# Seagrass and Aquatic Habitat Assessment Workshop Summary

Sponsored by:

U.S. Department of Interior; U.S. Geological Survey
Florida Department of Environmental Protection; Florida Marine Research Institute
U.S. Department of Commerce; National Oceanic and Atmospheric Administration-Coastal Services Center

## FORWARD

Seagrass communities are among the richest and most productive, photoautotrophic coastal systems in the world. They protect and improve water quality, provide shoreline stabilization, and are important habitats for an array of fish, birds, and other wildlife. Hence, much can be gained by protecting and restoring these important living resources. Human's impact on these vital resources from population growth, pollution, and physical damage from boating and other activities can disrupt the growth of these seagrasses communities and have devastating effects on their health and vitality. Inventory and monitoring are required to determine the dynamics of seagrasses and devise better protection and restoration for these rich resources.

The purpose of this seagrass workshop, sponsored by NOAA's CSC , USGS, and FMRI, was to move toward greater objectivity and accuracy in seagrass mapping and monitoring. This workshop helped foster interaction and communication among seagrass professionals. In order to begin the process of determining the best uniform mapping process for the biological research community. Increasing such awareness among the seagrass and management communities, it is hoped that an improved understanding of the monitoring and mapping process will lead to more effective and efficient preservation os submerged aquatic vegetation.


## ACKNOWLEDGMENTS

Many individuals contributed their valuable time and efforts toward completion of this seagrass workshop. Co-sponsors and organizers of the workshop were Frank Sargent, FDEP, Florida Marine Research Institute (FMRI), Mark Finkbeiner and Dorsey Worthy, NOAA Coastal Services Center, and Larry Handley, USGS_BRD. The American Society of Photogrammetry and Remote Sensing (ASPRS), provided lunch and refreshments for the workshop. Laura Cantral acted as lead facilitator for the workshop with help from Gail MacCauley, FDEP-FMRI, and Michael Eng, NOAA-CSC. Laura Cantral created this report and Katie Fitzsimmons, FDEP-FMRI, was responsible for its layout and production. Appreciated constructive comments and editorial guidance was provided by Chris Friel, FDEP-FMRI. Additional copies of this seagrass workshop review can be obtained from Frank Sargent at FMRI, 100 8th Avenue SE, St. Petersburg, Florida, 33710-5095, (727) 896-8626 or via email address; at frank@fmri.usf.edu

**Seagrass and Aquatic Habitat Assessment Workshop**
**Florida Marine Research Institute**
**St. Petersburg, Florida**

**July 28-29, 1998**

# MEETING SUMMARY

## DAY ONE: Tuesday, July 28th

## I Welcome, Introductions, and Objectives

Frank Sargent, FMRI, welcomed the participants to the workshop and introduced his co-leaders, Mark Finkbeiner of the NOAA Coastal Services Center, and Larry Handley from USGS. Frank also introduced Laura Cantral, Mike Eng, and Gail MacAulay, workshop facilitators. He thanked the participants for coming to take part in what the workshop leaders see as a timely effort to create a greater dialogue about issues such as terminology, classification schemes, and mapping protocols.

## II Desired Workshop Accomplishments

Following individual introductions, participants formed small groups to answer the question: "*In your opinion, what would this workshop have to accomplish to be successful?*" Group answers appear below:

Group 1: to be able to come up with ideas to extend current seagrass mapping capabilities; identify common areas of interest in seagrass mapping across the country; identify names and faces of people working in the field to ease networking.
-Group 2: develop new methodologies to map seagrass beds in the Western US; receive a general education of what's going on around the country; determine methods for characterization of large seagrass areas.
-Group 3: discuss techniques that work in turbid, dark water (i.e.: acoustic, side-scan sonar); obtain information on calibration and ground-truthing of the digital signatures generated by such instruments (i.e.: how do you relate digital signatures to traditional mapping techniques?); define parameters to establish potential habitat from a biological perspective.
-Group 4: compare the accuracy of multiple techniques; determine what constitutes a seagrass "bed" from both management and ecological perspective; determine a minimal mapping unit of a bed; identify appropriate techniques for mapping seagrass.
-Group 5: protocols for several scales of mapping and money issues; technology to define species ID.
-Group 6: arrive at consistent change analysis methods.
-Group 7: facilitate standardization of terms related to the Dobson report (i.e.: percent cover); blueprint for partnership approach in monitoring change in seagrass habitat and defining significant areas.

