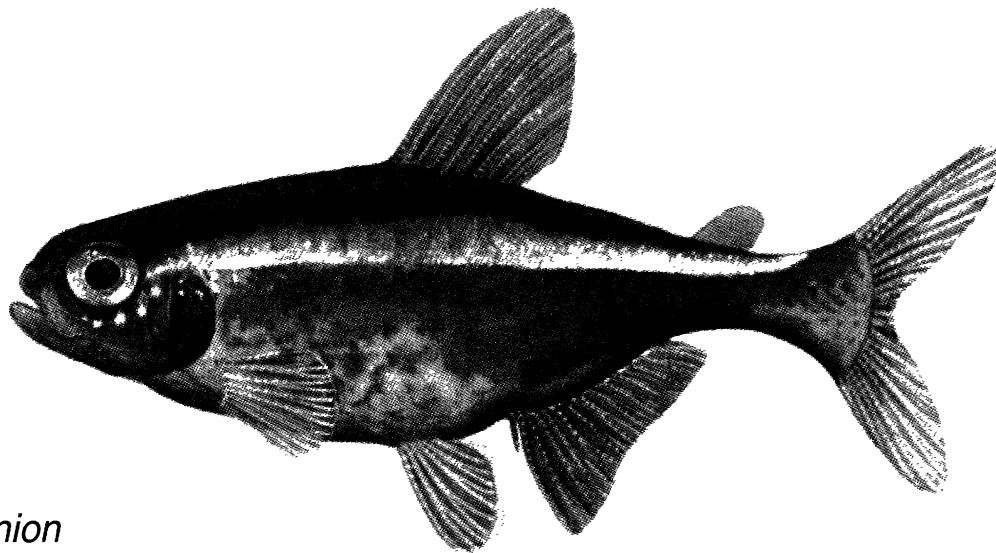


Endangered Species UPDATE

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Opinion

Science

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"Back off man, I'm a scientist." This bumper sticker has been percolating in my brain for many years. Here's why.

Science supposedly tells us why things are the way they are. However, science isn't value-free. Numerous prejudices are embedded in scientific training and thinking. Scientists, as humans, have individual agendas—personal, social, economical, and political.

I'm a scientist. I study animal behavior and am interested in the health and integrity of individuals, populations, species, and ecosystems. I love what I do; it's fun. Because I have a utopian dream of reconnecting humans with the souls, spirits and hearts of other humans, other animals (*anima* = soul), and with inanimate landscapes, and because I'm a sentimentalist, some think my science is flawed—too "soft," too subjective, not impersonal. I believe science should be more open to individual's world views. There are so many diverse problems it's unlikely there's only one sound scientific method.

Historically, scientists have been placed on pedestals by non-scientists and scientists themselves. Scientists were trusted, their autonomy and authority unquestioned. Most worked in a safe, insulated microcosm. Those who questioned science were considered anti-intellectual, perhaps Luddites. After all, scientists busily discover cures for countless diseases, the structure of the human genome, how to make weapons for global

destruction, ways to get to the moon and elsewhere, how to generate and process information faster, how to engineer better food, how animals behave, and how nature works. Alas, how to make our lives longer and presumably better. And indeed science has chalked up innumerable successes. But it can do better.

Nowadays more people, including some scientists, question science. Non-scientists are more aware and inquisitive, but aren't anti-intellectual. Rather, many feel science hasn't delivered. They're also concerned with the politics, economics (rush for patents, financial gains), and arrogance of science. Indeed, scientists make errors, and it's our fallibility that keeps science afloat. Increasingly science isn't seen as a self-justifying activity, but as another institution whose claims on the public treasury must be defended.

What about science and nature? While we've learned much about nature, one reason traditional science often falls short is that it fragments the world. Reductionistic science dissects, disembodies, and splits wholes into parts. It produces linear, mechanistic views of the universe and objectifies and devalues animals and nature. Science reduces the dynamic multidimensionality of our interactions with nature into static, dimensionless flatlands, rather than stimulating the understanding and appreciation of variegated landscapes. However, we aren't very good at reassembling wholes—reconstructing Humpty

Dumpty. We often discover wholes are greater than the sum of their parts and we're unable to understand how whole systems emerge from complex interdependent interactions among their constituents. Laudably, the National Science Foundation now supports a program in biocomplexity. Macroecology and the Biosphere project are good examples of large scale holistic thinking.

Reductionist science also misrepresents the world. This has serious consequences for the quality of knowledge we gather and for how we interact in and with nature. Reductionism promotes alienation, isolation, and disconnection. It forces a separation between the seer and the seen—a false dualism. Science often makes nature less magical and impedes our truly sensing, feeling, and understanding the scope of the amazing world within which we live.

Holistic and more heart-driven science is needed, deep science that's infused with spirit and compassion. Holistic heart-felt science reinforces a sense of togetherness and relationship, family and community, and awe. It fosters the development of deep and reciprocal friendships among humans, animals, and other nature. It helps us resonate with nature's radiance and lessens our tendency to think, egocentrically, that we're at the center of everything. Geologian (the term means student of earth's processes) Thomas Berry, author of "The Dream of the Earth," stresses we

should strive for a benign presence in nature. Native Americans are proud to claim that "animals are all our relations." Animals and inanimate landscapes need to speak for themselves. Trees need love too.

I often wonder what science might have become had its history not distanced and elevated humans from nature. My own idealistic dream is to live in a world in which humans perceive themselves as a part of nature and not apart from her, a world in which humans whose spirits have been robbed or squelched by living amongst steel, concrete, asphalt, noise, and a multitude of invasions of their private space reconnect with other humans and raw nature—with the fragrances of wild flowers, and the sounds, sights, odors, and touch of other animals and inanimate environs; a world in which sensing is feeling. We're an integral part of nature, one with nature, and have unique responsibilities to her. We must take care when we try to re-decorate nature. Nature has much to offer when we open our hearts to her boundless and breathtaking

splendor. She's our unconditional friend and reconnecting can help overcome alienation and loneliness.

We need to reinforce creative, passionate, and bold dreaming, and resist narrow thinking that claims there's only one way to do "good" science. Allowing individual idiosyncrasies, interdisciplinary collaborations, holism, and heart to inspire science will make it more exciting, creative, attractive to students. All scientists should be open to this. But some still resist the notion that science is value-laden and some don't want to impregnate science with feeling. Nonetheless, the Nobel prize winning geneticist, Barbara McClintock, stressed that scientists should have a feeling for the organism with which they worked, and she worked on corn!

Questioning science will help insure that we won't repeat past mistakes, that we'll move towards a world in which humans and other animals share peaceably the beneficence of nature. Magnificent nature—the cacophony of her deep and rich sensuality—will be respected, cherished, and loved.

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Cover: Cardinal tetra (*Paracheirodon axelrodi*). Illustration by Sally Landry.

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Survey of State Criteria Used to Determine the Status of Plant Taxa

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Abstract

This paper is an organized summary discussion of the basic considerations (criteria) used by state-level organizations in determining the status of native taxa on an individual basis (such as endangered, threatened, extinct, or other lesser rankings). First, I discuss general criteria used when classifying plant species and then I highlight seven categories used for ranking plant status in the United States.

Introduction

Consideration standards (criteria) used by individual states to rank their respective native taxa (species, subspecies or variety) can vary slightly from state to state. In this paper, I categorize and describe various listing options with associated criteria. General criteria used when assigning a plant taxon status for placement on one or more of the state-level lists include:

1) taxon must be native (indigenous) to that particular location (such as a state or range), even if no longer present in that location but historically known to be native there; verification of its past occurrence (such as through historical data) can be required;

2) research on the taxon needs to have been published in the scientific literature (e.g. Maine (Maine Critical Areas Program 1988));

3) total number of known viable populations and number of individuals within those populations occurring locally and globally, with both historical and current verification of distribution;

4) degree to which the continued existence of remaining populations have been scientifically deemed as currently or potentially threatened with endangerment or extinction from an identifiable cause; this crite-

tion includes the degree to which suitable habitat has been reduced to date, present size of remaining habitat, current and projected rate of habitat reduction, and other ecological and biological considerations including response of the taxon to disturbance;

5) number of its known populations (globally) believed to be securely protected in their remaining habitat;

6) geographic location of the state or habitat in regard to the taxon's entire main range and distribution, and if its occurrence in that state or habitat is locally endemic, regionally endemic, peripheral, or disjunct from its main range;

7) how phylogenetically close the plant is to its nearest relative(s), with the most distantly-related taxa assigned the highest priority while other undescribed, questionable, or hybrid species are generally given a lower priority; non-hybridizing taxa are given greater priority than taxa that hybridize.

