

National Strategic Environmental Assessment for Aquaculture Development in South Africa

GIS analysis for identifying optimal
areas for marine and freshwater
aquaculture development



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1. Strategic Environmental Assessment Overview

- 18 month study

- Commissioned by



environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA



**agriculture,
forestry & fisheries**

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

**Suitable
aquaculture
development
areas**

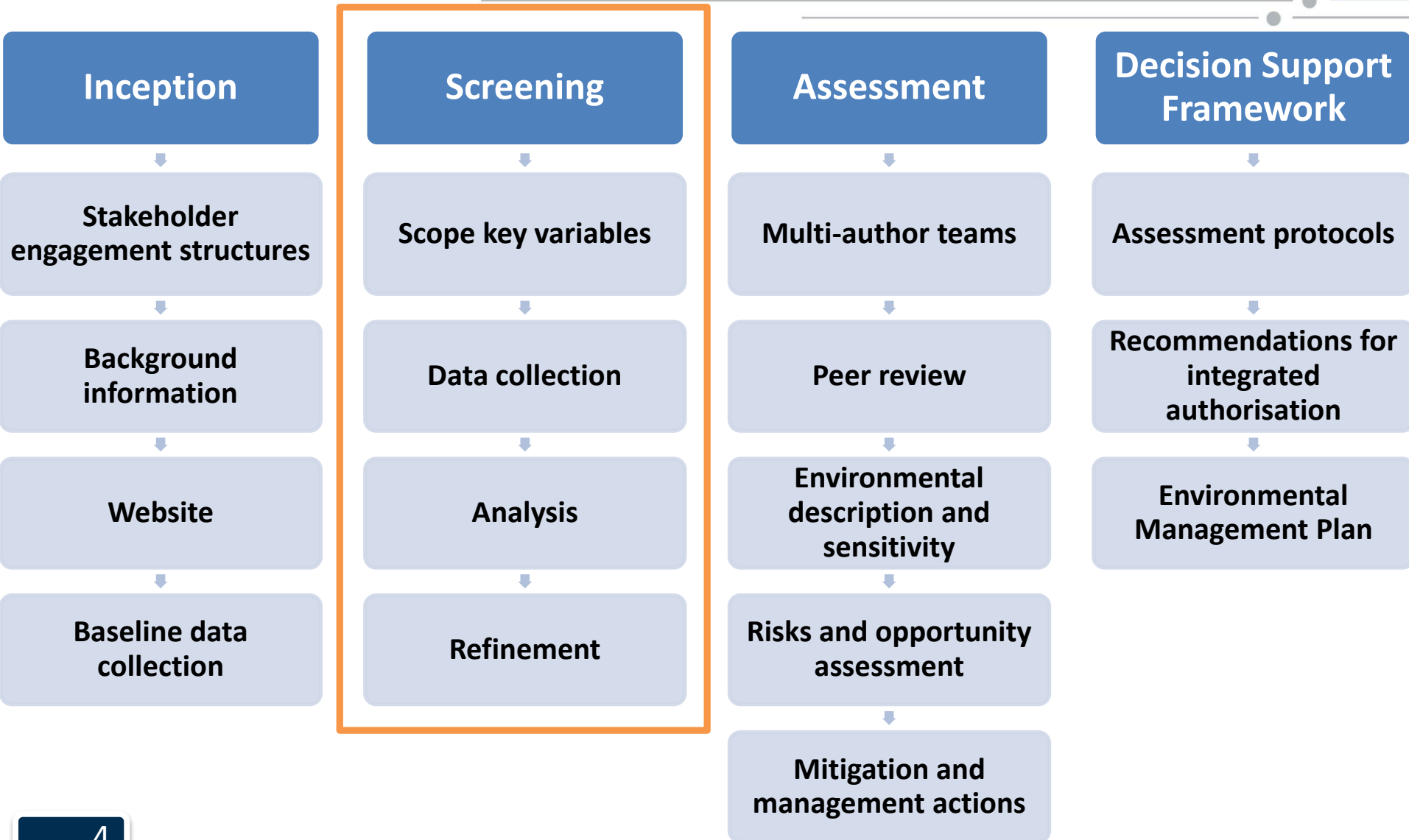


**Streamlined,
integrated
environmental
management
and regulatory
framework**



**Enabling
environment
for sustainable
and
responsible
aquaculture
development**

1. Strategic Environmental Assessment Overview



2. Screening for strategic aquaculture areas

- Identify study or “focus” areas for the SEA process.
- The study areas are based on the suitability for aquaculture using key high-level environmental and technical criteria.
- Note: Although aquaculture will not be prohibited in areas outside of these study areas, the SEA will further explore the potential to streamline or reduce regulatory requirements within these “focus” areas.

2. Screening for strategic aquaculture areas

Stakeholder engagement

Stakeholder input:

- **Project Steering Committee (PSC)**
- **Expert Reference Group (ERG)**

1.

**IDENTIFICATION OF
KEY VARIABLES AND
THRESHOLDS**

2.

GIS ANALYSIS

3.

**AREA SELECTION
AND REFINEMENT**

**Stakeholder input:
Broader participation,
including (PSC & ERG
members)**

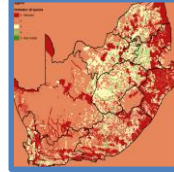
2. Screening for strategic aquaculture areas

GIS approach



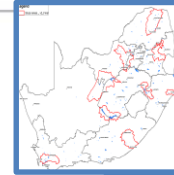
Variable identification & weighting

- Spatially explicit key variables, which would act as the input for the spatial analysis, were identified and selected in a workshop setting with stakeholders.
- Stakeholders ranked the importance of variables.



