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Updating the Register of International River Basins of the world

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ABSTRACT

The delineation of the world's international river basins has not been undertaken by any formal body since 1978. Researchers with the Transboundary Freshwater Dispute Database have attempted to fill this void through the 1999 Register, with online updates and currently with the present study. This current register delineates 310 international river basins, reflecting changes in political boundaries and increased data quality. These basins are shared by 150 countries and disputed areas, cover 47.1% of the Earth's land surface and include 52% of the world's population. This paper lists all international river systems, their basin areas, their riparian states and their respective territorial percentages.

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Introduction: past updates to the Register of International River Basins

The last assessment of international waters done by any formal agency was the Register of International Rivers, compiled by the now-defunct United Nations (UN) Department of Economic and Social Affairs in 1978 (United Nations Centre for Natural Resources, Energy and Transport of the Department of Economic and Social Affairs, 1978). That register was an update of a 1970 edition to the 1958 UN panel report Integrated River Basin Development, which included a map illustrating 166 international river basins (United Nations, 1970). The 1978 Register did not define an international river basin directly; however, it identified a 'river basin' as 'the area within which waters of natural origin (rain, groundwater flow, melting or snow and ice) feed a given river' and narrows the definition 'continental basins' or those 'communicating directly with the final recipient of the water (oceans, closed inland seas or lakes)'. The register identified these 'continental' river basins as international if a national boundary divides the drainage basin. This register listed 214 basins shared by two or more countries separated by continent and the countries that share each basin. It also included a listing of rivers and lakes that serve as international borders and a listing of treaties on international water bodies (United Nations Centre for Natural Resources, Energy and Transport of the Department of Economic and Social Affairs, 1978).

The listing of international river basins was not updated again until Wolf, Natharius, Danielson, Ward, and Pender (1999), who used significant technological advancements in mapping and digital elevation models to create a new register, including spatial delineations

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of 261 international rivers basins. (The Oregon State University's Transboundary Freshwater Dispute Database (TFDD) separately updates its collection of treaties and river basin organizations, including coded assessments and PDF copies of most documents, available at www. transboundarywaters.science.oregonstate.edu). The 1999 paper identified basin areas and nations sharing each watershed, including their contributed land areas.[1] Shortly after that paper's publication, an online update was released delineating 263 international basins, as two basins were identified after publication (Wolf, Yoffe, & Giordano, 2003).

In the intervening years, the TFDD Register of International River Basins has been updated more frequently. In 2010, as part of a World Bank study on institutional capacity of basins to adapt to climate change, the register was updated to 276 international basins (De Stefano et al., 2010). The spatial focal point for that research was the basin country unit (BCU), which is the area of a basin within the boundaries of one of the riparian countries (De Stefano et al., 2010). For example, BCU code CLMB_USA refers to that part of the Columbia Basin that lies within the United States, as shown in Figure 1.

Before this current paper,[2] the most recent update to the Register of International River Basins was completed by TFDD researchers in 2016, in support of the Transboundary Waters Assessment Programme's Transboundary River Basin (TWAP-RB) Report (UNEP-DHI, 2016). That report updated the listing to 286 international basins, adding 10 basins to the previous update completed by the TFDD. The spatial delineations in the TWAP-RB report are the basis for the update discussed in this paper, which now includes 310 international river basins (see Table 1, which summarizes these updates to the register; and Figure 2, a current map of the world's 310 international river basins).

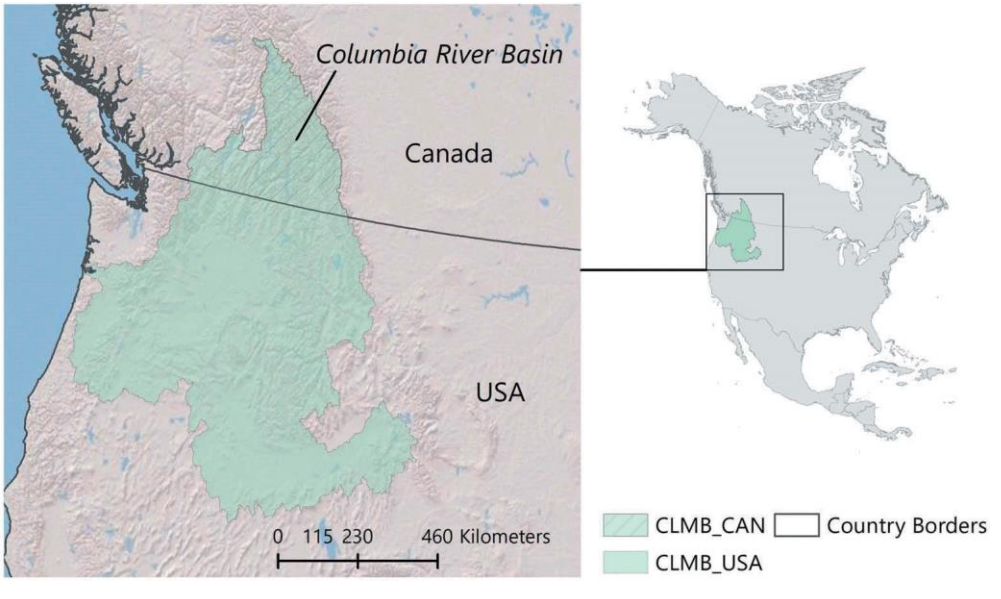

Figure 1. Columbia river basin country units (BCUs). International river basins are divided into BCUs, such as shown here. A BCU is the area of a basin within a particular country. An international river basin must have at least two BCUs. © Transboundary Freshwater Dispute Database, Oregon State University, Cartographer Melissa McCracken, North America Albers Equal Area Projection, Source: Data from ESRI (2018); TFDD (2018); FAO GAUL (2014).

Table 1. Comparison and evolution of the Register of International River Basins.

River basin study	Number of basins	Percentage of the world's land surface[a]
1978 Register (UNCNRET of the Department of Economic and Social Affairs, 1978)[b]	214	47.0%
1999 Update (Wolf et al., 1999)	261	45.3%
2010 Update (De Stefano et al., 2010)	276	46.1%
2014 Hydro-Political Dependency Study (Beck, Bernauer, Siegfried, & Böhmelt, 2014)	456	47.7%
2016 TWAP (UNEP-DHI, 2016)	286	46.2%
2018 Update (present paper)	310	47.1%

Notes: Listed is the evolution of the register and other studies that have delineated international river basin boundaries. Included here is the number of international river basins identified and the global percentage area coverage.

[a] Numbers for 1978 and 1999 are from Wolf et al. (1999). The other percentages were calculated in world cylindrical equal area projection. [b] The register lists 215 basins, but Juardo is included in both North and South America. The Juardo was only counted as part of South America (Wolf et al., 1999).

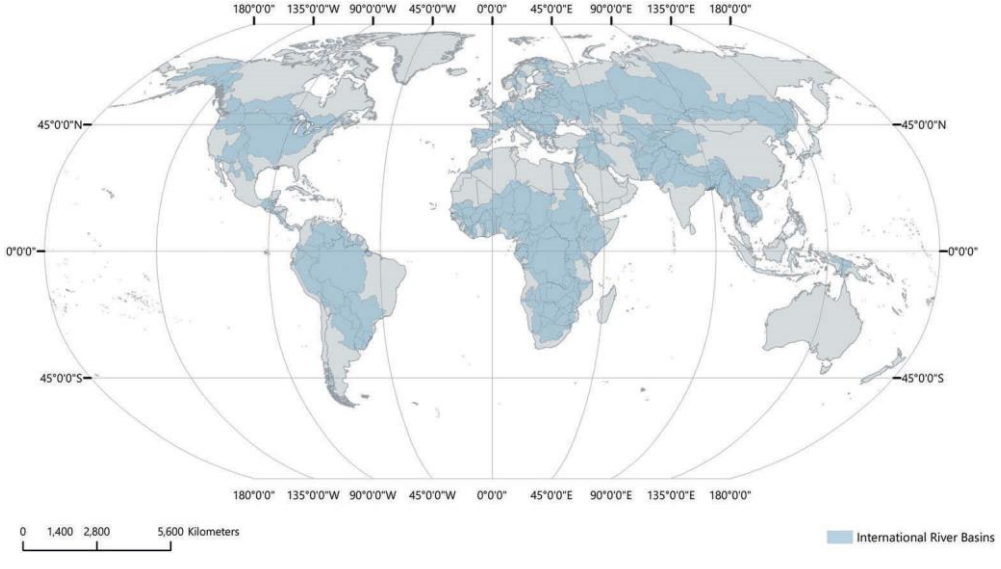

Figure 2. International river basins of the world. There are 310 international river basins, covering 47.1% of the Earth's land surface (without Antarctica). © Transboundary Freshwater Dispute Database, Oregon State University, Cartographer Melissa McCracken, Robinson Projection, Source: Data from TFDD (2018); FAO GAUL (2014).

One might ask, why are so many updates to the Register of International River Basins needed? The straightforward answer is that political borders have changed, and there have been improvements in the resolution of remotely sensed data. These data present snapshots in time of the number of international basins, the countries that are riparian to a basin, and provide a common understanding of the scope and extent of basin boundaries, which can aid states in developing cooperative arrangements and identifying mutual benefits over their shared waters. Furthermore, the data are used in monitoring and assessment of transboundary cooperation between states, by academics and international organizations alike. In order for these applications of the basin delineations to be effective, having a current, representative picture of the political and basin boundaries is ideal, hence the need for regular updates of the Register of International River Basins. This current update does not strictly rely on remotely sensed data but considers the political intentions of border development and the limitations of the remotely sensed data to expand upon a simple update of the list of basins in the register in the hopes of providing a more accurate and applicable Register of International River Basins. The following section describes the methodology undertaken to develop this update.

Methodology

Updating hydrological data

In delineating an international river basin, we follow the general concepts from the 1978 Register that carried over into the 1997 Convention on the Law of Non-Navigational Uses of International Watercourses, which in turn defines these basins as follows (United Nations, 1997):

For the purposes of the present Convention:

(a) 'Watercourse' means a system of surface waters and groundwaters constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus;
(b) 'International watercourse' means a watercourse, parts of which are situated in different States.

We prefer the term 'international river basin' as more intuitive than 'international watercourse', yet we retain the definition of a basin as being defined by its ultimate terminus, whether to an ocean or to an inland sea, and including both surface water and hydrologically connected groundwater. Thus, 'river basin' is synonymous with what is referred to in the United States as a 'watershed' and in the UK as a 'catchment'. As noted in our 1999 Update:

> By defining these basins by their ultimate outlet, we often group systems together that are commonly thought of as separate, even when they are treated as distinct politically. This situation occurs whenever the confluence of even major river systems takes place upstream of the outlet, such as on the Tigris–Euphrates and on the Ganges-Brahmaputra-Meghna systems. The Meuse, commonly treated by Europeans (and by the 1978 Register) as separate and distinct, is hydrologically part of the Rhine system, and is listed as such here. (Wolf et al., 1999, p. 389)

This definition creates two general characteristics, which are used to identify international river basins: (1) water flowing to a common terminus; and (2) perennial (yearround, as opposed to intermittent, which have periods of no flow) flow crossing a border. A river basin can be extrapolated from its terminus to the area of land that drains waters to a common outlet at the ocean or terminal inland water body. The second characteristic identifies a basin as international if a perennial tributary crosses a political boundary between two or more nation-states. For example, if all the tributaries that cross between two or more states are intermittent, then the basin is not considered international; it is a topographic 'basin' rather than one based on hydrology. However, if a perennial tributary crosses a border between two states in a basin, but the third basin state only has intermittent tributaries crossing, the basin is considered to be international, and the third state is included by necessity.[3] The term 'transboundary' is used colloquially to refer to any water that crosses any boundary, including those of states, provinces, and smaller jurisdictions and territories. For our purposes, all international river basins are transboundary, but the converse is not true.

This definition of an international river basin includes area that contributes to a system of connected groundwater and surface water, as much groundwater is hydrologically connected via shallow, unconfined aquifers whose bounds generally follow the bounds of the watershed divides (Eckstein, 2017; Jarvis, 2014; Wolf et al., 1999). The methodology would not, however, consider disconnected groundwater units, particularly deep, confined or fossil aquifers that generally contribute little water to surface flows, and where the recharge zone may be quite distinct from the surface water basin boundaries.[4]

This update of the international river basins is built upon previous work by TFDD researchers and collaborators, as noted above. The base map used as point of departure was created by TFDD researchers in collaboration with the International Union for Conservation of Nature (IUCN) for the Transboundary Water Assessment Programme – River Basins (TWAP-RB) project (Eynard, 2014). This update improves upon the TWAP-RB listing of basins and improves the delineation of the basins. In addition to the TWAP-RB spatial data (identifying 286 basins), we used the HydroBASINS data set – part of the HydroSHEDS database. We are able to maintain consistency between the two data sets, as the TWAP-RB data were developed using a previous version of the TFDD's basins (identifying 276 basins) and the HydroBASINS data set (De Stefano, Edwards, de Silva, & Wolf, 2010; Eynard, 2014).

