

# Study Guide for the Analytical Framework

## Objectives of this Module

1. Introduce an analytical approach to conducting jeopardy analyses for consultations
2. Identify the primary steps of this analytical approach
3. Define additional terminology associated with this analytical approach
4. Discuss the relationship between the procedures associated with consultation and this analytical approach to consultation

### Section 7 of the Endangered Species Act

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. §1536; ESA), requires Federal Agencies to insure that their actions are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat that has been designated for those species. To comply with this section of the ESA, Federal agencies are required to “consult” with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service (the Services).

The Services’ regulations define *jeopardize the continued existence of* as engaging in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02, also see Box 1, glossary of terms). Several, recent court decisions have vacated the Service’s regulatory definition of *destruction or adverse modification* of critical habitat. Until the Services promulgate a new regulatory definition, the Services rely on the statutory definitions of “conserve” and “critical habitat” to interpret the meaning of destruction or adverse modification of critical habitat; that is, we help Federal agencies insure that their actions are not likely to appreciably reduce the value of critical habitat for the conservation of listed species. This background paper only addresses issues related to the “jeopardy” standard.

The Services’ role in consultations is to analyze the direct and indirect effects of a Federal Action to determine if

the Action is likely to *contribute* to the endangerment of threatened and endangered species by appreciably reducing their likelihood of both surviving and recovering in the wild. The Services reach this conclusions by adding the Action’s effects to the effects of other human activities and natural phenomena on the species’ status and trend in a particular Action Area (usually one or more populations of the species) and the species’ “global” status and trend (that is, as the species has been listed).

### Challenges to Implementing Section 7

Section 7 of the ESA has been surrounded by controversy for almost 30 years, since the controversy surrounding the biological opinion on the Tennessee Valley Authority’s Tellico Dam project. Since then, Service consultations on various Federal actions have been the subject of hundreds of legal challenges and an even greater amount of political controversy.

In addition to legal challenges to specific consultations, controversy about how to properly interpret the “jeopardy” standard and the methodology the Services use to make “jeopardy” determinations has surrounded section 7 consultations for decades. Following a series of legal challenges associated with several consultations on fisheries management plans in the late-1990s, the Services began working on a framework that would make the consultation process — the premises, evidence, analyses, and decision-making process — transparent, replicable, and supported by a complete series of well-reasoned arguments.