Spatial analysis

- Selected key variables were used as inputs for a weighted overlay spatial analysis using GIS software.
- The output consisted of a mosaic of “suitability” classes ranging from least suitable/restricted to most suitable.



Refinement

- Most suitable areas were extracted and refined in an iterative process with various stakeholders to produce strategic aquaculture areas.

2. Screening for strategic aquaculture areas

Key siting variable selection and weighting

Freshwater



- Proximity to major centres
- Protected Areas
- Slope
- Dams and water users
- Fish Sanctuaries
- Irrigated crops
- Stressed catchments
- Perennial rivers

Marine



- Sea surface temperature
- Marine water depth
- Proximity to launch Harbours
- Proximity to major Centres
- Protected Areas
- Coastal and inland slope
- Extreme wave height

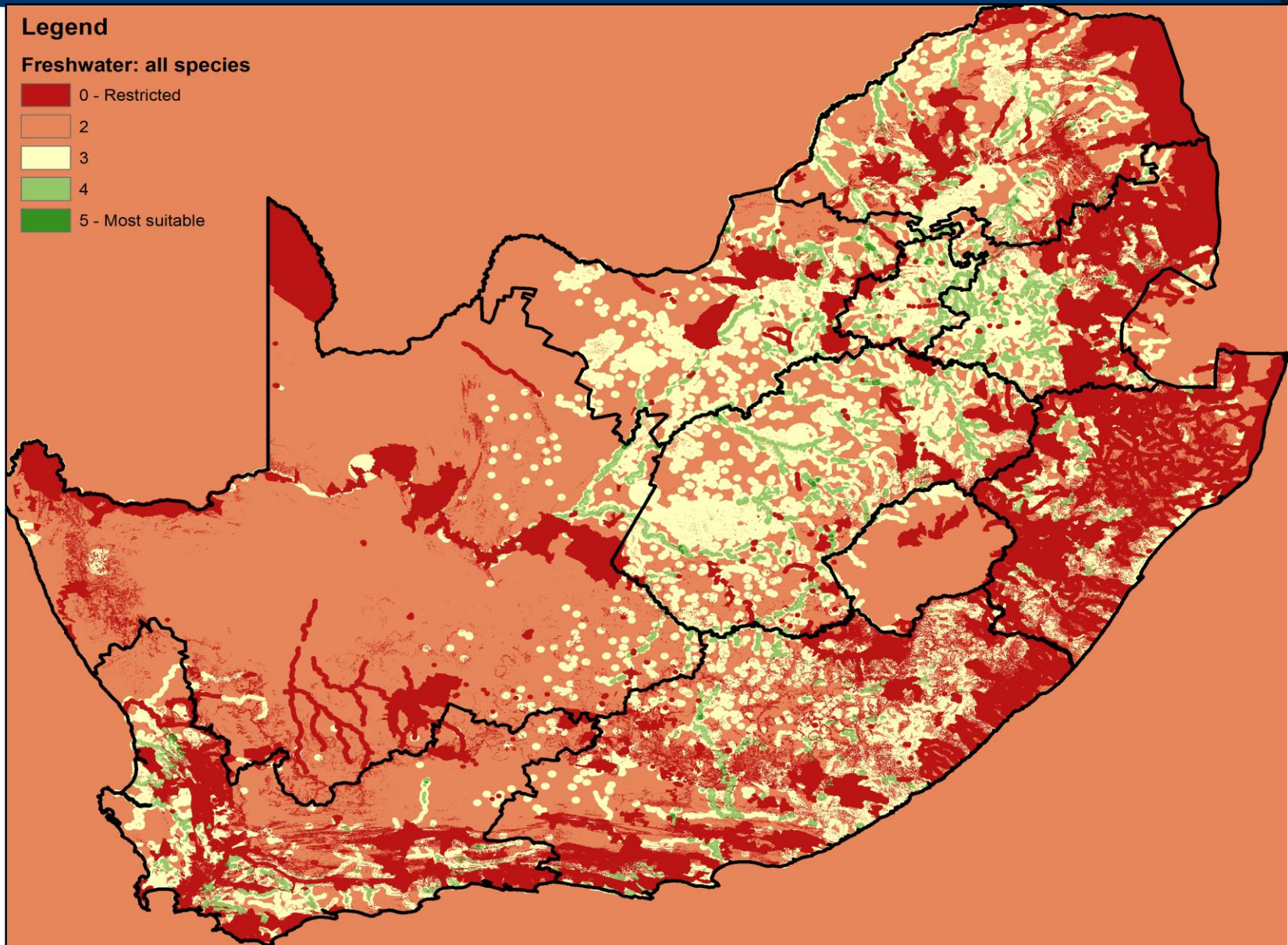
2. Screening for strategic aquaculture areas

Key siting variable selection and weighting

Feature		Rank	Weighting
Major Centres	20 km	4	5%
	No data	1	
Protected Areas	Botanical Garden/Mountain Catchment Area/Marine Protected Area/Protected Environment/Special Nature Reserve/Ramsar /National Park	Restricted	15%
	Biosphere Reserve	3	
	NPAES/Nature Reserve/Forest Nature Reserve/Forest Wilderness Area	4	
	No data	5	
Slope	> 10%	Restricted	10%
	No data	5	
Dams and dam users (3 km buffer around dams for purpose of analysis)	Biological Control	2	25%
	Divert Water	3	
	Domestic	Restricted	
	Electricity	5	
	Erosion Control	2	
	Fish Barrier	Restricted	
	Flood Control	2	
	Flow Measurement	3	
	Industrial	4	
	Irrigation	5	
	Limited Agricultural Use	5	
	Mining	2	
	Municipal	Restricted	
	Recreation	3	
	River Diversion	3	
	Stock Watering	2	
Storage	2		
No data	1		
Fish Sanctuaries	Fish sanctuaries	Restricted	2%
	No data	5	
Irrigated crops	Optimal	5	20%
	Tolerable	4	
	No data	2	
Stressed catchments	Over-exploited / stressed catchments	1	3%
	No data	5	
Perennial rivers (3 km buffer around rivers for purpose of analysis)	PES A / PES B / Flagship free-flowing	Restricted	20%
	PES C / PES D	5	
	PES > E	3	

