality was occurring. Garrison noted that habitat models may be a good approach to incorporate dynamic distributions of marine mammals and fisheries.

Scott concluded that it appears NMFS is able to monitor mortality on the US fleet and where needed has a mechanism (Take Reduction Plans) to address such mortality. Garrison responded that the current situation results in the US fleet taking most of the conservation burden in some cases where transboundary stocks interact with many nations' fisheries in international waters, and such a result is unsatisfactory. He asked if we wanted to force the US fleet to bear the burden of conservation actions if international bycatch rates are high. Forney asked whether the SRGs could suggest a better approach to address these transboundary issues.

Health and Stranding Response Program

Rowles provided background information about the health and stranding response program, noting the requirements in the MMPA and the elements of the program for data collection and analysis and for response to stranded or entangled marine mammals. She said the purpose of health surveillance was to monitor such things as effectiveness of management actions, continuing threats, and new factors affecting marine mammals. Major data sources included observations by network members, remote biopsies, live capture/release activities, and stranding events – particularly those related to unusual mortality events.

What types of data would be useful in SARs and for SRG deliberation? Garrison noted that more complete stranding network coverage that could attribute deaths or injuries to specific fisheries would be an asset. Rowles responded that she understood the desire for such information; however, it would require proper training for network participants and acknowledged there would remain gaps in information. She noted that current members are trained to ascertain whether human interactions were factors in the deaths of stranded marine mammals, but additional trained personnel in histology and histopathology were needed. The program now has real-time web-based consultations with trained individuals for consultations; but standardizing terms (and their interpretation) and ensuring quality assurance remain problems to be resolved. She also said that unless fishing gear was attached to the animals, the program could not link mortality or injuries to a specific fishery. The stranding network was prepared to ascertain injury types; however, attributing the death to a specific fishery would require more interactions between the program and the region or center staff more familiar with local fisheries.

Rowles noted that collaboration between the stranding and observer programs would enhance information collection and analysis; however, such collaborations have not been accomplished.

Discussion then focused on contaminants and risk assessment and on efforts to obtain and analyze more samples from marine mammals taken in fisheries.

Stock Assessment Improvement Plan and Budgets

Eagle described NMFS' protected species stock assessment improvement plan to the SRGs. The plan, completed in 2004, includes the biological parameters required to assess status of stocks (e.g., stock structure, abundance, mortality, etc.) and levels of information quality and quantity to evaluate the quality of assessments for marine mammals and sea turtles. This plan describes resource requirements necessary to achieve two tiers of excellence in stock assessment. Tier I includes the resources necessary to obtain maximum information from existing surveys. Tier II includes the resources necessary to obtain information for adequate assessment of stocks for completing annual SARs. The team preparing the plan did not include costs of achieving these levels of excellence; however, the plan estimated the expertise (FTEs), ship time (Days at Sea) and aircraft time (flight hours) to achieve these tiers of excellence. If you assume some values for these resources (\$100K for an FTE, \$10K for a Day at Sea, and \$1K per flight hour), the total cost to achieve the Tier II level for marine mammal and sea turtles assessments is approximately \$100 million per year in additional funds.

NMFS is operating under a continuing resolution based upon the FY2008 appropriations; therefore, FY 2008 funding is the best estimate for upcoming support. The 2008 budget included an additional \$3 million for marine mammal stock assessment; however, this increase was offset by the loss of funding in recent years that had been appropriated by Congress but had not been included in the President's budget request. These losses included \$5 million in a Marine Mammal Initiative and \$2 million for bottlenose dolphins. The change from FY 2007 to FY 2008 is a net loss of about \$4 million to the marine mammal program. The Marine Mammal Initiative supported marine mammal programs nationally and included support for assessment, Take Reduction Plan implementation, permitting, and the health and stranding response program. The bottlenose dolphin funding went primarily to the Southeast Center and Region and was a major part of their program support. The increase in stock assessment funding can partially offset the losses to the Southeast Center and the health and stranding response program, but would not help management efforts in the regional office or headquarters.

Climate Change in the Arctic

Kelly gave a presentation based upon his long experience in research on Arctic marine mammals and changes in climate due to human activity. He described the importance of sea ice to various marine mammal species and noted that extent of sea ice is shrinking. When the sea ice completely disappears seasonally, there will be an opening for economic opportunity, including shipping through Arctic sea lanes, commercial fishing and other activities. Such economic gain will come at a very large ecological cost, and he emphasized that ring seal pups are dependent on sea ice and subnivean dens. The recent ESA listing of polar bears focused attention on the threat of climate change to marine mammals in the Arctic; however, how many others will have to be listed? Kelly suggested that the impacts of fishery caused mortality of marine mammals in the area are likely small compared to the impacts due to climate change. He asked if we should

should be focused on the PBR process and fisheries interactions when such takes likely will be overwhelmed by threat from loss of sea ice.