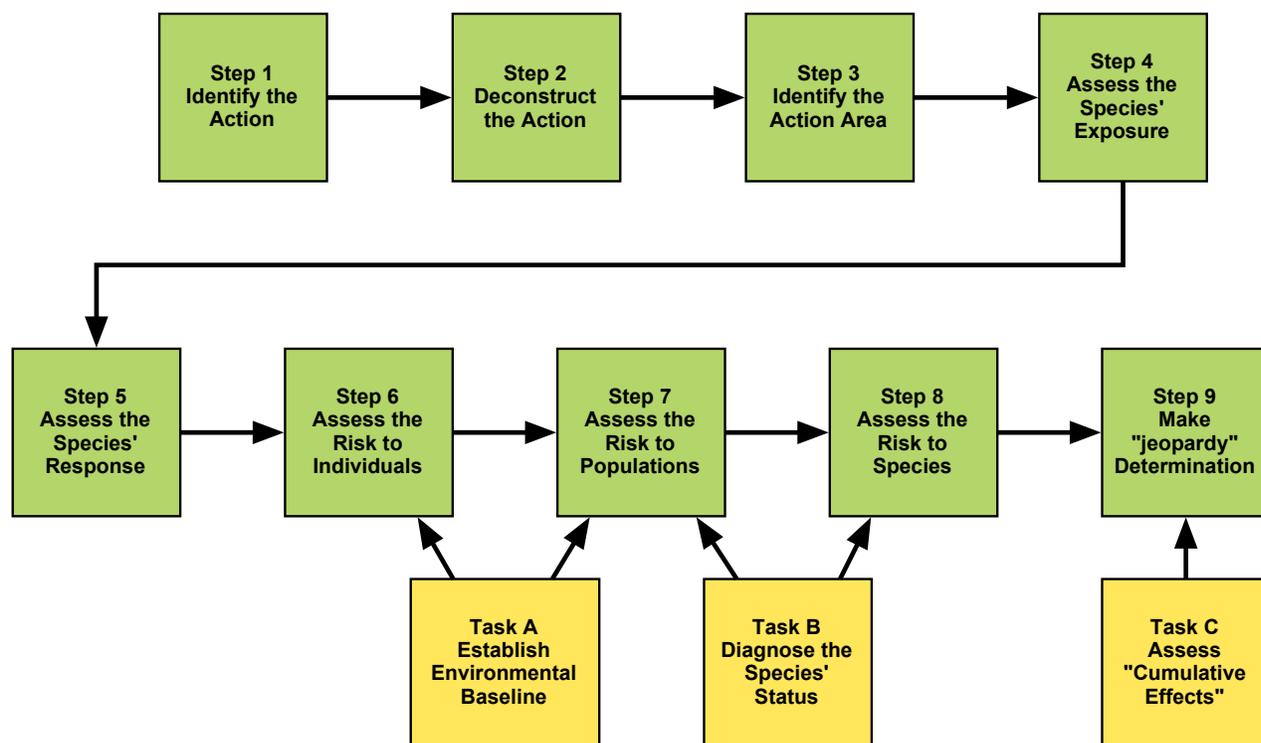


Figure 1. Conceptual model of the assessment framework

### Overview of the Assessment Framework

The result of those efforts was an assessment framework that integrates the procedural and analytical requirements of section 7 of the ESA with the general structure, primary concepts, and much of the nomenclature of the U.S. Environmental Protection Agency's ecological risk assessment framework. A sequence of 9 steps and two supporting tasks comprise the resulting assessment framework (Figure 1). At each step, Service biologists identify specific questions they need to answer by working with Action Agencies and Applicants (where applicable) to gather relevant evidence and data, and critically appraise the evidence they have gathered (which includes statistical analyses when the data allow) to reach a conclusion.

To respond to the Services' obligation to ensure that the conclusion of section 7 consultations are not arbitrary or capricious (see Boxes 1 and 2 for a glossary and discussion of the applicable standards), the Services approach each step of the assessment framework as a series of logical arguments (a) whose premises must be valid, warranted, or justified, (b) that must consider all of the evidence that is relevant to them, (c) that rationally connect evidence and

conclusions, and (d) that defend themselves.

The discussion that follows summarizes the 9 steps of the framework and the two supporting tasks. The appendices provide additional background information on the definitions of "best scientific and commercial data available," and the standards of review (see Box 3 for a discussion of the obligation to provide the reasoned "benefit of the doubt" to listed species and designated critical habitat during consultations).

#### Step 1: Identify the "Action"

By regulation, an Action for a consultation includes all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal Agencies in the United States or upon the high seas. Examples include, actions intended to conserve listed species or their habitat; promulgation of regulations; granting licenses, contracts, leases, easements, rights-of-way, permits, or grants-in-aid; or actions directly or indirectly causing modifications to the land, water, or air.

A consultation cannot begin without a Federal Action, so the first step of the assessment framework requires the Services

to work with Action Agencies and Applicants to develop a clear description of an Action. That description must contain sufficient detail to identify all aspects of the Action that have potential environmental consequence, where the Action and its different elements would occur, when they would occur, and how long they would endure over time. At a minimum, descriptions of an Action should identify

- a. the Federal agencies or agencies taking the Action
- b. the name of Applicant(s), if any
- c. the purpose for the Action
- d. the statutory authority for the Action
- e. what the Action entails, including any phases (construction, operations, and related activities)
- f. where the Action would occur
- f. interrelated and interdependent Actions