2. Screening for strategic aquaculture areas




Weighted Overlay Analysis

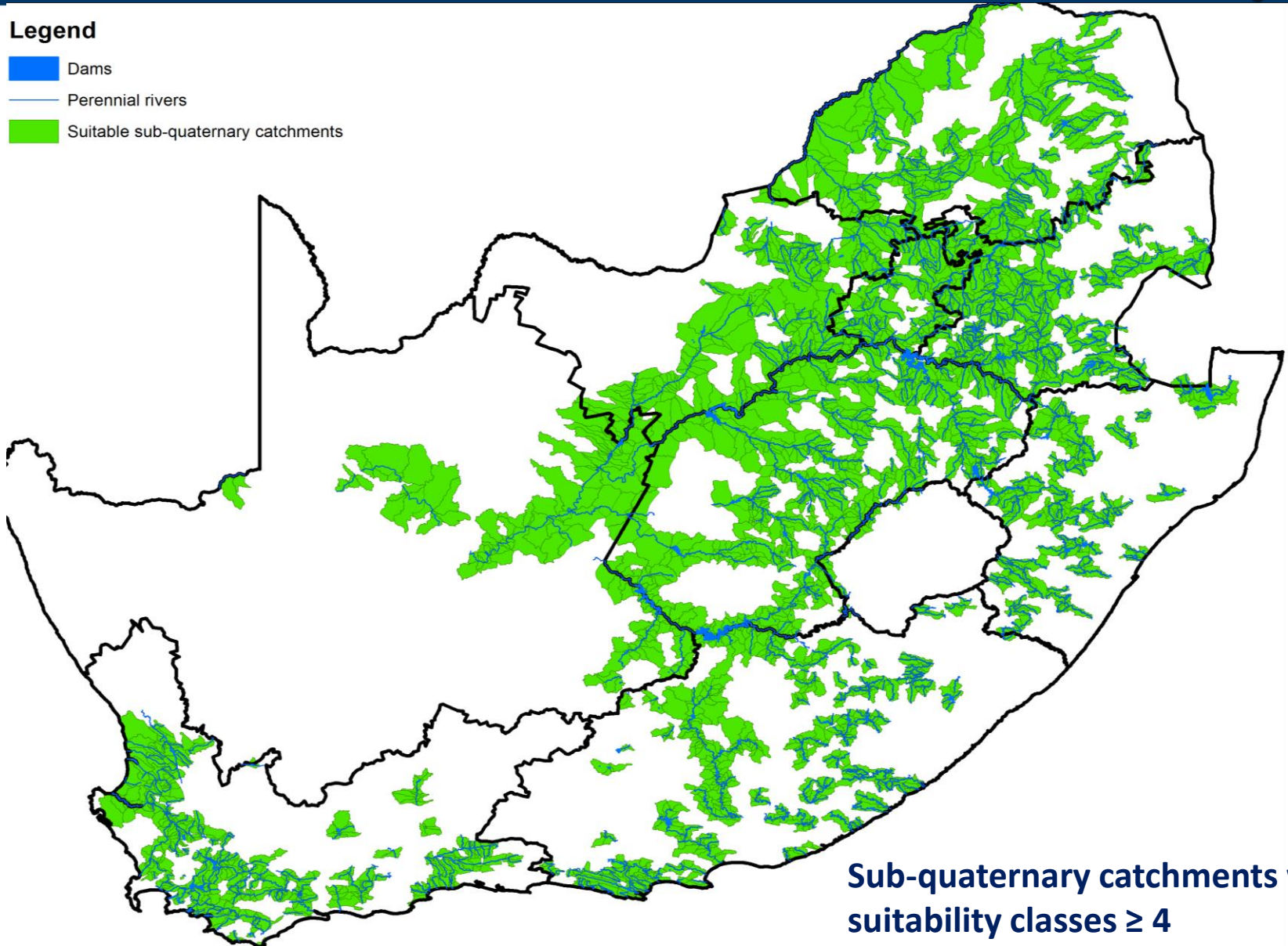


2. Screening for strategic aquaculture areas

Area selection and refinement

Legend

-  Dams
-  Perennial rivers
-  Suitable sub-quaternary catchments



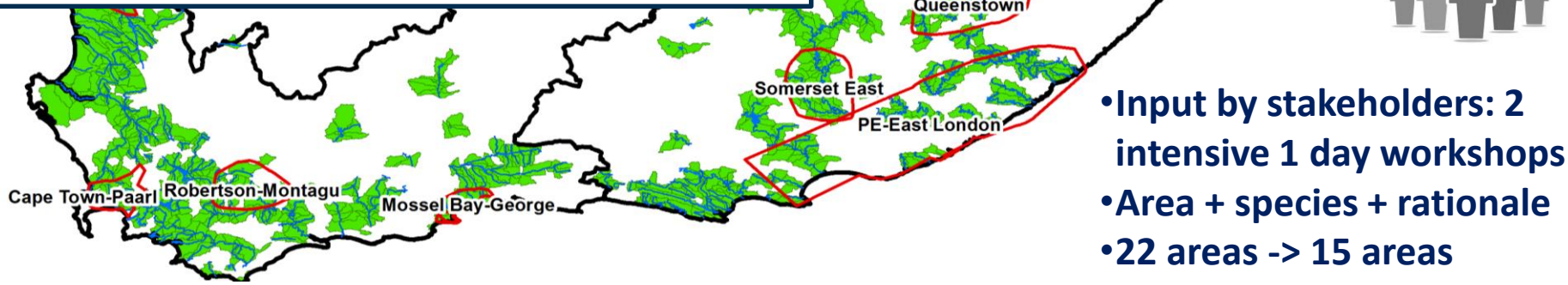
Sub-quaternary catchments with suitability classes ≥ 4