Discussion was initiated about specific examples of animals shifting habitats or other life-history parameters with Ballance noting that although no such shifts may have been documented for marine mammals, but have been in sea birds. Brix questioned whether the legal tools for marine mammals are appropriate for addressing such global issues as climate change. Bengtson added that we are missing important information by failing to monitor now and in the recent past and suggested we need to think about how we would manage or mitigate impacts to marine mammal populations.

Kelly noted that we have trouble managing interactions with fisheries and that it will be even more difficult to manage for loss of sea ice. We still do not understand what the local environmental changes will be; thus, mitigation strategies will be difficult to plan. Simpkins listed several things we can manage, especially human behavior. We can address new activities in the Arctic and ongoing activities, such as oil and gas development. We need to understand the interactions of individual stressors to evaluate overall impact. Kelly concluded that our resources are limited; however, government efforts must be the first line of action. Lowry added that future reauthorization of the MMPA and ESA may be mechanisms to bring attention to these problems for developing novel ways to address them. Mathews suggested a workshop with experts who have looked at climate changes and other who understand species biology to synthesize a paper or report.

Large Whale Recovery Plans

Kennedy led discussion related to the apparent lack of oversight for the agencies' implementation of recovery plans. He noted that once recovery plans had been drafted for right and humpback whales, the recovery teams had been disbanded. He questioned whether the SRGs would be appropriate forums for monitoring implementation of these plans. Simpkins noted that the Marine Mammal Commission monitored implementation of plans and the SRGs should be aware of processes for monitoring agency efforts. Valade noted that the agencies update plans periodically and are required to review the status of all listed species on every five years.

Following this discussion, the open meeting was adjourned. The SRGs met in a closed session to discuss the list of potential recommendations that had been distributed earlier in the day.

Appendices: List of potential recommendations; agenda; meeting participants

Joint SRG Recommendations draft

Develop alternative strategies for data collection (e.g, trends) where needed

Include a measure of quality for key parameters in SARs

Pursue ability to set recovery factors to zero

Include dates of surveys and CVs for abundances used to calculate PBR in SARs (TCE note: in 2007 SARs, all SAR summary tables include CVs for the abundance estimate when Nmin is derived from a statistical model rather than count – action from a previous recommendation and agreement among all SAR authors)

Convene a working group to analyze performance of alternatives for Nmin in declining populations

General discussion and perhaps a recommendation on documentation for estimates used in SARs

Specific recommendations: (1) HQ (or appropriate group) compile and make available all documents cited in SARs; (2) Pers. Comm. References for key PBR parameters inappropriate; (3) strict adherence to (2) could result in omission of important, late-breaking information affecting status of stock

Consider biennial vs annual updates to SARs (additional comments related to using fishery stock assessments as a model)

Put a paragraph in each SAR entitled “Priority of Stock Assessment Improvement Needs”

Consistency in interpretations of similar data availability for “strategic” vs “non-strategic” determinations (beaked whale discussions as an example)

Agenda: Joint SRG Meeting

Embassy Suites Hotel
Monterey (Seaside), CA
January 8-9, 2008

Day 1: January 8, 2008

0830 - Welcome and introductions; Finalize agenda

0850 - Overview of SAR performance (Tom Eagle)

- Summary of SAR info (Summary Table # stocks, abundance, PBR, strategic status: 1995, 2002, draft 2007), observer data for mortality estimates

0900 - Abundance Estimation and PBR calculation – Introducing the issues

- Incomplete – many stocks have no abundance or PBR (AK SRG rep)
- Range-wide abundance expensive (Do we really need a full PBR estimation? Do we have a choice, given the MMPA language?) – (AK SRG rep)
- Consistent calculating/reporting PBR for declining stocks
 - Case studies (why we do what we do)
 - Monk seals – undetermined (Jason Baker)
 - North Atlantic right whales – zero (Richard Pace)
 - Cook Inlet beluga – undetermined; Northern fur seals, Steller Sea Lions – PBR calculated. (Robyn Angliss)

0930 – Discussion of abundance topics

1030 - Break

1045 – Issues stemming from Taylor et al. 2007. Lessons learned from monitoring trends in abundance of marine mammals. *Mar. Mamm. Sci.* (Jan 2007) (Barb Taylor)

- History of abundance estimates in Population Size section
- Background documents for information in SARs
- Detecting declining trends: Type I vs Type II error

1100 – Discussion of issues Barb raised

1145 Current guidelines for abundance: do not use for PBR calculations after 8 years. Do we need to revisit this guideline? (*See p. 23 of Wade and Angliss (1997) for a brief rationale for the current guideline*)

