Advanced Interagency Consultation Training

Study Guide for Diagnosing Status

Objectives of this Module

1. Introduce students to
   - A sequential format diagnosing status
   - Areas to concentrate data collection effort
   - New terminology
2. Identify the role of diagnosing status in effects analyses for consultation
3. Demonstrate the importance of
   - Articulating the status to the Action Agency
   - Identifying threats, population limits, and conservation needs
   - Reporting and analyzing demographic data

di·ag·no·sis (dī'əg-nō'sĭs) **2. a**. A critical analysis. **b.** The conclusion reached by such analysis.

--from *Webster's Dictionary*

Introduction

The understanding of species' status is the foundation of section 7 consultation and is the basis for all of our discussions with Action Agencies. As such, a thoughtful and well-presented diagnosis of status is a critical step. If the diagnosis is flawed or inadequate, the effects analysis, including exposure profile, response-analysis, and risk analysis, will be flawed or inadequate, resulting in an effect determination and consultation conclusion that is either incorrect or unsupportable.

The importance of accurately portraying the species condition, prior to analysis, cannot be overstated. The 7(a)(2) requirement that Federal agencies insure that agency actions are not likely to jeopardize listed species presupposes that we have estimated or quantified the likelihood of extinction for those species. All too frequently consulting biologists do not articulate the risks to the species they are consulting on. The rate of decline or loss, geography of habitat, limiting resources, lack of survivorship, and the prevalence of threats are either not included in discussion and documentation or treated as an afterthought. While many biological opinions provide ample physical descriptions of listed species, very few convey to the reader the context of 7(a)(2) analysis: the "likelihood of survival and recovery."

Our charge to measure, notice or detect changes in a species' likelihood of survival and recovery cannot be met if we fail to diagnose the condition of the species and articulate the units of measure. This is problematic for biologists who believe that they do not have enough information to make a determination. Often valid reference points and numeric data are not used, due to confusion about what is "the best" information available[1]. Nonetheless, all consulting biologists have the following at their disposal: (1) the numbers and trends that led to the listing of the species[2], (2) scientific and commercial data made available to them through the Action Agency, or through their own searches, (3) their own expert knowledge, and (4) information in Service files.

If we think of this in medical terms, we can consider the listing of the species as the preliminary diagnosis and subsequent biological opinions as a reexamination during which we revisit the original diagnosis. Approach the diagnosis as a doctor would review the status of a patient prior to deciding whether to prescribe a new treatment or continue and existing treatment. A thorough diagnosis of status, clearly articulating the species' risk of extinction and impediments to recovery, sets the foundation for discussion of project effects during the consultation process. It is essential that the Section 7 Biologist convey this information to the Action Agency during consultation and to the reader of the accompanying biological opinion.

The Diagnosis

Describe Legal Status

Start by reviewing the "preliminary diagnosis" presented in the listing package. Describe, to the Action Agency, the legal status of the species and any immediate conservation issues. This introduces the Action Agency to the relevance of our concern for the species and establishes the logical foundation for any arguments supporting conservation. The condition of populations should be briefly described, with emphasis on those populations being analyzed during the consultation process. Physical descriptions of the species should not be included at this point[3], because they lack relevance to the argument.

Briefly report the conclusions of any recent analyses or analytical tools, such as population viability analysis, calculated probability of extinction (or persistence), or estimated time to extinction. Any analyses that indicate the species is in decline or recovering is relevant information, both to the consultation and to the

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[1] The best available scientific and commercial information, called upon throughout the ESA and implementing regulations, should not be supplanted with the more-limiting standard of available best-information (such as only using peer-reviewed literature and discounting field surveys, historical data, and monographs).

[2] This information is lacking for many of the species listed prior to 1973, but can be obtained through document research.

[3] Field identification is addressed further on page 14.

analysis that occurs during the consultation period. If a species is at a high risk of extinction, the Action Agency must be informed at the very beginning of the consultation.