The most widely used standardized ranking system in the United States is the one used by the state Heritage programs. These programs are part of a centralized information repository collectively known as The Network of Natural Heritage Programs and Conservation Data Cen-

ters, or simply The Natural Heritage Network. This network uses standard predetermined method for gathering, processing, and managing data about the occurrences of natural biological diversity, and a standard, predetermined criteria for determining and tracking or monitoring the various degrees of rarity of native species. Although this criteria and ranking system affords no legal protection, it is taken under consideration by land developers, government agencies, etc., especially when the status of a taxon on the list is deemed endangered or threatened throughout its entire range. In addition to the Natural Heritage Program's rankings, the various states may have one or more separate lists of taxa of concern that range from official (legally protected) to unofficial (no legal status) and are also taken under consideration in decisions.

Not all states maintain endangered species lists, however. West Virginia, for example, does not have an endangered species law. Instead they rely on the Federal Endangered Species Act and the Natural Heritage database to determine a species status (Defenders of Wildlife 2000). In addition, South Carolina has an official list of endangered and threatened species that includes animals only, no plants (South Carolina Heritage Trust 2000).

General categories of state-level status-ranking criteria in the U.S.

Because there can be slight variation among states' status-ranking criteria used for assigning a certain status to a particular taxon, I have subdivided the following discussion of state-level criteria into seven categories: (1) endangered (including protected); (2) threatened; (3) rare; (4) proposals for status; (5) special concern, vulnerable, sensitive, uncommon, state special interest, watch list, review list, tentatively undetermined, special concern-possibly extirpated; (6) possibly extirpated, extirpated, extinct, historical occurrence; and (7) other.

Endangered

In this discussion, "endangered" (E) refers to any state-native vascular plant taxon that, based on scientific research and field work, is believed to be or is in danger of becoming extinct or extirpated from all or a large part of the state in the immediate or foreseeable future if not given some type of protection or critical habitat designation (Arkansas Natural Heritage Commission 1987; Freeman et al 1979). This category includes native species and subspecies that are reproductively viable but are in immediate danger of extinction, threatened with extirpation from an identifiable cause(s), or their ability to sustain viable populations in the wild is being affected by one or more factors (Freeman et al. 1979; Idaho Natural Areas Council 1981).

Past and present criteria for designating a native taxon as state endangered can include the following: (1) its known occurrences in that state range from one to five extant sites, one to two known or estimated total occurrences, or one documented and recent occurrence; (2) it is federally listed as endangered, (3) the plant is a state-native species currently listed or proposed by the U.S. Fish and

Wildlife Service as federally endangered or threatened; or (4) it has between an average of six to 20 occurrences within the state. (Some states, however, consider a taxon with six to 20 occurrences as threatened.) Verified and documented recent occurrences (within the past 20 years or less) or historical occurrence of taxon in the specific state may be required for an endangered designation. In many states, plants that are federally listed as endangered are automatically listed as endangered on the state level.

In general, legally endangered taxa cannot be removed from private property without written permission of the landowner or a special permit from a state agent (Nevada Natural Heritage Program 2000). In states that allow propagation of endangered plants, these plants can be collected, sold, traded, and/or imported by permit. In Wisconsin, any endangered or threatened plants occurring on private property belong to the landowner and the ultimate fate of those plants is up to that landowner. However, the processing or selling of any listed species is prohibited without a valid endangered or threatened species permit (Wisconsin Department of Natural Resources 2000a), and the protection and management of these rare taxa is definitely encouraged (Wisconsin Department of Natural Resources 2000b). There is an exemption in such restrictions on public lands used for activities such as forestry, agriculture and utility (Wisconsin Department of Natural Resources 2000a). In Arizona, all protected native plants are prohibited from collection except under valid permit from the commission of agriculture and horticulture. Permits can be issued for scientific or educational purposes or if the plant is threatened by its location or a change in land usage (Arizona Commission of Agriculture and Horticulture 1981). (Issuance of

this permit means that permission for collection or removal of the protected plant[s] has been granted by the landowner or their agent). Minnesota's "Conservation of Certain Wild Flowers" statute says that "any persons may upon their own lands cultivate for sale and sell these flowers by registering the purpose to do the same with the commissioner" (Minnesota Department of Agriculture 1986a). Additionally, in Minnesota the accidental taking or killing of an endangered plant in cases where the existence of the plant isn't known at the time of the taking is not a violation of the prohibition-related part of their endangered and threatened species laws (Minnesota Department of Agriculture 1986b).

Other terms include "protected," which is used in one or more states to denote native taxa with current legal status or protection apparently comparable to legally endangered or threatened (Arizona Commission of Agriculture and Horticulture 1981). Protected also designates common taxa that could be exploited if not assigned protected status, or taxa deemed to be of cultural or historical value to the area or state in which they occur (Texas Parks and Wildlife Department 1983).

In one or more states the term "critically endangered" indicates that (1) a plant's occurrence is limited to anywhere from one to five extant sites, (2) population numbers are naturally low or have declined to critical levels, (3) its habitat has been drastically reduced or is threatened with destruction or severe modification, or (4) the taxa have been over-exploited, or threatened by disease or other factors.

Threatened

"Threatened" (T) refers to any state-native vascular plant taxon believed to be imperiled in its natural habitat due to various factors including rar-

ity or limited/uncommon occurrence (past and present interpretations of this criterion can range from two to 100 occurrences or sites). Threatened species include those (1) with restricted distribution (disjunct, peripheral, etc.) in the state but are locally abundant, (2) with a wide in-state distribution but comprise small populations, or (3) that exist within limited habitat that could be exploited within the foreseeable future. Threatened species include taxa that are (1) reproductively viable but shown by biological research and inventory to be rare or significantly declining within their partial or entire range, and (2) threatened in that state but whose populations are more common or stable elsewhere. In Rhode Island, a species can be listed as threatened if there are three to five known or estimated occurrences, or if the species has more than five known or estimated occurrences there but is especially vulnerable to loss of its habitat (Rhode Island Natural Heritage Program 1988).

As with endangered species, correctly documented and known recent in-state occurrences may also be a requirement for listing in this category. Some states, however, will include estimated occurrences(s) as a criterion for inclusion here.

Species with threatened status are generally considered not to be critically imperiled, but their status could change to endangered throughout all or a large part of their state range in the foreseeable future (Freeman et al. 1979; Arkansas Natural Heritage Commission 1987; Idaho Natural Areas Council 1981) if the continuing trend of threat(s) to their population and survival continues.

Potentially threatened status can include individual species that are not considered to be endangered or threatened in that state, but are either a proposed for federal E or T status, or are listed in the Federal Register

as being under review for such status (Ohio Department of Natural Resources 1988). Other types of potentially threatened species are those believed to be threatened, but more research and field work may be required to determine if this is so.

Taxa assigned state threatened status generally cannot be removed from private property without written permission of the landowner, and there can be rules by which threatened plants that are propagated can be sold or traded by permit.

