

A Socio-Spatial Assessment of Settlement and Livelihood Conditions in Nolia Sahi, Chandrabhaga, Puri

Mona Roja Biswal¹, Swapna Sarita Swain², Shrestha Das³

¹*School of Infrastructure and Planning, Odisha University of Research and Technology*

²*School of Infrastructure and Planning, Odisha University of Research and Technology*

³*School of Infrastructure and Planning, Odisha University of Research and Technology*

Abstract - This study presents an integrated settlement and livelihood planning framework for coastal fishermen communities, using Nolia Sahi, located near Chandrabhaga in Puri, Odisha, as a primary case study. While coastal regions are vital hubs for fisheries and tourism, traditional fishing communities frequently grapple with insecure livelihoods, substandard housing, and high exposure to coastal hazards. This research investigates the socio-economic conditions, livelihood patterns, and spatial characteristics of the community. Employing a mixed-method approach—comprising primary surveys, stakeholder interactions, and spatial analysis—the study addresses the gap where livelihood and coastal regulations are often treated in isolation. The findings provide policy-level recommendations aimed at improving the economic stability and living conditions of coastal settlements in Odisha.

Key Words: coastal planning, livelihood security, Nolia Sahi, sustainable settlements, climate resilience, Odisha

1. INTRODUCTION

The coastal regions of India support a significant proportion of the population through traditional fishing-based livelihoods [1]. In Odisha, these coastal fishing communities are among the most vulnerable social groups due to their heavy dependence on natural resources and high exposure to climatic risks. Rapid development in coastal tourism, coupled with environmental degradation and hazards such as cyclones, coastal erosion, and sea-level rise, has intensified the socio-economic challenges faced by these communities [2].

Nolia Sahi, located near the Chandrabhaga coast in Puri district, represents a traditional fishermen's settlement situated within an ecologically sensitive and tourism-influenced coastal zone [1]. Despite its proximity to

major tourist destinations, the settlement faces persistent issues, including poor housing quality, inadequate infrastructure, and limited integration with formal planning frameworks [2]. The absence of an integrated planning approach that addresses both settlement development and livelihood sustainability remains a primary cause of community vulnerability.

1.1 NEED OF THE STUDY

Fishermen communities in coastal Odisha are often excluded from mainstream urban and regional planning processes. Development interventions largely focus on tourism promotion and coastal infrastructure, while the socio-spatial needs of traditional fishing settlements remain inadequately addressed. There is a critical need to study the existing settlement structure, infrastructure gaps, livelihood patterns, and institutional support mechanisms affecting the fishermen communities.

This study aims to address the lack of integrated planning strategies that simultaneously enhance living conditions, livelihood security, and climate resilience for coastal fishermen settlements. The findings can contribute to inclusive coastal planning practices that align with the Sustainable Development Goals and coastal regulation norms.

1.2 STUDY AREA



Fig. 1: Block-wise district map of Puri highlighting fishermen dominant blocks



Fig. 2: Fishermen community of Chandrabhaga, Konark, Gop Block

Nolia Sahi is a traditional fishermen's settlement located near Chandrabhaga beach in Puri district. The settlement lies in proximity to the coastline and falls predominantly under CRZ-III, characterised by relatively undisturbed rural and traditional settlements, with certain adjoining areas influenced by tourism-related activities. The location exposes the settlement to direct impacts of coastal processes, while also placing it within a rapidly transforming tourism zone.

The settlement is primarily inhabited by traditional fishing households whose livelihoods depend on marine fishing and allied activities such as fish processing, net making, and local fish vending. The spatial structure of Nolia Sahi is organic and compact, comprising closely spaced dwelling units, narrow internal access paths, and limited provision of basic infrastructure such as drainage, sanitation, solid waste management, and organised water supply.

Housing structures are largely semi-permanent and temporary in nature, making them highly susceptible to cyclonic winds, tidal inundation, and coastal flooding. Development restrictions under CRZ regulations, coupled with limited institutional support, have constrained formal settlement upgradation. Additionally, increasing tourism activity around Chandrabhaga has led to competing land use demands and rising land values, further marginalising the fishermen community.

