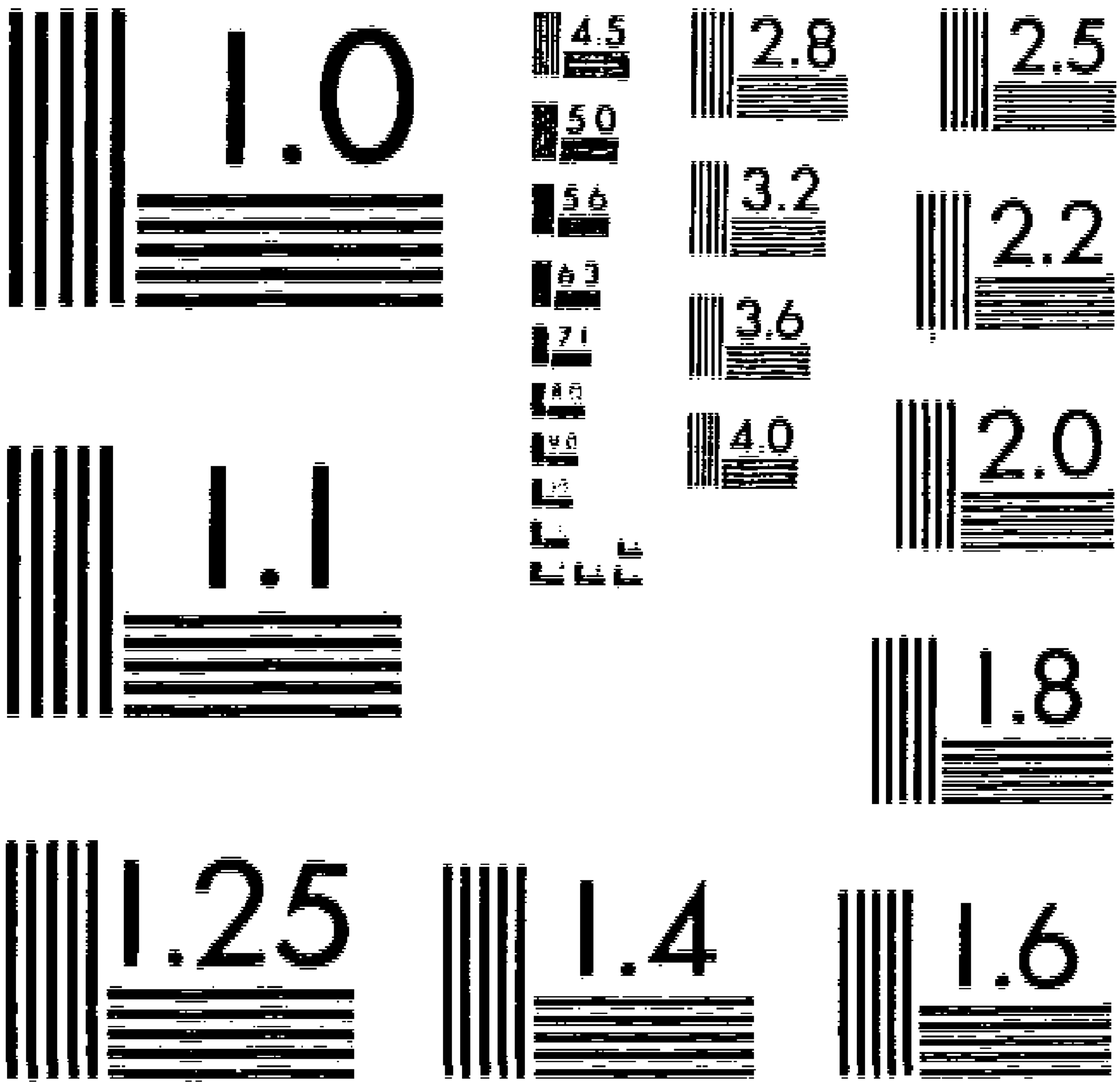


MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

DOCUMENT RESUME

ED 061 059 SE 013 379

AUTHOR	Hon, Will; Yeater, Larry W.
TITLE	Creating Effective Field Experiences for Coastal Schools.
INSTITUTION	Carteret County Public Schools, Beaufort, N.C.
SPONS AGENCY	Bureau of Elementary and Secondary Education (DHEW/OE), Washington, D.C.
PUB DATE	Aug 70
NOTE	18p.

EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Curriculum Development; *Ecology; Environmental Education; Field Studies; *Field Trips; *Organization; Program Effectiveness; *Teaching Guides
IDENTIFIERS	ESEA Title III

ABSTRACT

This publication is part of a curriculum series developed by the Regional Marine Science Project for use by teachers and administrators. Field work and field trips, being advocated as an integral part of the curriculum, are explained at length. The rationale and techniques of field ecology are offered relating them to the need for field trips and how to plan field experiences. A sample outdoor class is outlined together with a discussion of how to put a field trip program in the school system. This last part considers the design of an integrated program, implementation of the program, the nature of a field trip, and a field trip center. This work was prepared under an ESEA Title III contract. (BL)

CREATING EFFECTIVE FIELD EXPERIENCES FOR COASTAL SCHOOLS

by Will Hon and Larry W. Yeater

Regional Marine Science Project
Carteret County Schools
Beaufort, North Carolina 28516
August, 1970: 3,000

Cover by Hon
Photographs by Yeater

WHY FIELD TRIPS ARE NEEDED

In the early 1950's science educators found themselves facing a rugged situation. They were dealing with a technology that had doubled in the preceding ten years and, at the same time, were teaching far more students this mass of information.

The result of this stock-taking found some educators thinking along these lines:

> "We are dealing with an animal; granted, a highly developed and intelligent animal, but still an animal. The thing that we are trying to do is to cause this animal to learn—to affect a change in its behavior. Why not then attack the problem like any other problem in the behavioral sciences?"

In the 1950's a group of science educators used this scientific approach in the development of the Biological Sciences Curriculum Study (BSCS) materials. Since behavior was what they were trying to change, then behavior was what they caused the child to do; behavior in the laboratory. They produced a series of three texts of tenth grade biology. Each approached the subject from a different point of view and each was accomplished by an integrated laboratory manual. Ideally, the lecture and laboratory experiences were inseparable. The BSCS materials did not solve all the world's problems, however. On the contrary, its tightly structured, academic-lock-step approach has not been shown to be demonstrably better than more loosely structured methods.

