**A R T I C L E**

# AQUATIC HABITAT CLASSIFICATIONS: IMPLICATIONS FOR OTTER CONSERVATION

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**ABSTRACT:** Understanding the full range of aquatic habitats used by otters can influence how conservation protections are implemented. The distributional ranges of some species are restricted to geographic regions contained within defined political boundaries (e.g., states, provinces, nations) or management units (e.g., river basins, watersheds, conservation reserves), which can facilitate how conservation strategies are applied. For species distributed more widely, the conservation challenges become more complex. Additional factors, such as a species' population status, extent and enforcement of legal protections, and local environmental threats also influence how conservation strategies should be and can be implemented effectively. Several aquatic habitat classification systems, including Ramsar, were examined and matched to known species requirements to illustrate the importance of merging and communicating conservation concerns for otter species with other water-based protections that either carry greater legal standing or have greater visibility.

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## INTRODUCTION

Otters, as flagship species in aquatic habitats (Cianfrani et al., 2011, Stevens et al., 2011), are essential members of faunal communities in wetland, riverine, riparian, estuarine, and marine ecosystems. Similarly, they gain prominence in conservation discussions as top-level carnivores, ecotourism attractions, and for some, spiritual inspirations. Ecologically, the niche of each species of otter defines which aquatic habitats are used to meet foraging, reproduction, and spatial requirements. The distributional ranges of some species are restricted to geographic regions contained within defined political boundaries (e.g., states, provinces, nations) or management units (e.g., river basins, watersheds, conservation reserves), which can facilitate how conservation strategies are applied. For species distributed more widely, the

conservation challenges become more complex. Additional factors, such as a species' population status, extent and enforcement of legal protections, and local environmental threats, also influence how conservation strategies should be and can be implemented effectively. Here, we focus on how classifying the aquatic habitats used by individual otter species can be an important conservation tool. Linking the conservation of aquatic habitats to water-based policies, laws, regulations, and management strategies can gain protections for threatened fauna and flora not feasible from conservation actions alone. The first step in making these linkages is to use widely available habitat classifications systems.

Habitat protection is one of many conservation goals needed to insure otter populations remain viable worldwide. Only one otter species, the North American River Otter (*Lontra canadensis*) is considered to be of *Least Concern* with regard to species status, with the other 12 of 13 otter species worldwide listed as *Vulnerable* (2 species), *Near Threatened* (5 species), or *Endangered* (5 species) (Table 1). Thus, protecting existing otter habitats and restoring degraded habitats is of critical importance for the conservation of otter populations worldwide.

**Table 1.** Common name, scientific name, and conservation status of all otter species worldwide (Duplaix and Savage 2018).

| Common Name | Scientific Name | Species Status |
|---|---|---|
| African Clawless Otter | *Aonyx capensis* | Near threatened |
| Asian Short-Clawed Otter | *Aonyx cinereus* | Vulnerable |
| Congo Clawless Otter | *Aonyx congicus* | Near threatened |
| Eurasian Otter | *Lutra lutra* | Near threatened |
| Giant Otter | *Pteronaura brasiliensis* | Endangered |
| Hairy-Nosed Otter | *Lutra sumatrana* | Endangered |
| Marine Otter | *Lontra felina* | Endangered |
| Neotropical Otter | *Lontra longicaudis* | Near threatened |
| North American Otter | *Lontra canadensis* | Least concern |
| Sea Otter | *Enhydra lutris* | Endangered |
| Smooth-Coated Otter | *Lutrogale perspicillata* | Vulnerable |
| Southern River Otter | *Lontra provocax* | Endangered |
| Spotted-Necked Otter | *Lutra macullicolis* | Near threatened |

Given the dire conservation status of nearly all otter species, and the critical importance of protecting aquatic habitats for their sustained viability, the objectives of this paper were:

1 – To provide a pathway for standardizing classification of aquatic habitats used by otters worldwide by recommending a consistent and widely-used classification system, Ramsar (2013).