Legend

- Areas selected through stakeholder input
- Dams
- Perennial rivers
- Suitable sub-quaternary catchments

Bethlehem-Harrismith – Trout

- Highlands area with cooler climate is good for trout;
- SANBI trout mapping (Sept, 2016) shows trout is currently present in some sub-quaternary catchments in this area;
- Opportunity to employ raceways at the tunnel coming into South Africa from the Katse dam;
- Sterkfontein has been earmarked for trout (along with Vanderkloof) as an Operation Phakisa initiative.


















- Input by stakeholders: 2 intensive 1 day workshops
- Area + species + rationale
- 22 areas -> 15 areas

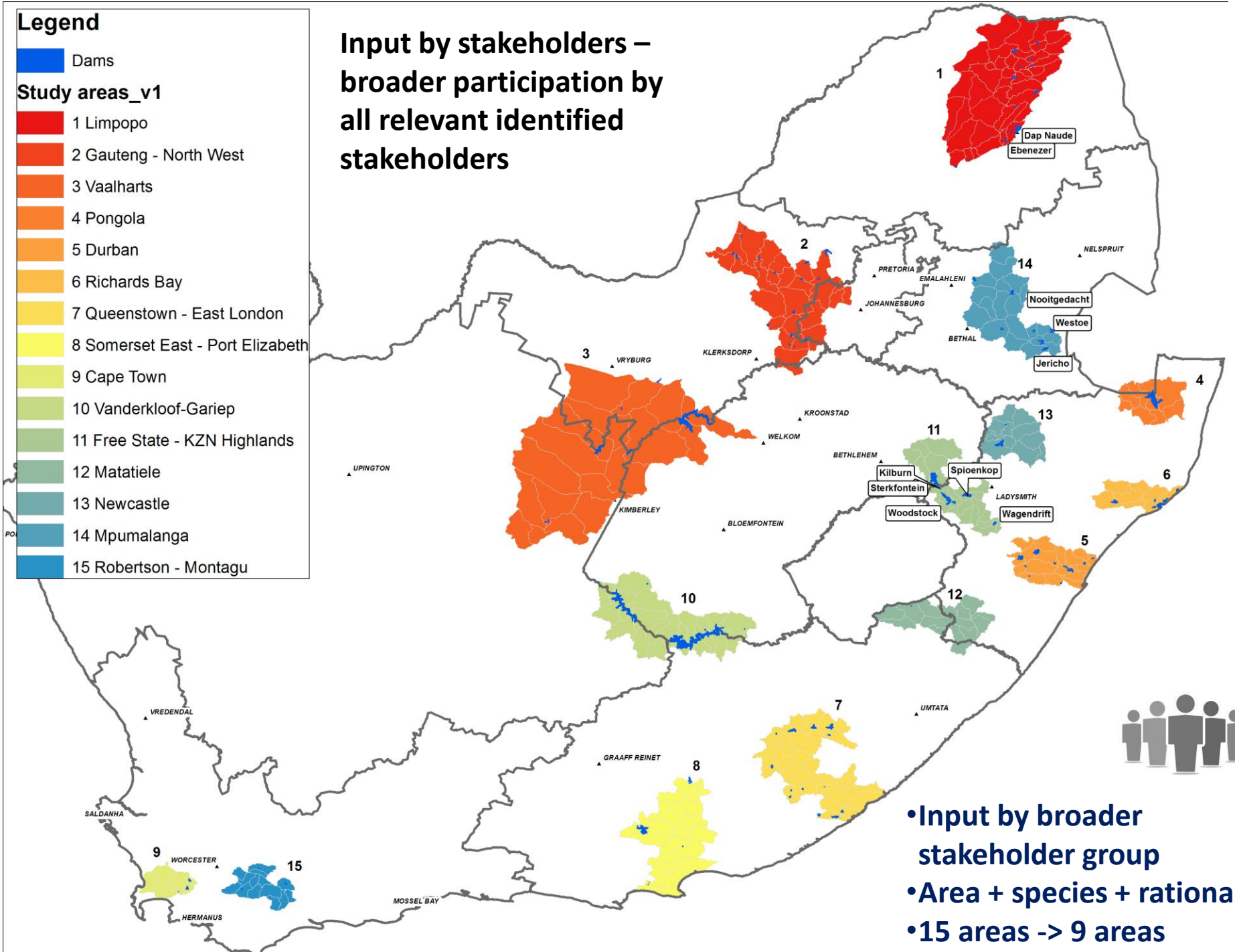
Legend

 Dams

Study areas_v1

-  1 Limpopo
-  2 Gauteng - North West
-  3 Vaalharts
-  4 Pongola
-  5 Durban
-  6 Richards Bay
-  7 Queenstown - East London
-  8 Somerset East - Port Elizabeth
-  9 Cape Town
-  10 Vanderkloof-Gariep
-  11 Free State - KZN Highlands
-  12 Matatiele
-  13 Newcastle
-  14 Mpumalanga
-  15 Robertson - Montagu

Input by stakeholders – broader participation by all relevant identified stakeholders