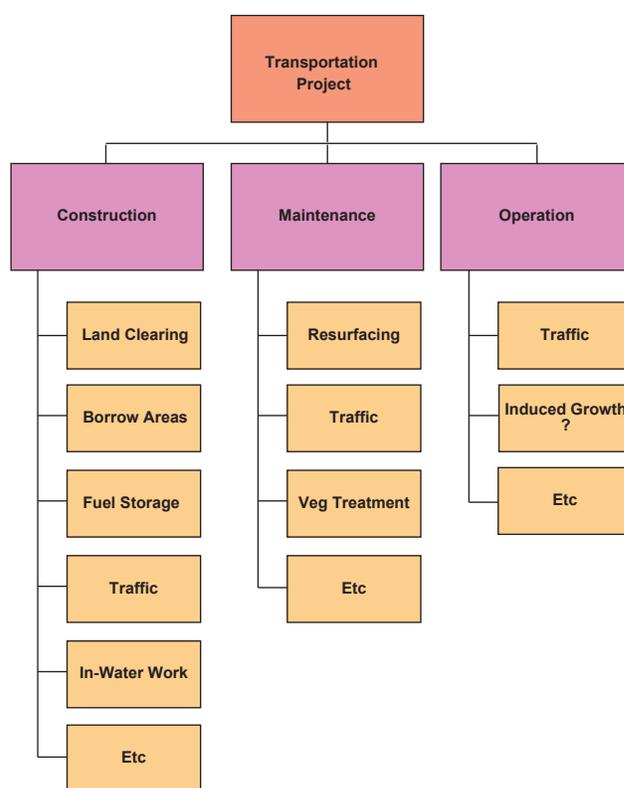
**Step 2: Deconstruct the Action**

Once the Services have a complete description of an Action, the Services “deconstruct” the Action into its constituent parts to identify any environmental stressors (physical, chemical, or biotic stressors that are directly or indirectly caused by the Action and, for indirect effects, are “reasonably certain to occur”) and any environmental subsidies caused by the Action (environmental changes that improve conditions for taxa that prey on, compete with, or serve as pathogens for one or more listed species). Figure 2 illustrates the “deconstruction” of a typical transportation construction project.

A feedback loop connects this step with the preceding step. If the Services cannot identify an Action’s constituent parts or cannot identify environmental stressors with sufficient detail to conduct robust exposure assessments, the Services will work with Action Agencies and applicants to refine the description of a proposed Action.

When this step is completed, the Services would be able to describe

- a. the specific physical, chemical, and biotic phenomena (stressors or subsidies) that are likely to result from an Action
- b. the intensity of those stressors (or subsidies) in the environment
- c. the spatial distribution of the stressors at particular intensities
- d. the temporal distribution of the stressors at



**Figure 2.** Partial “deconstruction” of a transportation project.

particular intensities

At this step in a consultation, Service biologists also separate elements of an Action that are known to have adverse environmental consequences from those that are known to have beneficial or no environmental consequence. Subsequent steps focus on those aspects of an Action that are known to have adverse or beneficial environmental consequence.

**Step 3: Identify the Action Area**

By regulation, an Action area for a consultation consists of all areas to be affected directly or indirectly by the Federal Action and not merely the immediate area involved in the Action.

To identify the Action Area for a consultation, Service biologists follow the Action’s physical, chemical, and biotic stressors as they move across lands and waters (through direct and indirect pathways) over time. They also identify the spatial and temporal distribution of the stressors that would be generated by the Action and use that distribution to define the Action Area for a consultation.

**Step 4: Assess the “Species” Exposure**

Threatened and endangered species are *exposed* to the physical, chemical, and biotic stressors of a Federal Action when their spatial and temporal distributions overlap. In this step of the assessment framework, Service biologists identify the spatial and temporal co-occurrence between those stressors and listed species as well as any direct or indirect exposure pathways. This is one of the most critical steps of the assessment because most attempts to resolve potential conflicts between listed species are designed to eliminate, modify, or mitigate listed species’ exposure to one or more stressors associated with an Action.

This step of the framework is designed to identify: (a) the specific physical, biotic, and chemical effects stressors to which individual members of listed species are likely to be exposed; (b) the pathway of exposure (that is, would individuals be directly exposed to a stressor or would the exposure be indirect, for instance through consumption of prey that were exposed directly); (c) where exposure would occur; (d) who or what would be exposed (e.g., what population, life history form, or life stage); (e) the number of individuals that would be exposed; (f) the timing, magnitude, duration, and frequency of the exposure; and (g) how exposure might vary depending upon the characteristics of the environment, stressor intensity, and individual behavior.