Rare

Depending on the state, most rare designations are unofficial and offer no legal protection. Across the states, definitions of rare vary somewhat and it isn't as easy to categorize as endangered or threatened. Past and present interpretation of rare can mean that known occurrence(s) for a particular state-native vascular plant taxon is (1) approximately ten or fewer sites; (2) limited to between 11 and 20 occurrences; (3) recorded 15 times or fewer in the state or recorded up to 20 times with known cases of extirpation; or (4) may rarely or uncommonly occur in small numbers or populations in-state but are found in substantial numbers elsewhere. This may mean that either its range is restricted and has never been far-reaching into that particular state, its requirements for survival in the wild are unique or unusual native habitat, and/or for other reasons has never occurred in substantial numbers there. In Idaho, for example, occurrence of less than ten locations greater than ten air miles apart is used as a general starting point for designating a species as rare (Idaho Natural Areas Council 1981). In Oklahoma, rare taxa are those whose numbers are small and not presently threatened with extinction but whose status could change to endangered if their environment continues to degrade (Smola and Teate 1975).

The ranking SR (significantly rare) can indicate rarity and necessity of population monitoring and conservation action (North Carolina Natural Heritage Program 2000). The terms "critically rare" and "very rare" can indicate taxa known or believed to be in danger or extirpation from the state for reasons such as extreme rarity or the habitat is seriously threatened.

Rare can imply that relative stability or viability of a taxon is not presently threatened, but concern is warranted due to threats that may not be readily apparent. In other words, as long as its status remains rare, it could be subject to a decline in numbers as long as it isn't monitored in its habitat on a continual basis.

Proposals for status

Proposals for status (PFS) indicates a taxon currently without statutory protection but is under consideration for legal state and/or federal listing. These taxa may be variously referred to as proposed endangered, proposed threatened, primary proposed, or recommended for critically endangered with formal listing pending (Arkansas Natural Heritage Program 1987; O'Kane 1986; Killeffer unpublished manuscript; Morefield and Knight 1989; New York Natural Heritage Program 2000; South Carolina Wildlife and Marine Resources Department 1989; Tennessee Department of Environment and Conservation 2000; Virginia Natural Heritage Program 2000).

Such a candidate designation can indicate rarity and necessity of population monitoring and conservation action. Also included here are candidate taxa that may or may not yet be under consideration for state or federal listing, including taxa for which an organization (such as U.S. Fish and Wildlife Service) has sufficient information on biological vulnerability and threat(s) to support list-

ing proposals. Because candidate taxa may be given some kind of endangered or threatened status in the future, their consideration in environmental planning is encouraged.

Special concern, etc.

As with rare, most of special concern designations are generally unofficial (providing no legal protection). A special concern-type of classification can refer to vascular state-native taxa of concern that include: (1) relict species with declining populations that would be recommended E or T status if the decline continues; (2) species whose abundance is greater than previously believed or assumed; (3) species whose in-state numbers are small or whose distribution is either restricted or very specialized and could become threatened; (4) species whose in-state occurrence is sparse or distinctive and peripheral to its main range; (5) species whose rangewide viability is of known or suspected concern; and (6) rare species whose status should be monitored. Special concern also includes taxa that cannot be included within any of the aforementioned status subcategories but are subsequently given other additional types of status rankings (such as that of the Natural Heritage Network) to indicate where current monitoring may be required. In Maine, five to 10 recent and documented occurrences is a criterion for state special concern, and such taxa could potentially become threatened in the foreseeable future (Maine Critical Areas Program 1988).

Special concern status can be assigned to rare species that require monitoring to help self-sustaining populations avoid deterioration to threatened or endangered status, without application of voluntary or legal protection (Freeman et al. 1979).

Rare and special concern criteria are apparently comparable in situations where a taxon's distribution is restricted in that state for reasons including requirement of unique or unusual native

habitat for survival, or that it has never been common or abundant in that state or its entire range.

Special concern population status can comprise colonies, groups, or individual taxonomic specimens whose occurrence there has been determined to be unique and in need of protection, with criteria including degree of diversity within a certain population (including unisexuality) and if the habitat occurs in an unusual geographic location (Pennsylvania Natural Diversity Inventory 1987).

Undetermined-special concern status designates taxa that are: (1) rare and currently in need of monitoring because of their apparent potential for upgrading to endangered or threatened if alteration and destruction of their habitat is not curtailed; or (2) potentially rare taxa whose status is currently undetermined but when more information becomes available may show one or more of them to be in need of endangered or threatened status, or may show them to be so abundant or stable that they are deleted or dropped from consideration for listing. This status also includes taxa whose correct taxonomic classification is questionable and cannot be determined currently due to various physical characteristics or other factors which sets them apart from being an accurate or typical representative of any known and recognized species group as a whole. This taxonomic question coupled with other factors (such as insufficient data or inadequate historical records) means that the proper conservation of these taxa can be difficult, even when their populations are believed to be declining in numbers.

At this level of classification, there are several terms that are essentially synonymous: vulnerable (Pennsylvania (Pennsylvania Natural Diversity Inventory 1987), sensitive (Washington (Washington Natural

Heritage Program 1990)), state special interest (Rhode Island) (Rhode Island Natural Heritage Program 1988), and watch list (Oregon and Utah (Kagan et al. 1989; Stone 2000).

Inclusion on a watch list can indicate a currently stable taxon and not in need of immediate monitoring or management but in the foreseeable future may become threatened in that state and therefore may require some type of continued monitoring (Kagan et al. 1989). A taxon on watch list can be regionally endemic but not of special concern rangewide (Stone 2000). Watch lists include species of concern whose occurrences in state are more than 10, and subspecies that qualify for listing in another category but belong to a species whose documented recent occurrences are more than 10 (Maine Critical Areas Program 1988). In addition, watch status can denote potentially vulnerable taxa requiring monitoring or additional information to determine status (Morefield and Knight 1989), or taxa whose abundance and distribution in state is uncertain and whose threats to the populations may or may not be currently defined (Morefield and Knight 1989).

Commercial or market value of a native taxon can be a factor in listing it on a state watch list. Though it may not be rare at the present time, its current 'value' may place its future viability in jeopardy, therefore monitoring of its population(s) can be justified.

Extirpated, etc.

Extirpated and extinct categories are assigned by states to their native taxa historically documented as occurring there but no longer occur in-state. In most cases their original sites of historical occurrence have been greatly altered or destroyed. This section includes (but is not limited to) taxa that have no known recent occurrences and the possibility of rediscovery is considered unlikely. Extirpated or extinct taxa include those for which recent field

surveys or searches have been unsuccessful in locating any populations (Sorrie 1987), but if found would automatically be upgraded to endangered (Rhode Island Natural Heritage Program 1988).

A taxon is believed extirpated when an occurrence has been found within the past twenty years but repeated efforts to relocate the occurrence have failed (Maine Critical Areas Program 1988). In Indiana, extirpated can mean the taxon has not been seen in state in over the last half century and the site(s) of historical occurrence have been field surveyed. However, there may be one or more endangered taxa assigned that are not known to be extant in the state but are listed as such because their historic sites haven't yet been adequately surveyed (Aldrich et al. 1986).

Like special concern, there are multiple terms and definitions for extinct or extirpated. In Washington, possibly extinct or extirpated taxa have a high priority for field survey, and the classification doesn't consider the status of that taxon's populations in other states (Washington Natural Heritage Program 1990). Presumed extirpated taxa in Ohio are those whose natural populations haven't been documented (no valid records) over the last 20 years (Ohio Division of Natural Areas 2000). Possibly extirpated taxa can also be those that haven't been seen in the state in the past two decades, or they have been documented as extirpated from all historically known sites there (Tennessee Department of Conservation 1986). Under favorable conditions, possibly extirpated taxa that still occur in other places could become re-established in-state (Wilson 1984). In Maryland, a taxon with endangered extirpated status would be upgraded to endangered if a self-sustaining naturally occurring population were to be found (Maryland Department of Natural Resources 1988).

Historical classifications include taxa presumed extinct or at least known only historically throughout their range, and taxa of historical occurrence that haven't been recently documented but for which suitable habitat still exists. If found, such taxa would be given an upgraded status ranking (Sorrie 1987). In North Carolina, historical taxa haven't been verified possibly the past 25 years but suspected to be still extant there (North Carolina Natural Heritage Program 2000). In South Dakota, "historical record only" can mean that a species hasn't been reported there for more than 50 years but habitat may still exist and rediscovery is possible (Houtcooper et al. 1985).