2 – To describe essential aquatic habitats for each otter species based on the best available literature, and crosswalk those types to existing classification systems. (A crosswalk between two or more systems matches terms with similar meaning so translations can be made between those systems, as in translating words between languages (see Brooks et al., 2011b for a habitat example).

3 – To show how otter conservation strategies can be enhanced by linking standardized habitat classification to existing protection and management approaches for wetlands, rivers, and other waters, including treaties, laws, regulations, land and water reserves, water quantity and quality management, voluntary actions, and education.

The recently released Global Otter Conservation Strategy (Duplaix and Savage, 2018) listed multiple habitat-related goals for protecting otters (Table 2).

**Table 2.** Habitat-related goals for otter conservation (Goal numerals from Duplaix and Savage 2018).

| |
|---|
| 1.5 Review international and national policies, protection legislation and regulations specific to wetlands and other otter habitat, including habitat structure, invasive species, pollution, overfishing and any other factor relevant to habitat quality for otters, in all range states; review compliance with legislation and regulation; and make appropriate revisions. |
| 1.5.1 Assist in drafting and promoting the adoption of new or modified legislation for range states that do not provide adequate legal protection for otter habitats. |
| 1.5.2 Assist in enhancing existing otter habitat protection legislation with text that is stronger, more specific, and/or more comprehensive in terms of otter habitat protection, as needed, including ensuring adequate penalties. |
| 2.4 Conserve and enhance critical otter habitats, by preventing the degradation of those habitats still suitable for otters and, for those currently unsuitable, achieve their regeneration by changing conditions of bankside and channel substrate and vegetation; restore appropriate hydrodynamics; reduce pollution, problematic invasive species and inappropriate debris; construct over- or underpasses where road mortality is a threat; and other locally appropriate actions. |
| 2.4.1 Promote region-specific, concerted efforts by the wide range of interest groups that share the common goal of conserving and improving rivers, other wetlands and coastal areas threatened by pollution, overfishing, hydrodynamic change, invasive species, climate change and/or any other relevant factor. |
| 2.4.2 Enhance national wetland protected area networks, consistent with the Aichi Biodiversity Targets. |
| 4.7 Clarify the habitat-use (including for widespread species, the geographical patterns) and other natural history aspects of the lesser-known otter species, prioritizing those aspects with the highest potential to inform the design and implementation of effective conservation. |
| 4.7.1 Particularly in regions where the waterscape changes dramatically between wet and dry season, understand seasonal patterns of otter movements to reduce the risk of locality-based otter conservation programs failing through the selection of insufficiently large and/or connected areas. |

## ESSENTIAL AQUATIC HABITATS FOR OTTERS

To link aquatic habitat classification to otter conservation goals we took the following steps. First, we reviewed the overall habitat goals listed in the Global Otter Conservation Strategy (Duplaix and Savage, 2018). Our primary source of habitat requirements for individual otter species also was gleaned from this "Strategy" report. This recent report was compiled from multiple sources of information, but foremost it contains the best available data and opinions proferred by designated experts and co-authors of the chapters for each otter species. Next, we extracted specific habitat requirements for each otter species from the "Strategy" report and associated literature.

After considering several widely used aquatic classification systems, we chose the Ramsar wetlands/waters classification as a base system and linked Ramsar terminology to other classifications of wetlands and waters as a first step toward developing a standardized, hierarchical system of classifying waters.

The utility of linking globally important wetlands and waters from the list of Ramsar sites accepted under the international Ramsar Treaty with otter habitat conservation was explored by Brooks et al. (2011a). Geographic locations of Ramsar recognized sites were placed within known distribution range maps for each otter species. Since completion of that work, geographic distribution maps have been refined with the inclusion of recent studies, increasing the likelihood that key habitats for otters will be identified, and hence, protected.

