AGENCIA: FISH AND WILDLIFE SERVICE

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Chapter 3. The numbering of this chapter is inaccurate, making specific sections difficult to locate by page numbers given in the Table of Contents, and difficult to reference for comments. This appears to be a simple error in the page numbering program for this section that should be simple to correct.	Se arreglara la numeración.
3.3.1 is a discussion of types of surface water resources that includes a brief discussion of lakes. Laguna Cartagena has historically been a natural freshwater lake or pond with seasonally variable water levels until additional hydrology was provided by the Lajas Valley drainage canal. Neither Laguna Cartagena nor Laguna de Guanica should be considered to be estuarine. Laguna Cartagena should be included here as a natural freshwater body.	Se acepta comentario y se incorpora al texto.
3.4 The discussions of the river crab or buruquena (*Epilobocera sinuatifrons*) contain conflicting information. The initial discussion implies that they do not need to migrate, the second mention is that they do not need water to reproduce, and the third mention near the end of the "ciclos de vida" section suggests that they may have a migratory component that is not well explained. Gravid females can survive with their eggs or young out of water in humid areas for short periods of time, but need water to wet their brachial cavities, and release the young crabs. Juvenile crabs are generally found in the streams. They do not need to migrate to salt water to complete their life cycles as do other river crustaceans because the young pass the larval stages in the egg and	Se acepta y se incorporaran los cambios.

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hatch out as juvenile crabs. Nevertheless, migrations of adult crabs through wet forested areas have been reported. Normally adult crabs stay in or near streams especially during dry periods with low humidity.	
Section 3.4 also mentions that the rivers have little protection, describing the lower portion of the Río Espíritu Santo as a protected area due to its designation as a Natural Reserve. This estuary was declared a Natural Reserve based on a DNER biological evaluation of at least 7 north coast river estuaries which indicated that this estuary had the highest diversity and best overall condition. The evaluation was carried out shortly before the Yunque Treatment plant dam and intake were placed in the river. This low dam is frequently dry, providing no downstream minimum flow approximately half of the time due to the excessive water extraction for the Yunque plant. It became the subject of a study carried out by personnel working with the Long Term Ecological Research program in the Luquillo Experimental Forest (Benstead, et al, 1999). This study provides one of the few published studies measuring impacts to river fauna from a low dam and flow interruption. The protection provided to this estuary is highly questionable with respect to the river fauna and freshwater flow to the estuary.	Se revisó el texto y se ajusto el mismo a la información provista.
In the section on dams and reservoirs, the presence of some native fish and shrimps in some lakes is reported. It is true that there appear to be landlocked populations of guavina in some lakes, however, there is no evidence of other native fishes in the lakes or that shrimps can reproduce within the lakes. Populations of some shrimp species have been found in or upstream of reservoirs that have frequent discharges of water over the dam weir, which is certainly the case with Matrullas Lake on the Manatí River with no other high dams or reservoirs below it. Holmquist (1997) confirmed that juvenile shrimps were capable of climbing even high dams (over 90' in height) if there was discharge over the dam for a sufficient period of time which is the case with Matrullas, Loco, Patillas, Guayabál, La Plata, Carraizo, and some other dams. Shrimps	Se agradece la información, se revisa el texto y se ajusta a la información provista.

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are normally absent above dams such as Dos Bocas, Guajataca, Caonillas, and Luchetti with the exception of recruitment following unusual discharge over the dam weir (Holmquist, et al, 1998). Discussions of life cycles can be difficult to interpret given the existing terminology (catadromous, anadromous, amphidromous, etc.) available, however, the distinctions between these are important for understanding potential impacts on native migratory stream fauna from water extraction, high dams, and reservoirs. The American eel is the only native river species currently considered to be strictly catadromous (with the adults returning to the sea to spawn). The larval stage, elvers, are capable of wriggling up small dam structures with a sloped ogee weir and can probably ascend some fairly steep stream passes. They are not capable of scaling high dams. Although the theses referenced in the draft Water Plan have described the dajao, olivo, saga, guavina, and *Macrobrachium*. populations as catadromous, more recent evidence would more correctly describe these as amphidromous or possibly anadromous since there is no evidence that the adults return to the sea to reproduce. On the contrary, there is considerable evidence that they mature and spawn (repeatedly over the years) in the rivers, and that their fertilized eggs or larvae are passively carried by the stream currents to estuarine waters where they pass through larval stages before re-entering the rivers. The olivo (whose larval stage is known as cetí) has been confirmed to lay sticky eggs on the undersides of rocks in the river system, and the young larvae are carried to the ocean. Late larval stages re-enter the rivers and move upstream, quickly metamorphosing into juveniles when they enter fresh water. Dajao have not been documented spawning, however, mature females with very ripe eggs have been found far upstream where they appear to remain (personal observation). *Macrobrachium* species have the same life cycle described later in the section for other shrimp. Females carry fertilized eggs under their abdomen and release early stage larvae to the streams. Aquaculture studies on a number of *Macrobrachium* and other species	Se agradece la información, se revisa el texto y se ajusta a la información provista.