Other

Other descriptions or definitions used by the various states on their respective plant lists include:

Disjunct: a taxon whose occurrence or distribution in the state is separate or discontinuous from the contiguous population of its main distribution or range (Houtcooper et al. 1985).

Endemic: a taxon with limited or restricted range or distribution within unique or specialized habitat (Pennsylvania Natural Diversity Inventory 1987); a species whose occurrence there represents all or a significant part of its range in the state or in the northern Great Plains region (Houtcooper et al. 1985).

Peripheral: a taxon with uncommon occurrence in state because its distribution there is at or near the borders of its entire natural range (Houtcooper et al. 1985); generally, peripheral can refer to taxa that are rare or uncommon in the state but are more common and widespread outside of state boundaries.

Restricted: a subclassification of plant species, which is composed of species found in specialized habitats or in habitats that are scarce within the state but may be common outside of that state (Pennsylvania Natural Diversity Inventory 1987).

Public participation

When relaying sighting information about an identified or suspected plant taxon of concern to the proper local agencies, persons should be advised to not uproot the plant or remove any of its parts as this can damage and possibly kill it (especially so with small or delicate specimens). Although plant parts such as leaves, flowers, twigs and bark will aid in identification, generally the taking of any parts of a legally protected plant species is prohibited without permit. In addition, one should try to avoid trampling the site and disturbing the habitat (and again, especially if the plants are small or delicate). When contacting the agency, the following information will be requested:

1) common and scientific names of the taxon and the name of the Family to which it belongs;

2) specific location of the original sighting (county, township, range, section, longitude, latitude, etc.), date and time of observation, and a detailed map (e.g., topographic) of the site's location with directions to the site;

3) detailed description of the habitat in which it was seen (microclimate, etc.), the dominant vegetation and any other observed rare taxa ;

4) current land usage and activities, and other related observational data;

5) total or approximate number of specimens of that taxon seen at the location, their general overall condition and life stage (flowering, fruiting, etc.), and approximate ages;

6) where and when the plant sighting or collection last occurred and by whom, probable present range, and estimated present status (i.e., possibly extirpated, endangered, etc....or status unknown); and

7) property ownership information (name of owner[s] or their agent, contact information, etc.) and the name(s) [and contact information] of the person(s) who originally made the sighting or collection.

Documentation of any report with specimens (if they can be legally and ethically removed) or photographs (South Dakota Game Fish and Parks Department 2000) is extremely important. In California, "photography should be used to document plant identification whenever possible, but especially when the population cannot withstand collection or voucher specimens" (California Department of Fish and Game 2000). A photographic record is generally the least complicated route to documentation, because permits are required for collecting in locations such as parks, protected areas, and private lands.

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Marine Matters

Xantus' Murrelet, *Sythliboramphus hypoleucus* I: Status and Conservation

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Abstract

The worldwide population of Xantus' Murrelets is likely less than 10,000 birds. Breeding populations are restricted to offshore islands from Pt. Conception, California to Central Baja California, Mexico. The Xantus' Murrelet breeding population on Santa Barbara Island, California has been monitored since the early 1980s and appears to be declining. Xantus' Murrelets face many threats, both at-sea and in breeding colonies. Measures to protect and restore this sensitive species should be implemented, and more information on population size and foraging ecology should be gathered throughout the species' range.

Santa Barbara Island is home to the largest colony of Xantus' Murrelets (*Sythliboramphus hypoleucus*) in the United States, constituting 25% of the world's population with its 1,000 to 3,000 breeding birds (Carter et al. in press; Sydeman et al. 1998). In the late winter or early spring of each year, murrelets return to their nest sites in the rock crevices and shrubs scattered along the cliffs of the Channel Islands. Two to three weeks after they begin visiting sites, murrelets lay two eggs, approximately eight days apart (Murray et al. 1983). The first egg is left alone, vulnerable to predation, until the second egg is laid. Murrelets then begin incubating, with incubation shifts of approximately three days. After 34 days, two chicks hatch in close succession despite the difference in laying date. Because parents are not tied to the nest waiting for a second chick to hatch, synchronous hatching allows the family to leave one to two nights after hatching, with the chicks still downy and unable to fly. Presum-

ably, the parents lead their young to foraging grounds, where the chicks grow and achieve independence.

Biologists at Channel Islands National Park have been monitoring the arrival and departure of the murrelets, and tracking their reproductive success, since the early 1980s, with assistance from Point Reyes Bird Observatory biologists from 1993 to 1999. Two study plots are established on Santa Barbara Island, one in habitat dominated by rock crevices, and the other dominated by *Eriophyllum nevini*, a low shrub that provides shelter to nesting murrelets. At the beginning of each breeding season, marked nest sites within these plots are checked for the presence of eggs and/or incubating birds. Sites are monitored throughout the season to determine the fate of the eggs, and data are used to generate occupancy, clutch initiation, hatching success, and productivity estimates. Annual estimates indicate that timing of breeding varied widely from year to year, probably

reflecting food availability at the start of the breeding season (Hunt and Butler 1980). Reproductive success has also fluctuated annually, due to a combination of predation on eggs and adults and variation in food supply in any given year (Murray et al. 1983; Drost and Lewis 1995; Sydeman et al. 1998).

The murrelets' nocturnal habits, concealed nests, and the inaccessibility of much of their nesting habitat (i.e. cliffs) have made population size difficult to estimate. However, rough population estimates indicate that the size of the murrelet population on Santa Barbara Island declined by 30 to 50% from 1977 to 1991 (Sydeman et al. 1998). In fact, two scenarios from a recent population dynamics model (viability analysis) indicate that if the current trend continues, the island population will be at a critically low level in 20 years (Sydeman et al. 1998). The decline is a major concern, not only for the Santa Barbara Island population, but for the worldwide population. There are

likely fewer than 10,000 individuals in the world; this estimate includes a total of 3,000 to 7,000 breeding birds in the Southern California Bight, including the Santa Barbara Island population (Carter et al. in press), and 2,225 to 6,700 birds (including breeding and/or roosting birds) on the islands off of Baja California, Mexico (Keitt 1999).

In addition to having a small population, Xantus' Murrelets have a limited breeding distribution, nesting on offshore islands from Point Conception to central Baja California (Drost and Lewis 1995). Recent radio-telemetry work indicates that murrelets in the Southern California Bight concentrate in particular regions of the Bight to forage (Whitworth et al. 2000). This limited distribution makes the murrelet population especially vulnerable to at-sea threats such as catastrophic oil spills, chronic oil pollution, military operations, organochlorine pollution, incidental bycatch from commercial fisheries, and attraction to bright lights on ships and platforms (Carter et al. in press).

Changes in oceanographic conditions, including El Niño/ Southern Oscillation Events and large-scale regime shifts (alternating periods of predominantly cold and predominantly warm water temperatures), which may affect the murrelet's food supply, have also been implicated in affecting the viability of the murrelet population (MacCall 1996; McGowan et al. 1998; Sydeman et al. 1998). Little is known about murrelets foraging habitats, though available evidence indicates that they rely primarily on larval fish, including anchovy, saury, and rockfish (Hunt et al. 1979; Hunt and Butler 1980). They may also rely heavily on zooplankton in some years. An 80% decline in zooplankton off southern California from 1951 to 1993, and the

concurrent increase of 1.6° C in sea surface temperature in the Southern California Bight, indicate a decline in primary and secondary productivity that may be detrimental to murrelets (Roemmich and McGowan 1995). Fluctuations in fish populations have also been linked to the alternation of warm and cold temperature regimes in the marine environment (MacCall 1996).