Identify threats

Often the threats that led to the listing of a species remain extant and are compounded by new threats, further impeding conservation of the species. Clearly articulate these threats to the Action Agency, because federal entities have a section 2(c) obligation to seek to conserve listed species and use their authority to conserve the ecosystems upon which listed species depend. Revisiting the threats helps us all understand what we are up against. Threats should be discussed early and often during consultation and must be included in the status section of the biological opinion.

A rational framework for summarizing threats is found in the "5-factor analysis" from Section 4(a)(1). Discuss the threats that led to listing and the additive threats that have arisen post-listing: (1) the present or threatened destruction, modification, or curtailment of the species habitat or range; (2) over-utilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; and (5) other natural or manmade factors affecting its continued existence. The existing threats are relevant to the consultation and should remain in the discussion of the species status, both in consultation and in the biological opinion.

New threats are of particular interest in this diagnosis. For species that have had an analysis of population viability, calculated probability of extinction (or persistence), or estimated time to extinction, determine whether the post-listing threats were included in the analysis. Be aware that the threats that led to the listing of many species have been seriously compounded by the presence of new threats. A few examples are:

- Northern spotted owl (*Strix occidentalis caurina*)- listed for habitat loss (55 **FR** 26113), now also threatened by barred owl.
- Hawaiian crow, 'Alala, (*Corvus hawaiiensis*) – originally declined from habitat loss and hunting, now imperiled by Allee effects, avian diseases, and toxoplasmosis.
- Shasta crayfish *(Pacifastacus fortis)*- listed for limited distribution and low numbers resulting from habitat loss (53 **FR** 38465), now imperiled by introduction of signal crayfish.
- Southern sea otter - listed for low populations due to hunting, now imperiled by contaminants, oil spills, and dog distemper.
- Least Bell's vireo (*Vireo bellri pusillus*- listed for habitat loss and cowbird parasitism (51 **FR** 16474), now also threatened by invasive plants (tamarisk, giant reed) degrading and converting habitat.
- The endangered Higgins' eye pearly mussel (*Lampsilis higginsii)*, from the Mississippi River and some of its larger northern tributaries (i.e., St. Croix and Wisconsin Rivers) was on its way toward recovery, but is now imperiled due to zebra mussel invasion.

Water quality is still an issue but unequivocally zebra mussels are the foremost threat currently facing Higgins' eye pearly mussel.

- San Francisco garter snake (*Thamnophis sirtalis tetrataenia*), listed as endangered due to wetland conversion and over-collection, but imperiled by loss of habitat from seral succession, population declines of their primary prey species, the threatened California red-legged frog (*Rana aurora draytonii*) (61 **FR** 25813), introduction of the bullfrog (*Rana catesbiena*), and Allee effects.

Identify limiting factors

Limiting factors are those components of the ecosystem that limit species abundance by virtue of their absence or low availability. Some or all of the resources necessary for breeding, feeding, and sheltering may be limited. Deterioration of a limiting factor will lead to declines in the species, through decreases in survival and reproduction or through increases in death and emigration. Articulating how an organism is limited in its environment, provides a strong foundation for quantifying project effects.

Too often we think that all readers of our administrative records are biologists. The primary reader may be a biologist, or in the field of natural resources; however, many of our documents fall into the hands of educated lay-readers. Such a reader can be better informed when the basic needs of the species are expressed clearly in terms of limiting factors.

Introduce Closely-Related Taxa (if surrogate species will be used in the diagnosis)

A common complaint among consultation biologists is that species-specific information is lacking. While this is often true, the best available scientific and commercial information may be abundant for a related species or subspecies. For example, the San Francisco garter snake (*Thamnophis sirtalis tetrataenia*) is listed as Endangered and is profoundly rare. As a result, the literature on the species is imprecise in many aspects of its life history--with the notable exception of prey preferences (Larsen 1994). Conversely, other subspecies of the common garter snake, such as the Eastern garter snake (*T. s. sirtalis*) and the red-sided garter snake (*T. s. parietalis*), have a tremendous body of literature on their physiology, behavior and ecology. Closely-related surrogates can provide a tremendous amount of information that can be inferred about the listed species. This available information can enlighten us about important aspects of the listed species' life history and assist in our interpretation of sporadic field notes.