Exposure analyses require Service biologists to provide detailed information on (a) a species’ developmental patterns (including how those patterns vary throughout a species’ range) (b) the species’ spatial distribution, including the distribution of individuals at particular life stages and how that distribution varies over time and (c) the species’ ecological relationships (to identify potential direct and indirect exposure pathways or a causal explanation for why the exposure would occur). Service biologists always present information on (a), but only provide information on (b) and (c) if an assessment requires it.

If Services biologists working with Action Agencies and Applicants, do not have sufficient information to establish the probable exposure, they develop exposure scenarios. These scenarios identify the kinds of exposure that are probable and, at a minimum, would include the “best-case” and “worst-case” scenarios for listed resources.

One of the critical assumptions underlying the framework relates to exposure: if individual members of threatened or endangered species are not directly or indirectly exposed to any stressor produced by an Action (for example, through its prey base, a change in the quality of its habitat, predators

or competitors, etc.), the individuals and, therefore, the species would not be affected by the Action.

**Step 5: Assess “Species” Responses to Exposure**

After determining that individual members of listed species would be exposed to one or more physical, chemical, and biotic stressors produced by an Action, Service biologists evaluate the available evidence to determine (a) how the individuals are likely to respond to the exposure, and (b) whether the probable exposure would be sufficient to evoke particular response(s). The former task includes sorting through the suite of possible responses to identify the probable response or responses, the latter verifies that the probable exposure would be sufficient to elicit particular responses.

If Service biologists, working with Action Agencies and Applicants, do not have sufficient information to establish the probable responses, they develop response scenarios. These scenarios would identify the kinds of exposure that are probable and, at a minimum, include the “best-case” and “worst-case” interactions (from the perspective of the species).

To answer these questions Service biologists, working with Action Agencies and Applicants, search published and unpublished sources of literature and review case studies to identify the available and relevant information. Relevant published and unpublished studies include, but are not limited to, studies of

- a. individuals of the same species from other populations,
- b. individuals representing other species,
- c. ecological theory, and
- d. computer simulation and modeling.

Service biologists then critically appraise the available evidence to identify particular responses or the range of responses that are most likely to occur. When no data are available on a particular species or the species’ exposure to particular stressors, Service biologists may use surrogates. When the evidence is equivocal, Service biologists identify the range of responses that have the strongest support in the available evidence (supported by their reasoning).

When practicable, Service biologists interpret the evidence available to them in terms that are relevant to a species’ (or population’s) demography and, therefore, the Services’ jeopardy analyses. That is, Service biologists try to relate

any responses they identify in the evidence available to them to the following, demographic responses:

$\Delta f_x$  = change in fecundity rates or the number of eggs produced by an adult female of age x

$\Delta m_x$  = change in maternity rates or the number of live births for adult females of age x

$\Delta g_x$  = change in somatic growth rates for an individual of age x

$\Delta n_x$  = change in the number of individuals of age x

$\Delta S_x$  = change in the number of individuals of age x that survive during a time interval

$\Delta I_x$  = change in number of individuals of age x that immigrate into a population

$\Delta E_x$  = change in number of individuals of age x that emigrate from a population

As part of these analyses, Service biologists also identify (a) causal pathway(s) that connect exposure to responses and (b) latent periods between exposure and the onset of a response (based on the evidence available).

If individual members of a threatened or endangered species are directly or indirectly exposed to one or more stressor produced by an Action, but are *known* not to respond negatively to the exposure (responses can include physiological stress, abandonment of a site, increased respiration, increased predation, etc.), then the Services would generally conclude that listed species are not likely to be affected by an Action and consultation can conclude. The framework requires Service biologists, Action Agencies, and Applicants to produce evidence that allows the Services to conclude that no “negative” responses are likely (and demonstrate that this evidence representing studies with sufficient power to identify and detect “negative” responses) before they can use that evidence to conclude a consultation rather than concluding consultations merely because there is no evidence of “negative” responses (that is, absence of evidence is not evidence of absence).

