Table 1
Shoreline's indicators derived from multispectral satellite images and their corresponding extraction methods modified from Payo et al. (2020) and Toure et al. (2019).

Feature e.g., tidal datums/reference lines etc	Coastal Shoreline Indicator (CSI)		Study	Shoreline extraction technique	Satellite Resolution
Morphological limits	Coastal Dunes	Dune Crest Line	Sparavigna (2016)	Using the GIMP, Image Manipulation Program the dunes and their footprints are identified and outlined by applying the filter for the edge detection with the **Sobel method**	<10 m
		Dune Foot	Dogru et al. (2006)	The unsupervised image classification technique **ISODATA (Iterative Self-Organizing Data Analysis Technique)** was used to identify five different land classes in satellite imagery.	>20 m
			Merlotto et al. (2014)	Dune foot was **manually** digitized with a high-resolution scanner and georeferenced from a minimum of 15 control points.	<10 m
	Cliffs and Backed Beach	Base of bluff/cliff	Eguchi and Albino (2018)	The shorelines were extracted manually from the satellite imagery	<10 m
	In case of Scree at the cliffs toe	Landslide headwall	Scaioni. et al. (2014)	**Visual interpretation** of images, including the use of stereovision.	<10 m >20 m
	Protected Seafront	Landward edge of shore protection structure	Balaji et al. (2017)	A **Vectorization technique** is applied to obtain the shoreline in the ArcGIS 10. This is input into the **Digital Shoreline Analysis System (DSAS)** tool to estimate the rate of shoreline changes.	<10 m
Vegetation Limits		Vegetation line	Tarmizi et al. (2014)	**ISODATA** was used to identify 7 classes to effectively separate water from land features	<10 m
			Bengoufa et al. (2021a)	Remotely sensed images were processed using a **Convolutional Neural Network** (CNN). The result was used as input data for the **Geographic Object Based Image Analysis (GEOBIA)** knowledge-based classification, which is used for segmenting geospatial imagery into meaningful image objects, and valuing their characteristics across spectral spatial, and temporal scales	<10 m
		Seaward edge of dune vegetation	Cenci et al. (2017)	**Geomatic-based Shoreline Analysis Method (GbSAM)** is applied in high energy coastal environments by exploiting Landsat images.	>20 m
			Ford (2013)	Vegetation lines were **manually digitized** by a single operator using ArcGIS 10.0.	<10 m
			Lira and Taborda (2014)	Detection and extraction were carried out **manually** by digitizing the visible vegetation line in ArcGIS 10.1	>20 m
			Rogers et al. (2021)	**A CNN,** VEdge_Detector was used for the automated detection of coastal vegetation edges by producing a heatmap, showing the pixels predicted with the highest confidence the vegetation line.	<10 m
Instant tidal levels and wetting limits		Instantaneous Waterline	Sunder et al. (2017)	The waterline was extracted using the **Normalized Difference Water Index (NDWI), Modified Normalized Difference Water Index (MNDWI), Automatic Water Extraction Index (AWEI)** with a **threshold** used to create a binary image of land-water.	>20 m
			Luijendijk et al. (2018)	Sandy beaches are detected by applying **Classification and Regression Trees (CART)** and the OSM Global transect system to identify the 'sandy transects'. Annual composite images are used to estimate the **NDWI** with the **Canny edge detection filter** and **thresholding** used to roughly estimate the position of the water-land transition.	10 m - <20 m
			Xu (2018)	The **MNDWI** and the **zero threshold** was applied to create a binary image of the land and water.	<10 m
			Hagenaars et al. (2017)	The waterline position is extracted using the **NDWI** and **Otsu's automatic threshold**. A **region growing algorithm** clusters the binary land-water image distinct water and land regions.	>20 m 10 m - <20 m
			Hagenaars et al. (2018)	The **NDWI** was used to extract the shoreline position, with **Otsu thresholding** used to find the optimal threshold value from the NDWI histogram. The **region growing** algorithm was used to cluster pixels identified as water into a coherent water mask.	>20 m 10 m - <20 m
			Choung and Jo. (2017)	A classification map was generated by the **Support Vector Machine (SVM)** and then the second binary image was generated from the coastal-surface classification map by grouping the land (rock, vegetation) and water features. A binary image separating the land and water features was generated using the **NDWI** and an **adaptive thresholding** method.	<10 m
			Bishop-Taylor et al. (2019)	The shoreline was extracted using the **NDWI, MNDWI, and AWEI.** Three different thresholds were then tested: an '**optimal' threshold**, a '**zero' water index threshold**, and an **automatically derived threshold.**	>20 m
			Yin and He (2011)	The **MNDWI** and **SVM** were combined for different shoreline types to create a whole shoreline. The MNDWI extracts the	>20 m