-Group 8: familiarize workshop attendees with procedures/approaches used in seagrass mapping in Central and Southern Florida; get feedback for these approaches and solutions to problems encountered (time of year for sampling, differences in attenuators); accuracy issues; different scales to use for different questions -- seagrass maps, transects or spot sampling, process oriented studies; can South/Central Florida data be integrated into a national database?
-Group 9:obtain a list of methodologies for mapping seagrass that have been used by workshop attendees; develop national protocol for mapping seagrass; getting information out to the public (i.e.: USGS maps); consistent change analysis–standardization of terminology; Dobson Report; blueprint for partnership approach for monitoring seagrass.

## III Roles and Responsibilities, Ground Rules, Process

Participants reviewed handout on roles, responsibilities, and ground rules for the workshop (see Attachment A). Laura Cantral provided general overview on workshop process.

## IV Group Charge and Challenges

Ken Haddad, FDEP/FMRI provided background to the workshop and acknowledged that significant advances have been made in recognizing seagrass as a marine resource, but that much work remains to be done. He offered the hope that the seagrass workshop would increase interest in seagrass mapping and help to advance needed technology.

Larry Handley, USGS/NWRC provided historical perspective on seagrass mapping to set the stage for the workshop objectives (see Attachment B).

## V Presentations: Technologies and Data Integration

**A.** Mark Finkbeiner, NOAA/CSC, presented information on photogrammetry for aquatic mapping (see Attachment C). A question and answer period followed his presentation.

Comments, Questions and Answers:

Q: How do you find GCPs when there is no land in the photo?
A: Approach is to build a strong photogrammetric model and extend it out to the submerged portion of photo.
Q: How are the sliver polygons in ARC/INFO data dealt with?
A: Only polygons below a certain threshold size were extracted–the effect was negligible; would like to come up with a threshold given scale, etc. where you would ignore polygons below a certain size; what change polygon; in one project only change polygons were mapped–ignored slivers; Mark and Frank are working

on a project to compare methods,

Q: How will acoustic data be used?

A: Aerial photo mapped, in areas with problems (too deep or too turbid) go into field and get acoustic data.

**B.** Stan Locker, USF, presented information about side-scan sonar for bottom imaging (see Attachment D). A question and answer period followed his presentation.

Comments, Questions and Answers

Q: Do you have to rectify images to match patches?

A: No "extra" techniques are used to rectify side-scan images.

Q: Is there any distortion in image you can correct for (i.e., does a patchy area look the same at 10m from the instrument as it does 50m from the instrument)?

A: Not known.

Q: What is the minimum density picked up (shoots per meter squared)?

A: Not known (would need to be directly ground truthed).

Q: How do epiphytes affect signal?

A: Change to higher frequency to see if you could quantify effect; epiphytes could increase backscatter.

Q: Would algae affect polygons mapped as seagrass?

A: Not sure, need to verify what is being looked at with video.

Q: Have two transects ever been done back to back, to see if any difference?

A: No.

**C.** Lisa Young, USF, presented information about hyperspectral imaging for aquatic resources (see Attachment E). A question and answer period followed her presentation.

Comments, Questions and Answers

Q: Has a single frequency instrument ( e.g. laser) ever been used?

A: Has not been tried at USF; MIT has used fluorescence for species/type identification on coral, but not tried on seagrass.