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have confirmed that they must reach brackish or marine waters in order to molt from the initially released first stage non-feeding larvae to later larval stages capable of feeding. The implications of these life cycles is that the critical stages for most species are downstream moving larvae or fertilized eggs, and upstream moving juveniles. The exception is for adult female American eels which move downstream to the estuaries, and both males and females move far out to sea to spawn. Water extraction entrains downstream moving larvae and upstream migrating juveniles. Reservoirs entrain downstream moving larvae where populations occur above high dams, rendering these populations incapable of being self-sustaining. Dams are obstacles mostly for upstream moving juveniles of all the migratory species. Ability to migrate over a dam is highly dependent upon the adaptations of each species.	Se agradece el comentario y el mismo se toma en cuenta.
Section 4.6 includes a brief discussion of the need for recreational, aesthetic and environmental considerations for river flows. Once again, Q_{99} and 50% of Q_{99} are mentioned as possible required minimum flows depending on the circumstances. For most streams 50% of Q_{99} would be inadequate unless balanced with other considerations such as severe limitation of the extraction rate in order to preserve variability in flows. Variable flows may be particularly important for maintaining healthy conditions in the estuaries and streams. Reduced extraction and higher flows at night would reduce entrainment impacts to downstream moving larvae and upstream moving juveniles. There are a number of factors that could reduce impacts depending upon the specifics of the extraction site. We concur that criteria or guidelines should be developed to provide better and more objective determinations of appropriate minimum flows.	Se aclara en los capitulos 7 y 8 que el Q99 o un caudal mayor será requerido aguas debajo de las tomas nuevas.

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6.5.3 Sostener rutas migratorias	
Most, but not all, of the native fishes and crustaceans are known to require migration between fresh and brackish or marine waters to complete their life cycles. Those requiring migration include approximately 13 species of shrimps, and at least 5 species of fishes. Of the fishes, the decline in populations of the American eel (*Anguilla rostrata*) has become an issue of international concern. All of the shrimp species are thought to be compulsory migrators. The exceptions, or species known to be able to live and reproduce entirely in fresh water, are the buruquena or river crab (*Epilobocera sinuatifrons*), and the big-mouth sleeper or guavina (*Gobiomorus dormitor*) which is still found in some land-locked lakes, although it usually migrates. There are also a number of species (tarpon, snook, burro grunt, etc.) considered to be mostly estuarine with the capability of moving some distance upstream in freshwater, but these are usually only an issue where water intakes are placed far downstream near the river estuary.	Se agradece la información, se revisa el texto y se ajusta a la información provista.
With regard to physical barriers, 3 meters in height was mentioned for low-head dams largely because small river intakes usually utilize dams this size or smaller to provide the pool for the intake. The ability of native stream fishes and shrimps to ascend these structures varies by species as it is dependent upon the species adaptations (jumping, crawling, or using the fin suction disk, in the case of gobies, to ascend steep passes). The cost and difficulty of designing and placing a fish/crustacean ladder or device can increase greatly with small increments in the height of these structures. Any fish or crustacean ladder will also require safe access and significant maintenance to keep it functional. Therefore, eliminating the need for low dam structures through intelligent intake placement and design may be the best way (economically and ecologically) to address this issue.	Se agradece la información, se revisa el texto y se ajusta a la información provista.