Use of closely-related taxa to infer aspects of a species' biology should be supportable. It should be done with thoroughness, first by addressing similarities within or between the taxa and then by addressing any known similarities between the surrogate and the listed species. For example, little was known about the nesting biology, dispersal ability, and recolonization potential of the marbled murrelet (*Brachyramphus marmoratus*) when the species was first listed as threatened in 1992. However, the literature included a broad range of family members where nesting biology, dispersal ability, and recolonization potential were studied: pigeon guillemot (*Cepphus columba*)(Drent 1965), guillemot (*Uria aalge*)(Halley and Harris 1992), murres (*Ibia spp.*)(Tuck 1960, Tuck 1961), Atlantic puffin (*Fratercula artica*)(Kress and Nettleship 1988), and Atlantic Alcids in general (Nettleship and Birkhead 1985, Thomson 1953). The literature for the family told a story of high site fidelity and low recolonization potential. By surmising that remnant forest stands functioned as ‘small "islands" of nesting habitat scattered throughout an ocean of unsuitable nesting areas,’ similarities between other members of the family Alcidae, all of which nest on islands or cliffs, shed light on our understanding of marbled murrelet ecology. Patterns of site fidelity, dispersal, and recolonization ability can be inferred for the marbled murrelet. Such consistency within the family may then be used to better understand to the consequences of increased fragmentation of nesting habitat in a forest environment.

When a surrogate species is sympatric with the listed species it may be used as an indicator for habitat or presence. For example, the threatened sand skink (*Neoseps reynoldsi*) has a wider distribution than the threatened bluetail mole skink (*Eumeces egregius lividus*), but is sympatric in the mole skink’s range (USFWS 1999). It is exceptionally difficult to successfully survey for the bluetail mole skink, because of its patchy distribution within habitat; however, it predominantly co-occurs in patches adjacent to the sand skink, which is readily surveyed and can therefore be used as an indicator for postulated presence of the mole skink, within the mole skink’s range.

Ascertain Distribution and Trends in Distribution

The distribution of the species must be quantified or qualified within the context of consultation, because assessing changes in distribution is an integral part of the jeopardy analysis. Distribution of the species, and distributional changes, are readily measured and quantified using presence/absence data, and may also be presented and interpreted using spatial data such as mapping. Trend information can be extrapolated from existing data sets and used to demonstrate how the species is responding to threats and limiting factors described above.

There are numerous ways to measure and quantify changes in distribution and a host of statistical tests, starting with the Z test (test for difference between two proportions or test for difference between observed and expected proportions) and extending to more complicated tests for measuring similarity, variance, and range. While we are not charged with statistical analysis (or measures of significance) in our section 7 analysis, the data that must be collected for statistical tests is foundationally the same as for a qualitative analysis—*i.e.,* we must make an effort to collect data to determine whether there is expected to be a measurable, noticeable, or detectable change in distribution as a result of the action under consultation. Collecting and retaining this information will also allow for future analysis of distributional changes.

When conveying distribution information, the importance of individual populations must be discussed. Of particular interest are the dynamics of distribution such as sources, sinks, and barriers. The implications inherent to population types must be discussed, so the Action Agency has a clear understanding of the distributional constraints of the population being consulted on in the context of the entire distribution of the species. Source populations are influential in maintaining genetic material and dampening the effects of radiation. Sink populations, if able to reintegrate with the source population or contribute reverse gene-flow, can introduce diversity and adaptive genes into the source population and increase its fitness. Barriers to gene flow between populations can change the status of a population from a source to a sink.