The 1999 TFDD Register of International River Basins was calculated with the HYDRO1K digital map of rivers, developed by the United States Geographical Survey (USGS) EROS Data Center using the global digital elevation model (DEM) GTOPO30. The HYDRO1K data set provided a base map of 1:1,000,000 for the original list in Wolf et al. (1999). Similarly, for this update, we are using the HydroBASINS data set, which provides global coverage of watershed boundaries with nested sub-basin delineations at scales from tens to millions of square kilometres, with resolution between 15 and 30 arcseconds (Lehner & Grill, 2013). It is derived from HydroSHEDS, which is based on a DEM from the Shuttle Radar Topography Mission (SRTM) at 3 arc-second resolution. The HydroSHEDS data provide comprehensive and consistent data that have been processed and corrected for accurate hydrological conditions (Lehner, 2014).

Using the TWAP-RB as a starting point, we used the HydroBASINS Level 08 data to group sub-basins based on coding for drainage to the same outflow.[5] In addition, HydroBASINS Level 12 data were manually selected and merged with the Level 08 data to include area within the basin that was not included as part of the first step.[6] The HydroBASINS data set is significantly higher in resolution than the original HYDRO1K data set used to create the original listing of international basins in 1999. The spatial data are invaluable as a part of this update; nonetheless, we do not rely solely on electronic data as, in our experience, truthing is required to address areas of low topography, especially deltas, or other issues for which satellite derived data are illsuited. For example, comparison with other sources is required to confirm the basins identified flowed to a common terminus and that tributaries had perennial flow. In general, we found that 25% of the basins required manual editing.[7] We relied heavily on satellite imagery available through Google Earth, the Environmental Systems Research Institute (ESRI) and local sources, as well as digital and hardcopy topographic maps. Furthermore, grey literature such as those available from local, regional or national governments, river basin organizations, or non-governmental organizations (NGOs), provided addition information for truthing.

Updating political boundaries

The UN Food and Agricultural Organisation (FAO) Global Administrative Unit Layers (GAUL) spatial database compiles administrative units of countries globally (FAO, 2014). The GAUL data set is the best available and consistent global scale data set; these vector data were used as the reference for political boundaries in the identification of international basins and used to generate BCUs. Unlike prior TFDD updates to the international river basin spatial data and listing, the GAUL data set includes disputed territories as separate areas. The data set aims to maintain the integrity of all countries involved in the dispute by recognizing their claim to the area (FAO, 2014). The TFDD follows the FAO GAUL naming convention for disputed territories.[8] The addition of disputed territories increases the number of BCUs in a few existing basins. Unlike past updates, very few major changes to international borders have occurred. One of the most notable changes was the formation of South Sudan. Therefore, most of the international basins added as part of this update are not due to the creation of new states.

Updating international river basins

The definition of an international river basin and the two general characteristics used to evaluate basins – common terminus and perennial – pose challenges to the above methodology. Past versions listing international basins and delineating their boundaries have several limitations because of these characteristics. These include correcting river outlets and deltaic areas, with 17% of the 310 basins in need of editing for delta and outlet inconsistencies. We also addressed ‘slivers’ – spatial resolution deviations between political and hydrological boundaries, where background research is necessary to determine the intent of the boundary. As part of this update, we developed further methods to correct

these limitations in order to provide a more complete and accurate listing and spatial delineation based on our definition.

Previous iterations of the delineation of international river basins have been inconsistent with respect to river outlets. Where a river ends has actually been the subject of extensive debate, with estuaries marking the transition zone between river and ocean. The boundary separating river and estuary has been considered to be the upper limit of saltwater intrusion, the tidal limit or the upper extent of marine influence (Potter, Chuwen, Hoeksema, & Elliott, 2010; Pritchard, 1967). These limits for defining the end of a river are dynamic and place specific. With the global scale of this update and limited global data available for these limits, we chose to adhere to our definition of common terminus of streams with the outlet of the river at the coast of the ocean, sea or inland body of water. Therefore, for those basins with an estuary that was previously not included, such the Gambia River (Figure 3), we selected appropriate nested sub-basin (s) from HydroBASINS Level 12 data that could be identified through satellite imagery, topographical maps and grey literature as draining into the estuary and bringing the outlet of the river to the coast. This included considering and identifying the transitions in local naming convention, such as from a river to a bay, when determining the location of the outlet. For visual verification, we identified a substantive, sudden widening of the river channel at the mouth as the transition point from outlet to coastline.

A specific and common case of inconsistency in river outlets was in river basins with deltas. Deltaic areas and distributaries were often not included in previous delineations of river basins – see the example of the Nile River Delta in Figure 4. Since the watershed boundaries were generated based on flow directions calculated from digital elevation models, often only the main channel was selected as part of the basin area.

Distributaries and the surrounding lands that locally drain surface water, particularly in low-lying regions with minimal elevation change, were not included in the delineation. In order to ensure the inclusion of delta regions, we visually compared each basin's outlet with satellite imagery, shaded relief or topographical maps. From this, we used the same methodology as with other river outlet inconsistencies and selected appropriate nested sub-basin(s) from HydroBASINS Level 12 data that coincided with the visually identified distributaries and merged the sub-basin(s) with the larger basin. Using this method, we corrected 53 basins to include deltaic land area and the river

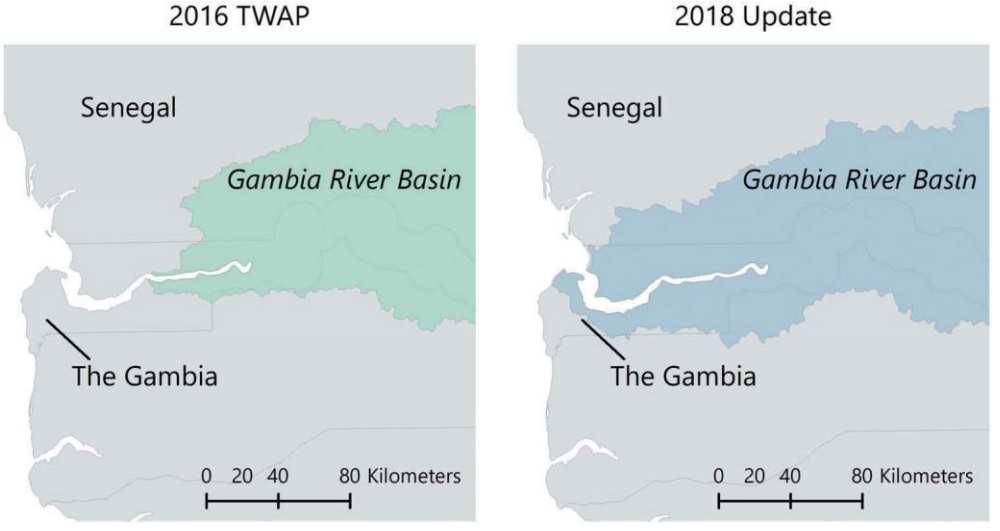

Figure 3. Gambia river basin – outlet comparison. As part of the 2018 update to the river basin delineations, the outlets of the rivers were corrected to be consistent with the definition of a common terminus of streams with the outlet of the river at the coast of the ocean, sea or inland body of water. The Gambia river exemplifies the update to adjust the delineation to common terminus of the river at the coast. © Transboundary Freshwater Dispute Database, Oregon State University, Cartographer Melissa McCracken, Africa Albers Equal Area Projection, Source: Data from TFDD (2018); UNEP-DHI (2016); FAO GAUL (2014).

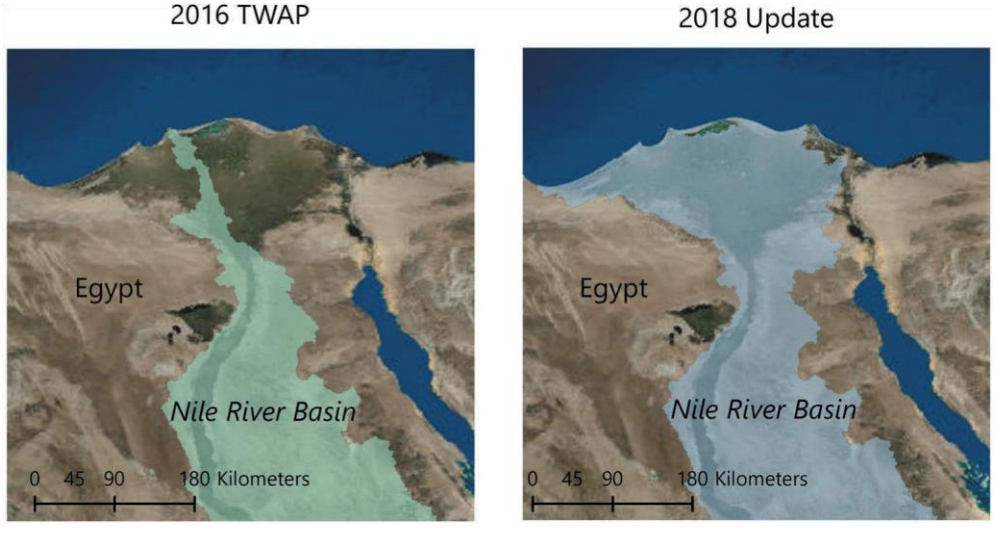

Figure 4. Nile river basin – delta comparison. As part of the 2018 update to the river basin delineations, the deltas of the rivers were corrected to be consistent with the definition of a common terminus of streams with the outlet of the river at the coast of the ocean, sea or inland body of water. The Nile River exemplifies how all distributaries were included in the update to include all common terminuses of the river at the coast. © Transboundary Freshwater Dispute Database, Oregon State University, Cartographer Melissa McCracken, Africa Albers Equal Area Projection, Source: Data from ESRI (2018); TFDD (2018); UNEP-DHI (2016); FAO GAUL (2014).

basins' distributaries. Corrections to river outlets were made by consistently applying the definition of an international river basin, as defined above. Including distributaries and deltaic land area to international river basins ensures the inclusion of the furthest downstream populations and land areas that are impacted by policy and management decisions on international rivers.

Part the value of previous TFDD compilations on international basins has been the identification of BCUs. BCUs are vector polygons that represent the area of a basin that is within a particular country. BCUs for this update were created by intersecting the hydrological data of watershed boundaries and the political data. During this process, artefacts are created due to resolution differences between the two data layers. Small vector polygons are created – termed 'slivers' – along borders between many BCUs (e.g., see Figure 5). There were 86 BCUs that were identified as a sliver or containing a sliver; this required edits to 150 BCUs or 18% to correct the resolution errors. Without correction, these slivers can falsely attribute basin area to states that do not actually contribute water to the river system; in several cases, these can cause the false identification of basins as international. Five basins were removed in this update from previous lists, where one of the two BCUs was a sliver, meaning the basin was not international.

A methodology was developed for identifying and determining the veracity of slivers. Three criteria were used: area, shape index and intersection tolerance test (Duncan & Eynard, 2015). The smaller the area of the vector polygon, the greater likelihood that the sliver is an error. The shape index criterion is calculated by the ratio of perimeter to area. This criterion helps to identify slivers that may have a large area but are very narrow and

