

## Generic Pattern 1: The Classic Scientific Report of Results

The classic scientific research paper has been developing for over 200 years, since the Royal Society first began accepting formal papers. It has evolved from a loose essay into a rigidly formatted paper, with many variations depending on field and specific type of research. You can use the guidelines for this genre as the basis for almost **any scientific paper**.

### A. Logic

The classic scientific research paper mimics the basic pattern of scientific thought. It is, in effect, a structured story of the research which was conducted. It omits all of the little diversions, confusions, and minor re-directions which go on in actual research. So it is not a true story. It's a sum of all of the iterations of research.

The paper has **two stories to tell**. First, it tells the story of the scientist's **thought** --in the introduction and the discussion. Second, it tells the story of the scientist's **action** -- in methods and results. The logic of these two stories is different; so the methods and results are really a separate story within the overall story.

The introduction and discussion are essentially parallel in logic and organization. The introduction presents:

- 1) What we think we know about something and, given this,
- 2) What we might hypothesize about the subject.

The discussion explains:

- 1) How the research reported has changed or confirmed what we knew, and given this.
- 2) What we now might hypothesize (given the inherent errors in the work reported)

The methods and results are parallel to one another as well. The methods explain what was done and the results explain what was discovered as a result of **each** method. There **must** be a method explained for each result presented.

## B. Logic Outline

The logical relationship between the four standard sections of the scientific paper is:

### *Introduction*

*Importance of subject*

*What we know*

*Literature Review A*

*Literature Review B*

*Literature Review C*

*What we hypothesize this means*

*D and E*

*Methods (what we did to collect data to test the hypotheses)*

*Hypothesis D*

*1*

*2*

*3*

*4*

*Hypothesis E*

*Methods (what we did to analyze the data)*

*Hypothesis D*

*Hypothesis E*

*Results (what we found out)*

*Hypothesis D*

*1*

*2*

*Hypothesis E*

*1*

*2*

*3*

*How reliable/useful are the data gathered*

*Discussion*

*How results confirm/falsify hypotheses*

*D [Compare Lit Review to Results]*

*E [Compare Lit Review to Results]*

*Implications of Findings*

The discussion is **synthetic**. It is an attempt to **combine** literature review and current results into a new statement of what we know about a subject. It is organized in parallel to the introduction. You **add** results and literature data to formulate new statements about the subject and develop new hypotheses.

## **C. Sample Logic for Scientific Papers**

### **INTRODUCTION**

#### **Importance of subject**

SKR-rats are endangered and we need to know how they will respond to creation of new habitat.

#### **From literature we know**

- A K-rats move out of crowded territories into marginal habitat
- B Marginal habitat may receive immigrants from several established colonies
- C In general, mixing tends to lead to genetic diversity

#### **We therefore hypothesize**

- D We will find greater genetic diversity in K-rat populations in new or marginal habitat than in established habitat

### **METHODS**

- 1 We catch K-rats from new, marginal, and established territories
- 2 We take tissue samples from all rats
- 3 We do DNA fingerprinting on all samples
- 4 We compare the samples statistically

### **RESULTS**

- 1 We caught X, X<sub>1</sub>, and X<sub>2</sub>, K-rats in each territory, respectively
- 2 We obtained adequate tissue samples from Y percent of animals
- 3 We had unambiguous RFLP results for Z percent of the Y subset
- 4 The populations in established territories had significantly less genetic diversity than those in either new or marginal territories; populations in marginal territories were the most genetically diverse
- 5 Populations in new and marginal habitat had characters from all three adjoining territories, characters which were not shared among the three established populations
6. Data are generally reliable because standard methods with low margin of error were used and sample size was adequate, given the natural range of variation expected

### **DISCUSSION**

#### **I. Consistency with Literature**

- A Results confirm that K-rats move out of crowded territories into marginal habitat

- B Results confirm that new and marginal habitat may receive immigrants from several established colonies
- C Results confirm that there is gene flow out of established territories into new and/or marginal territories; no results to confirm hybrid vigor

## **II. Consistency with Hypothesis**

- D There is greater genetic diversity in marginal and/or new habitat, as a result of gene flow out of established territories and mixing of populations

## **III. Implications**

- E. We can actually contribute to species genetic diversity and therefore to survival by creating new habitat, even if it is marginal, as long as populations can migrate to this habitat

## **D. Detailed Question Outline for the Scientific Paper – Most helpful to me in writing papers**

### **Abstract**

1. What did you study, for what general reason?
2. What basic method did you use?
3. What did you find out: key data items and key data relationships?
4. How do your findings agree or disagree with what has previously been found? (Optional in abstracts)
5. What general conclusions can you draw from your study? (Optional)

### **Introduction (Variant 1)**

1. What was the subject of your study?
2. Why is this subject worth study; why is your study important?
3. What particular question did your study focus on; what aspect of the subject did you focus on?
4. Why did you choose to place your focus on this aspect?
5. What have previous researchers found regarding this subject and this particular aspect?
6. What are the major data gaps in existing knowledge? What is it that is unknown?
7. Given what is known, what is your hypothesis?
8. What general approach did you take to your study (methods abstract)?