Barriers between populations can be temporal as well as spatial. Behavior barriers that exist between annual or seasonal cohorts, such as in salmon runs, can still maintain genetic cohesiveness with small amounts of overlap. For example, the small numbers of salmon that return to their spawning beds a year before or after their cohort ensures genetic mixing between cohorts, and the small number of salmon that may return to adjacent watersheds ensures genetic mixing between runs. Removal of a cohort can effectively isolate populations

Ascertain Numbers and Numeric Trends

Determining the species numbers and numeric trends is another element of diagnosing status that is a component of the jeopardy analysis. There are three numbers that must be included in this description: (1) the historical population estimates (usually from the literature), (2) the population estimates from the time of listing, and (3) the current population estimates. If an index was historically used to estimate population numbers, describe how the index was generated, and use the same index (if possible) for presenting today's numbers. If there are no numbers for the species, construct an index using habitat or some other measure as a proxy. When you construct an index, clearly state the assumptions that went into its development.

The condition of populations should be well-described. The brief introduction to the status of the species that began your discussion should be elaborated on so that the numbers and trends are well understood for each population. Graphically present your numeric data and identify which populations are stable and unstable. Consulting on impacts to a stable population will have different considerations if all of the other populations are unstable. Impacts to a declining population may have more profound effects over time if the viability of the population would be noticeably decreased from implementing the action under consultation.

Summarize the incidental take that has been previously exempted, if that take has noticeably or measurably reduced the overall numbers of the species; this is important, because the status of the species changes as individuals, habitat, and populations are removed. If past incidental take is quantified, and we find that it did not reduce the overall numbers, that information also has bearing on our discussion. The summary must include a discussion of how past incidental take affected each population.

Incidental Take Statements from past opinions contain the quantification of loss of individuals for actions that have undergone consultation. When these losses are not incorporated into the diagnoses of status, the foundation for the jeopardy analysis is missing. For example, a biologist may make a finding of no-jeopardy for a project that will remove a single population from a species that has 7 reported populations. If prior consultations have come to the same conclusion for 3 of the other populations, then the proper analysis should be on the loss of 1 of the 4 remaining populations not 1 of 7 remaining populations.

Summarizing past incidental take does not mean a biologist must collect and retain copies of every biological opinion ever written for a species. Rather, it is a numerical summary of the take that has been exempted from section 9 of the ESA as a result of past biological opinions. If prior opinions have correctly compiled baselines, the most recent biological opinion for each population should provide an excellent summary of local-area information.[4]

Identify Reproductive Needs and Quantify Reproductive Output

Reductions in reproduction are the third component of the jeopardy analysis and are a crucial part of consultation.[5] To diagnose this aspect of the status of the species, (1) identify the reproductive needs of the species, (2) quantify the existing level of reproduction, and (3) demonstrate how existing threats and limiting factors change reproductive success. In order to measure, notice or detect changes in reproduction, we must first establish the potential reproductive output of the species by carefully assessing demographic information, such as: number of offspring or seeds produced, age at sexual maturity, survivorship to sexual maturity, number of years in reproductive condition, survivorship during reproductive lifespan, timing of reproductive output (all at once or at discrete time intervals), sex ratio, ability to find mates or be pollinated, and ability to mate and produce offspring.

Carefully identify factors that lead to changes in reproduction or reproductive rates, specifically the factors that would lead you to answer these questions in the negative: Is the organism successfully reproducing? Are their offspring successfully reproducing? Does the F3 generation (and subsequent generations) have the ability and resources necessary to successfully reproduce?

Construct life-history tables or survivorship curves, if you have sufficient data to do so. Look closely at changes in fecundity and mortality and how the population's age-structure affects its resilience to perturbation. For species that have demographic stressors, which could lead to declines in reproduction, introduce the demographic model and discuss the ability for the population to successfully reproduce within the context of the model.

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[4] If biological opinions are being written with inadequate baseline information or unclear incidental take statements, it will become apparent during this step. This problem will need to be corrected in subsequent opinions. Past incidental take statements must be credible and supportable to be sufficient for this diagnosis.

[5] Be mindful that reductions in reproduction, distribution, and numbers are the measures in the jeopardy analysis: Measurable, noticeable, or detectable reductions in any of these is used to measure the risk to the species of implementing the action.