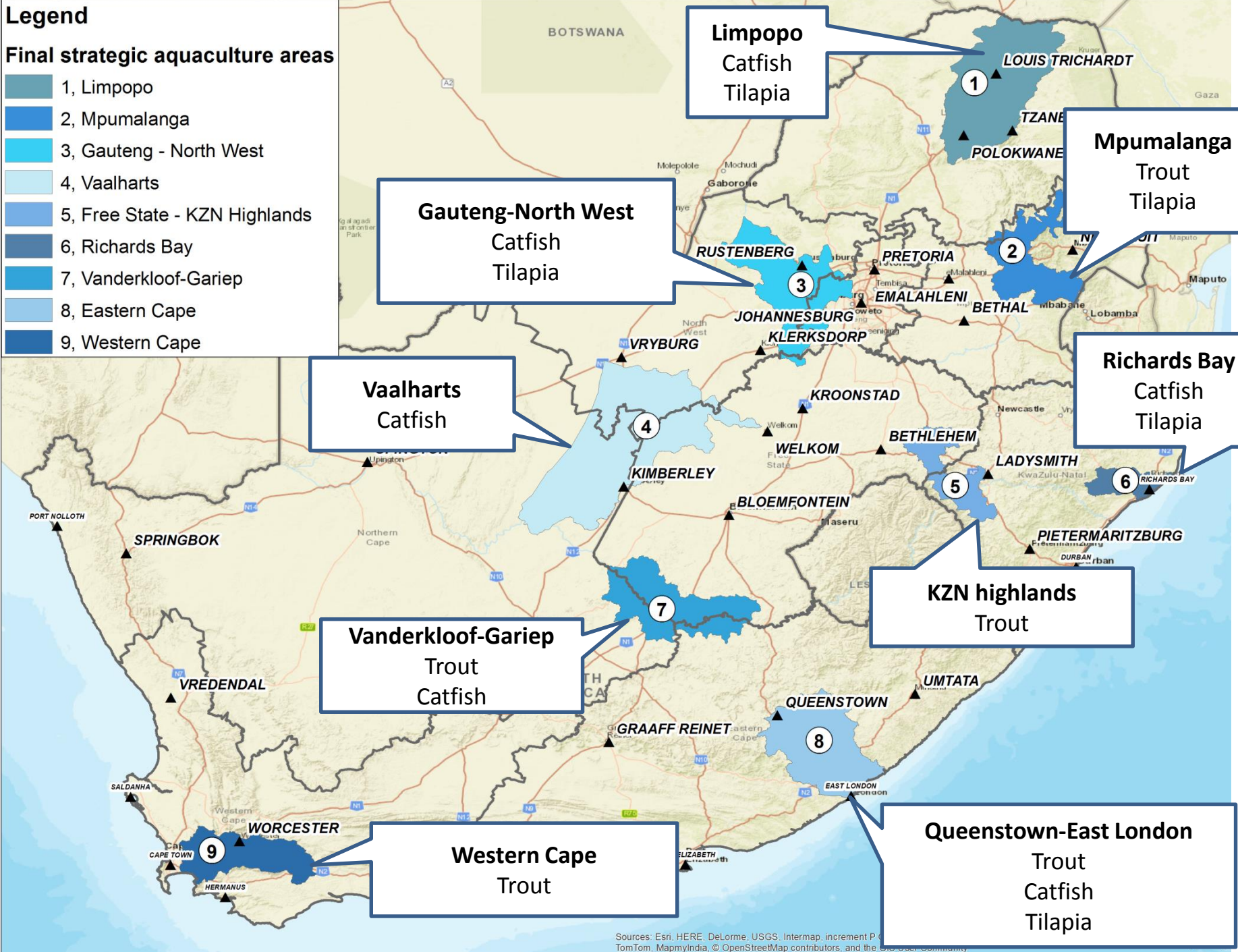


- Input by broader stakeholder group
- Area + species + rationale
- 15 areas -> 9 areas

Legend

Final strategic aquaculture areas

- 1, Limpopo
- 2, Mpumalanga
- 3, Gauteng - North West
- 4, Vaalharts
- 5, Free State - KZN Highlands
- 6, Richards Bay
- 7, Vanderkloof-Gariep
- 8, Eastern Cape
- 9, Western Cape



Limpopo
Catfish
Tilapia

Mpumalanga
Trout
Tilapia

Gauteng-North West
Catfish
Tilapia

Richards Bay
Catfish
Tilapia

Vaalharts
Catfish

KZN highlands
Trout

Vanderkloof-Gariep
Trout
Catfish

Queenstown-East London
Trout
Catfish
Tilapia

Western Cape
Trout

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P, TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