### **Introduction (Variant 2)**

1. What was the purpose of your study (in practical terms)?
  - a) What is the situation which led to your study?
  - b) What will the data from your study be used for?
2. What is known about this subject?
3. What are the important data gaps and or gaps in understanding of this subject which make it necessary for you to conduct this study before you can achieve the purpose of the study? (What is known? What is not known? What needs to be known in order for the practical purpose to be accomplished?)
4. What are the specific study objectives, for both data collection and data analysis?
5. What general approach did you take to your study?

### **Theory (Optional, mostly for physical science papers)**

1. What is the theoretical basis for your experiment?
  - a) What is the theory behind your work?
  - b) What does the theory predict for your experiment?
2. From a theoretical standpoint, what factors must you account for to ensure that your work is valid?

### **Study Area (Optional, for field study papers)**

1. Where is the study area (orient the reader)?
2. What is the general geography, climate, and use of the study area?
3. What elements of the study area were of particular concern to your study? (What variables in the study area were you concerned about measuring and/or accounting for in your study?)
4. What criteria did you use in selecting specific study sites?
5. What were the specific study sites selected?
  - a) What are the critical characteristics of the sites?
  - b) How do the sites constitute an environment appropriate for your study?
6. What environmental variables at the sites might affect your study results, how?
7. What efforts did you make to control study site characteristics to ensure valid data?

### **Materials and Methods**

For **each** hypothesis/objective, you should consider answering the following questions:

1. What did you do to collect data?
  - a) What tools did you use?
  - b) What procedure did you follow? (Time, sequence)
  - c) What controls did you apply to your work?
2. How did you analyze your data?
  - a) What statistical/mathematical methods did you use and how are these methods appropriate for your work?
  - b) After your initial data analysis, how did you alter your analysis approach to address new questions or extend the scope of your analysis?
3. In both data collection and analysis, what factors might have influenced the validity of your results? How? Based on these considerations, what limits would you place on your conclusions from your data?

### **Results**

For **each** section of results, answer the following questions.

1. What did you find out?
  - a) Data collected?
  - b) Data relationships revealed?
2. In terms of your hypothesis or objectives, which of the data and data relationships are the most important?

**Present** results in graphic or tabular form. **Summarize** or **abstract** your data in text. Do not repeat everything in text that you have put into a table or graphic.

### **Discussion/Conclusions<sup>3</sup>**

Note 3: In discussion, you return to the concerns of the introduction. The focus of discussion is on how your data are consistent with previous knowledge and confirm or falsify your hypothesis. There are many discussion patterns. The most common, and the easiest to use, involves answering the following questions in this order:

1. How were the data you collected and data relationships you identified consistent or inconsistent with what has been found previously?
2. Did the data or data relationships you identified confirm or falsify your hypothesis?
3. What factors could have influenced your results and accounted for any variation from what was expected?
  - a) Are your results valid?
  - b) What cautions must be taken in interpreting your results?
4. Given the level of validity of your results, how do your results confirm or change the way we look at your subject? What key questions do your results answer or raise?
5. What conclusions, if any, can be drawn from your work?
6. What (if anything, needs to be done in the future? Why? What questions would be answered by such work?

### **D. Format**

The format for the scientific paper varies from journal to journal. Some journals, such as Ecology are very text-oriented, primarily because they are very theoretical. Other journals, such as North American Journal of Fisheries Management are more graphic oriented.

In developing a scientific paper, consider starting with your graphics. You can do this **before** you do your research. Remember that for each method you are going to have results (2-3 methods may contribute to one result, of course). Therefore, when you have developed your methods (before you conduct your research), you can easily predict what kind of results you will get. If you can do this, you can lay out all of your graphics in advance.

So, before you go into the field or the lab, you **should** be able to make **data shells** which you will use to present your results -- as you get them. Some practical rules of format:

- 1) Tables and graphs are for data; text is for summary and discussion



- 2) Use as many sub-headings as the journal will allow, and as make sense logically. The reader should be able to use the sub-headings to find key items and to follow the logic of the paper.
- 3) Review the journal you are sending the paper to and identify the appropriate graphic forms for your data; don't bother inventing new forms unless you **cannot** find an existing form which suits your purpose.

## **Generic Pattern 2: The Methods Paper**

This pattern is used when you have developed a new technique or tool for research, or have refined a technique significantly enough to warrant a separate paper. The results of this type of paper are focused on establishing the validity of the method, not on "subject" oriented data relationships.

### **A. Logic**

The methods paper is "needs" oriented. It begins with a statement of need. The new method to meet the need is then explained. Then the paper describes how the new method was tested to ensure it meets the need. Like the classic research paper, the methods paper has two basic logics. First there is the logic of the need -- meeting the need. Then there is the logic of methods and results. As for the classic research paper, the methods-results are a sub-section of the overall paper:

#### **Introduction**

**Need**

**Objectives**

**Basis for Method (Literature Review)**

**New Method**

#### **Method of Test**

**1**

**2**

**3**

#### **Results**

**1**

**2**

**3**

#### **Discussion**

**How method meets objectives [1,2,3]**

**How method meets needs**

**Additional improvements needed**

## B. Sample Logic

### INTRODUCTION

**Need:** We're using too many antibiotics on dairies; we need a better method of preventing mastitis.

**Objectives:** The method should 1) eliminate the need for antibiotics, 2) be cheap, and 3) not harm the cow.

**Basis for Method:** The body responds to foreign objects with an enhanced immune response; perhaps we can introduce an irritant into the udder to produce such a response, and the cow will develop long-term increased resistance to disease.