In the colonies, murrelets suffer loss from natural and introduced predators. Predators on adult murrelets include Barn Owls (*Tyto alba*) and Peregrine Falcons (*Falco peregrinus*). Barn Owl predation on Santa Barbara Island has ranged from 16 to 165 adult murrelets, sometimes increasing with crashes in the deer mouse (*Peromyscus maniculatus*) population (Drost 1989; Wolf et al. 2000). Peregrine Falcons historically nested on the Channel Islands, but were reportedly absent from all of the islands by the 1950s, if not earlier (Kiff 1980). Currently, Peregrine Falcons are beginning to re-occupy the Channel Islands, and their return, and subsequent predation on adult birds, may have a negative impact on the murrelet population. Feral cats have been removed from the Channel Islands, but are still a problem on some of the islands off Baja California (Keitt 1999). In addition, depredation of eggs and chicks by introduced black rats (*Rattus rattus*) and native island deer mice can be substantial. Rats have probably negatively affected the murrelet population on Anacapa Island, California and several of the populations off of Baja California (Drost and Lewis 1995; Keitt 1999). Deer mice regularly prey on eggs on Santa Barbara Island, consuming an average of 46% of all eggs produced (Sydeman et al. 1998). In addition to predators, murrelets may suffer from human

activities in the southern part of their range, where colonies and fishing villages coincide (Keitt 1999).

In recent years, murrelets have faced an additional threat; the California squid fishery has been rapidly expanding near their nesting sites in the Channel Islands. Squid fishermen work close to shore, using generators to run bright lights intended to draw the squid to the surface of the water. The lighting may affect murrelets by attracting them to the boats, where they may run into structures or become entangled; disrupting social behaviors in staging areas near the island; illuminating habitat, making the small, nocturnal birds vulnerable to predation by owls; or disrupting nesting behavior by causing increased egg neglect or abandonment (Sydeman and Nur 1999). In addition, lights may disorient chicks trying to reunite with their parents after leaving the nest site.

The Xantus' Murrelet is designated as a "Species of Management Concern" by the U.S. Fish and Wildlife Service due to the small population size, limited distribution, and known threats listed above. In 2000, the Pacific Seabird Group, an international society of professional seabird biologists, initiated a petition aiming to upgrade the status of the Xantus' Murrelet to "threatened" under the Endangered Species Act of 1973. Measures to protect and restore this species, including removal of non-native predators from nesting islands, education of humans living and working near colonies, and possible management of native predators should continue or be considered while more information is gathered on population size, trends, and demography throughout the species' range. More information on foraging habits and important foraging areas is also necessary in order to

monitor the effects of possible increased pressure from commercial fisheries and long-term changes in the marine environment on prey populations.

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Xantus' Murrelet, *Synthliboramphus hypoleucus* II: Assessment of Listing Status

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Abstract

We considered the status of Xantus' Murrelet (Synthliboramphus hypoleucus), a rare seabird of the western United States and Mexico, under the World Conservation Union quantitative criteria for listing as vulnerable, threatened and endangered. Based on World Conservation Union Criterion B, Xantus' Murrelet qualifies for listing as vulnerable, although our information base is incomplete for many sites. Known and/or suspected population declines at colonies in Baja California and the Channel Islands (USA) and threats from a variety of sources make listing of this species as threatened under the U.S. Endangered Species Act an appropriate course of action.

Introduction

As detailed by Roth and Sydeman (this volume) the distribution of the Xantus' Murrelet (*Synthliboramphus hypoleucus*) is restricted to islands off the coasts of California and Baja California (Drost and Lewis 1995). There are two subspecies: *S. h. scrippsii* breeds on the California Channel Islands south to the San Benitos Islands, and *S. h. hypoleucus* occurs on the San Benitos and Guadalupe islands. Herein, we summarize and evaluate the listing status of the species based on the best available information on population distribution and abundance and threats facing the species. We evaluate this information in relation to quantitative criteria established by the World Conservation Union (IUCN) for listing of vulnerable, threatened and endangered species (IUCN 1994).

The IUCN categories of threat to a species include a major division: species are either listed as "threatened" which includes "critically endangered," "endangered" and "vulnerable" sub-classifica-

tions, or "lower-risk," which includes sub-classifications of "least concern," "near threatened," and "conservation dependent." Currently, the IUCN lists Xantus' Murrelet as "near threatened" owing to its limited breeding range, concentration of sub-populations at few colony sites, and pervasive threats including predation by native (mice, owls and falcons) and introduced (rats, cats) species and the close proximity of human population centers to colonies (Collar et al. 1994). The IUCN is currently considering uplisting the species to "vulnerable." Therefore, our analysis focuses on the question of whether a classification of "vulnerable" under IUCN criteria is appropriate. We base this evaluation primarily on population surveys conducted by Carter et al. (1992, 1996) and Keitt (1999) and syntheses by Drost and Lewis (1995) and Sydeman et al. (1998).

Evaluation of Xantus' Murrelet status

According to the IUCN (IUCN

1994), a taxa is considered "vulnerable" when it is not considered "critically endangered" or "endangered," but is facing a high risk of extinction in the wild in the "medium-term" future, as defined by any of the following criteria:

Criterion (A)

Population reduction in the form of either of the following:

(1) an observed, estimated, inferred, or suspected reduction of at least 20% over the last 10 years or three generations, whichever is longer, or

(2) a reduction of at least 20%, projected or suspected to be met within the next 10 years or three generations, based upon direct observation, an index of abundance appropriate for the taxon, a decline in the area of occupancy, actual or potential levels of exploitation, and ecological effects which may reduce population size.

In relation to the best information available, Xantus' Murrelet does not qualify for listing as "vulnerable" based on the above crite-

ria, mainly because the species is data deficient in regards to population trends. For most colony locations, population dynamics are unknown. At Santa Barbara Island (SBI), however, location of the largest Xantus' Murrelet population in the U.S. and representing about 25% of the global population, estimates from 1977 and 1991 indicate a population reduction of 30 to 50% over a 14-year period (Sydeman et al. 1998). The criterion above "...reduction of 20% over the last 10 years," implies an annual rate of change of -2.2% per year. However, three generations for a Xantus' Murrelet is at least 20 years (Sydeman et al. 1998). Hence the criterion should be interpreted as "... reduction of 20% over the last 20 years, which implies an annual rate of change of -1.1% per year. The population decline on Santa Barbara Island between 1977 and 1991 has exceeded this rate (-2.5% per year or greater [Sydeman et al. 1998]). Moreover, based on current and past levels of predation by native deer mice (*Peromyscus maniculatus*) on murrelet eggs and by barn owls (*Tyto alba*) on adults, we infer that the SBI population will continue to decline at >2% per year for the next 10 years (Sydeman et al. 1998). If the results observed at Santa Barbara apply across the whole species, this would qualify the species as "vulnerable" under Criterion (A).

Criterion (B)

Extent of occurrence estimated to be less than 20,000 km² or area of occupancy estimated to be less than 2000 km², and estimates indicating any two of the following:

- (1) severely fragmented or known to exist at no more than 10 locations, or
- (2) continuing decline, inferred, observed or projected, in any of the

following:

- (a) extent of occurrence,
 - (b) area of occupancy,
 - (c) area, extent, and/or quality of habitat,
 - (d) number of locations or sub-populations, or
 - (e) number of mature individuals, or
- (3) extreme fluctuations in any of the following: extent of occurrence, area of occupancy, number of locations or sub-populations, or number of mature individuals.

In relation to Criterion (B), Xantus' Murrelet qualifies for listing as "vulnerable" due to its small area of occupancy on offshore islands (<2000 km²) and its fragmented distribution (B1), coupled with extirpation/declines observed or inferred at some locations (B2d), and continuing declines in the number of mature individuals (B2e).

In the U.S., Xantus' Murrelets are known to breed at five locations (in this case we define a location as an island plus closely adjacent islets and sea-stacks): San Miguel Island and associated Prince Islet, Santa Cruz Island, Anacapa Island, Santa Barbara Island and associated Sutil Islet, and San Clemente Island (Carter et al. 1992; Drost and Lewis 1995). Breeding on Santa Catalina at present is suspected but unconfirmed (Drost and Lewis 1995).