Despite its strategic coastal location, Bali Nolia Sahi remains inadequately integrated into statutory planning frameworks. The settlement, therefore, presents a suitable case to study coastal settlement vulnerability and to formulate integrated planning strategies addressing housing, infrastructure, livelihood security, and climate resilience for fishermen communities.

2. FISHERIES AND FISHERMEN

According to the **Odisha Economic Survey (2025–26)**, the state produced approximately 11.92 lakh metric tonnes of fish in 2024–25, ranking fourth in India. Marine fisheries contribute nearly 20% of this production. However, field data indicate that the income of small-scale fishermen has not increased proportionately to production, pointing to structural issues like market dependency and lack of local value addition.

An empirical study by Badapanda (2007) introduced the Coastal Vulnerability Index (CVI) to quantify risks such as shoreline change and cyclone exposure. While this provides a macro-level assessment, a research gap exists in translating these hazards into micro-level settlement planning and spatial solutions for individual communities.

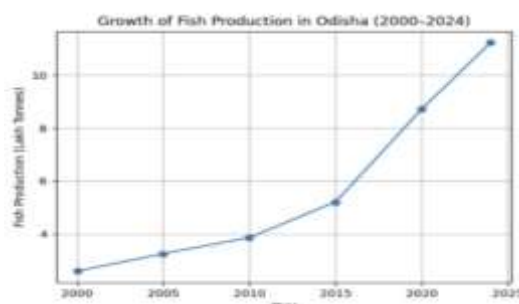


Fig -3: Fish production growth

Table -1:

ECONOMIC VALUE OF FISHERIES:

Year	Estimated Value
2005	₹6,300–8,400 million
2010	₹8,900–10,000 million
2011	₹10,052 million

EXPORT CONTRIBUTION GROWTH:

Year	Export Value
2000–01	₹379 crore
2021–22	₹4,526 crore
2024–25	~₹4,710 crore

Table -2:

FISHERMEN INCOME (BASED ON STUDIES):

Year Range	Average Monthly Income
2000–2005	₹3,000 – ₹5,000
2005–2010	₹5,000 – ₹8,000
2010–2015	₹8,000 – ₹12,000
2015–2020	₹12,000 – ₹18,000
2020–2025	₹15,000 – ₹25,000

2.1 METHODOLOGY & PLANNING FRAMEWORK

The study proposes an integrated framework across three pillars:

- **Settlement Upgradation:** Mapping housing layouts and infrastructure gaps (water, sanitation, drainage) to propose cyclone-resilient housing and organised spaces for fishing activities.
- **Livelihood Improvement:** Analysing the value chain from catch to market to identify needs for cold storage and tourism-related off-season jobs.
- **Climate Resilience:** Utilising hazard mapping to design evacuation routes, elevated structures, and coastal vegetation buffers.



Fig -4: Methodology

2.2 FISHING COMMUNITIES AND LIVELIHOOD SYSTEMS

The coastal district of Puri District is one of the major marine fishing regions of Odisha, having a coastline of about 155 km along the Bay of Bengal and supports a large number of fishing settlements and traditional fishermen communities. The district has an area of district is 3479 sq. km with a population of 1,698,730 as per the *Census, 2011*.

Below are the seasonal calendar and their daily livelihood activities. Also 61-day fishing ban for fish breeding and stock regeneration.

Table -3:

TIME	DAILY ACTIVITIES
2:30 – 3:30 AM	Preparation of nets, fuel, ice, and boat
3:30 – 4:00 AM	Departure to sea
4:00 – 10:00 AM	Fishing activity in the sea
10:00 – 11:30 AM	Return to shore and fish landing
11:30 – 1:00 PM	Sorting and selling fish at landing center
Afternoon	Net repairing, boat maintenance
Evening	Fish trading / preparation for next day