Other educators took a different tack. Rather than bind the students with tight constraints in the laboratory, why not allow them the opportunity to **discover?** One of these men, Jerome Bruner, claims four major benefits from this discovery mode.

1. **Increase in intellectual potency.** What the students learn they learn better.
2. **Shift from extrinsic to intrinsic rewards.** The students tend to find satisfaction in the act of accomplishment.
3. **Insight development through heuristics.** Concept formulation is increased.
4. **Aid to conserving memory.** What they learn, they retain longer.

Dr. Bruner also feels that the tightly structured curriculum causes the belief, among students, that nothing can be found in the environment by way of regularity or relationship. In other words, it removes from the student the desire to take his facts and integrate them into knowledge.

Advances in statistical procedures have given researchers a new tool to investigate educational problems. The literature is gorged with data concerned with discovery learning. This listing was gleaned from the journals and is presented out of context. I think you'll find it interesting.

> . . . A child tends to grasp principles more thoroughly when allowed to discover them . . . Not only does he learn more thoroughly but he retains the principles over a greater period of time . . . Discovery or guided discovery is particularly effective for the slow learner . . . Pupil interest is heightened . . . Principles are more readily transferable when discovered . . . Students prefer open endedness or discovery . . . Content sequence most meaningful to the learner is different from the sequence guessed by the instructor to be meaningful to the learner . . . Learner motivation increases as a function of the amount of control he is allowed to exercise over the learning experience . . . The field experience is a discovery-prone situation . . .

This somewhat-less-than-unbiased review should lead the reader to the conclusion that we are pushing field trips. We are, because we feel that these are compelling justifications for it. If pinned down to justifying this position in one word, any one of these would be appropriate: involvement, participation, DOING.

Field trips are far from new; teachers have been using them for years. They have been an excuse for avoiding everything from a visitation by the board of education to giving an all-day test battery. Herein lies the fault—they have been used as an **excuse.**

We have a **reason.** The Marine Science Project is in the business of teaching a broad spectrum of the sciences. Much of our curriculum is directly or indirectly ecologically oriented. Now, ecology can be taught with nothing but a text for reference. But that's rather like teaching automotive repair and never allowing the students to dirty their hands. The result is a half-taught student.

We invision the thing about which we teach (nature) as a logical extension of the classroom. So, periodically, we simply change classrooms for a few hours. We do this with objectives aforethought. And, when this natural classroom has been properly attended, the previously unattainable has often been learned.

HOW TO PLAN FIELD EXPERIENCES

Getting there may not be half the fun but it's nearly half the work in a field trip. Granted, they're aggravating sometimes, but most of the problems associated with field trips can be solved before they occur. The majority of these problems crop up for want of a simple commodity—**preparation.**

You have probably been on a well conducted field trip some time during your academic career. You remember it because of certain features which single it out from all other such trips. Here are some things that may occur to you and you can probably add to the list:

1. The trip started on time and ended on time.
2. You knew the purpose of the trip.
3. Materials were available.
4. You accomplished what you set out to do.

Common sense? You're right. But if common sense solved all the world's problems you could have stopped reading several pages ago. No, there is something else involved. I'll leave the answer hanging—I think you'll come up with your own.

The Marine Science Project is set up to give you assistance in your marine-oriented field work. For those of you in Carteret and adjacent counties we may be able to conduct the trip for you. Others may use us as a source of background information or other forms of assistance. Briefly, these items are available for your use.

1. Written units—grades 2, 4, 5, 6, 7, 8, and 10 (two units)
   and others in preparation
2. Films and film catalogue
3. Marine Science Project bus: rated at 54-passenger capacity (36 larger children)
4. Limited amounts of preserved material
5. Collecting gear
6. Color transparencies
7. Advice—all that you'd care to listen to

Let's back-track for a minute. You've just read several pages which have given you our justification of field trips. We have also told you the kinds of material help that you can expect from the Marine Science Project. There is one thing, though, that we haven't considered—how to conduct a field trip.

This is a knotty problem. It could be easily solved if all locales were identical; if all trips were taken in the same season; if each of you were an automaton and willing to follow a rigid academic lock-step outline. But they aren't, you can't and you most certainly won't. Guidelines, or something like it, would probably be helpful. That's what that part will cover: a selection of our experiences and ideas on the conduct of field trips to give **you** ideas on the conduct of your field trips.

Four people have to be notified that a trip is being planned: your superior, transportation facility, students and parents. A simple way to do this is with the permission slip. If you plan to take several trips during the year, you might find this format convenient. We've used it for several years with considerable variation depending on the complexity of the trips:

NAME ....
Last First

PERMISSION

TO TAKE Part In A

..FIELD TRIP..

As parent or legal guardian of this student, I hereby grant permission for him or her to take part in field trips conducted as a regular part of schoolwork. It is my understanding that students are to be supervised by the marine science staff and regular teacher throughout their absence from school. The trips to be covered by this permit are to be of this approximate place and date:

DATE **PLACE TO BE VISITED**

Signature of parent or guardian ....

If the permit is to be used for one trip only it should contain this information:

Your name and class being taught
Student's full name and age
Date of trip
Destination of trip
Departure time
Expected return and special instructions if you are getting back after school is out
Brief explanation of purpose of trip, including instructions on clothing and special gear
Signature of parent

To save yourself much grief, make this a firm rule: "If you don't have a signed permission slip you don't go on the field trip." In any event, it's always a good idea to jog everyone's memory with a **second** reminder the day before the expedition.

When you're planning transportation, plan on cars only as a poor second choice. If the class is young, the kids tend to spend more time attending to mother than to the instructions. The older the class, the messier trips tend to become—particularly those to the marsh. Be advised: muddy kids make muddy cars! Try to get a bus of adequate size. When haggling for a **school** bus remember that their capacity is **usually** rated at three students per seat. By virtue of new legislation (1969), school buses can now be used for science field trips. This assumes that you are presenting the trips as part of the regular course of study and stay within your county. Activity buses can be used, but drivers must have a chauffeur's license or be a school bus driver. It's important that you count heads each time the students load the bus. If you don't you may be judged and found wanting—one student.

For everyone's benefit, notify them of your plans at least two full school weeks ahead of time.