Requiring evidence that allows the Services to conclude that adverse responses are not likely, rather than reaching this conclusion because no evidence is available minimizes the likelihood of false, negative conclusions (concluding that adverse effects are not likely when such effects are, in fact, likely to occur). However, at the end of a consultation and in the face of uncertain or equivocal evidence, the Services must make jeopardy determinations based on a reasoned consideration of the best scientific and commercial data available.

### Application to Habitat-Based Assessments

Habitat-based jeopardy assessments, in which “habitat modification” or “habitat destruction” represents the mechanism by which an Action has potential demographic effect on individual members or populations of listed species, are a form of indirect pathway by which listed species are exposed to an Action’s effects on the environment. In these kinds of assessments, a species’ habitat changes in response to an Action’s effects on the environment and listed species respond to changes in the quantity, quality, or availability of one or more of the resources that form its habitat.

For example, destroying an organism’s prey base or eliminating the cover the organism needs to reduce its risk of predation can both have serious demographic consequences for the organism. Both of these habitat changes affect species through different mechanisms and have completely different demographic consequences for species. Destroying an organism’s prey base — either by reducing the quantity of prey, its quality, or its availability — can increase competition for the remaining prey, may reduce the fertility of adult females, decrease the number of live births in adult females, could reduce growth rates of individuals exposed, and tend to have disproportionate affects on younger, smaller, or subordinate individuals. Eliminating the cover an organism needs to reduce its risk of predation can increase the predation risks of individual organisms and, depending on the organism, could affect the survival of specific age classes or all age classes equally.

If the organism’s forage base or cover had been included in a critical habitat designation (for example, as constituent elements), reductions in the forage base or cover might result in “habitat destruction or modification” of the critical habitat designation if those changes were sufficient to reduce the value of the designated habitat.

### Steps 6 - 8: Assess the “Species” Risk

As Figure 1 illustrates, the final phase of the assessment framework consists of three separate steps: (1) identifying the probable risks to the individuals organisms that are likely to be exposed to an Action’s effects on the environment; (2) identify the consequences of changing the risks to those individuals for the populations those individuals represent; and (3) identify the consequences of changing the risks to those populations for the species those populations comprise.

During this phase of the assessment process, Service biologists ask three questions:

1. Would the response(s) of the individuals that are

- likely to be exposed to an Action's effects on the environment be *sufficient* to reduce the fitness of those individuals?
2. Would changes in the fitness of these individuals be *sufficient* to increase the extinction risk (or reduce the probability of persistence) of the populations those individuals represent given the population's base condition (= environmental baseline, see Task A, below) and given what Service biologists know about the species, in particular, or species of this kind in general?
  3. Would changes in the extinction risk (or probability of persistence) of those populations be *sufficient* to increase the extinction risk (or reduce the probability of persistence) of the species those populations, given the species' status (see Task B, below).

Service biologists present their results in terms of a population's extinction risk or persistence probability using one or more of the six general measures of a species' likelihood of becoming extinct in the wild: (1) estimated time to extinction; (2) mean time to extinction; (3) median time to extinction; (4) modal time to extinction; (5) probability of extinction in an interval of time; and (6) probability of extinction over any interval of time. In many instances, these same units to measure a species' risk of extinction are easily converted into a species' likelihood of persisting in the wild by subtracting the extinction risk from 1 (or likelihood of persistence = 1 – risk of extinction).

As an alternative to these measures of risk (or to supplement them), Service biologists assess the risks Actions pose to populations, species, or both using one of four measures of population growth: continuous rate of increase ( $r$ ), finite rate of increase ( $\lambda$ ), net reproductive rate ( $R_0$ ), and the two Dennis statistics ( $\mu$  and  $\sigma^2$ ).