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6.5.4 Sobrepesca y especies exóticas There is little evidence indicating that over-fishing by traditional methods (nets, hook and line, traps) has seriously affected populations of native river fishes or shrimps. On the other hand, there is documented evidence of mass mortalities attributed to the use of chemicals (pesticides or Chlorox) to fish in the streams. Effort should concentrate on eliminating any use of chemicals for stream fishing as this could affect fish and shrimp populations and water quality for human consumption. Maintaining some traditional artesanal fishing helps promote public interest in the native river fauna. The major documented evidence of impacts to native stream fauna is the elimination of some or most of the native species in watersheds upstream of high dams due to the interruption of their migrations. There is some evidence that the low head dams (under 3 meters in height) eliminate migration of species without adaptations for climbing, and impede migration of other species. Intakes affect aquatic populations by entraining downstream moving larvae and upstream migrating juveniles.	Se agradece la información, se revisa el texto y se ajusta a la información provista. En los Capítulos 7 y 8 se incluye estrategia dirigida a atender este asunto. Se agradece la información, se revisa el texto y se ajusta a la información provista.
Chapter 7. This chapter contains public policy and objectives for water use, breaking these down into water management, instruments or tools for evaluation, and land management. Nine tasks are listed under the water management and use section. The first of these in Figure 7.1 is the level of confidence in water supply. It is certainly the goal to provide steady (99% of the time) water supply to the public, but may not be practical in the long term in high altitude areas that continue converting from low to high density populations. At some point, to meet this goal, there should be planning and strict adherence to lower density development in areas with no reasonable alternative water sources. Lower altitude development near the coasts will also be subject to shortages, but may have alternatives such as desalinization of brackish or sea water. Currently, all of the large projects we have reviewed depend upon public water supply from systems that are already stretched. Many such large projects in other areas, like	Estamos de acuerdo con el comentario. La Junta de Planificación y la AAA tienen mayor inherencia sobre este asunto que el DRNA. No obstante, se tomará en consideración y se incorporará como elemento al momento de evaluar proyectos de desarrollo turístico en la costa.

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the Virgin Islands, are required to install and maintain their own desalinization water supply systems. Stresses on existing or planned water supply tend to fall in the winter (January through April) tourism season, coinciding with the strong dry season. To conserve aquatic habitats and meet the primary goal of providing water for the resident population, large tourism projects might be required to provide their own alternative water sources. As discussed in the water plan meetings, water loss in the distribution systems is unacceptably high. Additionally, it is not clear if all these perceived losses are real (whether production is over-estimated) or where or how they occur. We concur that detailed studies of various community types are needed to determine where and how water losses are occurring, but it is also necessary to verify the real production levels. Protocols for maintenance of water supply systems should include required metering at the water plant, and guidelines for maintenance and repair (stock parts to be maintained, pump capacities to be maintained, etc.). Many of the water systems are developed by Municipal Governments using Federal funds (Farmers Home Administration, Block Grants, etc.) Stricter guidelines and specifications may be needed to ensure that both water supply and sewer systems utilize designs and equipment that AAA is capable of maintaining and stocking.	Estamos de acuerdo con este comentario. En los Capítulos 7 y 8 se discute este asunto y se desarrolla una tarea para atender el mismo. La AAA institucionalizó el Programa de Agua No Contabilizada con el propósito de atender las pérdidas en el sistema de distribución a través de estudios pilotos dirigidos a identificar cuánta agua se pierde, cuál es la causa de las pérdidas y determinar que medidas hay que tomar para reducirlas. El Programa también tiene un componente para mejorar la toma de datos, la medición de la producción, entrega y de la extracción de agua.
Section 7.2.4 discusses the maintenance of minimum environmental flows. We previously discussed this issue at some length. We are pleased to see that the focus is the maintenance of the aquatic environment, and look forward to further discussions and a workshop to be conducted this year regarding minimum flow issues. As mentioned in the body of this letter, simple water supply systems with one intake may impact the aquatic environment, but potentially have less impact on the overall stream hydrograph as water supply systems with inter-connected or multiple intakes. The maintenance of reasonable flow variation should also be a goal.	Se agradece la información, se revisa el texto y se ajusta a la información provista.

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Section 7.2.5 briefly discusses protection of river channels and banks. Major existing perturbations include extraction of materials within the active river channel and channel "cleaning" for flood control purposes. The latter is responsible for major perturbation of miles of river on a periodic basis. It temporarily changes the configuration of the channel, removes protective vegetation on the river banks to allow machinery access, deposits additional material on these banks (reducing connection with the floodplain and increasing energy and erosion in the river channel), and ultimately results in increased downstream sedimentation that affects the rivers and coastal environments. Protocols should be developed for the need for and location of flood control work that would focus the need on protecting important public works such as bridges and roads while reducing the overall impacts to the river system. The stated objectives of classifying the river reaches and conducting workshops on natural river management would help address these impacts.	Se agradece la información, se revisa el texto y se desarrolló tarea en el capítulo 8 sobre este asunto.
Section 7.3 discusses various aspects of land use and management. Among the issues discussed is the protection of native species (7.3.4), particularly river fish and shrimps. The major public policy measures discussed here are to conduct studies of the native aquatic species, and identify risks to these species. We concur that developing data bases and information on these species is important. The current fishing law with respect to research on the river fauna requires information from the prospective researcher that may not be available (i.e. what species are to be studied, how many collected, exactly where they will be collected, life-cycle information, etc.), and may actually be the object of the study. There is also no current funding established to encourage such research. We recommend that permitting requirements for river fauna studies be reviewed to facilitate, rather than discourage, research, and that there be consideration for providing some funding for research under the Water	Se toma nota de esta situación y se informa a la unidad pertinente del DRNA sobre este asunto.