This, of course, puts the burden of planning the content of the trip on you well in advance. Where to go and why? We've already looked at a reason for going, but more than the simple utilization of the field trip is necessary. How will the trip fit into your class schedule? It can serve either as an extension of class activities or as a parallel exercise. Whatever route that you take you **must** have well in mind what you want the kids to DO while they are in the field. It may be a simple-minded suggestion, but try listing or outlining the objectives that you want the class to accomplish on the trip. You may find it convenient to change this list as the trip progresses but you will at least have in your hand a convenient guideline.

There is a fine line between constructive permissiveness and chaos. You've got to keep the kids on the right side of it in the field. If you regiment them too thoroughly, the benefits that you might gain from discovery learning are squashed. On the other hand, if you just turn them loose with little direction your major gain will likely be in applied first aid.

Let's assume that your class has been studying salt marsh ecology. When you arrive at the site for the trip the kids aren't completely naive. Neither are they very knowledgeable. The prudent thing to do is stand them off the bus and acquaint them with their surroundings.

Delineate the areas into which they may and may not go and give good reasons for it.

One of the problems with guided discovery (the method that we advocate) is being able to so question the students that their answers will lead them to the desired conclusion—and let them think that it was their own idea. It's not the sort of thing that you want to attempt with no preparation.

Start a series of general questions moving through the class.

Then begin to narrow the question.

Finally, get at the thing that you have been going after for the past ten minutes.

We have found it convenient to divide the class into groups of three to five students each for such an exercise. Give them adequate time to do the work but not so much that they will be idle. Thirty minutes is a good time to aim at. Remember that these kids are trying to describe a situation for which they have few labels. They know what they see but they don't know what to call it. The need for proper naming will be apparent to **them.** If you'll just take the time to circulate among the groups and casually identify the ten or so most common plants and animals, I think you'll be amazed at how quickly the students pick them up. With older groups you may want to link the Latin name with the common name: "salt meadow cordgrass, **Spartina patens**"; or "**Limonium**, the sea lavender".

When the time approaches to reassemble the groups, give them about five minutes warning. They should have time to organize their thoughts. You should take some care in selecting the place for the group discussions to be held. The majority of the class ought to be seated so that they aren't facing the wind or sun. Sand spurs don't make a good spot for sitting, either. In any event, use some thought, because if the students aren't comfortable you can't hold their attention.

Leading a group discussion is like directing a symphony. Smoothness and harmony come with practice. You've got to know just which string to pluck to start the rest of the instruments humming.

One person in each of the student groups will invariably try to do most of the talking. Don't let it happen! Fire questions at others in the group or in the audience and encourage them to ask questions in return.

These students are finding themselves in a unique position. They are reporting data that they have discovered and their opinions are being considered and respected by others. It's sometimes difficult to get them started. This initial reticence is generally followed by difficulty in making them shut up.

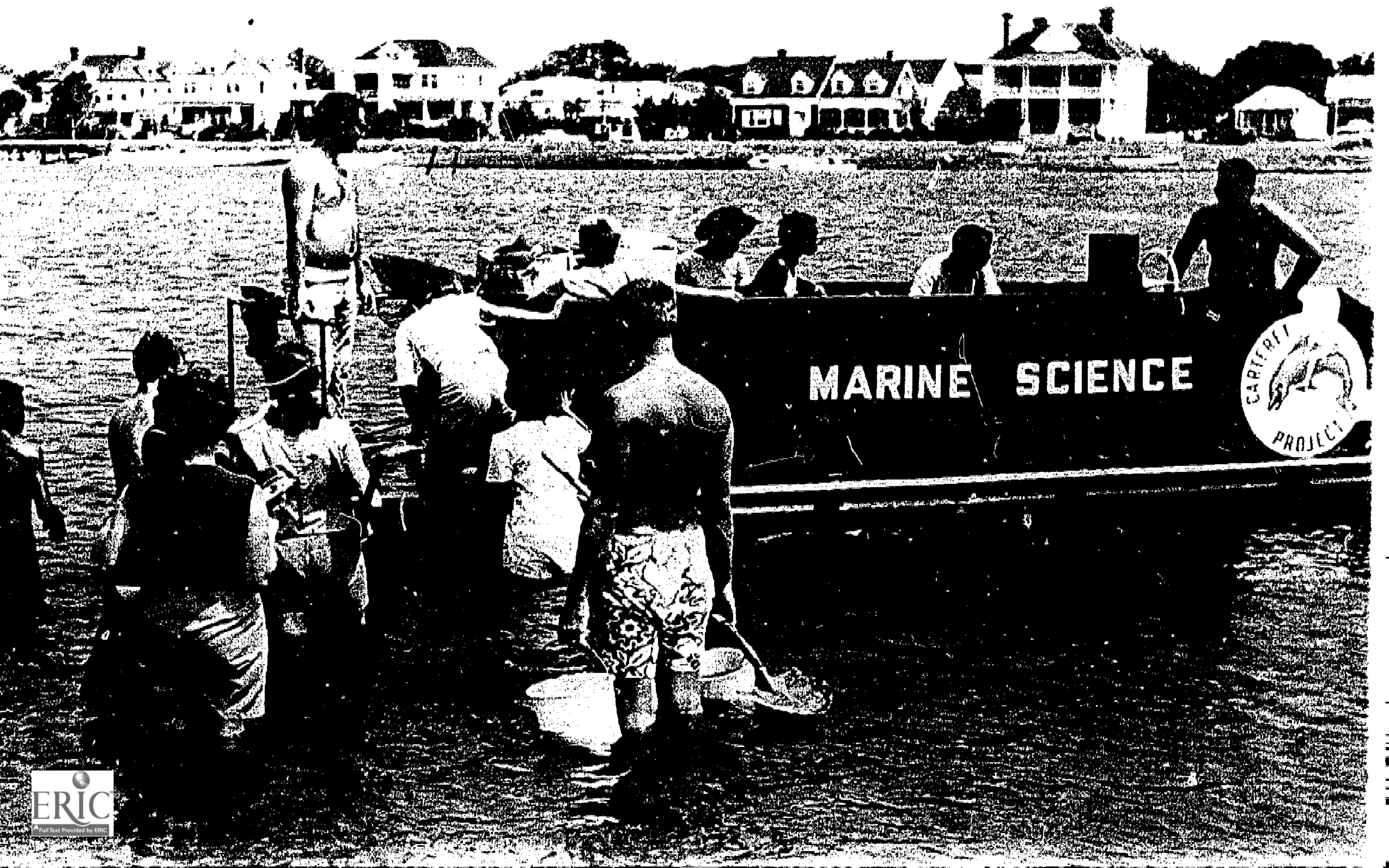
In any event, this exchange of ideas is vital to the success of the field trip. Leave ample time for it; at least thirty minutes for five groups. Complete the field work at the site. If you try to do the discussion in the classroom you have lost your immediate source of evidence.