To support this phase of an assessment, Service biologists compare probable changes in population growth or extinction associated with an Action with patterns that have been documented in (a) other species that have become extinct, (b) populations that have become extinct, (c) ecological theory, and (d) computer simulations and related modeling exercises (in order of preference). In many instances, the data necessary to develop mathematical models or simulation will not be available for this step of a consultation; in those instances Service biologists will develop their conclusions by making inferences from all of the evidence they have gathered during a consultation and relying on their knowledge of population ecology

and experience with populations and species that have collapsed or become extinct (that is, using approaches (a) or (b) described above). When Service biologists use these approaches to make inferences during this step of a consultation, they must establish the legitimacy of their analogy (that is, why they expect the responses of listed species addressed in a particular consultation would be similar to those of a surrogate).

### Step 9: Make “Jeopardy” Determination

Once Service biologists have concluded Steps 1 through 8 and the supporting tasks, they would draft recommendations for Service managers and decision-makers on whether an Action is or is not likely to jeopardize the continued existence of threatened or endangered species (as well as any conclusions on critical habitat that has been designated for those species). Ultimately Service jeopardy determinations are policy decisions that are informed by and based on the analyses conducted by Service biologists (including consideration of “cumulative effects” or the effects of *future* State, local, or private actions that occur in an Action Area. Note that this regulatory definition of “cumulative effects” is distinct from the term “cumulative impact” under the National Environmental Policy Act).

Although the Services' jeopardy determinations are policy decisions, those policy determinations must be made within the context of (a) the ESA (that is, consistent with the purpose of conserving the ecosystems upon which listed species depend as well as the species themselves and insuring that proposed actions are not likely to jeopardize the continued existence of listed species) and (b) the Administrative Procedure Act (that is, they should not be arbitrary or capricious, an abuse of discretion, or not otherwise in accordance with law).

### Task A: Determining the Environmental Baseline

By regulation, the environmental baseline for an Action includes the past and present *impacts* of all Federal, State, or private actions and other human activities in an Action Area, the anticipated *impacts* of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process.

The environmental baseline is designed to assess the condition of individuals and populations of listed species in an Action Area, given their exposure to human activities and natural phenomena in the area. For example, environmental

baselines identify individuals that have small body sizes at a particular age or stage, populations with skewed gender ratios or with gaps in their age structure, “source” populations that have declined to the point where emigrants no longer leave their territories, or “sink” populations that are failing because of lack of immigration. As a result, environmental baselines identify the antecedent conditions for individuals and populations before the Services consider any new stressors produced by an Action under consultation.

### **Task B: Diagnosing a Species’ Status**

By regulation, Service biologists are required to consider a species’ status and trend when they make jeopardy determinations. Diagnosing a species’ status is critical to the assessment framework because the jeopardy standard assumes that threatened or endangered species, by virtue of being listed as threatened or endangered, have crossed thresholds where they face unacceptable risks of extinction (= quasi-extinction) and are assumed to be dominated by the dynamics of declining populations, small populations, or both. Subsequent human activities are considered in light of this core assumption.

Diagnosing a species’ status is similar to the process of establishing the environmental baseline for an Action Area and involves many of the same considerations. The main difference between an environmental baseline and a species’ status is scale: while an environmental baseline is limited to an Action Area, a species’ status encompasses the base condition of the entire species (as they are listed), given their exposure to human activities and natural phenomena throughout their geographic distribution. For example, the Services diagnose a species’ status to identify its risk of extinction (or probability of persistence) at the time of consultation even if a proposed Action did not occur. As a result, a species’ status provides the point of reference for the jeopardy analyses in a consultation.

The status of listed species represent two different sets of information that are pivotal to our assessments:

- a. the status of the species, in terms of the species’ risks of extinction, the conservation value of critical habitat that has been designated for the species, or both, and
- b. the background information necessary to support and explain our status assessment, our exposure analyses, our response analyses, and our risk analyses.

Service assessments of a species’ status require knowledge

of a species’ population structure, general distribution, metapopulation dynamics abundance, migratory habit(s) (if any), life history strategy, and vital statistics (to the extent the latter are known or can be estimated). The vital statistics include (a) the species’ longevity, (b) how long it takes for the species’ to become sexually mature, (c) whether the species is semelparous or iteroparous, (d) if the species’ is iteroparous, the number of times adults can be expected to reproduce in their lifetimes and the interval between reproductive events, and (e) the species’ probable survivorship curve.