**New Method:** We will test a plastic device which can be inserted into the udder to stimulate immune response.

### METHODS

1	Number of cows: case and control
2	Insertion method
3	Period of test
4	Measurement of immune response
5	Measurement of disease incidence
6	Measurement of side effects

### RESULTS

1	Immune response up, case vs controls
2	Disease incidence down, case vs controls
3	Side effects = bleeding, some clinical mastitis

### DISCUSSION

**Meets Objective 1?** Does not eliminate need for antibiotics, but does reduce need

**Meets Objective 2?** Cost is lower than cost of antibiotics for an equivalent reduction in disease incidence

**Meets Objective 3?** Minor bleeding is acceptable side effect

**Meets Need?** Method adds a tool to the dairy manager's arsenal of disease control technologies

**Future work:** Next step is to increase immune response (try roughening the surface to provide more

surface area for contact) and reduce bleeding (try changing the shape from a spiral into a circle)

## **C. Detailed Question Outline for the Methods Paper**

### **Abstract**

1. What was the old technique for XXXXXXXX?
2. Why was a new technique needed?
3. What is the new technique you have developed?
4. How was it shown to be better than the old technique?
5. What implications does this technique have for future work in this field? (Optional question)

### **Introduction**

1. Why is it important to have an effective method for accomplishing XXXXX?
2. What is the standard method for doing this?
3. What are the limitations of the standard method that make a new method necessary?
4. What criteria or objectives must a new method meet in order to overcome these limitations?
5. What is the theoretical basis for your method?
6. What have others done along these lines to develop a new method, work you have built on?
7. What is the new method -- basic description?

### **Materials and Methods**

1. How did you develop your technique?
2. How did you test the method?
  - a) Where?
  - b) When?
  - c) Under what range of conditions?
  - d) With what controls?
  - e) Over what period of time?
3. How did you analyze your test results?
4. How did you determine that your method was superior to the old method?

### **Results**

1. How accurately, precisely, reliably did your method do the thing it was supposed to do?
2. How do your results compare to those of other methods?

### **Discussion**

1. How well does the new method meet the objectives?
2. Thus, how is this method an improvement over the standard method?
3. What are the advantages and disadvantages of the new method?
4. When is this new method appropriate / not appropriate?
5. What else needs to be done to further refine or develop methods for this purpose?

## Generic Pattern 3: Manuals

Manuals are a class of practical technical and scientific writing which include a vast variety of sub-types.

**Policy:** Policy manuals tell you what you may, may not, must, or do not have to do under a given set of circumstances. The California Civil Code is an example of a Policy Manual.

**Procedure:** Procedures manuals tell you how to do something that you know you want or have to do. Cookbooks and software documentation are examples of procedures manuals. There are two types of procedures manuals: some describe a number of procedures done within the context of a job; some describe a single overall procedure, the accomplishment of which constitutes a job.

**Encyclopedia:** Encyclopedias give you the information you need to deal with a problem, understand a job, perform a task. For example, an encyclopedia-type manual on audio-visual aids might tell you that screen glare becomes a problem for viewers when the viewing angle exceeds 30°. What you do with this information is your business.

**Introduction:** Introductory manuals explain the basics of a job or a thing. An "Introduction to the State Personnel Board" is an example of an introduction manual.

### Manuals are not read but used.

No sane person *reads* manuals. People *consult* manuals when they want to know how to do something specific. So you cannot write them as if they will be read from front to back.

### A. Logic

There are two logics to manuals: functional and encyclopedic:

- The functional manual is for people who want to know how to do something.
- The encyclopedic manual is for people who want to know something.

### A1. Functional Manuals

Functional manuals are cookbooks, software manuals, guidelines to research procedures that come with equipment, and the like. They are organized according to what the reader wants to do.

So, for a software manual for word processing, the manual should be organized according to the things people want to do when word processing. Headings should be functional:

*Page format*  
    *Formats available*  
    *Setting*  
    *Changing*  
*Typefaces*  
    *Typefaces available*  
    *Setting*  
    *Changing*

The headings should not be "feature" oriented. You have to think about what the reader wants to do, not the features of the program. DO NOT WRITE MANUALS LIKE THE HELP GUIDELINES FOR WINDOWS OR OTHER SOFTWARE PROGRAMS. THESE ARE AMONG THE LEAST USED MANUALS ON EARTH. For example, in software manuals, you will find out how to delete a file under:

“files, deleting”

This not what the user is thinking. The user is thinking “How do I delete a file”? The reader is not thinking “How do I file a deletion”?

ALWAYS WORK FROM WHAT THE READER IS TRYING TO DO, NOT FROM THE STRUCTURE OF THE JOB, PROGRAM, ENGINE, ETC.

So, for a cookbook, you would not have a chapter on "mixing" because cooks are not interested in "mixing" *per se*; mixing is subordinate to the sauce, or the cake batter, or the drink. Mixing becomes a sub-heading in various recipes -- because it is recipes that cooks are interested in.