It is valuable to direct the students (or let the students direct you) on a blackboard walk-through of the trip at a later date. Errors can be corrected and the repetition will help them retain cogent materials. I think you'll be pleasantly surprised at the **amount** and **quality** of knowledge that they have retained—particularly in the academically slower classes.

Now, the ideas and manipulation that we have been discussing have been in part specific and in part general. It was the purpose of this paper to simply start you "thinking field trip". Let me suggest that you take the specifics and adapt them, and the generalities and convert them.

You can do it as well as anyone.

By Larry W. Yeater
formerly field specialist



A SAMPLE OUTDOOR CLASS

FIELD TRIP TO A SALT MARSH

Units can be designed around a field approach. Anticipation of the field trip will add a sense of immediacy and reality to the classroom discussions. When the unit is complete, the students who have taken a trip will have a different relationship with a marsh than if they had only talked about it. That difference is observable and significant. However, there are problems.

A field trip to a salt marsh is, at best, messy. Carelessly handled, it can be a nightmare from the first forgotten permission slip to the last irate parent picking up her child with a cut foot.

The difference is in **your** attitude toward the trip. You know that the children will be thinking of it as a chance to break out of the classroom strait jacket. If you also think of it as a diversion or a novelty, you are in for trouble. Use the field as an extension of the classroom. Then capitalize on these advantages which a salt marsh has over other classrooms:

1. There is **proof of much of what you have told them** in class. Students often must accept abstract truths without corroboration, so this is a rare chance to narrow the credibility gap.
2. There is some **deviation from what you have told them.** This gives students a feel for the transition from generalized statements to specific situations, which are never exactly like the text books. Each little hunk of environment is unique, but lies within a broad pattern. This is a valuable insight.
3. Soggy feet and mud-caked legs do not detract from the experience—they energize it. There will be individual students who respond poorly, but **most will feel a challenge in the physical conditions if you present them with a task they consider worthwhile.** Let them waste their time (as they will seem to want to do), and you will take home a boisterous but dissatisfied group.
4. **Some of your poorer students (academically) will be most effective** in the new situation and their gains can be among the greatest benefits of the trip. Their success may impress other students enough to carry over into the classroom and change their role as class underdogs.

ESSENTIAL PLANNING

Don't let your commendable efforts be spoiled by a careless oversight. The minimum planning should include:

1. **Getting the principal on your side.** Take him with you if possible.
2. **Field assistance.** If no competent biologist is available, at least have someone to stand by throughout the trip so that minor emergencies will not destroy the whole field trip. This person should have a car if the group has come by bus, so that you do not have to be stranded if he has to take some student back to civilization.
3. **Transportation.** Routine if you have a bus, but remember, if using cars, that students will be muddy to their knees unless you have some way to rinse off. Remember, however, that bus drivers must be specially qualified.
4. **Clothing.** Have students change clothes. Students conscious of good clothes will miss the spirit of the trip and, in the end, ruin them anyway. **Insist that everyone wear shoes.** The common tale of woe on seashore field trips is cut feet (oyster shells, broken bottles, tin cans), and tennis shoes will eliminate nine-tenths of the problem. Do not make exceptions. If a student shows up in street shoes, put him on a problem that will keep him high and dry.
5. **Field trip site.** To find an area of marsh close to school, you may pick a site less ideal than others you know. Such is life. The decision and the compromise are important. Choose a marsh near a parking place, and a spot in which you can get to the water without crossing a tremendous stretch of mud. Try for typical salt marsh conditions, but accept what is available. With careful study, any area can yield fruitful results.
6. **Time.** Two elements here—elapsed trip time and hour of the day. Check tides and be at the marsh about low tide. Remember that tides announced on TV and in newspapers are for inlets, and up the sound tides may run hours behind. Tide tables are tricky if you are not familiar with their use.

   The other element is the amount of on-the-site time. Ninety minutes seems about ideal, but an hour can be barely adequate if you keep things humming. Two hours would be the maximum desirable. Transportation and clothes changing would be in addition to this.

7. **Weather.** A warm rain during a pleasant month would not harm anything except the girls' hair. Decide in advance what your limits of tolerance are, and have an alternate plan already laid out. If a trip is postponed, tidal conditions will be **opposite** at the same time the next week, but the same again **two** weeks off.
8. **Equipment.** If the problems to be tackled by the students are like the ones described here, you will want these tools:
   a. **Minnow seine,** which some student or his father is almost sure to have. They are a few dollars at the hardware stores.
   b. **Buckets,** about one for each half-dozen students. Cheap plastic ones are best, for tin ones rust badly.
   c. **Glass jars** and **preservatives** if you plan to bring back specimens for the class. Discourage wanton collecting and, for the sake of all concerned, discourage students from bringing back buckets full of live animals.
   d. **Shovels, several,** but if you borrow them be sure to rinse with fresh water when you get back.
   e. **Sieves** can be made by tacking screen wire or rabbit wire on the bottom of apple crates. Use both and you can sort materials by size.
   f. **Yardstick** and **tape measure.**
   g. **Thermometer, hydrometer** and **test kits** if you want to get fancy with some of your better students.

TIP: For maximum student effort, let the kids plan the trip (with your subtle guidance, check list discreetly in hand).

CONDUCT OF THE TRIP

After you've visited the site (prior to the trip) and have ecological situation straightened out in your own mind, the problem is to guide the students into a new awareness of **what** a marsh is and **why.** It would be a simpler thing to tell them what you know. However, it's demonstrably more effective for them to "discover" these phenomena for themselves.

When a student has "solved" or worked through a problem himself, the knowledge gained is retained longer and is more useful—that is, the knack of **discovering** is transferrable to other situations. Maximum benefit is gained if the students are able to identify and define the problems themselves, but time is a factor here. So are class capabilities.

For the first fifteen minutes or so after the class arrives at the field trip site, your questions can **lead** and **guide** them into inquiries about what they are seeing. They will all think that, having seen salt marshes before, they are experts at marsh-watching. In truth, they have no answers because they haven't known what questions to ask. Get them to wonder, for example:

1. What is the relationship between water depth and salinity, and how does this influence plant distribution?
2. How are plants physically adapted to being flooded twice a day?
3. Is zonation of plants really dependent on slight changes in elevation?
4. Does the animal life vary noticeably from the head of the marsh down toward the mouth?