Construct the demographic model that is most informative for the Action Agency and the reader. In conversations with the Action Agency, use terminology and data that plan on integrating into the biological opinion—for your analysis of reproductive consequence. For example, if the population you are addressing has an hourglass-shaped population structure (as in figure 1), the demographic consequences of that population structure should be well discussed, even if it represents a crisis situation for the species. Explain how the restricted recruitment of juveniles will lead to lower numbers of reproducing adults under that scenario. Using the graphic, it is easy to infer and demonstrate that the age-classes represented in the pinch point will lead to lower reproduction for the population when those individuals become the breeders in the population. As the 13 to 18-year-old reproducing adults die out, they will be replaced by the very-low numbers of reproducing adults in the younger age-classes.

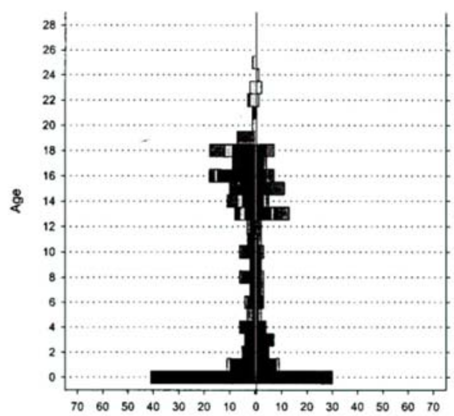

Figure 1. Age Structure of Hawaiian Monk Seals in 2002

It is acceptable to introduce ecological theory into your diagnosis, as long as you reference it. In addition to theory, identify any data or literature on how the species may alter reproductive behavior, based on similar stimuli as will be expected from the project. This can be from biotic factors, such as changes in sound, light, movement, air or water quality, that lead to reductions in quantity or quality, reductions in the availability of resources, landscape fragmentation and barriers to movement, disruption of ecological processes that maintain habitat value, or introduction of organisms that compete for resources.

The density-dependent influence that low numbers will have on reproductive success (Allee 1931) must be well understood and carefully guarded against, especially when consulting on species or populations that: (1) are geographically isolated (Groom 1998), highly dispersed (Forsyth 2003), or have low numbers; (2) exhibit packing behavior (Courchamp et. al. 1999), herd dependency, or flocking behavior; or (3) are dependent on the density of a pollinator (Schmitt 1983) or frequency of pollinator visits (Steven et.al. 2003).

Discuss the potential for these “Allee effects” with the Action Agency. If Allee effects are a consideration, articulate the susceptibility of the species to reduced reproductive potential and discuss species’ vulnerability. Allee effects should be discussed in light of a contemporary understanding; however, wildlife biologists have two compelling historical examples of species that depended on social interaction for successful reproduction and are now only known from study skins: The passenger pigeon (*Ectopistes migratorius*) and Eskimo curlew (*Numenius borealis*). These species illustrate that flocking birds are likely to be dependent on the flock for reproductive cues. However, more current research on Allee effects has extended our measure of effects to other taxa, such as the African wild dog (*Lycaon pictus*)(Courchamp et. al. 2000), and plants (Groom 1998, Schmitt 1983, Steven et.al. 2003).

When using population models as a basis for species status, biologists should be aware that untested models are merely tools to guide investigation. Hidden aspects of models (Fox 2003) may lead us to underestimate population response to perturbation. Additionally, overestimation of persistence can occur when the maximum reproductive capacity of an organism is used in a model, rather than the observed maximum from the field (Goodman 1987).

Utilize surrogates, as necessary. Published data on other species or subspecies should be discussed in conjunction with empirical data on the target species. For example, although the numbers of San Francisco garter snakes are too low to speak with certainty about sex ratios, both the eastern garter snake and red-sided garter snake (members of the same species) have skewed sex ratios, with males substantially outnumbering females; therefore, we can infer that the San Francisco garter snake populations have skewed sex ratios. Other aspects of garter snake biology, such as precocial mating, breeding at den entrance, low survivorship of juveniles, limited hibernacula can be inferred—even if supported by limited observational data.