The logic of functional manuals is therefore:

- Figure out what the user wants to do
- Organize accordingly

A complete manual *section or logic unit* is written for each function; functions may be organized chronologically (if that works), by type of function (deserts, main courses), or alphabetically.

## **A2. Encyclopedias**

Encyclopedias are organized alphabetically and may provide both information and procedures. The sections are not chosen by function, but by subject. This type of manual is written when the same subject comes up over and over again while people are doing many different functions.

For example, in an office, you may need information about "chain of command" when doing many different functions. So, a descriptive passage dealing with this subject may be important as a separate item.

### **A3. Combined Manuals**

Most manuals are a combination of functional and encyclopedic forms, with distinct sections for each, each section then arranged alphabetically.

### **B. Organization**

The key to organizing manuals is to approach them from the reader's point of view. What will the reader be **doing** when using the manual, and what will the reader **need to know**? If the reader needs to know how to do something, you generate a section which explains this. If the reader needs to know something, you generate a section which provides the data. And you keep the two separate and distinct -- even if there is substantial overlap.

### **C. Content, by type**

#### **C1. Policy Manuals**

Policy manuals may contain any or all of the following sections:

1. Goals and Objectives (encyclopedic)
2. Authority (encyclopedic)
3. History (encyclopedic)
4. Duties and Responsibilities/Required Output (encyclopedic)
5. Organization/Chain of Command (encyclopedic)
6. Personnel (Duty statements) (encyclopedic)
7. General Code of Ethics/Behavior (functional)
8. Rules (alphabetical) for work to be done, personnel matters, public contact, intra-and inter-agency contact, use of resources, reporting, travel, etc. (encyclopedic)

#### **C2. Procedures Manuals**

Procedures manuals generally look like cookbooks. They are divided into sections, each section a recipe. This type of manual may have the following sections:

1. Goals and Objectives (encyclopedic)
2. Authority (encyclopedic)
3. History (encyclopedic)
4. Duties and Responsibilities (encyclopedic)
5. Duty Statements (encyclopedic)
6. General Principles (encyclopedic)
7. Recipes (functional; for each duty or responsibility or task)



Purpose  
General Description  
Relation to whole  
Materials  
Steps-Product  
Contingencies  
Benefits/uses  
Relation to other steps  
Standards/checklists

### **C3. Introduction Manuals**

The whole function of an introduction manual or manual section is to orient someone to a task or job, to make it possible for the person to understand the task or job, and therefore work somewhat independently. The items which often are included in such a manual are:

1. Goals/Objectives
2. History
3. Importance
4. Client Population
5. Organization
6. Work Flow
7. Authority
8. Principles
9. "A Day in the Life of. . ."
10. "An Interview with. . ."

### **C4. Encyclopedias**

These manuals may contain virtually any descriptive data about an office, a product, etc. The operative words here are "descriptive data." The purpose of this type of manual is to convey information which can then be used in any way the reader sees fit. This is a resource book. It is often appended to a policy or a procedures manual.

### **D. Format**

Page format is particularly important in manual writing; you must use format to guide the reader to the information needed.

Manuals often have no logical flow. To find something in a manual, thus, you must be given lots organizational cues -- headings, indents, numbers, boldface type, and so forth. These cues are not optional; they are essential. Without them, the reader will become frustrated and will stop using the manual. AN INDEX IS CRITICAL.

For page layout, see any manual that you yourself **use** and have found helpful. Use headings, lists, and bullets.

## **E. Style (generic to all manuals)**

The style will change as you change sections and even sub-sections. But there are some general rules. Try to write directly to a reader. Use "you" or the implied "you." Write formally, but as if you were writing to a person. Write shorter sentences than you might normally write. Be more direct than you might normally be. Focus on being specific.

### **E1. Policy Statements**

Policy statements should be written as if they were laws. They should specify

who may/may not/must/is exempt from what

*"Employees must report the discharge of a firearm in public."*

Verbs should describe actions, and include one or more of the standard auxiliary verbs: "should," "may," "must," "shall," "will," "are required to," "can," and "cannot."

Put conditions for the policy up front in the sentence, exceptions and penalties at the end:

*"When an investigator discharges a firearm in public, the investigator must file a written report with his/her immediate supervisor within 24 hours, unless the investigator is incapacitated and is physically incapable of preparing the report."*

Be specific, even if it means repeating a word:

*"Supervisors are responsible for evaluating employee performance and for ensuring that employees follow all instructions. Supervisors must report employee violations of office policies within 24 hours of the incident."*

### **E2. Procedures**

Work in chronological order. Make the main idea of each instruction an action:

*"File the report under. . . ."  
"Instruct the employee to . . . ."  
"Document all cases in which. . . ."*

Put objectives/goals up front in the sentence, put references to tools, methods, conditions in the back:

*"To ensure that the form is processed within the required 30-day period, send the evaluated form to Accounting within 5 days of receipt, using the interdepartmental "express pouch."*

Give "conditional" examples:

*"For example, if you receive the form on May 2, you should send it to Accounting no later than May 7th."*

List or tabulate, do not write in text, things like:

*Materials needed  
Personnel to consult  
The "approvals ladder" for each action  
Questions to ask  
Main points to remember  
Names, addresses, telephone numbers*

If you are describing a calculation, work it out on the paper, and describe it in a parallel example:

*"To determine the amount due for early payment to the contractor, calculate:*

*Invoice Amount - (discount rate x invoice amount) = due.*

*For example, a \$1,000 invoice with a 3% discount would be figured:  
\$1,000 - (.03 x \$1,000) = \$1,000 - \$30 = \$970*

Start general and work toward specific:

*"There are five steps to take after you log in the complaint. In doing each step, remember that the general rule is to try to solve the problem, not start a dispute. First, . . . . ."*

### **E3. Encyclopedia Style**

Write these sections like an encyclopedia or dictionary. Begin general and work toward specific. Start with simple language and get technical at the end. Use pictures and charts as often as possible. Generally follow the style rules for A and B above.

### **E4. Introduction Style**

Make sure these sections have a "story" quality to them, that they flow. Keep language simple for at

least the first few pages. Give examples, especially for "abstract" concepts such as goals/objectives. For example:

*"One goal of the department is to encourage the public to take needed precautions to avoid becoming a victim of crime. To encourage use of locks and alarms, for example, the department conducts residence inspections and sends out a "Lock it up-keep it" pamphlet once a year. . . ."*

## **F. Steps in Manual Writing: Talk to the users**

Don't assume that you fully understand what is needed. Discuss the proposed manual with your users. Find out what they use the manual for and how they normally use it. Some questions to ask:

### **1. Who uses the manual?**

- a) Novice workers? If yes, then the manual will have to contain an introduction manual section.
- b) Experienced workers? If yes, then the manual will have to contain technical details.
- c) Supervisors? If yes, then the manual will probably contain policy statements.
- d) Untrained people? If yes, then the manual must be accurate enough to ensure against lawsuit.

### **2. What is it used for?**

- a) Quick reference to refresh the memory? If yes, then at least some parts must be alphabetically organized. An index may be needed.
- b) To make judgments/decisions? (If yes, then the manual must have a policy component, and must contain goals, objectives, and background information adequate to define the context of each decision. Examples may be needed.
- c) To follow, like a recipe? If yes, then the manual should be step-by-step.
- d) To problem solve? (If yes, then the manual may need a troubleshooting guide and extensive cross-referencing.)
- e) Training? If yes, the manual at least needs an introduction section, a policy overview, and a procedures section.)
- f) Disciplinary action? If yes, the policy must be fully and legally delineated.

### **3. How/when will the manual be used?**

- a) Frequently? If yes, the manual will need to be organized for quick reference.
- b) As background to work. If yes, then the manual will need to be easy to read and broken into distinct "topic" sections.
- c) For review of work? If yes, then a checklist of standards is needed for each

task/product covered.

**F. Steps in Manual Writing: Decide manual type**

Even if you are going to combine all four manual types into a single volume, you should decide what type will dominate the manual. Use the answers to the above questions to guide you in deciding type and needed content.

**F. Steps in Manual Writing: Develop format**

The manual should have some format consistency, regardless of section format. Some of the general rules for format are:

- A. Use a "dictionary-type" heading system at the top of each page so that anyone reading can find sections quickly.
- B. If you number paragraphs, put the numbers in the right-hand margin, where they can be seen quickly by someone skimming the manual.
- C. Use headings extensively. Identify each block of information clearly.
- D. Separate policies, procedures, and examples clearly.
- E. Separate information intended for novices from that intended for specialists.
- F. Summarize -- in marginal notes, in summary sections, in tables, in charts, in checklists.
- G. Use familiar manuals as models -- like car repair manuals, cookbooks, and the like.

## Generic Pattern 4: The Project Report

Project reports are "practical" research papers. The difference between practical and theoretical work is simple:

**Practical science** is aimed at achieving some defined objective, the accomplishment of which requires data. The focus of discussion is on whether objectives have been achieved, and thus on what should be done. **Theoretical science** is aimed at advancing knowledge, by acquiring data. The focus of discussion is on whether the hypothesis has been confirmed or falsified, and therefore **what we should now believe to be true**. These are not discrete categories -- most papers fall somewhere between pure theory and pure practice. But the distinction is important because it slightly shifts content and style.

### A. Logic

The logic of project reports is identical to that of scientific papers, except that objectives for the research are formulated --rather than hypotheses. And the data are then discussed in terms of these objectives, rather than in terms of the hypotheses. A key point in the logic is a shift from **goal** to **objectives**:

The **goal** is what you ultimately want to do with the data. "Live long and prosper" is a goal, an end in itself.

The **objective** is what you must know or do to be able to accomplish the goal. **Research objectives** for the above goal might include:

- Find out what makes people prosper
- Find out what makes people live long

Depending on how practical the research really is, the discussion section for a project report may or may not include a **plan**.

The logic of the project report discussion is: you look at the data collected and decide if they are adequate to meet the objectives. You do this in exactly the same way you examine the quality of data in a normal discussion -- comparison to literature, examination of error potential, etc. If the data are adequate to meet the objectives, then you may or may not be required to address the **implicit objective** -- to show how to achieve the goal. You may or may not have to make recommendations.