These four example are just that—examples. The specific questions that you might create to suit your own conditions are infinite. By assigning four or five students to each task, all are kept busy and the discussions which develop in the small groups often are very productive. Enough time should be allowed for each group to do a little exploring, decide on an approach, collect some information and prepare an opinion to be presented to the other students.

Probably, for the first time in their academic experience, the students are going to have an opportunity to report results that are theirs and are the results of their own ingenuity.

As groups are working out their problems, circulate among them. This is an opportunity to enlarge their scientific vocabulary. The ten or so animal and plant names that they acquire give them a more direct and valid means of expression during the discussion period to follow.

Now sit the class down facing the marsh and let one or more speakers from each group explain the problem and answer. The others should be encouraged to question the speaker, to criticize, to examine.

On this field trip the students are taking the roles of scientists, not simply data collecting technicians. They must have an opportunity **at the site** to discuss what they have done. If you wait to do this when you return to the classroom, the ability to demonstrate your points will be weakened.

Having had several days to think over the field trip happenings, the students will doubtless have questions. These demand a follow-up evaluation. The purpose is to take a verbal, blackboard walk-through of what was done in the field. Again, the secret of making this a good learning experience is skillful questioning: tell little, but ask much. When you ask a question of a student and receive his answer, then ask him how he knows.

After the trip the students should have a better grasp of some valuable ideas. You can evaluate the extent of their learning in follow-up discussions.

1. **Ability to tackle a field problem.** Largely a matter of attitude, but partly of know-how. The biggest hurdle is reluctance to dive in, and experience with four approaches to a marsh should give enough confidence to overcome some of this.
   TEST: See if they now know how to begin a study of another area—the woods behind the school, for example.
2. **A feel for the scientific method of problem solving.** They can see the kinds of problems researchers draw up for study, some observation and recording techniques, and evaluation of the results.
   TEST: Consider the classroom as an environment. See if the class can design a research problem to find out whether there is a pattern to the amount of dust settling on objects in various parts of the room.
3. **Appreciation of the role of salt marshes.** While the ecosystem functions of a salt marsh were not observed in the field and are still a matter of faith only, an arena has been established for their discussion. The students can picture a specific marsh and hopefully have a strong sense of the marsh-to-estuary link.
   TEST: Have the students imagine the marsh they visited, now being completely walled off and filled with dirt for a large construction project. See if they can give you the sequence of events which will occur in the estuary next to the new sea wall. P. S. Don't overdo it. Destruction of one small marsh affects a limited area. The problem comes from the **numbers** of such projects recently undertaken.
   TEST: To see whether all of this really matters to the students ask whether they had rather have the original marsh or each of these alternatives:
   a. weed field
   b. corn field
   c. waterfront recreation park
   d. industrial plant

   There is no right or wrong answer, but free discussion will yield ample evidence of whether the "wasteland" marshes now have some real value attached to them.

By Will Hon and Larry W. Yeater

HOW TO PUT A FIELD TRIP PROGRAM IN THE SCHOOL SYSTEM

Marine science doesn't belong in the elementary school and has little place in secondary schools. If that seems a strange foundation on which to build a marine science project, consider these ideas. In a coastal area, the marine sciences make a fine vehicle for teaching basic biology, sociology, economics, history, geography, literature, mathematics . . . in a word, anything. There is no excuse for teaching facts of the shore just to say you have marine science in the curriculum. Yet, if you live by the shore, there is no excuse for not teaching about the sea because it is *there*.

"Because it is there" is not used in the sense that Sir Edmund Hillary used it to justify climbing Mount Everest. Here it means that a teacher is obliged to relate teaching to reality and in this place marine environments *are* the reality. To emphasize the point, consider the case of the upstate high school which wants to add marine science as an elective. Except in unusual circumstances I would recommend against the idea, suggesting instead a course in freshwater limnology. The choice would be between a book-oriented marine course with a couple of field trips to the ocean and an experience-oriented course with students in the field almost every week. Field work as a teacher of basic biology is important enough to make the choice very easy.

The contributions of field trips are many, but a main one is that they narrow down the generalities of textbook pages to the specifics of local situations. The gain in relevance is usually tremendous. With a nucleus of interesting, observed information, a teacher can build outward from the known to the unknown. Of course there are ways other than field trips to get relevance in instruction.

Our local problem with fish meal, used as a poultry food supplement, is a good example. Here is a problem in economics, in which our poultry farmers can now purchase Peruvian fish meal cheaper than our own factories can produce it, and our local menhaden industry is in trouble. This ties in with our sixth grade unit on man's uses of marine resources, but you don't have to stand knee-deep in fish meal to explain it. The subject makes a nice, relevant classroom discussion, although the exchange is livelier if students have visited the processing plant. The point is that explanation of a specific field situation may sometimes replace a field trip.

A relevant laboratory exercise can do the same. The chemistry of seawater is, except for crude field measurements used in research problems, best studied in the chemistry lab. Yet, students will find even Winkler test situations more meaningful if they go out, collect the samples themselves, and relate water to specific locale.

Some types of study cry out for field trips, however, and seem shallow without them. Ecology is the prime example. It is an effete subject when over-lectured, and this may be why teachers often shun it in their biology courses. They don't have a field trip capability or inclination, so omit the subject which is jibberish without strong ties to natural environments.

Ecology can be effectively taught as just a series of field experiences. In public schools no such potential exists, so a minimal compromise must be found. Ten percent field work is quite adequate, giving enough actual experience to support classroom discussions. For example, a three-week teaching unit can hinge on a two-hour field trip if the teacher points toward the trip in early discussions and relates back to it in later discussions.

Designing an Integrated Program

It sounds simple to say, "Decide what needs to be taught and *then* look around to see how it should be done." However, in an amazing number of cases, teachers choose a certain type of field trip because of availability, ease, proximity, or imitation and then try to warp it to fit a course need. Shortcuts in field trip planning are poor economy. Most require much leg-work, yet justify the effort.

Ideally, field-oriented instruction should be integrated so that a continuity is set up from lower grades to upper levels. Actual continuity will always be more theory than fact, of course, because of turnover in student enrollment, weak links in the teaching, and individual student differences. However, even a hypothetical sequencing of ideas from simple to complex and known to unknown is helpful to teachers. Relating field trips to existing textbooks and grade level requirements will automatically solve much of the problem.