Q: Different signatures at grass beds–does leaf area index affect spectral signature?

A: Yes, many things affect spectral signature, may need to come up with some sort of "library" of possibilities.

**D.** Bruce Sabol, ACOE, presented information about hydro acoustic sensing for submerged aquatic presentation (see Attachment F). A question and answer period followed his presentation.

Comments, Questions and Answers

Q: Will acoustic signature of a species change during the day (as it accumulates more

gas, e.g., *Thallasia*)?

A: Theoretically, it should but it hasn't been observed in the field.

## VI Identifying Issues: What are the issues we want to address during the workshop?"

Participants engaged in an exercise to identify and build consensus on the seagrass issues to address during the workshop. Through a process of small group discussion issues were identified, written on index cards, and posted for the entire group to examine. The full group then arranged the issues into categories or "issue areas" and formulated a heading for each issue area. The issue area headings with issues that were grouped into that category appear below:

**Classification**
-Standardized Classification
-Develop a Hierarchical Classification System
-How do you define a bed?

**Standards**
-Consistency (imagery, nomenclature, approach, etc.)
-Need to establish accuracy standards
-Standardize mapping methods and metrics
-Standardization of seagrass mapping data, methodology, and accuracy assessment
-Development of standards, e.g., data acquisition, accuracy, sampling schemes (for appropriate scale)

**Change Analysis**
-Quantitative change
-Quantitative change analysis
-Qualitative change
-Monitoring of status and trends
-Anthropogenic impacts
-Quantitative and Qualitative Change – natural change (climatic), anthropogenic, stochastic variation

**Techniques**
-Developing multiple protocols
-Advantages and disadvantages of techniques
-Evaluate current mapping systems
-Cost effectiveness
-Techniques for documenting location of seagrass beds

**Accuracy and Precision**
-Develop accuracy assessment methods

**Scale**

-Choice of scale
-What are the appropriate spatial & temporal scales of analyses?
-Multi-scale monitoring

**User Needs**
-Improved map products
-Analyze user needs
-Management vs. research needs
-Development of predictive seagrass model
-Mapping needs for monitoring and restoration

**Ancillary Data**
-What are appropriate ancillary data?

**Baseline Data**
-Lack of comprehensive national data set
-Baseline data

**Funding**
-Money for mapping

Two views regarding relationships among categories were offered:

(1) Dorsey Worthy, Sandy Wyllie-Echeverria, Jim Thomas
Standards–classification, accuracy, techniques
Protocol Categories–in-situ sampling, modeling, change analysis (all have standards)
User Needs–scale, funding, ancillary data

(2) Jay Ziemann–drew flow chart that reflected:
Needs (funding)–lead to accuracy, precision, standards
Accuracy, Precision, Standards–lead to techniques and scale
Techniques and Scale–lead to classification
Classification–leads to change analysis
Change Analysis (with ancillary data)–leads to output

Participants were asked to rank the issues areas according to their personal level of priority for what they want to address during the workshop. The resulting ranking is reflected below:

1st: Classification, Standards (tie)
2nd: Techniques
3rd: Change Analysis
4th: Accuracy and Precision
5th: Scale
6th: User Needs
7th: Ancillary Data

8th: Baseline Funding
9th: Funding

Participants voted on the issues areas they personally wanted to work on for the remainder of the workshop. The following issues areas were chosen:

Techniques (11 participants)
Classification (10 participants)
Change Analysis (18 participants, split into two groups)
Standards (6 participants)

## VII Identifying Desired Goals: "In 2-3 years, what would we like to see in place regarding these issue areas?"

Each of the issue area groups formulated a goal statement that would reflect its collective vision of a goal that would address its issue area. Each issue area group presented its goal statement to the full group for review and refinement. The following represents each goal statement as presented by a small group along with comments offered by other workshop participants:

1) Group: Change Analysis 1

Goal: Develop standard protocols with respect to spatial scale for accurate detection and quantification of short term changes within an historical context with the ability to distinguish underlying causative factors.