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Table 1 (*continued*)

Feature e.g., tidal datums/reference lines etc	Coastal Shoreline Indicator (CSI)	Study	Shoreline extraction technique	Satellite Resolution
			coastline of artificial and rock coast and SVM extracts the coastline of sandy and muddy coast.	
		Vos et al. (2019a)	The CoastSat toolkit (Vos et al., 2019b) is used to extract the shoreline position. A **Multilayer Perceptron** (**MLP**) segments the image into 4 classes allowing only the sand/water classes to be used when applying the **MNDWI** and **Otsu's histogram thresholding** to the image.	>20 m 10 m - <20 m
		Thanh Tung et al. (2021)	The waterline is detected using, CoastSat (Vos et al. 2019b) with a **MLP**, the **MNDWI** with **Otsu's automatic threshold**.	>20 m 10 m - <20 m
		Manaf et al. (2018)	Supervised classification approaches were used to classify land and water classes including **MLP**, **Artificial Neural Network (ANN), Decision Tree (DT), Naïve Bayes (NB), K-Nearest Neighbour (KNN),** and **SVM.**	>20 m
		Minghelli et al. (2020)	**SVM** classification method was compared with four other methods the **Euclidean Distance (ED), the Spectral Angle Mapper (SAM), MLC, SVM** and **ANN**	<10 m
		Almonacid-Caballer et al. (2016)	The **optimum threshold** is obtained from a **histogram** of an infrared band when water and land are both present.	<10 m >20 m
		Randazzo et al. (2020)	Binary images were created from the NIR band, and the red band based on a **threshold** between the two bands**.**	<10 m
		Ge et al. (2014)	The waterline position is extracted using **object-oriented classification.**	>20 m
		Bamdadinejad et al. (2021)	Image classification using **SVM,** and **MLC** was applied using the ENVI software.	>20 m
		Kalkan et al. (2013)	**Object Based Classification (OBC)** was used with the **NDWI** to separate water surfaces. This was compared to **SVM** image classification to distinguish water bodies.	>20 m
		Cheng et al. (2017)	A **CNN,** SeNet **(**structured edge network) was developed for the segmentation of sea-land from using a fully convolutional neural network (FCNN) based model.	<10 m
		Li et al. (2018)	A **CNN,** DeepUNet was developed for pixel level sea-land segmentation from a FCNN based model.	<10 m
		Erdem et al. (2021)	A **CNN,** WaterNet was used for shoreline segmentation. This is a Conditional Generative Adversarial Network (cGAN) based model	>20 m
		García-Rubio et al. (2015)	**ISODATA** was used for image classification in ERDAS software.	<10 m
		Ali et al. (2015)	The shoreline was extracted using **ISODATA** and vectorized to obtain the shoreline.	<10 m
		Chen and Chang (2009)	The shoreline was extracted using the **Canny edge detection algorithm**.	<10 m
		Al-Mansoori and Al-Marzouqi (2016)	The **NDWI** and **local adaptive thresholding** converts the image into a binary image, with the **Sobel edge detector** used to create continuous edges representing the coastline.	<10 m
	Wet/Dry Line	Sekovski et al. (2014)	The shoreline position was extracted using semi-automatic shoreline delineation using both supervised (**Parallelepiped, Gaussian Maximum Likelihood, Minimum-Distance-to-Means, and Mahalanobis distance**) and unsupervised (**ISODATA**) image classification techniques on satellite imagery.	<10 m
	High Water Line	Bengoufa et al. (2021b)	Based on supervised image classification, **Random Forest** (**RF**) and **SVM** were used within the **pixel-based image analysis** (**PBIA**) and **Object-based image analysis** (**OBIA**) approaches.	<10 m