For plants, discuss the viability of the seeds. Describe the conditions that the seeds need in order to germinate and the factors that are known or suspected to reduce germination. If a seed bank is a component of reproduction for the species, project the life of the seed bank and discuss its viability.

If hybridization has been recognized as a potential threat to the species, discuss the mechanism for the cross and the consequences of the cross. If the offspring of a hybrid are reproductively viable, the consequences of that viability should be discussed—including introduction of maladaptive traits that may be introduced as a result of the pairing and of back-crosses. Introgression, or introduction of genetic material, can have varying consequences in both plants and animals. Include an analysis of the level of natural hybridization that is thought to occur and the reported, as well as hypothesized, consequences. For both plants and animals, contemplate the consequences of both sub-lethal recessive genes and of loss of adaptive traits, as well as the need for genetic diversity.

The following are some factors that lead to measurable or detectable reductions in reproduction or reductions in a population's intrinsic growth rate. For each factor that has bearing on your effects analysis, consider and discuss the mechanisms that led to it and the consequence at a population level. Each factor below can lead to reductions in reproduction, either proximately or ultimately, and many are linked to, or caused by, other factors. Be sure to address cumulative effects as well as action-related effects, and include a discussion of each pertinent factor in the biological opinion.

For animals:

- reduced caloric intake
- intake of, or exposure to, contaminants
- Allee effects
- isolation from breeding opportunities
- loss of territory or territorial abandonment
- disease
- parasites
- discrepancy in ages of pair-bonded mates
- increased depredation
- annoyances and stress
- competition
- heightened aggression
- fewer eggs or young
- unviable eggs or young
- unthrifty young (lack of survivorship in juveniles)
- reduced growth in young
- lengthened time to maturity leading to delayed reproduction
- inbreeding depression
- outbreeding depression
- reduced reproductive lifespan
- broken pair-bonds

For plants:

- reduced soil nutrition
- deposition of metals and minerals--including salts, nutrients and NO_3.
- precipitation
- intake or exposure to contaminants
- reduced growth
- post-season flowering
- pre-season flowering
- increased or decreased herbivory
- loss of pollinators
- isolation
- Allee effects
- inbreeding depression
- outbreeding depression
- early senescence

- fewer seeds produced
- reduced germination
- unviable seeds
- unthrifty seedlings
- degradation or decay of seed bank

Describe Ecological Relationships

Any ecological relationships that have bearing on the diagnosis of status should be discussed. A particular emphasis should be placed on those relationships which have been shown or theorized to elicit individual or population responses, or changes in fitness. Trophic level and trophic relationships should be discussed—including the roles predators, competitors, parasites, commensals, and pathogens.

Introduce Ecological Correlate (if applicable)

In instances where an ecological correlate has bearing on the discussion, an argument must first be made for its inclusion. Introduce the aspect of life history that is shared between the listed species and the ecological correlate. If the species or population you are consulting on has a similar life-history to a population that has become unstable or extinct, the ecological correlate can be used as an illustrative device.

Shared life-history patterns can occur in unrelated taxa, and biologists should not be discouraged from utilizing the best science available on demography even when the correlate is from another order. Demographic data on many species can be illustrated using a life history table. Localized extinctions for those species with constricted life-history tables are powerful reminders of the role demography plays in the survival of species. For species or populations with life-history tables with an hourglass shape (as described above, on page 8) or spire shape, such as the Northern Idaho ground squirrel (*Spermophilus brunneus brunneus*) (Sherman and Runge 2002), there are multible examples, across taxa, of the consequences of those demographic patterns.

Discuss Species Biology Relative to Effects

In *Conner v. Burford*, the judges wrote: “Although we recognize that the precise location and extent of future oil and gas activities were unknown at the time, extensive information about the behavior and habitat of the species in the areas covered by the leases was available.”