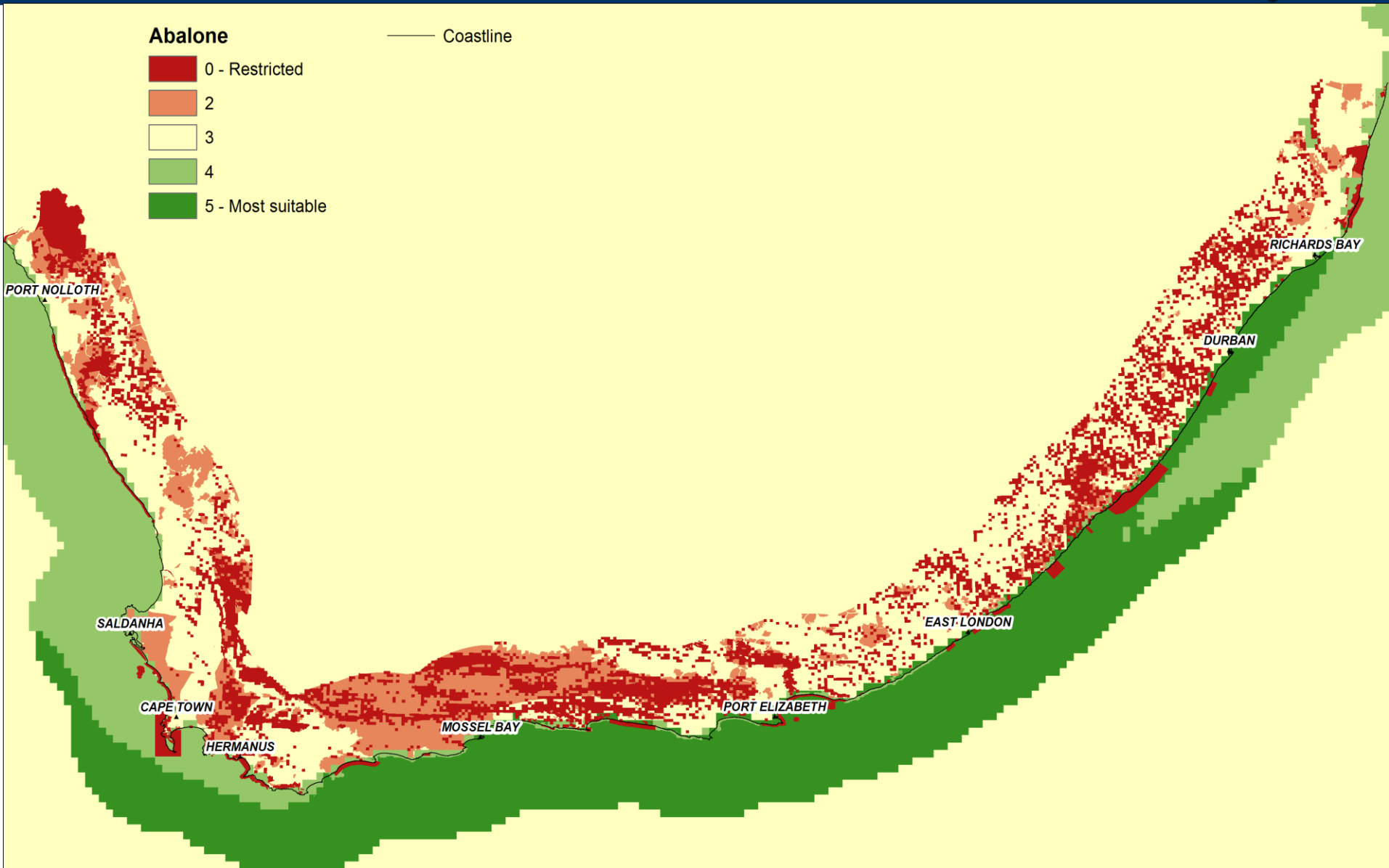
2. Screening for strategic aquaculture areas

Key siting variable selection and weighting

Feature		Rank	Weighting
Temperature	Optimal	5	50%
	Tolerance	4	
	No data	1	
Launch Harbours	10 km	5	5%
	No data	2	
Major Centres	20 km	4	5%
	No data	1	
Protected Areas	Botanical Garden/Mountain Catchment Area/Marine Protected Area/Protected Environment/Special Nature Reserve/Ramsar /National Park	Restricted	15%
	Biosphere Reserve	3	
	NPAES/Nature Reserve/Forest Nature Reserve/Forest Wilderness Area	4	
	No data	5	
Slope	> 10%	Restricted	15%
	No data	5	
Extreme wave height (1:1yr at 15 m depth)	Extreme waves < 3.5 - 3.65	5	10%
	Extreme waves < 3.65 - 4.05	4	
	Extreme waves < 4.05 - 4.35	3	
	Extreme waves < 4.35 - 4.65	2	
	Extreme waves < 4.65 - 5.75	Restricted	
	No data	4	

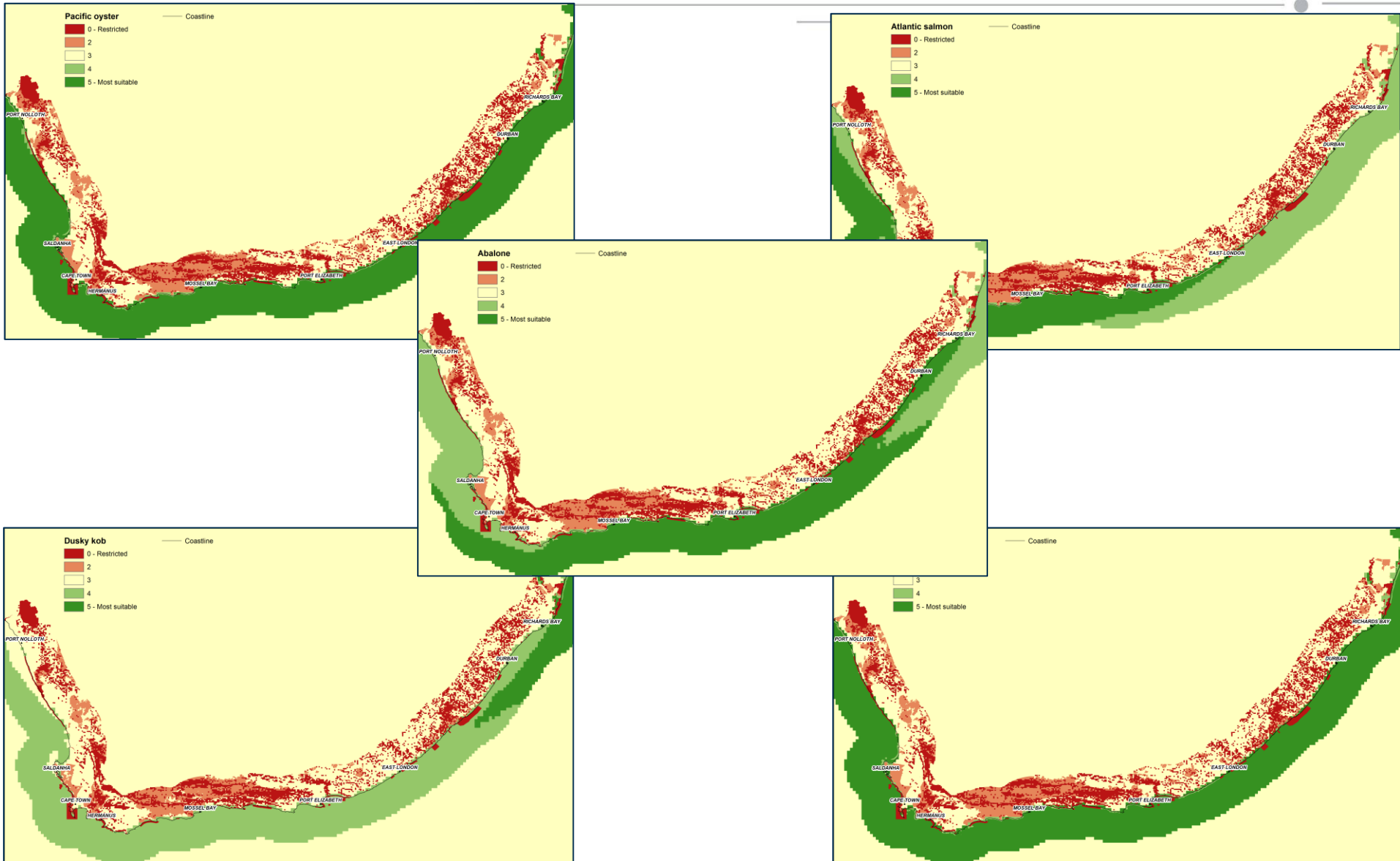
2. Screening for strategic aquaculture areas