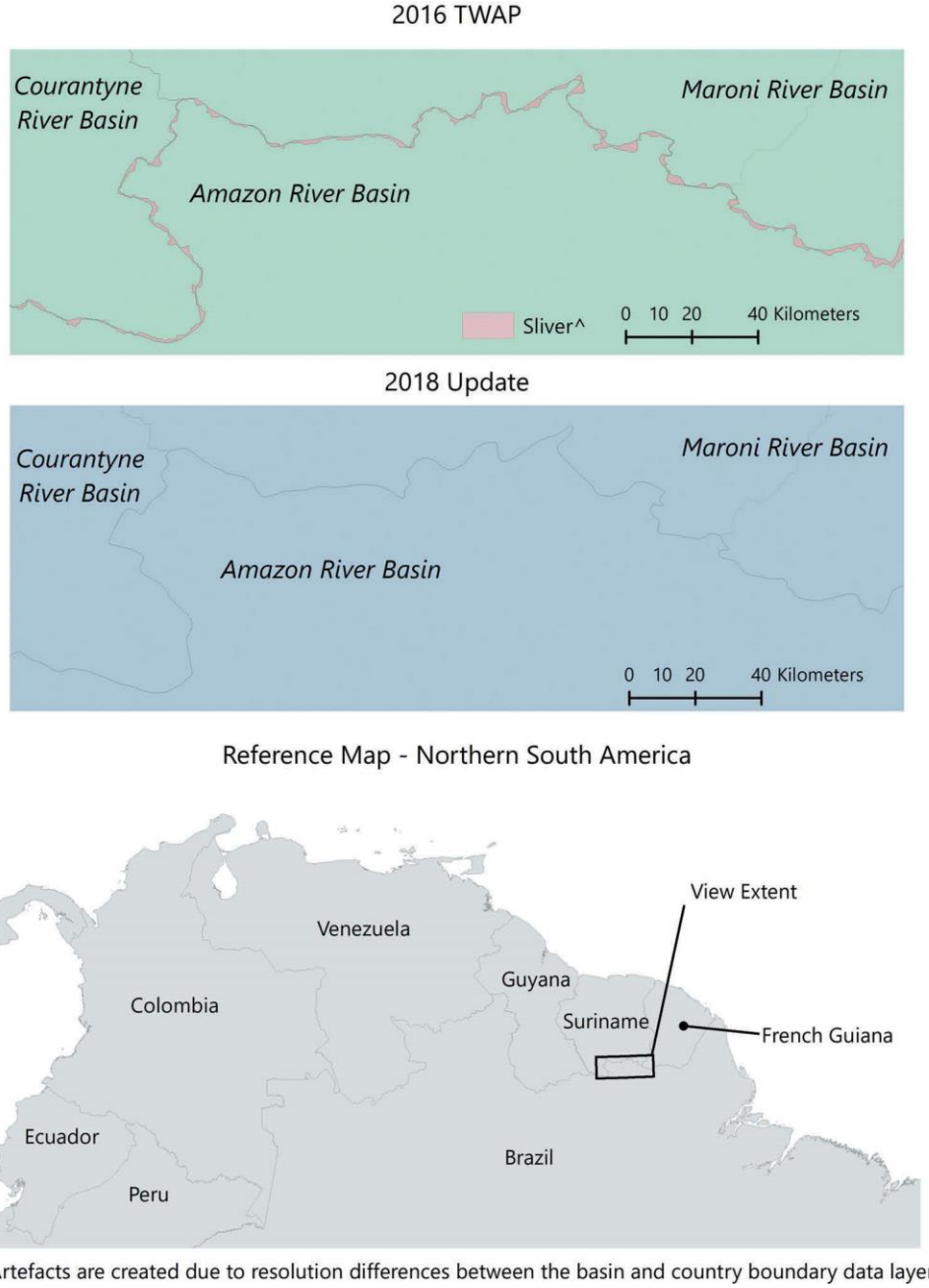

Figure 5. Sliver correction. As part of the 2018 update to the river basin delineations, the artefacts created during the basin country unit (BCU) development because of resolution differences between the underlying data sets were removed. The Amazon and neighbouring basins had significant slivers between the various BCUs, which were corrected in the update. © Transboundary Freshwater Dispute Database, Oregon State University, Cartographer Melissa McCracken, South America Albers Equal Area Projection, Source: Data from TFDD (2018); UNEP-DHI (2016); FAO GAUL (2014).

elongated in shape. This could occur when a political border appears to crisscross a watershed boundary, such as along a ridgeline. The last criterion is the intersect tolerance; if the vertices of the two data sets are within a 1 km threshold distance of one another, then the polygon created when the data sets are intersected are likely slivers (Duncan & Eynard, 2015). Once the slivers had been identified via this methodology, a visual analysis was completed to verify the results of the identification. In addition, qualitative research was conducted on the political border along which each sliver was identified. Anderson's (2003) Atlas of International Boundary Descriptions, published articles and available boundary treaties were consulted in order to determine if the political boundary was purposefully designated as a basin divide. If so, such as a political border following a mountain ridgeline, the sliver was determined to be an error of the intersection process and merged with the appropriate BCU so that the basin boundary follows the political boundary between the nations, thereby attributing the sliver area to the correct BCU.

This process identified a unique basin that highlights the value of qualitative and political research into the defining of political boundaries when delineating international river basins. The Laguna Colorada basin is a small endoreic basin predominantly in Bolivia on the border with Chile (Figure 6). There is a small BCU in Chile, which was flagged for further research as a potential sliver based on the above methodology. The Treaty between Bolivia and Chile Respecting Boundaries, signed on 6 August 1874, defines the boundary in this region as either running along ridges or in straight lines between

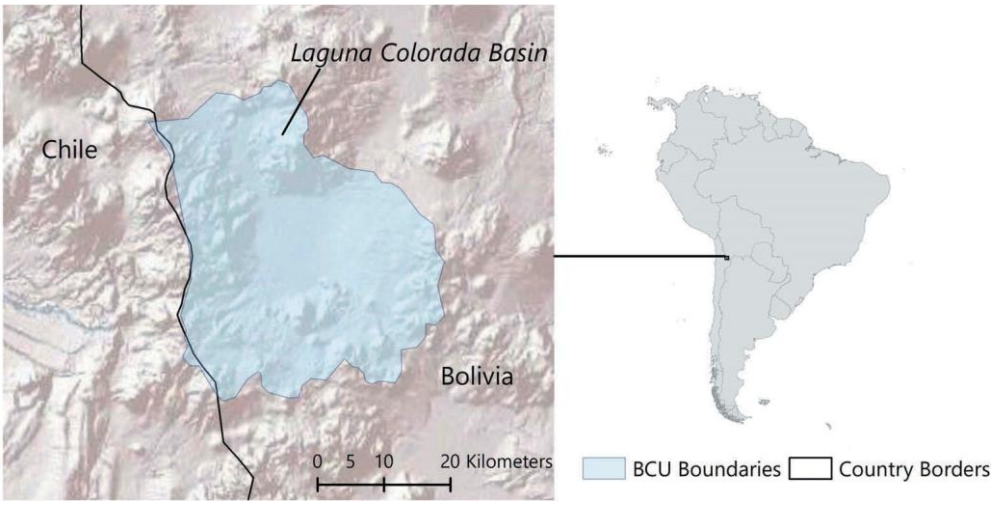

Figure 6. Laguna Colorada Basin – international basin identification. As part of the 2018 update, qualitative and political research on political boundaries was completed to assess international basins and the validity of slivers. The Laguna Colorada basin presented a unique case of a potential sliver in the Chile BCU. This was determined to be a sliver politically, as the intent behind the Treaty between Bolivia and Chile Respecting Boundaries in defining the border as following the ridgeline and between mountain peaks approximates the watershed boundary. Therefore, the BCU was determined to be a sliver, making the Laguna Colorada basin a domestic basin within Bolivia. © Transboundary Freshwater Dispute Database, Oregon State University, Cartographer Melissa McCracken, WGS 1984 TW 60 SW, Source: Data from ESRI (2018); TFDD (2018); Beck et al (2014); FAO GAUL (2014).

the major mountain peaks in the Andes (Anderson, 2003). The minute BCU area in Chile, while technically not a sliver geographically as the small area in the mountain valley does cross the political boundary, was determined to be a sliver politically, as the intent behind the treaty in defining the border as following the ridgeline and between mountain peaks approximates the watershed boundary. Therefore, the BCU was determined to be a sliver, making the Laguna Colorada basin a domestic basin within Bolivia.

Temporal and spatial comparison

In addition to the methodology described above, the multiple updates over the past several decades allow for temporal and spatial comparison between the data sets. Noted in the introduction, Table 1 details the number of basins and the percentage of the world's land surface (excluding Antarctica) found for this update, and compares them with previous TFDD updates, as well as with Beck et al. (2014), for comparison. As can be seen, the Beck et al. study identifies significantly more international basins than previous lists. We completed a comparison of the 2016 TWAP list of basins with the Beck et al. study to understand the discrepancy. The primary reason found is differing definitions of international rivers. The TFDD's definition excludes basins that do not have a perennial tributary that crosses an international border; this accounts for most of the differences. Less common differences also arose from the TFDD's definition of the outlet; the TFDD combines several sub-basins that are considered separate basins within the Beck et al. data set. Beck et al. present an alternative view of international river basins, and through the comparison of the two data sets and our analysis described above, we were able to locate several basins missing from the TFDD data set that fit our definition of an international basin.

The other main aspect provided by this data set and the previous updates is that this register – and previous data sets – are snapshot data. This differs from the Beck et al. (2014) data, which count the basins that have been international over a range of time – 1946 to 2012. This means that some basins included in the Beck et al. data set could be international, or not, depending on the political boundaries at the time of interest. While this information is valuable to an understanding of the historical context of shared waters, this register rather is aiming to provide a current list of international river basins and their boundaries. The trend globally is toward more international basins, such as with the breakup of the Soviet Union, or more riparians added to an already international basin, such as with the creation of South Sudan in the Nile Basin. This trend can be seen through comparison of the snapshot data throughout the various updates.[9]

Summary of the findings

This update follows several previous studies delineating international river basins, and lists 310 international basins, which cover 47.1% of the world's land surface and have 52% of the world's population residing within their boundaries. Figure 2, Table A1 and the associated Figures A1–A5 in the Appendix list the basins and BCUs by continent. Compared with the

2016 TWAP-RB study, this update adds 35 'new' international basins. Most of the basins added are small in area, less than 10,000 km^2. Particularly when compared with the 1999 and 2010 data sets, the increased resolution of the hydrologic data and country boundaries is the primary reason for 'finding' these new basins. The new basins added are as follows:

- Africa: Annole, Bahr at Tubat, Oued Bou Namoussa, Galana, Lake Chilwa, Lake Cayo, Lak Dera, Lake Rukwa.
- Asia: Alakol, Lake Sarygamesh, Naaf, Rann of Kutch, Rach Giang Thanh, Song Tien Yen.
- Europe: Adige, Angerman, Berbyelva, Cetina, Gruzskiy Yelanchik, Indalsalven, Nidelva, Narynka, Peschanaya, Poldnevaya, Vecht, Vefsna.
- North America: Caetani, Connecticut, Copper, Lake Azuei, Lake Enriquillo, Lucia, Santa Clara, Unuk.
- South America: Laguna Filaret.

In contrast, 11 basins were removed as part of this update. Nine were found to be incorrectly labelled as international through the sliver analysis described above or had only intermittent flows. The remaining two basins were combined with existing basins when we consistently applied our definition of an international river basin outlet. The basins removed or combined are as follows:

- Africa: Atui, Corubal, Thukela.
- Asia: Bahu Kalat/Rudkhanehye, Song Vam Co Dong, Wadi Al Izziyah.
- North America: Chanelecon, Chiriqui, Conventillos, Corredores/Colorado, El Naranjo.

In addition to contributing the number of international basins, this study also updates the riparian nations that share an international river basin. These updates were found necessary through our analysis of slivers, where basin area was incorrectly attributed to a non-riparian nation. For example, in the 2016 TWAP, 2010 Update and 1999 Update, China was listed as a riparian nation to the Har as Nur basin. However, the treaty designating the border between China and Mongolia defines the boundary as the crestline of the Altai Mountains south of the tripoint with Russia (Anderson, 2003); therefore, the political boundary and the hydrological boundary coincide, and China is not a riparian to the Har as Nur basin. There were few new riparian states found to be

Table 2. Percentage of country areas within international river basins.

Percentage within international river basin (s)	Number of countries
90–100%	52
80–89.9%	14
70–79.9%	12
60–69.9%	12

50–59.9%	18
40–49.9%	11
30–39.9%	10
20–29.9%	12
10–19.9%	8
0.01–9.9%	8

Note: Listed are the number of countries that have area in one or more international river basin within the specified range.

contributing to a basin; the notable exception being the addition of South Sudan as a riparian to the Nile basin with the state's creation in 2011.

The focus thus far has highlighted the significant number of changes this update as made to the number of international river basins and the number of riparian states to a particular basin. However, the total changes that have been added amount to a relatively small area. With net basins added, deltas and river outlets edited, and silvers addressed, only slight less than 2% of the total area was added compared with the 2016 TWAP-RB study and only 4% was added compared with the original 1999 Update. The minor amount of land area, while small, is important in increasing the accuracy and usefulness of the listing. For example, previous data sets excluded distributaries and the surround deltaic area from basin delineations. Deltas tend to be heavily populated and fertile areas, such as the Nile or Mississippi deltas. Recognizing these populations and agricultural developments as a part of the basin aids their participation in governance processes.