## STANDARDIZED CLASSIFICATION OF OTTER HABITATS

### Ramsar Classification and Criteria

With the OSG'S habitat-oriented goals in mind, we determined that using the existing, internationally-accepted, Ramsar classification would be an important tool (Table 3). An existing Memorandum of Cooperation (MOC) between the International Union for the Conservation of Nature and Natural Resources (IUCN, parent organization for the Otter Specialist Group, OSG) and the Ramsar Convention that was signed in 2003, promotes cooperation and collaboration between these two groups, which is especially valuable for otter conservation.

There are provisions in the Ramsar listing process for wetlands and waterbodies that pertain directly to biodiversity concerns. For a site to qualify as a Wetland of International Importance, *only one of nine criteria needs to be met* (http://www.ramsar.org). Most criteria address the importance of a given wetland to a region (e.g., large area, flood storage, unique habitats, regional resource, education). If a particular wetland supports populations of otter prey or habitats of wetland-dependent biota (e.g., waterbirds, fish, otters), then these protections also may benefit otters.

Criteria of particular relevance to otters are these three related to vulnerable species and communities, including habitats (numbers match the Ramsar list of nine criteria):

- Criterion 2: A wetland should be considered internationally important if it *supports vulnerable, endangered, or critically endangered species or threatened ecological communities*.
- Criterion 3: A wetland should be considered internationally important if it *supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region*.
- Criterion 4: A wetland should be considered internationally important if it supports plant and/or *animal species at a critical stage in their life cycles, or provides refuge during adverse conditions*.

Any vulnerable wetland-dependent species can meet a criterion needed to submit an important wetland for listing under the Ramsar Convention, but otters in particular as flagship or umbrella species can provide a focus for protecting entire aquatic communities.

Classification of aquatic habitats under the Ramsar Treaty has evolved since its origins in 1971. The classes currently used in this system cover most of the recognized aquatic habitats throughout the world, except for large expanses of sea ice and ice caps, and deep oceans. The close association between IUCN and Ramsar has led to widespread adoption of these aquatic types by conservation organizations, as well as researchers of otter species. The 31 Ramsar classes are listed in Table 3 as they appear in documents of the Ramsar Convention.

### Aquatic Habitat Classification for Otters.

We assembled habitat descriptions provided in Duplaix and Savage (2018) by species. Next, we organized those descriptive terms into an initial hierarchy of habitats using terminology and definitions from recognized wetlands/waters classification systems (Table 4). We focused on the major habitats selected by the authors of individual species profiles, but other types may serve as habitat for otters in some capacity.

**Table 3.** Marine/coastal and inland wetland/water habitats classified by the Ramsar Convention Secretariat (6th edition, 2013; letters and numerals used in coding Ramsar types, https://www.ramsar.org), with those reported as relevant to otters designated with an asterisk (*).