2) Group: Change Analysis 2

Goal: Be able to understand causality behind seagrass change (abundance, composition)
Steps:
1) accurately assess seagrass change
2) collect ancillary data needed to support
3) determine causality
4) perform experiments needed to confirm cause of change

Comments to both Group Goal Statements:
-determine over time loss or gain in seagrass
-short term and historical data–quantify change in seagrass over a temporal scale
-monitoring programs should be continuous to determine variability (i.e., 10, 15, 20 years)
-if there is a change in seagrass, see if there has also been a change in uplands along the shore
-emphasis on historical analysis–want to show real change at this level of accuracy
-west coast of US–expanding distribution a positive or negative–change analysis needs to understand relationship with other critters.
-causative factors when seagrass changes may cause changes in system, e.g., erosion–may affect how to do change detection.

3) Group: Techniques

Goal: Develop a matrix of remote sensing and ground truthing techniques that show scale, resolution, and cost relative to specific resource management needs (i.e., for managers who know little about the field, decision guide for specific needs, etc.)

Comments:
-will computer processing techniques be included? A: yes, as they relate to mapping.
-matrix for NW, consider how sensors "sense" changes.
-annual nature of some seagrasses may be important.

4) Group: Classification

Goal: Develop a comprehensive hierarchical classification scheme for estuarine, marine, and submerged systems compatible with existing systems, useful to managers and researchers. (Develop definitions for classification categories.)

Comments:
-aquatic GAP program? Traditional GAP does not have extensive mapping portion, mainly to gather existing data.

5) Group: Standards

Goal: Evaluate and incorporate existing applicable standards/guidelines/conventions and develop a set of standards for seagrass mapping to provide consistent interpretation, data acquisition, data production, and data management for multiple scales and needs to include methods, accuracy, assessment, and evaluation metrics.

Comments:
-GAP areas: high biodiversity areas not currently under management (primarily riverine, estuarine/marine GAP dependent on Congress)
-Florida–watershed level

## DAY TWO: Wednesday, July 29th

## VIII Agenda review for day two

Frank Sargent welcomed the group back to day two of the seagrass workshop. Information was offered about two upcoming meetings.

## IX Identifying Restraining and Driving Forces

The full group focused on an exercise to brainstorm forces that either restrain or drive the execution of each goal statement formulated during day one. Forces as identified are listed

below:

**Issue Area: Classification**

Restraining Forces:

- Achieving national acceptance
-Tradition (states, agencies)
-Lack of biological information
-Time to put it together
-Consensus
-Coordination
-Initial goals are too narrow
-Remote sensing group and ecological group have different ideas on classification (meeting the needs of various users)
-Implementation, training, learning new classification scheme
-No funding available
-Application of classification scheme
-Confirmation, integration of existing data sets
-Lack of initiative, leadership to undertake

Driving Forces:

- there is a strong need for one
-consistency/ nation wide mapping
-nationwide applicability
-facilitates change detection
- supports resource management
- fosters responsible resource utilization
-data utilization
-providing legislative information
- allows incorporation/refinement into other programs
-acquiring funding
- will help in resolving user conflicts of the resources

**Issue Area: Standards**

Restraining Forces:

- lack of collective agreement
-tradition (resistance to change)
-need for training
-time to put standard together
-lack of baseline for new methods (i.e.: hydro acoustic data)
-multi-disciplinary approach needed
-software and hardware limitations (individual program capabilities)
-difficult to maintain imagery standards because it's so hard to rely
-extensibility of standards to new technology (can new technologies be easily

incorporated?)
-changing technology/ maintenance of standards
-limited initiative/leadership to undertake issue
-changing public values
-resentment of non-funded mandates
-lack of consensus
-lack of coordination
-application
-no funding available

Driving Forces:

-need for data compatibility
-public pressure
-need for extensibility of standards
-legislative mandates require standards
-legal mandates require standards
-comparability across systems (i.e.: Tampa Bay and Chesapeake Bay could be compared
if using the same standards)
-will minimize duplication of efforts and maximize cost effectiveness
-accuracy assessment

**Issue Area: Techniques**

Restraining Forces:

-multiple technologies involved
-poorly designed user needs or projects
-lack of comparability of techniques in same geographic area
-changing technologies
-lack of funding
-undefined operational windows of technique
-lack of biological information
-time required to codify
-initial project goals often too narrow
-lack of knowledge about techniques (experts know several, but not all)
-no one technique fully satisfactory
-tradition
-updating with new technologies
-application to scale
-initiative of leadership to undertake
-knowledge of a given technique's accuracy
-validation guidelines for new technology
-cost
-comparability with historic assessment

Driving Forces:

-managers' needs
-greater cost effectiveness
-eliminate duplication of effort
-enhanced sensor capability and resolution
-no one technique fully satisfactory in all situations
-new technologies
-unsatisfactory/inappropriate application of existing technologies
-application to scale
-resource utilization
-resource management
-providing legislative information
-resolving user conflicts

**Issue Area: Change Analysis (Groups 1 and 2)**

Restraining Forces:

-funding often difficult to maintain for long term datasets
-lack of commitment to long term monitoring
-constantly changing state mandates for monitoring programs
-rarely is the appropriate question asked
-lack of baseline data
-lack of resources for frequent sampling (return interval)
-turn around time for data is too great
-change analysis using disparate techniques
-accuracy of historic data
-incorporating historic data
-incompatibility of scale, class scheme and resolution of existing data
-predictive tools are limited
-coordination effort
-accuracy assessment of change data
-difficulty in delineating cause and effect
-lack of ancillary data
-coordination between mapping and water quality monitoring efforts
-lack of coordination between federal, state, and local agencies
-interpretation for political agendas
-techniques need to be applicable both locally and nationally
-seagrass systems are difficult to monitor

Driving Forces:

-public demand for information on status and trends
-management issues (ability to implement directed )
-population growth
-will help in resolving user conflicts
-habitat value well documented

-catastrophic events
-need to detect differences between natural variability and anthropogenic causes
-"dog and pony shows"
-will support predictive capabilities
-need for monitoring
-interpretation for political agendas
-land use change
-success stories

## X Developing Action Plans

Small groups worked to develop action plans, which were recorded on an "Action Plan Worksheet." The worksheets recorded the issue area, desired goal, a ranking of the restraining and driving forces, and an identification of those forces that can be addressed by the workshop participants. The worksheets also identified activities and tasks, persons responsible for executing those activities and tasks, and a time frame. Each group presented its action plan to the full group for review and comment. The following represents small group presentations about their action plans and full group comments to their plans (for completed action plan worksheets, see Attachment G.)

**Issue Area: Classification**

draft system and action plan

-easier to edit than to create, so came up with draft classification scheme for editing

-developed working DRAFT classification scheme with five levels

-activities/tasks : develop draft classification scheme; post scheme with reference material on web site (FMRI or CSC) solicit and compile electronic feedback; circulate electronic input before October; discuss at ERIM meeting in October

Comments:

Q: How does this compare with existing classification scheme?

A: Part of Cowardin; not based on FLUCCS

-Nice to see proposed classes for seagrass - Subsequent effort:

May alter proposal

may need more work (biomass, %cover)

group discussed "branchiness," use modifiers as descriptors

- Include fresh too? What about floating aquatics in SAV

-Nice to see proposed classification for seagrass itself (species)

-Density differences or coverages

-what about oligohaline? Incorporate as part of classification

-needs to be tested in mapping -- Techniques -- does it work; PT specific vs. in-situ