This update aims to identify and delineate accurately international river basins to further international efforts towards cooperation over shared waters. With 47.1% of the land surface within an international river basin, many countries have a significant proportion of their area that contributes – either hydrologically or topographically – to an international river. The number of countries with land area in an international river basin is 150.[10] While, 21 countries have their entire territory within one or several international basins. Table 2 gives an overview of the number of countries that have a percentage range of national land area that falls in an international basin. Table 3 and the associated Figure 7 breakdown per country the land area

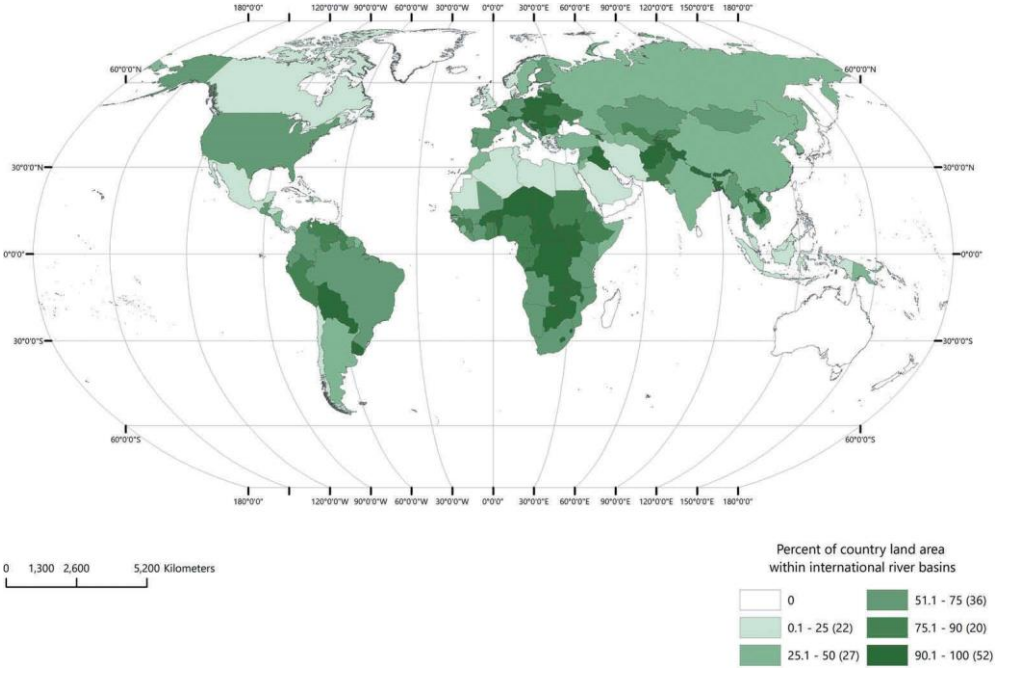

Figure 7. Degree of land area within international river basins. The percentage of land area of a country that is within an international river basin or basins. Counts of the number of countries within the percentage range are provided. © Transboundary Freshwater Dispute Database, Oregon State University, Cartographer Melissa McCracken, Robinson Projection, Source: Data from TFDD (2018); FAO GAUL (2014).
within an international basin.

The final contribution this update provides is an updated listing of the number of countries that are co-riparian to a particular basin. Table 4 and Figure 8 list the number of countries that share a basin. Twenty-three basins have more than five co-riparians.

Discussion and conclusions

Given the extensive and growing political and legal activity around transboundary river basins and the number of international bodies with robust transboundary water programmes, delineating and updating the world's international river basins is of utmost importance. No formal international agency has taken on this task since 1978; therefore, researchers associated with Oregon State University's Transboundary Freshwater Dispute Database have tried to fill this void since 1999 and will continue to do so for as long as possible. To do this task well is no trivial undertaking, and we are hopeful that the results of these efforts are valuable.

One motivation for doing this work with intention is to try to contribute to growing efforts to help prevent and resolve disputes inherent in managing water that is shared across political boundaries. From a paucity of activity when the first update was undertaken in 1999, national and international bodies that have global programmes designed to enhance capacity

and alleviate tensions on transboundary waters now include The World Bank and most regional development banks; several UN agencies, including the

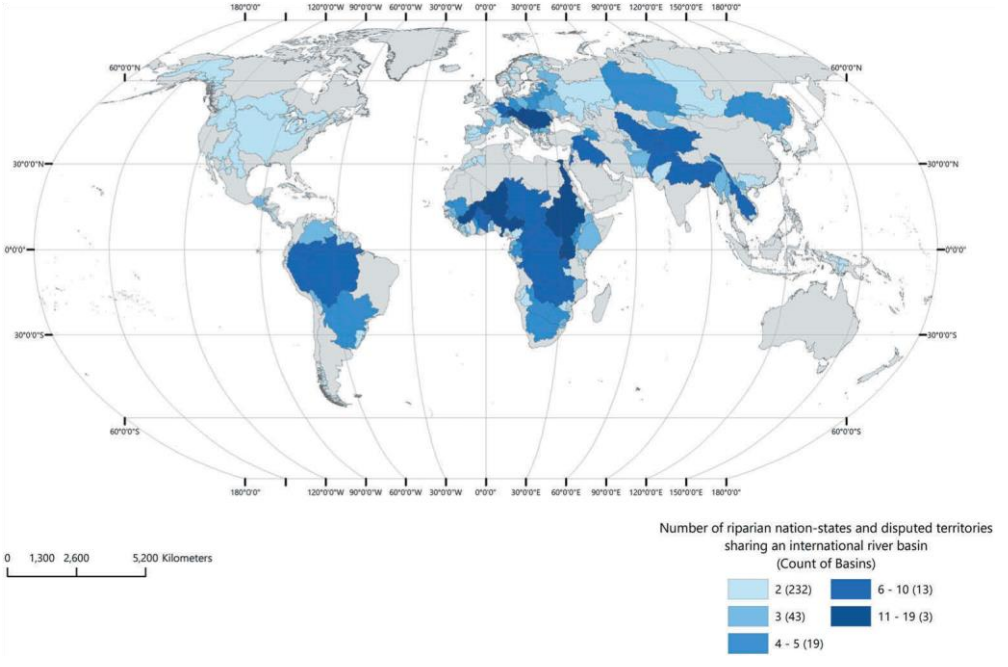

Figure 8. Number of riparians sharing an international river basin. The number of riparian nationstates and disputed territories that share an international river basin. The number of basins that have the same number of riparians are included. © Transboundary Freshwater Dispute Database, Oregon State University, Cartographer Melissa McCracken, Robinson Projection, Source: Data from TFDD (2018); FAO GAUL (2014).

Table3.

Country/territory	rnationalbasin untry/territory km^2)	Percentageofcountry/ter-ritoryareainaninterna- tionalbasin %
	9900	100.0
	641,500	100.0
	30,500	99.5
	18,800	65.7
	391,500	17.0
		%
	470	99.8
	346,500	67.9
	363,500	31.1
		%
	29,600	100.0
	68,000	100.0
	84,000	100.0
	60,400	36.7
		94.1
	207,600	100.0
	28,600	93.4
	10,200	46.1
	111,700	96.6
	37,700	100.0
	023,200	94.4
	47,500	92.9
	578,300	100.0
	305,000	62.5
	1100	18.4
	95,500	85.8
	273,300	100.0

(Continued)

rnationalbasin untry/territory km^2)	Percentageofcountry/territoryareainaninterna- Country/territory
26,900	100.0%
163,100	89.9%
399,200	85.8%
279,800	23.1%
619,600	100.0%
152,900	91.2%
95,300	12.6%
356,600	35.9%
1900	52.8%
730,700	64.2%
277,500	81.5%
15,700	30.7%
184,100	57.2%
38,400	67.0%
78,800	100.0%
49,500	40.4%
328,400	
1000	2.4%
11,100	51.1

tionalbasin

%
100.0

(Continued)

).

Table3. Continued

(

Country/territory	rnationalbasin untry/territory km^2)	Percentageofcountry/ter-ritoryareainaninterna-
	6100	% 12.6 %
	150,500	58.8 %
	244,900	25.0 %
	12,400	59.6 %
	21,100	78.0 %
	66,600	55.3 %
	26,000	57.1 %
	969,200	85.8 %
	181,900	54.0 %
	284,400	51.8 %
	41,600	49.9 %
	230,500	87.1 %
	9900	92.4 %
	39,300	56.3 %
	265,900	74.4 %
	191,100	80.0 %
	17,100	12.9 %
	78,500	71.9 %
	199,000	81.3 %
	14,600	43.0 %
	159,300	75.3 %
	7900	29.1 %
	6000	34.0 %
	23,300	20%
	93,100	100.0

tionalbasin

(Continued)

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Table3. Continued

(

Country/territory	rnationalbasin untry/territory km^2)	Percentageofcountry/ter-ritoryareainaninterna-	tionalbasin
	3200	% 100.0	
	371,800	% 46.0	
	133,900	% 7.1	
	385,200	% 23.0	
	397,700	% 91.3	
	4500	% 6.4	
	9600	% 46.5	
	86,600	% 28.7	
	186,000	% 100.0	
	22,900	% 25.7	
	804,400	% 63.5	
	416,500	% 71.5	
	176,200	% 88.5	
	230,000	% 99.8	
	55,800	% 86.4	
	3000	% 29.7	% 100.0
	30,200	% 99.2	
	63,500	% 66.2	
	59,100	% 3.6	
	150	% 93.0	
	60,400	% 100.0	
	2600	% 100.0	
	118,700		

(Continued)

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Table3. Continued

(

Country/territory	tionalbasin	rnationalbasin untry/territory km^2)	Percentageofcountry/ter-ritoryareainaninterna-
		7100	% 2.1 %
		744,500	59.5 %
		2000	100.0 %
		171,100	16.5 %
		411,300	21.0 %
		33,600	99.4 %
		757,600	48.4 %
		10,200	74.1 %
		146,000	35.2 %
		438,400	55.7 %
		486,900	% 73.0 %
		564,100	68.4 %
		147,400	100.0 %
		19,000	54.0 %
		52,600	40.8 %
		182,400	100.0 %
		301,900	88.1 %
		76,200	23.5 %
		592,700	% 87.2 %
		3800	5.0 %
		153,500	33.2 %
		399,400	100.0 %
		023,200	79.2 %
		285,100	91.4 %

(Continued)

rnationalbasin untry/territory km^2)	Percentageofcountry/ter-ritoryareainaninterna- Country/territory	tionalbasin
47,400	53.5 %	
25,000	25.2 %	
232,500	97.6 %	
894,400	46.4	
	%	
25,400	100.0 %	
16,700	0.9 %	
136,800	69.4 %	
88,500	100.0 %	
26,900	37.2 %	
49,100	100.0 %	
18,600	91.5 %	
225,200	35.6 %	
786,300	64.4 %	
629,800	100.0 %	
293,100	58.0 %	
451,800	78.8 %	
75,700	52.3 %	
17,300	100.0 %	
	27.8 %	
41,200	99.9 %	
139,000	73.9	%
142,000	%	100.0
210,300	40.8 %	
25,400	100.0	
	%	
1900	12.5	

(Continued)

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496,900

Table3. Continued

Country/territory	Country/territory area (km^2)[a]	International basin(s)	Total international basin area per country/territory (km^2)	Percentage of country/territory area in an international basin
Togo	56,800	Mono, Oueme, Volta	48,800	85.9 %
Tunisia	155,300	Medjerda, Oued Bou Namoussa	15,800	10.1 %
Turkey	780,600	Asi/Orontes, Coruh, Kura-Araks, Maritsa, NahrElKebir, Rezvaya, Tigris-Euphrates/Shatt alArab, Velaka	246,200	31.5 %
Turkmenistan	488,100	AralSea, Atrak, Hari/Harirud, LakeSarygamesh, Murgab	227,400	41.0 %
United Kingdom of Great Britain and Northern Ireland	244,300	Bann, Castletown, Erne, Fane, Flurry, Foyle, LoughMelvin	9700	4.0 %
Uganda	241,500	LakeTurkana, LotagipiSwamp, Nile	241,500	100.0 %
Ukraine	603,700	Danube, Dnieper, Dniester, Don, Elancik, GruzskiyYelanchik, Kogilnik, Mius, Sarata, Vistula/Wista	454,300	75.7 %
United Republic of Tanzania	945,100	Congo/Zaire, Galana, LakeNatron, LakeRukwa, Nile, Pangani, Ruvuma, Umba, Zambezi	496,900	52.8 %
United States of America	9,326,600	Alsek, Caetani, Chilkat, Colorado, Columbia, Connecticut, Copper, Firth, Fraser, Lucia, Mississippi, Nelson-Saskatchewan, RioGrande(NorthAmerica), SantaClara, Skagit, St. Croix St. John(NorthAmerica), St. Lawrence, Stikine, Taku, Tijuana, Unuk, Whiting, Yaqui, Yukon	5,865,500	62.9 %
Uruguay	178,100	Chuy, LaPlata, LagoonDosPatos-LagoonMirim	171,900	96.5 %
Uzbekistan	449,500	AralSea, LakeSarygamesh	384,700	85.6 %
Venezuela	912,100	Amacuro, Amazon, Barima, Catatumbo, Essequibo, Orinoco	733,200	80.4 %
VietNam	327,600	BeiJiang/Hsi, Beilun/SongKaLong, Ca/SongLam, Ma, Mekong/Lancang, NhaBe	198,000	60.4 %
WestBank	5900	Jordan, Saigon-SongVamCoDong, RachGiangThanh, Red/SongHong, SongTienYen	3000	51.2 %
Zambia	751,100	Congo/Zaire, LakeRukwa, Zambezi	751,100	100.0 %
Zimbabwe	390,600	Buzi, Limpopo, Okavango, Pungwe, Sabi, Zambezi	390,600	100.0 %

Notes: Listed are all the countries or territories that are riparian to an international river basin. Further identified are what basin country units (BCUs) are within the country or territory and the percentage of the country/territory's area that is within an international river basin(s).

[a] Country areas and the total international basin areas per country have been rounded to significant digits. Percentages were calculated based on raw data; therefore, they do not reflect the rounding in the country areas and the total international basin areas per country.

Table 4. Number of countries or territories that share a basin.