Here is a good, solid, almost classical solution for putting marine science in grades 4 through 12.

Grade 4. Studies in *adaptation of individual animals* to the conditions. Emphasis not on evolutionary process but on variety of adaptation within existing life forms in the sea. Field trip: salt water aquarium ideal, but any natural habitat would be suitable if specimens can be collected and/or observed.

Grade 5. Studies of *community organization,* showing how the variety of adaptations makes it possible for many species to have inter-related roles in a complex web. Field trip: on the New England or Pacific Coast, tide pools and vertical zonation on rocks would be ideal sites. In coastal Carolina we use a dredge and trawl to bring up life from the bottom of the sound and recreate a picture of the community (oyster bed).

Grade 6. Man's role at the edge of the sea, emphasizing uses of marine resources and human impact on natural communities of coastal areas. Field trip: visit to the port terminal (transportation) and a seafood processing plant (sea harvest).

Grade 7. A *survey of local communities,* discussing the variation of environmental factors which give rise to diverse conditions for life. Field trip: a transect through an offshore island, showing in close proximity an open ocean beach, dunes, maritime forest, shrub thicket, salt marsh, and mud flat.

Grade 8. As part of the earth science course, a study of *coastal processes,* with emphasis on the natural struggle between land, sea, and atmosphere. Field trip: visit to an open beach to observe waves, longshore current, berm characteristics, and the dynamics of inlet maintenance.

Grade 9. Not included (physical science in the North Carolina system).

Grade 10. In support of the basic biology course of our high schools, the unit emphasizes *ecology* and uses marine habitats to demonstrate. Field trip: visit to a salt marsh to study the relation of plant and animal distribution to tidal levels and environmental gradients.

Grade 11 and 12. Advanced biology now being broadly desired in high schools, marine science seems an ideal subject in coastal counties. In the North Carolina project, two courses have actually evolved. One is a rather tough college prep research-oriented course in marine ecology. The other is a current event-oriented study of local problems of marine resource management, designed primarily for students preparing to work soon in the county rather than going to college. Field trip: Both courses include extensive field work, the first aimed at giving students experience in individual and team research, the latter course concerned with seeing and doing constructive management projects, and with observing local problems.

While *all* advanced biology students conduct individual research, there are many opportunities for extra experiences for those with initiative. Students who are willing to put forth extra effort are offered weekend research trips with professional biologists; visits to research facilities; and trips aboard oceanographic research vessels.

Implementing the Program

In this whole scheme, field trips may be considered the culmination of each grade level study, but classroom teaching remains the arena for most of the unit's instruction. This offers a clue as to how a school system can, with a limited number of marine biologists, put oceanology into many classrooms. A few basic facts, gleaned from experience, are necessary to explain the rationale.

In the first place, it may be assumed that an average or better teacher can take any text materials given to her and do a creditable job of having the students learn it. If she is also enthusiastic about the subject, her presentation will almost certainly be a success, and if the subject is one of inherent appeal to students, a vigorous learning situation will be created. Marine science usually has all of these things going for it in the classroom. Even a teacher who is generally weak may find that oceanology is very teachable because of its high interest nature, and the unenthusiastic teacher may find herself swept along by natural class interest. Summary: Marine science stands a good chance of being pretty successful when taught by regular classroom teachers if they are given appropriate materials.

The second fact to consider is that the best of teachers seem to fall apart in the field. One can speculate that the approaches demanded by classroom and salt marsh are too different; that both teacher and students have a rigorous in-class relationship which is difficult to alter; and that the novelty and the desire to "get out" obscure the field trip's real potentials. It's not likely that one classroom teacher in 20 can set up a field trip to satisfy an evaluator. There aren't many more teachers than 1-in-20 who are willing to mess with biology field trips. Follow-up of full-week in-service training for enthusiastic school teachers shows that only about 15% consistently use field trips in the years ahead, in spite of their sincere expectations.

The reasons why teachers don't conduct trips are many: logistics of transportation, permission slips, liability and obtaining a site; scheduling problems; administrative disapproval; added responsibilities; and reluctance to experiment. Many of the reasons are valid and very real, but the chief one is often psychological: lack of confidence. It does take a leader with much environment-specific knowledge to conduct most kinds of field trips superbly, but creditable trips could be conducted by average teachers properly inspired. The type of student discovery trip described later in this paper has many possibilities for the non-biology major serving as trip leader. However, the results of efforts to get masses of teachers to conduct effective field trips are discouraging. Summary: You cannot expect your elementary teachers to carry out extensive field trip programs, and even upper-level science teachers will need constant bolstering.

Now, combining these two facts, we have a feasible approach.

1) Let subject matter experts design curriculum units which relate closely to local environments.

2) Prepare teachers as well as is practical in the use of units; but don't be dismayed by loopholes in your in-service training.

3) Let classroom teachers present the three-week units as best they can.

4) Have field specialists conduct a field trip for each class.

This final step assures that each student will get an expertly-guided look at the real environment and will not be too misinformed even if he happened to have a poor classroom teacher. The student will have a written unit for basic information, an inspiring field trip for attitude orientation, and usually a fair three-week discussion of the environment in layman's (the teacher's) terms.

If this scheme of three-week units is adopted, the following steps (with suggested limits of practicality) would seem logical.

1) Get *administrative endorsement* from the top down. Reluctant principals are a constant deterrent to extensive field trip use. It is often overlooked that many principals who talk of wanting field trips really mean that a couple each year are okay, but they don't want it to be contagious. A clear-cut statement from the county superintendent about the magnitude of the field trip campaign may help really aggressive teachers to get what they need: help and encouragement.

Closely tied to general approval are the logistical problems. Most can be handled with cooperation, but transportation is a rascal. Administrative approval should include money and approval for using school buses. There are unforeseen problems

here, such as maintenance crews having difficulty fueling busses which are not on the parking lot during their scheduled service stops. Don't make every teacher fight these problems individually and don't expect her to use parent-driven cars. It is poor economy and not a long-term solution anyway.

Achieving all of these things is tricky, and there are several approaches. The obvious one is to brainwash several school board members or the superintendent at a cocktail party and get a master plan adopted for the school system. Do that, of course, if you can, but remember that principals will still be the keys to success. How about a Friday-Saturday workshop in which principals will either observe or themselves *be* a field trip class, conducted by the best leaders within your reach. Carefully plan everything for their comfort and complete brainwashing.