Fig -5: Seasonal Calendar

Source: Primary

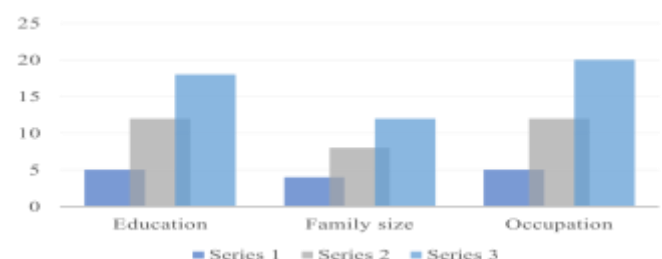
3. DATA COLLECTION AND ANALYSIS

The site is located near Chandrabhaga Beach, which falls under the CRZ Zone III of the Puri-Konark Development Authority (PKDA). The total number of fishermen households is 1155, and each household comprises 6-8 members. They mostly have joint families, and some are nuclear.

3.1 GENERAL HOUSEHOLD ANALYSIS

The surveyed households show a mix of age groups, with a significant portion belonging to the working-age population. Family sizes are generally medium to large, indicating dependency pressure on earning members. Education levels are predominantly low to moderate, with limited access to higher education. A majority of households are native residents and belong to traditional fishing families, reflecting strong occupational continuity.

Chart no: 1



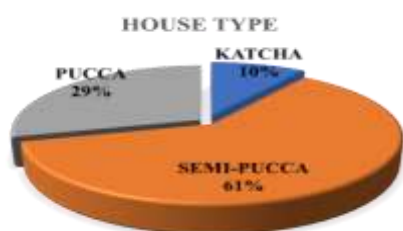
Source: Primary

There are nearby schools for children, those are Ratna school, Bharat Seba Ashram, Anganwadi school. Girls of Nolia Sahi are more educated than the boys, even use to study upto 10th standard. One of the main causes behind this is that the boys are generally engaged in fishing from 10 years of age. Most of the fishermen are illiterate and some have read up to 5th standard. A fewer number of boys study up to 10th standard.

3.2 HOUSING AND SETTLEMENT ANALYSIS

The settlement consists of a mix of kutchha, semi-pucca, and pucca houses, indicating varying levels of structural stability. A majority of households have experienced cyclone impacts, particularly during events like Fani, highlighting high exposure to coastal hazards. Although road access and drainage are relatively adequate, perceived safety during cyclones remains a concern.

Chart no: 2

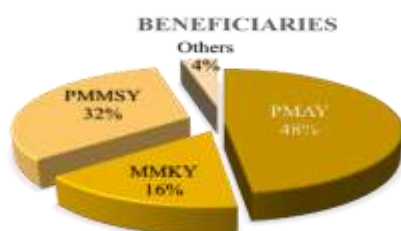


Source: Primary

3.3 BASIC SERVICES AND SCHEMES

Basic services such as drinking water, electricity, and toilets are available but vary in quality and accessibility. While some households benefit from government schemes like – PMAY (Pradhan Mantri Awas Yojana), MMMKY (Mukhya Mantri Maschyajibi Kalyan Yojana), PMMSY (Pradhan Mantri Maschya Sampada Yojana), awareness and coverage remain inconsistent.

Chart no: 3



Source: Primary

3.4 SPACE AND ACTIVITY USE

Fishing-related activities such as net and fish drying are carried out near individual houses due to lack of designated spaces. Although some households report sufficient space, the absence of government-provided drying yards leads to un-organized usage of residential areas



Fig -6: Space and activity use

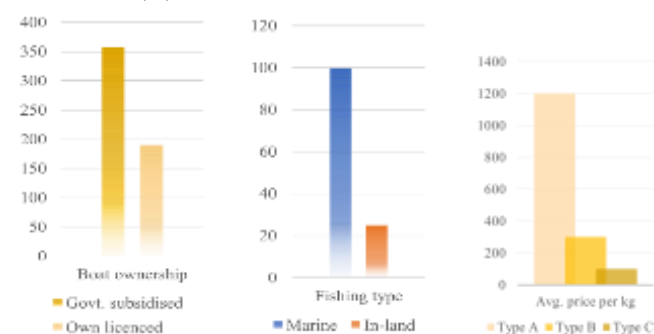


Fig -7: Space and activity use

3.5 LIVELIHOOD AND OCCUPATION

Fishing remains the dominant occupation, with limited diversification into alternative income sources. Marine fishing is prevalent, supported by owned boats, and activities are carried out either daily or seasonally depending on conditions.