Number of riparians and disputed territories	International basins
2 (232)	Adige, Akpa, Alakol, Alsek, Amacuro, An Nahr Al Kabir, Angerman, Annole, Artibonite, Astara Chay, Atrak, Aviles, Aysen, Baker, Bann, Bahr at Tubat, Bidasoa, Bia, Beilun, Belize, Bangau, Oued Bou Namoussa, Berbyelva, Baraka, Barima, Barta, Buzi, Caetani, Ca/Song Lam, Candelaria, Changuinola, Carmen Silva/Chico, Chira, Choluteca, Chuy, Colorado, Chilkat, Columbia, Cancoso/Lauca, Connecticut, Coco/Segovia, Comau, Copper, Cross, Corantijn/Courantyne, Coruh, Castletown, Cestos, Coatan Achute, Cetina, Catatumbo, Cullen, Daoura, Digul, Don, Dragonja, Dra, Dasht, Douro/Duero, Elancik, Erne, Essequibo, Cuvelai/Etosha, Fane, Flurry, Fly, Fenney, Foyle, Fraser, Firth, Gallegos/Chico, Glama, Galana, Golok, Goascoran, Gruzskiy Yelanchik, Great Scarcies, Guadiana, Guir, Gauja, Han, Hamun-i-Mashkel/Rakshan, Har Us Nur, Bei Jiang/Hsi, Indalsalven, Isonzo, Jayapura, Jacobs, Jurado, Kaladan, Kemi, Kogilnik, Karnaphuli, Kowl E Namaksar, Krka, Klaralven, Kunene, Laguna Filaret, Lima, Lake Azuei, Lake Chilwa, Lake Cayo, Lak Dera, Lake Enriquillo, Lake Fagnano, Lake Natron, Lake Rukwa, Lake Sarygamesh, Lake Ubsa-Nur, Lielupe, Lough Melvin, Lagoon Dos Patos-Lagoon Mirim, Loes, Loffa, Little Scarcies, Lucia, Maro, Massacre, Ma, Mbe, Medjerda, Muhuri (aka Little Feni), Mino, Mira, Mississippi, Mius, Moho, Mono, Motaqua, Murgab, Maroni, Mataje, Naaf River, Naatamo, Nidelva, Negro, Nelson-Saskatchewan, Nahr El Kebir, Neretva, Nestos, Nyanga, Narynka, Oued Bon Naima, Olanga, Oral/Ural, Oulu, Oiapoque/Oyupock, Pangani, Paz, Peschanaya, Pedernales, Pakchan, Poldnevaya, Palena, Pandaruan, Prohladnaja, Parnu, Pascua, Psou, Patia, Puelo, Pu Lun T'o, Pungwe, Rann of Kutch, Rezvaya, Rio Grande (North America), Rio Grande (South America), Rach Giang Thanh, Rhone, Roia, Sabi, Santa Clara, Nha Be-Saigon-Song Vam Co Dong, Salaca, Samur, Sanaga, Sassandra, Sebuku, St. Croix, Seine, Seno Union/Serrano, Sepik, Song Tien Yen, Shu/Chu, Sixaola, St. John (Africa), St. John (North America), San Juan, Skagit, St. Lawrence, San Martin, Sembakung, St. Paul, Sarata, Sarstun, Stikine, Suchiate, Sujfun, Sulak, Tafna, Tagus/Tejo, Taku, Talas, Tami, Tana, Tano, Temash, Terek, Tijuana, Tjeroaka-Wanggoe, Tuloma, Tumbes, Umba, Unuk, Utamboni, Vanimo-Green, Vecht, Valdivia, Venta, Vefsna, Vijose, Velaka, Volga, Whiting, Wiedau, Yalu, Yaqui, Yelcho, Jenisej/Yenisey, Yser, Yukon, Zarumilla
3 (43)	Asi/Orontes, Awash, Benito/Ntem, Chiloango, Cavally, Dnieper, Dniester, Ebro, Gambia, Gash, Geba-Corubal, Grijalva, Garonne, Hari/Harirud, Helmand, Hondo, Incomati, Ili/Kunes He, Irrawaddy, Juba-Shibeli, Lava/Pregel, Lake Prespa, Lake Titicaca-Poopo System, Lempa, Mana-Morro, Moa, Maputo, Maritsa, Oder/Odra, Orinoco, Oueme, Po, Pasvik, Red/Song Hong, Ruvuma, Salween, Schelde, Torne/Tornealven, Tumen, Umbeluzi, Vardar, Vuoksa, Zapaleri
4 (13)	Amur, Drin, Elbe, Komoe, Limpopo, Narva, Ob, Ogooue, Okavango, Orange, Senegal, Struma, Vistula/Wista
5 (6)	Daugava, Kura-Araks, Lotagipi Swamp, Lake Turkana, La Plata, Neman
6 (6)	Aral Sea, Jordan, Mekong, Tigris-Euphrates/Shatt al Arab, Tarim, Volta
7 (2)	Amazon, Indus

8 (3)	Ganges-Brahmaputra-Meghna, Lake Chad, Zambezi
9 (1)	Rhine-Meuse
10 (1)	Congo/Zaire
11 (1)	Niger
14 (1)	Nile
19 (1)	Danube

Note: Listed are the number of countries that are riparian to a basin. In parentheses are the number of basins that have the same number of riparians.

United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Economic Commission for Europe (UNECE), the United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP) and the FAO; development partners including those of Sweden, the Netherlands, Switzerland, the UK, the United States, Japan and Norway; research and management agencies such as such as the International Water Management Institute (IWMI), the IUCN and the Global Environment Facility; and intergovernmental organizations such as the South African Development Community (SADC). These all contribute to the activities of the individual countries within international basins, each with its own approaches to shared water management. Progress toward shared water management is dependent on having consistent baseline data, such as river basin delineations, to help gauge activities and each country's and agency's individual and collective efforts.

Recent global initiatives such as the TWAP and the Sustainable Development Goals (SDGs) have explicitly required a base map from which to work, and these updates – both the 2016 TWAP update and the current 310 data set – have provided both the base map and unit of analysis. For example, the TWAP-RB used the BCU as the unit of analysis for the calculation of majority of its indicators. SDG 6.5.2, on the other hand, measures the percentage of the international river basin area with an operational arrangement for cooperation. While the unit of analysis for the SDGs is the nation-state, the river basin delineations and the BCUs provided by this update were used by the indicator's custodian agencies – UNECE Water Secretariat and UNESCO-IHP, as the reference data for the first assessment of SDG Indicator 6.5.2. Furthermore, it can be used by countries in their reporting on SDG Indicator 6.5.2, if they do not have the national-level river basin area data required by the indicator. This update has also been used by researchers to analyze and evaluate other topics related to the sharing of international river basins, as management and understanding of these complex human and natural systems is inherently spatial. These, and future, global and regional-scale assessments require regularly updated data as provided here. With the increase in global awareness, development and implementation of transboundary water management, it is increasingly useful to be able to identify the territory where there is cooperation and law being applied, or where it is not – meaning areas where resources, support and capacity development could be targeted.

One critical lesson learned in the past 20 years of updates is the ease on relying on digital data in crafting global data sets, yet how critical it is to groundtruth whenever possible. As

discussed in the Methodology section, 25% of the basins that were digitally derived needed manual modification. These discrepancies in the digitally derived delineations were identified based on careful examination of the intent behind the international boundaries drawn decades ago, a consistently applied definition of the end of a river and/or the precise delineation of distributaries in a delta. As ever more data are available in digital format, the lessons of careful inspection and truthing become ever more important.

A lot has changed in the world of international waters since we attempted our first register in 1999. Recognition of the special complexity of hydropolitics has grown, as have efforts to help stave off conflicts and enhance capacity for cooperation across international boundaries. In 1999, we wrote (Wolf et al., 1999, p. 393):

> 'We recognise too that this register is limited; that political boundaries will continue to shift; and that the technology of watershed analysis will continue to improve.'

This is as true now as it was then, if not truer. However, so is the hope that we expressed then (Wolf et al., 1999, p.393):

> 'In the meantime, it is to be hoped that this updated register of the world's international river basins [. . .] will contribute to continued analysis of these basins and perhaps, through greater understanding, tendencies towards cross-boundary cooperation might even be strengthened.'

Notes

1. The Register of International River Basins was an original component of the Transboundary Freshwater Dispute Database. For the current update and several updates to the listing and delineation of international rivers, see the database at http://transboundarywaters.science.oregonstate.edu/.
2. Separately, Beck et al. (2014) also completed a comprehensive analysis of international river basins and hydro-political dependence of basin states, the only effort undertaken outside of the Oregon State University team, which is discussed below in more detail.
3. 'For example, Egypt is listed as riparian to the Jordan, even though no perennial streams cross its boundary with Israel' (Wolf et al., 1999, p. 426). 'This definition, which we feel is the best available, does allow for one occasional inconsistency: If a basin is shared by only two nations, and all tributaries which cross the boundary are intermittent, we do not include it in the Register' (Wolf et al., 1999, p. 426).
4. UNESCO's International Groundwater Assessment Centre has been mapping all groundwater units shared by countries around the world (https://www.un-igrac.org).
5. The HydroBASINS 'MOST-DOWN' coding was used to merge nested sub-basins that drain to the same outflow.
6. This method was used to select distributaries in basins with deltas.
7. Some basins were edited for both holes, deltas and outlet inconsistencies, as well as slivers; the total percentage of edits in 310 basins does not count these basins twice, even if edited for multiple reasons.
8. The BCUs for disputed areas are coded using '/' to separate country code, i.e., INDU_CHN/ IND for the area in the Indus River Basin within the disputed Aksai Chin region between China and India. Notes in the tables denote which countries are administering these disputed areas.
9. Several of these historical data sets are available for download through the TFDD website at https://transboundarywaters.science.oregonstate.edu.
10. There are 150 countries with area in an international river basin; this increases to 157 if disputed areas are counted separately.

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Data Availability Statement

The data that support the findings of this study are openly available in the Transboundary Freshwater Dispute Database at http://transboundarywaters.science.oregonstate.edu/content/ transboundary-freshwater-dispute-database/.

Disclosure statement

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Appendix

Table A1. International river basins with area and country units.

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area
AFRICA				
Akpa	2400	Cameroon	570	23.7%
		Nigeria	1800	76.3%
Annole	11,200	Kenya	6600	58.9%
		Somalia	4600	41.1%
Awash	152,300	Djibouti	11,100	7.3%
		Ethiopia	140,900	92.6%
		Somalia	210	0.1%
Bahr at Tubat	7800	Egypt	6200	79.4%
		Libya	1600	20.6%
Benito/Ntem	44,300	Cameroon	17,900	40.5%

		Gabon	11,500	25.9%
		Equatorial Guinea	14,900	33.6%
Bia	11,300	Ivory Coast	4700	41.9%
		Ghana	6600	58.1%
Oued Bou Namoussa	2800	Algeria	2400	85.9%
		Tunisia	390	14.1%
Baraka	63,800	Eritrea	42,100	66.0%
		Sudan	21,700	34.0%
Buzi	2850	Mozambique	24,800	87.0%
		Zimbabwe	3700	13.0%
Chiloango	13,000	Angola	4600	35.2%
		Congo	1100	8.2%
		Democratic Republic of the Congo	7300	56.6%
Congo/Zaire	3,688,900	Angola	287,700	7.8%
		Burundi	13,600	0.4%
		Central African Republic	404,100	11.0%
		Cameroon	95,000	2.6%
		Congo	24,7800	6.7%
		Malawi	60	0.0%
		Rwanda	4500	0.1%
		United Republic of Tanzania	161,700	4.4%
		Democratic Republic of the Congo	2,300,500	62.4%
		Zambia	17,3800	4.7%
Cross	52,800	Cameroon	13,400	25.4%
		Nigeria	39,400	74.6%
Cestos	12,700	Ivory Coast	2200	17.5%
		Liberia	10,500	82.5%
Cavally	29,500	Ivory Coast	16,100	54.8%

Guinea	1400	4.8%
Liberia	11,900	40.5%

(Continued)

Table A1. (Continued).

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area
Daoura	49,700	Algeria	9600	19.3%
		Morocco	40,100	80.7%
Dra	94,200	Algeria	15,600	16.5%
		Morocco	78,600	83.5%
Cuvelai/Etosha	17,3700	Angola	54,100	31.2%
		Namibia	119,600	68.9%
Gambia	77,200	Guinea	11,700	15.2%
		Gambia	9900	12.8%
		Senegal	55,500	72.0%
Gash	23,700	Eritrea	16,800	71.2%
		Ethiopia	5900	25.2%
		Sudan	850	3.6%
Geba-Corubal	36,600	Guinea	17,700	48.5%
		Guinea-Bissau	17,600	40.0%
		Senegal	4200	11.6%
Galana	46,700	Kenya	40,800	87.6%
		United Republic of Tanzania	5800	12.4%
Great Scarcies	7800	Guinea	5200	66.8%
		Sierra Leone	2600	33.2%
Guir	108,700	Algeria	83,600	76.9%
		Morocco	25,100	23.1%
Incomati	46,600	Mozambique	15,300	32.9%
		Swaziland	2600	5.5%
		South Africa	28,700	61.6%
Juba-Shibeli	792,300	Ethiopia	365,700	46.2%
		Kenya	208,900	26.4%

Table A1. (Continued).

