

The Pacific is the largest ocean on Earth, occupying about one-third of the planet. This large body of water has important influences on, and interactions with, the global climate system. The strongest of these influences originates in the tropics as the El Niño - Southern Oscillation (ENSO). The North Pacific Ocean occupies 20% of the Pacific, with an average depth of 4,270 m and trenches descending to 10,924 m. It is the terminus of the oceanic "conveyor-belt" circulation system that starts in the Northwest Atlantic and winds its way through the Atlantic and Indian Oceans before ending up in the Gulf of Alaska. The result is that the Northeast Pacific Ocean contains some of the oldest water in the world.

introduction

Living marine resources in the North Pacific Ocean have been observed and used by coastal peoples and early seafarers for thousands of years, but (what has evolved to be called) scientific methods of investigation began during the European explorations of the 18th century. Understanding what used to live, what lives now, and what may live in a future North Pacific Ocean is not only critical for sustainable use by humans – but also for sustaining the present functioning of our planet, since the North Pacific Ocean comprises such a large proportion of the Earth’s surface. Understanding what lives there is critical to knowing how its ecosystems are structured, how they function, and how they may change in response to stresses – both natural and human-induced.

This report provides a broad overview of what we know, what we do not yet know, and what may be unknowable about marine life in the North Pacific Ocean. Its objectives are to:

- Consider what is “known” about marine life; to provide an overview, rather than a comprehensive inventory;
- Identify the critical “unknowns” of marine life and to assess what might be changed from “unknowns” into “knowns” with appropriate research;
- Consider what might be fundamentally “unknowable” about marine life in the North Pacific Ocean.

Marine life in the North Pacific Ocean can be examined in a number of ways. Size is often the simplest organisational scheme, ranging from smaller to larger organisms, but size is also a good biological scheme since, in general, smaller organisms are eaten by progressively larger organisms in the ocean. The major groups that are considered in this report are listed in Table 1 and are ordered roughly by increasing size. In general terms, “plankton” are organisms that tend to drift with ocean currents, and are divided into three types: bacteria, plant (“phyto”) plankton, and animal (“zoo”) plankton; “benthos” are organisms that live most of their lives on the sea bottom. An important distinction can also be made between coastal and oceanic regions of the North Pacific Ocean, with “coastal” including organisms that live from the seashore to the edge of the continental shelf (200 m deep).

[Table 1] Major groups of marine life in the North Pacific Ocean.

bacterioplankton
small phytoplankton
large phytoplankton
small zooplankton
large zooplankton
gelatinous plankton
benthos
non-exploited fish & invertebrates
exploited fish & invertebrates
seabirds
marine mammals

To understand what lives where in the North Pacific Ocean and how its ecosystems are changing, information is needed on important characteristics of these major groups. In general terms, the required information can be broadly categorised as either “core census” or “function-related.”

“Core census” information

Taxonomy (morphological, genetic, functional)

- have most, if not all, species been described?
- are catalogues, keys, or voucher specimens available?
- are taxonomic relationships among groups known?

Geographic distribution

- are general distributions known for major taxonomic groups (plankton) or for individual species of higher trophic level animals?
- can their general distributions be mapped?
- can their general habitats be described?

Abundance and biomass

- are indicators or estimates of abundance or biomass available?
- are relative abundances of major groups or species known?

“Function-related” information

Life history

- are basic life histories known for major groups or species?
- are estimates of basic life history parameters such as growth and fecundity available for major groups?

Productivity

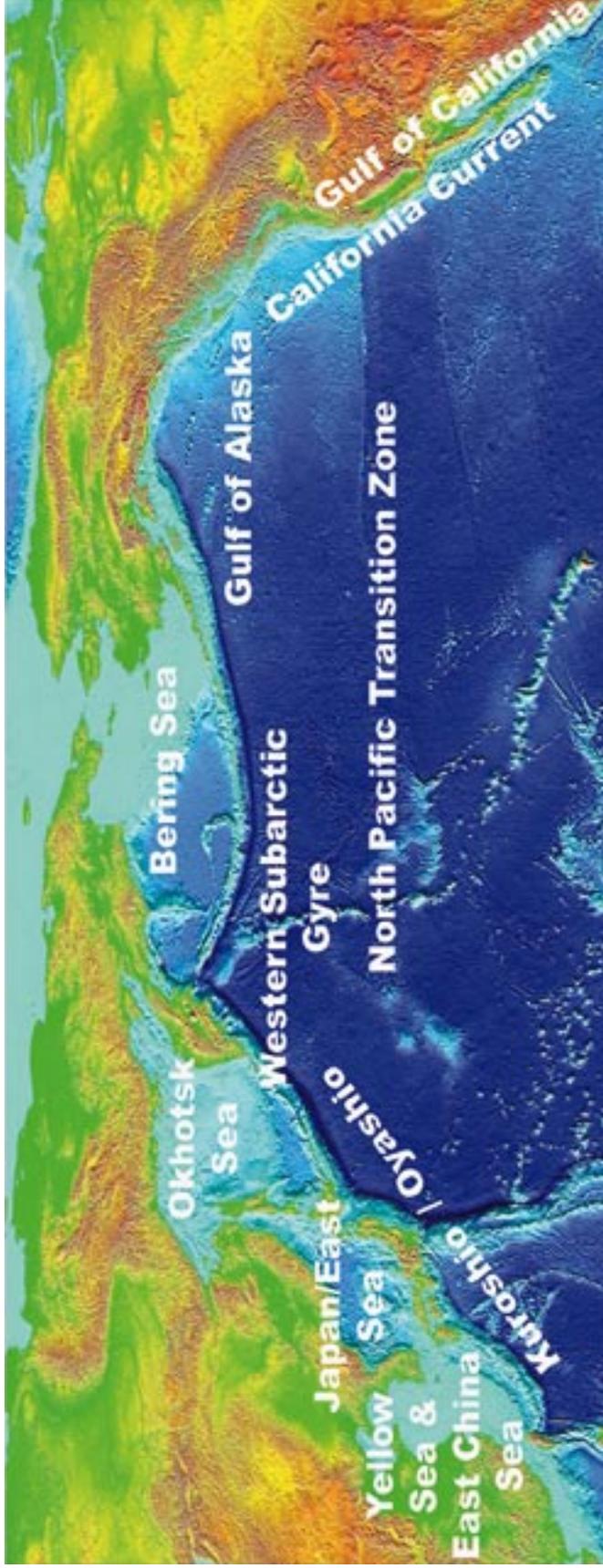
- are estimates of annual production available (e.g., total production for plankton, recruitment and growth for some or most major fish species)?
- are time series of productivity available (estimates or indices of total production, recruitment)?

Variability

- what are the seasonal cycles of biological production, distribution and migration (fishes, mammals, etc.), and growth?
- are there annual estimates of key quantities (production, recruitment, abundance) and are their causes of variability known?
- are spatial patterns in distribution, abundance, productivity sufficiently understood to estimate spatial averages of key quantities?
- is the spatial resolution of data sufficient for management or other purposes?

To understand the roles that organisms play in the structure and function of marine ecosystems (e.g., Figure 1), information is needed at the community and ecosystem levels on:

- food web pathways;
- food web efficiencies;
- other food web characteristics;
- species richness, diversity and evenness;
- size / diversity spectra;
- keystone species.



[Figure 2] Large marine ecosystems in the North Pacific Ocean provide a geographic basis to describe the trophic levels of the North Pacific Ocean. (Source of base map: <http://ngdc.noaa.gov/mgg/image/2minrelief.html>)