| |
|---|
| **Ramsar: Marine/Coastal Wetlands** **7 of 11 Ramsar marine/coastal wetlands types relevant to otters* |
| A -- **Permanent shallow marine waters** in most cases less than 6 m deep at low tide; includes sea bays and straits |
| *B -- **Marine subtidal aquatic beds**; includes kelp beds, sea-grass beds, tropical marine meadows |
| C -- **Coral reefs** |
| *D -- **Rocky marine shores**; includes rocky offshore islands, sea cliffs |
| *E -- **Sand, shingle or pebble shores**; includes sand bars, spits and sandy islets; includes dune systems and humid dune slacks |
| *F -- **Estuarine waters**; permanent water of estuaries and estuarine systems of deltas |
| G -- **Intertidal mud, sand or salt flats** |
| *H -- **Intertidal marshes**; includes salt marshes, salt meadows, saltings, raised salt marshes; includes tidal brackish and freshwater marshes |
| *I -- **Intertidal forested wetlands**; includes mangrove swamps, nipah swamps and tidal freshwater swamp forests |
| *J -- **Coastal brackish/saline lagoons**; brackish to saline lagoons with at least one relatively narrow connection to the sea |
| K -- **Coastal freshwater lagoons**; includes freshwater delta lagoons |
| Zk(a) – **Karst and other subterranean hydrological systems**; marine/coastal |
| **Ramsar: Inland Wetlands** **10 of 20 inland Ramsar wetlands types relevant to otters* |
| *L -- **Permanent inland deltas** |
| *M -- **Permanent rivers/streams/creeks**; includes waterfalls |
| *N -- **Seasonal/intermittent/irregular rivers/streams/creeks** |
| *O -- **Permanent freshwater lakes** (over 8 ha); includes large oxbow lakes |
| *P -- **Seasonal/intermittent freshwater lakes** (over 8 ha); includes floodplain lakes |
| Q -- **Permanent saline/brackish/alkaline lakes** |
| R -- **Seasonal/intermittent saline/brackish/alkaline lakes and flats** |
| Sp -- **Permanent saline/brackish/alkaline marshes/pools** |
| Ss -- **Seasonal/intermittent saline/brackish/alkaline marshes/pools** |
| *Tp -- **Permanent freshwater marshes/pools**; ponds (below 8 ha), marshes and swamps on inorganic soils; with emergent vegetation water-logged for at least most of the growing season. |
| *Ts -- **Seasonal/intermittent freshwater marshes/pools on inorganic soils**; includes sloughs, potholes, seasonally flooded meadows, sedge marshes. |
| U -- **Non-forested peatlands**; includes shrub or open bogs, swamps, fens |
| Va -- **Alpine wetlands**; includes alpine meadows, temporary waters from snowmelt |
| Vt -- **Tundra wetlands**; includes tundra pools, temporary waters from snowmelt |
| *W -- **Shrub-dominated wetlands**; shrub swamps, shrub-dominated freshwater marshes, shrub carr, alder thicket on inorganic soils |
| *Xf -- **Freshwater, tree-dominated wetlands**; includes freshwater swamp forests, seasonally flooded forests, wooded swamps on inorganic soils |
| *Xp -- **Forested peatlands**; peatswamp forests |
| Y -- **Freshwater springs; oases** |
| Zg -- **Geothermal wetlands** |
| Zk(b) – **Karst and other subterranean hydrological systems**, inland |
| **Ramsar: Human-made wetlands** **5 of 10 human-made Ramsar wetlands types relevant to otters* |
| *1 -- **Aquaculture** (e.g., fish/shrimp) **ponds** |
| *2 -- **Ponds**; includes farm ponds, stock ponds, small tanks; (generally below 8 ha) |
| *3 -- **Irrigated land**; includes irrigation channels and rice fields |
| 4 -- **Seasonally flooded agricultural land** (including intensively managed or grazed wet meadow or pasture). |
| 5 -- **Salt exploitation sites**; salt pans, salines, etc. |
| *6 -- **Water storage areas**; reservoirs/barrages/dams/impoundments (generally over 8 ha) |
| *7 -- **Excavations**; gravel/brick/clay pits; borrow pits, mining pools |
| 8 -- **Wastewater treatment areas**; sewage farms, settling ponds, oxidation basins, etc. |
| 9 -- **Canals and drainage channels, ditches** |
| Zk(c) – **Karst and other subterranean hydrological systems**, human-made |

We converted the descriptive narratives from the "Strategy" report into the Ramsar wetland/water classes listed in Table 3. As a first step toward organizing the 31 Ramsar classes into a hierarchical classification system, we used terms from the U.S. National Wetlands Inventory (derived from Cowardin et al., 1979), U.S. Hydrogeomorphic Classification System (Brinson, 1993), and U.S. Mid-Atlantic Regional Classification System (Brooks et al., 2011b, 2013) as high-level organizers (e.g., riverine, lacustrine, palustrine). The purpose of providing common terms for wetland habitats is to make this approach accessible to a wide range of practitioners. Descriptive terminology, however, is often subject to regional geographic interpretations, so it is important to offer a standardized set of recognized terms to define aquatic habitat types to avoid misinterpretation.