		Somalia	217,700	27.5%
Komoe	83,400	Burkina Faso	17,800	21.3%
		Ivory Coast	62,600	75.1%
		Ghana	2500	3.0%
		Mali	420	0.5%
Kunene	108,500	Angola	94,100	86.7%
		Namibia	14,400	13.3%
Lotagipi Swamp	31,700	Ethiopia	160	0.5%
		Kenya	20,500	64.5%
		Ilemi triangle[b]	2600	8.1%
		South Sudan	6900	21.9%
		Uganda	1600	5.0%
Lake Chad	2,596,900	Central African Republic	214,800	8.3%
		Cameroon	48,000	1.9%
		Algeria	106,000	4.1%
		Libya	57,500	2.2%
		Niger	694,500	26.7%
		Nigeria	178,900	6.9%
		Sudan	163,700	6.3%
		Chad	1,133,400	43.7%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area
Lake Chilwa	8700	Mozambique	2900	33.2%
		Malawi	5800	66.8%
Lake Cayo	3500	Angola	100	3.0%

Table A1. (Continued).

		Congo	3400	97.0%
Lak Dera	5400	Kenya	2800	50.9%
		Somalia	2700	49.1%
Lake Natron	27,300	Kenya	17,700	64.8%
		United Republic of Tanzania	9600	35.2%
Lake Rukwa	79,300	United Republic of Tanzania	77,700	98.0%
		Zambia	1600	2.0%
Lake Turkana	173,100	Ethiopia	99,000	57.2%
		Kenya	65,300	37.8%
		Ilemi triangle[b]	600	0.4%
		South Sudan	5300	3.1%
		Uganda	2900	1.7%
Limpopo	406,500	Botswana	81,400	20.0%
		Mozambique	79,500	19.6%
		South Africa	182,800	45.0%
		Zimbabwe	62,700	15.4%
Loffa	10,400	Guinea	1400	13.8%
		Liberia	9000	86.2%
Little Scarcies	18,500	Guinea	5500	29.7%
		Sierra Leone	13,000	70.4%
Mana-Morro	7600	Guinea	30	0.4%
		Liberia	5700	74.6%
		Sierra Leone	1900	25.0%
Mbe	8200	Gabon	7500	92.0%
		Equatorial Guinea	600	8.0%
Medjerda	23,200	Algeria	7800	33.7%
		Tunisia	15,400	66.3%

Table A1. (Continued).

Moa	19,600	Guinea	8500	43.5%
		Liberia	1700	8.8%
		Sierra Leone	9300	47.8%
Mono	24,000	Benin	2700	11.3%
		Togo	21,300	88.7%
Maputo	30,600	Mozambique	2000	6.6%
		Swaziland	11,100	36.3%
		South Africa	17,500	57.1%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area
Niger	2,132,200	Benin	44,700	2.1%
		Burkina Faso	83,400	3.9%
		Ivory Coast	23,600	1.1%
		Cameroon	86,800	4.1%
		Algeria	161,000	7.6%
		Guinea	95,800	4.5%
		Mali	555,700	26.1%
		Mauritania	2700	0.1%
		Niger	487,900	22.9%
		Nigeria	571,200	26.8%
		Chad	19,500	0.9%
Nile	2,961,300	Burundi	13,200	0.5%
		Egypt	236,400	8.0%
		Ma'tan al-Sarra[c]	2000	0.1%

Table A1. (Continued).

		Hala'ib triangle[d]	4100	0.1%
		Eritrea	7700	0.3%
		Ethiopia	357,300	12.1%
		Kenya	49,500	1.7%
		Rwanda	20,800	0.7%
		Sudan	1,265,500	42.7%
		Abyei[e]	9900	0.3%
		South Sudan	617,600	20.9%
		United Republic of Tanzania	119,700	4.0%
		Uganda	237,000	8.0%
		Democratic Republic of the Congo	20,500	0.7%
Nyanga	24,900	Congo	5000	19.9%
		Gabon	20,000	80.1%
Oued Bon Naima	370	Algeria	100	27.4%
		Morocco	270	72.6%
Ogooue	214,900	Cameroon	5200	2.4%
		Congo	20,200	9.4%
		Gabon	187,900	87.4%
		Equatorial Guinea	1700	0.8%
Okavango	690,200	Angola	150,100	21.8%
		Botswana	344,400	49.9%
		Namibia	170,200	24.7%
		Zimbabwe	25,500	3.7%
Orange	935,600	Botswana	135,400	14.0%
		Lesotho	30,200	3.1%

Table A1. (Continued).

		Namibia	242,800	25.1%
		South Africa	557,200	57.7%
Oueme	59,900	Benin	49,100	82.0%
		Nigeria	10,500	17.5%
		Togo	320	0.5%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area
Pangani	40,300	Kenya	2700	6.8%
		United Republic of Tanzania	37,600	93.2%
Pungwe	32,100	Mozambique	30,700	95.7%
		Zimbabwe	1400	4.4%
Ruvuma	155,200	Mozambique	100,500	64.8%
		Malawi	2600	1.7%
		United Republic of Tanzania	51,900	33.5%
Sabi	102,400	Mozambique	17,600	17.2%
		Zimbabwe	84,800	82.8%
Sanaga	133,000	Central African Republic	720	0.5%
		Cameroon	132,300	99.5%
Sassandra	68,100	Ivory Coast	60,000	88.0%
		Guinea	88,100	12.0%
Senegal	448,400	Guinea	314,500	7.0%
		Mali	171,600	38.3%
		Mauritania	168,300	37.5%
		Senegal	77,000	17.2%
St. John (Africa)	16,300	Guinea	2700	16.3%
		Liberia	13,700	83.7%

Table A1. (Continued).

St. Paul	20,300	Guinea	9300	45.6%
		Liberia	11,000	54.4%
Tafna	7300	Algeria	5300	73.7%
		Morocco	1900	26.3%
Tano	16,800	Ivory Coast	1800	11.0%
		Ghana	14,900	89.0%
Umbeluzi	9800	Mozambique	6100	62.0%
		Swaziland	3600	37.0%
		South Africa	90	0.9%
Umba	6700	Kenya	1600	23.9%
		United Republic of Tanzania	5100	76.1%
Utamboni	7400	Gabon	3600	48.1%
		Equatorial Guinea	3800	51.9%
Volta	411,200	Benin	15,100	3.7%
		Burkina Faso	17,100	41.9%
		Ivory Coast	13,000	3.2%
		Ghana	167,100	40.6%
		Mali	16,800	4.1%
		Togo	27,200	6.6%
Zambezi	1,375,000	Angola	255,800	18.6%
		Botswana	17,000	1.2%
		Mozambique	159,000	11.6%
		Malawi	110,200	8.0%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area

Table A1. (Continued).

		Namibia	17,200	1.2%
		United Republic of Tanzania	27,700	2.0%
		Zambia	575,700	41.9%
		Zimbabwe	212,500	15.5%
ASIA				
Alakol	63,500	China	203,00	32.1%
		Kazakhstan	43,100	67.9%
Amur/Heilong Jiang	2,092,700	China	889,200	42.5%
		Mongolia	195,000	9.3%
		Democratic People's Republic of Korea	60	0.0%
		Russian Federation	1,008,400	48.2%
An Nahr Al Kabir	1000	Lebanon	300	28.8%
		Syrian Arab Republic	730	71.2%
Aral Sea	1,218,400	Afghanistan	166,400	13.7%
		Kazakhstan	358,000	29.4%
		Kyrgyzstan	118,800	9.8%
		Tajikistan	141,200	11.6%
		Turkmenistan	58,100	4.8%
		Uzbekistan	375,900	30.9%
Asi/Orontes	23,800	Lebanon	2000	8.6%
		Syrian Arab Republic	16,100	67.5%
		Turkey	5700	24.0%
Astara Chay	400	Azerbaijan	160	40.6%
		Iran (Islamic Republic of)	240	59.7%
Atrak	36,400	Iran (Islamic Republic of)	24,700	67.9%
		Turkmenistan	11,700	32.1%
Beilun/Song Ka Long	840	China	710	84.8%
		Viet Nam	130	15.2%

Table A1. (Continued).

Bangau	130	Brunei Darussalam	120	90.0%
		Malaysia	10	10.0%
Ca/Song Lam	27,250	Lao People's Democratic Republic	9300	34.0%
		Viet Nam	18,000	66.0%
Coruh	22,000	Georgia	1800	8.3%
		Turkey	20,200	91.7%
Digul	30,000	Indonesia	29,500	98.3%
		Papua New Guinea	510	1.7%
Dasht	31,000	Iran (Islamic Republic of)	6300	20.4%
		Pakistan	24,700	79.6%
Fly	71,400	Indonesia	2600	3.6%
		Papua New Guinea	68,900	96.4%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area
Fenney	3000	Bangladesh	1500	49.8%
		India	1500	50.2%
GangesBrahmaputraMeghna	1,662,000	Bangladesh	117,600	7.1%
		Bhutan	37,700	2.3%
		China	317,700	19.1%
		Arunachal Pradesh[f]	68,000	4.1%
		China/India[g]	1700	0.1%
		India	971,200	58.4%
		Myanmar	780	0.1%
		Nepal	147,400	8.9%
Golok	2300	Malaysia	990	42.6%
		Thailand	1300	57.3%
Han	33,400	Republic of Korea	25,000	74.9%
		Democratic People's Republic of Korea	8400	25.1%

Table A1. (Continued).

Hari/Harirud	119,100	Afghanistan	38,900	32.7%
		Iran (Islamic Republic of)	40,900	34.3%
		Turkmenistan	39,300	33.0%
Hamun-i-Mashkel/ Rakshan	116,500	Iran (Islamic Republic of)	36,400	31.3%
		Pakistan	80,100	68.7%
Helmand	403,000	Afghanistan	312,300	77.5%
		Iran (Islamic Republic of)	46,600	11.6%
		Pakistan	44,100	11.0%
Har Us Nur	187,200	Mongolia	183,600	98.1%
		Russian Federation	3600	1.9%
Bei Jiang/Hsi	401,100	China	389,500	97.1%
		Viet Nam	11,600	2.9%
Ili/Kunes He	414,900	China	57,000	13.7%
		Kazakhstan	357,200	86.1%
		Kyrgyzstan	730	0.2%
Indus	855,900	Afghanistan	71,300	8.3%
		China	82,200	9.6%
		Aksai Chin[g]	8300	1.0%
		Jammu and Kashmir[h]	184,100	21.5%
		China/India[i]	1900	0.2%
		India	78,800	9.2%
		Pakistan	429,400	50.2%
Irrawaddy/ Ayeyarwady	375,400	China	21,400	5.7%
		India	17,200	4.6%
		Myanmar	336,800	89.7%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area

Table A1. (Continued).

Jayapura	5200	Indonesia	4800	90.7%
		Papua New Guinea	490	9.3%
Jordan	45,000	Egypt	2300	5.1%
		Israel	9600	21.4%
		Jordan	22,600	50.3%
		Lebanon	670	1.5%
		West Bank[j]	3000	6.7%
		Syrian Arab Republic	6800	15.1%
Kaladan	23,700	India	8200	34.6%
		Myanmar	15,500	65.5%
Karnaphuli	13,900	Bangladesh	9800	70.6%
		India	4100	29.4%
Kowl E Namaksar	42,300	Afghanistan	13,900	32.8%
		Iran (Islamic Republic of)	28,400	67.2%
Kura-Araks	189,900	Armenia	29,600	15.6%
		Azerbaijan	59,800	31.5%
		Georgia	34,500	18.2%
		Iran (Islamic Republic of)	37,100	19.5%
		Turkey	28,900	15.2%
Lake Sarygamesh	72,400	Turkmenistan	63,600	87.8%
		Uzbekistan	8800	12.2%
Lake Ubsa-Nur	70,300	Mongolia	50,200	71.3%
		Russian Federation	20,200	28.7%
Loes	2600	Indonesia	710	27.7%
		Timor-Leste	1900	72.3%
Maro	3300	Indonesia	1700	50.0%
		Papua New Guinea	1700	50.0%

Table A1. (Continued).

Ma	29,500	Lao People's Democratic Republic	12,600	42.7%
		Viet Nam	16,900	57.3%
Mekong/Lancang	781,600	China	164,700	21.1%
		Cambodia	154,100	19.7%
		Lao People's Democratic Republic	206,500	26.4%
		Myanmar	21,700	2.8%
		Thailand	188,100	24.1%
		Viet Nam	46,500	6.0%
Muhuri (aka Little Feni)	3800	Bangladesh	1300	33.8%
		India	2500	66.2%
Murgab	93,300	Afghanistan	38,800	41.5%
		Turkmenistan	54,600	58.5%
Naaf	1600	Bangladesh	390	24.4%
		Myanmar	1200	75.7%
Nahr El Kebir	1600	Syrian Arab Republic	1300	83.6%
		Turkey	260	16.4%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area
Ob	3,047,600	China	50,000	1.6%
		Kazakhstan	790,700	26.0%
		Mongolia	1100	0.0%
		Russian Federation	2,205,800	72.4%
Pakchan	3200	Myanmar	1600	49.0%
		Thailand	1600	51.0%
Pandaruan	1200	Brunei Darussalam	970	81.1%
		Malaysia	230	18.8%

Table A1. (Continued).