2) Put a staff to work designing the overall *plan and individual units.* You can hire marine biologists, have teachers critique for grade level, and then edit extensively; or you can hire writers, have marine biologists and teachers as consultants, and edit a bit less. Both systems depend on personalities too much for generalizations. Don't hire teachers to moonlight the work, since the job is bigger than anyone will assume, time is critical, and the odds are against a good product anyway. Although a curriculum specialist can sit down and bang out some superficially good-looking material in a few weeks, allow three months for preparation of a three-week unit. Then pilot test it on a few classes and present it to an in-service training session and revise it. An additional revision will be desirable after a year's use in the system. An experienced curriculum developer will do well to produce three units a year, and even a knowledgeable neophyte will have trouble getting out two.

3) Begin *in-service training* as soon as possible, using the master plan even before units are finished. Split teachers, giving background material suitable for elementary teachers in perhaps three Saturday mornings of ecology-appreciation field trips, and for the secondary science teachers conduct a more subject matter-oriented session.

As units are completed, have grade level one-day workshops, which should probably be voluntary. Common sense prevails over zeal here, indicating that forced compliance will breed only trouble. When the time comes for units to be taught and field trips to be aranged, would you like to be the teacher who tells her class that they will not participate? There is much in your favor, and over the years you will win over many dissenters — and lose a few supporters who find that field trips aren't what they thought.

4) Introduce marine science as a new high-interest subject which replaces a chapter or two in each science book and teaches basic principles of biology, ties in with other subjects, and receives a maximum of central office help to bolster the teacher's own efforts.

5) Document all of your activities and results, maintain evaluation procedures, and use the avenues of publicity which will open up to you because of the glamourous nature of your project — boats, gulls, laughing children, wriggling sea creatures, and squealing girls.

The Nature of a Field Trip

Axiom: Field trips teach things which cannot be taught in the classroom. They have a very different texture from the classroom experience, even when supposedly teaching the same thing. Most children like field trips, some do not, but success of a trip depends on utilizing these differences without letting chaos develop.

In all field trips, the most important things that happen have little to do with facts. Most facts observed will already have been known from study of the unit, but there are all degrees of knowing. The knowing which emerges from field trips is knowing from experience, which is worth 10,000 words, to warp the Chinese proverb.

The type of field trip which seems to capitalize best on these field trip potentials is a loosely structured one which allows students to observe and hypothesize. The framework which keeps it from becoming a messy debacle is the assignment of rather specific areas of investigation. As designed by Larry Yeater, field trip specialist for this marine science project, a high school trip to a salt marsh to explore community relationships would go like this:

Seat the class on relatively high ground with a panoramic view of the marsh and tidal creeks. Letting the students do as much of the talking and questioning as they will, explore what they see. Search for patterns and come up with questions about key relationships between plants, animals, water, and land. Discuss ways that the questions might be investigated and divide the group into research teams to carry out the research. The teams might be (1) subtidal animals (by seining), (2) intertidal animals, and (3) relation of plant distribution to tidal fluctuation (elevation).

Given an hour or less to sample, observe, sketch, argue, and to ask questions of the leader if they wish, the group forms hypotheses about the processes at work in the marsh.

At the end of the research period, the three groups convene to explain and demonstrate their findings to each other. The leader subtly steers the unfolding story.

Results: Each group (hopefully each individual) has a chance to do some guided reasoning on the basis of self-obtained information. The concensus of the group is usually superior to the thoughts of any one individual, and the competition between groups heightens the desire to excel. The amateur conclusions are almost always adequate and preferable in total impact to the vast amount of relatively meaningless facts which the expert trip leader could have spouted out in the same length of time.

This is a college field trip technique, very similar to general ecology or field botany trips for sophomores. The revelation here is that tenth-graders, or even seventh-graders, respond well to the challenge. The results are different, going back to our original idea that in public schools we are teaching *not* marine science *per se* but attitudes toward coastal environments. Universities have given up trying to produce Renaissance men, but in the public school we can retain that potential. For example, do not let a pedantic leader bloat his ego by bludgeoning small children with Latin binomials. Except as illustrations of the basic Linnean problem of classifying and naming organisms, scientific names serve little useful purpose. If high school students have need for the names in further research, this is obviously another matter. However, the tendency of professional marine biologists hired as teachers is to err in the direction of weakening their presentation by over-dilution with pointless parading of facts.

Summary: The field trip as a technique, and as an approach to concept formation, ordinarily overshadows the factual material handled. The emotionally-colored factual material is more relevant to life, is retained longer, and is more easily retrieved than facts acquired in ordinary classroom situations.

One comment may be very pertinent here. While field trips are the exception in schools, they are very common in the child's total experience. Of course, the first half dozen years of his life were spent in environmental exploration, and now he takes off on a field trip every day when school is out. He goes out on his bike, however, with a consciously contrived block against learning in the formal sense, for he is sick of "learning," which is boring. And, in fact, he learns little because his play time is poorly organized (from an educator's point of view), and he overlearns what is pleasant and easy and rewarding.

No adult familiar with children would seriously expect to funnel youthful, meandering recreation into efficient productivity. However, there is fertile ground here, suitable for a little sowing of seeds. How is this for an objective toward which to point an environmental ecology project?

> To see that our students, in the years ahead, can never pass a marsh, a mudflat, or a beach without having their curiosity piqued enough to try once again to answer the questions raised by our study of these habitats. Every future encounter then becomes another field trip and a chance to add a few more facts to an equation and to get a better answer.

To all of this discussion about the purposes and potency of field trips, this warning should be added. If there is anything more sterile than handing out facts to be regurgitated by students, it is the insidious gimmick of asking for creative thought and expecting cliches. It happens all the time and probably explains why there is a gradient of creativity and imagination sloping *downward* from the beginning of formal education to the end. We educate really free wheeling ideas right out of children. Since field trips are the device that deals with personal observation and concept formation, by-passing books is worth pondering.