Regardless of the classification system used, the context of habitat classification for wetlands and waters must be given appropriate consideration. Different wetland types (and other aquatic types) exist, and vary structurally, functionally, and in response to stressors. It is important to classify types correctly and consistently, but perfection is neither possible nor necessary because nature resists compartmentalization. Although mixed types of wetlands may be common in many areas, classification should focus on identifying the dominant type. Consider these important questions when classifying wetlands. Why is the wetland or river of interest where it is, and why is it there? Is the dominant water source precipitation, surface flow, or groundwater flow? Is the habitat dominated by inland, coastal, or a mix of types? Following water flows will lead you to think about the upslope source and the downslope receiving waterbody, thereby helping to choose the appropriate classes (see Brooks et al., 2013).

We are in the process of developing a hierarchical key using these terms, with the intent of moving the conservation community toward the use of a single system of aquatic habitat classification, not only for otters, but other aquatic and semi-aquatic species. This system, initially focused on otters, would be built around the widely-used Ramsar system, with some minor modifications. Other studies have developed crosswalks between regional geographic classifications of aquatic habitats and the Ramsar system (e.g., Clausen et al., 2006, Wittmann, 2015), which can serve as initial templates for other geographic regions. A word of caution - as the spatial scale rises to cover wetlands and waters throughout the world, the complexity of deriving a single classification system to satisfy all needs grows substantially.

For those interested in more detail regarding habitat requirements and use by individual otter species, we refer readers to the species chapters in Duplaix and Savage (2018) and the literature citations contained within that report. To further explore the terminology used for standardized wetland and water types, we refer readers to the three cited classifications for aquatic habitats (Cowardin et al., 1979; Brinson, 1993; Brooks et al., 2011b).

## LINKING AQUATIC HABITAT CLASSIFICATIONS FOR OTTERS TO OTHER WATER-BASED PROTECTION ACTIONS

We believe there are significant benefits for conserving otters by linking habitat protection to water-based policies, laws, regulations, and management strategies and programs that often have stronger levels of protection and enforcement than conservation actions alone. Where implementation of regulatory programs is relatively weak, the recognized need to protect otters, fisheries, and other aquatic communities can provide an impetus to seek higher levels of legal protection for coastal and inland waters under threat. The otter's status as a flagship species is clearly valuable in these cases. Here, we describe several broad considerations for

melding biodiversity conservation and water management together, with specific examples.

**Table 4.** Habitats descriptions from individual chapters of Duplaix and Savage (2018) for each otter species, followed by translations of Ramsar Wetland Codes (see Table 3) organized into broad systems for wetlands and waters (modified from Cowardin et al., 1979; Brinson 1993; Brooks et al., 2011b; i.e., Marine, Estuarine, Riverine, Lacustrine, Palustrine).

**African Clawless Otter** (*Aonyx capensis*)
Tropical forests, lowland swamps, impoundments, estuaries (near freshwater), mangroves
Palustrine W,Xf,Xp; Lacustrine O,P,6; Marine/Estuarine F,I,J

**Asian Short-Clawed Otter** (*Aonyx cinereus*)
Meandering rivers, small streams, peat swamps, mangrove forests, tidal pools, rice fields, fish ponds
Riverine M,N; Palustrine W,Xf,Xp; Lacustrine 1,2,3; Marine/Estuarine I,J

**Congo Clawless Otter** (*Aonyx congicus*)
Equatorial rainforests, lowland swamps, coastal freshwater lagoons, mangroves
Riverine L,M,N; Palustrine W,Xf,Xp; Marine/Estuarine J

**Eurasian Otter** (*Lutra lutra*)
Lakes, reservoirs, marshes, swamp forests, coastal areas
Riverine L,M,N; Lacustrine O,P,6; Palustrine Tp,Ts,W,Xf,Xp; Marine/Estuarine D,E,J