Pu Lun T'o	48,700	China	38,800	79.7%
		Mongolia	9900	20.3%
Rann of Kutch	402,800	India	288,300	71.6%
		Pakistan	114,500	28.4%
Red/Song Hong	141,300	China	75,000	53.1%
		Lao People's Democratic Republic	1600	1.1%
		Viet Nam	64,700	45.8%
Rach Giang Thanh	2200	Cambodia	1700	77.8%
		Viet Nam	490	22.2%
Nha Be-Saigon-Song Vam Co Dong	46,000	Cambodia	7300	15.9%
		Viet Nam	38,700	84.1%
Salween/Nu	265,300	China	136,800	51.6%
		Myanmar	109,300	41.2%
		Thailand	19,200	7.3%
Sebuku	3100	Indonesia	2700	86.8%
		Malaysia	410	13.2%
Sepik	79,800	Indonesia	3500	4.3%
		Papua New Guinea	76,300	95.7%
Song Tien Yen	1200	China	80	6.5%
		Viet Nam	1100	93.5%
Shu/Chu	75,500	Kazakhstan	53,500	70.9%
		Kyrgyzstan	22,000	29.1%
Sembakung	10,200	Indonesia	4800	47.0%
		Malaysia	5400	53.0%
Sujfun	16,800	China	10,000	59.6%
		Russian Federation	6800	40.4%
Talas	45,400	Kazakhstan	34,700	76.4%
		Kyrgyzstan	10,700	23.6%
Tami	78,800	Indonesia	78,200	99.4%

Table A1. (Continued).

		Papua New Guinea	470	0.6%
Tigris-Euphrates/ Shatt al Arab	869,000	Iran (Islamic Republic of)	164,500	18.9%
		Iraq	397,700	45.8%
		Jordan	220	0.0%
		Saudi Arabia	16,700	1.9%
		Syrian Arab Republic	114,000	13.1%
		Turkey	175,800	20.2%
Tjeroaka-Wanggoe	8000	Indonesia	5400	67.6%
		Papua New Guinea	2600	32.5%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area
Tarim/Talimu He	1,097,800	China	1,048,700	95.5%
		Aksai Chin[g]	22,200	2.0%
		Jammu and Kashmir[h]	2000	0.2%
		Kazakhstan	110	0.0%
		Kyrgyzstan	23,900	2.2%
		Tajikistan	920	0.1%
Tumen	33,300	China	22,700	68.1%
		Democratic People's Republic of Korea	10,500	31.4%
		Russian Federation	150	0.5%
Vanimo-Green	2700	Indonesia	40	1.5%
		Papua New Guinea	2600	98.5%
Yalu/Amnok	62,300	China	31,700	50.9%
		Democratic People's Republic of Korea	30,600	49.1%
Jenisej/Yenisey	2,504,600	Mongolia	317,900	12.7%
		Russian Federation	2,186,700	87.3%

Table A1. (Continued).

EUROPE				
Adige	14,500	Switzerland	130	0.9%
		Italy	14,300	99.1%
Angerman	32,900	Norway	1500	4.6%
		Sweden	31,400	95.4%
Bann	5700	United Kingdom of Great Britain and Northern Ireland	5400	93.5%
		Ireland	370	6.5%
Bidasoa	720	Spain	700	97.5%
		France	20	2.4%
Berbyelva	1300	Norway	700	52.8%
		Sweden	620	47.2%
Barta	2700	Lithuania	690	25.4%
		Latvia	2000	74.6%
Castletown	270	United Kingdom of Great Britain and Northern Ireland	190	70.2%
		Ireland	80	30.2%
Cetina	5100	Bosnia and Herzegovina	3200	63.3%
		Croatia	1900	36.8%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area
Danube	801,000	Albania	140	0.0%
		Austria	80,600	10.1%
		Bulgaria	47,600	5.9%
		Bosnia and Herzegovina	37,800	4.7%
		Switzerland	1800	0.2%
		Czech Republic	21,700	2.7%

Table A1. (Continued).

		Germany	56,100	7.0%
		Croatia	33,700	4.2%
		Hungary	93,100	11.6%
		Italy	700	0.1%
		Moldova, Republic of	12,300	1.5%
		The Former Yugoslav Republic of Macedonia	50	0.0%
		Montenegro	6900	0.9%
		Poland	370	0.1%
		Romania	232,500	29.0%
		Serbia	81,900	10.2%
		Slovakia	47,200	5.9%
		Slovenia	16,300	2.0%
		Ukraine	30,400	3.8%
Dnieper	511,400	Belarus	118,700	23.2%
		Russian Federation	99,700	19.5%
		Ukraine	293,000	57.3%
Dniester	73,400	Moldova, Republic of	19,400	26.4%
		Poland	230	0.3%
		Ukraine	53,800	73.3%
Don	439,300	Russian Federation	384,600	87.5%
		Ukraine	54,700	12.5%
Dragonja	150	Croatia	60	39.6%
		Slovenia	90	60.4%
Drin	18,200	Albania	7700	42.1%
		The Former Yugoslav Republic of Macedonia	2500	13.8%

Table A1. (Continued).

		Montenegro	3300	18.4%
		Serbia	4700	25.7%
Daugava	86,300	Belarus	33,400	38.7%
		Estonia	130	0.2%
		Lithuania	1900	2.2%
		Latvia	23,400	27.1%
		Russian Federation	27,500	31.9%
Douro/Duero	97,400	Spain	78,700	80.8%
		Portugal	18,700	19.2%
Ebro	85,500	Andorra	460	0.5%
		Spain	84,500	98.9%
		France	530	0.6%
Elbe	145,200	Austria	930	0.6%
		Czech Republic	49,900	34.4%
		Germany	94,100	64.8%
		Poland	240	0.2%
Elancik	1400	Russian Federation	940	67.9%
		Ukraine	440	32.2%
Erne	4400	United Kingdom of Great Britain and Northern Ireland	1900	43.2%
		Ireland	2500	56.8%
Fane	340	United Kingdom of Great Britain and Northern Ireland	60	17.6%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area

Table A1. (Continued).

		Ireland	280	82.4%
Flurry	200	United Kingdom of Great Britain and Northern Ireland	50	22.9%
		Ireland	160	77.1%
Foyle	2900	United Kingdom of Great Britain and Northern Ireland	2000	69.4%
		Ireland	890	30.6%
Glama	41,400	Norway	41,000	99.1%
		Sweden	370	0.9%
Garonne	81,300	Andorra	20	0.0%
		Spain	590	0.7%
		France	80,700	99.3%
Gruzskiy Yelanchik	1200	Russian Federation	100	8.3%
		Ukraine	1100	91.6%
Guadiana	67,100	Spain	55,400	82.6%
		Portugal	11,600	17.4%
Gauja	9200	Estonia	1200	12.6%
		Latvia	8100	87.4%
Indalsalven	26,600	Norway	2100	7.8%
		Sweden	24,500	92.3%
Isonzo	3400	Italy	1100	33.8%
		Slovenia	2200	66.2%
Jacobs	940	Norway	690	73.4%
		Russian Federation	250	26.6%
Kemi	53,900	Finland	50,700	94.2%
		Russian Federation	3100	5.8%
Kogilnik	4000	Moldova, Republic of	1500	39.0%
		Ukraine	2400	61.1%

Table A1. (Continued).

Krka	2500	Bosnia and Herzegovina	90	3.5%
		Croatia	2400	96.5%
Klaralven	50,100	Norway	9100	18.2%
		Sweden	41,000	81.8%
Lava/Pregel	14,500	Lithuania	60	0.4%
		Poland	7900	54.5%
		Russian Federation	6500	45.1%
Lima	2500	Spain	1300	52.9%
		Portugal	1200	47.1%
Lake Prespa	7700	Albania	6600	85.2%
		Greece	350	4.5%
		The Former Yugoslav Republic of Macedonia	790	10.3%
Lielupe	17,700	Lithuania	8800	50.1%
		Latvia	8800	49.9%
Lough Melvin	290	United Kingdom of Great Britain and Northern Ireland	120	39.7%
		Ireland	170	60.0%
Mino	16,700	Spain	16,200	96.9%
		Portugal	520	3.1%
Mius	7100	Russian Federation	2200	31.7%
		Ukraine	4800	68.3%
Maritsa	52,500	Bulgaria	35,000	66.8%
		Greece	3000	5.7%
		Turkey	14,500	27.6%
Naatamo	720	Finland	190	25.7%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area

Table A1. (Continued).

		Norway	530	74.3%
Nidelva	3100	Norway	2800	91.4%
		Sweden	270	8.6%
Neman	92,900	Belarus	44,800	48.3%
		Lithuania	43,700	47.1%
		Latvia	80	0.1%
		Poland	2500	2.7%
		Russian Federation	1800	1.9%
Neretva	6800	Bosnia and Herzegovina	6400	93.7%
		Croatia	430	6.4%
Narva	56,500	Belarus	30	0.1%
		Estonia	17,500	30.9%
	56,500	Latvia	3400	6.0%
		Russian Federation	35,600	63.0%
Nestos	6000	Bulgaria	3400	57.2%
		Greece	2500	42.8%
Narynka	92,000	Kazakhstan	74,700	81.2%
		Russian Federation	17,300	18.8%
Oder/Odra	119,300	Czech Republic	7300	6.1%
		Germany	5700	4.8%
		Poland	106,300	89.1%
Olanga	41,800	Finland	5800	13.9%
		Russian Federation	36,000	86.2%
Oral/Ural	211,700	Kazakhstan	90,400	42.7%
		Russian Federation	121,300	57.3%

(Continued)

Table A1. (Continued).

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area
Oulu	26,000	Finland	24,700	95.0%
		Russian Federation	1300	5.0%
Peschanaya	1300	Finland	1200	91.0%
		Russian Federation	120	9.0%
Poldnevaya	2600	Kazakhstan	480	18.7%
		Russian Federation	2100	81.4%
Po	74,100	Switzerland	3800	5.1%
		France	130	0.2%
		Italy	70,200	94.7%
Prohladnaja	1800	Poland	350	19.3%
		Russian Federation	1400	80.7%
Parnu	6900	Estonia	6900	99.9%
		Latvia	10	0.1%
Psou	420	Georgia	220	52.3%
		Russian Federation	200	48.0%
Pasvik	18,000	Finland	14,300	79.4%
		Norway	1500	8.2%
		Russian Federation	2200	12.5%
Rezvaya	770	Bulgaria	150	19.7%
		Turkey	620	80.3%
Rhine-Meuse[k]	198,300	Austria	2400	1.2%
		Belgium	14,600	7.3%
		Switzerland	27,900	14.1%
		Germany	106,400	53.7%
		France	32,700	16.5%
		Italy	50	0.0%

Table A1. (Continued).

		Liechtenstein	150	0.1%
		Luxembourg	2600	1.3%
		Netherlands	11,400	5.8%
Rhone	96,700	Switzerland	7600	7.9%
		France	89,100	92.1%
Roia	700	France	590	85.2%
		Italy	100	14.9%
Salaca	3600	Estonia	270	7.6%
		Latvia	3300	92.4%
Samur	6900	Azerbaijan	490	7.1%
		Russian Federation	6400	92.9%
Seine	73,600	Belgium	70	0.1%
		France	73,600	99.9%
Schelde	19,700	Belgium	12,800	64.9%
		France	6700	33.9%
		Netherlands	230	1.2%
Sarata	1200	Moldova, Republic of	440	35.2%
		Ukraine	800	64.8%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area
Struma	16,800	Bulgaria	8500	50.5%
		Greece	6000	35.8%
		The Former Yugoslav Republic of Macedonia	1600	9.6%
		Serbia	680	4.1%
Sulak	14,200	Georgia	950	6.7%
		Russian Federation	13,200	93.3%

Table A1. (Continued).

Tagus/Tejo	71,200	Spain	55,800	78.3%
		Portugal	15,400	21.7%
Tana	16,900	Finland	5900	35.0%
		Norway	11,000	65.0%
Terek	43,000	Georgia	1800	4.1%
		Russian Federation	41,300	95.9%
Torne/Tornealven	40,800	Finland	12,800	31.2%
		Norway	1800	4.3%
		Sweden	26,300	64.5%
Tuloma	27,000	Finland	2500	9.2%
		Russian Federation	24,500	90.8%
Vecht	10,600	Germany	3300	30.7%
		Netherlands	7400	69.3%
Venta	11,900	Lithuania	5200	43.7%
		Latvia	6700	56.3%
Vefsna	4200	Norway	3600	86.0%
		Sweden	580	14.0%
Vijose	6800	Albania	4500	65.7%
		Greece	2300	34.3%
Velaka	1100	Bulgaria	790	73.0%
		Turkey	290	27.0%
Volga	1,411,700	Kazakhstan	1500	0.1%
		Russian Federation	1,410,300	99.9%
Vardar	24,600	Greece	2900	11.8%
		The Former Yugoslav Republic of Macedonia	20,400	83.2%
		Serbia	1200	5.0%
Vistula/Wista	192,100	Belarus	10,100	5.3%
		Poland	167,300	87.1%

Table A1. (Continued).