Weighted Overlay Analysis



2. Screening for strategic aquaculture areas


Weighted Overlay Analysis



2. Screening for strategic aquaculture areas

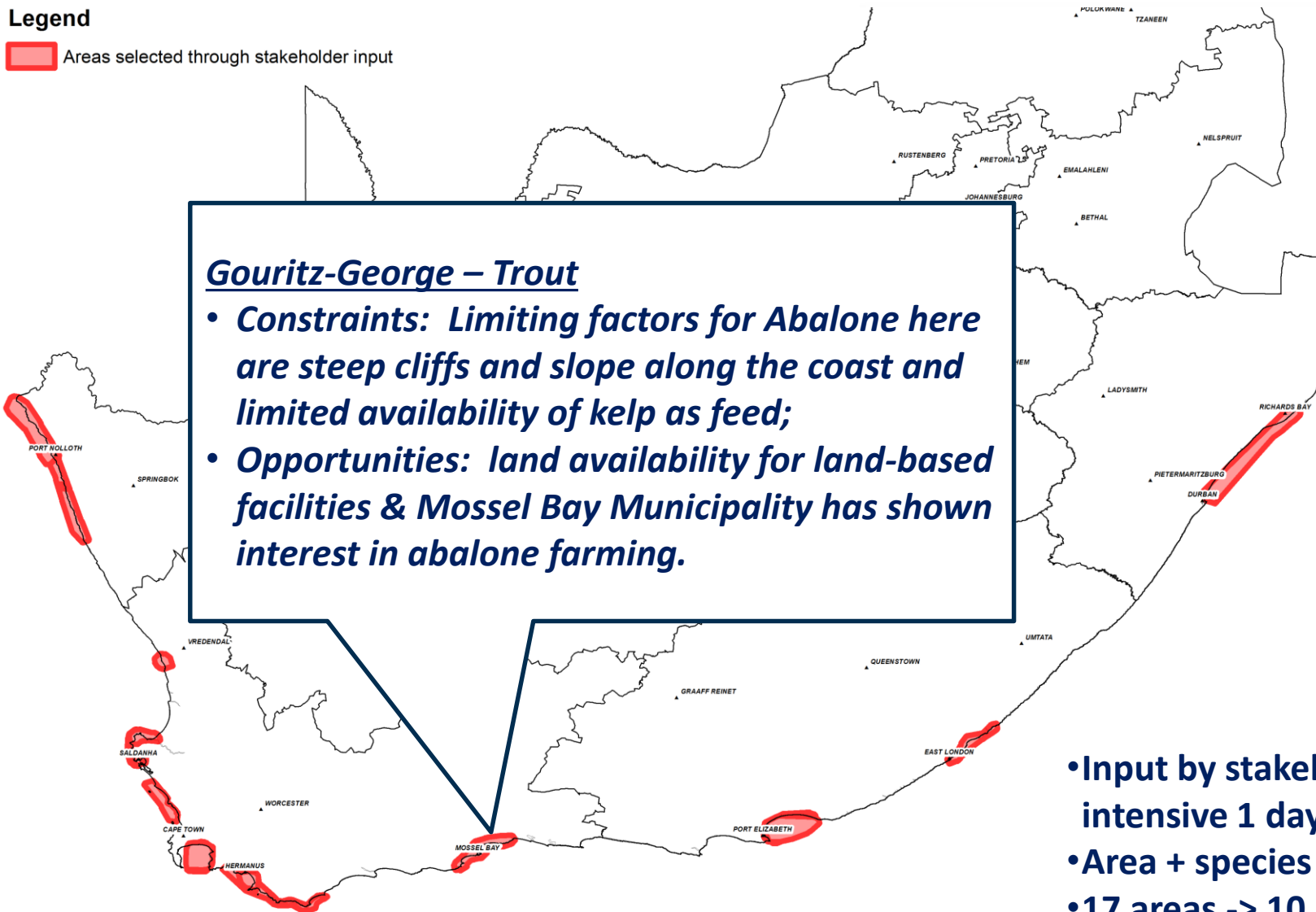
Area selection and refinement

Legend

 Areas selected through stakeholder input

Gouritz-George – Trout

- **Constraints:** Limiting factors for Abalone here are steep cliffs and slope along the coast and limited availability of kelp as feed;
- **Opportunities:** land availability for land-based facilities & Mossel Bay Municipality has shown interest in abalone farming.