## Box 1. Glossary of Terms

“Action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. Examples include, but are not limited to: (a) actions intended to conserve listed species or their habitat; (b) the promulgation of regulations; (c) the granting of licenses, contracts, leases, easements, rights-of-way, permits, or grants-in-aid; or (d) actions directly or indirectly causing modifications to the land, water, or air.

“Action area” means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.

“Applicant” refers to any person, as defined in section 3(13) of the Act, who requires formal approval or authorization from a Federal agency as a prerequisite to conducting the action.

“Biological opinion” is the document that states the opinion of the Service as to whether or not the Federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

“Cumulative effects” are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation.

“Effects of the action” refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

“Formal consultation” is a process between the

Service and the Federal agency that commences with the Federal agency’s written request for consultation under section 7(a)(2) of the Act and concludes with the Service’s issuance of the biological opinion under section 7(b)(3) of the Act.

“Incidental take” refers to takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant.

“Informal consultation” is an optional process that includes all discussions, correspondence, etc., between the Service and the Federal agency or the designated non-Federal representative prior to formal consultation, if required.

“Jeopardize the continued existence of “ means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

“Listed species” means any species of fish, wildlife, or plant which has been determined to be endangered or threatened under section 4 of the Act. Listed species are found in 50 CFR 17.11-17.12.

“Recovery” means improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of the Act.

“Service” means the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, as appropriate.

## Box 2. Standards of Review

The standards used to review biological opinions are established by the Administrative Procedure Act [APA; 5 U.S.C. 701 et seq.], sections 7 of the Endangered Species Act of 1973, as amended [ESA; 16 U.S.C. 1536], and regulations promulgated to implement section 7 of the ESA [50 CFR 402].

1. Section 706 of the APA, among other things, cautions against Federal agencies from taking actions that are arbitrary, capricious, or not otherwise in accordance with law. a consultation, a biological opinion, or both would be arbitrary and capricious if
  - a. the Services relied on factors which Congress did not intend us to consider,
  - b. the Services failed to consider an important aspect of a problem,
  - c. the Services offered an explanation for our conclusion that runs counter to the evidence before us,
  - d. the Services failed to articulate a rational connection between the facts that were found and the conclusions we reached in our biological opinion.<sup>1</sup>
2. Section 7(a)(2) of the ESA requires Federal agencies to insure that their actions are not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat. Regulations that implement section 7 of the ESA [50 CFR 402] define "jeopardize the continued existence of" as *to engage in an action that reasonably would be expected to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.*
3. Section 7(a)(2) of the ESA requires Federal agencies to utilize the best scientific and commercial data available when insuring that their actions are not likely to jeopardize the continued existence of listed species in the wild or destroy or adversely modify designated critical habitat.

### Footnotes

- <sup>1</sup> See *Bennett v Spear*, 520 U.S. 154 (117 S.Ct. 1154). Also *Idaho Department of Fish and Game v. National Marine Fisheries Service et al.*, 850 F. Supp. 886 (D.Or 1994)] in which the court concluded that "judicial review is limited to an assessment of whether the agency 'conducted a reasoned evaluation of the relevant information and reached a decision that, although perhaps disputable, was not arbitrary or capricious.'" In determining "whether an agency decision was 'arbitrary or capricious,' the reviewing court 'must consider whether the decision was based on a consideration of the relevant factors and whether there has been a clear error of judgment.'" *Marsh v Oregon Natural Resources Council*, 490 U.S. 360 (109 S.Ct. 1851). "Normally, an agency rule would be arbitrary and capricious if the agency has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a different in view or the product of agency expertise." *Motor Vehicle Manufacturers Association v State Farm Mutual Automobile Insurance Company*, 468 U.S. 29 (103 S.Ct. 2856). An agency action is also arbitrary when the agency fails "to articulate a satisfactory explanation for its action." *Northern Spotted Owl v Hodel*, 716 F.Supp. 479 (W.D. Wash. 1988). "A biological opinion is arbitrary and capricious and will be set aside when it has failed to articulate a satisfactory explanation for its conclusions or when it has entirely failed to consider an important aspect of the problem. While courts must defer to an agency's reasonable interpretation of equivocal evidence, such deference is not unlimited. The presumption of agency expertise may be rebutted if its decisions, even though based on scientific expertise, are not reasoned." *Greenpeace et al. v NMFS*, 55 F.Supp. 2d 1248 (W.D. Wash. 1999). See also *Defenders of Wildlife v Babbitt*, 958 F.Supp. 670 at 679 ("The deference a court must accord an agency's scientific...expertise is not unlimited, however. Thus the presumption of agency expertise may be rebutted if its decisions, even though based on scientific expertise, are not reasoned.").