		Slovakia	1900	1.0%
		Ukraine	12,800	6.6%
Vuoksa	287,100	Belarus	460	0.2%
		Finland	63,900	22.2%
		Russian Federation	222,800	77.6%
Wiedau	1400	Germany	310	22.6%
		Denmark	1000	77.4%
Yser	1600	Belgium	1200	75.8%
		France	380	24.2%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area
NORTH AMERICA				
Alsek	28,200	Canada	26,200	92.7%
		United States of America	2100	7.3%
Artibonite	8900	Dominican Republic	2600	29.4%
		Haiti	6300	70.6%
Belize	8600	Belize	6100	71.3%
		Guatemala	2500	28.7%
Caetani	870	Canada	160	18.8%
		United States of America	700	81.3%
Candelaria	14,600	Guatemala	2300	16.0%
		Mexico	12,300	84.0%
Changuinola	3200	Costa Rica	240	7.4%
		Panama	3000	92.6%
Choluteca	8000	Honduras	7800	96.5%
		Nicaragua	280	3.5%
Colorado	662,500	Mexico	14,700	2.2%

Table A1. (Continued).

		United States of America	647,800	97.8%
Chilkat	4000	Canada	1800	45.2%
		United States of America	2200	54.8%
Columbia	654,300	Canada	102,800	15.7%
		United States of America	551,500	84.3%
Connecticut	29,100	Canada	310	1.1%
		United States of America	28,800	99.0%
Coco/Segovia	24,500	Honduras	5600	22.9%
		Nicaragua	18,900	77.1%
Copper	66,100	Canada	3400	5.2%
		United States of America	62,700	94.8%
Coatan Achute	680	Guatemala	260	38.9%
		Mexico	420	61.1%
Fraser	231,600	Canada	231,000	99.7%
		United States of America	630	0.3%
Firth	6100	Canada	3500	57.8%
		United States of America	2600	42.2%
Grijalva	125,700	Belize	30	0.0%
		Guatemala	46,900	37.4%
		Mexico	78,700	62.6%
Goascoran	2700	Honduras	1400	51.3%
		El Salvador	1300	48.7%
Hondo	12,700	Belize	2700	21.3%
		Guatemala	4900	38.7%
		Mexico	5100	40.0%
Lake Azuei	910	Dominican Republic	90	9.6%
		Haiti	830	90.4%
Lake Enriquillo	3100	Dominican Republic	2800	92.8%

Table A1. (Continued).

		Haiti	220	7.2%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area
Lempa	18,200	Guatemala	2600	14.3%
		Honduras	5500	30.0%
		El Salvador	10,100	55.7%
Lucia	3000	Canada	1600	53.1%
		United States of America	1400	46.9%
Massacre	780	Dominican Republic	360	46.2%
		Haiti	420	53.8%
Mississippi	3,264,800	Canada	52,300	1.6%
		United States of America	3,212,500	98.4%
Moho	1200	Belize	730	61.0%
		Guatemala	460	39.0%
Motaqua	16,300	Guatemala	14,200	87.5%
		Honduras	2000	12.5%
Negro	6200	Honduras	990	16.1%
		Nicaragua	5200	83.9%
Nelson-Saskatchewan	1,088,800	Canada	934,000	85.8%
		United States of America	154,800	14.2%
Paz	2200	Guatemala	1200	55.8%
		El Salvador	960	44.2%
Pedernales	320	Dominican Republic	150	47.8%
		Haiti	170	52.2%
Rio Grande (North America)	538,400	Mexico	223,800	41.6%
		United States of America	314,700	58.4%
Santa Clara	4600	Mexico	4100	89.9%

Table A1. (Continued).

		United States of America	470	10.1%
St. Croix	4300	Canada	1700	38.9%
		United States of America	2600	61.1%
Sixaola	2900	Costa Rica	2300	81.7%
		Panama	520	18.3%
St. John (North America)	55,100	Canada	36,200	65.7%
		United States of America	18,900	34.3%
San Juan	41,400	Costa Rica	13,100	31.8%
		Nicaragua	28,200	68.2%
Skagit	8200	Canada	1000	12.7%
		United States of America	7200	87.3%
St. Lawrence	810,600	Canada	480,700	59.3%
		United States of America	329,900	40.7%
Sarstun	2200	Belize	220	10.2%
		Guatemala	1900	89.8%
Stikine	50,900	Canada	49,600	97.6%
		United States of America	1200	2.4%
Suchiate	1400	Guatemala	1100	77.6%
		Mexico	320	22.4%
Taku	17,500	Canada	16,700	95.6%
		United States of America	760	4.4%
Temash	470	Belize	450	94.5%
		Guatemala	30	5.5%
Tijuana	4400	Mexico	3200	72.1%
		United States of America	1200	27.9%
Unuk	2500	Canada	1700	67.2%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area

Table A1. (Continued).

		United States of America	810	32.8%
Whiting	2500	Canada	1900	78.5%
		United States of America	530	21.5%
Yaqui	72,900	Mexico	68,700	94.3%
		United States of America	4200	5.7%
Yukon	848,700	Canada	333,200	39.3%
		United States of America	515,500	60.7%
SOUTH AMERICA				
Amacuro	3700	Guyana	710	19.0%
		Venezuela	3000	81.0%
Amazon	5,952,600	Bolivia	712,500	12.0%
		Brazil	3,741,900	62.9%
		Colombia	340,700	5.7%
		Ecuador	132,100	2.2%
		Guyana	12,400	0.2%
		Peru	961,200	16.2%
		Venezuela	51,800	0.9%
Aviles	300	Argentina	260	89.2%
		Chile	30	10.8%
Aysen	12,600	Argentina	730	5.8%
		Chile	11,800	94.2%
Baker	26,900	Argentina	6600	24.4%
		Chile	20,300	75.6%
Barima	920	Guyana	40	4.3%
		Venezuela	880	95.7%
Carmen Silva/Chico	2100	Argentina	1200	59.0%
		Chile	850	41.0%
Chira	17,700	Ecuador	7200	40.5%
		Peru	10,500	59.5%

Table A1. (Continued).

Chuy	720	Brazil	630	86.6%
		Uruguay	100	13.4%
Cancoso/Lauca	32,900	Bolivia	26,400	80.3%
		Chile	6500	19.7%
Comau	910	Argentina	70	8.1%
		Chile	840	91.9%
Corantijn/Courantyne	65,400	Guyana	27,600	42.2%
		Suriname	37,700	57.8%
Catatumbo	27,400	Colombia	16,500	60.2%
		Venezuela	10,900	39.8%
Cullen	920	Argentina	220	24.3%
		Chile	700	75.8%
Essequibo	157,500	Guyana	118,500	75.3%
		Venezuela	39,000	24.8%

(Continued)

Basin	Basin area (km^2)[a]	Country	Basin country unit (BCU) area (km^2)	Percentage total basin area
Gallegos/Chico	16,800	Argentina	10,200	60.4%
		Chile	6700	39.6%
Jurado	920	Colombia	640	70.0%
		Panama	280	30.0%
Laguna Filaret	2100	Argentina	240	11.6%
		Chile	1800	88.4%
Lake Fagnano	3600	Argentina	3100	85.8%
		Chile	500	14.2%
Lake Titicaca-Poopo System	112,200	Bolivia	61,700	55.0%
		Chile	1300	1.2%
		Peru	49,200	43.8%
Lagoon Dos PatosLagoon Mirim	168,700	Brazil	136,100	80.7%
		Uruguay	32,600	19.3%

Table A1. (Continued).

La Plata	2,981,500	Argentina	807,300	27.1%
		Bolivia	222,000	7.4%
		Brazil	1,413,700	47.4%
		Paraguay	399,400	13.4%
		Uruguay	139,200	4.7%
Mira	10,500	Colombia	4200	40.3%
		Ecuador	6300	59.7%
Maroni	66,300	French Guiana	28,300	42.7%
		Suriname	38,000	57.3%
Mataje	1000	Colombia	440	43.5%
		Ecuador	570	56.6%
Orinoco	973,800	Colombia	346,200	35.6%
		Guyana	10	0.0%
		Venezuela	627,600	64.5%
Oiapoque/Oyupock	26,000	Brazil	12,600	48.6%
		French Guiana	13,400	51.4%
Palena	13,200	Argentina	5800	43.9%
		Chile	7400	56.1%
Pascua	14,100	Argentina	7400	52.3%
		Chile	6700	47.7%
Patia	22,300	Colombia	22,000	98.4%
		Ecuador	350	1.6%
Puelo	9200	Argentina	5900	64.8%
		Chile	3200	35.3%
Rio Grande (South America)	8600	Argentina	3900	45.5%
		Chile	4700	54.5%
Seno Union/Serrano	8600	Argentina	1900	21.7%
		Chile	6800	78.3%
San Martin	360	Argentina	70	20.3%

Table A1. (Continued).

Basin	Basin area (km²)[a]	Country	Basin country unit (BCU) area (km²)	Percentage total basin area
Yelcho	11,400	Argentina	7300	63.8%
		Chile	4100	36.2%
Zapaleri	2500	Argentina	470	18.6%
		Bolivia	560	22.3%
		Chile	1500	59.1%
Zarumilla	1100	Ecuador	520	49.0%
		Peru	540	51.0%
		Chile	290	79.7%
Tumbes	5400	Ecuador	3600	67.6%
		Peru	1700	32.4%
Valdivia	10,200	Argentina	1000	10.2%
		Chile	9200	89.8%

(Continued)

Notes: Identified are the international river basins per continent and shown is a breakdown of the total basin area (km²) and the area of the BCUs that comprise the basin.

[a]The basin areas have been rounded to significant digits. Therefore, the area within all BCUs does not necessarily sum to the total basin area. Percentages were calculated based on raw data; therefore, they do not reflect the rounding in the basin and BCU areas.

[b]The Ilemi Triangle is a disputed area between Kenya and South Sudan. The area is administrated by Kenya (CIA, 2018c, 2018g).

[c]Disputed area between Egypt and Sudan. It is administered by Egypt and is part of the Hala'ib Triangle (CIA, 2018d, 2018f).

[d]Disputed area between Egypt and Sudan. It is administered by Egypt (CIA, 2018d, 2018f).

[e]Disputed area between Sudan and South Sudan. Area is jointly administered by both countries (CIA, 2018d, 2018g).

[f]Disputed area between India and China. It is administered by India (Government of Arunachal Pradesh, 2018).

[g]Disputed area between India and China. It is administered by China (CIA, 2018b, 2018e).

[h]Disputed area between India and China. It is administered by India (CIA, 2018b).

[i]Disputed area on the border of Jammu/Kashmir, which is administered by India (CIA, 2018b, 2018e).

[j]Parts of the West Bank are under the control of the Palestinian Authority through the Oslo Accords; however, much of the West Bank is occupied by the Israeli military (CIA, 2018a).

[k]'While the Meuse basin is topographically part of the Rhine basin, European nations treat it as a politically separate basin' (Huisman, de Jong, & Wieriks, 1998; Wolf et al., 1999).

Figure A1. International river basins of Africa. This map identifies 68 international river basins on the African continent. © Transboundary Freshwater Dispute Database, Oregon State University, Cartographer Melissa McCracken, World Cylindrical Equal Area Projection, Source: Data from TFDD (2018); FAO GAUL (2014).

FigureA2. (internationalriverbasinsontheAsiancontinent.©TransboundaryFreshwaterDispute InternationalriverbasinsofAsia.Thismapidenti fies Database,OregonStateUniversity,CartographerMelissaMcCracken,AsiaNorthAlbersEqualAreaandAsiaSouthAlbersEqualAreaProjections,Source:Data fromTFDD(2018; FAOGAUL 2014).

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FigureA3. InternationalriverbasinsofEurope.Thismapidenti fies internationalriverbasinsontheEuropeancontinent.©TransboundaryFreshwaterDispute Database,OregonStateUniversity,CartographerMelissaMcCracken,EuropeAlbersEqualAreaProjection,Source:DatafromTFDD(2018;FAOGAUL 2014).

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Figure A4. International river basins of North America. This map identifies 49 international river basins on the North American continent. © Transboundary Freshwater Dispute Database, Oregon State University, Cartographer Melissa McCracken, North America Albers Equal Area Conic Projection, Source: Data from TFDD (2018); FAO GAUL (2014).

Figure A5. International river basins of South America. This map identifies 39 international river basins on the South American continent. © Transboundary Freshwater Dispute Database, Oregon State University, Cartographer Melissa McCracken, South America Albers Equal Area Projection, Source: Data from TFDD (2018); FAO GAUL (2014).