For every deconstructed component of the project description, focus on the behavior of the organism relative to that factor. Some examples:

- If there will be lighting at night, discuss whether or not the animal is nocturnal or shown to have a response to lights at night.
- If there will be discing, discuss whether or not the pollinator is dependent on undisturbed soil.
- If the animal is monogamous, and the action will break pair-bonds, present the science on monogamy and pair bonds.

Pay close attention to the auditory, visual, or olfactory acuity of the animal and its sensitivity to stimuli: light, sound, scent, etc. Articulate and summarize expected behavioral responses to stimuli, based on the best scientific and commercial information available.

Life-history stages should be addressed, with particular emphasis on the sensitivity of each stage.

Know the Conservation Mechanism

It is important to know whether preserves, or preserve areas, are able to support the conservation of the species. For established preserves: (1) obtain a copy of the conservation easement (or deed-restriction) that protects the preserve from non-conservation uses, (2) read or review the management plan, (3) read or review the monitoring reports, and (4) check the status of the funding to make sure that land-management actions can be implemented.

For animals subject to harvest, determine where the harvest activities are permissible and where they are not. Ascertain whether harvested populations are able to persist within establish harvest limits. In areas where harvest is excluded, ascertain whether those populations are stable, increasing, or decreasing.

Know the Geography of Conservation and How Policy is Being Implemented

For conserved private lands, determine whether the deed-restriction or easement, management plan, funding, and monitoring are in place for conservation, restoration, or mitigation areas. Make sure that any conservation, restoration, or mitigation lands offered are available for conservation. For federal lands, review the management plan and monitoring reports and discuss any questions with the Action Agency.

If available in your field office, take a global positioning system unit (GPS) into the field on site visits. Complete the necessary training, and sign the appropriate forms, to demonstrate knowledge of the equipment being used. Download the GPS coordinates onto a layer in your Geographic Information System, or transfer the coordinates to a USGS quadrangle map. These records are important for avoiding conflicts that occasionally arise when more than one party offers the same parcel for mitigation or conservation.

If working with the Forest Service, Department of Interior, or Department of Commerce on setting aside lands for conservation, carefully review Section 5 of the Act. Coordinate closely with the property officer involved, to minimize confusion over Section 5 implementation.

Determine the Conservation Needs

If the conservation needs have been identified through the recovery planning process, or through a structured needs-analysis, review them to determine whether they are being met in the action area and for the species. If conservation needs have not been identified, review each threat and limiting factor discussed above (on pages 2, 3 and 4). Generate a list of what can be done to ameliorate the threats and to provide ample conditions for the species to persist. Discuss the list with experts from within your agency, as well as from other agencies or institutions.

Show the Status of Recovery Implementation

Review the most recent status reviews and the biennial, recovery-implementation reports. Compare the recovery needs for the affected population with the effectiveness of meeting that need range-wide. Identify the recovery units that will have bearing on your effects analysis. Describe how these units contribute to the survival and recovery of the species, and report on how close conditions in the recovery units are relative to the target conditions for the unit.

If status reviews and recovery-implementation reports have not been completed, coordinate with the recovery staff in your office or region to gain access to information that is readily available in Service files. Discuss with the Action Agency each priority-one action item from the recovery plan that is anticipated in the action area. Determine whether the Action Agency is a responsible party for the action item, whether the item has been implemented or whether funding has been obligated for its implementation.

Articulate the Management History and Ongoing Experimentation

Be aware that some forms of active management are experimental. If the listed species is present, even in low numbers, carefully quantify the existing management practices. If changes have occurred in the management of the species, identify what those changes were. Compare the species numbers before and after the change in management application, in order to approximate the effect of the change.

Sometimes the application, or misapplication, of management techniques tells us more about the condition, or plight, of a species than any other factor. For example, if a management treatment, such as prescribed fire, is proposed for the entire range of a listed plant, or the last known location(s) of the species, the potential outcome of the treatment could have profound effects. The decision to attempt a management prescription may be well-founded, but the scale must also be considered. There is a tremendous body of literature on the effects of fire on fire-adapted plants. Even if the science favors a burn, the specifics of timing and weather conditions may change the outcome of the action.