## **B. Sample Logic**

### **INTRODUCTION**

#### **Goal**

We need to save the winter-run chinook salmon

#### **What we know**

We know it's endangered

We know it needs high flows in the fall

We know it needs gravel to spawn

#### **What we don't know**

We don't know where it spawns

We don't know spawning habitat requirements

#### **Problem**

We can't save it if we don't know these things

#### **Objectives**

Identify spawning habitat

Measure habitat variables

Develop plan for increasing spawning habitat

### **METHODS**

How we identified spawning habitat

- Tagging

- Releasing

- Monitoring

How we measured habitat variables

- Substrate classes

- Water temp

- Water Quality

- Geographic sub-area designations

How we analyzed the data



## RESULTS

Where is the spawning habitat?

- Gravel beds
- Small tributaries
- Upper Sacramento River only

What are the habitat variables

- Shallow
- Cold
- High DO/Low TDS

How good are the data?

- Significant at 0.01

Can we use them to plan?

- Yes

## DISCUSSION

Plan goals

- Save salmon

Plan Objectives to be achieved in order to achieve the goal

- Preserve existing habitat
- Restore habitat

Time frame for achieving the goal

- 3 years (why?)

Planning strategies and constraints

- Protect habitat immediately
- Restore key habitats

Alternatives (Specific approaches, single or combined strategies)

- A. Buy X river and restore
- B. Buy Y creek and restore
- C. Buy both and restore

Ability to meet objectives; costs and benefits

Chosen Alternative: buy both

Resources required

- Land: 3,000 acres
- People: 100 people years
- \$: \$10,000,000
- Equipment: 6 tractors
- Materials: 2,000 tons gravel
- Facilities: filtration plant
- Energy: 200mW
- Time: 3 years

Actions/Sequence. . . and so forth

Evaluation or feedback procedures

Formal recommendation. . . Buy X and Y, implement plan

### **C. Format**

The format for project reports varies with department/agency/organization. In general, the scientific portion of the report can look and read just like a scientific paper. In general, the practical/plan portion of the project report should not read like a scientific paper. It should read like an administrative report. So, to do a complete project report, you may actually prepare two reports.

For the administrative report, work with short paragraphs, lots of headings and sub-headings, bullets. Tabulate data; put major tables in an appendix; use simple graphics.

### **D. Style**

Project reports often have dual styles, appropriate to their dual audiences. There must be a basic scientific style to the majority of the scientific text. But there should also be passages in a simpler, more administrative, style. You accomplish this:

- 1) Write the scientific paper as if you were preparing a normal manuscript for publication
- 2) Add short paragraphs to the beginning and end of each section -- in plain English.
- 3) Write the plan in simple, everyday formal English

The style of the short passages and the plan section should have:

- 1) Shorter sentences
- 2) More simple and loose sentences
- 3) Fewer technical terms

## Generic Type 5: The Management Plan

The management plan is prepared in numerous settings. As a formal genre, it is only about 50 years old. It has become increasingly important in the biological sciences since the advent of NEPA and other environmental law and regulation--because these laws and regulations **require** that government actions be documented. As public and administrative scrutiny of resource managers has increased, the need for management plans has also increased.

### A. Logic

The management plan has a "step-down" logic. The steps are:

*Goal*  
*Problem/Status*  
*Objectives*  
*Strategies*  
*Actions*  
*Monitoring*  
*Revision of Plan*

It's relatively easy to set up this structure in format. The logic is more difficult. The key is to understand what each step involves logically, how the steps are interrelated:

#### A1. Goal

Goals are not necessarily logical or based on good science. They are human generated. It is critical to know the goal of management before you start formulating the plan. Goals are not necessarily quantifiable, but objectives are. "Improve resource" is not a useful goal from a management perspective. The goal should be as precisely described as possible, even to the extent of describing it as a "scene."

*Goal: We want a self-sustaining population of lake sturgeon in Missouri, capable of supporting a major sport fishery.*

*Objectives: Do the above in 10 years or less*  
*Do the above to support at least 100,000 angler days per year*

#### A2. Problem/Status

This is the logical link missing in most management plans:

- If the goal has already been reached, and there is nothing preventing it from being maintained, then there is no need to manage.

- Management is required to remove problems or upgrade status. In short, you manage when the status of the resource falls short of the desired status or goal.
- The objectives of management must be logically and actually related to both the goal and the problem/status.

For example:

*Goal: Self sustaining winter run of salmon*

*Problem/status: Run is now at 200-400 fish per year; self-sustaining requires escapement of at least 10,000 fish per year. Low escapement is a result of overfishing at the mouth of SF Bay by commercial boats. Self-sustaining populations also require adequate habitat for spawning; spawning habitat has declined due to pollution.*

*Objectives:*

- 1) *Control overfishing*
- 2) *Reduce pollution in spawning streams*
- 3) *Take compensatory actions to improve escapement and existing habitat*

Notice that the objectives are derived not from the goal -- but from the comparison of the goal and the existing status. The objectives must address the problem.