In Baja California, Mexico, murrelets are known to breed at four locations: Islas Los Coronados, Isla San Geronimo, Islas San Benitos and Isla Guadalupe (Drost and Lewis 1995; Carter et al. 1996; Keitt 1999). Breeding populations on Islas Los Coronados, San Benitos, and Guadalupe are relatively large. Drost and Lewis (1995) indicated that the populations on Todos Santos, San Geronimo, and San Martin were extirpated, but Keitt (1999) found active nesting on San

Geronimo. Keitt (1999) also suspected a small number of breeding individuals on Todos Santos and San Martin, but this was not confirmed.

Thus, the known breeding population is restricted to nine locations. Of these locations only four, Santa Barbara Island (c. 1,500 individuals), Islas Los Coronados (c. 1,500 individuals), Islas San Benitos (c. 500 individuals) and Isla Guadalupe (c. 2,500 individuals), support relatively large populations (defined as at least 500 breeding birds; see Sydeman et al. 1998 for justification of this criterion).

Recent Xantus' Murrelet population declines have been documented on Santa Barbara Island (see discussion above) and there is ample reason to suspect that this decrease has continued.

Based on Criterion (B) alone, Xantus' Murrelets appear to qualify for a listing of "vulnerable" under IUCN rules. In our view, this listing would be analogous to listing as "threatened" under the U.S. Endangered Species Act.

Criterion (C)

Population estimated to number less than 10,000 mature individuals and either:

- (1) an estimated or continuing decline of at least 10% within 10 years or three generations, whichever is longer, or
- (2) a continuing decline, observed, projected, or inferred, in numbers of mature individuals and population structure in the form of either:
 - (a) severely fragmented (i.e., no subpopulation estimated to contain more than 1,000 mature individuals, or
 - (b) all individuals are in a single subpopulation.

Based on Criterion (C) alone, Xantus' Murrelet does not qualify as "vulnerable." While the global population of mature individuals at

large colonies is likely to be in the range of about 6,500 birds (assuming c. 2,500 at Guadalupe, [Jehl and Everett 1985], 525 at Benitos [Keitt 1999], 1,500 at Coronados [Carter et al. 1996; Keitt 1999], and 1,500 at Santa Barbara [Carter et al. 1992]) and an additional 500 birds may be in elsewhere in Baja California (Keitt 1999) and the U.S (Drost and Lewis 1995), we lack information on overall population trends for the species. Also, three locations likely contain more than 1,000 mature individuals (Guadalupe, Coronados and Santa Barbara). However, if populations at Guadalupe and Coronados are also declining, then, coupled with the decline in population level of 30 to 50% over 14 years observed at Santa Barbara, it is likely that the global population is declining at a rate of at least 10% per 20 year period. In that case, Xantus' Murrelet would qualify as "vulnerable" under criterion C.

Criterion (D)

Population very small or restricted in the form of either of the following:
 (1) population estimated to number less than 1,000 mature individuals
 (2) populations is characterized by an acute restriction in its area of occupancy (typically less than 100 km²) or in the number of locations (typically less than 5). Such a taxon would thus be prone to the effects of human activities (or stochastic events whose impact is increased by human activities) within a very short period of time in an unforeseeable future, and is thus capable of becoming critically endangered or even extinct in a very short period.

In relation to Criterion (D), Xantus' Murrelet does not qualify for a status of "vulnerable." The population is certainly larger than 1,000 mature individuals, and while

its distribution is localized, there are nine locations with confirmed breeding populations. Then again, only four of these locations contain populations that are likely to exceed 500 mature individuals.

Criterion (E)

Quantitative analysis showing that the probability of extinction in the wild is at least 10% within 100 years.

In relation to Criterion (E), Xantus' Murrelet cannot be considered "vulnerable." There have been no attempts at quantitative analyses for the entire Xantus' Murrelet population. Using RAMAS/METAPOP to model the population, Sydeman et al. (1998) investigated the probability of "quasi-extinction" (defined as fewer than 500 breeding birds) for the Santa Barbara Island sub-population. They found that this sub-population had a 30 to 80% chance of reaching quasi-extinction within 20 years. The likelihood of extirpation of this colony is essentially zero for 20 years (PRBO unpublished data), but analyses were not extended to a timeline of 100 years.

Conclusion

The Xantus' Murrelet is deserving of listing as "vulnerable" under IUCN criteria due to its small population, limited range, and continuing threats to its long-term viability. We view this recommendation as equivalent to a listing of threatened under the U.S. Endangered Species Act. A declining trend in abundance, evident on Santa Barbara Island, may apply to other colonies. Better information on the existence (or lack of existence) of breeding colonies on San Clemente, Santa Catalina, Todos Santos, and San Martin is required. Just as important is information on popula-

tion trends at colonies other than on Santa Barbara Island. Finally, in order to fully evaluate the species' status and management options, more data are needed regarding population size and dynamics, demographic processes, and factors affecting mortality throughout its range in California and Baja California.

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Conservation Spotlight

Project Piaba: Working Toward a Sustainable Natural Resource in Amazon Freshwater Fisheries

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Abstract

A non-endangered species has become the focus of an ongoing research project in the Amazon and may prove to be the key to preserving the ecology and way of life for the people of the mid-Rio Negro Basin. The cardinal tetra (Paracheirodon axelrodi) is one of the most abundant vertebrates in the Amazon. It is a very small fish, reaching a size of about one inch. This species' adaptability to environmental fluctuations has made it extremely resilient and though at least 20 million are harvested annually for the pet trade, the populations have shown no detected decline from the commercial fishery. Project Piaba, coordinated by Dr. Ning Labbish Chao, Professor at the Universidade do Amazonas, is becoming an international model for sustainable development. The Project includes partners from Brazilian agencies, members of the ornamental fish industry, and the American Zoo and Aquarium Association (AZA). The AZA Conservation Action Partnership: Brazil and the AZA Freshwater Fishes Advisory Group have both made Project Piaba a priority, and have placed it on their action plans.

Introduction

The Amazon rainforest ecosystem is one of the richest and most diverse on the planet. Some of the world's most spectacular animals, many of which are endangered, come from the Amazon. The large cats, primates, parrots, river dolphins, and all other species we associate with the Amazon depend on the integrity of the ecosystem.

There is another species dependent on the Amazon ecology—our own. Although the people living in the rainforest know better than anyone the uniqueness and value of the Amazon, life there is difficult and people will do what they need to do to feed their families. Most of the available options for making a living have disastrous results on the ecosystem—gold mining introduces mercury to the environment and timber harvesting, cattle ranch-

ing, and agriculture dramatically reduce biodiversity and have severe impacts on aquatic ecosystems. Furthermore, these environmentally destructive practices are usually unsustainable and remove options for future ecologically sound development.

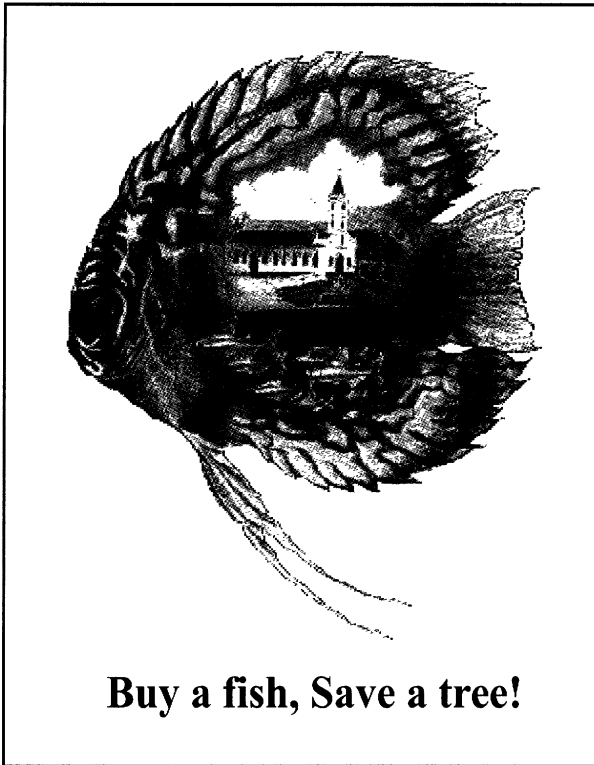
In a developing country with limited resources to apply to conservation projects and land management, it is difficult to deploy successful programs that increase the likelihood of preserving biodiversity. In addition, the vastness of the region and sparse population make regulations very difficult to enforce. If the rainforest is to be preserved, it cannot be saved species by species. Rather, preservation must be addressed in a systematic fashion at the ecosystem level. Project Piaba is a community-based project established to work with the

ecological and cultural systems of the middle Rio Negro basin, Amazonas, Brazil. The project began in 1989 to promote the sustainable commercial harvest of aquatic resources that will ensure the survival of both the Amazonian rainforests and its human inhabitants.