For the type of project you are consulting on, look at the range of potential outcomes for management application, including restoration, grazing, prescribed fire, etc. If there is not a definitive method for success, attempt to diversify the timing or type management applications. This, in combination with monitoring and reporting requirements, should allow future biologists to make informed decisions.

Include References for Accurate Field Identification

In order for the monitoring and reporting of incidental take to be valid, applicants, permittees, and Action Agencies must be able to accurately identify the listed species. Available field guides that are acceptable for field identification must be referenced clearly. When field guides do not include descriptions of local phenotypes, or when subtle morphological differences exist between species or subspecies, clarification and identification of field characteristics should be included in the text of the biological opinion and cross-referenced with the 402.14(i)(3) term of the incidental take statement.

Things to Keep in Mind When You Diagnose the Status of the Species

1. **Unoccupied suitable habitat is essential for the survival of some species.** In 2002, Russell Lande wrote: ". . .metapopulation models reveal that a metapopulation may become extinct in the presence of suitable habitat and that currently unoccupied suitable habitat may be critical for long- term persistence of a species." (in Beissinger and McCullough 2002). For species that have a known metapopulation dynamic, where populations come and go as a result of fluctuating weather patterns, seasonal changes, or random stochasticity, populations beyond local population can be impacted or lost by disruption of the metapopulation structure.
2. **Small populations face a greater risk of extirpation/extinction that large populations**. If the species you are consulting on has small populations explain the implications by describing the conservation biology of small populations in general. Describe potential for inbreeding depression and the likely consequences. Conduct Population Viability Analysis (PVA), if you have or can collect the data to support it. Estimate the probability of extinction for a given interval (Bayesian statistics) or estimated time to extinction (Neyman-Pearson statistics) or both.
3. **Structure your diagnosis of status to protect against Type II error**.

   Avoid the consequences of a "failed alarm" by giving the benefit of the doubt to the species.
4. **The geography of conservation is essential to species' survival**

   Know how policy is being implemented, specifically how conserved areas are being conserved.
5. **The Action Agency will not know or understand the conservation needs of a species unless you explain what they are.**

   Respect their expertise, but share your own.
6. **Some conservation mechanisms are flawed.**

   Knowing the weakness can allow you to fix it.
7. **In-place recovery plans are the yardstick for measuring survival and recovery.**
8. **An endangered species is one that is likely to go extinct.**
9. **Some land-management applications are experimental.**
10. **"Conserved" is also a management term.**

    Conservation Easement

Size, buffers, connectivity

Funding/Endowment

PAR--Property Analysis Record

Monitoring

11. **Frequency statistics (changes in distribution) are sensitive measures of change.**

12. **Statistics with projected numbers can be used as a simple model**.

13. **Beware of flaws in logic**

    "There are plenty of other places for them to go."

    "I've been here for 30 years and never seen one of those."

    "If found during construction, we'll ask you for avoidance measures."

    "Trust us, we know exactly what we're doing."

    "We know the area, species, etc., and we're sure there's no problem."

    "The estimated time to extinction is 15 years. This is a 20-year project so effects are not significant."

14. **The best available data is not the available best data**

    A small subset of available data is peer-reviewed. Do not discount the remaining available data, simply because it lacks pedigree.

Summary of the Diagnosis

Throughout the 90-day consultation period, focus discussion on the items that will be addressed in your analysis. By the end of the consultation period, the Action Agency should have a clear understanding of the status of the species and what aspects of their project could contribute to any reductions in numbers, distribution, or reproduction.

In the biological opinion, identify threats and limiting factors, ascertain distribution and trends in distribution, ascertain numbers and numeric trends, identify reproductive needs, and quantify reproductive output. Include in your analysis the biological, ecological, and geographical information that is the basis for your analysis. Include only those diagnostic items that are relevant to the argument.

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