Chart no: 4,5,6



3.6 INFRASTRUCTURE & WOMEN INVOLVEMENT

Women play a significant role in post-harvest activities such as drying, processing, and selling fish. However, their contribution remains informal and limited to traditional roles, with no significant engagement in alternative occupations. The absence of cold storage and dry storage facilities creates significant challenges in preserving fish quality. Although fish processing activities are present and women are highly involved, infrastructure support is inadequate. Storage-related issues directly impact income and efficiency.



Fig -8: Women involvement in fish cleaning & processing



Fig -9: Fish drying space

3.7 SEASONAL AVAILABILITY OF FISH SPECIES

Among all coastal blocks studied, Puri-Sadar (Pentakatha) achieves the highest income due to access to mechanized fish processing, preservation equipment, and cooperative market channels. Nolia Sahi lags behind mainly due to the absence of storage infrastructure and dependency on traditional drying methods. Upgrading fish processing and establishing small-scale cold storage

or cooperative collection facilities would significantly enhance income stability and reduce post-harvest losses.

Table -4:

Table 4.3: COMPARATIVE ANALYSIS OF FISH PROCESSING TECHNIQUES AND INCOME GENERATION AMONG THE 5 FISHERMEN DOMINANT BLOCKS				
BLOCK	FISH PROCESSING TECHNIQUES	EQUIPMENT USED	STORAGE FACILITIES	AVG. ANNUAL INCOME FROM FISHERIES (₹)
KRISHNAAPURAD	Traditional fish drying and smoking; some mechanized processing near Cuttika	Drying racks, bamboo mats, smoking kilns	Limited cold storage; dependence on open air drying	2.8 - 3.1 lakh per household
BEAMRAGIRI	Manual sorting, icing, and semi-mechanized filtering for marine fish	Ice boxes, wooden cutting boards, small chillers	Community ice plant functioning seasonally	2.8 - 3.5 lakh per household
PURISADAR (PENTAKATHA)	Mechanized fish curing, smoking, and packaging	Electric smokers, sealing units, insulated trucks	Functional cold storage and cooperative units	3.8 - 4.5 lakh per household
AKTARANG	Dry fish processing and local market sale	Bamboo racks, open-drying yards	No cold storage; shared sheds for drying	1.8 - 2.3 lakh per household
NOLIA SAHI (CHANDRABAGA DISTRICT)	Manual cleaning, sun-drying and small-scale fish sale	Iron knives, bamboo mats, plastic tubs	Cold and dry storage both needed	2.0 - 2.6 lakh per household

Chart no: 7

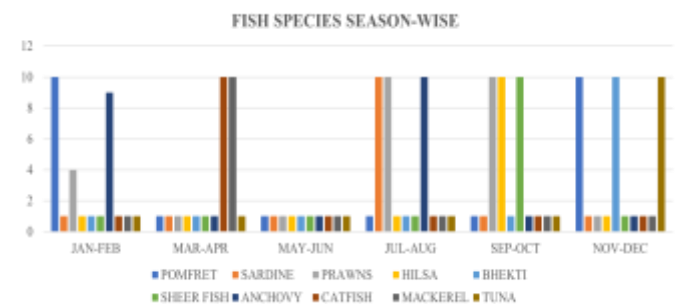


Table -5:

Table 3.8: FISH SPECIES, SEASONAL AVAILABILITY, AND INCOME CONTRIBUTION					
MONTH/SEASON	Topmost Fish Species	Category (Marine / Inshore)	Average Local Price (₹/Kg)	Major Buyers / Market Linkages	Income Contribution (%)
JAN-FEB	Pomfret, Anchovy	Marine	380-450	Local market & cold-chain vendors (Puri)	18
MAR-APR	Mackerel, Catfish	Marine	220-300	Middlemen traders	12
MAY-JUN	Fishing Ban (Breeding Season)	—	—	—	—
JUL-AUG	Sardine, Anchovy, Prawns	Marine / Brackish	150-350	Nearby beach markets	10
SEP-OCT	Hilsa, Seer Fish, Prawn	Marine	500-750	Wholesale buyers (Puri-Konark route)	25
NOV-DEC	Tuna, Bhetki, Pomfret	Marine	400-550	Local markets & tourism sector demand	20
ANNUAL AVERAGE	—	—	—	—	100

3.8 INCOME ANALYSIS

High value fish such as hilsa, seer fish and pomfret dominate the income profile despite lower catch percentages, while low-priced species like sardine and mackerel form the bulk of total volume but yield limited profit margins. Market linkage and value addition (dry fish packaging, frozen fish export chains) can potentially double income levels.

Chart no: 8

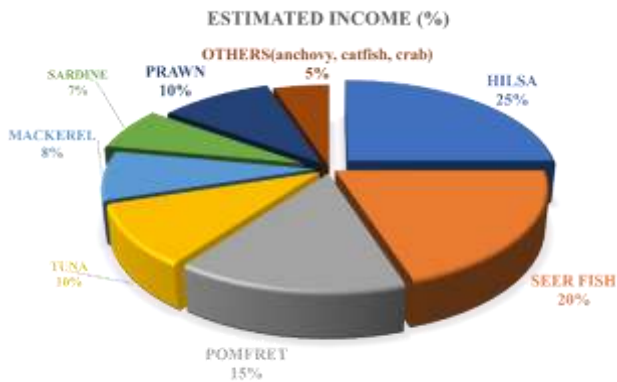


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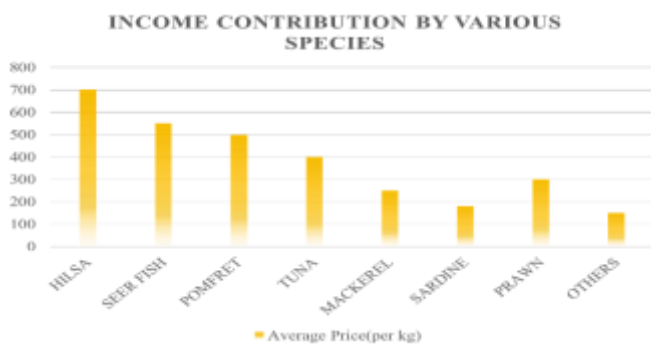
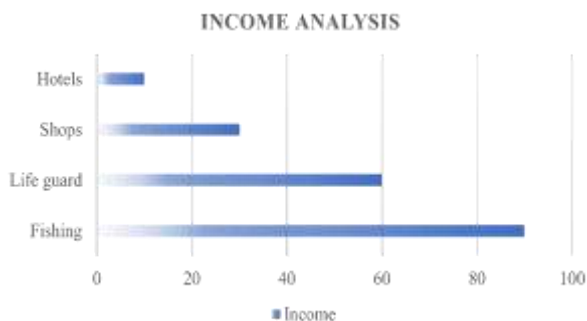


Chart no: 10



Chart no: 11



3.9 VALUE-CHAIN & MIDDLE-MEN

Fish sale primarily occurs near the shore, reducing transportation time but limiting access to larger markets. The involvement of middlemen in price determination reduces fishermen's control over income. Same-day

selling indicates lack of storage facilities, forcing immediate disposal or drying of unsold fish.



Fig -10: Fish selling and auctioning

3.10 DISASTER IMPACT SAFETY

The Coastal Regulation Zone Notification issued by the Government of India under the Environment Protection Act 1986 to control and manage development activities along the coastal areas of the country.

- CRZ-I: Ecologically sensitive areas (mangroves, coral reefs) development is highly restricted.
- CRZ-II: Developed urban coastal areas (existing buildings close to the shoreline).
- CRZ-III: Relatively undisturbed rural coastal areas, including traditional fishing villages.
- CRZ-IV: Coastal water areas Territorial waters & tidal water bodies.