### **Box 3: Providing the Benefit of the Doubt to Listed Resources**

Scientists have two general points of reference available when they consider data, information, or other evidence to support analyses (1) they can analyze the information available to avoid concluding that an action had an effect on listed species or critical habitat, when, in fact, it did not or (2) they can analyze the information available to avoid concluding that an action had no effect on listed species or critical habitat when, in fact, the action had an effect. In statistics, these two points of reference are called “errors”: the first point of reference is designed to avoid what is called Type I error while the latter is designed to avoid what is called Type II error (see Cohen, 1987). Although analyses that minimize either type of error are statistically valid, most biologists and ecologists still focus on minimizing the risk of concluding that there was an effect when, in fact, there was no effect (Type I error) and tend to ignore Type II error.

To meet the statutory requirement to “insure” that proposed actions are not likely to jeopardize the continued existence of listed species and critical habitat that has been designated for them, the Services design their analyses to avoid concluding that actions had no effect on listed species or critical habitat when, in fact, there was an effect (Type II error). This approach also complies with direction from the U.S. Congress to provide the “benefit of the doubt” to threatened and endangered species [House of Representatives Conference Report No. 697, 96th Congress, Second Session, 12 (1979)]. At times, this approach to error may lead to different conclusions than scientists who take a more traditional approaches to avoiding error, but this approach is more consistent with the purposes of the ESA, direction from Congress, and the statutory language of section 7 of the ESA. Box 3: Best Scientific and Commercial Data Available

The Services and Federal agencies are required by statute and regulation to use the best scientific and commercial data in consultation. The 1979 Amendments to the Act (H.R. Conf. Rep. No. 697, 96<sup>th</sup> Cong., 2d Sess. 12) further clarify that this standard applies to data that is available or can be developed during consultation. In the event the Services must render a biological opinion on the basis of inadequate information, the Federal agency has a continuing obligation to make a reasonable effort to develop the needed information.

The criteria for what constitutes the best available scientific and commercial data are extensive. The Services’ 1994 *Interagency Cooperative Policy on Information Standards Under the ESA* (59 FR 34271), the Administrative Procedures Act [5 U.S.C. 701 et seq.], the Information Quality Act [See Treasury and General Government Appropriations Act for Fiscal Year 2001, Pub. L. No. 106-554, 114 Stat. 2763, at App.C § 515 (codified in a note to 44 U.S.C. § 3516)], and an extensive number of legal cases address the best available data mandate. The Administrative Procedure Act directs reviewing courts to hold unlawful and set aside agency actions that are “arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law.” Numerous challenges have been brought on the Services’ biological opinions under the “arbitrary” and “capricious” standards of the Administrative Procedure Act. Although agency decisions are generally treated as deferential in court, these standards instruct the Services’ to clearly articulate the premises of the reasoning for their decisions, including the reasoning for rejection relevant information in favor of other evidence.

The Services’ obligation to base their inquiries and biological opinions on reliable, explicit, rational, objective, and replicable evidence, however, does not limit the evidence to published peer-reviewed literature. Suitable data may come from a wide variety of sources ranging from peer-reviewed literature to unpublished empirical information commonly shared by the relevant scientific community. In all cases, the Services would render their biological opinions examining the strength of the available evidence and providing the benefit of the doubt to the listed resource in the face of uncertainty, and the absence of robust data the Services would assist the consulting Federal agency in developing the data as needed.