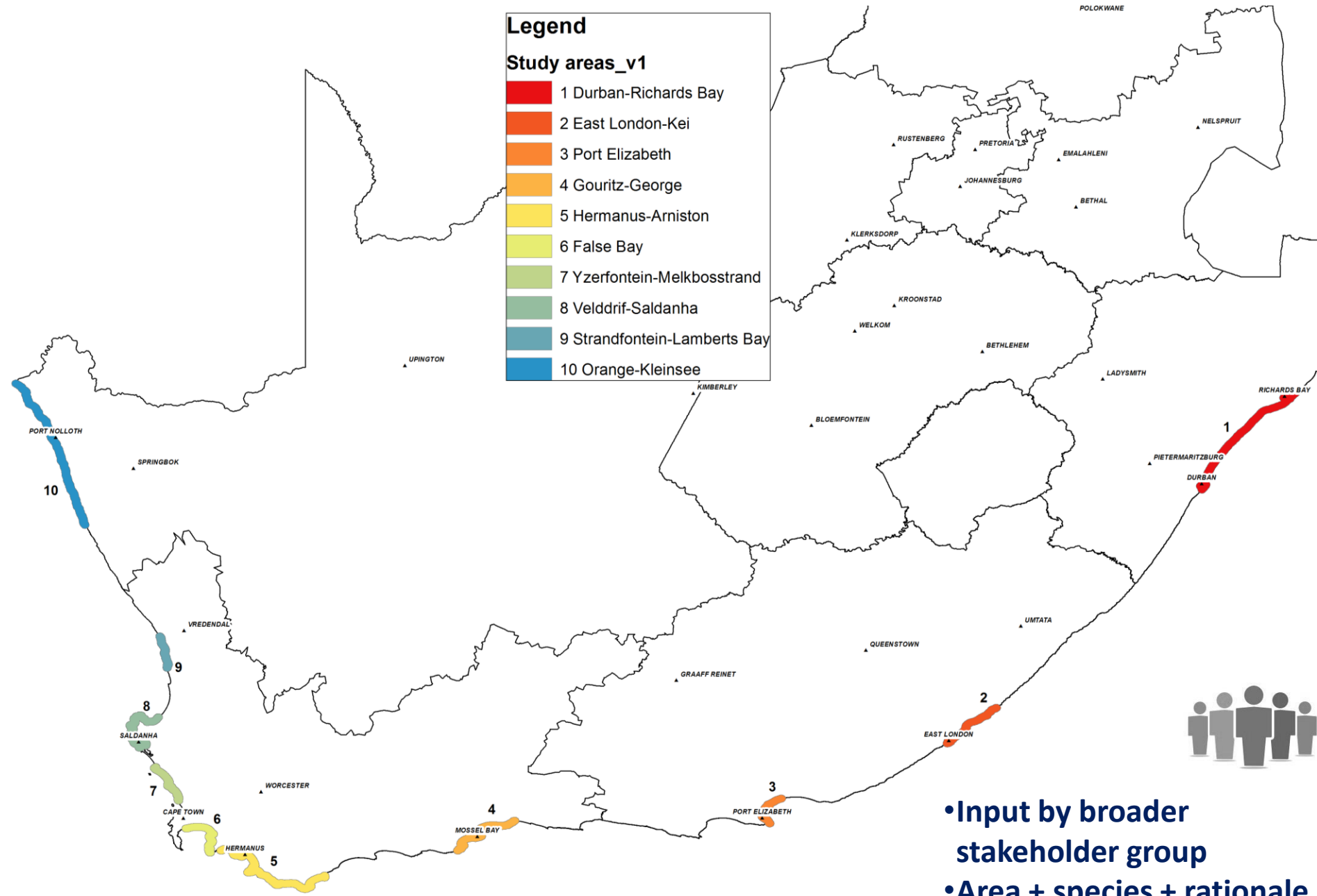


- Input by stakeholders: 2 intensive 1 day workshops
- Area + species + rationale
- 17 areas -> 10 areas

Legend

Study areas_v1

- 1 Durban-Richards Bay
- 2 East London-Kei
- 3 Port Elizabeth
- 4 Gouritz-George
- 5 Hermanus-Arniston
- 6 False Bay
- 7 Yzerfontein-Melkbosstrand
- 8 Velddrif-Saldanha
- 9 Strandfontein-Lamberts Bay
- 10 Orange-Kleinsee



- Input by broader stakeholder group
- Area + species + rationale
- 10 areas -> 8 areas

Legend

Final strategic mariculture areas

- 1, Durban-Richards Bay
- 2, East London-Kei
- 3, Port Elizabeth
- 4, Gouritz-George
- 5, Hermanus-Arniston
- 6, Velddrif-Saldanha
- 7, Strandfontein-Lamberts Bay
- 8, Orange-Hondeklip Bay



Conclusion & way forward

- **Specialist investigation**

**Biodiversity &
Ecology**

Heritage

**Visual & aesthetic
resources**

Socio-economics

Sensitivity

Impacts

**Risk &
opportunity**

**Limits of
acceptable
change**

**Best practice
guideline**

**Gaps in
knowledge**

- **Decision Support Framework**

**Assessment
processes**

Regulation

**Decision-
making process**

**Assessment
protocol**

**Monitoring
requirements**

Thank you

<http://seasgd.csir.co.za/>

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