The classical example is in the realm of physics, dealing with a professor who explained atmospheric pressure and barometers and asked them the question: "How could a barometer be used to measure the height of a tall building?" Creative? Yes, in that students were supposed to use his facts to come up with the idea that the pressure at top and bottom of the building would be different and the difference in height could be calculated. Most got it right, but one student suggested tying string to the barometer, lowering it the ground from the roof, and measuring the string. The professor was convinced the boy knew nothing until a debate revealed that the boy had half a dozen other solutions including dropping it and calculating the height from $S = \frac{1}{2} at^2$; triangulation of the shadows of building and barometer; measuring "g" force of barometer on a string at roof level and on the ground to calculate height; and moving up the stairs measuring the building's height in barometer units. The crowning blow was the proposal that one take the barometer to the basement and offer it to the building superintendent in exchange for the information. The student then admitted that he had known the professor's solution from the beginning but thought that such cut-and-dried logic defeated the whole purpose of logic. *When you ask a child to think, let him,* and don't be blocked by your own bedrock bias.

Your Raw Material, The Students

The subheading, "raw material," is in jest. If a character named Marshall McLuhan is correct, modern youth are less raw than we old codgers who teach them. In some important ways they are sophisticated beyond our means to teach them very effectively.

To summarize the many books by and about McLuhanism, let's begin by saying that communication media have changed dramatically, and that the new generation isn't just going through a phase, they are a new breed of cat. Having grown up in an electric environment, they have an approach to life very different from those of us who grew up in the linear environment of the printed page. They have a tremendous talent, learned from television, for absorbing multi-dimensional environments. Yet, we go into classrooms and throw Gutenburg at them day after day, the dull printed page, and they are bored stiff. The phrase "participation mystique," which is sometimes used to describe the youngsters' yen for involvement implies that they want to be all wrapped up in what they study, to play a role *in* the thing instead of just talking *about* the thing. Good or bad, television has probably really done this thing to us, and with 96% of our children exposed to TV we are in for change. This sounds encouraging for those who deal with field trips and other types of student experimentation. Other implications, as McLuhan sees them, are that classification has lost its significance and fragmented learning no longer appeals. Total environments and personal interpretations are the new order.

This may explain the current upswing of ecology in the mass media. Ten years ago nobody knew what an ecologist was — now everybody *is* one. Ecologists may be the key to the greatest philosophical revolution since science took over mankind. This may be a genuine reaction against technology and against specialization. Some precision will be sacrificed for a greater degree of suggestion and the value of individual response shoots way up. In fact, McLuhan goes so far as to say that myth again becomes a mode of life, for myth is the only way man can approach, with simultaneous awareness, the complexities of total environments.

This sounds a great deal like what Louis Agassiz was talking about and is much the feeling some modern educators have about field trips. Alfred North Whitehead, a pretty sensible spokesman for the scientific community, once had this to say about myth and reality:

> In the study of ideas, it is necessary to remember that insistence on hard-headed clarity issues from sentimental feeling, as it were a mist, cloaking the perplexities of fact. Insistence on clarity at all costs is based on sheer superstition as to the mode in which human intelligence functions. Our reasonings grasp at straws for premises and float on gossamers for deductions.

If this seems an escape mechanism of a frustrated old man and a frustrated young generation, recall that many scientists have deplored the hard-nosed, blinders-in-place push of science. Take Robert Oppenheimer, who fathered our atom bomb in the 1940's. He once mused that there were unschooled children on local street corners who could throw light on some of his most perplexing problems because they had ways of thought which had been educated out of him.

This may be anti-scientific softheadedness or it may be the science of the new generation. One wishes that education were as simple as chemistry, so that we could devise a litmus test for "sweet" and "sour" ideas. All new philosophies seem bittersweet and history helps us little in their evaluation. It seems safe to say, however, that those of us dabbling in environmental ecology are on the lip of a gigantic forming wave and don't have much surfing experience.

A Field Trip Center

In a local school system with ample, widely-dispersed field trip sites, there will be no thought of a special facility for instruction. However, any effort to serve a broad area or to broaden the field experience, will lead to thought of an interpretive center.

Some ideas, in fact, are done better with good exhibits and demonstrations than with field trips. Food chains and pyramids of numbers are good examples, since they require students to visualize abstract relationships even though they are standing knee-deep in water with a predator and its prey in hand.

The ideal teaching situation would be a combination like this:

A group of tenth-grade students arrives by bus and is met at the door by a biologist. He ushers them to an animated diagram of marsh interrelationships which shows lower stages of the food chain in movie form (rearview projectors) and leads up to higher levels illustrated with actual animals. Cross-sections of the salt marsh show elevational and tidal cycle relationships. After half an hour of posing the questions to be answered by the day's study, students see a movie on marshes and then take out sack lunches to be eaten during a two-hour field trip. In the early afternoon they are back in the center, in the basement this time studying specimens collected on the field trip. In salt water tanks simple experiments can be conducted and the teacher can summarize the day's six-hour, multidimensional marsh experience.

For each grade level there would be a comparable but different day of demonstrations, field trip, and laboratory work. The continuity of units could follow the course outline presented earlier in this paper.

In fact, such a center is already materializing in North Carolina. The center will be sponsored by the State, a forum where marine scientists can meet the public and explain problems and programs of estuarine management. Money will come from both state and Federal sources with the idea that public awareness of coastal resource use will have an effect on the economy of the region. All ages and all types of agencies will be served. The center will be part of a marine sciences complex encompassing basic and applied research, management, school, adult education and technical institute training in marine vocations. Construction will begin during 1970.

Creation of this center places field trips in a context which should squeeze maximum benefit from them. Within reasonable limits of time and staff efforts, this would seem the ideal way to give large numbers of students (or other groups) an "experience" to remember and a great deal of food for future thought. □

Will Hon

1969 NATIONAL MARINE SCIENCE IN EDUCATION CONFERENCE

AN E.S.E.A. TITLE III PUBLICATION

by the

REGIONAL MARINE SCIENCE PROJECT

of the

CARTERET COUNTY PUBLIC SCHOOLS

Beaufort, N. C.

T. Lenwood Lee, Superintendent

This publication is designed for use as part of a curriculum series developed by the Regional Marine Science Project of the Carteret County Public Schools, financed primarily by ESEA TITLE III. The series will include three-week teaching units for grades four through ten and two full-year courses in advanced biology. The tenth grade unit will consist of a three-week fall and a three-week spring unit.

All materials take an ecological approach to nature, stressing the ties between culture, economy and resource use. Field work is an integral part of the curriculum.

Publications are distributed at cost to interested school systems. Most are designed for use on the central eastern seaboard.

Address inquiries to:

Will Hon, Director
Regional Marine Science Project
Carteret County Public Schools
Beaufort, N. C. 28516