Project Piaba

In the Amazon rainforest, the aquatic ecosystem and its resources are the basis of the economic and socio-cultural systems. More than 20 million live fishes are exported from the region (Chao 1993) and represent in excess of \$100 million in worldwide retail trade value (Prang 1996). The mid-Rio Negro basin is the primary fishing ground and the municipality of Barcelos is the principal trading post for the ornamental fish trade. Barcelos depends on the export of ornamental

Conservation Spotlight is produced in conjunction with the American Zoo and Aquarium Association.



Buy a fish, Save a tree!

Logo for Project Piaba.

fishes—the industry now contributes over 60% of the local revenue (Chao 1993). Food fishes comprise the principal component of the Amazonian diet (67 kg/capita/year [Chao and Prang 1997b]) thus increasing the importance of aquatic ecosystems.

A single species, the cardinal tetra (*Paracheirodon axelrodi*), constitutes over 80% of the total ornamental fish export from the Rio Negro basin (Chao and Prada-Pedreras 1995; Prang 1996; Chao 1998). Natural fluctuations in fish populations, fish mortality rate during capture and transport, and market demands significantly impact local fishing communities. As an adaptation to the extreme habitat fluctuations, many ornamental fishes have a short life cycle (1-2 years) and high fecundity (500 eggs, 0.55mm in diameter) (Chao 1992, 1993). These life history traits appear to allow tetra populations to endure the ornamental fishery. Though the ornamental fish stocks are very resilient, they are sensitive to long term environ-

mental disruptions. In order for the ornamental fishery to thrive, the entire aquatic ecosystem must be intact and functional. Project Piaba helps develop fishery management procedures, which give local people incentive to preserve the integrity of their aquatic ecosystems and maintain their cultural and terrestrial environment as well.

The Rio Negro is the largest tributary of the Amazon basin in terms of annual discharge. At three times the size of the Mississippi, it covers an area of 0.75 million km², and it extends over 1,700 km (Prang 1996; Chao and Prang 1997a). To date, deforestation in the Barcelos area has been minimal, due in part to the infertile sandy soils, which are not suitable for agriculture. Perhaps more important, though, is the fact that the local people are largely engaged in limited subsistence activities, such as the ornamental fishes and piassava (palm fiber) trade, which generate enough cash to provide for basic necessities. Low human population densities, typical of the black water areas of Amazonia, play an important role as well (Chao and Prang 1997). The Project Piaba study area extends from the mouth of Rio Negro (Manaus) to Tapuruquara (600 km up river), including the lower Rio Branco and Rio Demini in the municipality of Barcelos, an area approximately the size of the State of Pennsylvania (Figure 1) (Chao 1993; Chao and Prada-Pedreras 1995).

To develop an appropriate management strategy, a firm under-

standing of the ecosystems and sociocultural perspectives of the ornamental fishery is essential. Despite the economic and social importance of the fishery, fishes are frequently overlooked in conservation or development projects in the Amazon despite their enormous diversity (over 3,000 species) (Chao 1992, 1993, 1998). All stakeholders, fisherfolk, exporters/importers, distributors, and retailers must understand their role in this important industry. Furthermore, local control of the ornamental fishery and trade practices will better establish long-term sustainability of a quality livelihood for the fisherfolk.

Since 1989, Dr. Ning Labbish Chao and students of the Universidade do Amazonas and National Institute of Amazonia Research (INPA) have studied aquatic biodiversity and collected baseline data on ornamental fishery and socioeconomic aspects of the riverine communities in the Rio Negro basin. In 1991, Project Piaba, in collaboration with the New England Aquarium, began to involve members of the American Zoo and Aquarium Association in field programs. The team concluded that the ornamental fishery in the region is likely to be manageable, and more importantly, is a key to protecting the Amazon rainforest. Conditions needed to maintain a thriving fishery include an intact rainforest.

Concepts of sustainability inevitably reflect societal choices at the local, regional, and global levels. Balancing ecological with economic and other considerations is the fundamental problem in defining sustainability. Biological inquiry alone will not satisfy the needs of a sustainable ornamental fishery. Thus, Project Piaba has gradually evolved from a fish biology study into a community-based, interdisciplinary project, which is

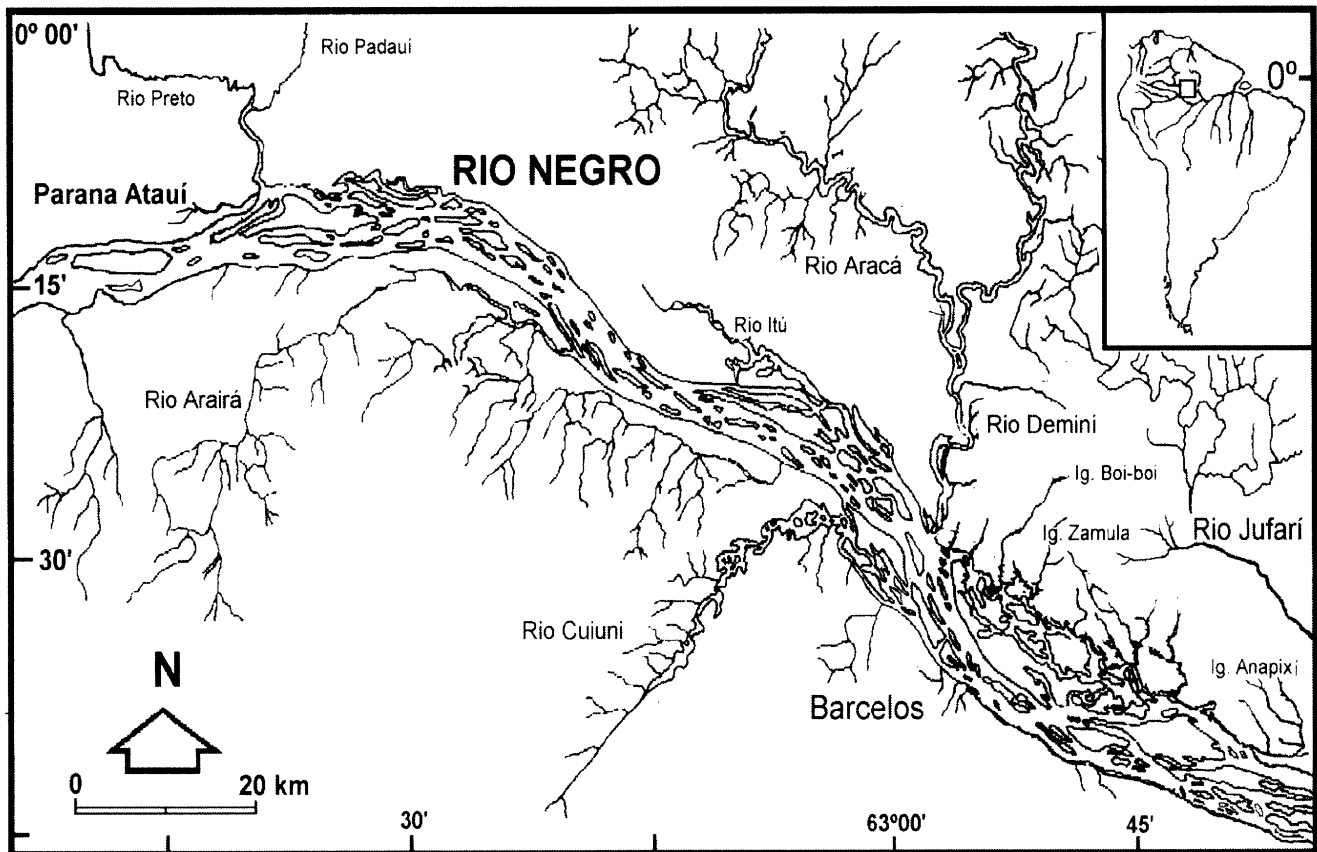


Figure 2. Principal study areas of Project Piaba in the mid-Rio Negro basin.

aimed at understanding the relationship of the ecological and cultural systems of the middle Rio Negro basin. It also aims to conserve and maintain the live ornamental fishery resources at commercially feasible and ecologically sustainable levels.