-Drift micro algae? -- phytoplankton and epiphytes

-Sedimentary facies definition -- grain size and composition categories

-Fixed transects -- want a scheme applicable to all platforms

**Issue Area: Change Analysis 1**

-identified key issues in restraining/driving forces

-Restraining forces grouped into themes:

linking cause and effect
coordination (interagency) -- nationwide overlay on nautical charts
commitment (funding) -- distribute theme packs to managers
accuracy assessment -- developing protocol for multiple scales
adequate baseline data

-Driving forces grouped into themes:

1) natural vs. anthropogenic change
2) capability
3) implementation of management issues

-Driving Action Plans:

1) identify data resources and link to existing programs -> expand environmental data inventory (NOAA) 3 year updates; determine data gaps and how to address (NOAA sponsored workshop); identify metrics necessary for change analysis

2) evaluate existing models to get estuary model;

3) management issues -- linking research results to management efforts; develop web page with posted research digest (summary of articles being produced) for managers; coordinate seagrass education with existing outreach programs (local, regional, national levels)

Comments:

-NOAA key organization for central effort
-need to identify where in NOAA
-NOAA would bring in key stats
-coordinate with EPA and USGS
-ex. in Florida -- IFAS (already set up - University of Florida)
-concept should have a lot of support
-if to become a "clearinghouse" for info need support of local group
-"grey" paper from Australia lists regional work
-Chesapeake Bay–coordinated through the Chesapeake Bay Program ($1mill/yr)
-Don't want two agencies thinking they are the lead

**Issue Area: Change Analysis 2**

Restraining forces:

1) difficulty linking cause and effect
2) lack of commitment for long term monitoring
3) accuracy (reliability of data)
4) funding
5) disparate techniques
6) lack of baseline data
7) interagency coordination
8) constantly changing mandates

can't correctly interpret spatial and temporal patterns in seagrass coverage with

appropriate ancillary data (i.e.: water quality) which is dependent on long-term monitoring itself

Driving forces:

1) need to detect differences in natural and anthropogenic change
2) effect of catastrophic events (one event can lead to significant change)
3) predictive capability (explaining spatial and temporal differences)
4) ability to implement management actions
5) public demand for info on status and trends
6) accountability of studies themselves
7) population growth and land use (varies tremendously across nation -> NW vs. South Florida)
8) interpretation for political agenda

Action Plans:

-obtain a commitment of long-term monitoring of seagrass and water quality, etc. from appropriate agencies (how, who, )

-develop a process for comparing status and trends between water quality, etc. and seagrass coverage over the long-term (coordinating entity -> location/scale/politics; identifying good model that works for question and area to be dealt with; before any monitoring program started, have peer review process that approves methods that will be used)

-workshop that reviews change analysis and mapping programs of seagrasses (review good and bad programs; multiple agencies in charge of review/workshop -- state, local, and federal)

Comments:

-long-term water quality monitoring stations -- NERR web site

-contact NERR research coordinators about placing water quality monitoring stations in seagrass beds -- Mike Shirley will do before next NERR conference in fall

-most estuaries are not research reserves

**Issue Area: Techniques**

divided restraining and driving forces into 3 categories -- 1) vital, 2) important, 3) less important, with regards to developing matrix in goal statement.

Driving forces:

-management needs -- vital
-greater cost effectiveness -- vital
-eliminate duplication of efforts -- vital
-enhance sensor capability and resolution

Matrix Items:

-resource management needs (species mapping, etc.)
-sensor type (limitations/advantages)
-sensor limitations/advantages

-ground truthing required
-spatial resolution
-positional accuracy
-thematic accuracy
-cost
-turn around time
-processing requirements (workstation, software, etc.)
-temporal frequency
-validation of technique (previous studies, etc.)
-repeatability for change analysis
many sub-items to be included under each item

Action Plan:

Q: How do we get the information we need for the matrix?