### **A3. Objectives**

Objectives are the link between the goals and the actual action plan. Objectives are quantifiable descriptions of what must be accomplished to eliminate a problem or upgrade a resource status. They should be expressed precisely -- because lack of precision makes it difficult to evaluate whether the plan is adequate to meet the objectives.

### **A4. Strategies**

Strategies are general approaches to action, not specific actions, for example:

*Strategy: Place limits on commercial catch of winter-run salmon*

*Action: Limit season, Limit size, Limit catch*

The strategy is "limit." The actions are ways of accomplishing the strategy – specific limiting actions.

## **A5. Actions**

Actions are what you propose to do. The actions you propose must be consistent with the strategy you select, and it must be clear that by taking the actions you actually accomplish the objective. Therefore, the actions must have two components:

- Action
- Anticipated result/how it will be measured

It needs to be clear that the action is capable of producing the anticipated result.

## **A6. Monitoring and Plan Revision (Adaptive Management)**

Few people believe that plans are infallible. So, it is logically reasonable to expect the management plan to have a monitoring component and provisions for revising it.

## **B. Sample Logic for Management Planning**

### **Goal**

Provide water for southern California on a reliable basis; in the year 2030, southern Californians will be able to use water at the current per capita rate.

### **Problem**

Projections comparing population and supply suggest that per capita use will have to decline by 22% by 2030.

- Causes:
- Waste of water in agricultural areas
  - Use of drinking water for irrigation in urban areas

### **Objectives**

1. Make agriculture more efficient and transfer water saved to municipalities, providing up to 200,000 acre-feet of new water to southern California.
2. Convert irrigation of golf courses, parks, and other open areas to reclaimed water, saving 200,000 acre-feet per year

### **Strategies**

- 1A) Buy out inefficient ag. users
- 1B) Pay for improvements in ag. irrigation
- 2A) Build new infrastructure to treat and transport reclaimed water

2B) Provide incentives for use of reclaimed water and let local districts do the job

### **Actions**

1A1) Identify ag. users who use lots of water and whose profits are low

Offer to buy out property, with water rights

Offer to turn over property to environmental groups for parks and refuges

Offer to provide water for environmental needs

Take remaining water

Need 100,000 acres (6 af/acre - 3af/acre for environmental needs . . . . and so forth

### **Monitoring**

1A1) Need to accomplish 5,000 acres per decade

If we fall below, analyze problems

If local resistance, offer local economic incentives . . . . and so forth

### **C. Content Checklist**

Management plans should follow the logic described above; that is, they should cover all of the "steps" in roughly that order. In filling out this logic, you may want to consider including the following data in the appropriate sections.

#### For Goals

What is the setting for the plan, the general environment which determines the goals?

What are the needs of the people/resource?

What is the organization's general philosophy regarding resource management?

#### Problem/Status Review Section

What is the history of the resource?

Historic status?

Factors responsible for historic status?

What is the current status?

Factors (causes) responsible for current status?

How is the current status a problem?

Consequences to the resource if nothing is done?

Consequences to the "goal" if nothing is done?

#### Objectives

How were objectives formulated?

What are the objectives?

How will accomplishing these objectives actually accomplish the goal (demonstrate it logically and

scientifically).

Do we actually have the resources needed to accomplish these objectives? Are they realistic?

Time -- Money -- Staff -- Organization -- Natural resources --

Public support -- Knowledge -- Technology

What should our priorities be in implementing, given limited resources?

### Strategies

What are the strategies available to us?

Any limits on our actions due to legal/policy considerations?

Any limits on our actions due to philosophy?

What are the general advantages and disadvantages of each strategy?

Which strategies do you recommend we pursue as a priority?

### Actions

What do you propose to do?

What?

Where?

When?

How?

With whom?

At what cost?

How do you know that this will work?

Previous experience

Literature

Scientific basis/legal basis

How do you propose to acquire and organize the resources needed to accomplish each action?

Budget

Staffing

Coordination

How do you propose to monitor and evaluate progress?

Monitoring

Performance standards

What plan adjustments will you consider if progress falls below performance standards?

### Discussion

How will the plan ensure that the objectives are met -- goal achieved? Reverse the logic of the step down process in a brief description and discussion?

## D. Format

Management plan format should reflect the "step-down" logic of the planning process. Format should also be appropriate for managers, that is:

- Use headings and sub-headings
- Use bullets and lists
- Use simple graphics

## E. Style

Management style is similar to scientific style, with the following general exceptions:

- Use fewer technical terms. In general, try to drop the level of vocabulary one notch. For example:

*Scientific:*                    *recruitment to the population*  
*Managerial:*                *survival of young*

- Use loose sentences (main idea right up front). For example:

*Scientific:*                    *As a result of over-fishing and other stresses on lake sturgeon populations, the lake sturgeon is almost extinct in Missouri.*

*Managerial:*   *Lake sturgeon are almost extinct in Missouri as a result of over-fishing and other stresses on their populations.*

- You can be a bit less formal in management reports. For example, you can use:

*we*  
*our*  
*should*

Do not use casual terms, however. Keep the report basically formal:

*Not:*    ". . .we get a lot of reports"

*But:*   ". . .we receive many reports"



## Generic Pattern 6. Question List for Proposals

There are dozens of specific formats for making proposals, and in general the person or organization requesting or receiving proposals will supply a format. However, it is not uncommon for those preparing these formats to make them so general as to be almost worthless. A *generic* understanding of the logic and content of proposals is therefore of some help whether or not you are provided with a pattern.