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Plan.	
Chapter 8 is a collection of project proposals for the Water Plan. The proposed projects address one or more of the objectives in Chapter 7. The project descriptions should include a brief analysis of which goals and objectives would be served by the particular project. There are also specific projects discussed in Chapter 7 (such as the repairs to the Guajataca canal system) that might be more appropriately placed in Chapter 8 with the slate of projects. There should be some mechanism to incorporate additional projects (that may prove to be more critical) into the plan as the need for them becomes apparent. **Appendices:** Including the information developed for the Water Atlas database in the written version of the Water Plan may not be suitable since the database will require frequent updates, the basic island-wide maps developed for the Water Atlas should be included with the dates at the time these were made. Internet links should be provided to allow access to the water database.	Se revisó el capítulo 8 y se modificó completo. Esta nueva versión cumple con las sugerencias aquí presentadas. Se agradece el comentario, la tarea desarrollada en el capítulo 8 atiende este asunto.
Appendix A: The table shows USGS stations used to determine safe yields with analysis of the area they cover and annual precipitation. The data was then used to generate a single regression which was apparently used island wide to estimate safe yields (Q99 low flows) at existing intake sites. We understood that part of the detailed analysis was to determine regional curves to provide more accurate estimates for various intake sites around the island.	Se agradece la información y se revisó el informe.
Appendix B: The purpose of this appendix is not clear as it consists solely of a map of the Aguadilla Region indicating that all of the municipalities have deficiencies in water supply. We recommend that this figure be eliminated or incorporated into the body of	Se eliminó este apéndice.

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the plan under that region, if the figure is necessary.	
Appendix H: This appendix consists of maps intended to show potable water treatment plants, supply lines, etc. by region. Many of the maps appear to be incomplete or inaccurate. The map key indicates red lines for raw water supply lines, however, these are rarely shown and inaccurate in some cases where shown (see Aguadilla, raw water line to the Culebrinas River). The Metro supply system does not indicate the water supply transmission from the Superaqueduct system. It might be more useful to simplify these maps, and to include water amounts transferred between regions to better understand available supply to a region.	Se acepta recomendación.
We have some questions on the information shown in the Fajardo map regarding the Espíritu Santo/El Yunque water supply, the Mameyes River water supply, and the Fajardo River water supply. The Fajardo map shows the El Yunque plant with a production of 20 mgd. While this plant was constructed for this capacity, the intakes that supply this plant (Río Grande and Río Espíritu Santo) frequently do not provide this amount of water. As a result, the Río Espíritu Santo frequently provides no downstream flow over this dam. When the dam is dry, upstream migration of shrimps and gobies is interrupted. The excessive extraction of water at this site also affects the quality of the estuary which extends up to the dam. The Fajardo map indicates that the Mameyes River treatment plant would be eliminated. It is clarified in the regional discussions (Section 5) that the intake would not be eliminated, but the water would be diverted to the Yunque filtration plant. The maps should clarify that the water would be transferred to another filtration plant, and that the extraction would continue. The new Fajardo dam was intended to replace an upstream extraction site. It is unclear if the 5 mgd upstream extraction shown on the map is the new intake to service the new reservoir, or the original intake which is supposed to be eliminated (and the dam	Los datos provienen de la AAA, se hace el arreglo con respecto a la ilustración de la extracción en el Río Mameyes.

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removed) once the Fajardo reservoir is operational. In order to evaluate potential impacts, the extraction sites may have to be mapped separately from the filtration plants.	
The Humacao map indicates that the Río Blanco plant currently produces 5 mgd. Our understanding was that the existing plant was already upgraded and has been regularly processing up to 12 mgd when adequate water is available.	Se ajusta a la información provista por la AAA.
The Lajas Valley potable water supply system map infers that the upgrade from 1.5 to 6.6 mgd for Yauco would come from the Río Duey. The upgrade for this system would come predominantly from the Lajas Valley irrigation system through a diversion from the tunnel between Luchetti and Loco Lakes.	Se agradece el comentario y el texto se ajusta al mismo.