**Giant Otter** (*Pteronaura brasiliensis*)
Large rivers, streams, lakes, swamps, seasonally floodplains
Riverine L,M,N; Lacustrine O,P; Palustrine Tp,Ts,W,Xf,Xp

**Hairy-Nosed Otter** (*Lutra sumatrana*)
Peat swamps, mangroves, seasonally flooded forests
Palustrine W,Xf,Xp; Marine/Estuarine I

**Marine Otter** (*Lontra felina*)
Rocky coasts with caves, freshwaters connected to coast; central & so. SA Pacific Coast
Marine/Estuarine D,J

**Neotropical Otter** (*Lontra longicaudis*)
River, streams, lakes, lagoons, estuaries, mangroves, marshes, coastal shorelines, coastal savanna swamps
Riverine L,M,N; Lacustrine O,P, 1,2; Palustrine Tp,Ts,W,Xf; Marine/Estuarine E,F,H,I,J

**North American River Otter** (*Lontra canadensis*)
All freshwater systems, riparian habitats, estuaries, coastal marine
Riverine M,N; Lacustrine O,P, 1,2,3,6,7; Palustrine Tp,Ts,W,Xf,Xp; Marine/Estuarine D,E,H,J

**Sea Otter** (*Enhydra lutris*)
Kelp beds and coastal lagoons NA Pacific Coast
Marine/Estuarine B,D

**Smooth-Coated Otter** (*Lutrogale perspicillata*)
Lowlands, floodplains, large rivers & lakes, peat swamp forests, coastal mangroves, estuaries, rice fields
Riverine M,N; Lacustrine O,P, 1,2,3; Palustrine W,Xf,Xp; Marine/Estuarine E,H,I,J

**Southern River Otter** (*Lontra provocax*)
Rivers, ponds, wetlands, lakes, rocky coastlines (Chile and Argentina)
Riverine M,N; Lacustrine O,P, 1,2; Palustrine Tp,Ts,Xf; Marine/Estuarine D,E

**Spotted-Necked Otter** (*Hydrictis maculicollis*)
Large lakes, large deltas, dense vegetation and rocky shores, fish ponds
Riverine L; Lacustrine O,P, 1,2; Palustrine Tp,Ts,Xf; Marine/Estuarine D,E

## Connectivity

To further link aquatic habitat classification to conservation actions, we considered the importance of emphasizing connectivity among waters (Figure 1). Otters are highly mobile species, and thus, interconnectivity among aquatic habitats is often essential for their survival and proliferation. Although the hydrologic regime of some aquatic systems is relatively stable (some lakes) or at least predictable (most tidal systems), most aquatic habitats have dynamic hydrology that can vary seasonally or across years. For example, riverine floodplain width and depth vary considerably due to precipitation patterns (e.g., wet and dry seasons) or human disturbances (e.g., dam

releases). Perennial versus intermittent flows influence plant and animal communities, which can affect protective cover and prey abundance for otters. Connectivity amongst aquatic habitats should be an essential metric when mapping or designing reserves when otter are a target species.