1215 – Lunch

1330 - Estimating and reporting mortality

- Mortality estimation from small numbers of observed takes: consistent approach – Palka and Rossman (10-15 min presentation with 30 min discussion)

1415 – Additional uncertainties in mortality estimation (Discussion – no formal presentation)

- Low levels of observer coverage, no observed take
- No observer program, Stranding information, fisher self-reports
- Distinguishing fishery mortality from other human-caused mortality in SARs – implications for section 118 (Where to bin mortality from rec fisheries, derelict gear, fisheries-related research, foreign fisheries, and shooting)

1500 – Break

1515 - Serious Injury Technical Workshop

- Update from the Sep 2007 workshop, best management approach during review of guidelines (Melissa Andersen) – 15 mins
- Re-capture history (fate) of bottlenose dolphins in Sarasota Bay post injury (Randy Wells) - 15 mins
- Discussion

1630 - Consistent reporting of status (Strategic vs Non-strategic)

- Case studies: Beaked whales in ATL (strategic) vs PAC and AKA (non-strategic)

1700 – Adjourn for the day

Day 2: January 9, 2008

0830 - Transboundary stocks (Mike Simpkins)

- Issues: Stock structure, Abundance/PBR, Mortality
- Existing guidelines – what do they say?
 - (Existing guidelines - see p. 4; Wade and Angliss (1997), p. 13-15)
- Apparent inconsistent application: Case studies (Why we do what we do)
 - GME/BOF harbor porpoise – White-sided dolphins (Debi Palka)
 - West Coast pilot whales – Long-beaked common dolphins (Karin Forney)
 - Pacific Islands false killer whales (Karin Forney)
 - Migratory whales (Jay Barlow)

0850 – Discussion of transboundary stocks issues

0950 - Incorporating health assessment information into SARs (Teri Rowles)

1015 - Break

1030 - Outlook for greater level of effort in the intermediate future: Protected Species Stock Assessment Improvement Plan, 2008 President's budget (We may have the appropriation by the meeting – if so, we'll use it.)

1100 – Climate change in the Arctic – Brendan Kelly

1130 - Large Whale Recovery Plans: who's monitoring implementation without a recovery team? (Bob Kenney)

1200 Adjourn Joint meeting for lunch – After lunch – regional SRG meetings

List of Participants

Joint SRG Meeting, Jan 8-9, 2008, Monterey, CA

Alaska SRG

Lance Barrett-Lennard
Brendan Kelly
Lloyd Lowry
Beth Mathews, Chair
Grey Pendleton
Jan Straley
Robert Suydam
Kate Wynne

Atlantic SRG

Don Baltz, Chair
Bob Kenney
Bill Lang
Jim Mead
Doug Nowacek
Dan Odell
Randy Wells
Sharon Young

Pacific SRG

Hannah Bernard
Robin Brown
Mark Fraker
Doyle Hanan
Jim Harvey
Steve Jeffries
Kathy Ralls
Michael Scott, Chair
Terry Wright

Fish and Wildlife Service

Diane Bowen (HQ)
Lilian Carswell (CA)
Deanna Lynch (WA)
Jim Valade, (SE)

Other Participants

Robert Small (AK F&G)
Robin Baird (Cascadia Research)
Mark Braza (GAO)
Beth Faraguna (GAO)
Steve Seachrist (GAO)
Svein Fougner (HLA)
Bob Gisiner (MMC)
Mike Simpkins (MMC)

NMFS

Dee Allen (AKC)
Robyn Angliss (AKC)
John Bengtson (AKC)
Marcia Muto (AKC)
Kaja Brix (AKR)
Melissa Andersen (F/PR)
David Cottingham (F/PR)
Tom Eagle (F/PR)
Teri Rowles (F/PR)
Richard Pace (NEC)
Debi Palka (NEC)
Gordon Waring (NEC)
Brad Hanson (NWC)
Jason Baker (PIC)
Adam Bailey (PIR)
Lisa Van Atta (PIR)
Michelle Yuen (PIR)
Carol Fairfield (SEC)
Lance Garrison (SEC)
Larry Hansen (SEC)
Keith Mullin (SEC)
Patricia Rosel (SEC)
Laura Engleby (SER)
Stacey Carlson (SER)
Lisa Ballance (SWC)
Jay Barlow (SWC)
Robert Brownell (SWC)
Karin Forney (SWC)
Barb Taylor (SWC)
Jim Carretta (SWC)
Susan Chivers (SWC)
Karen Martien (SWC)
Monica DeAngelis (SWR)
Tina Fahy (SWR)