Fig -11: CRZ zones of Nolia Sahi, Chandrabhaga

Access to cyclone shelters and evacuation routes exists but may not be adequate or easily accessible for all households. Distance to shelters and awareness levels vary. The community is frequently exposed to hazards such as cyclones and flooding. These events significantly impact housing, livelihood, and fishing equipment. Though there was sufficient funding from the government for boats and houses (GAIS- Group Accidental Insurance Scheme).

Table -6:

Table 3.11.2: MAJOR CYCLONES IN 3 DECADES				
YEAR	CYCLONE	CATEGORY / INTENSITY	APPROX. WIND SPEED	RELATIVE SEVERITY
1999	Odisha Super Cyclone	Super Cyclonic Storm (Cat-V)	260-270 km/h	Extreme
2013	Phailin	Extremely Severe Cyclonic Storm	205-220 km/h	Very High
2014	Hudhud	Extremely Severe Cyclonic Storm	180-190 km/h	Moderate
2018	Titli	Very Severe Cyclonic Storm	140-150 km/h	Moderate
2019	Fani	Extremely Severe Cyclonic Storm	200-215 km/h	Most Devastating in Recent Years
2019	Bulbul	Very Severe Cyclonic Storm	110-120 km/h	Low
2020	Amphan	Super Cyclonic Storm	155-165 km/h	Moderate
2021	Yaas	Very Severe Cyclonic Storm	130-150 km/h	High

Source: Secondary Data- department of Fisheries, Odisha
Primary Survey, 2026

Chart no: 12



4. RECOMMENDATIONS

COMMUNITY NEEDS & SUGGESTIONS

- Infrastructure: Demand For Fish Landing Center and Improved Basic Facilities
- Settlement Issues: Poor Maintenance and Lack of Organized Spaces
- Livelihood Support: Need For Income Stability and Better Market Access
- Suggested Improvements: Digital Awareness (E.G., Sagar Kavach), Infrastructure Upgrade

The younger generation shows relevant interest in continuing the tradition of their family yet some show a shift away from traditional fishing, with interest in alternative occupations such as life-guard and service-based jobs. Skill development and training opportunities are strongly demanded, indicating a transition in livelihood preferences.

4.1 PROPOSAL

4.1.1 COMMUNITY FISH PROCESSING & STORAGE HUB

A mini community-scale cold storage, solar-assisted colling system and ice storage chamber to preserve

unsold fish, avoid distress selling, stabilize prices and increase bargaining power.

Currently the unsold fish are dried near their houses and roadside which can be replaced by raised bamboo or steel drying platforms, covered solar drying sheds, segregated drying spaces and hygienic processing zone.

As women are highly involved in the fish processing activities facilities like fish cleaning tables, cutting equipment, packaging unit, drying chamber, storage racks and a proper training hall is necessary.

4.1.2 FISH LANDING CENTER

A Fish Landing Center is a coastal infrastructure facility developed for the safe landing, handling, sorting, storage, auctioning, and transportation of fish catch brought by fishermen from marine fishing activities to enhance income security and reduce post-harvest losses among the fishermen community of Nolia Sahi, Chandrabhaga.

4.1.3 REDUCING MIDDLEMEN EXPLOITATION

We cannot remove the involvement of middlemen completely as they are a part of the fish supply chain. Instead, we can propose a Transparent Fish Marketing System that will include:

- Fish cooperative Society (collective selling, price negotiation, bulk transport, shared storage)
- Digital Fish price display board to reduce price manipulation
- Mobile-based Fish Auction System where buyers can pre-order and fishermen will know the market rate.
- Government Benchmark Pricing

District Fisheries Department should publish minimum benchmark fish prices, species-wise rates and seasonal market value that will improve the fisheries market mechanism as well as help in the economic upliftment of the Nolia Sahi.

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BIOGRAPHIES



Mona Roja Biswal is an Architect and a student of Urban and Regional Planning at Odisha University of Technology and Research in Bhubaneswar. Inclusive planning and sustainable livelihoods are areas of interest. She loves reading and likes to explore.