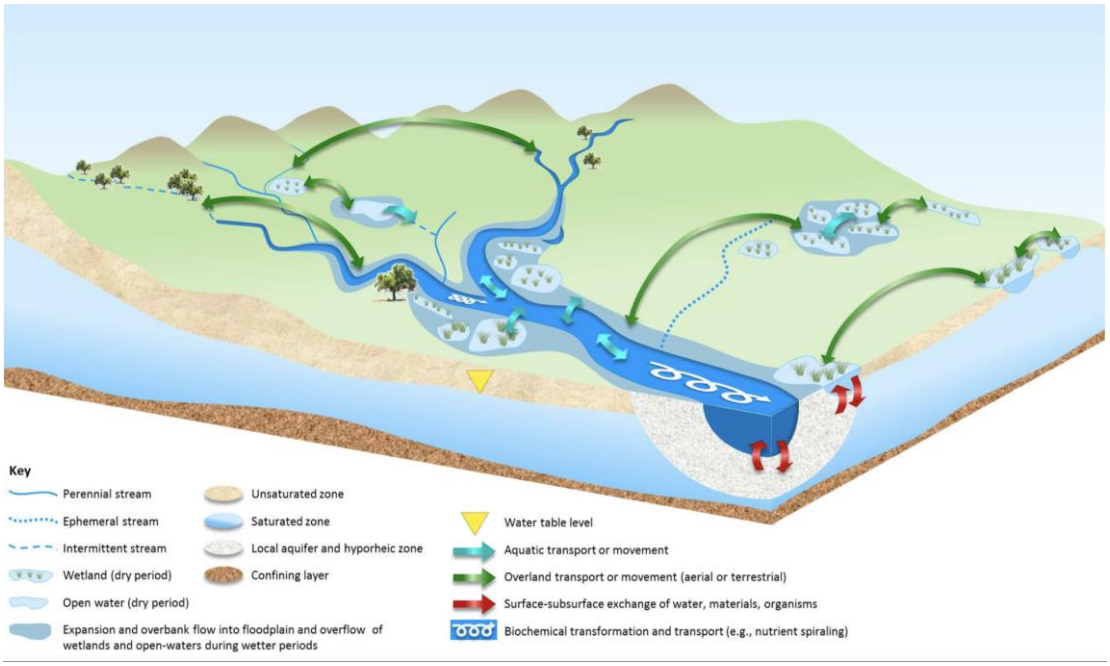


**Figure 1.** Biological pathways within a schematic watershed amongst hydrologic elements creating connectivity of potential importance to otters (USEPA 2015, Fig. 1-1B).

## Threats and Stressors

Likewise, being aware of the threats and stressors that can alter aquatic habitats is important when selecting areas for protection, and choosing sites for restoration. Aquatic ecosystems impacted by chronic stressors are likely to be degraded and will be challenging to restore. Possible threats to consider for both otters and their aquatic habitats are listed below, ordered approximately from local to global scale:

- Water projects - dams, flood control, withdrawals, channelization
- Mining - sedimentation, hydrologic modification, acidification
- Intensive agriculture - sedimentation, eutrophication, fragmentation
- Urban/Industrial development - contaminant/toxicity, thermal alteration
- Illegal trade in wildlife - live specimens, products
- Climate change - temperature increases and seasonal shifts, changing precipitation and weather patterns (see Cianfrani et al. 2018)

Threats operate at different spatial and temporal scales, therefore, conservation solutions must match those scales. In addition, mapping and assessment approaches need to match the geographic extent and seasonality of aquatic habitats being classified and evaluated. Prioritizing the conservation of highly interconnected waters and knowing threats to otter populations will enhance conservation actions.

## Approaches to Habitat Protection

Approaches to protecting aquatic habitats can benefit otters and other biota, as well as non-biological ecosystem services (e.g., carbon storage, floodwater retention, nutrient transformation). They can be physically based, as in defining boundaries of parks, reserves, refuges, buffers, or conservation banks. They can be tied to treaties (e.g., World Heritage, Ramsar, Migratory Birds), policies, and laws. They can be related to

regulations for drinking water standards, wastewater treatment, or management of water flows. They can be linked to decisions about land use planning, sustainable agriculture, watershed management, and broad-based conservation initiatives. If there is a "secret" to including otters and their habitats within these environmental and conservation mechanisms, it is to follow the flows of water and think and act broadly and creatively.

Finally, we would like to call attention to recent work by Cianfrani et al. (2018) and Loy and Cianfrani (2018) who developed a vulnerability index for how climate change affects predicted range change for otters by modeling suitable habitat regions. Their approach assesses otter species exposure and sensitivity to climate change impacts across broad range distributions. The advantages are that one potentially can identify which aquatic ecosystems will be most negatively or positively impacted, and then seek strategies to conserve and restore habitats and their connectivity. Maps for single species, and in multi-species groups are provided in the cited references. Combining these global and continental approaches, tying climate change to local environmental assessments, can lead to specific conservation actions with positive outcomes for otters worldwide.