1) develop a draft survey; that workshop attendees would peer review, CSC would post on their web site

2) compile survey results

3) identify gaps in survey information

4) target the experts on gaps in survey

5) develop matrix

John Thompson will compile techniques mentioned in literature within two months

Comments:

-NW U.S. matrix has already been developed (use as a reference?)

-Other references on matrices:

Ed Green -- matrix for aerial sensors in 1997 for tropics (Coastal Zone Management–24:1-40)

Meylan Kelly -- Handbook of Seagrass Biology, 1984

1983, Marine Technology Society Journal–special issue literature review

1996 -- C-CAP workshop corals

Kirkman – small chapter in seagrass methods handbook

USGS -- standards for lu/lc program (due out Sept. 98)

-Perhaps create some sort of web interface for matrix that would guide managers through the process

-preface for matrix: need to say that for west coast the biodiversity of seagrass is not well known and will be difficult to get a handle on (a lot is known about certain seagrasses; very little is known about other types)

Q: where do we go from here? How do groups tie together?

A: Matrix will aid other issues talked about

-matrix may need R&D column

-C-CAP grant program targeted

-Fl–mapping by remote sensors-difficult to map *Halophila* (not visible in photos)

**Issue Area: Standards**

Restraining forces:

-need for training -- low; Web site w/ publications; videos, manuals, workshops
-changing public values -- low; multi-media education
-identifying user needs -- low; surveys
-tradition -- low; education
-multi-disciplinary
-leadership -- high; volunteer task force
-funds/time -- high; no funds available
-development -- high; put task force together, put existing standards together
-collaboration -- high; email, web sites, iterative process
-application/limitation -- high; peer review

Driving forces:

-consistency, quality, comparability -- high; incorporate assessment of standards (USGS, ---metrics, ASPRS) into peer review process.
-legislative/legal mandates -- low;
-key -- standards must promote consistency (comparability and compatibility) so data can be shared, compared, etc.
-public pressure
-cost effectiveness

Action Plan:

-establish a standard volunteer "task force"; multi-agency, multi-purpose group
list standards needed
minimum requirements for standard
survey existing standards
review/evaluate existing standards
identify gaps in standards
compile existing standards together
-generate info on missing/incomplete/inadequate standards
identify development groups/individuals who will work on missing standards
identify components of standards that are missing (bring in some from literature?)
-develop standards collaborated with other working groups
review draft standards product

Comments:

include Water Management Districts and EPA as named entities
Q: Any way to update/modify standards?
A: That is a recognized problem

## XI Wrap Up and Next Steps

Discussion revolved around what ideas participants had for what to do as follow up to the workshop. The following actions were offered (responsible parties appear in parentheses):

1) all attendees will get summary of workshop -- ideas presented, etc (hard copy report will be generated by FMRI before October workshop)

2) NOAA-CSC plans to develop web site to keep track of classification ; also will use to receive feedback about this workshop (CSC)

3) NOAA asked to take the lead on a lot of issues -- Dorsey Worthy response; NOAA will provide web page, not sure about other things

4) develop good steering committee; use interns and graduate students to do bulk of work

5) form steering committees or task forces: for specific issues, not seagrass as a whole use NOAA-CSC homepage to volunteer for task forces/steering committees (interactive)

6) submit map legends to classification group for first cut of classifications already out there

7) define course and direction of task group/steering committee efforts (task force, once formed)

8) provide funding assistance for travel to workshops -(CSC)

9) present successful examples of seagrass change analysis with critiques from peers (CSC workshop?)

10) list relevant "grey literature" - (EPA)

11) the emphasis for this workshop was "WORK", not relating what people are currently working on -- need to decide emphasis of workshop beforehand (work or presentations?; hard to mix both)

12) a symposium format suggested for relating what people are currently working on have a few studies representative of current research efforts presented -- critique the studies as a "learning tool"

13) focused workshop -- e.g., how do you draw the outer boundary of a seagrass bed?