### A. Logic

The fundamental logic of the proposal is comparative:

Need *compared to* What is Being Proposed

Thus, if I need a fast car and you propose to provide me with a Toyota Camry, you have not set up a productive comparison. The idea is simple. If what you proposes matches the need, then you are likely to get the job (or whatever else you are proposing for). This comparative logic should influence all aspects of your proposal – text, graphics, tables.

### B. Sample Question List for Proposals (Use as a generic checklist)

#### EXECUTIVE SUMMARY

1. What is your proposal?
  - What you propose to do
  - Special features of the work
2. How does this proposal respond to the high priority needs of the client/granting agency?
  - Objectives
  - Schedule
  - Coordination
  - Quality
  - Cost
3. What is your proposed execution plan?
  - The project team
  - Deliverables
  - Schedule
4. How does your expertise and experience ensure success?
  - Experience
  - Expertise
  - Quality Control
5. What is your bid for the work?

## INTRODUCTION

1. **Background:** What is your understanding of the proposed project?  
Type of project  
Location  
Scope
2. **Needs and goals:** What are the clients needs and goals (or major priorities), as you sees them?  
Related to the final product desired  
Related to how the work is accomplished
3. **Proposal development:** Who participated in the development of this proposal and how was it developed?

## SCOPE OF WORK

1. What deliverables does the client require?
2. How does the client want the work accomplished?  
Schedule  
Coordination with client  
Quality control
3. (Optional) Does you find any ambiguities (elements of the scope which are not clear), omissions (requirements of the work which are not specified by the ITB), or unnecessary items (requirements in the ITB which do not in fact have to be accomplished to meet the stated goals of the project) in the Scope of Work and what does you propose related to these?

## YOUR QUALIFICATIONS

1. **Your organization**
  - a. What is your general experience in this type of work?
  - b. What similar types of projects has you completed successfully recently? Who may we contact? (optional)
  - c. What resources does you have to accomplish the work?  
Staff  
Offices and facilities  
Capital/staying power  
Compatibility
  - d. What is your relationship with its clients?  
Will you adjust your way of working to meet our needs?  
Will you work out of our office?  
Do you stand behind your work (guarantee)?  
Can we audit?

- e. What is your willingness to take on the risks associated with this type of project? (Financial partnership, shared risk, etc. answer if appropriate)

**2. Your Project Team**

- a. Who will you assign to this project and how will the team be organized?
  - Project leader?
  - Team members?
  - Support available?
  - Where will the work be performed?
- b. How is this project team appropriate for the job?
  - Expertise?
  - Experience?
  - Organization?

**PROJECT EXECUTION PLAN AND SCHEDULE**

**1. Overview**

- a. What resources will the work require to be completed on schedule?
  - People
  - Time
  - Facilities
  - Coordination
- b. What alternative approaches or strategies are there to the work? (Timing, phasing, project organization, coordination, design strategy, construction strategy).
- c. What general approach or strategy has you selected and why is this the right approach?

**2. Execution Plan**

- a. What is you going to do?
  - Deliverable -- method -- reliability of method
  - Deliverable -- method -- reliability of method
- b. What is the schedule for this work?
- c. What standards and procedures will be implemented to ensure quality (QA -QC - Inspection)?
- d. What provisions does you propose for security?

**3. Contingencies**

- a. What problems does you foresee in the work?
  - General (say, there is a worldwide shortage of 12-foot concrete pipe or all petroleum safety firms are currently engaged in fighting fires in Kuwait)
  - Contractual?

- Estimate reliability?
- b. How does you propose to anticipate and solve these potential problems?  
If A, then B  
If C, then D. . . . .

**COMMERCIAL**

1. What is your price?
2. What is the basis for this price?

**ASSUMPTIONS AND EXCEPTIONS**

1. What are the assumptions behind your bid?  
Assumptions which reduce the scope of work?  
Status of work completed to date  
Level of work required  
Client participation  
Data already available  
Assumptions which increase the scope of work?  
Omissions/ambiguities in the ITB/RFP related to any of the above
2. If these assumptions are not valid, how would this change the bid?
3. What elements of the ITB scope are not covered by the bid? Why? How is the bid substantially responsive despite these omissions?

**APPENDICES**

1. Team organization chart
2. Team resumes
3. Schedules
4. Cost breakdowns

## **Simple Generic Patterns for Everyday Use**

### **Question List for Resume Cover Letters**

1. Who are you?
2. What do you want?
3. What can you do for me?
4. If you're so good, why do you want this job?
5. What do you want me to do next?

### **Question List for Letters of Recommendation**

1. Who are you recommending, for what job?
2. Who are you and how are you qualified to make the recommendation?
3. Why are you making this recommendation?
4. How well do you know the person you are recommending?
5. What do you know about what this person has done that leads you to believe that he/she is qualified for the work required?
6. How do you think the person will be useful to his/her employers?
7. How strongly are you making this recommendation -- how does this person compare with others?
8. How can we get in touch with you to discuss the recommendation if we need to?