## SUMMARY

In summary, we matched habitat descriptions for individual otter species to Ramsar wetland/water types, emphasized the importance of connecting aquatic habitats, and recommended alternative ways of protecting and conserving waters. Our intent is to expand on approaches for conserving otter species throughout their respective ranges. Revisiting the habitat themes (#s from Table 2) from the Global Otter Conservation Strategy (Duplaix and Savage, 2018), we recommend the following high priority approaches for otter conservation:

- Conserve and enhance critical aquatic habitats; prevent degradation of suitable habitats; restore degraded habitats – *consider chemical, physical, and biological elements* (2.4)
- Promote region-specific conservation goals within a wide range of stakeholder and interest groups having common goals (2.4.1)
- Include otter conservation actions within existing protected wetland and river networks (2.4.2)
- Clarify habitat use for all species, including those with widespread or narrow niches – *prioritize for conservation, using available strategies and tools* (4.7)
- *Strive for aquatic connectivity,* particularly where wet-dry patterns or human impacts change seasonal flows and uses (4.7.1).

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## RESUME : CLASSIFICATIONS DE L'HABITAT AQUATIQUE: IMPLICATIONS POUR LA CONSERVATION DE LA LOUTRE

La compréhension de l'ensemble des habitats aquatiques utilisés par les loutres peut influencer la mise en œuvre des protections de conservation. Les aires de répartition de certaines espèces sont limitées à des régions géographiques contenues dans des limites politiques définies (par exemple : États, provinces, nations) ou à des unités de gestion (par exemple: bassins hydrographiques, bassins versants, réserves naturelles), ce qui peut faciliter l'application des stratégies de conservation. Pour les espèces réparties plus largement, les défis de conservation deviennent plus complexes. D'autres facteurs, tels que le statut de la population d'une espèce, l'étendue et l'application des protections légales, et les menaces environnementales locales influencent également la manière dont les stratégies de conservation doivent et peuvent être mises en œuvre efficacement. Plusieurs systèmes de classification de l'habitat aquatique, y compris Ramsar, ont été examinés et mis en correspondance afin de connaitre les exigences des espèces pour illustrer l'importance du regroupement et de la communication des préoccupations de conservation pour les espèces de loutres avec d'autres protections basées sur l'eau qui apportent une plus grande valeur juridique ou ont une plus grande visibilité.

## RESUMEN: CLASIFICACIONES DE HÁBITATS ACUÁTICOS: IMPLICANCIAS PARA LA CONSERVACIÓN DE LAS NUTRIAS

Entender todo el espectro de hábitats acuáticos utilizados por las nutrias puede influir en cómo se implementan las medidas de conservación. Las áreas distribucionales de algunas especies están restringidas a regiones geográficas contenidas dentro de límites políticos definidos (p.ej. estados, provincias, naciones) ó unidades de manejo (p.ej. sistemas de ríos, cuencas, reservas de conservación), que pueden facilitar la aplicación de estrrategias de conservación. Para especies distribuidas en forma más amplia, los desafíos de conservación se hacen más complejos. Factores adicionales, tales como el status poblacional de una especie, el grado y control de protecciones legales, y las amenazas ambientales locales también influyen en cómo deberían y cómo se pueden implementar efectivamente las estrategias de conservación. examinamos varios sistemas de clasificación de hábitats acuáticos, incluyendo el de Ramsar, y los comparamos con los requerimientos conocidos de las especies, para ilustrar la importancia de integrar y comunicar las preocupaciones de conservación de las especies de nutria con otras protecciones ligadas al agua, que tienen más fuerza legal ó mayor visibilidad.