14) next workshop can focus on specific issues, techniques -- this workshop has covered broad, major issues

15) time frame for next workshop: within a year

16) everyone has responsibility to bring colleagues up to speed on workshop results so what was accomplished here does not need to be redone. (All)

17) attend Ft. Myers workshop in October if possible -- presentations will be given on current seagrass research

18) takes about 8-9 months to organize workshop

19) set up steering committee for next seagrass workshop (pay attention to academic calendars) (USGS, CSC, FMRI)

20) most people seem to prefer June '99 as time frame for next workshop

21) location/region for next meeting? Need to consider cost effectiveness of location, etc. (FMRI)

22) ASPRS meeting in Portland next; consider putting on a technical workshop at the meeting?

21) FMRI/ St. Petersburg -- cheapest/easiest location; west coast U.S. folks need travel funds

## XII Meeting Evaluation

| | Agree | | | | Disagree |
|---|---|---|---|---|---|
| | *Circle One* | | | | |
| **WERE THE WORKSHOP OBJECTIVES MET?** | | | | | |
| • To create a forum to foster interaction and strengthen relationships among seagrass professionals. | **5 [9]** | **4 [3]** | **3 [2]** | **2** | **1** |
| • To initiate a dialogue for reaching greater consensus on seagrass issues, e.g., terminology, classification schemes, and mapping protocols. | **5 [5]** | **4 [8]** | **3 [1]** | **2** | **1** |
| • To develop a draft action plan to address identified seagrass issues. | **5 [3]** | **4 [7]** | **3 [4]** | **2 [1]** | **1** |
| **WORKSHOP ORGANIZATION** | | | | | |
| • Materials were helpful. | **5 [5]** | **4 [5]** | **3 [4]** | **2** | **1** |
| • Presentations were effective and informative. | **5 [6]** | **4 [4]** | **3 [4]** | **2 [1]** | **1** |
| • Use of plenary and small group discussion format was effective. | **5 [6]** | **4 [8]** | **3** | **2 [1]** | **1** |
| • Participation was balanced. | **5 [6]** | **4 [6]** | **3 [3]** | **2** | **1** |
| • Facilitators guided participant efforts effectively. | **5 [6]** | **4 [5]** | **3 [3]** | **2** | **1 [1]** |

**What did you like best about the workshop?**
-Interaction/feedback
-Chance to interact with peers and learn about seagrass mapping efforts
-Raised issues, foster communication
-Very active interactions within small groups
-Networking and brainstorming
-Participants–an inspiring group!
-Format of Action Plan development and group activities
-Interactions, networking,, common lunch
-Identification of issues
-Professional interaction
-Very timely
-Networking, consensus building

**What could be improved?**
-Less workshop “process” focus with more time to work on action items and strategy
-More experts? Longer sessions (days)?
-Merging of group findings
-More time for brainstorming
-Bring in other federal agency experts (e.g., USF&W, NASA, EPA, NOS, etc.) and academic/research experts on sensing and mapping

-Preparation of participants–although it's hard to strike a balance between helping participants prepare for the workshop and narrowing the focus too much at the start
-Beer time
-More time to construct goals
-Less facilitation, more openness to discussion, faster pace of discussion, less time of the whole group waiting for organization
-Length and geographic representation
-Keeping on time

**Other comments (continue on back in needed).**
-Need a longer workshop–too many issues–short time
-Well organized and planned workshop
-Could use more remote sensing experts for new technologies (e.g. NASA)
-Best results occurred in day 2when participants rolled up sleeves and "attacked" the issues with straw proposal/actions–could have reached point sooner with less "process" time
-Good beginning–need to continue the push and attempt collaboratives with states, and other federal agencies like EPA, USF&W
-Perhaps several participants could recommend relevant literature to review before the workshop, e.g., the C-CAP report and proceedings from other workshops, so that participants can start from "where we last left off"
-Goals and objectives should be spelled out more clearly in a future workshop