For the next three years, Project Piaba will expand the areas of research to include the study of genetic diversity of fishes, habitat/stream gradient, ecosystem function, shipping and handling of live fish, fish pathology, and the various trade mechanisms. We are working with the fisherfolk to develop improved techniques for fish collection, transport, conditioning, and exports to produce high quality fishes of the region and maximize the economic benefit to local communities. Project Piaba actively contributes to the sustainable use of aquatic resources and the long-term conservation of the Amazon ecosystem.

Acknowledgements

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from the Universidade do Amazonas, the Brazilian Institute for the Environmental and Natural Renewable Resources (IBAMA), Asher Benzaken—Turkys Acuario (ACEPOAM), the Piaberos and citizens of Barcelos, the AZA Conservation Action Partnership: Brazil and AZA Freshwater Fishes Advisory Group, New England Aquarium, the FAO, Ornamental Fish International, and many organizations and individuals that have volunteered their time to help Project Piaba work towards its goals. We thank Sally Landry for the use of the cardinal tetra illustration. We would also like to acknowledge Dr. Chao for his tireless efforts in this unique and challenging endeavor.

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News from Zoos

Flock of baby flamingos not so "cheep"

The estuaries around the Rio Lagartos Reserva de la Biosfera in Yucatan, Mexico are one of the major nesting areas for flamingos. Recently, a jaguar raided a nesting colony of flamingos in the Rio Lagartos reserve, killing a number of adult flamingos. The flock abandoned the nesting site, leaving an estimated 400 eggs just as they were about to hatch. Reserve biologists, as well as keepers from a local zoo, collected the eggs and began incubating them in an attempt to hatch and rear the birds.

With over 200 chicks hatched and more hatching daily, the biologists needed help feeding and rearing the chicks. Chris Brown, curator of birds with the Dallas Zoo, put out the call for help from his Mexican colleague, Rodrigo Migoya von Bertrab, to the Fort Worth Zoo and many members of the American Zoo and Aquarium Association (AZA) through several bird-related listservs.

Bird keepers and biologists from the Dallas Zoo and Fort Worth Zoo, as well as colleagues from SeaWorld Orlando, SeaWorld San Diego, the Franklin Park Zoo in Boston and others have made their way to Rio Lagartos to help. Many other AZA-accredited zoo and aquarium members have also responded by sending food and other supplies to help facilitate the mass feedings.

The chicks would normally be fed by the flamingo parents for three to four months before they are weaned. However, due to the necessity of hand-feeding such a large number of chicks (flamingo chicks need to be hand-fed special liquid diets via eye-droppers every three hours around the clock), protocols have been established that will allow for weaning to begin by the end of one month, with the eventual goal of releasing the birds to the wild in Rio Lagartos.

Over the past several years the Fort Worth Zoo has played an integral role in helping establish an American flamingo conservation program and conducting nutritional research in Mexico. As a partner with the Rio Lagartos Reserva de la Biosfera, and with several other zoo and conservation programs, the Fort Worth Zoo hopes to conserve the flamingo habitat and educate people in Mexico about flamingo biology.

Lincoln Park Zoo releases captive bred golden lion tamarins in Brazil

Six golden lion tamarins, which were born at the Lincoln Park Zoo as part of the AZA Species Survival Plan, arrived in Brazil where they will be introduced into the wild in a forest reserve in Rio de Janeiro. The family of tamarins—a father, mother, and four youngsters—will be monitored closely over the next few months to ensure that they are adapting to their new environment.

The squirrel-sized tamarin has been brought back from the brink of extinction through a global captive breeding effort, and is one of the few primates that have been successfully reintroduced to their natural environment. In the 1960s, there were only about 200 golden lion tamarins left in the wild, due to habitat destruction in Brazil's Atlantic coastal rain forest. The golden lion tamarin was one of the first of AZA's Species Survival Plans, and has had great success by focusing on the education of Brazilian residents.

AZA members come to the aid of South African penguins following oil spill

On Friday, 23 June, the oil tanker *Treasure*, carrying about 1300 tons of fuel oil, ruptured and sank six miles off the coast of Cape Town, South Africa. The oil spill directly affected Robben Island, home to more than 20,000 wild African penguins. "This is devastating," said Steve Sarro, curator of birds for The Baltimore Zoo and coordinator of the AZA African Penguin Species Survival Plan. "This spill is hitting just in the midst of the breeding season and there are approximately 6,000 penguin chicks that have been abandoned." About 20% of the wild population of African penguins are nesting on islands affected by this spill.

According to Tom Schneider, coordinator of the AZA Penguin Taxon Advisory Group (TAG) and curator of birds for the Detroit Zoological Institute, "experts from seven AZA-accredited zoos and aquariums are going to South Africa on 30 June to assist with feeding the chicks, cleaning the adults, the relocation of the birds and any other efforts they can make on behalf of this wild population." Bird staffers from The Baltimore Zoo, Utah's Hogle Zoo, Mystic Marineland Aquarium, New England Aquarium, Riverbanks Zoo, and SeaWorlds of Orlando and California will be flying at a reduced rate courtesy of South Africa Airlines. Mervyn's of California has generously donated funds to the Penguin TAG to help with expenses while they are in country.

Information for News from Zoos is provided by the American Zoo and Aquarium Association.

News and Events

Policy resource

A new web resource is available on environmental values and policy making. The Carnegie Council on Ethics and International Affairs (New York) launched a project in 1998 on "Understanding Values: A Comparative Study of Values in Environmental Policy Making in China, Japan, India, and the United States." This multisite, multiyear collaborative research project is designed to help explain and compare values held by diverse constituencies in each of the four countries and their role in environmental policy making. The new web resource that draws from this project is available at <http://www.cceia.org/environment.htm>.

Nature in Focus: Rapid Ecological Assessment

Before any government, community, or environmental organization can act to protect biodiversity in their community, they first must find out what resources exist in that region. A common obstacle in obtaining an accu-

rate assessment is that evaluations often need to be performed with limited time and limited financial resources. How, then, do communities perform a rapid survey that is both scientifically and financially viable?

Rapid Ecological Assessment (REA) is a biodiversity survey method developed by The Nature Conservancy to provide comprehensive and reliable information about biodiversity resources in situations where time and financial resources are limited.

The Rapid Ecological Assessment method is outlined in a new book from Island Press, *Nature in Focus: Rapid Ecological Assessment*, an in-depth, yet nontechnical, guide to the theory and practice of REAs.

Conservation group purchases pristine tropical island

The Nature Conservancy has announced its intention to purchase Palmyra Atoll, the last intact marine wilderness in the U.S. tropics. The atoll, located 1,052 miles south of

Hawaii, consists of 680 acres of land and 15,512 acres of pristine coral reefs, emerald islets and turquoise lagoons. Palmyra is the only nesting habitat for migratory seabirds and shorebirds within 450,000 square miles of ocean.

Acquisition of the atoll is being made possible by the generosity of Palmyra's current owners, the Fullard-Leo family of Hawaii.

Population

The Population Reference Bureau (PRB) and the National Council for Science and the Environment (NCSE) have officially launched their new web site <http://www.popplanet.org> to examine the relationships among population, health, and environmental issues.

Announcements for News and Events are welcomed. Some items have been provided by the Smithsonian Institution's Biological Conservation Newsletter. If you would like to submit an announcement to News and Events, e-mail esupdate@umich.edu or call (734) 763-3243.

Endangered Species UPDATE

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